AEI Consultants

October 2020

REMEDIAL INVESTIGATION WORK PLAN

Property Identification:
323-325 Yonkers Avenue
Yonkers, NY 10701

BCP Site No. C360184
AEI Project No. 401130

Prepared for:
Simchah 325 Yonkers, LLC
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Yonkers, New York 10701

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Qualified Environmental Professional:

I, Anthony Cauterucci, certify that I am currently a Qualified Environmental professional as defined in 6 NYCRR Part 375 and that this Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Anthony Cauterucci

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TABLE OF CONTENTS

FIGURES

APPENDICES

1.0 INTRODUCTION AND PURPOSE

1.1 Background Information

This Remedial Investigation Work Plan (RIWP) is being prepared under the New York State Brownfield Cleanup Program (BCP) for the site located at 323-325 Yonkers Avenue in Yonkers, New York (the "Site"). The Site is owned by Simchah 325 Yonkers, LLC and the portion of the Site within the Brownfield Site Boundary is located within Block 2272, Lot 3 (see Figures 1 and 2). The current owner of the Site, Simchah 325 Yonkers, LLC, has been accepted into the BCP program as a Participant, per the acceptance letter from the New York State Department of Environmental Conservation (NYSDEC) dated February 5, 2020.

The Site is currently occupied by BoniClean dry cleaner, Deli Buffet, and a church.

The current owner, Simchah 325 Yonkers, LLC, purchased the Site in 2006. Based on the presence of the tetrachloroethene (PCE) detected in groundwater and soil vapor at the Site (see Previous Investigations, Section 2.2), the NYSDEC recommended that the current owner enter into the BCP to address the onsite PCE contamination.

AEI was retained by Simchah 325 Yonkers, LLC to assist in the entry into the NYSDEC BCP and the Site was accepted into the BCP in February of 2020.

The purpose of the project moving forward is to conduct a remedial investigation to characterize impacts in soil, soil vapor, and groundwater onsite and fully investigate and characterize the nature and extent of contamination that has migrated or emanated from the Site to off-site locations.

The Site owner plans to maintain the property for its current commercial use following completion of remedial action at the Site.

This RIWP is prepared in accordance with the NYSDEC's DER-10/Technical Guidance for Site Investigation and Remediation in order to fully-characterize impacts at the Site and to fully characterize the area of concern identified in the BCP application.

1.2 Statement of Purpose

This remedial investigation is planned to define the nature and extent of all contamination within the BCP on-site target boundary (see Figure 3) and support the subsequent evaluation and development of remedial actions, as appropriate. This investigation will also determine if other compounds of concern are present at the site (e.g., SVOCs, metals, pesticides/herbicides, and PCBs) and emerging contaminants.

The work scope proposed here is based on the investigation work completed to date, and an understanding of the Site from records searches and site visits. This RIWP details specific tasks that will facilitate Site characterization and compliance with the NYSDEC and New York State Department of Health (NYSDOH) requirements. Specifically, the data gathered as part of this work will be used in conjunction with prior investigation results to:

- Identify the sources of contamination, the migration pathways, and actual or potential receptors of contaminants
- Evaluate the amount, concentration, persistence, mobility, and other characteristics of the contamination present
- Delineate the horizontal and vertical extent of contaminants in all media on the Site
- Characterize the material beneath the Site
- Evaluate the potential for contaminant migration and threats to sensitive receptors
- Provide information to allow for the identification and preliminary evaluation of viable remedial alternatives.

These findings will be summarized in a Remedial Investigation Report (RIR) that will be submitted to the NYSDEC for review and approval. Remedial Action Objectives (RAOs) will also be developed for the Site based on the contaminant characterization results, current land use, and potential exposure pathways. Based on an understanding of potential Site issues and the presence of chlorinated VOCs, the RAOs for the Site may require soil removal, groundwater treatment, and/or the implementation of a sub-slab depressurization system.

2.0 SITE HISTORY AND DESCRIPTION

2.1 Site and Surrounding Neighborhood Descriptions

2.1.1 Site Description

The portion of the Site within the Brownfield Site Boundary totals approximately 0.23 acres and is improved with one (1) two-story, slab-on-grade building, located on the north side of Yonkers Avenue, in a mixed commercial and residential area of Yonkers, New York (Figures 1 and 2). The Site is currently occupied by BoniClean dry cleaner, Deli Buffet, and a church. Additionally, the portions of the exterior of the Site are improved with asphalt-paved parking areas and concrete walkways.

The portion of the Site within the Brownfield Site Boundary is located within Block 2272, Lot 3.

2.1.2 Surrounding Area

The Site is located in a mixed residential and commercial area, and is bordered by the Fairways at Dunwoodie Golf Course to the north, an adjoining gas station and conveience store to the east followed by a vacant, wooded land and Tibbets Creek, Yonkers Avenue followed by Planet Fitness to the south, and the Fairways at Dunwoodie Golf Course to the west.

The nearest school to the Site is St Ann's private school, located at 40 Brewster Ave, Yonkers, NY 10701, approximately 0.6 miles to the northeast of the Site. There are no daycares identified within a one-mile radius of the Site.

No other sensitive populations such as medical or senior citizen facilities were identified within a one-mile radius of the Site.

The nearest hospital is Saint Joseph's Medical Center, located at 127 S Broadway, Yonkers, NY 10701, approximately two miles to the west/southwest of the Site.

2.2 Previous Investigations

2.2.1 June 2005 – Phase II Subsurface Investigation

A Phase II Subsurface Investigation was completed at the BCP Site and adjacent gas station and auto repair in 2005 by Laurel Environmental Associates, Ltd. (LEA).

A total of 18 soil borings were advanced at the Site using a direct-push drilling rig. The majority of the borings were advanced in the area of the adjacent gas station and auto repair; however, one boring was advanced in the area of the BCP Site dry cleaner and one soil sample, SB-18, was submitted for halogenated VOCs analysis. Laboratory analysis of the soil sample from boring SB-18 showed detectable levels of PCE, but below NYSDEC Restricted Residential Use Soil Cleanup Objectives (RRUSCOs).

Based on these results, LEA recommended the following:

- Conduct additional sampling to assess the presence or absence of PCE inside and in the immediate surroundings of the dry cleaner.

2.2.2 February 2006 – Additional Dry Cleaner Soil Investigation

LEA was retained by the former property owner, Yonkers Ave. Realty Corporation, to conduct a soil investigation at the Site. On February 8, 2006, LEA collected six (6) soil samples in the vicinity of the dry cleaning unit, from within the tenant space of 21st Century Dry Cleaning. A total of ten (10) soil samples were collected from zero to a maximum depth of two (2) feet below grade surface (bgs) from the six borings advanced beneath the concrete slab of the building. Bedrock was encountered at varying depths between one (1) to two (2) feet bgs.

PCE was detected in all soil samples at concentrations below the NYSDEC Unrestricted Soil Cleanup Objective (SCO) of 1.3 milligrams per kilogram (mg/kg) with the exception of B-1 and B-4, which had concentrations of 9.8 mg/kg and 5.7 mg/kg, respectively.

A letter report including a summary of this information was reportedly submitted to Mr. Frederick Beck, Jr. of the Westchester County Department of Health (WCDOH).

2.2.3 April 2006 – Closure Report: Removal of Contaminated Soil

Based on the results of the February 2006 soil sampling conducted at the Site, LEA was retained by the former property owner to complete the removal of contaminated soil in the area beneath the dry cleaning facility. On March 20-24, 2006, LEA completed the following tasks:

- Disassembled and temporarily moved the dry cleaning machine located inside the building in order to gain access to the proposed excavation area;
- Removed and disposed of approximately 12 tons of concrete;
- Excavated impacted soil in the area beneath the former dry cleaning machine. A total of 23.62 tons of impacted soil were excavated from beneath the concrete slab and disposed of at a licensed facility in Belleville, Michigan;
- Six endpoint soil samples were collected from the sidewalls and bottom of the excavation and analyzed for VOCs;
- Excavation was lined with 6-millimeter poly sheeting and backfilled with clean bank-run sand, concrete slab was replaced sealed with a watertight epoxy coating;

- Dry cleaner was reassembled and installed in its previous location;
- Closure report was submitted to WCDOH and NYSDEC.

This remedial excavation work was conducted with oversight of the WCDOH representative, Mr. Frederick Beck, and the closure report was reportedly submitted to NYSDEC representative, Ms. Michelle Tippel.

2.2.4 October 2018 - Limited Phase II Subsurface Investigation

AEI completed a Limited Phase II Subsurface Investigation at the Site on September 26, 2018. The purpose of the investigation was to evaluate potential impacts related to the BCP Site dry-cleaning operations, the potential heating oil USTs to the west of the retail building, the oil-water separator (OWS), and the gasoline filling and auto service operations.

A total of five (5) soil borings, three (3) temporary well points, two (2) interior sub-slab soil vapor samples, one (1) indoor air sample, and one (1) exterior air sample were collected at the Site.

The soil sample analytical results indicated that no VOCs were detected at concentrations greater than the most stringent Unrestricted Use SCOs in the soil samples analyzed.

The groundwater sample analytical results indicated that PCE was detected in groundwater sample TW-1, near the current dry cleaner on the BCP Site, at a concentration greater than the AWQS.

The sub-slab soil vapor sample analytical results indicated that PCE was detected at concentrations greater than the NYSDOH screening levels and EPA Vapor Intrusion Screening Levels (VISLs) in both sub-slab soil vapor samples analyzed. No other VOCs were detected above the NYSDOH or EPA screening levels in the sub-slab soil vapor samples analyzed. Due to the PCE exceedances in sub-slab soil vapor samples SSV-1 and SSV-2, indoor air sample IA-1 and ambient air sample AA-1 were analyzed to determine whether a vapor intrusion pathway exists.

PCE was detected in indoor air sample IA-1 at a concentration of 9.9 micrograms per cubic meter (ug/m^3). This concentration exceeds the NYSDOH Matrix B Indoor Air Concentrations Criteria of 3 ug/m^3 for PCE. When considered along with the concentrations of PCE detected in sub-slab soil vapor samples SSV-1 and SSV-2 of 1,720 ug/m^3 and 78,700 ug/m^3, respectively, the NYSDOH Matrix B guidance table recommends that mitigation be conducted to minimize current or potential exposures associated with soil vapor intrusion. Additionally, AEI recommended conducting an additional round of sampling that includes sub-slab soil vapor and indoor air samples within the Dunwoodie Deli/Buffet space to delineate the extent of the PCE vapor contamination in order to determine which areas of the Site building will require mitigation activities.

Because exceedances of petroleum-related VOCs were detected in groundwater throughout the Site, the release was reported to the NYSDEC and Spill No. 18-07608 was issued.

2.2.5 December 2018 – Supplemental Phase II Subsurface Investigation

AEI completed a Supplemental Phase II Subsurface Investigation at the Site on November 27, 2018. The purpose of the investigation was to delineate elevated PCE levels detected in soil vapor near the dry-cleaner tenant space, and the tenant space immediately adjoining the eastern side of the dry-cleaner space.

A total of four (4) sub-slab soil vapor samples, two (2) indoor air samples, and one (1) exterior air sample were collected and analyzed in tenant spaces to the east of the dry-cleaner space.

The sub-slab soil vapor sample analytical results indicated that no chlorinated VOCs were detected at concentrations greater than the NYSDOH screening levels in the sub-slab soil vapor samples analyzed during this investigation.

The indoor air sample analytical results indicated that PCE was detected in indoor air sample IA-01 at a concentration of 5.16 ug/m^3, which is greater than the Matrix B NYSDOH Indoor Air screening level of 3.0 ug/m^3. Additionally, TCE was detected in indoor air samples IA-01 and IA-02 at concentrations of 7.74 ug/m^3 and 0.269 ug/m^3, respectively, which are greater than the Matrix A NYSDOH Indoor Air screening level of 0.2 ug/m^3. However, no chlorinated VOCs were detected in ambient air sample AA-01 at concentrations greater than the NYSDOH screening levels.

The fact that TCE was identified in the indoor air samples but not in the sub-slab soil vapor samples to the east of the dry-cleaner space suggests that TCE vapors are migrating aboveground, and within the tenant spaces, from the suspected source near the dry-cleaning space. Similarly, although PCE was detected in the sub-slab soil vapor and indoor air of the tenant spaces to the east of the dry-cleaner tenant space, the concentrations were substantially lower than those detected near the dry-cleaner space and diminish with distance from the dry-cleaner space.

Based on the findings above, vapor intrusion mitigation (i.e. Sub-Slab Depressurization System [SSDS]) was recommended for the dry-cleaning tenant space and tenant space immediately east of the dry-cleaner tenant space; however, the large deli tenant space adjacent further east of that area does not appear to require mitigation. The deli tenant space would likely benefit from improved aboveground/interior ventilation, perhaps through Heating, Ventilation, and Cooling (HVAC) system modifications or other means. Future testing of indoor air should be performed to verify the effectiveness of mitigation actions at reducing indoor air levels of chlorinated VOCs.

3.0 CONCEPTUAL SITE MODEL

In order to evaluate the significance of the impacted media at the Site, the potential pathways by which individuals may come in contact with these media must be determined. The combination of factors (chemical source, media of concern, release mechanisms, and potential receptors) that could produce a complete exposure pathway and lead to human uptake of chemicals is assessed in this Conceptual Site Model ("CSM").

3.1 Receptors

Based on the current land use and the anticipated future land use of the Site, the following potential receptors may be exposed to on-Site media:

- Retail customer or worker (current/future)
- Construction worker (current/future)
- Trespasser (current/future)

Impacted media at the Site include groundwater and soil vapor. Ingestion, dermal contact, and inhalation are the potential routes of exposure.

Groundwater at the Site is not currently used as a potable drinking water source. The potable water for the Site and the surrounding area is currently supplied by a municipal source and this is expected to continue.

In addition, off-Site receptors may be exposed to contaminants that have migrated. Potential off-Site receptors include the following:

- Visitors, customers, and workers at the adjacent properties (current/future); mainly downgradient (east/southeast).

3.2 Geology and Hydrogeology

According to information obtained from the United States Geological Survey (USGS) the Site is underlain by Pleistocene glacial till deposits. Based on a review of the United States Department of Agriculture (USDA) Soil Survey, the majority of the soils in the vicinity of the Site are classified as the Charlton-Chatfield complex, which is indicative of coarse-loamy melt-out till derived from granite, gneiss, and/or schist. The soil recovered in the borings advanced during the October 2019 Remedial Investigation generally consisted of a layer of fill followed by brown sand and silt.

Groundwater has been encountered between 8 and 16 feet bgs throughout the Site during previous investigations and has been measured to flow towards the east/southeast. The closest surface water body is Tibbets Creek, which is located 150 feet to the east of the Site.

3.3 Contaminant Source

Based on a review of historical sources, the Site has been used as a dry cleaner since 1985.

Based on the above, it is likely that a release(s) from the dry-cleaning activities at the Site has led to on-site contamination, specifically within the BCP Site boundary.

4.0 SPECIFIC CHEMICAL OBJECTIVES

Soil Cleanup Objectives (SCOs): As the Site will be used for commercial activities in the future, the Commercial Use Soil Cleanup Objectives (CUSCOs) per 6 NYCRR Part 375 have been targeted. Additionally, soil testing results will be compared to the NYSDEC Protection of Groundwater SCOs (PGWSCOs). The values for chlorinated VOCs are shown below in Table A.

Groundwater: The New York State Ambient Water Quality Standards and Guidance Values, Class GA (Groundwater), will be used to evaluate groundwater contaminants. The values for chlorinated VOCs are shown below in Table B.

Soil Vapor/Indoor Air: The New York State Department of Health (NYSDOH) Soil Vapor/Indoor Air Matrices A, B, and C will be used to evaluate soil vapor and indoor air contaminants. The values for chlorinated VOCs are shown below in Table C.

Table A – VOC Soil SCOs

Contaminant	CAS Number	Commercial (mg/kg)	Protection of Groundwater (mg/kg)
1,1,1-Trichloroethane	71-55-6	500	0.68
cis-1,2-Dichloroethene	156-59-2	500	0.25
Carbon tetrachloride	56-23-5	22	0.76
Methylene chloride	75-09-2	500	0.05
Tetrachloroethene	127-18-4	150	1.3
Trichloroethene	79-01-6	200	0.47
Vinyl chloride	75-01-4	13	0.02

Table B - NYS Groundwater Standards and Guidance Values

Contaminant	CAS Number	Groundwater Standard (µg/L)
1,1,2,2-Tetrachloroethane	79-34-5	5
1,1,1-Trichloroethane	71-55-6	5
cis-1,2-Dichloroethene	156-59-2	5
Carbon tetrachloride	56-23-5	5
Chloroform	67-66-3	7
Methylene chloride	75-09-2	5
Tetrachloroethene	127-18-4	5
Trichloroethene	79-01-6	5
Vinyl chloride	75-01-4	2

Table C - NYSDOH Soil Vapor/Indoor Air Screening Levels

Contaminant	CAS Number	Soil Vapor Screening Level (ug/m^3)	Indoor Air Screening Level (ug/m^3)
1,1,1-Trichloroethane	71-55-6	100	3
1,1-Dichloroethene	75-35-4	6	0.2
Carbon tetrachloride	56-23-5	6	0.2
cis-1,2-Dichloroethene	156-59-2	6	0.2
Methylene chloride	75-09-2	100	3
Tetrachloroethene	127-18-4	100	3
Trichloroethene	79-01-6	6	0.2
Vinyl chloride	75-01-4	6	0.2

5.0 SAMPLING PLAN

5.1 Sampling Strategy

An investigation of soil, groundwater, and soil vapor is proposed to further characterize the Site for potential environmental impacts from the historical on-site dry-cleaning activities. The sampling procedures of this investigation will be performed in accordance with the NYSDEC Technical Guidance for Site Investigation and Remediation DER-10.

In summary, the installation and survey of one (1) additional groundwater monitoring well (along with the sampling of an existing on-site monitoring well), advancement of five (5) borings for soil sampling, advancement of five (5) sub-slab soil vapor points, one (1) exterior soil vapor sample, collection of five (5) indoor air samples, and one (1) ambient air sample is proposed. The proposed sample locations are depicted on Figure 4. These locations may be modified slightly based on actual field conditions; however, final boring/sample locations will be measured to fixed benchmarks (e.g., building corners) or by hand-held GPS equipment.

Access to Site buildings will be needed for conducting the sampling detailed throughout this report. Building access will occur during normal business hours. AEI assumes complete access to all necessary tenant spaces. However, most buildings are currently occupied. Therefore, Covid-19 protocols as outlined in the site-specific Health and Safety Plan (HASP) in Appendix B, including proper PPE and appropriate social distiancing, must be followed when entering buildings. AEI will provide each tenant a notice with information regarding the scope of work to be completed within their tenant space 2-weeks in advance of the fieldwork mobilization.

5.2 Summary of Samples and Media to be Sampled

The proposed scope of sampling is designed to complement the existing data to provide a more complete characterization in order to support the evaluation of remedial goals and alternatives. While previous data has been collected at the Site, this RI has been designed to be comprehensive to identify the nature and extent of contamination under a NYSDEC and NYSDOH approved workplan and to inform the Qualitative Human Health Exposure Assessment. Table C below provides a summary of the samples to be collected during the remedial investigation. Proposed sample locations are shown on Figure 4.

Table D - Analytical Program Summary

Sample Media	Number of Samples					Analysis[1]
	Field Samples	Duplicates	MS/MSD	Field Blank	Trip Blank	
Soil	15 (3 samples from each boring)	1	1	1	1	-VOCs+TICs per Method 8260C (not analyzed in surface soil samples)
Soil	5 (1 sample from each boring)	1	1	1	0	-SVOCs+TICs by Method 8270D -TAL Metals by EPA 6010C / 7471B -TCL PCBs and Pesticides by Method 8082A/8081B -Herbicides by Method 8151A -1,4-Dioxane by EPA Method 8270D-SIM -PFAS[2] by modified EPA Method 537
Groundwater	3	1	1	1	1	-VOCs+TICs per Method 8260C
Groundwater	1	1	1	1	0	-SVOCs+TICs by Method 8270D -TAL Metals by EPA 200.7 / 200.8/ 245.2 / 6010C / 6020A / 7470A (filtered and total metals) -TCL PCBs and Pesticides by Method 8082A/8081B -Herbicides by Method 8151A -1,4-Dioxane by EPA Method 8270D-SIM -PFAS[3] by modified EPA Method 537
Sub-Slab Soil Vapor	5	0	0	0	0	-VOCs per Method TO-15
Exterior Soil Vapor	1	0	0	0	0	-CVOCs per Method TO-15
Indoor/Ambient Air	6	0	0	0	0	-VOCs per Method TO-15

[1] Target Compound List (TCL) VOCs, including Tentatively Identified Compounds (TICs); Semi-volatile organic compounds; Target Analyte List (TAL) Metals; Polychlorinated Biphenyls (PCBs); Per- and Polyfluoroalkyl substances (PFAS).
[2] MD/MSD = Matrix Spike/Matrix Spike Duplicate
[3] Full list of 21 PFAS will be analyzed

6.0 SAMPLING PLAN DETAILS

6.1 Soil Borings and Samples

Soil borings will be completed in five (5) locations in the subsurface as per DER-10 Section 3.5.2. A total of 15 soil samples will be collected from the five (5) borings for analysis of Site-related CVOCs. Additional soil samples will be collected for potential analysis of SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS as described below. A geologist/QEP will screen the soil samples during borehole advancement for organic vapors with a photo-ionization detector (PID) with a 10.6 eV lamp and evaluate for visual and olfactory impacts prior to collecting samples for laboratory analyses. Pending the identification of analytes detected on the Site, a PID with a 11.7 eV lamp may be utilized. All field work will be recorded in a field log book.

The borings will advanced to a target depth of 20 feet bgs if feasible using a track-mounted GeoProbe® equipped with 2.25-inch outer diameter Macro-Core® samplers (rods), and samples will be collected continuously by advancing the five-foot-long rods equipped with acetate sample liners. After each interval, the core will be retrieved, core barrel disassembled, and the sample liner will be removed, transferred to the on-site geologist, inspected, logged and field screened from grade surface to the final depth of each boring using a PID.

Three (3) soil samples will be collected from each boring (total of 15 soil samples) for laboratory analysis of VOCs+TICs. Soil samples from each boring will be collected for potential laboratory analysis from four depths as follows: surface soil samples (from 0-2 inches bgs), shallow soil samples (from 1.5-2 feet bgs), from the six-inch interval above the groundwater table or at the depth of the highest PID reading, and from the terminus of each boring. The surface soil samples (0-2 inches bgs) will not be analyzed for VOCs+TICs. Additionally, one (1) soil sample from each of the five (5) soil borings (i.e., total of five samples) will be analyzed for SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS at the depth interval at that represents the highest likelihood for contamination based on the field screening results. The remaining samples will be placed on hold for potential laboratory analysis of SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS pending receipt of the primary soil results. When sampling for PFAS, the special precautions and guidelines outlined in the attached Quality Assurance Project Plan (QAPP) will be employed to avoid contamination of environmental samples or site media with PFAS. This data may be used to optimize remedial designs (if required) and off-site soil/material disposal requirements. The sample results will be compared to the applicable NYSDEC Commercial and Protection of Groundwater SCOs, with the goal of delineating and remediating Site-related CVOCs to the CUSCOs.

Based on on-site observations and information from previous investigations completed at the Site, bedrock is present at shallow depths beneath the dry cleaning tenant space (within 4 feet bgs) and a bedrock outcrop is present behind (to the northwest of) the dry cleaning tenant space; therefore, it is likely that refusal will be encountered in some of the borings due to on-site geologic conditions. If shallow refusal is encountered in the proposed boring locations, the proposed soil sample collection intervals and number of soil samples collected may be altered in the field.

If bedrock is encountered deeper than expected beneath the building slab, additional samples may be analyzed for a full suite of constituents. Field observations regarding depth to bedrock, sampling intervals, and analysis will be reported to NYSDEC on the same day as sampling.

Prior to installing soil borings, the public underground utility locating service will be notified to mark out utilities in the work area and a private geophysical survey will be conducted to evaluate the presence of underground structures and subsurface features using GPR, electromagnetic induction and possibly utility tracing instruments in order to clear the boring locations of utilities.

6.2 Monitoring Well Installation and Groundwater Sampling

6.2.1 Monitoring Well Installations

There are currently six (6) permanent groundwater monitoring wells present on the Site which were installed as a part of a separate investigation of the adjoining gas station; the western-most monitoring well (MW-5) is located at the southeastern boundary of the BCP target area, directly to the south of the dry cleaning tenant space, and monitoring well (MW-4) is located approximately 80 feet to the east of the dry cleaning tenant space.

One (1) additional 2-inch diameter permanent groundwater monitoring well (identified as MW-7) will be installed by a NY-licensed well driller. The additional well will be installed on the southwestern portion of the target area at the location illustrated on Figure 4. Based on information from previous investigations completed at the Site, bedrock is present at shallow depths beneath the dry cleaning tenant space (within 4 feet bgs) and a bedrock outcrop is present behind (to the northwest of) the dry cleaning tenant space; therefore, installation of an upgradient overburden monitoring well to the northwest of the dry cleaner is not feasible due to onsite geologic conditions.

The additional permanent groundwater monitoring well will be installed to 20 feet bgs. As groundwater at the Site has been detected between 8 and 16 feet below the top of casing (TOC) in the six permanent monitoring wells on-site to date, a 15-foot long section of PVC screen will be set at the base of the well from approximately 20 feet bgs to 5 feet bgs in order to straddle the groundwater interface. Solid-walled PVC casing will extend from 5 feet bgs to ground surface. A silica sand pack will be placed from the base of the borehole to between one feet and two feet above the top of the well screen, using media appropriately sized based on Site-specific geologic conditions (tentatively 0.010-slot screen and 20-40 silica sand). No other groundwater units have been encountered at this Site in the overburden formation and therefore only the shallow groundwater unit identified between 8 and 20 feet bgs will be evaluated at this time.

The annular space of the well will be sealed to ground surface using cement-bentonite grout. The top of the well installed will be finished with a lockable, water-tight cap and flush-mount steel cover. The newly installed monitoring well will be developed by purging and/or pumping the water in the well to loosen and remove suspended fines. Measurements of the water volume removed and water quality parameters including temperature, pH, conductivity, and turbidity will be recorded at regular intervals throughout the development process. Development will continue until the NYSDEC standard of 50 Nephelometric Turbidity Unit (NTU) is measured with a nephelometer and water is visibly free of sediment. The top of the PVC casing for the new well will be surveyed by a NY-licensed surveyor and depth to groundwater measurements will be recorded in the well.

After allowing the newly installed well to equilibrate for approximately one (1) week following installation and development, the wells will be sampled as described in Section 6.2.2 below.

Based on on-site observations and information from previous investigations completed at the Site, bedrock is present at shallow depths beneath the dry cleaning tenant space (within 4 feet bgs) and a bedrock outcrop is present behind (to the northwest of) the dry cleaning tenant space; therefore, it is unlikely that groundwater will be encountered in the borings proposed to be advanced within the building and to the west of the building due to on-site geologic conditions. If groundwater is encountered in the proposed boring locations, temporary well points will be installed, and a maximum of two (2) additional groundwater samples will be collected and analyzed for a full suite of constituents. Field observations regarding depth to bedrock, presence of shallow groundwater, samping, and analysis will be reported to NYSDEC on the same day as sampling.

6.2.2 Groundwater Sampling and Testing

Three (3) groundwater samples will be collected from permanent monitoring wells on-site including the newly installed MW-7, the western-most monitoring well (MW-5), and monitoring well (MW-4) which is located approximately 80 feet to the east of the dry cleaning tenant space. Groundwater sampling will be conducted as per the groundwater guidance in DER-10 Section 3.7.2. Prior to collecting each groundwater sample, the well will be gauged for groundwater depth/NAPL using a decontaminated oil-water interface probe. The groundwater samples will be collected from each well with low-flow purging techniques using dedicated non-teflon lined high density polyethylene (HDPE) and silicon tubing and a peristaltic pump to purge and collect samples for laboratory analysis. When sampling for PFAS, the special precautions and guidelines outlined in the attached QAPP will be employed to avoid contamination of environmental samples or site media with PFAS. During purging, groundwater field parameters including pH, specific conductivity, temperature, turbidity, and dissolved oxygen will be measured using a calibrated water quality meter equipped with a flow-through cell. Depending on the yield of the well, a minimum of three well volumes will be removed prior to sample collection. Analytical samples will be collected when water quality parameter measurements have stabilized.

Each well will be sampled for laboratory analysis of VOCs+TICs. The groundwater sample collected from monitoring well MW-5, located immediately downgradient of the dry-cleaning facility, will also be analyzed for SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS. The groundwater samples from monitoring well MW-4 and MW-7 will be placed on hold for potential laboratory analysis of SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS pending receipt of the primary soil and groundwater results. Groundwater samples collected for TAL Metals will be analyzed for filtered and total (unfiltered) metals.

All groundwater samples will be collected in laboratory supplied sample bottles in accordance with protocols for analysis shown in Table C of Section 5.2. Appropriate QA/QC samples will be collected for the groundwater sampling event including one trip blank, one field duplicate sample, one matrix spike sample, and one matrix spike duplicate sample per day of sampling. After sample collection, the groundwater samples will be placed in an ice-filled shipping cooler and transported under chain-of-custody to a NY-certified analytical laboratory.

6.3 Soil Vapor Sampling

Prior to completing the soil sampling and groundwater monitoring well installation described in Sections 6.1 and 6.2, five (5) interior sub-slab soil vapor samples and one (1) off-site, exterior soil vapor sample will be collected at the locations illustrated on Figure 4. Soil vapor sampling will be conducted in accordance with Section 2.7.1 of the New York State SVI Guidance and DER-10 Section 3.6.

The soil vapor samples will be collected in accordance with the New York State Department of Health (DOH) - Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006; Updated May 2017). Accordingly, the interior sub-slab soil vapor samples will be collected from beneath the concrete slab of the on-site building by drilling a ½-inch borehole through the concrete, inserting an implant connected to Teflon-lined tube in the area beneath the concrete invert, and sealing off the surface area where the tubing meets the concrete with bee's wax or a VOC-free clay. The exterior soil vapor sample will be collected by advancing a borehole to approximately five (5) feet bgs, inserting an implant connected to Teflon-lined tube, filling the annular space with sand, and sealing off the surface area where the tubing meets the ground surface with hydrated granular benotine.

The vapor points will be allowed to stabilize for approximately one hour, and the sampling tubing will then be purged to remove ambient air. The sampling tubing will subsequently be connected to a 6-liter Summa® canister equipped with a flow controller set at a flow rate allowing for collection of a soil vapor sample over a period of approximately eight (8) hours. Helium gas will be used as a leak check compound during the sampling to ensure no "short circuiting" is occurring and for sample quality assurance. Collection of the soil vapor samples will not proceed until the helium detector indicates that no helium was detected during the leak check process. Following completion of the soil vapor sampling, the holes will be filled with concrete or asphalt patch to match the surrounding surface.

A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, identity of samplers, sampling methods and devices, vacuum of canisters before and after the samples are collected, apparent moisture content of the sampling zone, and chain of custody protocols.

The interior sub-slab soil vapor samples will be analyzed for VOCs using EPA method TO-15. The exterior soil vapor sample will be analyzed for CVOCs using EPA method TO-15.

AEI will also conduct an evaluation of the gas station conveineince store building to determine if this building has employees present for a full workday who are not involved in auto repair activities.

6.4 Indoor/Ambient Air Sampling

A total of six (6) air samples will be collected at the Site. Five (5) of the samples will be collected from locations within the buildings that will be collocated with the sub-slab vapor sample locations, and one (1) of the samples will be an ambient/background air sample collected outside of the building. The air samples will be collected concurrently with the interior sub-slab soil vapor samples at the locations proposed on Figure 4. The air samples will be collected over a period of approximately eight-hours per NYSDOH Vapor Intrusion (VI) Guidance Manual requirements for non-residential buildings. The air samples will be collected using laboratory-supplied six (6) liter evacuated Summa® canisters with calibrated flow controllers.

The air samples will be analyzed for VOCs using EPA method TO-15.

6.5 Field Management of Investigation Derived Waste

Following completion of sample collection, the soil borings will be backfilled with sand and hydrated bentonite chips and the soil vapor points will be backfilled with concrete. The borings will be completed at the surface to match existing conditions. Soil boring cuttings and purge water from the monitoring well installation will be placed in 55-gallon drums for future disposal, pending receipt of soil and groundwater analytical results. Investigation derived waste will remain on-site for a maximum of 30 days.

The following documentation will be established and reported for each disposal destination used in this project to document that the disposal of regulated material exported from the Site conforms with applicable laws and regulations: (1) a letter to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is generated at an environmental remediation site in NYC under a governmental remediation program. The letter will provide the project identity and the name and phone number of the Professional Engineer or Volunteer. The letter will include as an attachment a summary of all chemical data for the material being transported; and (2) a letter from each disposal facility stating it is in receipt of the correspondence and is approved to accept the material. These documents will be included in the RIR.

The RIR will include an itemized account of the destination of all material removed from the site during the investigation. Documentation associated with disposal of all material will include records and approvals for receipt of the material. This information will be presented in the RIR.

All soil/fill or other waste removed from the site will be managed and disposed in accordance with applicable laws and regulations. Any soil/fill or other waste that is characterized as non-hazardous material taken off-site will be disposed of at a Soil Recycling Facility.

Waste characterization will be performed for off-site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the RIR. A manifest system for offsite transportation of exported materials will be employed. Manifest information will be reported in the RIR. Wastes derived from the site will be stored, transported, and disposed of in compliance with applicable laws and regulations.

6.6 Quality Exposure Assessment

As per the DER-10 Section 3.3, a qualitative exposure assessment for both human health and/or fish and wildlife resources will be completed during the RI to determine the route, intensity, frequency and duration of potential exposures to contaminants. A description of the nature and size of the population potentially exposed to the contaminants that are present at or migrating from a site will follow the DER-10 guidance.

7.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

A Quality Assurance Project Plan (QAPP) has been prepared for review by the NYSDEC and NYSDOH. It is provided in this RIWP as Appendix A and summarized below.

7.1 Analytical Methods

All samples collected during the RI will be analyzed using EPA-approved analytical methods that follow the most recent edition of the EPA's "Test Methods for Evaluating Solid Waste" (SW-846), Methods for Chemical Analysis of Water and Wastes" (EPA 600/4-79-020), and Standard Methods for Examination of Water and Wastewater" (prepared and published jointly by the American Public Health Association, American Waterworks Association and Water Pollution Control Federation).

Laboratory reporting limits for PFAS in soil will be no higher than 0.5 micrograms per kilogram (ug/kg). Laboratory reporting for 1,4-dioxane in soil will not exceed 0.1 milligrams per kilogram (mg/kg) in soil.

The laboratory reporting limit for PFAS in groundwater will be 2 nanograms per liter (ng/L) (ppt). The method detection limit for 1,4-dioxane in groundwater will not exceed 0.35 micrograms per liter (ug/L).

7.2 Laboratory

The subcontracted laboratory will be certified by the New York State Department of Health to perform Contract Laboratory Program (CLP) analysis on all media to be sampled during this investigation. The laboratory will perform the sample analysis in accordance with the most recent NYSDEC Analytical Services Protocol (ASP) and will have an Environmental Laboratory Approval Program (ELAP) certification for the applicable analytes. Laboratory certifications are included in the QAPP in Appendix A.

7.3 Data Submittal

Analytical data will be submitted in complete ASP category B data packs. Procedures for chain of custody, laboratory instrumentation calibration, laboratory analyses, reporting of data, internal quality control, and corrective actions shall be followed as per SW-846 and as per the laboratory's Quality Assurance Plan. Where appropriate, trip blanks, field blanks, and field duplicates shall be performed at a rate of 5% and will be used to assess the quality of the data. The laboratory's in-house QA/QC limits will be utilized whenever they are more stringent than those suggested by the EPA methods. Preliminary data will be submitted to the NYSDEC and the NYSDOH as soon as the data becomes available.

7.4 Data Usability Summary Report

The data package will be evaluated for accuracy and precision of the analytical results. A Data Usability Summary Report (DUSR) will be prepared to describe the compliance of the analyses with the analytical method protocols detailed in the NYSDEC ASP.

The DUSR will provide a determination of whether the data meets the project-specific criteria for data quality and data use. The validation effort will be completed in accordance with NYSDEC Division of Environmental Remediation DUSR guidelines.

The laboratory will have an ELAP certification for the applicable analytes.

8.0 HEALTH AND SAFETY

Field tasks will be performed using industry standard health and safety procedures. A site-specific Health and Safety Plan (HASP) has been prepared by AEI and reviewed by the NYSDEC. This plan details known and potential hazards of the Site and field tasks as well as air monitoring and emergency procedures. The HASP is included with this RIWP as Appendix B.

9.0 COMMUNITY AIR MONITORING

All of the planned RIWP work will be completed within the Site boundary. When any ground intrusive, potentially impacted material staging, and potentially impacted material handling occurs, an active Community Air Monitoring Plan (CAMP) will be implemented to protect the surrounding community. An AEI representative will monitor VOCs and dust in the work area and exclusion zone using appropriate real time monitoring equipment as specified in the NYSDOH Generic CAMP. If sustained VOC measurements above 5 parts per million (ppm) or elevated dust readings are detected in the work area, work will be suspended until dust and VOC levels return to acceptable levels. If elevated dust and/or VOC levels persist, mitigation measures (i.e., water for dust control, odor-suppressant foam, etc.) and alternate work practices will be employed to control fugitive dust/VOC levels. At no time will work continue if elevated dust or VOC levels at the exclusion zone are detected. For work conducted within the interior of the Site buildings, the special CAMP requirements for work conducted within 20 feet of receptors will be implemented as described in Appendix C, Attachment 1. CAMP data will be reported to the NYSDEC and NYSDOH Project Managers on a daily or weekly basis in an easy to read format and include explanations for any exceedance as well as actions implemented and results of those actions; if exceedances of action levels are detected, information regarding CAMP action level exceedances and Corrective Actions taken will be provided to the NYSDEC and the NYSDOH project managers the same business day of occurrence. CAMP reports will include a figure depicting daily work zones, wind direction, and other appropriate site information including specific work activities.

A copy of the CAMP is provided as Appendix C.

10.0 CITIZEN PARTICIPATION PLAN

This Citizen Participation Plan (CPP) provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the Site. The CPP provides opportunities for citizen involvement and encourages two-way communication with citizens before decision makers form or adopt final positions. The CPP also identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program and identifies locations of the reports and information related to the site's investigation and cleanup program.

A copy of the CPP is provided as Appendix D.

11.0 PROJECT ORGANIZATION

AEI has established a project team for this project whose collective qualifications and experience are strongly suited for successful completion of the project. The resumes of the individuals are included as Appendix E. The proposed responsibilities of the key staff are summarized below:

Jordan Farber will be the Project Manager for the work. In this capacity Mr. Farber will be responsible for the successful completion of each task including coordination and supervision of subcontractors, engineers and scientists, and adherence to the work plan, schedule and budget.

Anthony Cauterucci, CHMM will be the Quality Leader, responsible for the development of the work plan, and maintaining quality assurance policies that pertain to all aspects of sample acquisition and data management.

David Bausmith, PE will act as an advisor for initial remedial investigation activities as preparations are made for remediation. Mr. Bausmith will be the supervising environmental professional for remediation activities.

Philip Clark, PE, of HCS Civil & Environmental Engineering, LLC will act as an advisor for initial remedial investigation activities as preparations are made for remediation. Mr. Clark will be the supervising professional engineer (NYS PE License Number 88422) for remediation activities.

12.0 REPORTING

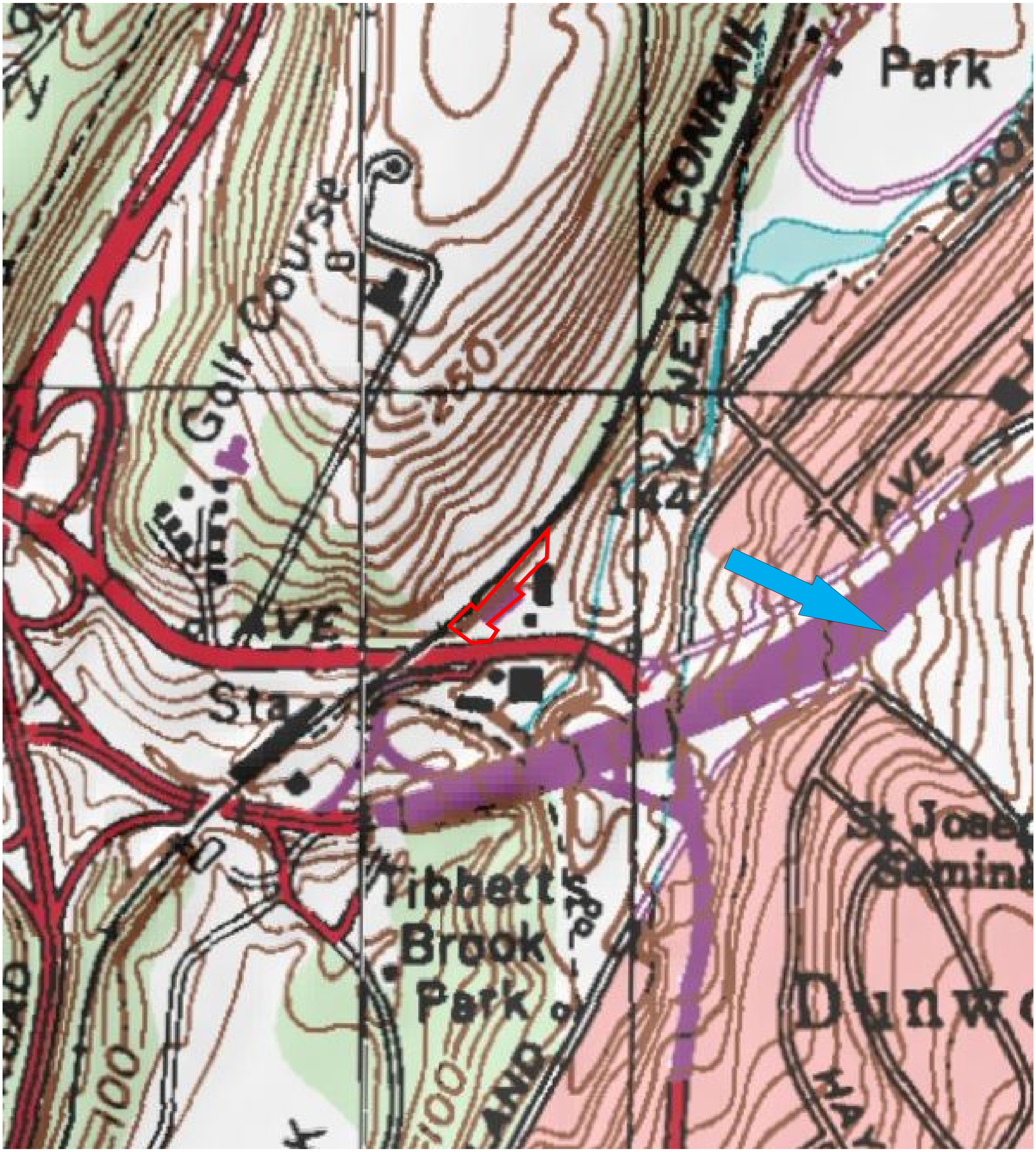
Following receipt of the validated analytical results, AEI will prepare a Remedial Investigation Report. Preparation of the report will entail a summary of fieldwork performed to date; data collected, and will include appropriate summary data tables, soil boring logs, well construction logs, analytical results, and maps.

13.0 PROJECT SCHEDULE

The following is the anticipated schedule for execution of the RIWP:

- Submission of RIWP – October 2020
- Approval of RIWP and Public Comment Period – October-November 2020
- Remedial Investigation Fieldwork – December 2020
- Submit RIR to NYSDEC – January 2021

FIGURES



Legend

Approximate Property Boundary ▬

Inferred Direction of Groundwater Flow ➡

N

Figure 1: Site Location Map

323-325 Yonkers Avenue, Yonkers, NY 10701

Project Number: 401130

AEI Consultants

Legend

BCP Site Boundary □

Source: Property Research Partners LLC
Satellite Image: 2019

0 60 120

SCALE: 1" = 120'

N

Figure 2: Site Map

323-325 Yonkers Avenue, Yonkers, NY 10701
Project Number: 401130

AEI Consultants

AEI Consultants

DRAWN BY: AC	REVIEWED BY: JF
APPROVED BY: DB	Date: 10/20/2020

BCP SITE BOUNDARY

323–325 Yonkers Avenue
Yonkers, New York 10701

AEI Project #401130

FIGURE
3

AEI Consultants

DRAWN BY: AC	REVIEWED BY: JF
APPROVED BY: AC	Date: 10/27/2020

PROPOSED REMEDIAL INVESTIGATION
SAMPLE LOCATION MAP

323–325 Yonkers Avenue
Yonkers, New York 10701

BCP Site No. C360184
AEI Project #401130

FIGURE
4

APPENDICES

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

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QUALITY ASSURANCE PROJECT PLAN

Property Identification:
323-325 Yonkers Avenue
Yonkers, NY 10701

BCP Site No. C360184
AEI Project No. 401130

October 2020

Prepared for:
Simchah 325 Yonkers, LLC
327 Yonkers Avenue
Yonkers, New York 10701

Prepared by:
AEI Consultants
20 Gibson Place, Suite 310
Freehold, New Jersey 07728
(732) 414-2720

Environmental & Engineering Due Diligence

Site Investigation & Remediation

Energy Performance & Benchmarking

Industrial Hygiene

Construction Consulting

Construction, Site Stabilization & Stormwater Services

Zoning Analysis Reports & ALTA Surveys

TABLE OF CONTENTS

Attachments

Sampling Considerations When Analyzing for PFAS

List of 21 PFAS Compounds to be Analyzed

Data Validator Resume - Veronica Champagne

Alpha Analytical ELAP Certifications, SOPs for PFAS Analysis, Laboratory MDLs for PFAS Compounds and Quality Systems Manual

Introduction

This Quality Assurance Project Plan (QAPP) was prepared by All Environmental Inc. (AEI) for Simchah 325 Yonkers, LLC, who is conducting Remedial Investigation (RI) at the property located at 323-325 Yonkers Avenue Yonkers, New York 10701 (the "Site").

The purpose of this QAPP is to ensure that scientific data are acquired according to established methods and procedures designed to obtain results that are objective, true, repeatable, and of known accuracy. Specifically, this QAPP provides guidance and specifications to ensure that RI activities are planned and executed in a manner consistent with the Quality Assurance Objectives (QAO's) stated below:

- Field determinations and analytical results are valid through adherence to New York State Department of Environmental Conservation (NYSDEC) field procedures, NYSDEC-approved analytical protocols, and calibration and preventive maintenance of equipment;
- Samples are identified and controlled through sample tracking systems and chain of custody procedures;
- Records are retained as documentary evidence of field activities and observations;
- Samples are collected, and analytical data are validated in accordance with the NYSDEC requirements; and
- Evaluations of the data are accurate, appropriate, and consistent throughout the project

The contents of this QAPP are based on the NYSDEC requirements as stated in the EPA Requirements for Quality Assurance Project Plans (QA/R-5) (May 2006). This QAPP includes the following components:

- Problem Definition/Background;
- Project/Task Description;
- Project/Task Organization;
- Data Quality Objectives and Criteria for Measurement Data;
- Historical and Secondary Information/Data;
- Investigative Process Design;
- Field Instrumentation/Equipment Calibration and Frequency;
- Inspection/Acceptance of Supplies and Consumables;
- Sample Handling and Custody Requirements;
- Field Storage and Transport Procedures;
- Sample Containers, Preservation, and Holding Times;
- Analytical Methods Summary Table;
- Project Compounds and Analytical Summary;
- Analytical Quality Control;
- Laboratory Deliverables;
- Data and Records Management;
- Data Verification and Usability; and
- Corrective Action Processes.

As specific conditions and additional information warrant, this QAPP will be amended or revised to include site-specific quality assurance/quality control procedures.

1. Project Definition / Background

The Site is currently occupied by BoniClean dry cleaner, Deli Buffet, and a church.

Investigations and remedial work completed at the Site between June 2005 and December 2018 have identified tetrachloroethene (PCE) impacts in soil, groundwater, soil vapor, and indoor air at the Site.

The current owner, Simchah 325 Yonkers, LLC, purchased the Site in 2006. AEI is currently being retained by Simchah 325 Yonkers, LLC to assist in the completion of remedial actions regarding the PCE release at the Site, pursuant NYSDEC requirements.

This remedial investigation is planned to define the nature and extent of all contamination within the BCP on-site target boundary and support the subsequent evaluation and development of remedial actions, as appropriate. This investigation will also determine if other compounds of concern are present at the Site.

The data shall be used to determine if further soil or groundwater investigation is required. These decisions shall be made following receipt of all analytical data associated with the investigation. Data users for the project include the person responsible for conducting the remediation, the environmental consultant, and ultimately the NYSDEC.

These findings will be summarized in a Remedial Investigation Report (RIR) that will be submitted to the NYSDEC for review and approval. Remedial Action Objectives (RAOs) will also be developed for the Site based on the contaminant characterization results, current land use, and potential exposure pathways. Based on an understanding of potential Site issues and the presence of chlorinated VOCs, the RAOs for the Site may require soil removal, groundwater treatment, and the implementation of a sub-slab depressurization system.

2. Project Summary

The work that is planned to be conducted includes a Remedial Investigation of soil, groundwater, soil vapor, and indoor air. Personnel required to conduct the remedial investigation activities include a Qualified Environmental Professional.

All of the data shall be collected through soil, groundwater, soil vapor, indoor air sampling and laboratory analysis. No data shall be collected from other sources.

The sample results shall be compared to the applicable NYSDEC Restricted Commercial Use Soil Cleanup Objectives (RCUSCOs) and the Protection of Groundwater SCOs (PGWSCOs) for soil, NYSDEC Ambient Water Quality Standards (AWQS) for groundwater, and the New York State Department of Health (NYSDOH) Soil Vapor/Indoor Air Matrices A, B, and C for indoor air and soil vapor, and a conclusion shall be made, based on the comparison, as to whether contamination exists that requires further investigation/delineation or if no further investigation is required, and remedial action can be commenced.

The anticipated project schedule from initiation to final report is included as Section 12 of the RIWP. The applicable regulatory quality standards are: RCUSCOs and PGWSCOs for soil, NYSDEC AWQSs for groundwater, and the NYSDOH Soil Vapor/Indoor Air Matrices A, B, and C for indoor air and soil vapor.

3. Project / Task Organization

Project Team

The Health and Safety Coordinator, Quality Assurance Coordinator, and Project Manager for this project is Mr. Jordan Farber of AEI Consultants, Inc. (AEI). He is responsible for implementing the Quality Assurance Project Plan and the Remedial Investigation in accordance with NYSDEC regulations and serves as the central point of communication with all other individuals and organizations associated with this project. AEI can be reached at (732) 414-2720.

The Quality Assurance Officer for this project is Anthony Cauterucci. While Mr. Cauterucci will not be directly involved in the collection and analysis of samples from the Site, he has worked in conjunction with Mr. Farber in the development of the sampling and analytical portion of this QAPP. He is responsible for reviewing sampling procedures and certifying that the data was collected and analyzed using the appropriate procedures. Mr. Cauterucci is familiar with analytical methods, data interpretation and validation, the development of sampling plans, quality control procedures and auditing requirements and techniques. During the course of the sampling and analytical portion of the project Mr. Cauterucci may conduct periodic field and sampling audits, interface with the analytical laboratory to resolve problems, and interface with the data validator and/or the preparer of the Data Usability Summary Report (DUSR) to resolve problems.

Resumes for the project team are included as Appendix E of this RIWP.

Laboratory Analysis: Alpha Analytical Laboratory (NY Certification #11148): 35 Whitney Rd # 5, Mahwah, NJ 07430 (Contact: Brittney Bodtke) (610) 532-5742. Special training is required to operate laboratory equipment and conduct laboratory analyses.

Special Training Needs/Certification
Training needs and certifications of field oversight include requirements to have completed the OSHA 40- Hour training with annual 8-hour refresher training in accordance with 29 CFR 1910.120 (Hazardous waste operations and emergency response).

4. Data Quality Objectives and Criteria for Measurement Data

Data quality objectives ("DQOs") are qualitative and quantitative statements that are developed in the first six (6) steps of the DQO process. DQOs define the purpose of the data collection effort, clarify what the data should represent to satisfy this purpose, and specify the performance requirements for the quality of information to be obtained from the data.

The development of the data quality criteria can be developed through the formal DQO process described in the EPA document titled "Guidance for the Data Quality Objectives Process", EPA/600/R-96/055. For most projects, however, a less iterative process is normally used to develop the project specific DQOs.

Data of Known Quality Protocols ("DKQP") describe specific laboratory quality assurance and quality control procedures which, if followed, will provide data of known and documented quality (i.e. scientific reproducible and reliable data). When data of known quality ("DKQ") is obtained, an evaluation of the data with respect to its intended purpose can be made. To this end, a NY-certified laboratory must be used to analyze samples whenever possible.

Typical DQOs are often expressed in terms of data quality indicators ("DQIs") including precision, accuracy, representativeness, comparability, completeness and sensitivity (also known as the "PARCCS" parameters). These measures of performance are discussed in detail below.

Precision

Precision is the measure of agreement among repeated measurements of the same property under identical or substantially similar testing conditions. The investigator will determine the precision of the data by:

- Using the same analytical methods to perform repeated analyses on the same sample (laboratory or matrix duplicates);
- Collection of a field duplicate and submittal of both to evaluate the precision from sample collection, for sample handling, preservation and storage and analytical measurements

Precision for laboratory and field measurements can be expressed as the relative percent difference ("RPD") between two duplicate determinations or percent relative standard deviation ("%RSD") between multiple determinations.

Acceptance criteria for field precision shall be assessed through the splitting of a sample in the field and submitting both to the laboratory. Field duplicates will be collected at a frequency of one (1) per twenty (20) investigative samples per matrix per analytical parameter. Precision will be measured through the calculation of RPD. The resulting information will be used to assess sample homogeneity, spatial variability at the site, sample collection reproducibility, and analytical variability.

Accuracy

Accuracy is the degree of agreement of a measured value and an accepted reference or true value. The difference between the measured value and the reference or true value includes components of both systematic error (bias) and random error (precision). It should be noted that precise data may not be accurate data. Accuracy can be expressed as a percent recovery or percent deviation of the measurement with respect to its known or true value.

The accuracy will be determined through establishing acceptance criteria for spike recoveries (e.g., surrogate recoveries, laboratory control sample recoveries, matrix spike recoveries, reference material recoveries etc.) or allowable deviations for calibration (e.g., % RPD for calibration verification). Acceptance criteria for matrix spike measurements are expressed as a percent recovery and are usually specified in the analytical method (or laboratory SOP, as applicable). Various blank samples (laboratory or field) may also be used to assess contamination of samples that may bias results high. Accuracy in the field shall be assessed through the adherence to sample collection, handling, preservation, and holding time requirements.

Representativeness

Representativeness is a qualitative measurement that describes the extent to which analytical data represent the site conditions. In almost every project, the investigator will not be able to measure the whole system, process, or situation of interest. Instead, the investigator will choose sample locations, quantities, and analyses in order to capture a sufficiently broad and/or weighted view of the situation.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample holding times. Following the detailed requirements outlined in the EPA methods and the laboratory SOPs will maximize the representativeness of the laboratory data.

Comparability

Comparability is a qualitative term that expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Comparability is defined as the extent to which data from one data set can be compared directly to similar or related data sets and/or decision-making standards.

Historical data should be evaluated to determine whether they may be combined with data being collected in present time. Comparability should discuss comparisons of sample collection and handling methods, sample preparation, and analytical procedures, holding times, stability issues and QA protocol.

Comparability in the laboratory is dependent on the use of recognized methods and approved laboratory SOPs. Comparability in the field is dependent upon adherence to the sampling methodology and that the proper preservation techniques are used.

Completeness

Completeness is a measure of the amount of usable data collected compared to the amount of data expected to be obtained. Three measures of completeness are defined as:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;

- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

<u>Sensitivity</u>
Sensitivity refers to the ability of an analytical procedure to quantify an analyte at a given concentration. The sensitivity requirements should be established such that the laboratory method Reporting Limits ("RLs") are at or below the relevant and applicable regulatory limits for each Contaminant of Concern ("COC") for the project. For the purpose of this project:

- The RL for a specific substance when determining the extent and degree of polluted soil from a release. For the purpose of this document, the RL is defined as:
    - Organics, the lowest initial calibration standard as adjusted for the dilution factor, sample weight/volume, and moisture content;
    - Inorganics, the concentration of that analyte in the lowest level check standard (which could be the lowest calibration standard in a multi-point calibration curve).

Methods for analysis have been chosen to meet the sensitivity requirements for a project (e.g., compound- specific and matrix-specific). If however, the laboratory RLs exceed the project sensitivity requirements (i.e., the RL is above the relevant and applicable regulatory standard), the analytical methods may need to be adjusted (e.g., analysis conducted using a more sensitive method or sample preparation and analysis features adjusted to gain sensitivity) and/or the project objectives may need to be adjusted (i.e., certain COCs may not be able to be screened out during this phase of the evaluation).

Due to the low regulatory limits, it will be ensured that laboratory reporting limits for PFAS in groundwater and soil are to be 2 nanograms per liter (ng/L) (ppt) and 0.5 micrograms per kilogram (ug/kg) (ppb), respectively.

The method detection limit for 1,4-dioxane in groundwater and soil will not exceed 0.35 micrograms per liter (ug/L) and 0.1 milligram per kilogram (mg/kg) in soil.

5. Historical and Secondary Information / Data

The potential sources of data for any project include both historical data (i.e., data not collected by the current investigator) and secondary data (i.e., data that were collected for a different purpose than that for which they are now being used). Historical data should be evaluated for applicability to current project objectives. Secondary data should be assessed to determine if the quality of the data is sufficient for the current project objectives and meets comparability criteria (it is not sufficient that the secondary data were produced by a reliable source or a known environmental monitoring project with an approved QAPP).

Historical data and secondary data have been collected at the Site; however, this data is not sufficient to address present concerns.

6. Investigation Process Design

A description and justification of the investigation design should include, for each area of interest:

- The COCs or other parameters of interest
- The number of anticipated investigation points and how and why they will be selected including a site map depicting proposed sample locations
- Method of obtaining/determining locational information (such as the use of GPS instrumentation)
- Factors which could affect the variability of the data such as physical obstructions, seasonal variations, tidal influences, soil profile changes, weather-related variation, and process variation within the source
- Design basis (i.e., probability based or judgment based)
- Results comparison (i.e., versus previous data, regulatory standards, reference population, etc.) Matrices to be monitored including any special sampling requirements
- Monitoring frequency (if applicable)
- Heterogeneity or homogeneity of the matrix
- Appropriateness of composite samples
- Required quality control samples

The investigative process design is based generally on the following:

- NYSDEC DER-10 / Technical Guidance for Site Investigation and Remediation
- Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006) with updates

7. Field Quality Control

Field quality control activities, along with their frequency, acceptance criteria, and corrective actions to be taken are provided for each DQI in the following tables.

Analyte(s)	DQI	Data Quality Element	Frequency of Collection	Acceptance Criteria	Corrective Action(s)
-VOCs+TICs per Method 8260C -SVOCs+TICs by Method 8270D -TAL Metals by EPA 200.7 / 200.8/ 245.2 / 6010C / 6020A / 7470A / 7471B -TCL PCBs and Pesticides by Method 8082A/8081B -Herbicides by Method 8151A -1,4-Dioxane by EPA Method 8270D-SIM -PFAS by modified EPA Method 537	Sensitivity	Samples reported to RL	For each target analyte	Analyte specific	Qualify sample data

-VOCs+TICs per Method 8260C -SVOCs+TICs by Method 8270D -TAL Metals by EPA 200.7 / 200.8/ 245.2 / 6010C / 6020A / 7470A / 7471B -TCL PCBs and Pesticides by Method 8082A/8081B -Herbicides by Method 8151A -1,4-Dioxane by EPA Method 8270D-SIM - PFAS by modified EPA Method 537	Accuracy	Laboratory Control Samples (LCS)	One (1) per preparatory batch of 20 samples	Analyte specific	Reanalyze all samples in the batch
-VOCs+TICs per Method 8260C -SVOCs+TICs by Method 8270D -TAL Metals by EPA 200.7 / 200.8/ 245.2 / 6010C / 6020A / 7470A / 7471B -TCL PCBs and Pesticides by Method 8082A/8081B -Herbicides by Method 8151A -1,4-Dioxane by EPA Method 8270D-SIM - PFAS by modified EPA Method 537	Precision	Laboratory Duplicates	One (1) per preparatory batch of 20 samples	RPD≤ 25%	Qualify sample data
-VOCs+TICs per Method 8260C -SVOCs+TICs by Method 8270D -TAL Metals by EPA 200.7 / 200.8/ 245.2 / 6010C / 6020A / 7470A / 7471B -TCL PCBs and Pesticides by Method 8082A/8081B -Herbicides by Method 8151A -1,4-Dioxane by EPA Method 8270D-SIM - PFAS by modified EPA Method 537	Accuracy	Method Blanks	One (1) per preparatory batch of 20 samples	No target analytes concentrations ≥ RL	Investigate the source of contamination and document and reanalyze all samples processed
-VOCs per Method TO-15	Accuracy and precision	Leak Check	Every soil vapor sample	<10% helium in sample probe	Purge tubing and reseal annular space at surface

* Target Compound List (TCL) VOCs, including Tentatively Identified Compounds (TICs); Semi-volatile organic compounds; Target Analyte List (TAL) Metals; Polychlorinated Biphenyls (PCBs); Per- and Polyfluoroalkyl substances (PFAS).

Equipment to be decontaminated during the project may include tools, monitoring equipment, and sample collection equipment.

Contaminated tools and sampling equipment will be dropped into a plastic pail, tub or other container. The tools will be brushed off, rinsed, and transferred into a second pail to be carried to further decontamination stations where they will be washed with a non-PFAS containing detergent and water solution, rinsed with clean potable water, and finally rinsed with deionized water.

Any direct or obvious contamination on monitoring equipment will be brushed or wiped with a disposable paper wipe. The units will then be wiped off with damp disposable wipes and dried. The units will be checked, standardized, and recharged, as necessary, for the next day's operation. They will then be prepared with new protective coverings.

Sample containers will be wiped clean at the sample site, taken to the decontamination area to be further cleaned, as necessary, and transferred to a clean carrier. The samples will be checked off against the COC record. The samples will then be stored on ice in a secure area prior to shipment. Sample handling areas will be cleaned/wiped down daily using disposable wipes. Disposable wipes will not be used on any equipment that comes in contact with samples. For final cleanup, all equipment will be disassembled and decontaminated. Any equipment which cannot be satisfactorily decontaminated will be disposed (e.g., glassware, covers for surfaces).

Analysis of an equipment/field blank sample shall be conducted for the COCs being investigated that day with that equipment.

Due to the ubiquitous nature and low detection levels for PFAS compounds, several additional specific considerations and protocols must be taken during project setup, sampling, and decontamination procedures when sampling for PFAS compounds as follows:

- PFAS sampling will occur at the beginning of the work day prior to any other sampling planned, to avoid possible contamination sources.
- Clothing for the day must have been previously washed a minimum of 6 times (i.e. no new clothing) without fabric softener.
- No waterproof, water-repellent, fire-repellant or stain-resistant clothing or footwear will be worn.
- On the day of sampling the project manager will shower only with PFAS-free soap and shampoo, brush teeth with fluoride-free toothpaste only (no mouthwash or dental floss), and will not use lotions, moisturizers, deodorant cosmetics, makeup sunscreen or insect repellents.

- Prior to sampling the project manager will not handle any packaged food or drinks, aluminum foil, adhesive labels, etc. at or around sampling site.
- Sampling bottles will be pre-labeled before arrival at the sampling site and marked with a ball-point pen only (no markers).
- No waterproof logbooks or plastic clipboards will be used, only untreated paper and aluminum clipboards.
- Prior to collection of samples, field personnel must wash their hands and wear a new set of powderless, disposable, nitrile gloves and will take extra caution not to touch any surface prior to sample collection.
- High density polyethylene (HDPE) and polypropylene will be used during sampling and all sampling equipment components and sample containers will not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.
- Samples will be collected directly into the provided preserved, HDPE bottle, which will be sealed and bagged immediately and will be stored and transported in a clean, dedicated cooler between bags of PFAS-free, fresh, bagged ice (no chemical ice packs will be used).
- Field sampling equipment, including oil/water interface meters, water level indicators, and other nondedicated equipment used at each sample location, will be cleaned between use.
- The safety data sheets (SDSs) of detergents or soaps used in decontamination procedures will be reviewed to ensure fluoro-surfactants are not listed as ingredients.
- Laboratory-certified PFAS-free water will be used for the final rinse during decontamination of sampling equipment.
- Larger equipment (for example, drill rigs and large downhole drilling and sampling equipment) will be decontaminated with potable water using a high-pressure washer or steam.
- To the extent practical, equipment coming in direct contact with samples will be rinsed with PFAS-free water. Water used for the decontamination of sampling equipment will be laboratory certified "PFAS-free" water.

8. Sampling Methods and Techniques

Soil Borings and Samples

Soil borings will be completed in five (5) locations in the subsurface as per DER-10 Section 3.5.2. A total of 15 soil samples will be collected from the five (5) borings for analysis of Site-related CVOCs. Additional soil samples will be collected for potential analysis of SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS as described below. A geologist/QEP will screen the soil samples during borehole advancement for organic vapors with a photo-ionization detector (PID) with a 10.6 eV lamp and evaluate for visual and olfactory impacts prior to collecting samples for laboratory analyses. Pending the identification of analytes detected on the Site, a PID with a 11.7 eV lamp may be utilized. All field work will be recorded in a field log book.

The borings will advanced to a target depth of 20 feet bgs if feasible using a track-mounted GeoProbe® equipped with 2.25-inch outer diameter Macro-Core® samplers (rods), and samples will be collected continuously by advancing the five-foot-long rods equipped with acetate sample liners. After each interval, the core will be retrieved, core barrel disassembled, and the sample liner will be removed, transferred to the on-site geologist, inspected, logged and field screened from grade surface to the final depth of each boring using a PID.

Three (3) soil samples will be collected from each boring (total of 15 soil samples) for laboratory analysis of VOCs+TICs. Soil samples from each boring will be collected for potential laboratory analysis from four depths as follows: surface soil samples (from 0-2 inches bgs), shallow soil samples (from 1.5-2 feet bgs), from the six-inch interval above the groundwater table or at the depth of the highest PID reading, and from the terminus of each boring. The surface soil samples (0-2 inches bgs) will not be analyzed for VOCs+TICs. Additionally, one (1) soil sample from each of the five (5) soil borings (i.e., total of five samples) will be analyzed for SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS at the depth interval at that represents the highest likelihood for contamination based on the field screening results. The remaining samples will be placed on hold for potential laboratory analysis of SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS pending receipt of the primary soil results. When sampling for PFAS, the special precautions and guidelines outlined in the attached Quality Assurance Project Plan (QAPP) will be employed to avoid contamination of environmental samples or site media with PFAS. This data may be used to optimize remedial designs (if required) and off-site soil/material disposal requirements. The sample results will be compared to the applicable NYSDEC Commercial and Protection of Groundwater SCOs, with the goal of delineating and remediating Site-related CVOCs to the Commercial SCOs.

Based on on-site observations and information from previous investigations completed at the Site, bedrock is present at shallow depths beneath the dry cleaning tenant space (within 4 feet bgs) and a bedrock outcrop is present behind (to the northwest of) the dry cleaning tenant space; therefore, it is likely that refusal will be encountered in some of the borings due to on-site geologic conditions. If shallow refusal is encountered in the proposed boring locations, the proposed soil sample collection intervals and number of soil samples collected may be altered in the field.

Prior to installing soil borings, the public underground utility locating service will be notified to mark out utilities in the work area and a private geophysical survey will be conducted to evaluate the presence of underground structures and subsurface features using GPR, electromagnetic induction and possibly utility tracing instruments in order to clear the boring locations of utilities.

Monitoring Well Installations

There are currently six (6) permanent groundwater monitoring wells present on the Site which were installed as a part of a separate investigation of the adjoining gas station; the western-most monitoring well (MW-5) is located at the southeastern boundary of the BCP target area, directly to the south of the dry cleaning tenant space, and monitoring well (MW-4) is located approximately 80 feet to the east of the dry cleaning tenant space.

One (1) additional 2-inch diameter permanent groundwater monitoring well (identified as MW-7) will be installed by a NY-licensed well driller. The additional well will be installed on the southwestern portion of the target area at the location illustrated on Figure 4. Based on information from previous investigations completed at the Site, bedrock is present at shallow depths beneath the dry cleaning tenant space (within 4 feet bgs) and a bedrock outcrop is present behind (to the northwest of) the dry cleaning tenant space; therefore, installation of an upgradient overburden monitoring well to the northwest of the dry cleaner is not feasible due to onsite geologic conditions.

The additional permanent groundwater monitoring well will be installed to 20 feet bgs. As groundwater at the Site has been detected between 8 and 16 feet below the top of casing (TOC) in the six permanent monitoring wells on-site to date, a 15-foot long section of PVC screen will be set at the base of the well from approximately 20 feet bgs to 5 feet bgs in order to straddle the groundwater interface. Solid-walled PVC casing will extend from 5 feet bgs to ground surface. A silica sand pack will be placed from the base of the borehole to between one feet and two feet above the top of the well screen, using media appropriately sized based on Site-specific geologic conditions (tentatively 0.010-slot screen and 20-40 silica sand). No other groundwater units have been encountered at this Site in the overburden formation and therefore only the shallow groundwater unit identified between 8 and 20 feet bgs will be evaluated at this time.

The annular space of the well will be sealed to ground surface using cement-bentonite grout. The top of the well installed will be finished with a lockable, water-tight cap and flush-mount steel cover. The newly installed monitoring well will be developed by purging and/or pumping the water in the well to loosen and remove suspended fines. Measurements of the water volume removed and water quality parameters including temperature, pH, conductivity, and turbidity will be recorded at regular intervals throughout the development process. Development will continue until the NYSDEC standard of 50 Nephelometric Turbidity Unit (NTU) is measured with a nephelometer and water is visibly free of sediment. The top of the PVC casing for the new well will be surveyed by a NY-licensed surveyor and depth to groundwater measurements will be recorded in the well.

After allowing the newly installed well to equilibrate for approximately one (1) week following installation and development, the wells will be sampled as described in Section 6.2.2 below.

Groundwater Sampling and Testing

Three (3) groundwater samples will be collected from permanent monitoring wells on-site including the newly installed MW-7, the western-most monitoring well (MW-5), and monitoring well (MW-4) which is located approximately 80 feet to the east of the dry cleaning tenant space. Groundwater sampling will be conducted as per the groundwater guidance in DER-10 Section 3.7.2. Prior to collecting each groundwater sample, the well will be gauged for groundwater depth/NAPL using a decontaminated oil-water interface probe. The groundwater samples will be collected from each well with low-flow purging techniques using dedicated non-teflon lined high density polyethylene (HDPE) and silicon tubing and a peristaltic pump to purge and collect samples for laboratory analysis. When sampling for PFAS, the special precautions and guidelines outlined in the attached QAPP will be employed to avoid contamination of environmental samples or site media with PFAS. During purging, groundwater field parameters including pH, specific conductivity, temperature, turbidity, and dissolved oxygen will be measured using a calibrated water quality meter equipped with a flow-through cell. Depending on the yield of the well, a minimum of three well volumes will be removed prior to sample collection. Analytical samples will be collected when water quality parameter measurements have stabilized.

Each well will be sampled for laboratory analysis of VOCs+TICs. The groundwater sample collected from monitoring well MW-5, located immediately downgradient of the dry-cleaning facility, will also be analyzed for SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS. The groundwater samples from monitoring well MW-4 and MW-7 will be placed on hold for potential laboratory analysis of SVOCs+TICs, TAL Metals, TCL PCBs and Pesticides, Herbicides, 1,4-Dioxane, and PFAS pending receipt of the primary soil and groundwater results. Groundwater samples collected for TAL Metals will be analyzed for filtered and total (unfiltered) metals.

All groundwater samples will be collected in laboratory supplied sample bottles in accordance with protocols for analysis shown in Table C of Section 5.2. Appropriate QA/QC samples will be collected for the groundwater sampling event including one trip blank, one field duplicate sample, one matrix spike sample, and one matrix spike duplicate sample per day of sampling. After sample collection, the groundwater samples will be placed in an ice-filled shipping cooler and transported under chain-of-custody to a NY-certified analytical laboratory.

Soil Vapor Sampling

Prior to completing the soil sampling and groundwater monitoring well installation described in Sections 6.1 and 6.2, five (5) interior sub-slab soil vapor samples and one (1) off-site, exterior soil vapor sample will be collected at the locations illustrated on Figure 4. Soil vapor sampling will be conducted in accordance with Section 2.7.1 of the New York State SVI Guidance and DER-10 Section 3.6.

The soil vapor samples will be collected in accordance with the New York State Department of Health (DOH) - Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006; Updated May 2017). Accordingly, the interior sub-slab soil vapor samples will be collected from beneath the concrete slab of the on-site building by drilling a ½-inch borehole through the concrete, inserting an implant connected to Teflon-lined tube in the area beneath the concrete invert, and sealing off the surface area where the tubing meets the concrete with bee's wax or a VOC-free clay. The exterior soil vapor sample will be collected by advancing a borehole to approximately five (5) feet bgs, inserting an implant connected to Teflon-lined tube, filling the annular space with sand, and sealing off the surface area where the tubing meets the ground surface with hydrated granular bentonite.

The vapor point will be allowed to stabilize for approximately one hour, and the sampling tubing will then be purged to remove ambient air. The sampling tubing will subsequently be connected to a 2.7-liter Summa® canister equipped with a flow controller set at a flow rate allowing for collection of a soil vapor sample over a period of approximately eight (8) hours. Helium gas will be used as a leak check compound during the sampling to ensure no "short circuiting" is occurring and for sample quality assurance. Collection of the soil vapor samples will not proceed until the helium detector indicates that no helium was detected during the leak check process. Following completion of the soil vapor sampling, the holes will be filled with concrete or asphalt patch to match the surrounding surface.

A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, identity of samplers, sampling methods and devices, vacuum of canisters before and after the samples are collected, apparent moisture content of the sampling zone, and chain of custody protocols.

The interior sub-slab soil vapor samples will be analyzed for VOCs using EPA method TO-15. The exterior soil vapor sample will be analyzed for CVOCs using EPA method TO-15.

Ambient Air Sampling

A total of five (5) air samples will be collected at the Site. Four (4) of the samples will be collected from locations within the buildings near the sub-slab vapor sample locations, and one (1) of the samples will be an ambient/background air sample collected outside of the building. The air samples will be collected concurrently with the interior sub-slab soil vapor samples and at the locations proposed on Figure 4. The air samples will be collected over a period of approximately eight-hours per NYSDOH Vapor Intrusion (VI) Guidance Manual requirements for non-residential buildings. The air samples will be collected using laboratory-supplied six (6) liter evacuated Summa® canisters with calibrated flow controllers.

The air samples will be analyzed for VOCs using EPA method TO-15.

9. Field Instrumentation / Equipment Calibration and Frequency

Field instrumentation/equipment that will require calibration includes a photo ionization detector (PID), a peristaltic pump, a U-50 Multiparameter Water Quality Meter and flow through cell, a helium detector, and flow regulators for Summa canisters. Calibration of PID will be conducted using isobutylene gas at the beginning at each day of field work. The U-50 Multiparameter Water Quality Meter calibration record will be provided by Pine Environmental Services, Inc. upon request. Alpha Laboratory will provide all calibration records on the flow regulators and the helium detector calibration record will be provided by Pine Environmental Services, Inc. upon request

10. Inspection / Acceptance of Supplies and Consumables

Critical supplies or consumables are planned for use in soil, groundwater, and soil vapor sampling events. All consumables must be unused and dedicated specifically to this project. The soil and groundwater samples will be collected into laboratory-supplied bottleware. The soil vapor and indoor air samples will be collected into laboratory-supplied Summa canisters. Summa canisters shall be batch certified as clean from the laboratory.

11. Sample Handling and Custody Requirements

Sample containers will be wiped clean at the sample site, taken to the decontamination area to be further cleaned, as necessary, and transferred to a clean carrier. The samples will be checked off against the chain of custody (COC) record. The samples will then be stored on ice in a secure area prior to shipment. At the time samples are obtained, the following must be recorded by the sampler in the field logbook and/or on sample data sheets:

- Sample location
- Sample type
- Date and time of sampling
- Project and sample designations
- Sample identification

- Analyses requested

Sample handling areas will be cleaned/wiped down daily using disposable wipes. Disposable wipes will not be used on any equipment that comes in contact with samples. For final cleanup, all equipment will be disassembled and decontaminated. Any equipment which cannot be satisfactorily decontaminated will be disposed (e.g., glassware, covers for surfaces). Samples shall be maintained on-site for no more than two (2) consecutive days and shall be delivered to the laboratory within one (1) day of shipment from the field.

The following COC protocol will be followed by the sampling crews:
- Documenting procedures and reagents added to the sample during sample preservation
- Recording sampling locations, sample bottle identification, and specific sample collection procedures on the appropriate forms
- Using sample labels that contain all information necessary for effective sample tracking
- Completing standard field data records to establish analytical sample custody in the field before sample shipment.

Prepared labels are normally developed for each sample to be collected. Each label is numbered to correspond with the appropriate sample(s) to be collected.

The COC record is used to document sample-handling information (i.e., sample location, sample identification, and number of containers corresponding to each sample number). The following information is recorded on the COC record:
- Project reference
- The site location code, sample identification number, date of collection, time of collection, sample bottle number, preservation, and sample type, number of containers, sample matrix
- The names of the sampler(s) and the person shipping the samples
- Serial number of custody seals and shipping cases (if applicable)
- The date and time that the samples were delivered for shipping
- Analyses required
- The names of those responsible for receiving the samples at the laboratory.

COC Forms may be obtained from the subcontractor laboratory or from AEI. A copy of the COC is sent with the analytical samples to the laboratory; another is kept by the sample crew leader and maintained in the project file. When this shipment is received by the laboratory, the COC is signed by the laboratory and returned with the test results as part of the data package submittal.

12. Field Storage and Transport Procedures

Samples shall remain in direct sight and in the custody of field personnel at all times until transfer to the laboratory.

13. Sample Containers, Preservation, and Holding Times

Sample containers, preservation, and holding times are specified on Table 1.

14. Analytical Methods Summary Table

Analytical methods are summarized on Table 1.

15. Project Compounds and Analytical Summary

Volatile organic compounds (VOCs), specifically PCE, trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC), are the COCs for the soil, groundwater, and soil vapor at the Site. The project action limits are the NYSDEC RCUSCOs and NYSDEC PGWSCOs for soil, NYSDEC AWQSs for groundwater, and NYSDOH Soil Vapor/Indoor Air Matrices A, B, and C for indoor air and soil vapor. The analytical methods chosen can meet the DQOs of the project.

Analytical sensitivity requirements include the use of instruments or methods to detect the contaminants of concern at or below the action limits. The RLs are expected to be below the applicable regulatory standards. NYSDEC and EPA methods were selected to achieve the action limits. Laboratories may need to adjust RLs based on dilutions, sample sizes, extract/digestate volumes, percent solids and cleanup procedures. Sensitivity will be maximized by following the NYSDEC and EPA methods or laboratory SOPs utilizing experienced, trained laboratory personnel and by conducting laboratory audits.

16. Analytical Quality Control

Quality assurance and quality control ("QA/QC") requirements for analysis are specified in the most recent version of the document titled "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", prepared by EPA. The laboratory may also have QA/QC procedures in addition to those specified by the test method.

17. Laboratory Deliverables

The laboratory deliverable format to be used for this project shall be the Analytical Services Protocols (ASP) Category B full laboratory data deliverable. The laboratory shall also generate spreadsheets of the analytical results.

18. Data and Records Management

The recording media for the project will be both paper and electronic. The project will implement proper document control procedures for both. For instance, hand-recorded data records will be taken with indelible ink, and changes to such data records will be made by drawing a single line through the error with an initial by the responsible person. The Project Manager will have ultimate responsibility for all changes to records and documents. Similar controls will be put in place for electronic records.

The Quality Assurance Coordinator shall retain all updated versions of the QAPP and be responsible for distribution of the current version of the QAPP. The Quality Assurance Coordinator/Project Manager will approve periodic updates. The Project Manager shall retain copies of all management reports, memoranda, and all correspondence between the parties identified in Section 3.

Project data shall be stored in the Project Manager's office.

19. Data Verification and Usability

The data package will be evaluated for accuracy and precision of the analytical results. A DUSR will be prepared to describe the compliance of the analyses with the analytical method protocols detailed in the NYSDEC ASP.

The DUSR will provide a determination of whether the data meets the project-specific criteria for data quality and data use. The validation effort will be completed in accordance with NYSDEC Division of Environmental Remediation DUSR guidelines.

The procedure for review (verification and usability procedures) including data assessment versus stated data quality objectives of the investigation is specified in the NYSDEC's DER-10.

The data validator for this project will be Ms. Veronica Champagne. Ms. Champagne’s resume is included as an attachment to this QAPP.

20. Corrective Action Processes

Corrective action in the field may be needed when the work plan is modified (i.e., number or locations of samples) or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. The corrective action may be implemented at the time the determination is made in the field or may be implemented later, depending on the circumstances. Any corrective actions taken shall be documented in the field logbook and in the technical report.

Corrective actions in the laboratory may be needed when Non-Conformances occur. The laboratory shall implement and document corrective actions in accordance with the laboratory SOP.

TABLE 1

Analytical Methods/Quality Assurance Summary Table
4778 Broadway, New York, New York 10034

Matrix Type	Number of Samples	Analytical Parameters	Analytical Methods	Sample Preservation	Sample Container & Volume	Permissible Holding Time
Soil	19[1]	TCL VOCs+TICs[2]	8260C	0-6 °C	(3) Terracore samplers	48 Hours
Soil	8[1]	TCL SVOCs+TICs TAL Metals Total PCBs TCL Pesticides Herbicides 1,4-Dioxane PFAS[4]	8270D 6010C / 7471B 8082A 8081B 8151A 8270D Modified 537	0-6 °C None 0-6 °Core 0-6 °C 0-6 °C 0-6 °C Trizma/0-6 °C	4 oz amber glass 4 oz amber glass 4 oz amber glass 4 oz amber glass 4 oz amber glass 4 oz amber glass (2) 250 ml HDPE	14 Days[3] 180 Days (28 days for Hg) 14 Days 14 Days[3] 14 Days[3] 14 Days[3]
Groundwater	7[5]	TCL VOCs+TICs	8260C	HCL	(3) 40 ml VOA amber glass	14 days
Groundwater	4[5]	TCL SVOCs+TICs TAL Metals (filtered and total metals) Total PCBs TCL Pesticides Herbicides 1,4-Dioxane PFAS[4]	8270D 200.7/200.8/ 245.2/6010C/ 6020A/7470A 8082A 8081B 8151A 8270D-SIM Modified 537	0-6 °C 0-6 °C HNO_3 0-6 °C 0-6 °C 0-6 °C 0-6 °C Trizma/0-6 °C	(2) 1000 ml amber glass (1) 500 ml HDPE (2) 1000 ml amber glass (2) 500 ml HDPE (2) 1000 ml amber glass (2) 1000 ml amber glass (2) 250 ml HDPE	7 Days[6] 180 Days (28 days for Hg) 7 Days 7 Days[6] 7 Days[6] 7 Days[6] 14 Days[7]
Soil Vapor	5	VOCs	EPA TO-15	Ambient temperature	Summa Canister; 2.7-liter	30 days
Soil Vapor	1	CVOCs	EPA TO-15	Ambient temperature	Summa Canister; 2.7-liter	30 days
Indoor/ Ambient Air	6	VOCs	EPA TO-15	Ambient temperature	Summa Canister; 6-liter	30 days

1. Includes 15 field samples for VOCs+TICs and 5 field samples for all other analytes, 1 duplicate, 1 MS/MSD, 1 field blank, and 1 trip blank (duplicate, MS/MSD samples will be collected with a frequency of 1 in every 20 samples, trip blanks will be collected for VOCs at a frequency of 1 per cooler).
2. Surface soil samples collected from 0-2 inches below ground surface will not be analyzed for VOCs+TICs.
3. Permissible holding time for SVOCs+TICs, TCL Pesticides, Herbicides, 1,4-Dioxane, and PFAS in soil is 14 days to extract and 40 days to analyze.
4. Full list of 21 PFAS will be analyzed. List of 21 PFAS compounds to be analyzed is attached to this QAPP.
5. Includes 3 field samples for VOCs+TICs and 1 field sample for all other analytes, 1 duplicate, 1 MS/MSD, 1 field blank, and 1 trip blank (duplicate, MS/MSD samples will be collected with a frequency of 1 in every 20 samples, trip blanks will be collected for VOCs at a frequency of 1 per cooler and equipment blanks for PFAS will be collected at a frequency of 1 per day)
6. Permissible holding time for SVOCs+TICs, TCL Pesticides, Herbicides, and 1,4-Dioxane in groundwater is 7 days to extract and 40 days to analyze.
7. Permissible holding time for PFAS in groundwater is 14 days to extract and 28 days to analyze.

SAMPLING CONSIDERATIONS WHEN ANALYZING FOR PFAS

SAMPLING CONSIDERATIONS WHEN ANALYZING FOR PFAS	
Prohibited Materials	**Acceptable Materials**
Field Equipment	
Fluoropolymer tubing, valves and other parts in pumps (Teflon®)	High density polyethylene (HDPE) and silicon materials
Fluoropolymer bailers or pump bladders	Disposable Equipment / Dedicated Equiment (no PTFE parts)
Aluminum foil	Thin HDPE sheeting
Blue (chemical) ice	Ice contained in plastic (polyethlene) bags (double bagged), secured to avoid meltwater from contacting sample containers, overnight shipping
Post-it notes, sharpies, waterproof fieldbook	Ball point pens, Loose paper on aluminum clipboard, non weatherproof fieldbook, pre-printed labels
Glass containers (due to potential loss of analytle through adsorption)	Polypropylene or HDPE sample bottles fitted with an unlined (no PTFE), polypropylene or HDPE screw cap
Decon 90	Alconox soap for decontamination, if needed
Decontamination water from the site	Water used for the decontamination of sampling equipment will be laboratory certified "PFAS-free" water
Field Clothing and Personal Protective Equipment (PPE)	
New clothing or water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex	Well-laundered clothing, defined as clothing that has been washed 6 times or more after purchase, made of synthetic or natural fibers.
Clothing laundered using fabric softener	No fabric softener
Boots containg Gore-Tex	Boots made with polyurethane and polyvinyl chloride
Cosmetics, moisturizers, hand cream or other related products as part of personal cleaning/showering routine on the morning of sampling	Sunscreens - Alba Organics Natural Sunscreen, Yes to Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural"
	Inspect Repellents: Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Inspect repellent, Herbal Armor, BabyGanics
Handling or prepackaged food products	Do not have at sampling location, wash hands well after handing wear powderless nitrile gloves

LIST OF PFAS COMPOUNDS TO BE ANALYZED

PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

DATA VALIDATOR RESUME - VERONICA CHAMPAGNE

Veronica J. Champagne

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957 Broadway, Haverhill, MA 01832, (650) 515-8860, ronni89@earthlink.net

Job Description

Environmental Project Manager/Data Quality Specialist

Summary of Professional Experience:

Ms. Champagne has worked in the environmental consulting field for 28 years and specializes in performing laboratory data validation and usability assessments for hazardous waste sites, as well as authoring technical reports based on Massachusetts Contingency Plan (MCP) and CERCLA federal guidelines. Although her residence and primary knowledge base is Massachusetts, she has experience in data validation under state and federal guidelines in all of New England, as well as New York, New Jersey and other locations. Ms. Champagne is well versed in the U.S. EPA National Functional Guidelines and Region I Data Validation Protocol, Massachusetts Compendium of Analytical Methods (CAM), and Representativeness Evaluation and Data Usability Assessment (REDUA) guidelines.

She has worked on many projects, providing support and guidance in the investigation and remediation of environmentally impacted sites. She has played a lead role in the discovery, clean-up, and closure of many sites. She has extensive experience with sites contaminated with chlorinated and gasoline contaminants, monitored natural attenuation (MNA) programs, and remediation of subsurface contamination through excavation, chemical injection (ISCO) and numerous other technologies.

Professional Experience

Environmental Chemical Corporation (ECC), Hudson, Massachusetts
Associate Environmental Scientist October 2012-Current

- Performed task management for several multi-million dollar U.S. Air Force and U.S. Army Environmental Projects under Performance-Based Remediation contracts. Work performed under CERCLA and multiple state environmental programs.
- Authored numerous documents under the CERCLA program, including many Quality Assurance Project Plans written according to the current federal guidance.
- Performed Tier II and Tier III laboratory data validation, QC Program Evaluation, and authored Data Usability Assessments for numerous projects. Validation performed both manually and using EDMS (Electronic Data Management System) database.
- Managed field and office junior staff for project support tasks, including teaching data validation methodology.

Self-Employed
Data Validation Specialist February 2010-Current

- Performed Tier II and Tier III laboratory data validation, QC Program Evaluation, and authored Data Usability Assessments for numerous New England, New York and New Jersey sites.
- Authored several MCP report submittals and Air Force OES Plans.

Environmental Compliance Services, Inc. (ECS), Woburn, Massachusetts
(previously d.b.a. Marin Environmental)
Project Manager/Environmental Scientist 2001 – February 2010

- Prepared CERCLA-guidance QAPPs for private industry clients.
- Experienced in performing Tier II and Tier III laboratory data validation, under both MCP and USEPA RCRA programs.
- Prepared numerous REDUA text sections for Phase II and Response Action Outcome (RAO) Statements.
- Managed environmental investigation and remediation projects for industrial, commercial, and residential sites in Massachusetts.
- Authored or reviewed numerous compliance and all types of MCP reports for projects.
- Performed Imminent Hazard Evaluations (IHEs) for both petroleum-impacted and chlorinated VOC sites.
- Remediation General Permit (RGP) application, management, and reporting for wastewater disposal.
- Performed OSHA internal health and safety management and refresher training.
- Responsible for local office safety audits and general safety program.

IT Corporation, Andover, Massachusetts
(previously d.b.a. EMCON and Wehran Engineering)
Task Manager, Environmental Scientist 1990-2001

- Performed over 200 ASTM Phase I Investigations and prepared reports.
- Field sampling activities, all environmental media.
- Task management for environmental sampling programs.
- Performed data validation for a 3-year groundwater sampling program, with EPA Contract Laboratory Program Tier III review of laboratory data packages.

Select project experience for Ms. Champagne includes:

- Aided in the performance of full CLP-level Data Validation for a private consultant client and the U.S. Air Force in relation to data collected at the Ravenna Army Ammunition Plant in Ravenna, Ohio. Project included extensive analytical testing, including methods related to explosives, PCBs, herbicides, pesticides, et. al.
- Performed extensive Tier II data validation for a private consultant client on a project located in Raynham, MA. The project analytical centered primarily on PCB contaminants.

- Performed Modified Tier II data validations for a private clients, for a project located in Bridgeport, Connecticut. The validation and evaluation was performed according to Connecticut DEEP guidelines. Produced Data Quality Assessment (DQA) spreadsheets and Data Usability Evaluation (DUE) Memos for a private consultant client.

Education

B.A., Biology, Boston University; 1989

OSHA Training:	40-Hour OSHA Health and Safety Training, US; (24-hour in 1990; 16-hour in 1994)
	8-Hour OSHA Health and Safety Training Refresher; annually, 1990-2018
Courses:	Technical Writing Course: Strategies and Styles, October 2009
	Technical Course: Groundwater Monitoring Well Design, Construction and Development, The Nielsen Environmental Field School, Inc. 2005
	Government Institutes, Inc. Course, Environmental Site Assessments From A to Z; 1998
	Professional Analytical and Consulting Services, Inc. (PACS) Course, Environmental Data Validation; 1997
Seminar:	The Revised CAM, What you Need to Know, December 2009

August, 2018

ALPHA ANALYTICAL

ELAP CERTIFICATIONS, SOPs for PFAS ANALYSIS, MDLS FOR PFAS COMPOUNDS AND QUALITY SYSTEMS MANUAL

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

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NY Lab Id No: 11148

MR. JOSEPH L. WATKINS
ALPHA ANALYTICAL
8 WALKUP DR
WESTBOROUGH, MA 01581-1019

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Bacteriology

Coliform, Total / E. coli (Qualitative)	SM 20, 21-23 9223B (-04) (Colilert)
E. coli (Enumeration)	SM 20, 21-23 9223B (-04) (Colilert)
Heterotrophic Plate Count	SM 20, 21-23 9215B (-04)

Disinfection By-products

Bromide	EPA 300.0 Rev. 2.1

Fuel Additives

Methyl tert-butyl ether	EPA 524.2
Naphthalene	EPA 524.2

Microextractibles

1,2-Dibromo-3-chloropropane	EPA 504.1
1,2-Dibromoethane	EPA 504.1

Miscellaneous

Odor	SM 21-23 2150 B (-97)
Organic Carbon, Dissolved	SM 21-23 5310C (-00)
Organic Carbon, Total	SM 21-23 5310C (-00)
Perchlorate	EPA 332.0 Rev. 1
Turbidity	SM 21-23 2130 B (-01)
	EPA 180.1 Rev. 2.0

Non-Metals

Alkalinity	SM 21-23 2320B (-97)
Chloride	EPA 300.0 Rev. 2.1
Color	SM 21-23 2120B (-01)
Cyanide	SM 20, 21-23 4500-CN E

Non-Metals

Fluoride, Total	EPA 300.0 Rev. 2.1
	SM 21-23 4500-F C (-97)
Nitrate (as N)	EPA 353.2 Rev. 2.0
	EPA 300.0 Rev. 2.1
	SM 21-23 4500-NO3 F (-00)
Nitrite (as N)	EPA 353.2 Rev. 2.0
	SM 21-23 4500-NO3 F (-00)
Orthophosphate (as P)	SM 19, 21-23 4500-P E (-99)
Solids, Total Dissolved	SM 21-23 2540C (-97)
Specific Conductance	SM 21-23 2510B (-97)
Sulfate (as SO4)	EPA 300.0 Rev. 2.1

Trihalomethanes

Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2
Total Trihalomethanes	EPA 524.2

Volatile Aromatics

1,2,3-Trichlorobenzene	EPA 524.2
1,2,4-Trichlorobenzene	EPA 524.2
1,2,4-Trimethylbenzene	EPA 524.2
1,2-Dichlorobenzene	EPA 524.2
1,3,5-Trimethylbenzene	EPA 524.2
1,3-Dichlorobenzene	EPA 524.2
1,4-Dichlorobenzene	EPA 524.2

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Volatile Aromatics

2-Chlorotoluene	EPA 524.2
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2
n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2
sec-Butylbenzene	EPA 524.2
Styrene	EPA 524.2
tert-Butylbenzene	EPA 524.2
Toluene	EPA 524.2
Total Xylenes	EPA 524.2

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 524.2
1,1,1-Trichloroethane	EPA 524.2
1,1,2,2-Tetrachloroethane	EPA 524.2
1,1,2-Trichloroethane	EPA 524.2
1,1-Dichloroethane	EPA 524.2
1,1-Dichloroethene	EPA 524.2
1,1-Dichloropropene	EPA 524.2
1,2,3-Trichloropropane	EPA 524.2

Volatile Halocarbons

1,2-Dichloroethane	EPA 524.2
1,2-Dichloropropane	EPA 524.2
1,3-Dichloropropane	EPA 524.2
2,2-Dichloropropane	EPA 524.2
Bromochloromethane	EPA 524.2
Bromomethane	EPA 524.2
Carbon tetrachloride	EPA 524.2
Chloroethane	EPA 524.2
Chloromethane	EPA 524.2
cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2
Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,2-Dichloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

Sample Preparation Methods

SM 20, 21-23 4500-CN C (-99)

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All approved analytes are listed below:

Acrylates

Acrolein (Propenal)	EPA 8260C EPA 624.1
Acrylonitrile	EPA 8260C EPA 624.1
Ethyl methacrylate	EPA 8260C
Methyl methacrylate	EPA 8260C

Amines

1,2-Diphenylhydrazine	EPA 625.1 EPA 8270D
2-Naphthylamine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 625.1 EPA 8270D
Carbazole	EPA 625.1 EPA 8270D
Diphenylamine	EPA 8270D
Pyridine	EPA 625.1 EPA 8270D

Bacteriology

Coliform, Fecal	SM 9221C E-2006
Coliform, Total	SM 9221B-2006 SM 9222B-2006

Bacteriology

Heterotrophic Plate Count	SM 18-21 9215B

Benzidines

3,3'-Dichlorobenzidine	EPA 625.1 EPA 8270D
Benzidine	EPA 625.1 EPA 8270D

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B EPA 608.3
4,4'-DDE	EPA 8081B EPA 608.3
4,4'-DDT	EPA 8081B EPA 608.3
Aldrin	EPA 8081B EPA 608.3
alpha-BHC	EPA 8081B EPA 608.3
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B EPA 608.3
Chlordane Total	EPA 8081B EPA 608.3
delta-BHC	EPA 8081B EPA 608.3
Dieldrin	EPA 8081B

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Chlorinated Hydrocarbon Pesticides

Dieldrin	EPA 608.3
Endosulfan I	EPA 8081B
	EPA 608.3
Endosulfan II	EPA 8081B
	EPA 608.3
Endosulfan sulfate	EPA 8081B
	EPA 608.3
Endrin	EPA 8081B
	EPA 608.3
Endrin aldehyde	EPA 8081B
	EPA 608.3
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
	EPA 608.3
Heptachlor epoxide	EPA 8081B
	EPA 608.3
Lindane	EPA 8081B
	EPA 608.3
Methoxychlor	EPA 8081B
	EPA 608.3
Toxaphene	EPA 8081B
	EPA 608.3

Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C

Chlorinated Hydrocarbons

1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 625.1
	EPA 8270D
2-Chloronaphthalene	EPA 625.1
	EPA 8270D
Hexachlorobenzene	EPA 625.1
	EPA 8270D
Hexachlorobutadiene	EPA 625.1
	EPA 8270D
Hexachlorocyclopentadiene	EPA 625.1
	EPA 8270D
Hexachloroethane	EPA 625.1
	EPA 8270D

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
2,4-DB	EPA 8151A
Dalapon	EPA 8151A
Dicamba	EPA 8151A
Dichloroprop	EPA 8151A
Dinoseb	EPA 8151A

Demand

Biochemical Oxygen Demand	SM 5210B-2011
Carbonaceous BOD	SM 5210B-2011

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Demand

Chemical Oxygen Demand	EPA 410.4, Rev. 2.0 (1993) SM 5220D-2011

Fuel Oxygenates

Di-isopropyl ether	EPA 8260C
Ethanol	EPA 8260C
Methyl tert-butyl ether	EPA 8260C EPA 624.1
tert-amyl methyl ether (TAME)	EPA 8260C
tert-butyl alcohol	EPA 8260C EPA 624.1
tert-butyl ethyl ether (ETBE)	EPA 8260C

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 625.1 EPA 8270D
4-Bromophenylphenyl ether	EPA 625.1 EPA 8270D
4-Chlorophenylphenyl ether	EPA 625.1 EPA 8270D
Bis(2-chloroethoxy)methane	EPA 625.1 EPA 8270D
Bis(2-chloroethyl)ether	EPA 625.1 EPA 8270D

Low Level Halocarbons

1,2-Dibromo-3-chloropropane, Low Level	EPA 8011

Low Level Halocarbons

1,2-Dibromoethane, Low Level	EPA 8011

Low Level Polynuclear Aromatics

Acenaphthene Low Level	EPA 8270D SIM
Acenaphthylene Low Level	EPA 8270D SIM
Anthracene Low Level	EPA 8270D SIM
Benzo(a)anthracene Low Level	EPA 8270D SIM
Benzo(a)pyrene Low Level	EPA 8270D SIM
Benzo(b)fluoranthene Low Level	EPA 8270D SIM
Benzo(g,h,i)perylene Low Level	EPA 8270D SIM
Benzo(k)fluoranthene Low Level	EPA 8270D SIM
Chrysene Low Level	EPA 8270D SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270D SIM
Fluoranthene Low Level	EPA 8270D SIM
Fluorene Low Level	EPA 8270D SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D SIM
Naphthalene Low Level	EPA 8270D SIM
Phenanthrene Low Level	EPA 8270D SIM
Pyrene Low Level	EPA 8270D SIM

Metals I

Iron, Total	SM 3500-Fe B-2011

Metals II

Chromium VI	EPA 7196A SM 3500-Cr B-2011

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Mineral	
Acidity	SM 2310B-2011
Alkalinity	SM 2320B-2011
Chloride	EPA 300.0, Rev. 2.1 (1993)
	SM 4500-Cl- E-2011
	EPA 9056A
Fluoride, Total	EPA 300.0, Rev. 2.1 (1993)
	SM 4500-F C-2011
	EPA 9056A
Sulfate (as SO4)	EPA 300.0, Rev. 2.1 (1993)
	SM 4500-SO4 E-2011
	EPA 9056A

Miscellaneous	
Bromide	EPA 300.0, Rev. 2.1 (1993)
Color	SM 2120B-2011
Cyanide, Total	LACHAT QuikChem 10-204-00-1-X
	EPA 9014
	SM 4500-CN E-2011
	EPA 9012B
Formaldehyde	EPA 8315A
Oil and Grease Total Recoverable (HEM)	EPA 1664A
	EPA 1664B
Organic Carbon, Total	SM 5310C-2011
	EPA 9060A
Perchlorate	EPA 6860
Phenols	EPA 420.1 (Rev. 1978)

Miscellaneous	
Phenols	EPA 9065
Specific Conductance	EPA 120.1 (Rev. 1982)
	SM 2510B-2011
	EPA 9050A
Sulfide (as S)	SM 4500-S2- D-2011
Surfactant (MBAS)	SM 5540C-2011
Total Recoverable Petroleum Hydrocarbor	EPA 1664A
	EPA 1664B
Turbidity	SM 2130 B-2011
	EPA 180.1, Rev. 2.0 (1993)

Nitroaromatics and Isophorone	
1,3-Dinitrobenzene	EPA 8270D
2,4-Dinitrotoluene	EPA 625.1
	EPA 8270D
2,6-Dinitrotoluene	EPA 625.1
	EPA 8270D
Isophorone	EPA 625.1
	EPA 8270D
Nitrobenzene	EPA 625.1
	EPA 8270D

Nitrosoamines	
N-Nitrosodimethylamine	EPA 625.1
	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 625.1
	EPA 8270D

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Nitrosoamines	
N-Nitrosodiphenylamine	EPA 625.1
	EPA 8270D
Nutrient	
Ammonia (as N)	SM 4500-NH3 H-2011
	EPA 350.1, Rev. 2.0 (1993)
Kjeldahl Nitrogen, Total	EPA 351.1 (Rev. 1978)
	SM 4500-NH3 H-2011
Nitrate (as N)	EPA 353.2, Rev. 2.0 (1993)
	EPA 300.0, Rev. 2.1 (1993)
	SM 4500-NO3 F-2011
	EPA 9056A
Nitrate-Nitrite (as N)	EPA 353.2, Rev. 2.0 (1993)
	SM 4500-NO3 F-2011
Nitrite (as N)	EPA 353.2, Rev. 2.0 (1993)
	SM 4500-NO3 F-2011
	SM 4500-NO2 B-2011
Orthophosphate (as P)	SM 4500-P E-2011
Phosphorus, Total	SM 4500-P E-2011
Organophosphate Pesticides	
Atrazine	EPA 8270D
Parathion ethyl	EPA 8270D
Thionazin	EPA 8270D
Petroleum Hydrocarbons	
Diesel Range Organics	EPA 8015D

Petroleum Hydrocarbons	
Gasoline Range Organics	EPA 8015D
Phthalate Esters	
Benzyl butyl phthalate	EPA 625.1
	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 625.1
	EPA 8270D
Diethyl phthalate	EPA 625.1
	EPA 8270D
Dimethyl phthalate	EPA 625.1
	EPA 8270D
Di-n-butyl phthalate	EPA 625.1
	EPA 8270D
Di-n-octyl phthalate	EPA 625.1
	EPA 8270D
Polychlorinated Biphenyls	
Aroclor 1016 (PCB-1016)	EPA 8082A
	EPA 608.3
Aroclor 1221 (PCB-1221)	EPA 8082A
	EPA 608.3
Aroclor 1232 (PCB-1232)	EPA 8082A
	EPA 608.3
Aroclor 1242 (PCB-1242)	EPA 8082A
	EPA 608.3
Aroclor 1248 (PCB-1248)	EPA 8082A
	EPA 608.3

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WESTBOROUGH, MA 01581-1019

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is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Polychlorinated Biphenyls

Aroclor 1254 (PCB-1254)	EPA 8082A
	EPA 608.3
Aroclor 1260 (PCB-1260)	EPA 8082A
	EPA 608.3
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A

Polynuclear Aromatics

Acenaphthene	EPA 625.1
	EPA 8270D
Acenaphthylene	EPA 625.1
	EPA 8270D
Anthracene	EPA 625.1
	EPA 8270D
Benzo(a)anthracene	EPA 625.1
	EPA 8270D
Benzo(a)pyrene	EPA 625.1
	EPA 8270D
Benzo(b)fluoranthene	EPA 625.1
	EPA 8270D
Benzo(g,h,i)perylene	EPA 625.1
	EPA 8270D
Benzo(k)fluoranthene	EPA 625.1
	EPA 8270D
Chrysene	EPA 625.1
	EPA 8270D

Polynuclear Aromatics

Dibenzo(a,h)anthracene	EPA 625.1
	EPA 8270D
Fluoranthene	EPA 625.1
	EPA 8270D
Fluorene	EPA 625.1
	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 625.1
	EPA 8270D
Naphthalene	EPA 625.1
	EPA 8270D
Phenanthrene	EPA 625.1
	EPA 8270D
Pyrene	EPA 625.1
	EPA 8270D

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 625.1
	EPA 8270D
2,4,6-Trichlorophenol	EPA 625.1
	EPA 8270D
2,4-Dichlorophenol	EPA 625.1
	EPA 8270D
2,4-Dimethylphenol	EPA 625.1
	EPA 8270D
2,4-Dinitrophenol	EPA 625.1

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOSEPH L. WATKINS
ALPHA ANALYTICAL
8 WALKUP DR
WESTBOROUGH, MA 01581-1019

NY Lab Id No: 11148

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Priority Pollutant Phenols

2,4-Dinitrophenol	EPA 8270D
2-Chlorophenol	EPA 625.1 EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 625.1 EPA 8270D
2-Methylphenol	EPA 625.1 EPA 8270D
2-Nitrophenol	EPA 625.1 EPA 8270D
3-Methylphenol	EPA 625.1 EPA 8270D
4-Chloro-3-methylphenol	EPA 625.1 EPA 8270D
4-Methylphenol	EPA 625.1 EPA 8270D
4-Nitrophenol	EPA 625.1 EPA 8270D
Cresols, Total	EPA 8270D
Pentachlorophenol	EPA 625.1 EPA 8270D
Phenol	EPA 625.1 EPA 8270D

Residue

Settleable Solids	SM 2540 F-2011
Solids, Total	SM 2540 B-2011

Residue

Solids, Total Dissolved	SM 2540 C-2011
Solids, Total Suspended	SM 2540 D-2011
Solids, Volatile	SM 2540 E-2011

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 625.1 EPA 8270D
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D
n-Decane	EPA 625.1
n-Octadecane	EPA 625.1

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C EPA 624.1
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C

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All approved analytes are listed below:

Volatile Halocarbons

2-Chloroethylvinyl ether	EPA 624.1
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
	EPA 624.1
Bromoform	EPA 8260C
	EPA 624.1
Bromomethane	EPA 8260C
	EPA 624.1
Carbon tetrachloride	EPA 8260C
	EPA 624.1
Chloroethane	EPA 8260C
	EPA 624.1
Chloroform	EPA 8260C
	EPA 624.1
Chloromethane	EPA 8260C
	EPA 624.1
cis-1,2-Dichloroethene	EPA 8260C
	EPA 624.1
cis-1,3-Dichloropropene	EPA 8260C
	EPA 624.1
Dibromochloromethane	EPA 8260C
	EPA 624.1
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
	EPA 624.1
Hexachlorobutadiene, Volatile	EPA 8260C

Volatile Halocarbons

Methyl iodide	EPA 8260C
Methylene chloride	EPA 8260C
	EPA 624.1
Tetrachloroethene	EPA 8260C
	EPA 624.1
trans-1,2-Dichloroethene	EPA 8260C
	EPA 624.1
trans-1,3-Dichloropropene	EPA 8260C
	EPA 624.1
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
	EPA 624.1
Trichlorofluoromethane	EPA 8260C
	EPA 624.1
Vinyl chloride	EPA 8260C
	EPA 624.1

Volatiles Organics

1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
	EPA 624.1
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C

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All approved analytes are listed below:

Volatile Aromatics

1,3-Dichlorobenzene	EPA 624.1
1,4-Dichlorobenzene	EPA 8260C
	EPA 624.1
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
	EPA 624.1
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
	EPA 624.1
Ethyl benzene	EPA 8260C
	EPA 624.1
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
	EPA 624.1
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
	EPA 624.1
Total Xylenes	EPA 8260C

Volatile Aromatics

Total Xylenes	EPA 624.1

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
	EPA 624.1
1,1,2,2-Tetrachloroethane	EPA 8260C
	EPA 624.1
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
	EPA 624.1
1,1-Dichloroethane	EPA 8260C
	EPA 624.1
1,1-Dichloroethene	EPA 8260C
	EPA 624.1
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
	EPA 624.1
1,2-Dichloropropane	EPA 8260C
	EPA 624.1
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C

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All approved analytes are listed below:

Volatiles Organics	
Di-ethyl ether	EPA 8260C
Ethyl Acetate	EPA 8260C
Isopropanol	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
n-Butanol	EPA 8260C
o-Toluidine	EPA 8270D
Tetrahydrofuran	EPA 8260C
Vinyl acetate	EPA 8260C
	EPA 624.1

Sample Preparation Methods	
	SM 4500-P B(5)-2011
	EPA 5030C
	SM 4500-CN B-2011 and C-2011
	EPA 9030B
	EPA 3510C
	SM 4500-NH3 B-2011
	SM 4500-F B-2011
	SM 4500-N Org B-2011 or C-2011
	EPA 9010C

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All approved analytes are listed below:

Acrylates

Acrolein (Propenal)	EPA 8260C
Acrylonitrile	EPA 8260C
Ethyl methacrylate	EPA 8260C

Amines

1,2-Diphenylhydrazine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D
Diphenylamine	EPA 8270D

Benzidines

3,3'-Dichlorobenzidine	EPA 8270D
Benzidine	EPA 8270D

Characteristic Testing

Corrosivity	EPA 9040C
	EPA 9045D
Free Liquids	EPA 9095B
Ignitability	EPA 1030
	EPA 1010A
Synthetic Precipitation Leaching Proc.	EPA 1312
TCLP	EPA 1311

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
Atrazine	EPA 8270D
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Pentachloronitrobenzene	EPA 8270D
Toxaphene	EPA 8081B

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Chlorinated Hydrocarbons

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D
2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 8270D
Hexachlorobutadiene	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 8270D

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
2,4-DB	EPA 8151A
Dalapon	EPA 8151A
Dicamba	EPA 8151A
Dichloroprop	EPA 8151A
MCPA	EPA 8151A
MCPP	EPA 8151A

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270D
4-Bromophenylphenyl ether	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270D

Low Level Polynuclear Aromatic Hydrocarbons

Acenaphthene Low Level	EPA 8270D SIM
Acenaphthylene Low Level	EPA 8270D SIM
Anthracene Low Level	EPA 8270D SIM
Benzo(a)anthracene Low Level	EPA 8270D SIM
Benzo(a)pyrene Low Level	EPA 8270D SIM
Benzo(b)fluoranthene Low Level	EPA 8270D SIM
Benzo(g,h,i)perylene Low Level	EPA 8270D SIM
Benzo(k)fluoranthene Low Level	EPA 8270D SIM
Chrysene Low Level	EPA 8270D SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270D SIM
Fluoranthene Low Level	EPA 8270D SIM
Fluorene Low Level	EPA 8270D SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D SIM
Naphthalene Low Level	EPA 8270D SIM
Phenanthrene Low Level	EPA 8270D SIM
Pyrene Low Level	EPA 8270D SIM

Metals II

Chromium VI	EPA 7196A

Minerals

Chloride	EPA 9251
Sulfate (as SO4)	EPA 9038

Miscellaneous

Cyanide, Total	EPA 9014 EPA 9012B

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All approved analytes are listed below:

Miscellaneous

Extractable Organic Halides	EPA 9023
Phenols	EPA 9065
Specific Conductance	EPA 9050A

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 8270D
2,6-Dinitrotoluene	EPA 8270D
Isophorone	EPA 8270D
Nitrobenzene	EPA 8270D
Pyridine	EPA 8270D

Nitrosoamines

N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D

Organophosphate Pesticides

Parathion ethyl	EPA 8270D

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D
Gasoline Range Organics	EPA 8015D
Oil and Grease Total Recoverable (HEM)	EPA 9071B (Solvent:Hexane)

Phthalate Esters

Benzyl butyl phthalate	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270D
Diethyl phthalate	EPA 8270D

Phthalate Esters

Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 8270D
Di-n-octyl phthalate	EPA 8270D

Polychlorinated Biphenyls

Aroclor 1016 (PCB-1016)	EPA 8082A
Aroclor 1016 (PCB-1016) in Oil	EPA 8082A
Aroclor 1221 (PCB-1221)	EPA 8082A
Aroclor 1221 (PCB-1221) in Oil	EPA 8082A
Aroclor 1232 (PCB-1232)	EPA 8082A
Aroclor 1232 (PCB-1232) in Oil	EPA 8082A
Aroclor 1242 (PCB-1242)	EPA 8082A
Aroclor 1242 (PCB-1242) in Oil	EPA 8082A
Aroclor 1248 (PCB-1248)	EPA 8082A
Aroclor 1248 (PCB-1248) in Oil	EPA 8082A
Aroclor 1254 (PCB-1254)	EPA 8082A
Aroclor 1254 (PCB-1254) in Oil	EPA 8082A
Aroclor 1260 (PCB-1260)	EPA 8082A
Aroclor 1260 (PCB-1260) in Oil	EPA 8082A
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1262 (PCB-1262) in Oil	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A
Aroclor 1268 (PCB-1268) in Oil	EPA 8082A

Polynuclear Aromatic Hydrocarbons

Acenaphthene	EPA 8270D
Acenaphthylene	EPA 8270D

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All approved analytes are listed below:

Polynuclear Aromatic Hydrocarbons

Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(g,h,i)perylene	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D
Chrysene	EPA 8270D
Dibenzo(a,h)anthracene	EPA 8270D
Fluoranthene	EPA 8270D
Fluorene	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 8270D
Phenanthrene	EPA 8270D
Pyrene	EPA 8270D

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D
2,4-Dichlorophenol	EPA 8270D
2,4-Dimethylphenol	EPA 8270D
2,4-Dinitrophenol	EPA 8270D
2-Chlorophenol	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D
2-Methylphenol	EPA 8270D
2-Nitrophenol	EPA 8270D

Priority Pollutant Phenols

3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 8270D
Pentachlorophenol	EPA 8270D
Phenol	EPA 8270D

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 8270D
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D

Volatile Aromatics

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C

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ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
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Volatile Aromatics

2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
m/p-Xylenes	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
o-Xylene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
Total Xylenes	EPA 8260C

Volatile Halocarbons

1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
1,1-Dichloroethane	EPA 8260C

Volatile Halocarbons

1,1-Dichloroethene	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
Bromoform	EPA 8260C
Bromomethane	EPA 8260C
Carbon tetrachloride	EPA 8260C
Chloroethane	EPA 8260C
Chloroform	EPA 8260C
Chloromethane	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C
Dibromochloromethane	EPA 8260C
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 8260C
Tetrachloroethene	EPA 8260C

Serial No.: 59553

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NELAP RECOGNIZED TNI ACCREDITATION BODY

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOSEPH L. WATKINS
ALPHA ANALYTICAL
8 WALKUP DR
WESTBOROUGH, MA 01581-1019

NY Lab Id No: 11148

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Volatile Halocarbons

trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 8260C
Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C

Volatile Organics

1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Di-ethyl ether	EPA 8260C
Ethyl Acetate	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
n-Butanol	EPA 8260C
tert-butyl alcohol	EPA 8260C
Vinyl acetate	EPA 8260C

Sample Preparation Methods

EPA 5035A-L
EPA 5035A-H

Sample Preparation Methods

EPA 3580A
EPA 3540C
EPA 3546
EPA 3060A
EPA 9010C

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CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

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MR. JOHN TRIMBLE
ALPHA ANALYTICAL
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards (2003) for the category ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Metals I

Arsenic, Total	EPA 200.8 Rev. 5.4
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Metals II

Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4

Metals II

Nickel, Total	EPA 200.8 Rev. 5.4
Thallium, Total	EPA 200.8 Rev. 5.4
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

Metals III

Boron, Total	EPA 200.7 Rev. 4.4
Calcium, Total	EPA 200.7 Rev. 4.4
Magnesium, Total	EPA 200.7 Rev. 4.4
Potassium, Total	EPA 200.7 Rev. 4.4
Sodium, Total	EPA 200.7 Rev. 4.4

Miscellaneous

1,4-Dioxane	EPA 522

Non-Metals

Calcium Hardness	EPA 200.7 Rev. 4.4

Perfluorinated Alkyl Acids

Perfluorooctanesulfonic acid (PFOS)	EPA 537
Perfluorooctanoic acid (PFOA)	EPA 537

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MANSFIELD, MA 02048

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All approved analytes are listed below:

Amines

1,2-Diphenylhydrazine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D
Pyridine	EPA 8270D

Benzidines

3,3'-Dichlorobenzidine	EPA 8270D
Benzidine	EPA 8270D

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B

Chlorinated Hydrocarbon Pesticides

Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Mirex	EPA 8081B
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D
2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 8081B EPA 8270D
Hexachlorobutadiene	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 8270D

Dioxins and Furans

1,2,3,4,6,7,8,9-Octachlorodibenzofuran	EPA 8290A EPA 1613B
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-diox	EPA 8290A EPA 1613B
1,2,3,4,6,7,8-Heptachlorodibenzofuran	EPA 8290A

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MANSFIELD, MA 02048

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All approved analytes are listed below:

Dioxins and Furans

1,2,3,4,6,7,8-Heptachlorodibenzofuran	EPA 1613B
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxi	EPA 8290A
	EPA 1613B
1,2,3,4,7,8,9-Heptachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,4,7,8-Hexachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
1,2,3,6,7,8-Hexachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
1,2,3,7,8,9-Hexachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
1,2,3,7,8-Pentachlorodibenzofuran	EPA 8290A
	EPA 1613B
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B
2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290A
	EPA 1613B
2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290A
	EPA 1613B
2,3,7,8-Tetrachlorodibenzofuran	EPA 8290A

Dioxins and Furans

2,3,7,8-Tetrachlorodibenzofuran	EPA 1613B
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 8290A
	EPA 1613B

Dissolved Gases

Ethane	RSK-175
Ethene (Ethylene)	RSK-175
Methane	RSK-175
Propane	RSK-175

Fuel Oxygenates

Ethanol	EPA 8015D
tert-amyl alcohol	EPA 8015D
tert-butyl alcohol	EPA 8015D

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270D
4-Bromophenylphenyl ether	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270D

Low Level Polynuclear Aromatics

Acenaphthene Low Level	EPA 8270D SIM
Acenaphthylene Low Level	EPA 8270D SIM
Anthracene Low Level	EPA 8270D SIM
Benzo(a)anthracene Low Level	EPA 8270D SIM
Benzo(a)pyrene Low Level	EPA 8270D SIM

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Low Level Polynuclear Aromatics

Benzo(b)fluoranthene Low Level	EPA 8270D SIM
Benzo(g,h,i)perylene Low Level	EPA 8270D SIM
Benzo(k)fluoranthene Low Level	EPA 8270D SIM
Chrysene Low Level	EPA 8270D SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270D SIM
Fluoranthene Low Level	EPA 8270D SIM
Fluorene Low Level	EPA 8270D SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D SIM
Naphthalene Low Level	EPA 8270D SIM
Phenanthrene Low Level	EPA 8270D SIM
Pyrene Low Level	EPA 8270D SIM

Metals I

Barium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Cadmium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Calcium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
Chromium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D

Metals I

Chromium, Total	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Copper, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Iron, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Lead, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Magnesium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
Manganese, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Nickel, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Potassium, Total	EPA 200.7, Rev. 4.4 (1994)

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WADSWORTH CENTER

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320 FORBES BOULEVARD
MANSFIELD, MA 02048

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All approved analytes are listed below:

Metals I

Potassium, Total	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Silver, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Sodium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Strontium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B

Metals II

Aluminum, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Antimony, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Arsenic, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D

Metals II

Arsenic, Total	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Beryllium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Mercury, Low Level	EPA 1631E
Mercury, Total	EPA 245.1, Rev. 3.0 (1994)
	EPA 7470A
Selenium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Vanadium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Zinc, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)

Metals III

Cobalt, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B

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All approved analytes are listed below:

Metals III

Cobalt, Total	EPA 200.8, Rev. 5.4 (1994)
Molybdenum, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Thallium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
	EPA 200.8, Rev. 5.4 (1994)
Tin, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
Titanium, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B

Mineral

Hardness, Total	EPA 200.7, Rev. 4.4 (1994)
	SM 2340B-2011

Miscellaneous

Boron, Total	EPA 200.7, Rev. 4.4 (1994)
	EPA 6010D
	EPA 6020B
Silica, Dissolved	EPA 200.7, Rev. 4.4 (1994)

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 8270D
2,6-Dinitrotoluene	EPA 8270D
Isophorone	EPA 8270D
Nitrobenzene	EPA 8270D

Nitrosoamines

N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D

Organophosphate Pesticides

Atrazine	EPA 8270D

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D

Phthalate Esters

Benzyl butyl phthalate	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270D
Diethyl phthalate	EPA 8270D
Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 8270D
Di-n-octyl phthalate	EPA 8270D

Polychlorinated Biphenyls

Aroclor 1016 (PCB-1016)	EPA 8082A
Aroclor 1221 (PCB-1221)	EPA 8082A
Aroclor 1232 (PCB-1232)	EPA 8082A

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All approved analytes are listed below:

Polychlorinated Biphenyls	
Aroclor 1242 (PCB-1242)	EPA 8082A
Aroclor 1248 (PCB-1248)	EPA 8082A
Aroclor 1254 (PCB-1254)	EPA 8082A
Aroclor 1260 (PCB-1260)	EPA 8082A
Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A
PCB 118	EPA 8082A
PCB 128	EPA 8082A
PCB 138	EPA 8082A
PCB 170	EPA 8082A
PCB 18	EPA 8082A
PCB 206	EPA 8082A
PCB 44	EPA 8082A
PCB 52	EPA 8082A
PCB 66	EPA 8082A
Polynuclear Aromatics	
Acenaphthene	EPA 8270D
Acenaphthylene	EPA 8270D
Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(g,h,i)perylene	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D
Chrysene	EPA 8270D

Polynuclear Aromatics	
Dibenzo(a,h)anthracene	EPA 8270D
Fluoranthene	EPA 8270D
Fluorene	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 8270D
Phenanthrene	EPA 8270D
Pyrene	EPA 8270D
Priority Pollutant Phenols	
2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D
2,4-Dichlorophenol	EPA 8270D
2,4-Dimethylphenol	EPA 8270D
2,4-Dinitrophenol	EPA 8270D
2-Chlorophenol	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D
2-Methylphenol	EPA 8270D
2-Nitrophenol	EPA 8270D
3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 8270D
Pentachlorophenol	EPA 8270D
Phenol	EPA 8270D

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Semi-Volatile Organics	
1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 8270D
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D
Volatiles Organics	
1,4-Dioxane	EPA 8270D SIM
Ethylene Glycol	EPA 8015D
Isobutyl alcohol	EPA 8015D
Methanol	EPA 8015D
Sample Preparation Methods	
	EPA 3015A
	EPA 3005A
	EPA 3510C

Serial No.: 59731

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Expires 12:01 AM April 01, 2020
Issued April 01, 2019

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. JOHN TRIMBLE
ALPHA ANALYTICAL
320 FORBES BOULEVARD
MANSFIELD, MA 02048

NY Lab Id No: 11627

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National Environmental Laboratory Accreditation Conference Standards (2003) for the category
ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved analytes are listed below:

Amines

1,2-Diphenylhydrazine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D

Benzidines

3,3'-Dichlorobenzidine	EPA 8270D
Benzidine	EPA 8270D

Chlorinated Hydrocarbon Pesticides

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B
alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B

Chlorinated Hydrocarbon Pesticides

Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Mirex	EPA 8081B
Pentachloronitrobenzene	EPA 8270D
Toxaphene	EPA 8081B

Chlorinated Hydrocarbons

1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D
2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 8270D
Hexachlorobutadiene	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 8270D

Dioxins and Furans

1,2,3,4,6,7,8,9-Octachlorodibenzofuran	EPA 8290A
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-diox	EPA 8290A
1,2,3,4,6,7,8-Heptachlorodibenzofuran	EPA 8290A
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxi	EPA 8290A
1,2,3,4,7,8,9-Heptachlorodibenzofuran	EPA 8290A
1,2,3,4,7,8-Hexachlorodibenzofuran	EPA 8290A

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All approved analytes are listed below:

Dioxins and Furans

1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	EPA 8290A
1,2,3,6,7,8-Hexachlorodibenzofuran	EPA 8290A
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	EPA 8290A
1,2,3,7,8,9-Hexachlorodibenzofuran	EPA 8290A
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	EPA 8290A
1,2,3,7,8-Pentachlorodibenzofuran	EPA 8290A
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	EPA 8290A
2,3,4,6,7,8-Hexachlorodibenzofuran	EPA 8290A
2,3,4,7,8-Pentachlorodibenzofuran	EPA 8290A
2,3,7,8-Tetrachlorodibenzofuran	EPA 8290A
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 8290A

Haloethers

2,2'-Oxybis(1-chloropropane)	EPA 8270D
4-Bromophenylphenyl ether	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270D

Low Level Polynuclear Aromatic Hydrocarbons

Acenaphthene Low Level	EPA 8270D SIM
Acenaphthylene Low Level	EPA 8270D SIM
Anthracene Low Level	EPA 8270D SIM
Benzo(a)anthracene Low Level	EPA 8270D SIM
Benzo(a)pyrene Low Level	EPA 8270D SIM
Benzo(b)fluoranthene Low Level	EPA 8270D SIM
Benzo(g,h,i)perylene Low Level	EPA 8270D SIM
Benzo(k)fluoranthene Low Level	EPA 8270D SIM
Chrysene Low Level	EPA 8270D SIM
Dibenzo(a,h)anthracene Low Level	EPA 8270D SIM
Fluoranthene Low Level	EPA 8270D SIM
Fluorene Low Level	EPA 8270D SIM
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D SIM
Naphthalene Low Level	EPA 8270D SIM
Phenanthrene Low Level	EPA 8270D SIM
Pyrene Low Level	EPA 8270D SIM

Metals I

Barium, Total	EPA 6010D EPA 6020B
Cadmium, Total	EPA 6010D EPA 6020B
Calcium, Total	EPA 6010D EPA 6020B
Chromium, Total	EPA 6010D EPA 6020B
Copper, Total	EPA 6010D EPA 6020B
Iron, Total	EPA 6010D EPA 6020B
Lead, Total	EPA 6010D EPA 6020B
Magnesium, Total	EPA 6010D

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Metals I

Magnesium, Total	EPA 6020B
Manganese, Total	EPA 6010D
	EPA 6020B
Nickel, Total	EPA 6010D
	EPA 6020B
Potassium, Total	EPA 6010D
	EPA 6020B
Silver, Total	EPA 6010D
	EPA 6020B
Sodium, Total	EPA 6010D
	EPA 6020B
Strontium, Total	EPA 6010D
	EPA 6020B

Metals II

Aluminum, Total	EPA 6010D
	EPA 6020B
Antimony, Total	EPA 6010D
	EPA 6020B
Arsenic, Total	EPA 6010D
	EPA 6020B
Beryllium, Total	EPA 6010D
	EPA 6020B
Mercury, Total	EPA 7471B
	EPA 7474
Selenium, Total	EPA 6010D
Selenium, Total	EPA 6020B
Vanadium, Total	EPA 6010D
	EPA 6020B
Zinc, Total	EPA 6010D
	EPA 6020B

Metals III

Cobalt, Total	EPA 6010D
	EPA 6020B
Molybdenum, Total	EPA 6010D
	EPA 6020B
Thallium, Total	EPA 6010D
	EPA 6020B
Tin, Total	EPA 6010D
	EPA 6020B
Titanium, Total	EPA 6010D
	EPA 6020B

Miscellaneous

Boron, Total	EPA 6010D
	EPA 6020B
Organic Carbon, Total	Lloyd Kahn Method
	EPA 9060A

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 8270D
2,6-Dinitrotoluene	EPA 8270D

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Nitroaromatics and Isophorone

Isophorone	EPA 8270D
Nitrobenzene	EPA 8270D
Pyridine	EPA 8270D

Nitrosoamines

N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D

Petroleum Hydrocarbons

Diesel Range Organics	EPA 8015D

Phthalate Esters

Benzyl butyl phthalate	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270D
Diethyl phthalate	EPA 8270D
Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 8270D
Di-n-octyl phthalate	EPA 8270D

Polychlorinated Biphenyls

Aroclor 1016 (PCB-1016)	EPA 8082A
Aroclor 1221 (PCB-1221)	EPA 8082A
Aroclor 1232 (PCB-1232)	EPA 8082A
Aroclor 1242 (PCB-1242)	EPA 8082A
Aroclor 1248 (PCB-1248)	EPA 8082A
Aroclor 1254 (PCB-1254)	EPA 8082A
Aroclor 1260 (PCB-1260)	EPA 8082A

Polychlorinated Biphenyls

Aroclor 1262 (PCB-1262)	EPA 8082A
Aroclor 1268 (PCB-1268)	EPA 8082A
PCB 1	EPA 8082A
PCB 101	EPA 8082A
PCB 110	EPA 8082A
PCB 118	EPA 8082A
PCB 128	EPA 8082A
PCB 138	EPA 8082A
PCB 141	EPA 8082A
PCB 151	EPA 8082A
PCB 153	EPA 8082A
PCB 170	EPA 8082A
PCB 18	EPA 8082A
PCB 180	EPA 8082A
PCB 183	EPA 8082A
PCB 187	EPA 8082A
PCB 206	EPA 8082A
PCB 31	EPA 8082A
PCB 44	EPA 8082A
PCB 5	EPA 8082A
PCB 52	EPA 8082A
PCB 66	EPA 8082A
PCB 87	EPA 8082A

Polynuclear Aromatic Hydrocarbons

Acenaphthene	EPA 8270D

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Polynuclear Aromatic Hydrocarbons

Acenaphthylene	EPA 8270D
Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(g,h,i)perylene	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D
Chrysene	EPA 8270D
Dibenzo(a,h)anthracene	EPA 8270D
Fluoranthene	EPA 8270D
Fluorene	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 8270D
Phenanthrene	EPA 8270D
Pyrene	EPA 8270D

Priority Pollutant Phenols

2,3,4,6 Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D
2,4-Dichlorophenol	EPA 8270D
2,4-Dimethylphenol	EPA 8270D
2,4-Dinitrophenol	EPA 8270D
2-Chlorophenol	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D
2-Methylphenol	EPA 8270D

Priority Pollutant Phenols

2-Nitrophenol	EPA 8270D
3-Methylphenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 8270D
Pentachlorophenol	EPA 8270D
Phenol	EPA 8270D

Semi-Volatile Organics

1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 8270D
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D

Volatile Organics

Ethylene Glycol	EPA 8015D
Isobutyl alcohol	EPA 8015D
tert-butyl alcohol	EPA 8015D

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Sample Preparation Methods

EPA 3570
EPA 3580A
EPA 3050B
EPA 3540C
EPA 3051A

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All approved analytes are listed below:

Acrylates

Acetonitrile	EPA TO-15
Acrylonitrile	EPA TO-15
Methyl methacrylate	EPA TO-15

Chlorinated Hydrocarbons

1,2,4-Trichlorobenzene	EPA TO-15
Hexachlorobutadiene	EPA TO-15

Metals I

Lead, Total	40 CFR PART 50 2013 APP G

Miscellaneous

Formaldehyde	EPA TO-11A

Polychlorinated Biphenyls

PCBs and Aroclors	EPA TO-10A

Polynuclear Aromatics

Acenaphthene	EPA TO-13A
Acenaphthylene	EPA TO-13A
Anthracene	EPA TO-13A
Benzo(a)anthracene	EPA TO-13A
Benzo(a)pyrene	EPA TO-13A
Benzo(b)fluoranthene	EPA TO-13A
Benzo(g,h,i)perylene	EPA TO-13A
Benzo(k)fluoranthene	EPA TO-13A
Chrysene	EPA TO-13A
Dibenzo(a,h)anthracene	EPA TO-13A

Polynuclear Aromatics

Fluoranthene	EPA TO-13A
Fluorene	EPA TO-13A
Indeno(1,2,3-cd)pyrene	EPA TO-13A
Naphthalene	EPA TO-13A EPA TO-15
Phenanthrene	EPA TO-13A
Pyrene	EPA TO-13A

Purgeable Aromatics

1,2,4-Trimethylbenzene	EPA TO-15
1,2-Dichlorobenzene	EPA TO-15
1,3,5-Trimethylbenzene	EPA TO-15
1,3-Dichlorobenzene	EPA TO-15
1,4-Dichlorobenzene	EPA TO-15
2-Chlorotoluene	EPA TO-15
Benzene	EPA TO-15
Chlorobenzene	EPA TO-15
Ethyl benzene	EPA TO-15
Isopropylbenzene	EPA TO-15
m/p-Xylenes	EPA TO-15
o-Xylene	EPA TO-15
Styrene	EPA TO-15
Toluene	EPA TO-15
Total Xylenes	EPA TO-15

Purgeable Halocarbons

1,1,1-Trichloroethane	EPA TO-15

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Purgeable Halocarbons

1,1,2,2-Tetrachloroethane	EPA TO-15
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA TO-15
1,1,2-Trichloroethane	EPA TO-15
1,1-Dichloroethane	EPA TO-15
1,1-Dichloroethene	EPA TO-15
1,2-Dibromo-3-chloropropane	EPA TO-15
1,2-Dibromoethane	EPA TO-15
1,2-Dichloroethane	EPA TO-15
1,2-Dichloropropane	EPA TO-15
3-Chloropropene (Allyl chloride)	EPA TO-15
Bromodichloromethane	EPA TO-15
Bromoform	EPA TO-15
Bromomethane	EPA TO-15
Carbon tetrachloride	EPA TO-15
Chloroethane	EPA TO-15
Chloroform	EPA TO-15
Chloromethane	EPA TO-15
cis-1,2-Dichloroethene	EPA TO-15
cis-1,3-Dichloropropene	EPA TO-15
Dibromochloromethane	EPA TO-15
Dichlorodifluoromethane	EPA TO-15
Methylene chloride	EPA TO-15
Tetrachloroethene	EPA TO-15
trans-1,2-Dichloroethene	EPA TO-15
trans-1,3-Dichloropropene	EPA TO-15
Trichloroethene	EPA TO-15

Purgeable Halocarbons

Trichlorofluoromethane	EPA TO-15
Vinyl bromide	EPA TO-15
Vinyl chloride	EPA TO-15

Volatile Chlorinated Organics

Benzyl chloride	EPA TO-15

Volatile Organics

1,2-Dichlorotetrafluoroethane	EPA TO-15
1,3-Butadiene	EPA TO-15
1,4-Dioxane	EPA TO-15
2,2,4-Trimethylpentane	EPA TO-15
2,5-Dimethylbenzaldehyde	EPA TO-11A
2-Butanone (Methylethyl ketone)	EPA TO-15
4-Methyl-2-Pentanone	EPA TO-15
Acetaldehyde	EPA TO-11A EPA TO-15
Acetone	EPA TO-11A EPA TO-15
Acrolein (Propenal)	EPA TO-15
Benzaldehyde	EPA TO-11A
Butyraldehyde	EPA TO-11A
Carbon Disulfide	EPA TO-15
Crotonaldehyde	EPA TO-11A
Cyclohexane	EPA TO-15
Hexanaldehyde	EPA TO-11A
Hexane	EPA TO-15

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Volatile Organics

Isopropanol	EPA TO-15
Isovaleraldehyde	EPA TO-11A
Methanol	EPA TO-15
Methyl tert-butyl ether	EPA TO-15
m-Tolualdehyde	EPA TO-11A
n-Heptane	EPA TO-15
o-Tolualdehyde	EPA TO-11A
Propionaldehyde	EPA TO-11A
p-Tolualdehyde	EPA TO-11A
tert-butyl alcohol	EPA TO-15
Valeraldehyde	EPA TO-11A
Vinyl acetate	EPA TO-15

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Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (LC/MS/MS)

Reference: EPA Method 537, Version 1.1, September 2009, EPA Document #: EPA/600/R-08/09

EPA Method 537.1, Version 1, November 2018, EPA Document #: EPA/600/R-18/352

Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 5.2, .2019

1. Scope and Application

Matrices: Drinking water, Non-potable Water, and Soil Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

1.1 This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water and soil Matrices. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters for the compounds listed in Table 1.

1.2 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.

1.3 This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS 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

2.1 A 250-mL water sample is fortified with extracted internal standards (EIS) and passed through a solid phase extraction (WAX) cartridge containing a mixed mode, Weak Anion Exchange, reversed phase, water-wettable polymer to extract the method analytes and isotopically-labeled compounds. The compounds are eluted from the solid phase in two fractions with methanol followed by a small amount of 2% ammonium hydroxide in methanol solution. The extract is concentrated with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 80:20% (vol/vol) methanol:water. A 3 µl injection is made into an LC equipped with a C18 column that is interfaced to an MS/MS. The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the isotope dilution technique. Extracted Internal Standards (EIS) analytes are used to monitor the extraction efficiency of the method analytes.

2.2 Method Modifications from Reference

None.

Table 1

Parameter	Acronym	CAS
PERFLUOROALKYL ETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	62037-80-3
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
PERFLUOROALKYLCARBOXILIC ACIDS (PFCAs)		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA *	307-24-4
Perfluoroheptanoic acid	PFHpA *	375-85-9
Perfluorooctanoic acid	PFOA *	335-67-1
Perfluorononanoic acid	PFNA *	375-95-1
Perfluorodecanoic acid	PFDA *	335-76-2
Perfluoroundecanoic acid	PFUnA *	2058-94-8
Perfluorododecanoic acid	PFDoA *	307-55-1
Perfluorotridecanoic acid	PFTrDA *	72629-94-8
Perfluorotetradecanoic acid	PFTA *	376-06-7
Perfluorohexadecanoic acid	PFHxDA	67905-19-5
Perfluorooctadecanoic acid	PFODA	16517-11-6
PERFLUOROALKYLSULFONATES (PFASs)		
Perfluorobutanesulfonic acid	PFBS *	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS *	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS *	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5

*** also reportable via the standard 537 method**

Table 1 Cont.

Parameter	Acronym	CAS
CHLORO-PERFLUOROALKYLSULFONATE		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
PERFLUOROOCTANESULFONAMIDES (FOSAs)		
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2
TELOMER SULFONATES		
1H,1H,2H,2H-perfluorohexane sulfonate (4:2)	4:2FTS	27619-93-8
1H,1H,2H,2H-perfluorooctane sulfonate (6:2)	6:2FTS	27619-97-2
1H,1H,2H,2H-perfluorodecane sulfonate (8:2)	8:2FTS	39108-34-4
1H,1H,2H,2H-perfluorododecane sulfonate (10:2)	10:2FTS	120226-60-0
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA *	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA *	2991-50-6
NATIVE PERFLUOROOCTANESULFONAMIDOETHANOLS (FOSEs)		
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol	NMeFOSE	24448-09-7
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol	NEtFOSE	1691-99-2

*** also reportable via the standard 537 method**

3. Reporting Limits

The reporting limit for PFAS’s is 2 ng/L for aqueous samples (20 ng/L for HFPO-DA) and 1 ng/g (10 ng/g for HFPO-DA) for soil samples.

4. Interferences

4.1 PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.

4.2 Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/3 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.2. **Subtracting blank values from sample results is not permitted.**

4.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.

4.4 SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

5.1 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.

5.2 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.

5.3 PFOA has been described as “likely to be carcinogenic to humans.” Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

6.1.1 Samples must be collected in two (2) 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap.

6.1.2 The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

6.1.3 Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

6.1.4 Fill sample bottles. Samples do not need to be collected headspace free.

6.1.5 After collecting the sample and cap the bottle. Keep the sample sealed from time of collection until extraction.

6.1.6 Field Reagent Blank (FRB)

6.1.6.1 A FRB must be handled along with each sample set. The sample set is composed of samples collected from the same sample site and at the same time. At the laboratory, fill the field blank sample bottle with reagent water and preservatives, seal, and ship to the sampling site along with the sample bottles. For each FRB shipped, an empty sample bottle (no preservatives) must also be shipped. At the sampling site, the sampler must open the shipped FRB and pour the reagent water into the empty shipped sample bottle, seal and label this bottle as the FRB. The FRB is shipped back to the laboratory along with the samples and analyzed to ensure that PFAS's were not introduced into the sample during sample collection/handling.

The reagent water used for the FRBs must be initially analyzed for method analytes as a MB and must meet the MB criteria in Section 9.2.1 prior to use. This requirement will ensure samples are not being discarded due to contaminated reagent water rather than contamination during sampling.

6.2 Sample Collection for Soil and Sediment samples.

Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided.

6.3 Sample Preservation

Not applicable.

6.4 Sample Shipping

Samples must be chilled during shipment and must not exceed 10 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 10 °C when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 °C until extraction, but should not be frozen.

NOTE: Samples that are significantly above 10° C, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

6.5 Sample Handling

6.5.1 Holding Times

6.5.1.1 Water samples should be extracted as soon as possible but must be extracted within 14 days. Soil samples should be extracted within 28 days. Extracts are stored at < 10 ° C and analyzed within 28 days after extraction.

7. Equipment and Supplies

7.1 SAMPLE CONTAINERS – 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.2 POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.

7.3 CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.

7.4 AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.

7.4.1 NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.

7.5 POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.

7.6 Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-µls.

7.7 PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.

7.8 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.

7.9 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.9.1 SPE CARTRIDGES – 0.5 g SPE cartridges containing a reverse phase copolymer characterized by a weak anion exchanger (WAX) sorbent phase.

7.9.2 VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB (Sect. 9.2.1).

7.9.3 SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8” O.D. x 1/16” I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB (Sect. 9.2.1) and LCS (Sect. 9.3) QC requirements. The PTFE transfer tubes may be used, but an MB must be run on each PFTE transfer tube and the QC requirements in Section 13.2.2 must be met. In the case of automated SPE, the removal of PTFE lines may not be feasible; therefore, MBs will need to be rotated among the ports and must meet the QC requirements of Sections 13.2.2 and 9.2.1.

7.10 Extract Clean-up Cartridge – 250 mg 6ml SPE Cartridge containing graphitized polymer carbon

7.11 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 65 °C.

7.12 LABORATORY OR ASPIRATOR VACUUM SYSTEM – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.

7.13 LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM

7.13.1 LC SYSTEM – Instrument capable of reproducibly injecting up to 10-µL aliquots, and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.4 mL/min). The LC must be capable of pumping the water/methanol mobile phase without the use of a degasser which pulls vacuum on the mobile phase bottle (other types of degassers are acceptable). Degassers which pull vacuum on the mobile phase bottle will volatilize the ammonium acetate mobile phase causing the analyte peaks to shift to earlier retention times over the course of the analysis batch. The usage of a column heater is optional.

NOTE: During the course of method development, it was discovered that while idle for more than one day, PFAS's built up in the PTFE solvent transfer lines. To prevent long delays in purging high levels of PFAS's from the LC solvent lines, they were replaced with PEEK tubing and the PTFE solvent frits were replaced with stainless steel frits. It is not possible to remove all PFAS background contamination, but these measures help to minimize their background levels.

7.13.2 LC/TANDEM MASS SPECTROMETER – The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.4 mL/min. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision.

7.13.3 DATA SYSTEM – An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.

7.13.4 ANALYTICAL COLUMN – An LC BEH C_{18} column (2.1 x 50 mm) packed with 1.7 µm d_p C_{18} solid phase particles was used. Any column that provides adequate resolution, peak shape, capacity, accuracy, and precision (Sect. 9) may be used.

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals should be used.

8.1.1 REAGENT WATER – Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/3 the RL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system's tubing.

8.1.2 METHANOL (CH_3OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.

8.1.3 AMMONIUM ACETATE ($NH_4C_2H_3O_2$, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences.

8.1.4 ACETIC ACID (H_3CCOOH, CAS#: 64-19-7) - High purity, demonstrated to be free of analytes and interferences.

8.1.5 1M AMMONIUM ACETATE/REAGENT WATER – High purity, demonstrated to be free of analytes and interferences.

8.1.6 2mM AMMONIUM ACETATE/METHANOL:WATER (5:95) – To prepare, mix 2 ml of 1M AMMONIUM ACETATE,1 ml ACETIC ACID and 50 ml METHANOL into I Liter of REAGENT WATER.

8.1.7 Methanol/Water (80:20) – To prepare a 1 Liter bottle, mix 200 ml of REAGENT WATER with 800 ml of METHANOL.

8.1.8 AMMONIUM HYDROXIDE (NH_3, CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences.

8.1.9 Sodium Acetate ($NaOOCCH_3$, CAS#: 127-09-3) – High purity, demonstrated to be free of analytes and interferences.

8.1.10 25 mM Sodium Acetate Buffer – To prepare 250mls, dissolve .625 grams of sodium acetate into 100 mls of reagent water. Add 4 mls Acetic Acid and adjust the final volume to 250 mls with reagent water.

8.1.11 NITROGEN – Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).

8.1.12 ARGON – Used as collision gas in MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.

8.2 STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

NOTE: Stock standards and diluted stock standards are stored at ≤4 °C.

8.2.1 ISOTOPE DILUTION Extracted Internal Standard (ID EIS) STOCK SOLUTIONS - ID EIS stock standard solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.

8.2.2 ISOTOPE DILUTION Extracted Internal Standard PRIMARY DILUTION STANDARD (ID EIS PDS) – Prepare the ID EIS PDS at a concentration of 500 ng/mL. The ID PDS is prepared in 80:20% (vol/vol) methanol:water. The ID PDS is stable for 6 months when stored at ≤4 °C.

Table 2

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Vol. of EIS Stock (mL)	Final Vol. of EIS PDS (mL)	Final Conc. of EIS PDS (ng/mL)
M4PFBA	1000	1.0	2.0	500
M5PFPeA	1000	1.0	2.0	500
M5PFHxA	1000	1.0	2.0	500
M4PFHpA	1000	1.0	2.0	500
M8PFOA	1000	1.0	2.0	500
M9PFNA	1000	1.0	2.0	500
M6PFDA	1000	1.0	2.0	500
M7PFUdA	1000	1.0	2.0	500
MPFDoA	1000	1.0	2.0	500
M2PFTeDA	1000	1.0	2.0	500
M2PFHxDA	50,000	.02	2.0	500
d3-N-MeFOSA	50,000	.02	2.0	500
d5-N-EtFOSA	50,000	.02	2.0	500
d7-N-MeFOSE	50,000	.02	2.0	500
d9-N-EtFOSE	50,000	.02	2.0	500
M8FOSA	1000	1.0	2.0	500
d3-N-MeFOSAA	1000	1.0	2.0	500
d5-N-EtFOSAA	1000	1.0	2.0	500
M3PFBS	929	1.0	2.0	464.5
M3PFHxS	946	1.0	2.0	473
M8PFOS	957	1.0	2.0	478.5
M2-4:2FTS	935	1.0	2.0	467.5
M2-6:2FTS	949	1.0	2.0	474.5
M2-8:2FTS	958	1.0	2.0	479
M3HFPO-DA	50,000	.4	2.0	10,000

8.2.3 ANALYTE STOCK STANDARD SOLUTION – Analyte stock standards are stable for at least 6 months when stored at 4 °C. When using these stock standards to prepare a PDS, care must be taken to ensure that these standards are at room temperature and adequately vortexed.

8.2.4 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only. ANALYTE PRIMARY SPIKING STANDARD – Prepare the spiking standard at a concentration of 500 ng/mL in methanol. The spiking standard is stable for at least two months when stored in polypropylene centrifuge tubes at room temperature.

Table 3

Analyte	**Conc. of IS Stock (ng/mL)**	**Vol. of IS Stock (mL)**	**Final Vol. of IS PDS (mL)**	**Final Conc. of IS PDS (ng/mL)**
PFBA	2000	1	4	500
PFPeA	2000	1	4	500
PFHxA	2000	1	4	500
PFHpA	2000	1	4	500
PFOA	2000	1	4	500
PFNA	2000	1	4	500
PFDA	2000	1	4	500
PFUdA	2000	1	4	500
PFDoA	2000	1	4	500
PFTrDA	2000	1	4	500
PFTeDA	2000	1	4	500
FOSA	2000	1	4	500
N-MeFOSAA	2000	1	4	500
N-EtFOSAA	2000	1	4	500
L-PFBS	1770	1	4	442.5
L-PFPeS	1880	1	4	470
L-PFHxSK	1480	1	4	370
Br-PFHxSK	344	1	4	86
L-PFHpS	1900	1	4	475
L-PFOSK	1460	1	4	365
Br-PFOSK	391	1	4	97.75
L-PFNS	1920	1	4	480
L-PFDS	1930	1	4	482.5
4:2FTS	1870	1	4	467.5
6:2FTS	1900	1	4	475
8:2FTS	1920	1	4	480

8.2.5 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only.

Table 4

Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)
ADONA	2000	1	4	500
PFHxDA	2000	1	4	500
PFODA	2000	1	4	500
HFPO-DA	100,000	.4	4	10,000
9ClPF3ONS	50,000	0.04	4	500
11ClPF3OUdS	50,000	0.04	4	500

8.2.6 LOW, MEDIUM AND HIGH LEVEL LCS – The LCS's will be prepared at the following concentrations and rotated per batch; 2 ng/L, 40 ng/L, 500 ng/l for drinking waters. The analyte PDS contains all the method analytes of interest at various concentrations in methanol. The analyte PDS has been shown to be stable for six months when stored at ≤4 °C.

8.2.7 Isotope Dilution Labeled Recovery Stock Solutions (ID REC) – ID REC Stock solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.

8.2.8 Isotope Dilution Labeled Recovery Primary Dilution Standard (ID REC PDS) - Prepare the ID REC PDS at a concentration of 500 ng/mL. The ID REC PDS is prepared in 80:20% (vol/vol) methanol:water. The ID REC PDS is stable for at least six months when stored in polypropylene centrifuge tubes at ≤4 °C.

Table 5

Analyte	Conc. of REC Stock (ng/mL)	Vol. of REC Stock (mL)	Final Vol. of REC PDS (mL)	Final Conc. of REC PDS (ng/mL)
M2PFOA	2000	1	4	500
M2PFDA	2000	1	4	500
M3PFBA	2000	1	4	500
M4PFOS	2000	1	4	500

8.2.9 CALIBRATION STANDARDS (CAL) –

Current Concentrations (ng/mL): 0.5, 1.0, 5.0, 10.0, 50.0, 125, 150, 250, 500

Prepare the CAL standards over the concentration range of interest from dilutions of the analyte PDS in methanol containing 20% reagent water. 20 µl of the EIS PDS and REC PDS are added to the CAL standards to give a constant concentration of 10 ng/ml. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity. The CAL standards may also be used as CCVs (Sect. 9.8). To make calibration stock standards:

Table 6

Calibration Standard Concentration	Final Aqueous Cal STD Level Concentration	Final Soil Cal STD Level Concentration	24 compound stock added (ul)	PFHxDA Stock added (ul)	500 ng/ml PFHxDA dilution added (ul)	PFODA Stock added (ul)	500 ng/ml PFODA dilution added (ul)	ADONA, HFPO-DA, 11Cl-PF3OUdS, 9Cl-PF3ONS Stock added (ul)	500 ng/ml ADONA dilution added (ul)	Final Volume in MeOH/H_2O (82:20)
.5 ng/ml	2 ng/L	.25 ng/g	6.25		25		25		25	25 mls
1 ng/ml	4 ng/L	.5 ng/g	5		20		20		20	10 mls
5 ng/ml	20 ng/L	1 ng/g	25		100		100		100	10 mls
10 ng/ml	40 ng/L	5 ng/g	125	5		5		5		25 mls

50 ng/ml	200 ng/L	25 ng/g	250	10		10		10		10 mls
125 ng/ml	500 ng/L	62.5 ng/g	625	25		25		25		10 mls
150 ng/ml	600 ng/L	75 ng/g	750	30		30		30		10 mls
250 ng/ml	1000 ng/L	125 ng/g	625							5 mls
500 ng/ml	2000 ng/L	250 ng/g	1250							5 mls

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 MINIMUM REPORTING LIMIT (MRL) CONFIRMATION

9.1.1 Fortify, extract, and analyze seven replicate LCSs at 2 ng/l. Calculate the mean measured concentration (*Mean*) and standard deviation for these replicates. Determine the Half Range for the prediction interval of results (HR_{PIR}) using the equation below

$$HR_{PIR} = 3.963s$$

Where:

s = the standard deviation
3.963 = a constant value for seven replicates.

9.1.2 Confirm that the upper and lower limits for the Prediction Interval of Result ($PIR = Mean \pm HR_{PIR}$) meet the upper and lower recovery limits as shown below

The Upper PIR Limit must be ≤150% recovery.

$$\frac{Mean + HR_{PIR}}{\text{Fortified Concentration}} \times 100\% \leq 150\%$$

The Lower PIR Limit must be ≥ 50% recovery.

$$\frac{Mean - HR_{PIR}}{\text{Fortified Concentration}} \times 100\% \geq 50\%$$

9.1.3 The RL is validated if both the Upper and Lower PIR Limits meet the criteria described above. If these criteria are not met, the RL has been set too low and must be determined again at a higher concentration.

9.2 Blank(s)

9.2.1 **METHOD BLANK (MB) -** A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch. Because background contamination is a significant problem for several method analytes, it is highly recommended that the analyst maintain a historical record of MB data.

9.2.2 **FIELD REAGENT BLANK (FRB)** - The purpose of the FRB is to ensure that PFAS's measured in the Field Samples were not inadvertently introduced into the sample during sample collection/handling. Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the RL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample.

9.3 Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicates (LCSD)

9.3.1 An LCS is required with each extraction batch. The fortified concentration of the LCS may be rotated between low, medium, and high concentrations from batch to batch. Default limits of 50-150% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%*R*) for each analyte using the equation

$$\%R = \frac{A \times 100}{B}$$

Where:

A = measured concentration in the fortified sample
B =fortification concentration.

9.3.2 Where applicable, LCSD's are to be extracted and analyzed. The concentration and analyte recovery criteria for the LCSD must be the same as the batch LCS The RSD's must fall within ≤30% of the true value for medium and high level replicates, and ≤50% for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

$$RPD = \frac{|LCS - LCSD|}{(LCS + LCSD) / 2} \times 100$$

9.3.3 **If the LCS and or LCSD results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.**

9.4 Labeled Recovery Standards (REC)

The analyst must monitor the peak areas of the REC(s) in all injections during each analysis day.

9.5 Extracted Internal Standards (EIS)

9.5.1 The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation

$$\%R = (A / B) \times 100$$

Where:

A = calculated EIS concentration for the QC or Field Sample
B = fortified concentration of the EIS.

9.5.2 Default limits of 50-150% may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. A low or high percent recovery for a sample, blank, or CCV does not require discarding the analytical data but it may indicate a potential problem with future analytical data. When EIS recovery from a sample, blank, or CCV are outside control limits, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4) instrument performance. For CCVs and QC elements spiked with all target analytes, if the recovery of the corresponding target analytes meet the acceptance criteria for the EIS in question, the data can be used but all potential biases in the recovery of the EIS must be documented in the sample report. If the associated target analytes do not meet the acceptance criteria,the data must be reanalyzed.

9.6 Matrix Spike (MS)

9.6.1 Analysis of an MS is required in each extraction batch and is used to determine that the sample matrix does not adversely affect method accuracy. Assessment of method precision is accomplished by analysis of a Field Duplicate (FD) (Sect. 9.6); however, infrequent occurrence of method analytes would hinder this assessment. If the occurrence of method analytes in the samples is infrequent, or if historical trends are unavailable, a second MS, or MSD, must be prepared, extracted, and analyzed from a duplicate of the Field Sample. Extraction batches that contain MSDs will not require the extraction of a field sample duplicate. If a variety of different sample matrices are analyzed regularly, for example, drinking water from groundwater and surface water sources, method performance should be established for each. Over time, MS data should be documented by the laboratory for all routine sample sources.

9.6.2 Within each extraction batch, a minimum of one Field Sample is fortified as an MS for every 20 Field Samples analyzed. The MS is prepared by spiking a sample with an appropriate amount of the Analyte Stock Standard (Sect. 8.2.3). Use historical data and rotate through the low, mid and high concentrations when selecting a fortifying concentration. Calculate the percent recovery (%*R*) for each analyte using the equation

$$\%R = \frac{\underline{(A - B)}}{C} \times 100$$

Where:

A = measured concentration in the fortified sample
B = measured concentration in the unfortified sample
C = fortification concentration.

9.6.3 Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Laboratory Duplicate

9.7.1 FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or MSD) – Within each extraction batch (not to exceed 20 Field Samples), a minimum of one FD or MSD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an MSD should be analyzed rather than an FD.

9.7.2 Calculate the relative percent difference (*RPD*) for duplicate measurements (*FD1* and *FD2*) using the equation

$$\text{RPD} = \frac{|\text{FD1} - \text{FD2}|}{(\text{FD1} + \text{FD2}) / 2} \times 100$$

9.7.3 RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the RL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCV, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7.4 If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

$$\text{RPD} = \frac{|\text{MS} - \text{MSD}|}{(\text{MS} + \text{MSD}) / 2} \times 100$$

9.7.5 RPDs for duplicate MSs should be ≤30% for samples fortified at or above their native concentration. Greater variability may be observed when MSs are fortified at analyte concentrations that are within a factor of 2 of the RL. MSs fortified at these concentrations should have RPDs that are ≤50% for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCSD where applicable, the result is judged to be matrix biased. If no LCSD is present, the associated MS and MSD are to be re-analyzed to determine if any analytical has occurred. If the resulting RPDs are still outside control limits, the result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.8 Initial Calibration Verification (ICV)

9.8.1 As part of the IDC (Sect. 13.2), and after each ICAL, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared and analyzed just like a CCV. Acceptance criteria for the QCS are identical to the CCVs; the calculated amount for each analyte must be ±

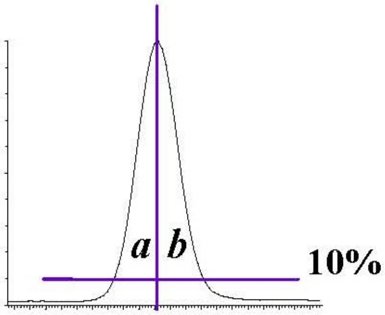
30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedureto locate and correct the problem.

9.9 Continuing Calibration Verification (CCV)

9.9.1 CCV Standards are analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch. See Section 10.7 for concentration requirements and acceptance criteria.

9.10 Method-specific Quality Control Samples

9.10.1 PEAK ASYMMETRY FACTOR – A peak asymmetry factor must be calculated using the equation below during the IDL and every time a calibration curve is generated. The peak asymmetry factor for the first two eluting peaks in a midlevel CAL standard (if only two analytes are being analyzed, both must be evaluated) must fall in the range of 0.8 to 1.5. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.



$$A_s = b / a$$

Where:

A_s = peak asymmetry factor
b = width of the back half of the peak measured (at 10% peak height) from the trailing edge of the peak to a line dropped perpendicularly from the peak apex
a = the width of the front half of the peak measured (at 10% peak height) from the leading edge of the peak to a line dropped perpendicularly from the apex.

9.11 Method Sequence

- CCV-LOW
- MB
- LCS
- LCSD
- MS
- Duplicate or MSD
- Field Samples (1-10)
- CCV-MID
- Field Samples (11-20)
- CCV-LOW

10. Procedure

10.1 Equipment Set-up

10.1.1 This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements (Sect. 9.2).

10.1.2 Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent (Sect 10.3.4) whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected (Sect. 10.3.4).

10.1.3 **NOTE:** The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.2 Sample Preparation and Extraction of Aqueous Samples

10.2.1 Samples are preserved, collected and stored as presented in Section 6.

The entire sample that is received must be sent through the SPE cartridge. In addition, the bottle must be solvent rinsed and this rinse must be sent through the SPE cartridge as well. The method blank (MB) and laboratory control sample (LCS) must be extracted in exactly the same manner (i.e., must include the bottle solvent rinse). It should be noted that a water rinse alone is not sufficient. This does not apply to samples with high concentrations of PFAS that are prepared using serial dilution and not SPE.

10.2.2 Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new 250mL HDPE bottle and record the weight of the new container.

NOTE: Some of the PFAS's adsorb to surfaces, thus the sample volume may **NOT** be transferred to a graduated cylinder for volume measurement.

10.2.3 The MB, LCS and FRB may be prepared by measuring 250 mL of reagent water with a polypropylene graduated cylinder or filling a 250-mL sample bottle to near the top.

10.2.4 Adjust the QC and sample pH to 3 by adding acetic acid in water dropwise

10.2.5 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC, cap and invert to mix.

10.2.6 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.3 Cartridge SPE Procedure

10.3.1 CARTRIDGE CLEAN-UP AND CONDITIONING – DO NOT allow cartridge packing material to go dry during any of the conditioning steps. Rinse each cartridge with 3 X 5 mL of 2% ammonium hydroxide in methanol, followed by 5mls of methanol. Next, rinse each cartridge with 5 mls of the 25 mM acetate buffer, followed by 15 mL of reagent water, without allowing the water to drop below the top edge of the packing. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Add 4-5 mL of reagent water to each cartridge, attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.

10.3.2 SAMPLE EXTRACTON – Adjust the vacuum so that the approximate flow rate is approximately 4 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

10.3.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample bottles with 4 ml reagent water followed by 4 ml 25 mM acetate buffer at pH 4 and draw the aliquot through the sample transfer tubes and the cartridges. Draw air or nitrogen through the cartridge for 5-10 min at high vacuum (10-15 in. Hg). **NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the entire sample has passed through the cartridge, the reservoirs must be rinsed to waste with reagent water.**

10.3.4 SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 1 – Turn off and release the vacuum. Lift the extraction manifold top and insert a rack with collection tubes into the extraction tank to collect the extracts as they are eluted from the cartridges. Rinse the sample bottles with 12 mls of methanol and draw the aliquot through the sample transfer tubes and cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 2 In a separate collection vial, rinse the sample bottles with 12 mL of 2% ammonium hydroxide in methanol and elute the analytes from the cartridges by pulling the 4 mL of methanol through the sample transfer tubes and the cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion. To the final extract, add 50 ul of acetic acid.

NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the reservoirs have been rinsed in Section 10.3.3, the elution solvent used to rinse the sample bottles must be swirled down the sides of the reservoirs while eluting the cartridge to ensure that any method analytes on the surface of the reservoirs are transferred to the extract.

CLEAN-UP CARTRIDGE ELUTION, Elute the clean-up cartridge with 8 additional mls of methanol and draw the aliquot through the cartridge. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

10.3.5 Fractions 1 and 2 are to be combined during the concentration stage (section10.6)

10.4 Sample Prep and Extraction Protocol for Soils

10.4.1 Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) intoa 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean sand is used.

10.4.2 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC.

10.4.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.4.4 To all samples, add 10 mls of methanol, cap, vortex for 25 seconds at 3000RPM and mix for 30 minutes using a shaker table of tumbler at 120RPM.

10.4.5 Following mixing, sonicate each sample for 30 minutes and let samples sit overnight (at least 2 hours is required for RUSH samples).

10.4.6 Centrifuge each sample at 3500RPM for 10 minutes.

10.4.7 Remove supernatant, and reserve for clean-up.

10.5 Extract Clean-up

10.5.1 CARTRIDGE CLEAN-UP AND CONDITIONING –. Rinse each cartridge with 15 mL of methanol and discard. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.

10.5.2 Adjust the vacuum so that the approximate flow rate is 1-2 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

10.5.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample collection vial with two 1-mL aliquots of methanol and draw each aliquot through the cartridges. Draw air or nitrogen through the cartridge for 5 min at high vacuum (10-15 in. Hg).

10.5.4 If extracts are not to be immediately evaporated, cover collection tubes and store at ambient temperature till concentration.

10.6 Extract Concentration

10.6.1 Concentrate the extract to dryness under a gentle stream of nitrogen in a heated water bath (60-65 °C) to remove all the water/methanol mix. Add the appropriate amount of 80:20% (vol/vol) methanol:water solution and 20 µl of the ID REC PDS (Sect. 8.2.7) to the collection vial to bring the volume to 1 mL and vortex. Transfer two aliquots with a plastic pipet (Sect. 7.6) into 2 polypropylene autosampler vials.

NOTE: It is recommended that the entire 1-mL aliquot not be transferred to the autosampler vial because the polypropylene autosampler caps do not reseal after injection. Therefore, do not store the extracts in the autosampler vials as evaporation losses can occur occasionally in these autosampler vials. Extracts can be split between 2 X 700 µl vials (Sect. 7.4).

10.7 Sample Volume Determination

10.7.1 If the level of the sample was marked on the sample bottle, use a graduated cylinder to measure the volume of water required to fill the original sample bottle to the mark made prior to extraction. Determine to the nearest 10 mL.

10.7.2 If using weight to determine volume, weigh the empty bottle to the nearest 10 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight (Sect. 10.2.2). Assume a sample density of 1.0 g/mL. In either case, the sample volume will be used in the final calculations of the analyte concentration (Sect. 11.2).

10.8 Initial Calibration - Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCV is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.

10.8.1 ESI-MS/MS TUNE

10.8.1.1 Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.

10.8.1.2 Optimize the [M-H]- for each method analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima.

10.8.1.3 Optimize the product ion for each analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions and the sulfonic acids have similar MS/MS conditions.

10.8.2 Establish LC operating parameters that optimize resolution and peak shape. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

Cautions: LC system components, as well as the mobile phase constituents, contain many of the method analytes in this method. Thus, these PFAS's will build up on the head of the LC column during mobile phase equilibration. To minimize the background PFAS peaks and to keep background levels constant, the time the LC column sits at initial conditions must be kept constant and as short as possible (while ensuring reproducible retention times). In addition, prior to daily use, flush the column with 100% methanol for at least 20 min before initiating a sequence. It may be necessary on some systems to flush other LC components such as wash syringes, sample needles or any other system components before daily use.

10.8.3 Inject a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. If analyzing for PFTA, ensure that the LC conditions are adequate to prevent co-elution of PFTA and the mobile phase interferants. These interferants have the same precursor and products ions as PFTA, and under faster LC conditions may co-elute with PFTA. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ([M-H]-) for the analytes in each window and choose the most abundant product ion. For maximum sensitivity, small mass windows of ±0.5 daltons around the product ion mass were used for quantitation.

10.8.4 Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.

10.8.4.1 If broad, split or fronting peaks are observed for the first two eluting chromatographic peaks (if only two analytes are being analyzed, both must be evaluated), change the initial mobile phase conditions to higher aqueous content until the peak asymmetry ratio for each peak is 0.8 – 1.5. The peak asymmetry factor is calculated as described in Section 9.9.1 on a mid-level CAL standard. The peak asymmetry factor must meet the above criteria for the first two eluting peaks during the IDL and every time a new calibration curve is generated. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to chromatographic resolution of the linear and branched isomers of these compounds. Most PFAS's are produced by two different processes. One process gives rise to linear PFAS's only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS's can potentially be found in the environment. For the aforementioned compounds that give rise to more than one peak, all the chromatographic peaks observed in the standard must be integrated and the areas totaled. Chromatographic peaks in a sample must be integrated in the same way as the CAL standard.

10.8.5 Prepare a set of CAL standards as described in Section 8.2.5. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity.

10.8.6 The LC/MS/MS system is calibrated using the IS technique. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve for each of the analytes. This curve **must always** be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes. A minimum of 5 levels are required for a linear calibration model and a minimum of 6 levels are required for a quadratic calibration model.

10.8.7 **CALIBRATION ACCEPTANCE CRITERIA** – A linear fit is acceptable if the coefficient of determination (r^2) is greater than 0.99. When quantitated using the initial calibration curve, each calibration point, except the lowest point, for each analyte should calculate to be within 70-130% of its true value. The lowest CAL point should calculate to be within 50-150% of its true value. If these criteria cannot be met, the analyst will have difficulty meeting ongoing QC criteria. It is recommended that corrective action is taken to reanalyze the CAL standards, restrict the range of calibration, or select an alternate method of calibration (forcing the curve through zero is still required).

10.8.7.1 **CAUTION:** When acquiring MS/MS data, LC operating conditions must be carefully reproduced for each analysis to provide reproducible retention times. If this is not done, the correct ions will not be monitored at the appropriate times. As a precautionary measure, the chromatographic peaks in each window must not elute too close to the edge of the segment time window.

10.9 CONTINUING CALIBRATION CHECK (CCV) – Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a "sample" is considered to be a Field Sample. MBs, CCVs, LCSs, MSs, FDs FRBs and MSDs are not counted as samples. The beginning CCV of each analysis batch must be at or below the RL in order to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCVs should alternate between a medium and Low concentration CAL standard.

10.9.1 Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.

10.9.2 Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each analyte for medium level CCVs must be within ± 30% of the true value with an allowance of 10% of the reported analytes to be greater than 30%, but less than 40%. The calculated amount for each EIS must be within ± 50% of the true value. The calculated amount for the lowest calibration point for each analyte must be within ± 50%. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken (Sect. 10.7.4) which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification should be reanalyzed after adequate calibration has been restored, with the following exception. **If the CCV fails because the calculated concentration is greater than 130% (150% for the low-level CCV) for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.**

10.9.3 REMEDIAL ACTION – Failure to meet CCV QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration (Sect 10.6) and verification of sensitivity by analyzing a CCV at or below the RL (Sect 10.7).

10.10 EXTRACT ANALYSIS

10.10.1 Establish operating conditions equivalent to those summarized in Tables 6-8 of Section 16. Instrument conditions and columns should be optimized prior to the initiation of the IDC.

10.10.2 Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration and completing the IDC can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.

10.10.3 Calibrate the system by either the analysis of a calibration curve (Sect. 10.6) or by confirming the initial calibration is still valid by analyzing a CCV as described in Section 10.7. If establishing an initial calibration, complete the IDC as described in Section 13.2.

10.10.4 Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.

10.10.5 At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.

10.10.6 The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to insure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.

11. Data Evaluation, Calculations and Reporting

11.1 Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 7.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.6. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.6 where:

C_{ex} = (Area of target analyte * Concentration of Labeled analog) / (area of labeled analog * CF)

C_s = (C_{ex} / sample volume in ml) * 1000

C_{ex} = The concentration of the analyte in the extract
CF = calibration factor from calibration.

11.3 Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.

11.4 PFHxS, PFOS, PFOA, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to the linear and branch isomers of these compounds (Sect. 10.6.4.1). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.

11.5 Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

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

12.1 Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

12.2 All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

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

13.1.1 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.

13.2 Demonstration of Capability Studies

13.2.1 The IDC must be successfully performed prior to analyzing any Field Samples. Prior to conducting the IDC, the analyst must first generate an acceptable Initial Calibration following the procedure outlined in Section 10.6.

13.2.2 INITIAL DEMONSTRATION OF LOW SYSTEM BACKGROUND – Any time a new lot of SPE cartridges, solvents, centrifuge tubes, disposable pipets, and autosampler vials are used, it must be demonstrated that an MB is reasonably free of contamination and that the criteria in Section 9.2.1 are met. If an automated extraction system is used, an MB should be extracted on each port to ensure that all the valves and tubing are free from potential PFAS contamination.

13.2.3 INITIAL DEMONSTRATION OF PRECISION (IDP) – Prepare, extract, and analyze four to seven replicate LCSs fortified near the midrange of the initial calibration curve according to the procedure described in Section 10. Sample preservatives as described in Section 6.2.1 must be added to these samples. The relative standard deviation (RSD) of the results of the replicate analyses must be less than 20%.

13.2.4 INITIAL DEMONSTRATION OF ACCURACY (IDA) – Using the same set of replicate data generated for Section 13.2.3, calculate average recovery. The average recovery of the replicate values must be within ± 30% of the true value.

13.2.5 INITIAL DEMONSTRATION OF PEAK ASYMMETRY FACTOR – Peak asymmetry factors must be calculated using the equation in Section 9.10.1 for the first two eluting peaks (if only two analytes are being analyzed, both must be evaluated) in a mid-level CAL standard. The peak asymmetry factors must fall in the range of 0.8 to 1.5. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.

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

13.2.7 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

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

14.2 This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.

14.3 The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories 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, particularly the hazardous waste identification rules and land disposal restrictions.

15. Referenced Documents

Chemical Hygiene Plan – ID 2124

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

SOP ID 1739 Demonstration of Capability (DOC) Generation SOP

SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 7: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 MeOH/H_2O)	100% Methanol
Initial	100.0	0.0
1.0	100.0	0.0
2.2	85.0	15.0
11	20.0	80.0
11.4	0.0	100.0
12.4	100.0	00.0
15.5	100.0	0.0
Waters Aquity UPLC ® BEHC_{18} 2.1 x 50 mm packed with 1.7 µm BEH C_{18} stationary phase Flow rate of 0.4 mL/min 2-5 µL injection		

Table 8: ESI-MS Method Conditions

ESI Conditions	
Polarity	Negative ion
Capillary needle voltage	.5 kV
Cone Gas Flow	25 L/hr
Nitrogen desolvation gas	1000 L/hr
Desolvation gas temp.	500 ºC

Table 9: Method Analyte Source, Retention Times (RTs), and EIS References

#	Analyte	Transition	RT	IS	Type
1	M3PBA	216>171	2.65		REC
2	PFBA	213 > 169	2.65	2: M4PFBA	
3	M4PFBA	217 > 172	2.65	1: M3PBA	EIS
4	PFPeA	263 > 219	5.67	4: M5PFPEA	
5	M5PFPEA	268 > 223	5.66	1: M3PBA	EIS
6	PFBS	299 > 80	6.35	6: M3PFBS	
7	M3PFBS	302 > 80	6.35	29:M4PFOS	EIS
8	FtS 4:2	327 > 307	7.47	9: M2-4:2FTS	

#	Analyte	Transition	RT	IS	Type
9	M2-4:2FTS	329 > 81	7.47	29:M4PFOS	EIS
10	PFHxA	303 > 269	7.57	10: M5PFHxA	
11	M5PFHxA	318 > 273	7.57	19:M2PFOA	EIS
12	PFPeS	349 > 80	7.88	18: M3PFHxS	
13	PFHpA	363 > 319	8.80	14: M4PFHpA	
14	M4PFHpA	367 > 322	8.80	19:M2PFOA	EIS
15	L-PFHxS	399 > 80	8.94	18: M3PFHxS	
16	br-PFHxS	399 > 80	8.72	18: M3PFHxS	
17	PFHxS Total	399 > 80	8.94	18: M3PFHxS	
18	M3PFHxS	402 > 80	8.94	29:M4PFOS	EIS
19	MPFOA	415 > 370	9.7		REC
20	PFOA	413 > 369	9.7	23: M8PFOA	
21	br-PFOA	413 > 369	9.48	23: M8PFOA	
22	PFOA Total	413 > 369	9.7	23: M8PFOA	
23	M8PFOA	421 > 376	9.7	19: M2PFOA	EIS
24	FtS 6:2	427 > 407	9.66	25: M2-6:2FTS	
25	M2-6:2FTS	429 > 409	9.66	29:M4PFOS	EIS
26	PFHpS	449 > 80	9.78	33: M8PFOS	
27	PFNA	463 > 419	10.41	33: M8PFOS	
28	M9PFNA	472 > 427	10.41	19: M2PFOA	EIS
29	M4PFOS	501 > 80	10.45		REC
30	PFOS	499 > 80	10.45	33: M8PFOS	
31	br-PFOS	499 > 80	10.27	33: M8PFOS	
32	PFOS Total	499 > 80	10.45	33: M8PFOS	
33	M8PFOS	507 > 80	10.45	29: M4PFOS	EIS
34	FtS 8:2	527 > 507	10.99	38: M2-8:2FTS	
35	M2-8:2FTS	529 > 509	10.99	29:M4PFOS	EIS
36	M2PFDA	515 > 470	11.00		REC
37	PFDA	513 > 469	11.00	38: M6PFDA	
38	M6PFDA	519 > 474	11.00	36: M2PFDA	EIS
39	PFNS	549 > 80	11.02	33:M8PFOS	
40	NMeFOSAA	570 > 419	11.41	41: D3-NMeFOSAA	
41	d3-NMeFOSAA	573 > 419	11.41	36: M2PFDA	EIS
42	PFOSA	498 > 78	11.48	29: M8FOSA	
43	M8FOSA	506 > 78	11.48	19: M2PFOA	EIS
44	PFUnDA	563 > 519	11.51	41: M7-PFUDA	
45	M7-PFUDA	570 > 525	11.51	36: M2PFDA	EIS
46	PFDS	599 > 80	11.51	33:M8PFOS	
47	NEtFOSAA	584 > 419	11.68	48: d5-NEtFOSAA	

#	Analyte	Transition	RT	IS	Type
48	d5-NEtFOSAA	589 > 419	11.68	36: M2PFDA	EIS
49	PFDoA	613 > 569	11.96	50: MPFDOA	
50	MPFDOA	615 > 570	11.96	36: M2PFDA	EIS
51	PFTriA	663 > 619	12.34	50: MPFDOA	
52	PFTeA	713 > 669	12.6	53: M2PFTEDA	
53	M2PFTEDA	715 > 670	12.6	36: M2PFDA	EIS
54	M3HFPO-DA	329>285	7.97	19: M2PFOA	EIS
55	HFPO-DA	332>287	7.97	54: M3HFPO-DA	
56	ADONA	377>251	8.00	23: M8PFOA	
57	PFHxDA	813>769	13.20	59: M2PFHxDA	
58	PFODA	913>869	13.50	59: M2PFHxDA	
59	M2PFHxDA	815>770	13.20	36:M2PFDA	EIS
60	NEtFOSA	526>169	11.00	61: NMeFOSA	
61	NMeFOSA	512>169	10.50	63: d3-NMeFOSA	
62	d3-NMeFOSA	515>169	10.50	29: M4PFOS	EIS
63	d5-NEtFOSA	531>169	11.00	29: M4PFOS	EIS
64	NMeFOSE	556>122	11.25	66: d7-NMeFOSE	
65	NEtFOSE	570>136	10.75	67: d9-NEtFOSE	
66	d7-NMeFOSE	563>126	11.25	29: M4PFOS	EIS
67	d9-NEtFOSE	579>142	10.75	29: M4PFOS	EIS
68	FtS 10:2	627>607	11.50	25: M2-6:2FTS	
69	PFDoS	699>99	12.50	33: M8PFOS	

Date Created: 10/03/19
Created By: Ben Rao
File: PM7496-1
Page: 1

AEI Consultants

NY PFAAs via EPA 537(M)-Isotope Dilution (SOIL)

Holding Time: 28 days
Container/Sample Preservation: 1 - Plastic 8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	1	0.0227	ug/kg	71-135	30	71-135	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	1	0.046	ug/kg	69-132	30	69-132	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	1	0.039	ug/kg	72-128	30	72-128	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	1	0.0525	ug/kg	70-132	30	70-132	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	1	0.0451	ug/kg	71-131	30	71-131	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	1	0.0605	ug/kg	67-130	30	67-130	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	1	0.0419	ug/kg	69-133	30	69-133	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	1	0.1795	ug/kg	64-140	30	64-140	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	1	0.1365	ug/kg	70-132	30	70-132	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	1	0.075	ug/kg	72-129	30	72-129	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	1	0.13	ug/kg	68-136	30	68-136	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	1	0.067	ug/kg	69-133	30	69-133	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	1	0.287	ug/kg	65-137	30	65-137	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOS	2355-31-9	1	0.2015	ug/kg	63-144	30	63-144	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	1	0.0468	ug/kg	64-136	30	64-136	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	1	0.153	ug/kg	59-134	30	59-134	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	1	0.098	ug/kg	67-137	30	67-137	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	1	0.0845	ug/kg	61-139	30	61-139	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	1	0.07	ug/kg	69-135	30	69-135	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	1	0.2045	ug/kg	66-139	30	66-139	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	1	0.054	ug/kg	69-133	30	69-133	30	30			
PFOA/PFOS, Total		1	0.0419	ug/kg				30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*60-153*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*65-182*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*70-151*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*61-147*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*62-149*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*63-166*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*62-152*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*32-182*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*61-154*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*65-151*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*65-150*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*25-186*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*45-137*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*64-158*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*1-125*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*42-136*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*56-148*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*26-160*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)

Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, In

Date Created: 10/03/19
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File: PM7495-1
Page: 1

AEI Consultants

NY PFAAs via EPA 537(M)-Isotope Dilution (WATER)

Holding Time: 14 days
Container/Sample Preservation: 1 - 2 Plastic/1 Plastic/1 H20 Plastic

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	2	0.408	ng/l	67-148	30	67-148	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	2	0.396	ng/l	63-161	30	63-161	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	2	0.238	ng/l	65-157	30	65-157	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	2	0.328	ng/l	69-168	30	69-168	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	2	0.2252	ng/l	58-159	30	58-159	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	2	0.376	ng/l	69-177	30	69-177	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	2	0.236	ng/l	63-159	30	63-159	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	2	1.332	ng/l	49-187	30	49-187	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	2	0.688	ng/l	61-179	30	61-179	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	2	0.312	ng/l	68-171	30	68-171	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	2	0.504	ng/l	52-151	30	52-151	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	2	0.304	ng/l	63-171	30	63-171	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	2	1.212	ng/l	56-173	30	56-173	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	2	0.648	ng/l	60-166	30	60-166	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	2	0.26	ng/l	60-153	30	60-153	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	2	0.98	ng/l	38-156	30	38-156	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	2	0.58	ng/l	46-170	30	46-170	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	2	0.804	ng/l	45-170	30	45-170	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	2	0.372	ng/l	67-153	30	67-153	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	2	0.3272	ng/l	48-158	30	48-158	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	2	0.248	ng/l	59-182	30	59-182	30	30			
PFOA/PFOS, Total		2	0.236	ng/l				30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*2-156*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*16-173*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*31-159*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*21-145*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*30-139*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*47-153*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*36-149*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*1-244*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*34-146*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*42-146*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*38-144*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*7-170*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*1-181*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*40-144*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*1-87*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*23-146*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*24-161*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*33-143*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)

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Quality Systems Manual

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D/B/A

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1 Mission Statement

The mission of Alpha Analytical is quite simply to provide our customers with the greatest value in analytical service available. For the ‘greatest value’ is not only found in the data that is delivered, it is also found in the services provided.

- Data must be of the highest integrity, accuracy and precision.
- Consultation and educational services must be provided to support the customer in establishing data quality objectives and interpretation of the final data package.
- Support services such as sample containers, courier service and electronic data deliverables must be available to the customer.

Alpha’s mission continues with an established commitment to our community and environment. We must ensure that we do not produce any additional contamination to our environment or harm our neighbors and community in any way.

The value of Alpha’s product is in the honesty and integrity with which each chemist, courier, login staff member, or office staff member performs their tasks. The customer or employee must always feel satisfied that they received the greatest value in their lab experience at Alpha.

Alpha Analytical will vigorously pursue its mission into the next millennium.

Mark Woelfel

President

2 Table of Contents

Section Description ....Page

3 Introduction

The Quality Systems Manual, referred to as Corporate Quality Systems Manual (CQSM) of Alpha Analytical describes the quality program in use at the laboratory for both Westboro and Mansfield facilities. This Quality Systems Manual provides employees, customers and accrediting agencies with the necessary information to become familiar with how the quality system operates within Alpha Analytical. The quality program includes quality assurance, quality control, and the laboratory systems including feedback mechanisms for the automated continuous improvement of the laboratory operations to meet customer needs.

Implementation of the laboratory operations is by documenting procedures, training personnel and reviewing operations for improvement. Written procedures are maintained as Standard Operating Procedures (SOPs). The SOPs are available to the staff as a controlled, electronic, secure copy. The provisions of the QSM are binding on all temporary and permanent personnel assigned responsibilities. All laboratory personnel must adhere strictly to the QSM and SOPs.

All policies and procedures have been structured in accordance with the NELAC Institute (TNI) Standards), DOD QSM 5.1 and applicable EPA requirements and standards.

Twenty-five (25) sections comprise the QSM. Related quality documentation including the listing of SOPs, forms, floor plan, equipment, personnel and laboratory qualifications are available. The QSM sections provide overview descriptions of objectives, policies, services and operations.

3.1 Scope

The QSM describes the requirements of the Laboratory to demonstrate competency in the operations for performing environmental tests for inorganic, organic, air and microbiological testing. The basis for the environmental tests is the methods found in documents published by the United States Environmental Protection Agency (EPA), ASTM, AOAC, APHA/AWWA/WEF, Standard Methods, and other procedures and techniques supplied by customers.

The QSM includes requirements and information for assessing competence and determining compliance by the laboratory to the quality system. When more stringent standards or requirements are included in a mandated test method, by regulation, or specified in a project plan the laboratory demonstrates achievement of the customer specified requirements through its documented processes.

The QSM is for use by Alpha Analytical for developing and implementing the quality system. Accrediting authorities and customers use the QSM for assessing the competence of Alpha Analytical. Alpha Analytical is committed to continually improving the quality system. Meeting customer needs, operating within regulatory requirements and adhering to Alpha's Data Integrity and Ethics policy are several of the mechanism used to continually improve the quality system.

3.2 Policy Statement

This Quality Systems Manual summarizes the policies, responsibilities and operational procedures associated with Alpha Analytical. This manual applies to all associates of the laboratory and is intended for use in the on-going operations at Alpha Analytical. Specific protocols for sample handling and storage, chain-of-custody, laboratory analyses, data reduction, corrective action, and reporting are described. All policies and procedures have been structured in accordance with the NELAC Institute (TNI) Standards, DOD QSM(which includes 17025 standards), applicable EPA requirements, regulations, guidance, and technical standards. This Quality Systems Manual, laboratory Standard Operating Procedures (SOPs), and related documentation describe the quality systems, policies and procedures for Alpha Analytical.

Alpha Analytical performs chemical analyses for inorganic and organic constituents in water, seawater, soil, sediment, oil, tissue and air matrices. Alpha Analytical's goal is to produce data that is scientifically valid, technically defensible, and of known and documented quality in accordance with standards developed by The NELAC Institute (TNI) Standards and any applicable state or EPA regulations or requirements. It is the commitment of the President, Operations Director, Laboratory Technical Manager and Quality Assurance Officer to work towards continuous improvement of the operation, and towards meeting our customer's needs, requirements, and intended data usage. This continued commitment is built into every activity of the laboratory. It is the responsibility of Senior Management and the Department Managers to ensure that all associates familiarize themselves with, and comply at all times with, the quality systems, procedures and policies set forth in this manual, laboratory SOPs, and related documentation.

Alpha Analytical analyzes Proficiency Test (PT) samples, in accordance with the NELAC Institute (TNI) Standards and other regulatory programs, from a National Institute of Standards and Technology (NIST)-approved PT provider for the analytes established by EPA for water samples, and for other analytes and matrices. The specific analytes and matrices analyzed are based on the current scope of the laboratory services as documented in the laboratory SOPs and state certifications.

The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. This includes a review of facilities and instrumentation, staffing, and any special QC or reporting requirements to ensure that analyses can be performed correctly and within the expected schedule. All measurements are made using published reference methods or methods developed by Alpha Analytical. Competence with all methods is demonstrated according to the procedure described in SOP/ 1739 prior to use.

Alpha Analytical has developed a proactive program for prevention and detection of improper, unethical or illegal actions. Components of this program include: internal proficiency testing, electronic data audits and post-analysis data review by the QA Officer; a program to improve employee vigilance and co-monitoring; and Ethics Training program identifying appropriate and inappropriate laboratory practices, instrument manipulation practices and consequences. Additionally, all associates are required to sign the Alpha Analytical *Ethics Agreement* form upon commencement of employment and each year following. This form clearly outlines the possible consequences of unethical or improper behavior, or data misrepresentation. All staff are required to report any suspected unethical conduct to management. Management will then investigate and determine if the situation was considered unethical and will take appropriate action as described in the Alpha Ethics policy.

It is the policy of the laboratory to discourage and reject all influence or inducements (whether commercial, financial or personal) offered either by customers or suppliers, which might adversely affect results or otherwise compromise the judgment or impartiality of the staff. It is the responsibility of the Operations Director and Laboratory Technical Manager to inform customers and suppliers of this policy when necessary.

In the event that any such influences or inducements are encountered, the staff is instructed to inform management immediately. It is the responsibility of the Operations Director and the Laboratory Technical Manager to take appropriate action to prevent recurrence.

3.3 References

External reference documents are available electronically in the Qualtrax system for staff to access the latest edition or version of the reference methods, regulations or national standards. The Quality Assurance Department maintains the electronic files in the Qualtrax system. Management purchases automated update services, where available, to provide the laboratory with the latest hardcopy edition, where electronic means is not available.

3.4 Definitions

Appendix A lists the definitions as adopted by the laboratory. The definitions are from the 2009 TNI standards.

4 Organization and Management

4.1 Legal Definition of Laboratory

Alpha Analytical is a full service analytical laboratory. Testing services include Drinking Water, Waste Water, Ground Water, Waste material and Air. Alpha Analytical is a privately held corporation incorporated in the state of Massachusetts. Alpha Analytical, Inc. does business as (D/B/A) Alpha Analytical.

Alpha Analytical has been in business since 1985. The types of businesses served include:

Consulting firms,
Engineering firms,
Waste Management Companies,
Industrial sites,
Municipal agencies
Department of Defense projects.

4.2 Organization

The laboratory operates a quality system approach to management in order to produce data of known quality. The laboratory organization provides effective communication and lines of authority to produce analytical data meeting customer specifications. The organizational design provides open communication while ensuring that pressures and day to day operating circumstances do not compromise the integrity of the reporting of the final data. See Appendix B for Organizational Chart.

The President is responsible for directing all areas of the company. The following job functions report to the President:

Operations Manager
Quality Assurance Officer
Marketing / Business Development / Sales
Financial Services
Human Resources

The Operations Manager is responsible for directing all laboratory operational areas of the company. The following job functions report to the Operations Manager:

Laboratory Technical Manager(s)
Customer Services Manager
Department Managers

The Laboratory Technical Manager(s) is(are) responsible for the laboratory data generated by the organics testing, inorganics testing and metals testing areas and the Air Technical Director is responsible for laboratory data generated by air analyses.

The Departmental Managers (Supervisors) have the following responsibilities:

The organics managers direct personnel in the organics extraction and instrumental laboratories.

The wet chemistry manager directs personnel and team leaders in the wet chemistry and/or microbiological testing areas.

The metals manager directs personnel and team leaders in the metals sample preparation and instrumental laboratories.

The Quality Assurance Officer is a member of the staff and reports directly to the President and has defined responsibility and authority for ensuring that the quality system is implemented and adhered to at all times. The Quality Assurance (QA) Officer is responsible for interacting and communicating certification requirements, implementing the Quality Systems Manual and reporting to the Laboratory Technical Manager and Senior Management the status of the quality program. The QAO oversees the Quality Systems Specialists and is responsible for oversight and/or review of quality control data and function independently from laboratory operations.

The Customer Services Manager is responsible for customer interactions, project coordination and laboratory personnel notification of project requirements.

The Marketing, Business Development and Sales personnel are responsible for increasing the volume of work from current customers and adding new customers to the base business of Alpha Analytical. The Marketing and Business Development personnel review all new work with the Laboratory Technical Manager, Operations Manager, President and/or Quality Assurance Officer before contractual commitment.

The CFO is responsible for maintaining and reporting on the financial status of the company. The CFO directs financial personnel on proper accounting procedures and maintaining the list of approved suppliers and subcontractors. The CFO reports directly to the President.

The Human Resource Director is responsible for personnel recruitment, hiring, performance reviews.

Personnel job descriptions define the operational function duties and responsibilities. Administration and Laboratory personnel assignments may include cross-functional training and work performance in multiple areas of the operations. Multiple function training ensures laboratory back up personnel during peak workloads.

During the absence of any staff member, assignment of alternative personnel occurs by memo or e-mail. The Manager or Supervisor authorizes the assignment. The naming of alternative personnel assures the continuing performance of critical tasks during the primary person's absence and ensures that lines of communication remain open for continued decision making. The deputy for the Laboratory Technical Manager is the Quality Assurance (QA) Officer. The deputies for the Quality Assurance (QA) Officer are the Quality Systems Specialists.

For the purposes of the NELAC Institute (TNI) Standards the Lead Laboratory Technical Manager is the Laboratory Technical Manager. The deputies for the Lead Technical Manager are the Quality Assurance (QA) Officer, and the Departmental Managers. The Laboratory Technical Manager meets the requirements specified in the Section 4.1.7.2 Volume 1, Module 2 of the 2009 TNI standards. If the Laboratory Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, a full-time staff member meeting the qualifications of Laboratory Technical Manager will be designated to temporarily perform this function. The primary Accrediting Body shall be notified in writing if the Technical Manager's absence exceeds 35 consecutive calendar days.

4.3 Business Practices

Alpha maintains certification for the programs and analytes required by regulatory programs. The listing of qualifications from the various certifications, registrations and accreditation programs are available upon request. Alpha Analytical operates Monday to Friday from 7:30 a.m. to 5:30 p.m. Management prepares and posts the holiday schedule for the year indicating closed operations. Sample delivery occurs during normal operating hours unless arranged in advance.

Alpha’s reputation depends upon timely reporting and quality data. The standard turnaround time for engineering and consulting firms is five business days from time of sample receipt. Standard turnaround for all other customers is ten business days from time of sample receipt. The time of sample receipt is when the verification of the chain of custody and samples meets the laboratory sample acceptance policy. Laboratory management must approve any special arrangements for rush or expedited turnaround time. The basis for data quality depends on customer, regulation and method performance criteria. Accuracy, precision, sensitivity and comparability are expressions of method performance criteria.

All work is performed in the strictest confidence. New and contract employees must review corporate policy and practice requirements for protecting customer confidentiality and proprietary rights. The review occurs during orientation and ethics training. It is the policy of the laboratory to release data to the customer authorized contact. Personnel assigned the duties of interacting with customers review project files and discuss data related only to the project. Personnel whose duties do not include routine customer contact must check with the customer service manager before discussing data with regulators or third parties

5 Quality System

Establishment, Audits, Essential Quality Controls and Data Verification

5.1 Establishment

The Mission Statement presents the policy and objectives for Alpha Analytical. The Quality Systems Manual provides the framework for the processes and operations to implement the Mission. The Quality Systems Manual and documentation controlled by the laboratory system detail the management authorized operations for achieving the objectives of the company.

The laboratory operates a quality system approach to management in order to produce data of known quality. Alpha Analytical is a full service laboratory designed to provide its customers with accurate, precise and reliable data within the best turn-around time and at the most reasonable prices. Alpha employs chemists of the highest training, ethics and caliber in the field of analytical chemistry. This and state-of-the-art instrumentation and automation combine to insure data of known and documented quality.

5.2 Quality Systems Manual

The QA Officer is responsible for the publication and distribution of the Quality Systems Manual and annual review. Management reviews and authorizes the manual. Implementation of major changes in the quality system occurs after revision of the appropriate Quality Systems Manual section and authorization by management.

The authorization of the Quality Systems Manual is documented electronically in Qualtrax. Updates of this manual occur at any time throughout the year. Document control procedures (SOP1729) apply to the distribution of the Quality Systems Manual. Controlled copies of the manual are maintained electronically within Qualtrax. Persons or organizations outside of Alpha Analytical may receive uncontrolled copies. Copies are distinctly indicated “Uncontrolled Documents” within the footer of each page.

5.3 Audits

Laboratory audits, both internal and external, review and examine the operations performed in the laboratory. Internal audits are conducted by qualified QA Specialists and external audits are reviews by external organizations to evaluate the ability of the laboratory to meet regulatory or project requirements. Internal audits are conducted on a frequency of bi-annually, method required and annually for DoD certified methods.

A QA designee schedules internal process audits to ensure the completion of the annual audit of each operational area. The process audits are a more detailed review of the operations. Personnel from areas other than the one audited perform process audits.

The internal system audit is a review of the implementation of the documented quality system. The system audit includes sample tracking from receipt to disposal, a data audit of a completed report, and all operations not audited during the process audit.

The purpose of the internal system audit is:

Verification that adequate written instructions are available for use;

Analytical practices performed in the laboratory are consistent with SOPs;

The quality control practices are applied during production;

Corrective actions are applied as necessary;

Deviations from approved protocols are occurring only with proper authorization and documentation;

Reported data is correct and acceptable for reporting;

SOPs, quality records, analytical records, electronic data files are maintained properly; and

Personnel training files and records are satisfactory and current.

Before a scheduled internal audit, the assigned auditor reviews checklists, if used, and/or the SOP specific to the area. The checklist may be from an external source or prepared by the auditor. . After the audit, the auditor submits a summary or notes from the audit to the Laboratory Technical Manager or QAO as part of the audit report. The summary identifies discrepancies found during the audit. Technical personnel are responsible for the inspection and monitoring of in-process and final data. Personnel independent of those having direct responsibility for the work performed audit the quality system and processes.

Representatives sent by customers and government or accrediting agencies often perform external audits. These audits are most often announced inspections, but sometimes are not announced. The Quality Assurance Officer, Laboratory Technical Manager or assigned deputy, and/or appropriate Department Manager accompany the external audit team through the laboratory. The auditors receive a brief overview of company objectives, activities, and facilities. Interviews with essential supervisory staff and technical staff are arranged, along with retrieval of any documentation pertinent to the audit. Auditors usually provide a report on their findings shortly after the audit. The QA Officer receives the audit report and copies are provided to laboratory personnel for review. Corrective actions are identified and distributed to responsible parties for implementation in response to any cited deficiencies.

5.4 Audit Review

Management reviews internal and external audit reports to evaluate system effectiveness at the annual management review meeting. Tracking of the audit findings occurs through the nonconformance action process. The management and staff work together to establish a time line for resolving the audit findings. The Quality Assurance team tracks the time line and reports to the Laboratory Technical Manager on any outstanding audit findings. Approved corrective actions for DoD that are not implemented or avoided may result in loss of DoD ELAP accreditation and may result in work being discontinued until implementation is verified by DOD ELAP AB.

5.5 Performance Audits

Alpha Analytical participates in inter-laboratory comparisons and proficiency test programs required by customers and certifying agencies. The performance audits provide information on the data comparability of results generated by the laboratory. Test samples received by the laboratory are handled following routine laboratory procedures. Proficiency test samples are unpacked, checked against the packing slip and examined for damage. Reporting requirements and deviations to routine practices are noted as would be required for any project.

Analysts demonstrate proficiency by analyzing either an external proficiency test sample, an internally prepared blind test sample or Initial Demonstration of Capability (IDC) before independent operation of a test method. The results of performance audits serve several purposes. The QA Officer may use performance audits for evaluating analyst proficiency, laboratory performance in a specified area to facilitate laboratory improvement efforts, and/or to provide information to an accrediting agency on correction of past performance of an external performance audit.

5.6 Corrective Actions/Preventative Actions (CAPA)

The corrective action process at Alpha Analytical is detailed in SOP 1736. The corrective action program at Alpha Analytical uses the Nonconformance workflow in Qualtrax to document and follow through the corrective action/preventative action process for three main areas: nonconformance's within the laboratory, customer complaints and failed PT studies. The process ensures continuous improvement of company performance by preventing the recurrence of quality problems.

Nonconformance reports are tracked for closure date and the type. Reports to management include the listing of open nonconformance reports and the frequency of the type of nonconformance occurring. A QA designee monitors the completeness of the forms, as well as verifies the actions are complete and acceptable.

Customers will be notified within 5 days of any question(s) regarding validity of results.

5.7 Managerial Review

The management review occurs at least once per year as part of the strategic planning process. Documentation of the management review meeting is by recording the meeting minutes and listing the attendees. The focus of the quality management review is the frequency of the type of nonconformance, closure status, audit progress and other quality assurance actions. Meetings include discussion and progress on quality system initiatives since the last meeting.

Prior to the meeting, an agenda is distributed to all personnel expected to be in attendance. The meeting is chaired by the President. Minutes are taken and distributed at the conclusion of the meeting by a QA designee. If action is necessary on any issue, a Summary Report is generated and distributed to responsible parties for implementation. Actions are monitored by the QAO or designee until completion.

5.8 Essential Quality Control Procedures

The following general quality control principles apply to all tests. The manner implemented is dependent on the type of test performed. The laboratory SOP presents the specific quality control checks undertaken to ensure precision, accuracy and sensitivity of each test method. Deviations from the existing SOP are allowed only upon approval of the deviation by the department manager and Quality Assurance Officer. This documentation must be either in form of written notice or email.

Alpha Analytical uses quality control samples to evaluate the following:

1. Adequate positive and negative controls to monitor blanks, spikes, reference toxicants, zero blanks;
2. Adequate tests to define the variability and/or reproducibility of laboratory results;
3. Measures to ensure the accuracy of the test data including sufficient calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples;
4. Measures to evaluate test performance, such as detection limits and quantitation limits or range of applicability such as linearity;
5. Selection of appropriate formulae to reduce raw data to final results such as linear regression, internal standards, or statistical packages;
6. Selection and use of reagents and standards of appropriate quality;

7. Measures to assure the selectivity of the test for its intended purpose;
8. Measures to assure constant and consistent test conditions for the method such as temperature, humidity, light, or specific instrument conditions.

   Note: All quality control samples are treated in the same manner as field samples.

All quality control measures are assessed and evaluated on an on-going basis, and quality control acceptance limits are used to determine the usability of the data. Control charts and/or calculated control limits monitor the long-term method performance by analyte, by instrument for water matrices. Routine evaluation and reporting of the control chart performance provides supervisors and management with additional performance measures to ensure data comparability. Control limits are recalculated when trends are observed.

Where no reference method or regulatory criteria exist, the laboratory specifies the acceptance/rejection criteria in the SOP. The test SOP specifies the QC samples performed per batch of samples. The quality control samples are categorized into the following, as appropriate to the method

- Method Blank
- Laboratory Duplicate
- Laboratory Control Sample (LCS)
- Laboratory Control Sample Duplicate (LCSD)
- Matrix Spike (MS)
- Matrix Spike Duplicate (MSD)

Selection of samples for Duplicate, Matrix Spike (MS) & Matrix Spike Duplicate (MSD)

2. Duplicate samples
   a. Samples will be selected if identified and requested by customer
   b. If no samples are identified by the customer then random samples will be analyzed within the batch as defined by the method, program or at a minimum batch of 20 samples.

3. Matrix Spike (MS) / Matrix Spike Duplicate (MSD) samples
   a. Samples will be selected if identified and requested by customer
   b. If no samples are identified by the customer then random samples will be selected and analyzed within the batch as defined by the method, program or at a minimum batch of 20 samples.
   c. If MS/MSD is not required, LCS/LCSD may be substituted for

precision and accuracy evaluation.
All DOD projects require MS/MSD.

The frequency is dependent on the reference method and test protocol. The following is the default requirement for quality control checks in lieu of any other guidance. The frequency for each quality control sample is generally one (1) per every 20 samples.

5.9 Data Reduction

After completion of the test procedure, the data reduction process begins.

Chromatography data may require the manual integration of peak areas or heights before reporting of results. The analyst must perform manual integration when software does not properly integrate or identify the peak. Manual integration must not occur for the purpose of achieving acceptable quality control or calibration. The analyst and reviewer sign and date the hardcopy of all manual integration. The analyst notes the rationale for performing the manual integration on the hardcopy printout and ensures the "TIC" marks from the software represent the integration area used for reporting the results. The analyst must minimize and avoid manual integration. The establishment of the proper integration parameters in the software reduces the number of manual integration occurrences.

The SOP for each test presents the formulas used for the specific test method. The formulas for the data calculations used throughout the laboratory are the following:

% Recovery (LCS)

$$\frac{MV}{TV} * 100 = \% R_{LCS}$$

where:
MV = Measured Value
TV = True Value

% Recovery (MS or MSD)

$$\frac{MV - SV}{TV} * 100 = \% R_{MS}$$

where:
MV = Measured Value
TV = True Value
SV = Amount found in sample

Average ($\overline{X}$)

$$\sum_{i-1}^{n} X_i \Big/ n = \overline{X}$$

where: $\overline{X}$ = Average of all values
X = Result of each measurement
n = Number of values

Relative Percent Difference (% RPD)

$$\frac{R_1 - R_2}{\left(R_1 + R_2\right) / 2} * 100 = \% RPD$$

where: R_1 = Larger of two observed values
R_2 = Smaller of two observed values

% Difference (%D)

$$\frac{X-\overline{X}}{\overline{X}}*100=\%D$$

where: $\overline{X}$ = Average of all values
X = Result of measurement

Standard Deviation of the sample (S_x)

$$\sqrt{\frac{\sum\left(X-\overline{X}\right)^2}{n-1}}=S_x$$

where: $\overline{X}$ = Average of all values
X = Result of each measurement
n = Number of values

Relative Standard Deviation (%RSD)

$$\frac{S_x}{\overline{X}}*100=\%RSD$$

where: $\overline{X}$ = Average of all values
Sx = Standard Deviation (n - 1)

Range of Logs (for microbiological enumeration analysis)

10% of routine samples are analyzed in duplicate and the range of logs is determined.

MDL (See 40CFR Part 136 for details)

$$\left[\sqrt{\frac{\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2 \Big/ n}{n-1}}\right] * t_{0.99} = MDL$$

where: *MDL* = The method detection limit
X = Result of each measurement
n = Number of values
t(n-1,1 = .99) = The students' T value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom. (See Students t Test Table)

Reporting Limit (RL)

Lowest calibration standard or greater

Control Limits

Upper Control Limit: $\overline{X} + 3 * S_x = UCL$
Lower Control Limit: $\overline{X} - 3 * S_x = LCL$

Warning Limits

Upper Warning Limit: $\overline{X} + 2 * S_x = UWL$
Lower Warning Limit: $\overline{X} - 2 * S_x = UWL$

Method of Standard Additions (MSA): (See EPA 7000A for details)

The simplest version of this technique is the single-addition method, in which two identical aliquots of the sample solution, each of volume Vx, are taken. To the first (labeled A) is added a known volume Vs of a standard analyte solution of concentration Cs. To the second aliquot (labeled B) is added the same volume Vs of the solvent. The analytical signals of A and B are measured and corrected for non-analyte signals. The unknown sample concentration Cx is calculated:

$$C_x = \frac{SB\ V_S\ C_s}{(SA - SB)\ V_X}$$

where SA and SB are the analytical signals (corrected for the blank) of solutions A and B, respectively. V_S and C_s should be chosen so that SA is roughly twice SB on the average, avoiding excess dilution of the sample. If a separation or concentration step is used, the additions are best made first and carried through the entire procedure.

Improved results can be obtained by employing a series of standard additions. To equal volumes of the sample are added a series of standard solutions containing different known quantities of the analyte, and all solutions are diluted to the same final volume.

For example, addition 1 should be prepared so that the resulting concentration is approximately 50 percent of the expected absorbance from the endogenous analyte in the sample. Additions 2 and 3 should be prepared so that the concentrations are approximately 100 and 150 percent of the expected endogenous sample absorbance.

The absorbance of each solution is determined and then plotted on the vertical axis of a graph, with the concentrations of the known standards plotted on the horizontal axis. When the resulting line is extrapolated to zero absorbance, the point of interception of the abscissa is the endogenous concentration of the analyte in the sample. The abscissa on the left of the ordinate is scaled the same as on the right side, but in the opposite direction from the ordinate. A linear regression program may be used to obtain the intercept concentration.

5.10 Document Control

The Document Control Procedure (SOP/1729) describes the process for controlled and uncontrolled documents. The use of the revision number allows for the retention of a previous document for historical information purposes.

Every document is assigned a unique identification number, which is present on each page of the document. A master list of documents includes the unique identification. Each controlled copy includes the revision number, published date and page number.

Full document control includes the status of each document: active, inactive or superseded/archived. Inactive documents are procedures not currently requested, but may be in the future. Archived documents are procedures replaced with a later revision. Authorized personnel must review and approve each document and any subsequent revisions before use in the laboratory. Personnel authorized to review and approve a document have access to all necessary information on which to base their review and approval. The history section of the document in Qualtrax includes a description of the nature of the document change.

Standard Operating Procedures (SOPs) are instructions for repetitive or standard operations performed by the laboratory. The SOP author is the person familiar with the topic. The standard format for writing SOPs is set-up as a template for administration and technical SOPs. Each SOP is peer reviewed, authorized by management, and QA before final publication and implementation. Authorized signatories for controlled documentation include one or more of the following personnel: Company President, Quality Assurance Officer, Laboratory Technical Manager, Department Manager, Department Team Leader. Personnel acknowledge approved documents as read, understood and agreed to through electronic attestation forms associated with each document as SOP Attestation Tests which reside in Qualtrax.

SOPs must receive evaluation and input by laboratory supervisors and key technical personnel. The content of each SOP must conform to applicable requirements of analytical methods and certification agencies. Within these constraints, the content of a SOP meets the needs of a particular area of the laboratory. A new or revised SOP is needed when regulatory programs update or add methods, the scope of the existing method is extended, or when activities are being performed without adequate documentation.

Updating, modifying and changing SOPs, forms and the contents of this QSM are prompt and part of the routine practices. The prompt modification of these documents ensures the documents reflect the current practices and operations of the laboratory. During annual review of a document, (including but not limited to: SOPs, Ethics Policy, Quality Systems Manual), requested changes are reviewed and the document reissued using the information and a new revision number is assigned and published in Qualtrax.

The laboratory maintains control over the possession and distribution of all documents that directly affect the quality of data. This includes, but is not limited to, documents such as the Quality Systems Manual, Standard Operating Procedures, customer instructions, Laboratory Work Instructions, data sheets, check lists and forms.

5.11 Detection Limits

Detection Limits (DLs), previously referred to as Method Detection Limits (MDLs), are determined for all analytes as specified in the Institute (TNI) Standards. DLs are determined for all new instrumentation, whenever there is a change in the test method or instrumentation that affects performance or sensitivity of the analysis. From these, detection limits, Reporting Limits (RLs), are established. The RL is the minimum concentration of an analyte that can be identified and quantified within specified limits of precision and bias during routine and analytical operating conditions.

Laboratory reporting limits lie within the calibration range, at or above the RL. For methods that require only one standard, the reporting limit is no lower than the low-level check standard, which is designed to verify the integrity of the curve at lower levels. If reporting limits are required below the lower level of the calibration curve, RL, or low-level check standard, method modifications are required. Refer to DL/LOD/LOQ SOP/1732. Note: ”J” Estimated value: Upon customer request, the Target analyte concentration can be reported below the quantitation limit (RL), but above the Detection Limit (DL) with a “J” qualifier as long as there is a LOD study on file.

5.12 LOD/LOQ Studies

A. LOD (Limit of Detection) Verification

1. LOD (Limit of Detection) verification is required annually for each target analyte in which test results are to be reported below the lowest calibration standard (“J” values) for each instrument, matrix and prep procedure. LOD is required quarterly for all DOD projects.

2. All sample-processing steps of the analytical method shall be included in the determination of the LOD.

3. The validity of the LOD shall be confirmed by ***qualitative*** identification of the analyte(s) in a QC sample in each quality system matrix containing the analyte at no more than 2-3X the LOD for single analyte tests, and 2X up to 4X the LOD for multiple analyte tests. This verification must be performed on every instrument that is to be used for analysis of samples and reporting of data.

4. An LOD study is not required for any component for which spiking solutions or quality control samples are not available such as temperature. Where an LOD study is not performed, the laboratory may not report a value below the limit of quantitation.

B. LOQ (Limit of Quantitation) Verification

1. LOQ (Limit of Quantitation) verification is required annually for each target analyte that is not reported below the lowest calibration standard for each matrix and prep procedure. LOQ is not required if an annual LOD verification is performed.
2. The validity of the LOQ shall be confirmed by successful analysis of a QC sample containing the analytes of concern in each quality system matrix 1-2 times the claimed LOQ. A successful analysis is one where the recovery of each analyte is within the established test method acceptance criteria for accuracy. LOQ are required quarterly for all DOD projects.

The LOQ study is not required for any component or property for which spiking solutions or quality control samples are not commercially available or otherwise inappropriate (e.g., pH).

The LOQ acceptance criteria are based on the established acceptance criteria for Laboratory Control Samples.

Refer to DL/LOD/LOQ SOP/1732

5.13 Range of Logs – Precision of Quantitative Methods - Microbiology

A. Precision of duplicate analyses is calculated for samples examined by enumerative microbiological methods according to the following procedure:

   a. Perform duplicate analyses on first 15 positive samples.

   b. Record duplicate analyses as D1 and D2 and calculate the logarithm of each result.

   c. If either of a set of duplicate results is <1, add 1 to both values before calculating the logarithms.

   d. Calculate the range (R) for each pair of transformed duplicates as the mean of these ranges.

6 Personnel

6.1 Laboratory Management Responsibilities

Management is responsible for communicating the requirements of the quality system, customer specifications and regulatory needs to all personnel. Management job descriptions detail the responsibilities of each position.

The H.R. Director has job descriptions for all positions in the laboratory defining the level of qualifications, training, and experience and laboratory skills. During initial training, management provides access to documented operations procedures, observes personnel performance, and evaluates personnel proficiency. Management documents technical laboratory staff's proficiency initially and on a continuing basis through use of laboratory control samples and purchased proficiency evaluation standards.

Management is responsible for verification of proper sample management and all aspects of data reporting. The communication of the operating practices of the laboratory is through the document control and attestation process.

Either the Quality Assurance Officer, Operations Director and/or Technical Managers have the authority to stop work due to non-conformances and have the authority to resume work after it has been stopped.

6.2 Laboratory Staff Requirements

Recruitment is the responsibility of the Operations Manager and HR Department, with input from other personnel as required. The Training Program procedure SOP/1565 details the process for completing requirements and training to ensure personnel have adequate skills and competence for the job function. Initial training includes ethics training, Qualtrax Training, QA Basics, IT/LIMs including computer security.

A job description details the necessary requirements for each job and includes position title, minimum educational requirements, skills, responsibilities and reporting relationships and any supervisory responsibility.

Initial training of new employees and contract staff includes laboratory ethics and quality policies, signing the Employee Signature Log, as well as execution of an Ethics Agreement. Any employee found to knowingly violate the Ethics Policy Agreement, report data values, that are not actual values obtained or improperly manipulated, or intentionally report dates and times of data analyses that are not the actual dates and times of analysis, will lead to disciplinary action, including termination, as outlined in Section V.K of the Employee Handbook. Each employee must report personally or anonymously to the Laboratory Technical Manager, QA Officer and/or Ethics Team Member any accidental or suspected intentional reporting of non-authentic data by others for follow up action. The review of the laboratory ethics and ethics training occurs annually with all personnel.

(DOD) All inappropriate and prohibited laboratory practices, as detailed in the DOD WSM 5.2.7, will be reported to the appropriate accrediting body within 15 business days of discovery. Records of corrective actions or proposed will be submitted within 30 business days. Failure to notify the AB within 15 business days will result in suspension of the DOD ELAP accreditation.

The Ethics program consists of the following key components:

- Ethics Policy /Agreement (Appendix F)
- Initial and annual ethics training

- Internal audits conducted annually
- Adherence to Manual Integration SOP/1731
- Ethical or Data Integrity issues reported to Lab Managers, QAO or HR Director
- Anonymous reporting to HR Director - This is accomplished by writing a detailed description of the suspected ethics breach and submitting the information, anonymously, to the Human Resource Director.
- "No-fault" policy encouraging reporting of incidences without fear of retribution
- Electronic tracking and audit trails through LIMs and instruments enabled where available.

6.3 Training

The Quality Systems Manual and related documentation is available to all employees. Cross training, supervisory training and other related training takes place on a scheduled and as-needed basis. Training ensures the communication and understanding of all personnel in the laboratory-documented procedures and practices.

All personnel undertake orientation-training sessions upon initial employment. Orientation training includes laboratory business practices, employment specifications, Ethics Policy, Quality Systems Manual, Chemical Hygiene Plan, and all SOPs required for the job function.

Managers ensure the training for new employees and review the continuing training for current employees. Training includes on-site and off-site programs presented by staff members, contractors, equipment manufacturers, and institutions of higher learning.

Training of new personnel to any job assignment takes place on-site according to the Training Program procedure. Laboratory personnel may perform their assigned methods/protocols without supervision only after documentation of acceptable proficiency. Training records lists the current training status.

On-the-job training includes demonstration of skills during job performance, initial demonstration of proficiency, and review of SOPs. Health and Safety training takes place on an annual basis with careful introduction to new principles. Personnel have access to the Chemical Hygiene Plan and Material Safety Data Sheets. On-site training includes side-by-side hands-on training, formal classroom type instruction on the SOP or a meeting to discuss procedural changes or to address questions related to the laboratory operation. All training is documented via the Training Attestation Form, which is signed by all in attendance that they understood and will implement what was presented to them.

Training is an on-going opportunity to evaluate the laboratory operations. The updating of SOPs, Quality Systems Manual and other related information documents all changes to the quality system. Training is documented via the Training Attestation Form or in Qualtrax with training test records.

Off-site training takes place on an as-needed basis. Recommendations and suggestions regarding educational programs come from all levels of staff. It is the employee's responsibility to present a copy of any certificates or attendance information to the HR Director. The information is added to the individual's training record.

6.4 Records

The QA Department is responsible for maintaining training records. Certificates, demonstration of capability forms and other records of training are placed in the individual's training file.

Appropriate personnel are notified through email and/or Qualtrax or by the QA department when a revision is complete for the controlled version of a document. The manager of the area determines when a change is significant to require training.

Job descriptions are included in the training record files. The Human Resources Department reviews the job descriptions, Resumes and/or biosketches are kept on file with the Human Resources Department and the QA Department.

7 Physical Facilities – Accommodation and Environment

This laboratory facility has a total area of 25,000 square feet for each of the Westboro and Mansfield Facilities

The laboratory functional areas include:

Administration and offices
Sample receiving
Sample management
Air analysis (Mansfield Facility only)
Microbiological (Westboro Facility only)
General analytical chemistry
Metals sample preparation (Mansfield Facility only)
Organic sample preparation
Metals analysis (Mansfield Facility only)
Volatiles gas chromatography (GC)
Volatiles gas chromatography/mass spectrometry (GC/MS)
Volatiles air analysis (Mansfield Facility only)
Semivolatiles gas chromatography/mass spectrometry (GC/MS)
Semivolatiles gas chromatography (GC)
Miscellaneous facility mechanical and storage areas.

All chemicals are stored in appropriate cabinets and properly disposed of as required. All flammable solvents are stored in OSHA and NFPA approved cabinets. Acids are stored in OSHA acid cabinets. Separate waste areas houses the sample and chemical waste before pickup by a licensed waste hauler.

7.1 Environment

Lighting, noise, humidity, heating, ventilation and air conditioning satisfy the needs of the testing performed on the premises. The laboratory building design ensures regulated temperature control for analytical equipment. Air-handling systems minimize airborne contaminants that may jeopardize sample integrity or analytical performance.

The analytical instrumentation is in separate rooms from laboratory activities that involve the use of large quantities of organic solvents or inorganic acids. A separate room, in the Westboro facility, provides the facilities for the microbiological testing.

Standards and other materials requiring below 0°C storage temperatures are placed in freezers and separated from samples or potential contaminating materials. Refrigerators provide cooling needs for samples and materials with temperature requirements of below room temperature and greater than freezing. Sample and standard storage areas are monitored and controlled for temperature and recorded in the data logger system. Sample storage areas for volatiles are separated from other samples and monitored for any effects due to cross contamination.

Bulk hazardous waste containers are located away from the testing activities. Waste disposal uses lab pack procedures and those designated by the regulatory authorities. The Chemical Hygiene Plan and the Waste Management and Disposal SOPs (Westboro: SOP/1728 and Mansfield SOP/1797)) include the procedures for handling and disposing of chemicals used in the laboratory.

The working and storage environments are maintained in a safe and appropriate manner. A Chemical Hygiene Plan details the requirements for safety and chemical handling. Safety measures that protect property and personnel from injury or illness include: fume hoods, fire extinguishers, fire blankets, alarm systems, safety training, protective clothing, emergency showers, eyewashes, and spill control kits.

7.2 Work Areas

Good housekeeping is the responsibility of all personnel. Each person is responsible for assuring clean and uncluttered work areas. The job descriptions list specific housekeeping duties. Records, samples and waste materials are the common cause for clutter in the laboratory.

. Removal of administration and laboratory records to the record storage area occurs to reduce clutter and ensure traceability. The individual filling the laboratory record box, labels the box with a number, the contents, date and laboratory area. Authorized personnel assign and record into a permanent record the box number, discard date and box contents. Authorized personnel review the box label for number, discard date and contents. Boxes are stored onsite and off-site for the record retention period identified in the NELAC Institute (TNI) Standards and EPA regulations, whichever is more stringent.

Sample management personnel remove samples to the sample storage area after all data is correct and complete. Sample coolers are removed to a designated storage area for recycling. Samples are stored in the designated process storage areas until testing is complete. Sample removal from the process storage occurs after mailing of the final report. The sample management staff places the samples in the archive storage area for thirty days after report release. The archive sample storage area is not controlled or monitored. Based on customer specifications, samples are properly disposed or returned to the customer.

Waste materials, expired reagents, expired standards and materials are disposed of and not stored in the laboratory. Hazardous waste labeled accumulation containers in the laboratory collect designated waste streams for later bulk disposal. Laboratory personnel remove the less than five-gallon accumulation containers when full from the laboratory and place the containers in the bulk hazardous waste area. Refer to the Waste Management and Disposal SOPS for Westboro: SOP/1728 and Mansfield SOP/1797. Personnel identifying out of date reagents and standards remove the materials to the proper disposal area.

7.3 Security

Alpha Analytical provides a secure environment for our employees, guests, customers, samples and analytical data. Security procedures require that all exterior doors remain locked unless manned. Access to the laboratory is limited to employees and contractors. Visitors not under signed contract are required to sign the Visitors Log and must be accompanied by a laboratory employee at all times within the testing areas.

The defined high security area is the sample management area. Identification card locks on the internal doors control entry into the laboratory area.

All doors are locked after hours and require a key for entry. The security alarm continuously monitors for smoke and fire related heat. When the alarm is activated, the appropriate emergency response officers are notified. The local emergency offices have the emergency contact list for the laboratory.

8 Equipment and Reference Materials

8.1 Maintenance

The laboratory has a proactive equipment maintenance program. The laboratory maintains service contracts for most major equipment, which include routine preventative maintenance visits by the service provider. Technical personnel perform manufacturer's specified maintenance on a routine basis to ensure equipment operates at peak performance.

A brief summary of some common preventive maintenance procedures is provided in Appendix D. All instrument preventative and corrective maintenance is recorded in the maintenance logbook assigned to the equipment. After maintenance or repair, the instrument must successfully calibrate following the method SOP. Laboratory personnel must demonstrate quality control performance before sample analysis.

The laboratory maintains a stock of spare parts and consumables for analytical equipment. Backup instrumentation for some analytical equipment is available on site for use in case of major equipment failure. The person discovering or suspecting an equipment maintenance problem or failure tags the equipment with 'out of service' tag. If routine maintenance measures do not eliminate the problem, the Laboratory Technical Manager or Operations Director is notified and the appropriate equipment service provider is contacted.

All major laboratory equipment has individual and traceable maintenance logbooks in which to document manufacturer's recommended maintenance procedures, specific cleaning procedures, comments on calibration, replacement of small worn or damaged parts, and any work by outside contractors. The person performing routine or non-routine maintenance signs and dates the maintenance logbook. If an instrument is down for maintenance, a complete record of all steps taken to put it back into service is recorded including reference to the new calibration and quality control checks. Any equipment service providers working on the equipment are recorded in the logbook.

Record repetitive or on-going equipment problems other than normal maintenance requirements on nonconformance action forms. The nonconformance action form notifies management and the Quality Assurance Officer of a problem affecting the performance and data quality.

The laboratory groups some equipment into a single laboratory equipment maintenance logbook. Examples include: autopipets, thermometer calibration. The identity of each item is by serial number or a laboratory-designated item number. The same data recorded for major equipment applies to this documentation.

The maintenance records shall include:

Equipment name;
Manufacturer's name, type identification, serial number or other unique identification;
Date received, date put into service, condition when received;
Current location;
Details of past maintenance and future schedule;
A history of any damage, malfunction, modification or repair;
Dates and results of calibration or verification.

The maintenance logbook may include the reference to the location of the equipment operational and maintenance manuals. The logbook may include the reference to laboratory run logbook or data files for the calibration and quality checks of daily or frequent calibrations.

The Courier Supervisor ensures that maintenance and records for transportation vehicles are complete. The purchasing process is used for ordering garage maintenance, the garage work order is reviewed, and the vehicle checked for condition. The Controller receives all paperwork for completion of the maintenance process.

8.1.1 Microbiology General Equipment Maintenance

Optics of the Quebec colony counter and microscope are cleaned prior to each use. The stage of the microscope is also cleaned and the microscope is kept covered when not in use.

Glassware is checked for residual alkaline or acid residue utilizing bromothymol blue (BTB) on each day of media preparation.

8.2 Equipment Listing

A listing of the major equipment used for testing is available upon request. The equipment list details the unique identification number, equipment location, serial number, model number, and purchase date. The unique identification number is attached to the piece of equipment.

The laboratory performs analyses using state of the art equipment. In addition to the major equipment, the most common equipment used in the laboratory are: thermometers, balances, autopipets, water baths, hot plates, autoclaves, pH meters, conductivity meters and a variety of labware. The SOPs list the calibration and verification requirements for all laboratory equipment used in measurements.

8.3 Laboratory Water

Laboratory water is purified from central DI and RO water systems and piped to all laboratory areas. The QA Department samples the laboratory grade water and submits the samples for analysis by the lab to document the water meets the drinking water certification criteria. The Laboratory Water Logbook lists the daily conductivity checks and acceptance criteria for the laboratory water. The laboratory documents the daily, monthly and annual water quality checks. Please refer to Table 8-1 for tested parameters, monitoring frequency and control limits for each parameter (SOP/1738). Additional parameters may be tested for at the laboratory’s discretion.

When additional treatment occurs in the test area, that test area records the water quality checks from the most frequently used tap. At a minimum the quality of the laboratory grade water is monitored daily by conductivity measurements. Records of the daily checks are found in the Laboratory Water Logbook. If out of specification results occur, a nonconformance action form is submitted.

TABLE 8-1

Parameter	Monitoring Frequency	Control Limits
Conductivity	Daily	<2 µmhos/cm @ 25^{o}C
pH	Daily	5.5 - 7.5
Total Organic Carbon (Westboro only)	Monthly	< 1.0 mg/L
Total Residual Chlorine	Monthly	< detection limit
Ammonia Nitrogen (Westboro only)	Monthly	< 0.1 mg/L
Metals: Cd, Cr, Cu, Pb, Ni and Zn (Mansfield only)	Monthly (Required Annually)	< 0.05 mg/L
Total Metals (Mansfield only)	Monthly (Required Annually)	< 0.1 mg/L

Heterotrophic Plate Count (Westboro only)	Monthly	< 500 CFU/mL
Water Quality Test (Biosuitability) (Westboro only)	Annually	0.8 – 3.0 ratio

8.4 Reference Materials

Reference materials include: Class 1 weights, NIST thermometers and reference standards. Logbooks record the reference materials used for calibration and verification. The Department Manager or QA Department maintains any certificates received with the reference materials. Laboratory personnel record in the standards logbook the reference standards date received, unique identification number, expiration date and number of containers. Each laboratory area records the unique identifier on the reference standard certificate and the Department Manager maintains the certificate. The identifier allows traceability from the certificate to the analytical data.

9 Measurement Traceability and Calibration

9.1 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests are calibrated and/or verified before put into service and on a continuing basis. The results are recorded in the instrument specific logbook. The laboratory has a program for the calibration and verification of its measuring and test equipment. The program includes all major equipment and minor equipment such as balances, thermometers and control standards. The Quality Systems Manual and method SOP describe the calibration records, frequency and personnel responsibilities.

9.2 Traceability of Calibration

The program of calibration and/or verification and validation of equipment is such that measurements are traceable to national standards, where available. Calibration certificates indicate the traceability to national standards, provide the results, and associated uncertainty of measurement and/or a statement of compliance with identified metrological specifications. A body that provides traceability to a national standard calibrates reference standards. The laboratory maintains a permanent file of all such certifications.

9.3 Reference Standards and Materials

Alpha Analytical has a program for calibration and verification of reference standards. The results and program are recorded in the appropriate instrument logbook. Required in-service checks between calibrations and verifications are described in method SOPs and are recorded in the appropriate instrument logbook.

Calibration standards are maintained within the area of consumption. A logbook of use is maintained and use is limited strictly to method required calibrations. Each calibration standard is identified as to test method used, date received, date opened, and expiration date. Calibrations are verified by using a second source or lot number of the calibration standard. Calibration check procedures are stated in applicable test method SOPs.

Preparation of standards must be performed using Class A glassware. Class A glassware must be used for all processes involving quantitative analyses.

Reference standards of measurement in the laboratory’s possession (such as calibration weights or traceable thermometers) are used for calibration only and for no other purpose.

Standards and reagents are uniquely identified as outlined in Westboro SOP 1745 and Mansfield SOP 1816.

9.4 Calibration General Requirements

Each calibration record is dated and labeled with method, instrument, analysis date, analyst(s) and each analyte name, concentration and response. For electronic processing systems that compute the calibration curve, the equation for the curve and the correlation coefficient are recorded in the appropriate instrument logbook. This is also true for manually prepared curves. Calibrations are tagged to the specific instrument through use of the instrument logbook and or sequence file documentation.

Initial calibration requires a standard curve that brackets the expected sample concentration. Initial calibration generally uses three to five standards depending on the equipment and reference method specifications. Before the start of each analytical sequence, initial calibration is verified by using a continuing calibration standard. Calibration verification or continuing calibration uses the same standard as the ICAL unless method specifies otherwise. The ICV is from a second source or lot number than that used for initial calibration. The acceptance criteria for the continuing calibration standard must meet acceptance criteria before analysis of any samples. When the acceptance criteria is not within limits, review maintenance protocols and perform any necessary maintenance before starting the initial calibration sequence.

9.5 Equipment Calibration

The SOP used for the analysis defines the instrument and equipment calibration required. The following defines the general practices for equipment calibration of selected equipment.

9.5.1 Gas Chromatography/Mass Spectrometry (GC/MS)

The GC/MS is hardware tuned before performing the initial and continuing calibrations. Results must meet the peak ratio specifications of the analytical methods. For volatiles analyses, bromofluorobenzene (BFB) is used, and for semivolatiles analyses, decafluorotriphenylphosphine (DFTPP) is used for instrument tuning.

The mass spectrometer response is calibrated by analyzing a set of five or more initial calibration solutions, as appropriate, for each GC/MS method. Each solution is analyzed once, unless the method or the customer requires multiple analyses. The relative response factor for each analyte is calculated for internal standard calibration. The calibration factor for external standard calibration is calculated using the expressions found in the laboratory method SOP. Calibration is acceptable when all acceptance criteria are within method criteria.

The initial calibration is verified through the analysis of a continuing calibration standard every 12 hours. The concentration of the continuing calibration standard is dependent on the requirements of the specific method. The relative response factors for all analytes of interest are calculated and verified against the initial calibration mean relative response factors. The percent difference (%D) for each analyte is calculated and must be less than the acceptance criteria stated in the method.

An acceptable continuing calibration run must have measured percent differences for the analytes within method specified ranges. If any criteria for an acceptable calibration are not met, either instrument maintenance must be performed until the continuing calibration analysis meets all criteria or a new initial calibration is established before any samples are analyzed. No samples may be analyzed unless the acceptance criteria are met for the initial and continuing calibration.

Additional quality control samples are part of the GC/MS analysis. These include internal standards, surrogates, method blanks, instrument blanks, laboratory control samples, matrix spikes and matrix spike duplicates. The frequency and control criteria are defined in the laboratory SOP.

9.5.2 Gas Chromatography (GC)

Internal standard calibration or external standard calibration is utilized for analysis by GC. The method-specified number of calibration standards is used. Each solution is analyzed once and the analyte relative response factors or calibration factors are calculated. The mean relative response factor for each analyte is then obtained by using the expression in the formula listed in the SOP. Integrated areas are utilized for these expressions.

For multiple response pesticides, PCBs or hydrocarbons the quantitation consists of the average of selected peaks or the integration of the area defined by a reference standard. The SOP details the integration criteria for each compound.

The initial calibration is verified through the analysis of a continuing calibration standard every 12 hours or 20 samples. The concentration of the continuing calibration standard is dependent on the requirements of the specific method. The relative response factors for all analytes of interest are calculated and verified against the initial calibration mean relative response factors. The percent difference (%D) for each analyte is calculated. The percent drift (%d) may be calculated when calibration factors are used for quantitation.

An acceptable continuing calibration must have measured percent differences or percent drift for the analytes within method specified ranges. Should any criteria for an acceptable calibration not be met, either instrument maintenance is performed until the continuing calibration analysis meets all criteria, or a new calibration is established before any samples are analyzed. No samples may be analyzed unless the acceptance criteria are met for the initial and continuing calibration.

Other standard checks may be required for a specified reference method. Instrument performance checks specified in the reference method must be performed and be within the acceptance limits stated in the reference method. Additional quality control samples are part of the GC analysis. These include internal standards, surrogates, method blanks, instrument blanks, laboratory control samples, matrix spikes and matrix spike duplicates. The frequency and control criteria are defined in the laboratory SOP.

9.5.3 Cold Vapor Atomic Absorption Spectrophotometry (CVAA)

An initial calibration is performed daily with freshly prepared working standards that bracket the expected concentration range of the sample. A minimum of a three-point calibration curve is acquired which must have a correlation coefficient of 0.995 or better. The initial calibration is verified every 10 samples. The continuing calibration is required to be within method-defined criteria, depending on the analytical method employed. Continuing calibration blanks are run at the same frequency. Analysis of samples cannot begin until an initial calibration verification has been performed and is found to be within ± 10% of the true value.

9.5.4 Inductively Coupled Plasma Emission Spectrophotometry-Mass Spectrometry (ICP-MS)

Initial calibration and instrument tune is performed daily, not to exceed 24 hours, and continuing calibrations are performed every 10 samples. Initial calibration consists of a minimum of three standards and a Blank that bracket the expected concentration range of the samples. Analysis of samples cannot begin until an initial calibration verification has been performed and is found to be within method-defined criteria. The continuing calibration is required to be within method-defined criteria. Interference check standards are performed at the beginning of the sequence. Acceptance criteria are stated in the SOP.

9.5.5 Inductively Coupled Plasma Emission Spectrophotometry (ICP)

Initial calibration is performed daily, not to exceed 24 hours, and continuing calibrations are performed every 10 samples. Initial calibration consists of one standard and a Blank that bracket the expected concentration range of the samples. Analysis of samples cannot begin until an initial calibration verification has been performed and is found to be within 5% of the true value for EPA Method 200.7 and 10% for SW846 6010 methods. The continuing calibration is required to be within 10% of the true value. Interference check standards are performed at the beginning and end of the sequence. Acceptance criteria are stated in the SOP.

9.5.6 Thermometers

Laboratory thermometers are checked annually for accuracy against certified, NIST traceable thermometers. Correction factors derived from the annual calibrations are applied to temperature readings where applicable. The analyst records the corrected temperature for all observations.

NIST traceable thermometers are calibrated professionally and re-certified every year. Records of thermometer calibrations are retained by the QA Department. All thermometers are tagged with the ID number, correction factor to be applied and the expiration of the calibration check.

NOTE: Electronic-based thermometers are calibrated on an annual basis. Thermometers are tagged with calibration information by the vendor, including the ID number, correction factor to be applied and the expiration of the calibration check. Certificates are kept on file in the QA Department.

Thermometers are not used past the calibration expiration date or if the thermometer is not reading properly. Replacement thermometers are calibrated and the maintenance logbook is updated when a change in the thermometer is required due to breakage, damage or expired calibration.

9.5.7 Balances

Calibration checks are performed for each day of use, for each balance. The calibration consists of a minimum of two weights, which bracket the weight to be measured. Additional calibration check procedures are performed on balances utilized in Microbiology laboratory. This additional procedure consists of a deflection test, which is performed to ensure that 100mg is detectable at a weight of 150 grams.

The balance logbook lists the acceptance criteria and performance criteria for the various balances used in the laboratory. Calibration weight measurements must meet the acceptance criteria listed on the record form.

Each balance is serviced and calibrated by a professional semi-annually. Balances are labeled with the balance number, date of service and the expiration date for the annual service check. The balance number used for any measurements requiring traceability is recorded with measurement data. Balances are not used past the expiration date or when the weight check is not within acceptable criteria. The accuracy of the calibration weights used by Alpha Analytical is verified annually by an accredited calibration service.

9.5.8 Mechanical volumetric pipettes

Delivery volumes for the mechanical volumetric pipettes (i.e. Eppendorf) are checked and recorded gravimetrically before use and on a quarterly basis. The verification is performed at the volume of use or bracketing the volume range of use. The check must be within the criteria stated in the laboratory logbook. Pipettes failing acceptance criteria are tagged and removed from service until repaired and the criteria are met, or discarded and replaced. Automatic pipettes are labeled with a unique ID number, volumes verified and expiration date.

9.5.9 Ion Chromatography

The ion chromatograph calibration is by analyzing a set of five or more initial calibration solutions, with concentrations of analytes appropriate to the analytical methods. The concentrations must bracket the expected concentration range of the samples analyzed. Procedures for verifying the calibration curve are method specific. The initial calibration is performed at the start of each day. The calibration curve is verified at least after every 20 samples.

9.5.10 pH Meters

pH meters are calibrated prior to use for each day of use. The meter is calibrated following the procedure for pH analysis. The records of the calibration are recorded in an instrument logbook or in the raw data for the analysis being performed. At least two buffer solutions that bracket the measurement range for the analysis are used for calibration. A second source check standard is used at the end of a run to verify meter stability. Buffer solutions used for calibration are NIST certified. Standard buffer solutions are not retained or re-used. The lot number of the buffer solutions is recorded in the data record to ensure traceability of the measurement to NIST.

9.5.11 Conductivity Meters

Three calibration standards of potassium chloride (KCL) solutions are analyzed annually on each instrument range. The calibration standards are used to verify instrument performance. The acceptance criteria are defined in the test SOP. If unacceptable performance is found, the cell is cleaned and rechecked. The cell is not used until satisfactory performance is achieved.

A single KCL standard solution is used to calibrate each range of the instrument. A second standard is used to check the calibration each day the meter is used. The check standard is near the measurement range for the samples to be analyzed. The acceptance criterion is ± 20% of the true value. The meter is labeled with expiration date for the annual calibration. A check standard that is NIST traceable is used to allow traceability. The check standard is performed at the end of the analysis run or at least after every 20 samples.

9.5.12 Autoclave

The date, contents, sterilization time and temperature, total cycle time and analyst's initials are recorded each time the autoclave is used. Autoclave cycles must be completed within 45 minutes when a 15 minute sterilization time is used. Autoclave timing mechanisms are checked quarterly with a stopwatch to verify timing controls. A maximum temperature thermometer is used with each cycle to ensure the sterilization temperature is reached.

Spore strips or ampoules are used weekly to confirm sterilization. BTSure ampoules are utilized as follows: An indicator ampoule is placed in most challenging area of sterilizer. Load is processed according to standard operating instructions. Remove from sterilizer and allow to cool for a minimum of 10 minutes. (Chemical indicator on label changes from green to black when processed.) Place the autoclaved indicator and un-autoclaved control indicator in an upright position in the plastic crusher provided. Gently squeeze crusher to break glass ampoules. Incubate both indicators at 55-60^{o}C for 24 hours. Examine appearance for color change. Yellow color indicates bacterial growth. No color change indicates adequate sterilization.

Calibration is conducted and certified annually by an outside service provider and recorded. Certificates are kept on file. Routine maintenance includes cleaning the autoclave seal to ensure freedom of caramelized media and cleaning drain screens to remove any debris buildup. For the efficient operation of the unit, overcrowding is avoided.

10 Test Methods and Standard Operating Procedures

10.1 Methods Documentation

Analysis consists of setting up proper instrument operating conditions, executing acceptable calibrations, monitoring instrument performance tests, analyzing prepared samples, and collecting data from the analyses. The test method SOP describes the instrumental analysis procedures, quality control frequencies and acceptance criteria. EPA accepted methods, national recognized methods or customer-specified methods are the basis for performance criteria, instrument conditions and the steps of the procedure. The method performance requirements of the published methods are followed unless otherwise specified by the customer.

The reference methods define the instrument operating conditions. In many of the reference methods, a range or general guidance on the operating conditions is defined. Documented modifications to the operating conditions clarify the reference methods or improve the quality of the results. In all cases where the method modifications are adopted, the performance criteria from the reference method must be met. Modifications to the operating conditions are stated in the SOP. Changes in the operating conditions made at the time of the analysis are documented in the appropriate laboratory or sequence log. A revision to the SOP takes place, when a day to day change in the operating condition improves performance for all matrices.

The laboratory SOPs include the operation of measurement equipment. The SOPs contain the - following information, as applicable:

The equipment used in the procedure, including equipment type

Equipment calibration and process for obtaining the measurement from the calibration

The step by step instructions to perform the measurement

Acceptance criteria for the calibrations

Corrective action for failed acceptance criteria, including assessment of previous calibration results

The basis used for the calibration standards such as traceability to NIST or EPA or demonstration of comparability

Frequency at which the equipment will be calibrated, adjusted and checked

The records maintained to document the calibration and use of measurement equipment

The calibration status for the equipment

The environmental conditions necessary before measurement equipment may be calibrated or used for measurement

Allowed adjustments to measurement equipment, including software, which will not invalidate the laboratory analysis

Maintenance of the equipment and record keeping to track performance before and after maintenance is completed

Define the standards, reagents and sample handling, interferences, preservation, and storage in order to assure measurement performance

10.2 Standard Operating Procedures (SOPs)

Alpha Analytical maintains SOPs that accurately reflect all phases of current laboratory activities such as assessing data integrity, nonconformance actions, handling customer complaints, sample receipt and storage, purchasing of all materials, and all test methods. These documents include equipment manuals provided by the manufacturer, internally written documents, and published methods with documented changes or modifications.

Copies of all SOPs are accessible to all personnel in electronic form through Qualtrax. Each SOP clearly indicates the published date of the document and the revision number.

10.3 Laboratory Method Manual (s)

All SOPs are posted as secure documents in the Alpha Qualtrax system. Directories are available for each laboratory area and administrative area in appropriate subfolders. Each SOP includes or references where applicable:

1) identification of the test method and where applicable;
2) applicable matrix or matrices;
3) method detection limit;
4) scope and application;
5) summary of method;
6) definitions;
7) interferences;
8) safety;
9) equipment and supplies
10) reagents and standards
11) sample collection, preservation, shipment and storage;
12) quality control;
13) calibration and standardization;
14) procedure;
15) calculations;
16) method performance;
17) pollution prevention;
18) data assessment and acceptance criteria for quality control measurements;
19) corrective actions for out-of-control data;
20) contingencies for handling out-of-control or unacceptable data;
21) waste management;
22) references; and
23) any tables, diagrams, flowcharts and validation data.

In cases where modifications to the published method have been made by the laboratory or where the referenced method is ambiguous or provides insufficient detail, these changes or clarifications are clearly described in the SOP.

10.4 Test Methods

The laboratory uses appropriate methods and procedures for all tests and related activities within its responsibility (including sampling, handling, transport and storage, preparation of items, estimation of uncertainty of measurement and analysis of test data). The method and procedures are consistent with the accuracy required, and with any standard specification relevant to the calibrations or tests concerned. When the use of mandated methods for a sample matrix is required, only those methods are used. Where methods are employed that are not required, the methods are fully documented and validated and are available to the customer and other recipients of the relevant reports.

The customer requests the reference method for sample analysis usually based on the regulatory program. The customer services staff may assist the customer with method selection when the customer specifies the regulatory program, but is unsure of the correct method required. The Laboratory Technical Manager or Quality Assurance Officer recommends methods for non-regulatory programs. In all cases, recommendation of methods is based on customer-defined method performance criteria. Customer services may recommend a procedure that meets the customer method performance criteria.

10.5 Method Validation/Initial Demonstration of Method Performance

Before acceptance and use of any method, satisfactory initial demonstration of method performance is required. In all cases, appropriate forms are completed and retained by the laboratory and made available upon request. All associated supporting data necessary to reproduce the analytical results is retained. Initial demonstration of method performance is completed each time there is a significant change in instrument type, personnel or method.

10.6 Sample Aliquots

The aliquot sampling process from a submitted sample is part of a test method. The laboratory uses documented and appropriate procedures and techniques to obtain representative sub-samples. Sample aliquots removed for analysis are homogenized and representative portions removed from the sample container. Personnel record observations made during aliquot sampling in the test method logbooks.

10.7 Data Verification

Calculations and data transfers are subject to appropriate checks which is a 3 tier approach. The initial analyst verifies all of his work, a secondary review of 100% of the initial is conducted by a an independent qualified analyst. A Customer Services representative reviews data for project and method performance requirements where applicable. A QA representative reviews data for project and method performance requirements when requested by a Customer. Final report review is performed by an authorized company signatory.

For drinking water suppliers, every effort is made to notify the Customer within 24-hours of obtaining valid data of any results that exceed any established maximum contaminant level or reportable concentration. Analyst or Department Supervisor notifies the Customer Services Department of the sample number(s), Customer name, analysis and sample results (preliminary or confirmed). The Customer Services Department notifies the customer.

The laboratory Report Generation and Approval SOP describes the practices to ensure that the reported data is free of transcription errors and calculation errors. Manually entered data into the LIMS is dual entered and checked by the LIMS to minimize transcription errors. The laboratory test method SOP describes the quality control measures used to assure method performance before reporting data.

10.8 Labeling of Standards and Reagents

The purchase, receipt and storage of consumable materials used for the technical operations of the laboratory include the following:

a) The laboratory retains records of manufacturer’s statement of purity, of the origin, purity and traceability of all chemical and physical standards.
b) Original reagent containers are labeled with the date opened and the expiration date.
c) Detailed records are maintained on reagent and standards preparation. These records indicate traceability to purchased stocks or neat compounds and include the date of preparation and preparer's initials.

d) Where calibrations do not include the generation of a calibration curve, records show the calibration date and type of calibration standard used.
e) All prepared reagents and standards are uniquely identified and the contents are clearly identified with preparation date, concentration and preparer's initials. These procedures are outlined in Westboro SOP/1745 and Mansfield SOP/1816.

10.9 Computers and Electronic Data Related Requirements

Computers or automated equipment are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of test data. The laboratory ensures that computer software is documented and adequate. The goals of the software development methodology, existing system validations and the change control system are to ensure that:

the software systems perform the required functions accurately,

the users understand how to use the system, and

auditors can assure themselves of the validity of the analytical data.

The computer systems used at Alpha Analytical are purchased. A coordinated effort is made with the supplier to assure the computer operations meet the laboratory requirements for data integrity. Alpha Analytical has a formal validation program of its computer systems. The validation program is a comprehensive program to ensure data transmitted, reported or manipulated by electronic means is correct and free of errors. The validation and verification approach is separated into three areas.

1. New software is developed and validated using test data. Records of validation include the test data report, date and initials. Where formulas are part of the program, documentation includes manual verification of the final calculated values. New software includes the development of macros for spreadsheets and other tools using commercial software packages.
2. Reasons for changes to software are identified through flaws in existing documentation or the need to improve system processes and are documented on the Nonconformance Report. Final implementation of the change is documented on the nonconformance action form. The tracking and timelines of making the change is readily available. This process also provides the complete documentation of all software and electronic data reporting problems. All nonconformance identified with electronic data process result in corrective action that are reported to management before or at the bi-weekly executive meeting. Customers will be notified prior to any changes to software or hardware that will adversely affect customer electronic data. This information is provided by IT department to QA and Project Managers to be communicated to appropriate customers.

Verification of system integrity is through routine maintenance, protection from unauthorized access and electronic verification programs. Routine maintenance including system backups are performed on a scheduled basis. The backup process and password and access protections are defined in the Computer System Backup Control SOP/1562 and Computer Security SOP/1563. Electronic verification may be used to assure the commercially purchased software is performing at its original specifications. This includes virus checking of all network operation at least once per week. Documentation of all verification and maintenance operations is retained.

11 Sample Handling, Sample Acceptance Policy and Sample Receipt

The Sample Login and Custody procedures define the process for sample management from sample receipt through analysis and to disposal. These procedures detail the process for sample receipt, records and storage pending analysis.

Customers or Alpha's Couriers deliver samples to the laboratory during normal business hours. Sample receiving occurs in the sample management area.

Customer service personnel place bottle orders. The orders are filled following the bottle order instruction form. Blanks are prepared as needed with minimal storage. All glass containers are packed to minimize or prevent breakage. The containers are placed in plastic coolers or shipping packages and Chain-of Custody forms, seals (if requested) and labels enclosed. The bottle order is shipped by third party, picked up by the customer or customer representative or delivered by Alpha courier to the customer.

11.1 Sampling Supplies

11.1.1 Sample Containers

Sample containers provided by Alpha Analytical include labels, preservatives and a blank chain of custody form. Preservatives and containers are lot controlled and verified as appropriate for the indicated type of analysis.

Each lot of containers used for the collection of samples for microbiological analysis is checked for sterility prior to distribution. Sterility checks are performed by Microbiology staff and results recorded in Microbiology Sample Container Sterility Log.

Sample Containers for collecting Air samples (TO-15) are cleaned and prepared according to SOP 2190 "Cleaning and Preparation Procedures for Equipment used to collect Air sample for analytis of Volatile Organic Compounds".

11.1.2 Chain of Custody

Chain of custody forms must accompany all samples received by Alpha personnel. The chain of custody form indicates the sample origin and arrival at the laboratory and identifies the analyses requested.

11.1.3 Reagent Water

Alpha Analytical supplies laboratory pure water for field QC blanks. Water used for volatile organics must be free of volatile compounds below the method detection limit. The quality of the laboratory water is monitored for conductivity once per day. Additional water quality criteria may be monitored based on customer specific requests. The water quality in the laboratory is monitored for chemical parameters as required by the EPA certification manual for drinking water (Water Quality Monitoring SOP/1738).

11.2 Sample Tracking

Alpha Analytical uses an internal chain-of-custody in LIMs for sample tracking control purposes. When requested or required by regulation a legal custody program is used in addition to the routine laboratory practices. Legal custody practices must be arranged at the time of contractual commitment.

For legal custody the process must include complete and continuous records of the physical possession, storage, and disposal of sample containers, collected samples, sample aliquots, and sample extracts or digestates. For legal custody a sample is in someone's custody if:

1. It is in one's actual physical possession;
2. It is in one's view, after being in one's physical possession;
3. It is in one's physical possession and then locked up so that no one can tamper with it;
4. It is kept in a secured area, restricted to authorized personnel only.

The routine sample handling and tracking process includes unique identification of all sample containers, initials of the person removing the sample from the sample management area and documentation of the date of sample removal for disposal.

Samples are assigned a unique identification number from the LIMS program. Each sample container label includes a unique identifier for the container. The person handling the sample is recorded along with the unique identifier in the container tracking records in LIMS.

ALPHA ANALYTICAL utilizes a custom designed Laboratory Information Management System (LIMS) to uniquely identify and track samples and analytical data throughout the facility. The LIMS log-in, is initiated by the Sample Custodian when the following information is entered into the computer:

- Quote number (unique to the project if requested)
- Project name or description
- Analyses requested (per matrices received)
- Sample number (unique to this sample)
- Sample descriptions (customer ID, including number of received containers)
- Date received
- Date(s) and time(s) collected
- Date analytical results are due

11.2.1 Chain of Custody

Chain of custody forms must accompany all samples received by Alpha personnel. The chain of custody form indicates the sample origin and arrival at the laboratory and identifies the analyses requested.

- Customer's name and address
- Notation of special handling instructions
- Additional comments or instruction for the laboratory
- Purchase order number(s), if applicable

Alpha Job Numbers (Process for assigning numbers)

Alpha Job Numbers are unique #'s automatically designated by our LIMS computer system for every individual customer project.

There are 3 parts to this number:

- All numbers start with the letter "L"
- The next two numbers are the last two numbers of the current year.
- The last five numbers are pulled sequentially by the LIMS as each Login personnel requests a new number for a job.

  For example…. L0904165 ---- Year 2009 and 4,165th job to be logged in this year.

  The Alpha Job Number then may contain as many extensions as there are individual samples in a job. L0904165-01 is the first sample, L0904165-02 is the second and so on. Each sample may contain as many as 26 containers as the containers are designated with the letters of the Alphabet, and each container receives its own bar-coded label. For example, L0904165-09A is the first container of the 9th sample listed on a customer's Chain of Custody.

Each container is labeled with a unique identifier, a label with a unique identifier number is placed on each sample container. Once labeled, the sample containers are placed in the appropriate storage area.

11.3 Sample Acceptance Policy

The sample management personnel check for proper sample labeling, preservation and handling at the time of arrival at the laboratory. The customer and customer services manager specifies the proper sample preservation, containers, cooling and other criteria on the project review form and in the LIMS. Sample management staff record all observations and immediate notify customer services of any discrepancies or questions arising during sample receipt.

It is possible for samples or sample containers to be lost, damaged, or determined to be unsuitable, for whatever reason, after initial receipt at Alpha Analytical. The problem is brought to the attention of a customer services manager who reports it to the customer. Plans for disposition of the affected samples or container are agreed upon with the customer, carried out, and recorded in the project records. Sample hold times and preservations are listed on the Alpha website (www.alphalab.com) under Support Services "Sampling Reference Guide".

11.4 Sample Receipt Protocols

The sample management staff receives all samples. A unique job number is assigned to each shipment of samples received from a customer. The in-house records for the incoming job, including the internal Chain-of -Custody, are initiated with a Sample Delivery Group (SDG) form. The customer, and Alpha courier and/or the sample management personnel sign the sample custody form at the time of receipt at the laboratory. Samples received via overnight courier are signed on the bill of lading. The bill of lading, SDG form and the sample custody form are completed for external courier delivered samples.

The sample management staff examines the shipping containers, their contents, and accompanying customer documentation. Information about the sample identification, the location, date and time of collection, collector's name, preservation type, sample type, presence and condition of custody seals, the state of preservation of the samples and other required information is noted on the SDG form. Any discrepancies in documentation or problems with sample condition such as appropriate sample containers, thermal preservation variation, holding times and adequate sample volumes are noted and brought to the attention of the customer via the nonconformance action form, The login staff or project manager contacts the client via email or or by phone. The Customer Services Manager provides clarification or further instruction to the sample management staff on the processing of the samples that are incomplete or missing required information.

The sample management staff logs the samples in the LIMs and a durable label for each container is printed. The custodian attaches each label to the appropriate sample container. The following information is recorded for tracking internal custody: laboratory sample ID, customer sample ID, sample matrix and storage location. Sample receipt and log-in specifically requires: date and time of laboratory receipt of sample(s); sample collection date; unique laboratory ID code; field ID code supplied by sample submitter; requested analyses; signature or initials of data logger; comments from inspection for sample acceptance or rejection and in some cases, sample bottle codes.

11.5 Storage Conditions

Alpha Analytical stores samples under proper environmental conditions to ensure their integrity and security. Samples are stored at temperatures that meet specifications of the methodology, regulatory agencies and customer directives. Refrigerators are monitored and controlled to be within 4 ± 2°C. Chemical, temperature, holding times and container storage requirements are listed in the LIMS project database.

Customer Quality Assurance Project Plans may list preservation requirements differing from the laboratory. The sample management staff reviews project information for projects specific handling. Addition of chemical preservative to sample containers normally is done in the field at the time of sampling. Chemical preservation and temperature preservation checks at the time of receipt are recorded except for volatile organic compounds, bacteria, sulfite, and dissolved oxygen preservation. Any differences from laboratory or customer specific requirements are recorded on nonconformance action forms and contact made with the customer by the Customer Services Manager or designee.

Sample storage facilities are located within the sample management area, walk-in custody refrigerator or in designated sample storage areas within the analytical departments. Internal chain-of-custody procedures and documentation pertaining to sample possession, removal from storage, and transfer are outlined in the sample custody procedure. Samples are returned to the sample storage area after the sample portion is removed for analysis. Extracts and digestates are tracked and follow the same internal custody operation. Extracts and digestates are removed to the waste disposal area after analysis for proper disposal.

Sample storage precautions are used to ensure that cross contamination does not occur during sample storage. Refrigerator storage blanks are monitored bi-weekly for volatile compounds.. The storage blank information allows the assessment of potential cross contamination in the sample storage refrigerator.

Temperatures of cold storage areas are recorded continuously in the data logger system. Corrective action is done as necessary when temperatures are not within the control criteria. In both the Westboro and Mansfield facilities, Automated Data loggers are linked to thermocouples in custody refrigerators and freezers in the Sample Storage areas as well as department standards/storage refrigerators and freezers. The Data logger is calibrated and certified by an outside vendor annually and on a quarterly basis for DOD standards/storage refrigerators and freezers. If there is a catastrophic failure of custody refrigerators, a record of all samples affected and customers associated with such samples are notified of any samples affected by the failure. Refrigerators and/or freezers not connected to the Data Logger system have temperatures measured with NIST traceable thermometers. Temperature records indicate the thermometer or sensor (Data logger) used for obtaining the measurement.

11.6 Sample Disposal

Samples are held for 21 calendar days after the report is released to the customer. Upon written customer request samples may be held longer in an uncontrolled area. Requests for controlled sample storage must be arranged at the time of contractual commitment. Air canister samples are held for 3 days after the report is released to the customer.

An authorized waste carrier is contracted to pick up waste as needed and dispose of it, in accordance with all regulatory requirements. Post-analysis disposition of samples is dependent upon project specific requests. Remaining sample material may be returned to the customer, safely discarded, or archived for a specific time prior to disposal. The waste disposal SOP 1797 defines the specific requirements for sample disposal and other waste disposal operations.

The sample management staff are responsible for the archival and disposal of raw samples, extracts and digestates. Raw and prepared samples may not be archived or disposed until all of the designated analyses are complete and resultant analytical data is sent to customers. Samples in storage are retained a minimum of 21 calendar days after reporting the results to the customer. Any samples requiring more than 21 calendar days are archived. Air canister samples requiring storage more than 3 business days require prior approval.

When a customer has requested the return of samples, the sample management staff prepares and ships the samples according to the same custody procedures in which the samples were received and following any customer specified requirements. Protection of the samples during delivery is ensured by the implementation of special packaging procedures. Packages are delivered by a commercial carrier whose procedures for protecting the samples are not within the control of this laboratory. Customers are informed that a commercial carrier will deliver their samples if required.

12 Records

Alpha Analytical has a record system that produces accurate records, which document all laboratory activities. The laboratory retains records of all original observations, calculations and derived data, calibration records and a copy of the test for ten years minimum. The system retains records longer than the minimum upon the request of authorized customers, agencies or another regulator. Note: Ohio VAP requires notification before disposal of any VAP records.

12.1 Record Keeping System and Design

The record keeping system allows reconstruction of laboratory processes that produced the analytical data of the sample.

a) The records include the names of personnel involved in sampling, preparation, calibration or testing.

b) Information relating to laboratory facilities equipment, analytical methods, and activities such as sample receipt, preparation, or data verification are documented.

c) The record keeping system provides retrieval of working files and archived records for inspection and verification purposes.

d) Documentation entries are signed or initialed by responsible staff.

e) Generated data requiring operator logging on appropriate logsheets or logbooks are recorded directly and legibly in permanent ink

f) Entries in records are not obliterated by any method. Corrections to errors are made by one line marked through the error. The person making the correction signs and dates the correction.

g) Data entry is minimized by electronic data transfer and ensuring the number of manual data transcriptions is reduced.

12.2 Records Management and Storage

1. Records including calibration and test equipment, certificates and reports are safely stored, held secure and in confidence to the customer.
2. The laboratory maintains hardware and software necessary for reconstruction of data.
3. Records that are stored or generated by computers have hard copy or write-protected backup copies.
4. Alpha Analytical has established a record management system, for control of hard copy laboratory notebooks.

5. Access to archived information is carefully controlled and is limited to authorized personnel. These records are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.
6. In the event that Alpha Analytical transfers ownership or goes out of business, there is a plan to ensure that the records are maintained or transferred according to the customer's instructions. A plan will be developed to maintain continuity of our record keeping systems as requested and/or required by both state and federal laws.

Alpha Analytical retains all original hard copy or electronic raw data for calibrations, samples, and quality control measures for ten years, including:

1. Analysts work sheets and data output records,
2. Reference to the specific method,
3. Calculation steps including definition of symbols to reduce observations to a reportable value,
4. Copies of all final reports
5. Archived SOPs,
6. Correspondence relating to laboratory activities for a specific project,
7. All nonconformance action reports, audits and audit responses,
8. Proficiency test results and raw data,
9. Data review and cross checking.

The basic information to tie together analysis and peripherals such as strip charts, printouts, computer files, analytical notebooks and run logs for Alpha Analytical includes:

1. Unique ID code for each Laboratory sample or QC sample;
2. Date of analysis;
3. Instrument identification and operating conditions;
4. SOP reference and version;
5. Calculations;
6. Analyst or operator's initials/signature.

In addition, Alpha Analytical maintains records of:

1. Personnel qualifications, experience and training
2. Initial and continuing demonstration of proficiency for each analyst
3. A log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory records. Use of electronic signatures has been approved by regulatory agencies.

12.3 Laboratory Sample Tracking

A record of all procedures to which a sample is subjected while in the possession of the laboratory is maintained. These include but are not limited to records pertaining to:

a) Sample preservation including appropriate sample container and compliance with holding time requirement; If the time of the sample collection is not provided, the laboratory must assume the most conservative time of day (i.e., earliest).

b) Sample identification, receipt, acceptance or rejection and log-in;

c) Sample storage and tracking including shipping receipts, transmittal forms, and internal routing and assignment records; this includes inter-laboratory transfers of samples, extracts and digestates.

d) Sample preparation including cleanup and separation protocols, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

e) Sample analysis;

f) Standard and reagent origin, receipt, preparation, and use;

g) Equipment receipt, use, specification, operating conditions and preventative maintenance;

h) Calibration criteria, frequency and acceptance criteria;

i) Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

j) Method performance criteria including expected quality control requirements;

k) Quality control protocols and assessment;

l) Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries;

m) Automated sample handling systems;

n) Records storage and retention; and

o) Disposal of hazardous samples including the date of sample or sub-sample disposal and the name of the responsible person.

p) The COC records account for all time periods associated with the samples.

q) The COC records include signatures of all individuals who had access to individual samples. Signatures (written or electronic) of all personnel who physically handle the samples. Time of day and calendar date of each transfer or handling procedure.

r) Common carrier documents.

13 Laboratory Report Format and Contents

The Process Planning and Control Procedure details the recording and reporting of data as required by the customer and in accordance with relevant environmental regulations.

Customers specify the report delivery and deliverables required for the work submitted. Report delivery includes standard turnaround and rush turnaround. Customers specify the delivery address or multiple addresses and method of delivery such as U.S. Mail, facsimile or electronic at the start of the project. Alpha Analytical provides data deliverables in hardcopy or electronic format. At the start of any project, the electronic deliverable formats required must be received before sample arrival. Affidavits are required with each report or series of reports generated for a particular project for Ohio VAP reports.

Reporting packages are available for routine regulatory reporting requirements. Regulatory reporting packages include only the information requested by the regulatory agency. In addition to regulatory report packages, Alpha Analytical prepares a standard report format. The standard report format includes:

1. Title: “Certification of Analysis”
2. Name and address of the laboratory
3. Laboratory Job Number, page number and total number of pages included in the report.
4. Name and address of the customer
5. Alpha sample number, Customer identification, Sample location
6. Samples identified that do not meet the sample acceptance requirements for project.
7. Date of sample receipt, sample collection, preparation or extraction date and time (if applicable), analysis date and time, report date and analyst
8. Identification of data reported by subcontractors
9. Test name and reference method number
10. Delivery method and sampling procedures when collected by lab personnel
11. Deviations or modifications that affect data quality and/or data integrity. These deviations or modifications are included in narrative statements and/or data merger files.
12. Statement that results relate only to the sample tested
13. Statement that report must be copied in full unless the laboratory provides written permission for partial copies
14. Glossary, References and limits of liability
15. Units of measure and reporting detection limit
16. Quality control data for: % Recovery surrogates, % Recovery of LCS, % RPD of LCSD, Blank analysis, % Recovery Matrix Spike, %RPD of Laboratory Duplicates, as applicable
17. Signature, title and date of report

18. A “Certificate/Approval Program Summary” page is included at the end of the report that identifies analytes for which Alpha Analytical holds certification and for those analytes reported that it does not. This summary also includes the certification numbers for either NELAP certified states, State certifications (e.g. Massachusetts laboratory certification identification number)..
19. Alpha Analytical does not accept samples from private residents for drinking water analysis and therefore maximum contaminant levels are not necessary. If Alpha were to change its policy and report drinking water samples, MCLs would be included with the report.

Results transmitted by facsimile or other electronic means include a statement of confidentiality and return of the materials at the laboratory’s expense.

The laboratory notifies the customer in writing of any circumstance that causes doubt on the validity of the results. The amended or modified report lists the change, reason for the change, affected page numbers, date of the amendment and authorized signature. The customer will be notified prior to changes in LIMs software or hardware configurations that will adversely affect customer electronic data.

13.1 Data Qualifiers

The following data qualifiers are used in conjunction with analytical results depending on the definition, state or regulatory program and report type.

Note: ”J” Estimated value: Upon customer request, the Target analyte concentration can be reported below the quantitation limit (RL), but above the Method Detection Limit (DL) with a “J” qualifier as long as there is a LOD study on file. (See section 5.11)

Data Qualifier	Qualifier Information	Regulatory Requirement
A	Spectra identified as "Aldol Condensation Product".	CT RCP, NC
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 <5x 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 10x the concentration found in the 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) For DOD related projects, flag applies to detectable concentration of target analyte in the blank that exceeds ½ the LOG or is greater than 1/10 the concentration in the field sample	EPA Functional Guidelines 'MassDEP MCP, CT RCP, NJ-TO15/LL-TO15; NJ Tech Guidance 2014, DOD QSM 5.1
C	Co-elution: target analyte co-elutes with a known lab standard (i.e. surrogates, 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.	NJ-TO15/LL-TO15 - Air only EPA Functional Guidelines; EPA Region 2,5
DL	Same was re-analyzed at a dilution. Qualifier applied to sample number.	

E		Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.	EPA Region 2,5 CT RCP, NJ-TO15/LL-TO15
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.	In-house/Forensics.
H		The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.	THE NELAC INSTITUTE (TNI) STANDARDS
I		The lower value for the two columns has been reported due to obvious interference.	In-house.
J		Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).	CT RCP (for TICs),
JN (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.	EPA Functional Guidelines 'NJ-TO15-LL
ND	DU-J	Not detected at the method detection limit (MDL) for the sample, or estimated detection limit (EDL) for same-related analysis	In-house
P	All DU	The RPD between the results for the two columns exceeds the method-specified criteria.	MassDEP MCP, CT RCP
Q	All DU	The quality control sample exceeds the associated acceptance criteria. 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	All DU	Analytical results are from sample re-analysis	Customer-specific

RE	All DU	Analytical results are from sample re-extraction.	Customer-specific
S		Analytical results are from modified screening analysis	

13.2 Compound Summation for Organic Analyses

In order to be compliant with regulations from certain states, Alpha Analytical has created the following Summation Rules to cover reporting “Total Analytes”. The following are an example of several compounds that can be reported as “Totals”:

Volatiles:	
1,3-Dichloropropene, Total	cis + trans isomers
Xylenes, Total	m/p + o isomers
1,2-Dichloroethene, Total	cis + trans isomers
Trihalomethanes, Total	Chloroform + Bromoform +
	Dibromochloromethane +
	Dichlorobromomethane
PCBs:	
PCBs, Total	Sum of reportable Aroclors
	(all Aroclors reported for the project)

The following are the summation rules that the LIMs uses to calculate the Total values:

Summation Rules:		
H + H = H		Key:
H + J = J		H = Hit (above RL)
J + J = J		J = J-flagged value
H + ND = H		ND = U-flagged value
J + ND = J		
ND + ND = ND		

The ND values are considered “0” during the calculations.
The “E” flagged values (over the calibration) are ignored and not utilized during the calculations.
Any “N” flagged values (do not report) are ignored and not utilized during the calculations.
For dual-column analysis, the Total is reported as part of column “A” data, unless all individuals are reported from “B” column.

For analytical group summations, the Total is reported based on the associated “Reporting List”. For example, if only 7 Aroclors are requested, then the Total is based on 7 Aroclors, not 9.

The RL and MDL for Totals will always be the lowest of the individual compounds used in the summation.

For each Total summation, two values are calculated: TOTALH (calculated from all associated hits above the R L– used in DU reporting formats) and TOTALJ (calculated from all associated hits and J flagged values – used in DJQL reporting formats). Total concentrations are calculated for all samples and QC samples (however, recoveries are not calculated since they are only calculated for the compounds spiked)

If a Total summation is requested, the individual compounds must also be reported.

14 Outside Support Services and Supplies

When Alpha Analytical purchases outside services and supplies in support of tests, the laboratory uses only those outside services and supplies that are of adequate quality to maintain confidence in the tests. Differences between Request/Tender and Contracts must be resolved before work commences.

The Purchasing SOP/1726 describes approval and monitoring of all suppliers and subcontractors used by the laboratory. Where no independent assurance of the quality of outside support services or supplies is available, the laboratory ensures that purchased equipment, materials, and services comply with specifications by evaluating method performance before routine use.

The laboratory checks shipments upon receipt as complying with purchase specifications. The use of purchased equipment and consumables is only after the evaluation and compliance to the specifications is complete. The Purchasing SOP/1726 describes the details for receipt and inspection of purchased product.

The Purchasing SOP describes the process for raising, review and placement of purchase orders. It is company policy to purchase from third party certified suppliers and subcontractors wherever possible. Purchases must be from suppliers approved by the Laboratory. Laboratory or sampling subcontractors specified by the customer are noted as “Trial” on the purchase order. This identifies the subcontractor as a non-approved subcontractor. All DoD work that is subcontracted must comply with Alpha’s management system and must comply with the QSM standard and is subject to DoD customer approval.

The laboratory maintains list of approved vendors (Form 18302) and subcontractors from whom it obtains support services or supplies required for tests.

14.1 Subcontracting Analytical Samples

Customers are advised, verbally and/or in writing, if any analyses will be subcontracted to another laboratory. Any testing covered under the NELAC Institute (TNI) Standards that requires subcontracting, will be subcontracted to another THE NELAC Institute (TNI) Standard accredited laboratory for the tests to be performed. The laboratory approves testing and sampling subcontractors by review of current state, national or other external parties’ certifications or approvals. This document must indicate current approval for the subcontracted work. Any sample(s) needing special reports (*i.e.*, MCL exceedance) will be identified on the chain of custody when the laboratory subcontracts with another laboratory. Subcontractor Laboratory Certifications are located in Qualtrax under Customer Services folder

The Sample Receipt and Login Procedure describes the process for sample handling when subcontracting samples. The quotation form lists the subcontractor in order to notify the customer of any subcontracted work. Customer notification of subcontracted work is in writing before releasing samples to the subcontractor.

The review of subcontractor documents for completeness and meeting the specifications defined for the project follows the laboratory process for reporting and verification of process data. The person responsible for receiving the order reviews the information supplied by the subcontractor instead of the Department Supervisor.

15 Customer Relations

15.1 Customer Service

The majority of the customer services occur from personnel in the administration, sample receiving and sampling areas. Customer service involves inquiries into services offered, technical consulting, placing orders, and receiving orders, providing updates on the status of orders and completing orders. Personnel interacting with customers must document and review customer specific project requirements. Call Tracker is used to document communications with customers (SOP/1723). Personnel must document customer interactions following the appropriate laboratory procedures. Each person must communicate deviations, modifications and customer requests following the laboratory defined procedures.

15.2 Project Management

During staff meetings the laboratory management reviews requests for new work. The Operations Director and/or Laboratory Technical Manager address all capacity and capability issues. Where conflicts in workload arise, customer notification is immediate. The Project Communication Form (PCF) contains the documentation of all project information. Cooperation between laboratory and customer services staff allows direct communication and scheduling. Management arranges complex scheduling and coordination between departmental areas. Documentation of approval for waivers from the DoD QSM requirements must be documented on a project specific waiver. This documentation needs to be in writing and readily available for review.

15.3 Complaint Processing

The laboratory staff documents all customers or other parties' complaints or concerns regarding the data quality or laboratory operations. The Nonconformance Report records complaints, correcting the concern, and resolving the concern with the customer or other party. The process uses the same form and process as the nonconformance action process. Where repetitive corrective actions indicate a problem, an audit of the area, Customer Inquiry and Complaint SOP/1722 is immediate to ensure the corrective action has effectively solved the concern.

16 Appendix A – Definitions/References

The following definitions are from Section 3.0 of the 2009 TNI Standard. The laboratory adopts these definitions for all work performed in the laboratory.

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. (TNI)

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (TNI)

Aliquot: A discrete, measured, representative portion of a sample taken for analysis. (EPA QAD glossary)

Analyst: The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (TNI)

Analyte: The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family, and which are analyzed together. (EPA Risk Assessment Guide for Superfund; OSHA Glossary)

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation. (TNI)

Assessment (Clarification): The evaluation process used to measure the performance or effectiveness of a system and its elements against specific criteria.

Assessment Criteria: the measures established by The NELAC Institute (TNI) Standards and applied in establishing the extent to which an applicant is in conformance with the NELAC Institute (TNI) Standards requirements.

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI).

Batch: Environmental samples, which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A

preparation batch is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates), which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed 20 samples. (TNI)

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (TNI)

Blanks include:

Equipment Blank: a sample of analyte-free media, which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

Field Blank: blank prepared in the field by filling a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)

Instrument Blank: a clean sample (e.g. distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses, (TNI)

Reagent Blank: (method reagent blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst or laboratory's proficiency in the execution of the measurement process.

Calibration: set of operations which establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of Reference Standards that are traceable to the International System of Units (SI).

2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the Laboratory with a certificate of analysis or purity, or prepared by the Laboratory using support equipment that has been calibrated verified to meet specifications.

Calibration Range: The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.

Calibration Curve: the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Method: A defined technical procedure for performing a calibration.

Calibration Standard: A substance or reference material used to calibrate an instrument. (TNI)

Certified Reference Material (CRM): Reference material, accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. See also Legal Chain of Custody Protocols (TNI)

Clean Air Act: the enabling legislation in 42 U.S.C. 7401 *et seq*., Public Law 91-604, 84 Stat. 1676 Pub.L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and to enforce them.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: Second column confirmation, Alternate wavelength, Derivatization, Mass spectral interpretation, Alternative detectors, or Additional cleanup procedures (TNI)

Customer: Any individual or organization for which items or services are furnished or work performed in response to defined requirements and expectations. (ANSI/ASQ E4-2004)

Congener: A member of a class of related chemical compounds (e.g., PCBs, PCDDs)

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund): the enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites.

Conformance: an affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Consensus Standard: A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof. (ANSI/ASQ ANSI/ASQ E4-2004)

Continuing calibration verification: The verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. (IDQTF)

Corrective Action: the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Completeness: the percentage of measurements judged to be valid compared to the total number of measurements made for a specific sample matrix and analysis.

Data Quality Objectives (DQO):

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (TNI)

Definitive Data: Analytical data of known quality, concentration, and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Suitable for final decision-making. (UFP-QAPP)

Demonstration of Capability: a procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Detection Limit: (previously referred to as Method Detection Limit –MDL) the lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit.

Detection Limit (DL) (Clarification): The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

Environmental Data: Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology. (ANSI/ASQ E4-2004)

False Negative: An analyte incorrectly reported as absent from the sample, resulting in potential risks from their presence.

False Positive: An item incorrectly identified as present in the sample, resulting in a high reporting value for the analyte of concern.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA): the enabling legislation under 7 U.S.C. 135 *et seq*., as amended, that empowers the EPA to register insecticides, fungicides, and rodenticides.

Federal Water Pollution Control Act (Clean Water Act, CWA): the enabling legislation under 33 U.S.C 1251 et seq., Public Law 92-50086 Stat. 8.16, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance.

Field Measurement: The determination of physical, biological, or radiological properties, or chemical constituents; that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation. (TNI)

Finding: an assessment conclusion, referenced to a laboratory accreditation standard and supported by objective evidence that identifies a deviation from a laboratory accreditation standard requirement. (TNI)

Finding (Clarification): An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative and is normally accompanied by specific examples of the observed condition (ANSI/ASQ E4-2004).

Holding Times: The maximum time that can elapse between two (2) specified activities. (TNI)

The maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR part 136)

Inspection: An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (TNI)

Isomer: One of two or more compounds, radicals, or ions that contain the same number of atoms of the same elements but differ in structural arrangement and properties. For example, hexane (C6H14) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.

Laboratory: Body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank or QC check 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. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (TNI).

Laboratory Duplicate: aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently.

Legal Chain of Custody Protocols: procedures employed to record the possession of samples from the time of sampling until analysis and are performed at the special request of the customer. These protocols include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples by the laboratory. In addition, these protocols document all handling of the samples within the laboratory. (TNI)

Limit of Detection (LOD): A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

Limit of Detection (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

Limits of Quantitation (LOQ): The minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence. (TNI) For DOD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard and within the calibration range.

Limit of Quantitation (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias.

Management: Those individuals directly responsible and accountable for planning, implementing, and assessing work. (ANSI/ASQ E4-2004)

Management System: System to establish policy and objectives and to achieve those objectives (ISO 9000).

Matrix: The substrate of a test sample. (TNI)

Matrix Spike (spiked sample, fortified 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. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (TNI).

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (TNI).

Measurement System: A test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s). (TNI)

Method: A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed. (TNI)

Method Detection Limit: (now referred to as Detection Limit) one way to establish a Detection Limit, defined as the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Method Detection Limit (MDL) (Clarification): The MDL is one way to establish a Detection Limit, not a Limit of Detection.

Method of Standard Additions: A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration. (This process is often called spiking the sample.) (Modified Skoog, Holler, and Nieman. Principles of Instrumental Analysis. 1998)

Mobile Laboratory: A portable enclosed structure with necessary and appropriate accommodation and environmental conditions for a laboratory, within which testing is performed by analysts. Examples include but are not limited to trailers, vans and skid-mounted structures configured to house testing equipment and personnel. (TNI)

National Institute of Standards and Technology (NIST): A federal agency of the US Department of Commerce’s Technology Administration that is designed as the United States national metrology institute. (NMI). (TNI)

National Environmental Laboratory Accreditation Program (NELAP): The overall National Environmental Laboratory Accreditation Program of which TNI is a part.

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI).

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Procedure: A specified way to carry out an activity or a process. Procedures can be documented or not. (TNI)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (TNI).

Protocol: A detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is the type and quality needed and expected by the customer. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EPA-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements or quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, the ensure the quality of its product and the utility of its product to the users. (TNI)

Quality Manual Clarification: Alpha Analytical refers to Quality Manual as Corporate Quality Systems Manual (CQSM). (Alpha)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC) activities. (TNI)

Quality System Matrix: These matrix definitions are to be used for purposes of batch and quality control requirements: (TNI)

Air and Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, ground water effluents, and TCLP or other extracts.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

Drinking Water: Any aqueous sample that has been designated a potable or potential potable water source.

Non-Aqueous Liquid: Any organic liquid with <15% settleable solids.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Reference Material: Material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or at a given location. (TNI)

Representativeness: the degree to which the sample represents the properties of the particular sample being analyzed.

Resource Conservation and Recovery Act (RCRA): the enabling legislation under 42 USC 321 *et seq.* (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage and disposal.

Safe Drinking Water Act (SDWA): the enabling legislation, 42 USC 300f *et seq.* (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations.

Sample Tracking: procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure. (TNI)**Second source calibration verification (ICV):** A standard obtained or prepared from a source independent of the source of standards for the initial calibration. Its concentration should be at or near the middle of the calibration range. It is done after the initial calibration.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent. (TNI)

Sensitivity: The capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Signal to Noise Ratio: The signal carries information about the analyte, while noise is made up of extraneous information that is unwanted because it degrades the accuracy and precision of an analysis and also places a lower limit on the amount of analyte that can be detected. In most measurements, the average strength of the noise is constant and independent of the magnitude of the signal. Thus, the effect of noise on the relative error of a measurement becomes greater and greater as the quantity being measured (producing the signal) decreases in magnitude. (Skoog, Holler, and Nieman. Principles of Instrumental Analysis. 1998)

Signatures, Electronic: A technology that allows a person to electronically affix a signature or its equivalent to an electronic document. The electronic signature links the signature to the signer's identity and to the time the document was signed. Alpha approves the use of electronic signatures for signing and initializing any laboratory record including, by not limited to: analytical reports, controlled documents, workflows and purchasing requests.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (TNI)

Standard Method: a test method issued by an organization generally recognized as competent to do so.

Standardized Reference Material (SRM): a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

Surrogate: a substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Technology: a specific arrangement of analytical instruments, detection systems, and/or preparation techniques. (TNI)

Test: A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2 - 12.1, amended)

Tentatively Identified Compound (TIC): 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. Tentatively Identified Compounds, 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.

Test Method: An adoption of a scientific technique for performing a specific measurement, as documented in a laboratory SOP or as published by a recognized authority.

Toxic Substances Control Act (TSCA): the enabling legislation in 15 USC 2601 et seq. (1976), the provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Tuning: A check and/or adjustment of instrument performance for mass spectrometry as required by the method.

United States Environmental Protection Agency (EPA): the federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e. the air, water and land) upon which human life depends. (US-EPA)

Validation: the confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Verification: confirmation by examination and provision of evidence that specified requirements have been met. (TNI)

NOTE - In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustments, or to repair, or to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring

REFERENCES:

40 CFR Part 136, Appendix A, paragraphs 8.1.1 and 8.2

American Association for Laboratory Accreditation. 1996. General Requirements for Accreditation.

American National Standards Institute (ANSI). 1994. Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs
(ANSI/ASQC E-4).

ANSI/NCSL. 1997. U.S. Guide to the Expression of Uncertainty in Measurement. Z540-2-1997.

American Society for Testing and Materials (ASTM). 1999. Standard Guide for Conducting Laboratory Soil Toxicity and Bioaccumulation Tests with the Lumbricid Earthworm Eisenia fetida. West
Conshohocken, PA. E11676-97.

ASTM. 1999. Standard Practice for Conducting Early Seedling Growth Tests. West Conshohocken, PA. E1598-94.

ASTM. 2003. Standard Guide for Laboratory Subsampling of Media Related to Waste Management Activities. West Conshohocken, PA. D6323-98.

American Type Culture Collection (ATCC). Catalog of Bacteria. Manassas, VA.

Doiron, T.D. and J.R. Stoup. 1997. Uncertainty and Dimensional Calibrations. Journal of Research of the National Institute of Standards and Technology.

Eurachem. 2000. Quantifying Uncertainty in Analytical Measurement. Eurachem/CITAC Guide, Second Edition.

European Accreditation Organization. 1999. Expression of Uncertainty of Measurements in Calibration. EA-4/02.

Georgian, Thomas. 2000. Estimation of Laboratory Analytical Uncertainty Using Laboratory Control Samples. Environmental Testing and Analysis. Nov/Dec: 20-24, 51.

Gerhard, Philip et al. 1981. Manual of Method for General Bacteriology. American Society for Microbiology.

Guidance on the Evaluation of Safe Drinking Water Act Compliance Monitoring Results from Performance Based Methods. September 30, 1994. Second draft.

Guide to the Expression of Uncertainty in Measurement. Issued by BIPM, IEC, IFCC, ISO, IUPAC and OIML.

Ingersoll, William S. Environmental Analytical Measurement Uncertainty Estimation, Nested Hierarchical Approach. ADA 396946.

International Laboratory Accreditation Cooperation (ILAC). Information and documents on laboratory accreditation.

International Organization for Standardization (ISO). 1986. General terms and their definitions concerning standardization and related activities. ISO/IEC Guide 2.

ISO. 1986. Quality - Vocabulary. ISO 8402.

ISO. 1989. Certification of reference materials - General and statistical principles. ISO/IEC Guide 35.

ISO. 1990. General requirements for the competence of calibration and testing laboratories. ISO/IEC Guide 25.

ISO. 1990. Guidelines for auditing quality systems - Part 1: Auditing. ISO 10011-1.

ISO. 1991. Guidelines for auditing quality systems - Part 2: Qualification criteria for quality system auditors. ISO 10011-2.

ISO. 1991. Guidelines for auditing quality systems - Part 3: Management of audit programmes. ISO 10011-3.

ISO. 1992. Quality assurance requirements for measuring equipment - Part 1: Metrological confirmation for measuring equipment. ISO 10012-1.

ISO. 1992. Terms and definitions used in connection with reference materials. ISO/IEC Guide 30.

ISO. 1993. Calibration and testing laboratory accreditation systems - General requirements for operation and recognition. ISO/IEC Guide 58.

ISO. 1993. Quality management and quality system elements - Part 4: Guidelines for quality improvement. ISO 9004-4.

ISO. 1993. Statistics - Vocabulary and symbols - Part 1: Probability and general statistical terms. ISO 3534-1.

ISO. 1994. Accuracy (trueness and precision) of measurement methods and results - Part 1: General principles and definitions. ISO 5725-1.

ISO. 1994. Accuracy (trueness and precision) of measurement methods and results - Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method. ISO 5725-2.

ISO. 1994. Accuracy (trueness and precision) of measurement methods and results - Part 3: Intermediate measures of the precision of a standard measurement method. ISO 5725-3.

ISO. 1994. Accuracy (trueness and precision) of measurement methods and results - Part 4: Basic methods for the determination of trueness of a standard measurement method. ISO 5725-4.

ISO. 1994. Accuracy (trueness and precision) of measurement methods and results - Part 6: Use in practice of accuracy values. ISO 5725-6.

ISO. 1994. Quality management and quality assurance standards - Part 1: Guidelines for selection and use. ISO 9000-1.

ISO. 1994. Quality management and quality system elements - Part 1: Guidelines. ISO 9004-1.

ISO. 1994. Quality Systems - Model for quality assurance in design/development, production, installation and servicing. ISO 9001.

ISO. 1994. Quality Systems - Model for quality assurance in production, installation, and servicing. ISO 9002.

ISO. 1995. Guide to the Expression of Uncertainty in Measurement (GUM). ISBN 92-67-10188-9. ISO. 1996. General requirements for bodies operating product certification systems.
ISO/IEC Guide 65.

ISO. 1996. Microbiology of food and animal feeding stuffs - General Guidance for Microbiological Examinations. ISO 7218.

ISO. 1997. Calibration in analytical chemistry and use of certified reference materials. ISO/IEC Guide 32.

ISO. 1997. Proficiency testing by inter-laboratory comparisons - Part 1: Development and operation of proficiency testing schemes. ISO/IEC Guide 43-1.

ISO. 1997. Proficiency testing by inter-laboratory comparisons - Part 2: Selection and use of proficiency testing schemes by laboratory accreditation bodies. ISO/IEC Guide 43-2.

ISO. 1997. Quality assurance for measuring equipment - Part 2: Guidelines for control of measurement processes. ISO 10012-2.

ISO. 1997. Quality management and quality assurance standards - Part 3: Guidelines for the application of ISO 9001:1994 to the development, supply, installation and maintenance of computer software. ISO 9000-3.

ISO. 1998. General criteria for the operation of various types of bodies performing inspection. ISO 17020.

ISO. 1999. General requirements for the competence of testing and calibration laboratories.
ISO 17025. (Annex A of ISO 17025 provides nominal cross-reference between this International Standard and ISO 9001 and ISO 9002.)

ISO. 2000. Contents of certificates of reference materials. ISO/IEC Guide 31.

ISO. 2000. General requirements for the competence of reference material producers. ISO/IEC Guide 34.

ISO. 2000. Uses of certified reference materials. ISO/IEC Guide 33.

ISO. 2005. General requirements for the competence of testing and calibration laboratories. ISO 17025.

International vocabulary of basic and general terms in metrology (VIM). 1984. Issued by BIPM, IEC, ISO and OIML.

National Accreditation of Measurement and Sampling (NAMAS). 1994. Guide to the Expression of Uncertainties in Testing. Edition 1. NIS 80.

NAMAS. 1995. The Expression of Uncertainty and Confidence in Measurement for Calibrations. Edition 8. NIS 3003.

THE NELAC INSTITUTE (TNI) STANDARDS.

Taylor, B.N. and C.E. Kuyatt. 1994. Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results. Technical Note 1297-1994.United Kingdom Accreditation Service (UKAS). 2000. The Expression of Uncertainty in Testing. LAB 12.

U.S. EPA. 1991. Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document. Office of Research and Development. EPA/600/3-89/013.

U.S. EPA. 1991. Evaluation of Dredged Material Proposed for Ocean Disposal - Testing Manual. Office of Water. EPA/503/8-91/001.

U.S. EPA. 1991. Manual for Evaluation of Laboratories Performing Aquatic Toxicity Tests. Office of Research and Development. EPA/600/4-90/031.

U.S. EPA. 1991. Protocol for Short-term Toxicity Screening of Hazardous Wastes.

Office of Research and Development. EPA/600/3-88/029.

U.S. EPA. 1993. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, 4th Ed. Office of Research and Development.
EPA/600/4-90/027F.

U.S. EPA. 1994. Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods. Office of Research and Development. EPA/600/R-94/025.

U.S. EPA. 1994. Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates. Office of Research and Development.
EPA/600/R-94/024.

U.S. EPA. 1994. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving
Waters to Freshwater Organisms, 3rd Ed. Office of Research and Development. EPA/600/4-91/002.

U.S. EPA. 1994. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Water to Marine and Estuarine Organisms, 2nd Ed. Office of Research and Development.
EPA/600/4-91/003.

U.S. EPA. 1995. EPA Directive 2185 - Good Automated Laboratory Practices.

U.S. EPA. 1996. Performance Based Measurement System. Environmental Monitoring Management Council (EMMC) Method Panel, PBMS Workgroup.

U.S. EPA. 1997. Manual for the Certification of Laboratories Analyzing Drinking Water. EPA/815/B-97/001.

U.S. EPA. 1998. Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Inland Testing Manual. Office of Water. EPA/823/B-98/004.

U.S. EPA. 2005. Uniform Federal Policy for Quality Assurance Project Plans, Part 1: Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) Manual (EPA-505-B-04-900A).

U.S. EPA. 2005. UFP-QAPP Workbook (EPA-505-B-040900C).

U.S. EPA. 2005. Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities (EPA-505-B-04-900B).

World Health Organization. 1983. Laboratory Biosafety Manual

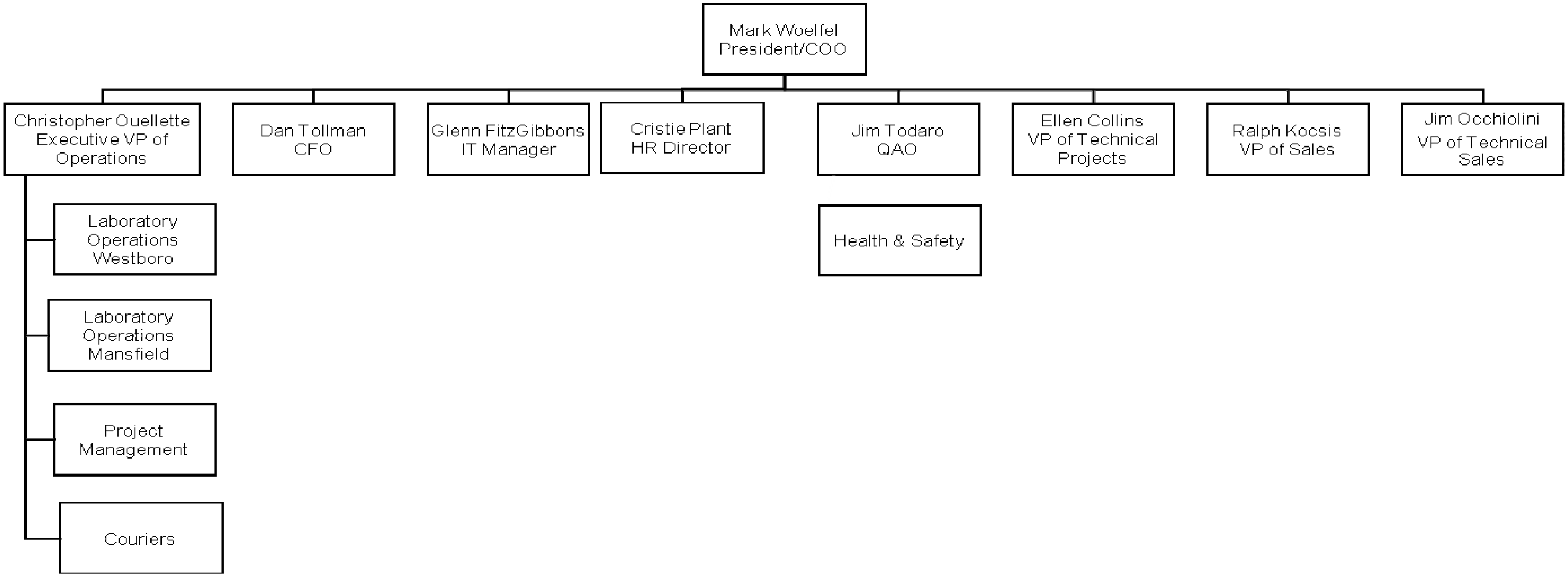
Department of Defense (DOD) Quality Systems Manual, Version 5.1, 2017

17 Appendix B – Organization Charts

The following charts provide an overview of the organizational structure of Alpha Analytical. The chart also identifies the key personnel responsible for the listed positions. For the various laboratory areas, the individual departmental supervisors are noted. For a listing of all current key personnel, please refer to Section 18, Appendix C.

Updated 09/28/2017

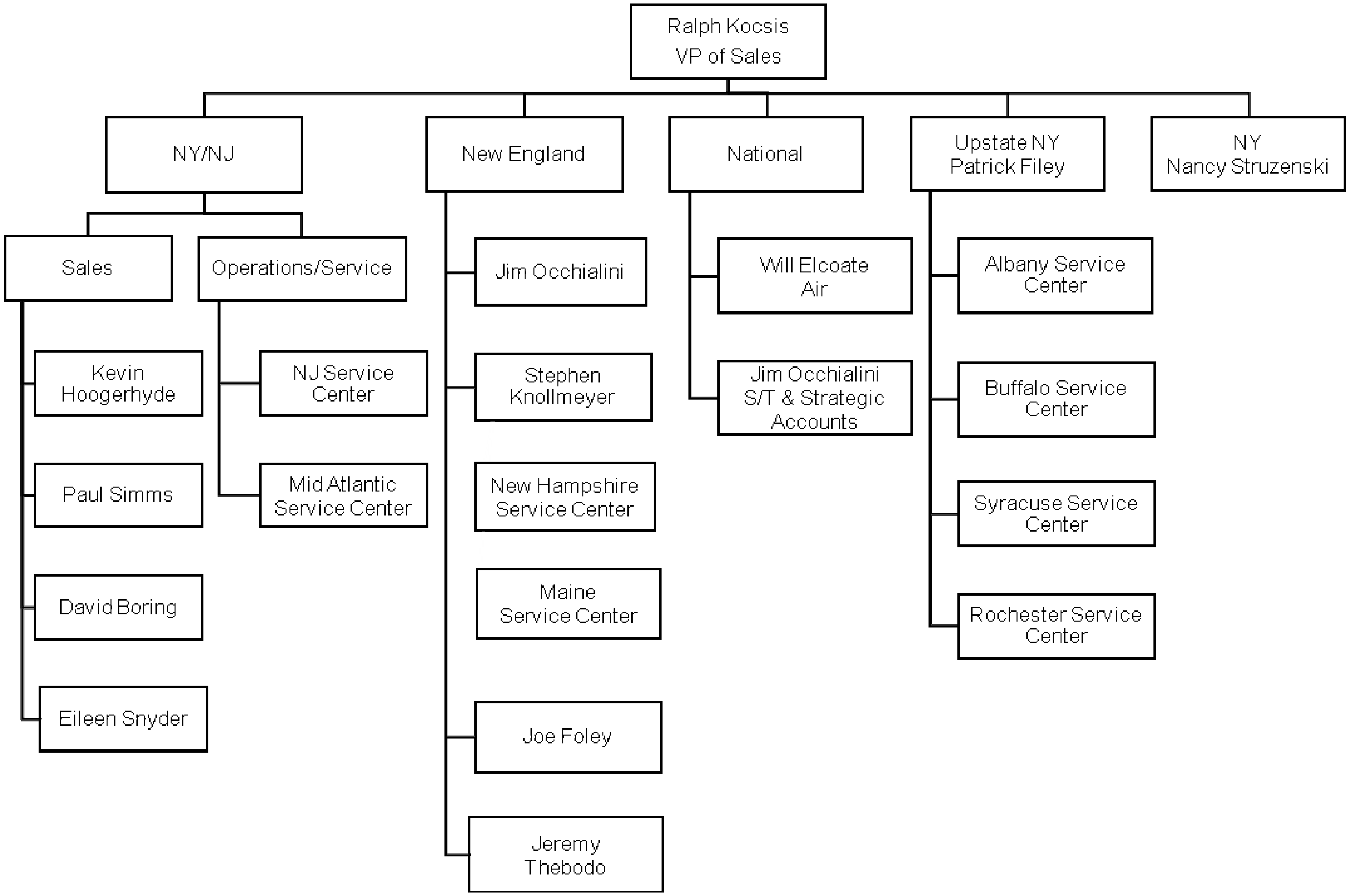
Alpha Analytical
Company Organizational Chart



Updated 09/28/2017

Alpha Analytical

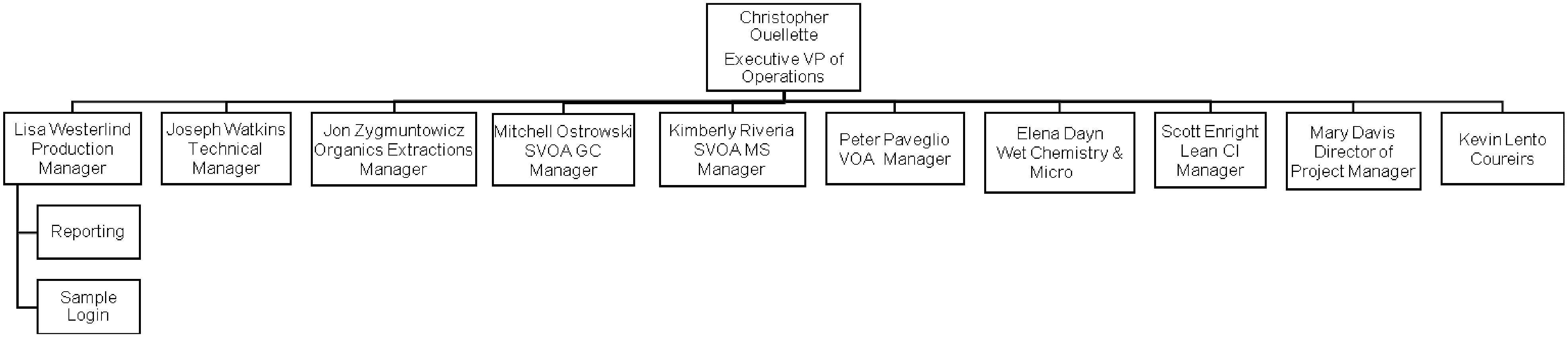
Sales Organizational Chart



Updated 09/28/2017

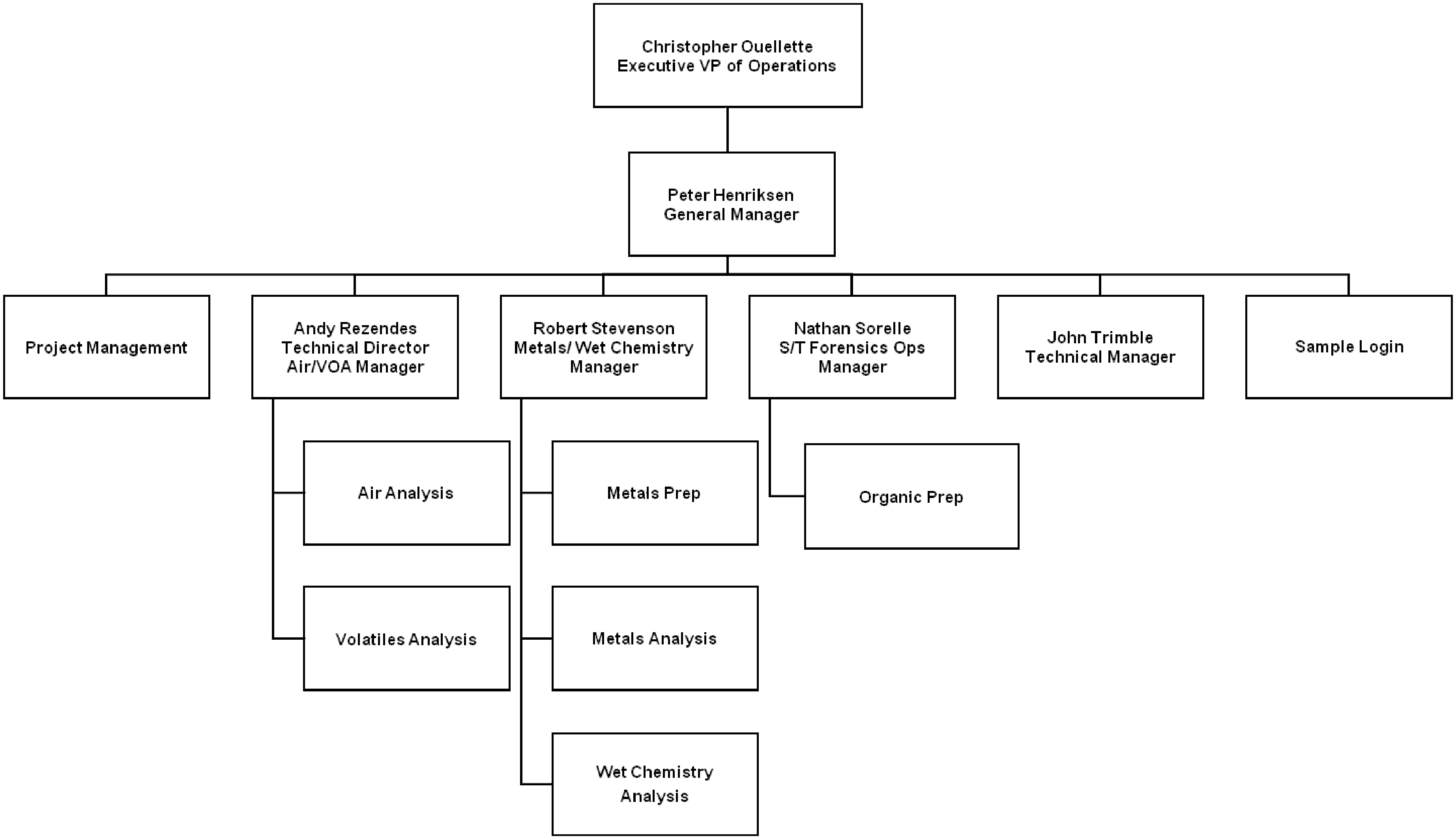
Westboro Facility

Organizational Chart



Updated 09/28/2017

Mansfield Facility Organizational Chart



18 Appendix C – List of Key Personnel

The following is a listing of all current key personnel. If role is specific to a facility it is denoted by either Westboro or Mansfield following the position title. **Updated 09/2017.**

President / COO: Mark Woelfel
Executive VP of Operations: Christopher Ouellette
CFO: Dan Tollman
Laboratory Technical Manager - Westboro: Joseph Watkins
Laboratory Technical Manager - Mansfield: John Trimble
Laboratory Technical Manager- Air, Volatiles Manager - Mansfield: Andy Rezendes
Quality Assurance Officer/Health & Safety Manager: James C. Todaro
VP, Technical Projects: Ellen Collins
VP of Sales: Ralph Kocsis
VP, Technical Sales: James Occhialini, Pat Filey, Kevin Hoogerhyde, Steven Knollmeyer, Nancy Struzenski
Technical Sales Reps: Paul Simms, David Boring, Joe Foley, Jeremy Thebodo
General Manager, Mansfield: Peter Henriksen
Director of Project Management: Mary Davis
National Air Account Manager: Will Elcoate
Information Technology Manager: Glenn Fitzgibbons
Human Resources Director: Cristie Plant
Health & Safety Officer: James Todaro
Forensic & S/T Operations Manager, Mansfield: Nathan Sorelle
SVOA GC Manager, Westboro: Mitchell Ostrowski
SVOA GC/MS Manager, Westboro: Kimberly Rivera
Extractions Manager, Westboro: John Zygmuntowicz
VOA Department Manager, Westboro: Peter Paveglio
Wet Chemistry Department Manager, Westboro: Elena Dayn
Metals Department Manager, Mansfield: Robert Stevenson
Login Manager/ Reporting Manager, Westboro Lisa Westerlind
Quality Systems Specialists: Amy Rice, Rene Bennett, Jason Hebert, Blake Buckalew
Purchasing: David Peak
Logistics Manager: Kevin Lento
Equipment Specialist: Syzmon Sus

19 Appendix D – Preventive Maintenance Procedures

Optimized Service-Calibration Intervals		
Equipment	**Frequency**	**Type of Calibration or Maintenance**
Balances	semiannually daily	cleaning & operations check by service technician (external) calibration verification using Class S-1 certified weights
COD Reactor	annually annually	complete operations check by service technician (external) reaction temperature verification
Conductivity Bridge	annually each use	verification of cell constant complete operations check by service technician (external) calibration verification
DI Water System	as needed monthly annually daily	complete operations check by service technician (external) Residual Chlorine check Biosuitability testing (external) pH and Conductivity check
DO Meter	annually each use	complete operations check by service technician (external) calibration against air as specified by manufacturer
Emergency/Safety Equipment	annually monthly	fire extinguishers and emergency exit lighting check eye washes, showers, fire blanket and first aid kits checked
Freezers	daily	temperature verification
Gas Chromatographs	as needed as needed beginning and end of batch and 10 to 20 samples as per method	injection port preparation; cleaning of detectors initial multi-point calibration continuing calibration verification (CCV) against initial calibration
ICP	Every other day Daily Annually Annually As needed	Change pump tubing Calibration, profile Complete operations check by service technician (external), Linear Dynamic Range determination Clean torch, clean nebulizer, clean spray chamber
Lachat analyzer	Daily As needed	Calibration, clean lines Change tubing, change O-rings
Mass Spectrometers (GC & ICP)	bi-annually as needed 12 hour or daily	change of mechanical pump oil by service technician (external) cleaning of source BFB, DFTPP or ICP-MS tune analysis followed by ICAL or CCV
Mercury Analyzer	monthly each use	clean cell and change pump windings calibration using multi-point curve
Auto-pipettes	Monthly Annually	verification of accuracy verification of precision
Microwave	Quarterly Annually	power and temperature verification RPM verification
Ovens	annually daily	complete operations check by service technician (external) temperature verification
pH Meters	annually each use	complete operations check by service technician (external) calibration using certified buffers
Refrigerators (General Use)	daily	temperature verification
Refrigerators (Sample Management)	daily	temperature verification
Spectrophotometer	Semi-annually Semi-annually daily	cleaning & operations check by service technician (external) wavelength verification (external) continuing calibration verification (CCV) against initial calibration
TCLP Rotator	annually	RPM verification
Thermometers (Mercury/Alcohol)	annually	calibration against NIST traceable thermometer (internal)
Thermometers (digital)	Quarterly	calibration against NIST traceable thermometer (external)
Thermometer (NIST Traceable)	annually	calibration and certification of conformance (external)
Turbidity meter	annually each use	cleaning & operations check by service technician (external) calibration using formazin
Weights (Class S-1)	annually	service/calibration and certification of conformance (external)

20 Appendix E – Alpha Code of Ethics Agreement

Alpha Analytical, Inc.
Ethical Conduct and Data Integrity Agreement

A. ***Personal Pledge:*** I understand that I am charged with meeting the highest degree of ethical standards in performing all of my duties and responsibilities and pledge to only report data, test results and conclusions that are accurate, precise and of the highest quality.

B. ***Protocol Pledges:*** I agree to adhere to the following protocols and principles of ethical conduct in fulfilling my work assignments at Alpha:

1. All work assigned to me will be performed using Standard Operating Procedures (SOPs) that are based on EPA approved methods or Alpha methods.

2. I will only report results or data that match the actual results observed or measured.

3. I will not intentionally nor improperly manipulate or falsify data in any manner, including both sample and QC data. Furthermore, I will not modify data values unless the modification can be technically justified through a measurable analytical process or method acceptable to Alpha. All such modifications will be clearly and thoroughly documented in the appropriate laboratory notebooks and raw data and include my initials or signature and date.

4. I will not intentionally report dates and times of analyses that are not the actual dates and times the analyses were conducted.

5. I will not intentionally represent another individual's work as my own or represent my work as someone else's.

6. I will not make false statements to, or seek to otherwise deceive Alpha staff, leaders or customers. I will not, through acts of commission, omission, erasure or destruction, improperly report measurements, standards results, data, test results or conclusions.

C. ***Guardian Pledge:***

1. I will not condone any accidental or intentional reporting of unauthentic data by other Alpha staff and will immediately report such occurrences to my supervisor, the QA Officer, the Laboratory Technical Manager or corporate leadership. I understand that failure to report such occurrences may subject me to immediate discipline, including termination.

2. If a supervisor or other member of the Alpha leadership group requests me to engage in, or perform an activity that I feel is compromising data validity or quality, I have the right to not comply with the request and appeal this action through Alpha's QA Officer, senior leadership or corporate officers, including the President of the company.

3. I understand that, if my job includes supervisory responsibilities, then I will not instruct, request or direct any subordinate to perform any laboratory practice that is unethical or improper. Also, I will not discourage, intimidate or inhibit a staff member who may

choose to appropriately appeal my supervisory instruction, request or directive that may be perceived to be improper, nor retaliate against those who do so.

D. ***Agreement Signature:*** I have read and fully understand all provisions of the *Alpha Analytical Ethical Conduct and Data Integrity Agreement*. I further realize and acknowledge my responsibility as an Alpha staff member to follow these standards. I clearly understand that adherence to these standards is a requirement of continued employment at Alpha.

____
Employee Signature

____
Printed Name

____
Date

Review Requirements

The *Ethical Conduct and Data Integrity Agreement* must be signed at the time of hire (or within 2 weeks of a staff member's receipt of this policy). Furthermore, each staff member will be required to review and sign this agreement every year. Such signature is a condition of continued employment at Alpha. Failure to comply with these requirements will result in immediate discharge from Alpha employment. This agreement is not an employment contract and does not modify in any manner the company's *Employment-at-Will* Agreement.

21 Appendix F – Floor Plan Westboro Facility

Fire Alarm Zones & Coverage

Zone 1	Manual Pull Stations, Heat & Smoke Detectors
Zone 2	Sprinklers, Tamper & Flow Switches
Zone 3	Duct Smoke Detectors
Zone 4	Smoke, Manual Pull Station, Fire suppression systems

22 Appendix G– Floor Plan Mansfield Facility

23 Appendix H – Job Titles and Requirements

TITLE*	REQUIRED EDUCATION**	MINIMUM REQUIRED ENVIRONMENTAL LAB EXPERIENCE	MINIMUM REQUIRED SKILLS***
Technical Manager (Director) Organic Laboratory	BS or BA in Chemical, Environmental, or Biological Science; including minimum 24 credit hours in Chemistry. Masters or Doctoral degree in one of above disciplines may be substituted for 1 year of experience.	Two (2) years with the analysis of organic analytes in an environmental laboratory	1. Advanced technical knowledge of all analytical methods performed by the lab 2. Advanced technical instrumentation/lab systems knowledge 3. Knowledge of safe laboratory practices, OSHA regs and emergency protocols 4. Experience with and understanding of LIMS 5. Experience with method development and implementation 6. Experience monitoring standards of performance in Quality Control and Quality Assurance
Technical Manager (Director) Inorganic Laboratory	BS or BA in Chemical, Environmental, or Biological Science; including minimum 16 credit hours in Chemistry. Masters or Doctoral degree in one of above disciplines may be substituted for 1 year of experience.	Two (2) years with the analysis of inorganic analytes in an environmental laboratory	1. Advanced technical knowledge of all analytical methods performed by the lab 2. Advanced technical instrumentation/lab systems knowledge 3. Knowledge of safe laboratory practices, OSHA regs and emergency protocols 4. Experience with and understanding of LIMS 5. Experience with method development and implementation 6. Experience monitoring standards of performance in Quality Control and Quality Assurance
Technical Manager (Director) Microbiology Laboratory	BS or BA in Chemical, Environmental, or Biological Science; including minimum 16 credit hours in the Biological Sciences, including at least one course having microbiology as a major component. Masters or Doctoral degree in one of above disciplines may be substituted for 1 year of experience.	Two (2) years with the analysis of microbiological analytes in an environmental laboratory	1. Advanced technical knowledge of all analytical methods performed by the lab 2. Advanced technical instrumentation/lab systems knowledge 3. Knowledge of safe laboratory practices, OSHA regs and emergency protocols 4. Experience with and understanding of LIMS 5. Experience with method development and implementation 6. Experience monitoring standards of performance in Quality Control and Quality Assurance
Quality Assurance Officer	BS/BA in Chemistry, Biology, Environmental or related Science	Two (2) years Environmental Laboratory Experience	1. Advanced technical knowledge of all analytical methods performed by the lab 2. Knowledgeable in Federal, State Programs (THE NELAC INSTITUTE (TNI) STANDARDS, etc.) 3. Able to develop QA/QC policies and certification requirements 4. Able to develop training programs for quality procedures 5. Documented training and/or experience in QA and QA procedures 6. Knowledge of safe laboratory practices and emergency protocols

TITLE*	REQUIRED EDUCATION**	MINIMUM REQUIRED ENVIRONMENTAL LAB EXPERIENCE	MINIMUM REQUIRED SKILLS***
Laboratory Coordinator	High School Diploma; Associates or BS/BA in Chemistry, Biology or Environmental or related Science preferred	1 year +	1. Knowledge of safe laboratory practices and emergency protocols 2. Proficient in all methods and SOP's within their department 3. Experience with and understanding of LIMS 4. Proven ability to meet TAT (turnaround times)
Quality Systems Specialist	BS/BA Chemistry	2 years +	1. General knowledge of laboratory methods 2. Experience with and understanding of LIMS 3. Strong attention to detail 4. Strong oral/written communication and organizational skills 5. Knowledge of QA/QC policies and certification requirements
EH&S Coordinator	High School or Equivalent	2 years +	1. General knowledge of lab operations 2. Detailed knowledge of safe lab practices and emergency protocols 3. Hazardous Waste Management and RCRA Regulation Training 4. DOT Hazardous Materials Regulations Training 5. OSHA Compliance Training 6. Able to develop and deliver new hire and ongoing safety training programs
Lab Technician I	HS or Equivalent	0-1 years. 1+ years preferred.	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures (SOP's) 3. Familiarity with standard and reagent preparation 4. Knowledgeable in using volumetric pipettes and glassware 5. Strong oral/written communication and organizational skills
Lab Technician II	HS or Equivalent	2-4 years	1. All skills of Lab Technician I 2. Trained in majority of technician skills relative to department
Lab Technician III	HS or Equivalent	5 years +	1. All skills of Lab Technician II 2. Experienced in training staff
Lab Technician/Chemist I	BS/BA in Chemistry, Biology, Environmental or related Science	0-1 years	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures (SOP's) 3. Familiarity with standard and reagent preparation 4. Knowledgeable in using volumetric pipettes and glassware 5. Strong oral/written communication and organizational skills
Lab Technician/Chemist II	BS/BA in Chemistry, Biology, Environmental or related Science	2-4 years	1. All skills of Chemist I 2. Trained in majority of department methods

TITLE*	REQUIRED EDUCATION**	MINIMUM REQUIRED ENVIRONMENTAL LAB EXPERIENCE	MINIMUM REQUIRED SKILLS***
Lab Technician/Chemist III	BS/BA in Chemistry, Biology, Environmental or related Science	5 years +	1. All skills of Chemist II 2. Experienced in training staff
Analyst I	HS or Equivalent	0-1 years	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures (SOP's) 3. Experienced with sample handling, preparation and/or extraction
Analyst II	HS or Equivalent	2-4 years	1. All skills of Analyst I 2. Experienced in machine operation, maintenance and troubleshooting
Analyst III	HS or Equivalent	5 years +	1. All skills of Analyst II 2. Experienced in data review and reporting 3. Experienced in training staff
Analytical Chemist I	BS/BA in Chemistry, Biology, Environmental or related Science	6 mos-1 year	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures (SOP's) 3. Experienced with sample handling, preparation and/or extraction
Analytical Chemist II	BS/BA in Chemistry, Biology, Environmental or related Science	2-4 years	1. All skills of Analytical Chemist I 2. Experienced in machine operation, maintenance and troubleshooting
Analytical Chemist III	BS/BA in Chemistry, Biology, or Environmental or related Science	5 years +	1. All skills of Analytical Chemist II 2. Experienced in data review and reporting 3. Experienced in training staff
Data Deliverable Specialist I	HS Diploma, BS/BA or Associates preferred	0-1 years	1. Introductory knowledge of laboratory methods 2.Able to follow direction and Standard Operating Procedures (SOP's) 3. Working knowledge of Adobe Acrobat, Microsoft Word, Excel 4. Good writing and typing skills
Data Deliverable Specialist II	HS Diploma, BS/BA or Associates preferred	2-4 years	1. All skills of Data Deliverable Specialist I 2. General knowledge of laboratory methods 3. Understanding of data review/ data reporting process 4. Experience with and understanding of LIMS and electronic data deliverables

TITLE*	REQUIRED EDUCATION**	MINIMUM REQUIRED ENVIRONMENTAL LAB EXPERIENCE	MINIMUM REQUIRED SKILLS***
Data Deliverable Specialist III	HS Diploma, BS/BA or Associates preferred	5 years +	1. All skills of Data Deliverable Specialist II 2. Intermediate/advanced knowledge of laboratory methods 3. Able to perform report review 4. Experience with and understanding of LIMS and electronic data deliverables 5. Able to initiate re-work where necessary
Laboratory Intern	2 Semesters of Chemistry, Biology or Environmental Science	None; Lab work study experience preferred	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures

KEY

* Internal terms only. Full title would have "Environmental Laboratory" and specific department preceding it.

** Substitutions: Equivalent knowledge may be substituted for a degree in some instances.

*** Not meant to be an exhaustive list of skill requirements. For full list of skills consult the "Laboratory Skills" list. Actual Job Duties and Responsibilities can be found within job descriptions for each position.

24 Appendix I – Standard Operating Procedures

WESTBORO SOP #	Title
1728	Waste Management and Disposal
1730	Balance Calibration Check
1733	Thermometer Calibration
1735	Analytical Guidelines for Method Validation
1737	Inorganics Glassware Cleaning and Handling
1738	Water Quality Monitoring
1745	Reagent, Solvent and Standard Control
1948	Separatory Funnel Liquid-Liquid Extraction – EPA 3510C
1953	Organic Extraction Glassware Cleaning & Handling
1954	Soxhlet Extraction – EPA 3540C
1955	Sulfur Cleanup – EPA 3660A
1956	Oil and Waste Dilution – EPA 3580A
1959	Microwave Extraction – EPA 3546
1960	Sulfuric Acid Cleanup – EPA 3665A
1962	Florisil Cleanup
1963	Fractionation Cleanup
1964	Preparation of Samples for Chlorinated Herbicides
2022	Volatile Organic Compounds – EPA 624
2107	Volatile Organic Compounds – EPA 524.2
2108	Volatile Organic Compounds – EPA 8260C
2109	Polynuclear Aromatic Hydrocarbons (PAHs) by SIM – EPA 8270D (modified)
2110	Semivolatile Organics by GC/MS – EPA 625
2111	Semivolatile Organics by GC/MS – EPA 8270D
2112	TCLP/SPLP Extraction - Volatile Organics SW-846 Method 1311/1312
2113	EDB & DBCP in Water by Microextraction & Gas Chromatography – EPA 504.1, 8011
2116	Organochlorine Pesticides by Capillary Column GC – EPA 8081B
2119	Extractable Petroleum Hydrocarbons – MADEP
2120	Volatile Petroleum Hydrocarbons – MADEP
2122	Organochlorine Pesticides & PCBs by Capillary Column GC – EPA 608
2123	Polychlorinated Biphenyls in Oil – EPA 600/4-81-045
2125	TPH-Diesel Range Organics, Maine 4.1.25, EPA 8015C (Modified)
2126	TPH- Gasoline Range Organics, Maine 4.2.17, EPA 8015C (Modified)
2127	CT-ETPH
2128	Herbicides by 8151A

WESTBORO SOP #	**Title**
2129	PCBs by Capillary Column Gas Chromatography - EPA 8082A
2131	New Jersey EPH Method
2133	TCLP Extraction Metals and Semi-Volatile Organics – SW-846 Method 1311
2135	SPLP Extraction Inorganics and Semivolatile Organics, EPA 1312
2161	Fecal Coliform by Membrane Filtration – SM 9222D
2163	Fecal Coliform by Multiple Tube Fermentation – SM 9221E
2191	Heterotrophic Plate Count – SM 9215B
2192	Total Coliform/E.Coli – Presence/Absence (Colilert) – SM 9223B
2193	Total Coliform by Membrane Filtration – SM 9222B
2194	Total Coliform by Multiple Tube Fermentation – SM 9221B
2195	Chlorophyll A – SM 10200H
2196	E. Coli – Membrane Filtration
2197	Chlorophyll A – EPA 446
2198	Air Density Monitoring
2199	Inhibitory Residue Test
2200	Enterococcus – MF
2201	Total Coliform, E.Coli & Enterococcus by Quantification Methods (Quanti Tray)
2202	pH, Liquid Samples
2203	pH, Soil & Waste Samples
2204	Hexavalent Chromium
2205	Biological Oxygen Demand
2206	Ammonia Nitrogen
2207	Total Kjeldahl Nitrogen
2208	Chemical Oxygen Demand
2209	Oil & Grease by n-Hexane Extraction Method & Gravimetry
2210	Cyanide, Total
2211	Phenol, Total
2212	Sulfate, Turbidimetric Method
2213	Alkalinity, Titration Method –SM 2320B
2214	Determination of Inorganic Anions by Ion Chromatography – EPA 300.0
2215	Total Organic Carbon/Dissolved Organic Carbon
2216	Chloride – SM 4500Cl-E, EPA 9251
2217	Nitrate, Nitrite and Nitrate/Nitrite Nitrogen – EPA 353.2, SM 4500NO_3-F
2218	Total Solids (Dried @ 103-105^o) and TVS – SM 2540B, SM 2540E
2219	Total Dissolved Solids – SM 2540C
2220	Total Suspended Solids – SM 2540D
2221	Total Sulfide – SM 4500S2-AD, EPA 9030B
2222	MBAS, Anionic Surfactants – SM 5540C

WESTBORO SOP #	Title
2223	Fluoride, Electrode Method – SM 4500F-BC
2224	Turbidity, Nephelometric Method – EPA 180.1, SM 2130B
2225	Orthophosphate, Colorimetric Single Reagent Method – SM 4500P-E
2226	Total Phosphorous, Colorimetric Combined Reagent Method – SM 4500P-E
2227	Flashpoint – EPA 1010
2228	Reactivity – EPA Chapter 7.3
2229	Total Solids (Dried @ 103-105^o) – SM 2540G
2230	Specific Conductance and Salinity
2231	True and Apparent Color, Visual Comparison Method
2232	Acidity, Titration Method
2233	Determination of Formaldehyde by HPLC, EPA 8315A
2234	Sulfite, Iodometric
2235	Ferrous Iron
2236	Residual Chlorine
2237	ORP
2238	Ignitability of Solids EPA 1030
2239	Physiologically Available Cyanide (PAC)
2240	Total Settleable Solids SM 2540 F
2241	Fixed and Volatile Solids in Solid and Semisolid Samples – SM 2540G
2242	Tannin & Lignin
2243	Nitrite - Manual Colorimetric Method
2244	Paint Filter Liquids Test
2245	Odor, Threshold Odor Test
2249	Dissolved Oxygen
2251	Perchlorate by IC/MS/MS
3743	Free Cyanide
9177	Total Phenol - SEAL Method
9733	Oil & Grease and TPH in Soil
10807	Percent Organic Matter in Soil
12838	Buchi Concentration
17972	Extractable Organic Halides (EOX)
18236	Chloropicrin and Carbon Tetrachloride by EPA 8011
19332	DI Water Extraction ASTM D3987

MANSFIELD SOP #	Title
1753	Glassware Cleaning
1754	Balance Calibration
1755	Pipette Checks
1796	Sample Management - Forensics
1797	Haz Waste
1816	Reagent Solvent Standard Control
2134	Hot Block Digestion for Aqueous Samples EPA 3005A
2137	ICP-MS EPA 6020A
2138	Mercury Aqueous 7470A
2139	Mercury Soil 7471B
2140	AVS SEM
2141	Hydride Generation
2142	Mercury Aqueous 1631E
2143	Mercury Soil 7474
2148	Metals Soil Digestion 3050
2150	Metals Microwave 3015
2151	Metals Acid Digestion 3020
2152	Seawater Extraction of Metals
2154	TCLP 1311
2155	EPA 8270D
2157	PAH by SIM
2158	EPA 8081B
2160	EPA 8082A Aroclors/Congeners by GC and TO-10A
2162	Pesticides/PCB Aroclors/Congeners by GC/MS SIM
2164	1,4-Dioxane GC/MS SIM
2165	Separatory Funnel Extraction EPA 3510C
2166	Tissue Prep
2167	GPC
2168	Sulfur Cleanup 3660
2169	Sulfuric Acid Cleanup 3665
2170	Silica Gel Cleanup
2171	% Lipids
2172	Microscale Solvent Extraction EPA 3570
2173	Soxhlet Extraction EPA 3540C
2174	Soxhlet Extraction of PUFs
2175	% Total Solids
2182	TOC by Lloyd Kahn
2183	Particle Size Determination
2184	Particulates in Air PM-10

MANSFIELD SOP #	Title
2186	TO-15
2187	APH
2188	Air PIANO
2189	Dissolved Gases
2190	Can Cleaning
2246	TPH and SHC
2247	Alkylated PAH
2248	Organic Lead
2252	Fixed Gases
2253	TO-11A
2255	PIANO Volatiles
2256	Ethanol in Oil
2257	Whole Oil Analysis
2259	Density Determination of Oils
2260	Alumina Cleanup
2261	Shaker Table
2263	Gravimetric Determination
2264	Tissue Extraction
2265	Organic Waste Dilution
2267	Client SOP: SGC - Manual Method
2268	Client SOP: DCM Extractable Method
4246	PAHs by SPME
6398	TO-17
6438	Mercury in Sorbent Tubes by CVAA
7900	Mercury 1631E Using Cetac-M-8000 Analyzer
9077	Porewater Generation
9480	EPA-TO-12
12863	EPA 8270D GC/MS Full Scan TO-13A
13091	HPAH
13406	Particulate Organic Carbon
14500	Lead in Particulate Matter
17452	TOC by EPA 9060A
17456	Moisture, Ash and Organic Matter
18086	Total Suspended Solids (TSS) SM 2540D
17829	Specific Gravity of Soil
17830	Liquid Limit, Plastic Limit and Plasticity Index of Soils
17940	1,4-Dioxane in Drinking Water by EPA 522
18705	PCB Congeners by GC/MS-SIM EPA 8270D
18710	Trace Elements in Waters and Wastes by ICP-MS EPA 200.8

MANSFIELD SOP #	Title
18711	Metals by ICP EPA 200.7
18714	Metals by ICP EPA 6010C
18715	Mercury in Water (CVAA) EPA 245.1
18716	Hot Block Digestion for Aqueous Samples EPA 3005A
18717	Microwave Assisted Acid Digestion of TCLP Extracts EPA 3015
18718	Microwave Assisted Acid Digestion for Metals EPA 3015A/3051A
18817	Alcohols by FID- Aqueous Direct Injection EPA 8015D
19625	Glycols by GC-FID EPA 8015D
19971	Air Drying Samples for PCBs and Metals Analysis
19978	Density of Soil
22132	Data Review – Ohio VAP
23511	PFAS by LC/MS/MS by EPA 537
23528	PFAS by LC/MS/MS Isotope Dilution by EPA 537(M)
24454	Acetonitrile Extraction for Unknown Compounds via GCFID

CORPORATE SOP #	Title
1559	Sample Receipt and Login
1560	Sample Custody and Tracking
1561	Bottle Order Preparation
1562	Computer System Backup/Control
1563	Computer and Network Security
1564	Software Validation and Control
1565	Training Program
1566	Report Generation and Approval
1567	Organics Data Deliverable Package Review
1722	Customer Inquiry and Complaint Procedures
1723	Customer Service
1724	Quote/Contract Procedure
1725	Project Communication Form Generation
1726	Procedure
1727	Accounts Payable Invoice Processing
1729	Document Control
1731	Manual Integration and Compound Rejection
1732	DL LOD LOQ Generation
1734	Control Limit Generation
1736	Corrective and Preventative Actions
1739	Demonstration of Capability (DOC) Generation
1740	Internal Audit Procedure

CORPORATE SOP #	Title
1741	Data Review – Organics
1742	Calculating Measurement Uncertainty
1743	Annual Management Review
1744	Sample Compositing Procedure
1746	Nonconformance Planning/Procedures
1747	Temperature Datalogger Operation
2274	Data Validation Package
17553	Lab Supply Transfer Procedure
18821	Weights Verification
18909	PT Corrective and Preventive Action Process

APPENDIX B

HEALTH & SAFETY PLAN

July 2020

SITE-SPECIFIC HEALTH AND SAFETY PLAN (HASP)

Property Identification:
323-325 Yonkers Avenue
Yonkers, NY 10701

BCP Site No. C360184
AEI Project No. 401130

Prepared For:
Simchah 325 Yonkers, LLC
327 Yonkers Avenue
Yonkers, New York 10701

Prepared By:
AEI Consultants
20 Gibson Place, Suite 310
Freehold, New Jersey 07728
(732) 414-2720

Emergency Contact Information

PERSONNEL		
AEI Consultants	**Office**	**Cell**
Qualified Environmental Professional: Anthony Cauterucci	732-414-2720	732-275-4719
Project Manager: Jordan Farber	201-332-1844	973-508-5050
Site Safety Officer: Jordan Farber	201-332-1844	973-508-5050
Regional Health and Safety Representative: Jack Katz	732-414-2720	732-266-3730
Corporate H&S Director: Kathleen Baxter	857-321-8673	781-718-1951
Subcontractors		
Company: Core Down Drilling	845-661-7164	845-803-4347
Company: Delta Geophysics, Inc.	610-231-3701	610-577-6064
Company: **Click or tap here to enter text.**		
Site Contact		
Baroukh Sassooness	N/A	212-234-0234
EMERGENCY RESPONSE AGENCIES		
	Emergency	Non-Emergency
Hospital: New York-Presbyterian Lawrence Hospital	911	(914) 787-1000
Fire: Yonkers Fire Department	911	(914) 377-7500
Police: Yonkers Police Department	911	(914) 377-7452
Ambulance: **Click or tap here to enter text.**	911	
OTHER EMERGENCY ASSISTANCE		
Poison Control Center	800-222-1222	

ROUTE DESCRIPTION AND MAP TO HOSPITAL

Hospital Information

Name: New York-Presbyterian Lawrence Hospital
Address: 55 Palmer Ave, Bronxville, NY 10708
Phone Number: (914) 787-1000

Directions

A 323-325 Yonkers Ave, Yonkers, NY 10701

1.	Head west toward Yonkers Ave	200 feet
2.	Turn left onto Yonkers Ave	0.2 miles
3.	Sharp right onto the Cross Country Pkwy ramp	0.2 miles
4.	Merge onto Cross County Pkwy/New York State Reference Rte 907K	0.4 miles
5.	Use the right 2 lanes to take exit 5 for Kimball Ave/W Broad St	1.1 miles
6.	Keep right at the fork to continue on Exit 6, follow signs for Bronx River Pkwy/Sprain Brook Pkwy	0.2 miles
7.	Keep left at the fork, follow signs for Bronx Pkwy N/Sprain Pkwy and merge onto Bronx River Pkwy	1.4 miles
8.	Take the exit toward Bronx Pkwy/White Plains	0.1 miles
9.	Continue onto Bronx River Pkwy	0.2 miles
10.	Take exit 2 toward Pondfield Rd W	374 feet
11.	Turn right onto Pondfield Rd W	449 feet
12.	Turn right	174 feet

B NewYork-Presbyterian Lawrence Hospital (914) 787-1000
55 Palmer Ave, Bronxville, NY 10708

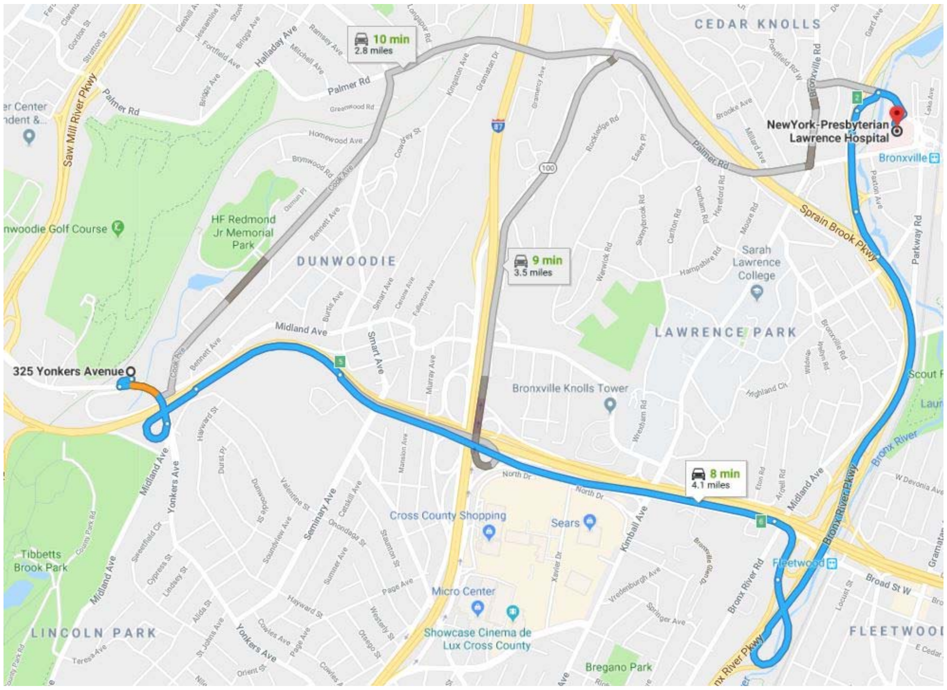


Table of Contents

List of Tables:

List of Figures:

List of Appendices:

Health & Safety Plan (HASP) Review and Approval:

By signing below, it is acknowledged that this HASP identifies the activities that are anticipated to be performed in the field. In addition, this HASP identifies the personal protective equipment (PPE) and monitoring instrumentation that may be necessary to be on Site and be available for use. It is also understood that the provisions of this HASP will be updated if there is a change of a task and/or the addition of tasks and will be approved by the individuals listed below or their designee.

Jordan Farber	Jordan Farber	July 2, 2020
HASP Preparer	Signature	Date
Anthony Cauterucci	Anthony Cauterucci	July 2, 2020
HASP Reviewer	Signature	Date
Jordan Farber	Jordan Farber	July 2, 2020
Project Manager	Signature	Date
Jordan Farber	Jordan Farber	July 2, 2020
Site Safety Officer	Signature	Date

This form MUST be signed prior to starting the on-site work. A hard copy of this form and the HASP will be brought to the site. After completion of the project, the original signed HASP will be retained in the project files.

1.0 INTRODUCTION

This Health and Safety Plan (HASP) was prepared to inform all AEI personnel of known or reasonably anticipated potential hazards and safety concerns at this Site. All personnel participating in field activities must be trained in the general and specific hazards unique to the job they are performing and, if applicable, meet recommended medical examination, medical monitoring and/or training requirements. All AEI employees will follow the guidelines, rules, and procedures contained in this site-specific HASP. AEI personnel will contact the Project Manager (PM), Senior Author (SA) or Regional Health and Safety Representative if unexpected conditions are encountered at the site, including but not limited to:

1. New processes;
2. Changes in work scope;
3. Changes in field conditions or operations;
4. Changes or modifications to products or services;
5. Additional or changes in the chemicals of concern; and/or
6. Of unsafe conditions encountered which were not previously addressed in this HASP.

Each contractor, subcontractor, and visitor shall be expected to review and understand the hazards, risks, and control methods (including emergency procedures) as outlined in this HASP, and sign off on the HASP. This can be accomplished either during the project planning stage or during the first health and safety briefing on site. However, contractors and subcontractors will be required to prepare their own HASP to address site safety and work hazards associated with their proposed site activities prior to mobilization to the site. In addition, each subcontractor will be required to provide AEI with their site-specific HASP, and communicate the types of hazards and control methods associated with their activities to AEI during the first safety briefing on site and as conditions change. Relevant contractor information regarding the identification of hazards and appropriate control strategies for the hazards for their particular job tasks should also be presented and a site-specific HASP should be available for review by all parties. Each contractor or subcontractor must assume direct responsibility for its own employees' health and safety.

Copies of the HASPs will be kept on Site for review and reference during all site activities. Upon completion of the project, the finalized and signed copy of the HASP will be placed in the project file.

1.1 Specific Work Activities

The field activities currently underway and/or planned include the following tasks as described below:

Task 1: Geophysical Survey

- Arrange for a private geophysical survey to identify the presence or absence of underground structures, including utilities, disturbed soils, and/or cavities at the proposed soil boring locations using ground penetrating radar (GPR) and other geophysical methods. If anomalies are identified which require further investigation, then the scope of this investigation may need to be altered.

Task 2: Soil/Groundwater/Soil Vapor/Indoor Air Sampling

- An investigation of soil, groundwater, soil vapor, and indoor air is proposed to further characterize the Site for potential environmental impacts from the historical on-site dry-cleaning activities. The sampling procedures of this investigation will be performed in accordance with the NYSDEC Technical Guidance for Site Investigation and Remediation DER-10.

  In summary, the installation and survey of one (1) additional groundwater monitoring well (along with the sampling of two existing on-site monitoring wells), advancement of five (5) borings for soil sampling, advancement of five (5) sub-slab soil vapor points and one (1) exterior soil vapor point, and collection of six (6) air samples are proposed.

1.2 Site Description and Chemicals of Concern

The Site is currently occupied by BoniClean dry cleaner, Deli Buffet, and a church.

Investigations and remedial work completed at the Site between June 2005 and December 2018 have identified tetrachloroethene (PCE) impacts in soil, groundwater, soil vapor, and indoor air at the Site.

The current owner, Simchah 325 Yonkers, LLC, purchased the Site in 2006. AEI is currently being retained by Simchah 325 Yonkers, LLC to assist in the completion of remedial actions regarding the PCE release at the Site, pursuant NYSDEC requirements.

This remedial investigation is planned to conduct a remedial investigation to characterize impacts in soil, soil vapor, and groundwater onsite and fully investigate and characterize the nature and extent of contamination that has migrated or emanated from the Site to off-site locations.

Contaminants of concern are CVOCs, including PCE, trichloroethene (TCE), 1,2-dichloroethane (DCE), and vinyl chloride (VC).

2.0 IDENTIFICATION OF KEY HEALTH AND SAFETY PERSONNEL

An efficient on-site operation requires that all key personnel be identified and that their roles and responsibilities be clearly defined. Below is a discussion of the management structure for this project.

2.1 Principal in Charge/Senior Author

Responsibilities include overall coordination of client services, scope of services, and site activities. The AEI Qualified Environmental Professional (QEP)/Senior Author has overall accountability and responsibility for the scope of services, the safety of operations and the health and safety of all personnel.

2.2 Regional Health and Safety Representative

The Regional Health and Safety Representative (H&SR) and AEI Health & Safety Director are resources for development of the site-specific HASP and will be consulted on all related health and safety issues that arise in the field, including any changes in the HASP. The Regional Health and Safety Representative will be the HASP Reviewer. The Regional Vice President and Director of Operations may be acceptable Health and Safety Representatives or an alternative may be assigned per region. The Health and Safety Director will make all final decisions regarding questions on the HASP.

2.3 Site Supervisor/ Project Manager

The Site Supervisor/ Project Manager (PM) is responsible for field-related activities under the direction of the Senior Author and for maintaining field operations in accordance with project requirements. This person is responsible for enforcing daily implementation of the HASP and resolving health and safety issues (with changes reviewed with the Regional H&SR). In addition, this person will:

- Establish and ensure maintenance of site work zones.
- Monitor the work area and personal breathing zone and ensure compliance of workers relative to pre-established personal protection levels.
- Evaluate site conditions (i.e., weather, chemical, physical) and recommend any modifications to existing levels of protection.
- Ensure that daily safety briefings are conducted and documented in this HASP (see Section 9) or in the field logbook.
- Initiate emergency response procedures with immediate communication to the project manager.
- Exercise stop-work authority in the event of imminent danger to project personnel.
- Notify PM of any noncompliance and/or unsafe conditions.
- Conduct regular inspections to determine effectiveness of the HASP.

2.3 Site Safety Officer

The AEI Site Safety Officer (SSO) is responsible for implementation of the HASP and for making decisions in the field regarding changes to the HASP that may result as the work activities/tasks are executed (may be the same person as the PM). The SSO will brief contractors and AEI personnel on the requirements of the HASP, answer questions and perform site inspections to ensure that the HASP is being properly implemented by all onsite personnel.

2.4 Project Personnel

AEI Project personnel involved in field activities are responsible for:

- Taking all reasonable precautions to prevent injury to themselves and to fellow employees.
- Conducting only those tasks that they believe they can do safely.
- Reporting all occurrences and/or unsafe conditions to the supervisor and/or project manager.
- All project personnel have stop work authority if they observe an unsafe condition or are unclear of how to safety execute a work task.

Table 1: AEI Site Personnel Contact Information

Personnel Telephone Roster			
Company/Title	**Personnel**	**Office**	**Cell**
Site Contact	Jordan Farber	201-332-1844	973-508-5050
QEP/Senior Author	Anthony Cauterucci	732-414-2720	732-275-4719
Director of H&S	Kathleen Baxter	857-321-8673	781-718-1951
Project Manager	Jordan Farber	201-332-1844	973-508-5050
Site Safety Officer	Jordan Farber	201-332-1844	973-508-5050
H&S Representative	Jack Katz	732-414-2720	732-266-3730

Table 2: Contractor/Subcontractor Contact Information

Contractor/Subcontractor Telephone Roster			
Company/Title	**Personnel**	**Office**	**Cell**
Core Down Drilling	Andrew Bellucci	845-661-7164	845-625-3401
Delta Geophysics, Inc.	Matthew Dilenno	610-231-3701	610-577-6064

3.0 HAZARD EVALUATION

The Project Hazard Analysis below identifies the hazards anticipated to be encountered by the project team based on the tasks described in Section 1.1. Refer to **Appendix A** specific information on controlling hazards and Job Safety Analysis sheets.

Table 3: Project Hazard Analysis

Chemical Hazards Present: ☐ None	☒ Flammable/combustible ☐ Compressed gas ☐ Explosive ☐ Organic peroxide ☐ Oxidizer ☐ Water reactive ☐ Unstable reactive ☒ Dust/Fumes/Particulates	☒ Corrosive ☐ Toxic ☐ Highly Toxic ☒ Irritant ☐ Sensitizer ☒ Carcinogen ☐ Mutagen ☐ Other:
Physical Hazards Present: ☐ None	☐ Heat ☒ Cold ☒ Walking/working surfaces ☒ Visible Dust ☒ Noise	☐ Ionizing radiation ☐ Non-ionizing radiation ☐ Electricity ☐ Severe Weather ☐ Poor lighting ☒ Overhead Hazards ☐ Other:
Equipment Hazards Present: ☐ None	☒ Heavy machinery/ Drill Rigs ☐ Trenching/excavation ☐ Docks-marine operations ☐ Docks-loading ☒ Drilling ☐ Forklifts ☐ Operations on Water ☐ Elevated heights (includes fall protection) ☒ Overhead/Underground utilities ☐ Confined spaces ☒ Power tools	☐ Cranes/Hoists/Rigging ☐ Ladders ☐ Scaffolding ☐ Manlifts ☐ Gas cylinders ☒ Work on/near Roadways ☐ Work near Railways ☐ Energized equipment (LO/TO) ☐ Pressurized equipment (LO/TO) ☐ Drums and containers ☐ Other:
Biological Hazards Present: ☐ None	☐ Animal/human fluids or blood ☐ Animal/human tissue(s) ☐ Poisonous/irritating plants ☐ Contaminated needles	☐ Live bacterial cultures ☒ Insects/rodents/snakes -Fire Ants ☐ Other:
Ergonomics Hazards Present: ☐ None	☐ Repetitive motion ☒ Awkward position ☐ Heavy Lifting ☐ Frequent Lifting	☐ Limited movement ☐ Forceful exertions ☒ Vibration ☐ Other:
Personal Safety/Security: ☐ None	☒ Personal safety ☐ Security issue ☐ Project site in isolated area ☐ Employees working alone ☐ Hunting Seasons (Fall)	☐ Employees working early/late ☐ Potentially dangerous wildlife ☐ Guard or stray dogs in area ☐ No/limited cell phone service ☐ Other:

3.1 Specific Chemicals of Concern

The chemicals listed in the Table 4 below include the identification of chemical contaminants known and/or suspected of being present on-site, the affected media, known concentrations (if applicable), the Permissible Exposure Limit (PEL) or Time Weighted Averages (TWA), and the Action Level (i.e., 50% of the PEL/TWA). Chemical information and Applicable Safety Data Sheet(s) (SDS) are included in **Appendix B**.

Table 4: Chemicals of Concern

SOIL			
Chemical	**Lower Range Concentration** (mg/kg)	**Higher Range Concentration** (mg/kg)	**PEL/TLV** (ppm)
PCE	Unknown	Unknown	100 (TWA)
TCE	Unknown	Unknown	100 (TWA)
DCE	Unknown	Unknown	50 (TWA)
VC	Unknown	Unknown	1 (TWA)
GROUNDWATER			
Chemical	**Lower Range Concentration** (ug/L)	**Higher Range Concentration** (ug/L)	**PEL/TLV** (ppm)
PCE	Unknown	Unknown	100 (TWA)
TCE	Unknown	Unknown	100 (TWA)
DCE	Unknown	Unknown	50 (TWA)
VC	Unknown	Unknown	1 (TWA)
SOIL VAPOR/INDOOR AIR			
Chemical	**Lower Range Concentration** (ug/m^3)	**Higher Range Concentration** (ug/m^3)	**PEL/TLV** (ppm)
PCE	Unknown	Unknown	100 (TWA)
TCE	Unknown	Unknown	100 (TWA)
DCE	Unknown	Unknown	50 (TWA)
VC	Unknown	Unknown	1 (TWA)

4.0 GENERAL SUBSURFACE CLEARANCE REQUIREMENTS

If the Tasks presented in Section 1.1 involve subsurface work, the following sections are applicable and must be followed. The Subsurface Clearance (SSC) Form (**Table 5**) must be completed before Site work commences. This table must be completed in its entirety. Also, all other pertinent requirements that must be met for subsurface work are identified in AEI's July 2019 SSC Policy (**Appendix C**) and must be followed.

Table 5: Subsurface Clearance (SSC)

	SSC Requirement	Yes	No	NA	Comments:
Subsurface Clearance (SSC) **Document the steps that must be followed and justify any exceptions.** **This table MUST be completed in its entirety.**	Prequalification of Contractor for SSC capability performed	☒	☐	☐	
	"Designated Person" (e.g., AEI PM) for SSC work assigned	☒	☐	☐	
	Site information reviewed	☒	☐	☐	Facility Plans and previous work completed on-site by other consultants.
	Site walkover including the approval of locations by facility personnel and service notifications provided?	☐	☒	☐	
	Underground utilities identified prior to commencement of intrusive activities as reasonably feasible	☒	☐	☐	Dig Safe must be previously notified and have cleared the site for subsurface work. Dig Safe Notification Date: N/A
	Consider/document "Critical Zones" (i.e., locations of known underground utilities) as reasonably feasible	☒	☐	☐	
	Will all drilling points be manually cleared if unknown hazards exist or slant borings be conducted?	☒	☐	☐	

4.1 Specific Procedures

1. Obtain and/or develop an accurate location plan for the target area where subsurface work will be conducted. Overlay this plan with the expected locations of where subsurface work will be conducted by AEI and/or their contractors or sub-contractors.
2. Arrange for approved public service locator to visit site and mark out utilities to property line.
3. Request site specific underground service information from the owner and/or occupier of the site and include on location plan.
4. You MUST conduct a site walk-over and complete the Subsurface Clearance Form included as Appendix C to this HASP, and Table 5 above. The main intent of this form is to identify above ground identifiers (e.g., the existence of an above ground gas valves, water outlets, telecommunications access point, patches, soil depressions, etc.) which may indicate the potential existence of subsurface issues. Ideally, the completion of this form should be conducted in conjunction with the efforts of the private locator or prior to their arrival on site. This would assist the locator in focusing their efforts on areas where potential subsurface issues may exist.
5. Ensure that identified utilities are traced/marked by the locator/owner/occupier, using the following as a minimum:

    - Where practicable, trace and mark/label all incoming services;
    - Agree on all locations for potential intrusive works; clear these with the Client Contact; and mark/identify locations on the ground and on the site plan;
    - Provide private locator with plans of potential intrusive work;
    - Ensure that the locator marks all detected services and those featured on location plans to within a 10 foot (3 meter) radius of EACH location where intrusive work will occur, and adhere to "Restricted Areas" directives in AEI's SCC Policy (Appendix C.)
    - Ensure locator surveys the proposed work site to find other potential service utilities, as applicable.
    - Ensure that any intrusive works are located a minimum of 10 feet (3 m) horizontally from any overhead electric cable supported on wooden poles, or 50 feet (15 m) horizontally in the case of those supported on metal poles/towers. Where this cannot be achieved, contact the relevant electricity provider for guidance as well as the SVP in Charge, Director of H&S, and the SSO.

6. Where any doubt exists over a service which cannot be traced, request a site visit from the appropriate utility provider or abandon locations in the immediate area and contact the PM or SVP.
7. Following the completion of the public/private surveys and other collected information (i.e., site walk-over and information provided by the Client Contact/site representative) but prior to commencing the intrusive investigation, review and verify the results of all information. Ensure that on-site contact information is available and/or that the location(s) of any isolators/stop-cocks/values are known and/or are marked/indicated on the location plans or otherwise highlighted, as applicable.
8. Locations which have been marked on the ground and have been cleared by the private locator are considered FIXED. Conducting intrusive operations outside the cleared area / radius is PROHIBITED.

9. Proceed with work activities in accordance with proposed scope of work utilizing all necessary control measures as detailed in this Project Health and Safety Plan (HASP). Work activities are NOT to be performed if:

    - There is an uncertainty with the results of the private locate;
    - Additional information is provided after the public/private locates have been performed which contradicts/conflicts with existing information;
    - Work is required within the restricted areas (refer to Section 2.1 of the Subsurface Clearance Policy); and/or
    - Identified conditions have not been resolved.

5.0 PERSONNEL PROTECTIVE EQUIPMENT (PPE)

This section of the HASP is used for the identification and selection of the appropriate PPE. The protective equipment will be selected based on the contaminant type(s), concentration(s) in air (if any), standing liquid (if any), or other applicable matrix (e.g., soil, sludge, sediment, etc.) and the known route(s) of entry into the human body.

The highest level of protection that is anticipated for any of the planned work tasks is Level D Modified Protection.

Table 6: General Level of Protection

Task Number as Defined in Section 1.1	**Level of Protection**				
	A	**B**	**C**	**Mod D**	**D**
Task No. 1 – Geophysical Survey	☐	☐	☐	☒	☐
Task No. 2 – Soil/Groundwater/Soil Vapor/Indoor Air Sampling	☐	☐	☐	☒	☐

Key:

Level D: Long sleeve natural fiber shirt; long pants (natural fiber); hard hat; eye protection; hearing protection (as needed); and safety shoes.

Level D Modified: Level D protection plus additional skin protection (e.g., protective coveralls, personal flotation device as required; and appropriate hand protection).

Level C: Level D (Modified) protection plus negative pressure respiratory protection with combination cartridges (VOCs and particulates); chemical protective coveralls in lieu of general coveralls; use of inner and (butyl or vinyl disposal gloves) outer sets of hand protection (Nitrile outer gloves).

Level B: Level C protection plus Pressure-demand supplied air respirator with escape bottle in lieu of negative pressure respirator; chemical resistant coveralls with hood; chemical resistant boots.

Level A: Level B protection plus fully encapsulating (gas tight) chemically resistant suit.

Table 7: Specific Personal Protective Equipment and Supplies

Equipment	Req	Rec	NA	Equipment	Req	Rec	NA
Steel-toe Boots	☒	☐	☐	SCBA	☐	☐	☒
Outer Disposable Boots :	☐	☐	☒	Full-face Airline Respirator	☐	☐	☒
Long Sleeve Shirt and Pants	☒	☐	☐	Full Face Negative Pressure Respirator	☐	☐	☒
Flame Retardant Coveralls	☐	☐	☒	Half Face Negative Pressure Respirator	☐	☒	☐
Tyvek Suit:	☐	☐	☒	Powered Air Purifying Respirator	☐	☐	☒
Poly-coated Tyvek/Saranex Suit	☐	☐	☒	Other: dust mask	☐	☒	☐
Fully Encapsulated Chemical Suit	☐	☐	☒	First Aid Kit	☒	☐	☐
Hearing Protection	☒	☐	☐	Fire Extinguisher	☐	☒	☐
Leather Gloves	☐	☐	☒	Mobile Phones	☐	☒	☐
Outer Chemical Gloves (Type): Nitrile	☒	☐	☐	Walkie Talkies	☐	☐	☒
Inner Chemical Gloves (Type): Butyl or Vinyl	☐	☐	☒	Water or Other Fluid Replenishment	☐	☒	☐
Hard Hat	☒	☐	☐	Eye Wash	☐	☒	☐
Safety Glasses with Side Shields	☐	☒	☐	Sunscreen	☐	☒	☐
Vented (Splash proof) Goggles	☐	☐	☒	Insect Repellent (with DEET)	☐	☒	☐
Hi-visibility reflective vest	☒	☐	☐				

Key: Req = Required; **Rec** = Recommended; **NA** = Not Applicable

6.0 AIR MONITORING PROCEDURES

Air monitoring for the presence of volatile organic compounds (VOCs) and will be conducted while all field work is being undertaken. Air monitoring may necessitate using one or more monitoring devices as listed in **Table 8**, particularly if gases, vapors, explosion hazards and/or oxygen deficient atmospheres can occur and/or are expected. If a monitoring device will be utilized, the corresponding device letter will be placed in the column labeled "**Required Monitoring Instrument**" as noted in **Table 9**.

Table 8: Monitoring Devices Available

A	PID (10.6 eV)	**H**	Summa Canister
B	PID (11.7 eV)	**I**	Heat Stress Monitor
C	FID	**J**	Air Sampling: mini-RAM pdr-1000
D	OVA	**K**	Air Sampling:
E	CGI/LEL	**L**	Radiation Detector
F	Colorimetric Indicator Tubes	**M**	Gas Multimeter
G	Dust Monitoring	**N**	Other Device:

Table 9 lists the applicable Action Level in the appropriate box using 50% of the most restrictive (lowest) PEL or TLV as the Trigger as presented in Appendix A or other recognized source. VOCs and particulates are the potential airborne hazards anticipated during the planned Site work.

Table 9: Required Monitoring Instrument

Required Monitoring	**Constituent**	**Task(s)**	**Trigger (Action Level)**	**Insert Monitoring Instrument 'Letter' identified in Table 8**
If monitoring is necessary to identify that a risk is at or above acceptable limits and/or is used in controlling a risk on site, document the task and the maximum allowable exposure or trigger, and the monitoring instrument required to be used.	Oxygen			
	Carbon Monoxide			
	H_2S			
	C_2S			
	CH4			
	VOCs: Total	2	5 ppm (sustained)	A
	Semi - VOCs:			
	Metals			
	Dusts	2		
	Others:			
	Others:			

6.1 Action Level Guidance

6.1.1 Air Monitoring Action Response Limits

This HASP addresses site-specific chemicals as noted in Section 3.1 entitled "**Chemicals of Concern**". An action level for each chemical or group of chemicals is based on 50% of the most restrictive (lowest) occupational exposure limit, specifically the PEL or TWA. If a sustained PID measurement (i.e., over a 3-minute period) for total VOCs was observed in the worker's breathing zone above the action level, site personnel will immediately don respiratory protection. Full face air purifying respirators (APRs) or half face APRs with combination cartridges equipped for both particulates and organic vapors protection will be utilized. Due to the limited area of subsurface disturbance (i.e., 2-inch borehole), dust is not expected to be a concern during the course of work.

Table 10: General Action Levels

Compound	Action Level	Permissible Exposure Limit (PEL) Time Weighted Average (TWA)
Volatile Organic Compounds (VOCs)	5 ppm (sustained)	see Appendix B

6.1.2 Combustible Gas Indicator (CGI) Oxygen Meter

Action levels for situations involving a combustible Gas Indicator / Oxygen meter are outlined in Table 11 below but LEL and oxygen hazards are not anticipated during the current planned Site work. It is not anticipated that an oxygen deficient or explosive atmosphere will be present during the planned site work.

Table 11: Combustible Gas Indicator (CGI) Oxygen Meter

Meter Response	Action/Respiratory Protection
CGI response <10% LEL	Continue normal operations with regular, periodic monitoring
CGI response > 10% LEL	Discontinue operations; evacuate personnel and prohibit entry; allow to vent until readings are <10%.
Oxygen level <19.5% or >23.5%	Retreat from work area; consult with PM and SSO about upgrading to Level B respiratory protection, adding mechanical ventilation, or possible changes in work practices.

6.1.3 Odors

If strong unexpected and unidentified odors are encountered, site personnel shall evacuate the area until an assessment of the origin and composition of the odor has been completed, and a control solution has been implemented.

7.0 DECONTAMINATION

7.1 Sampling and Construction Equipment Decontamination

Decontamination involves the orderly controlled removal of contaminants. All undedicated sampling equipment and sampling meters (if applicable) will be cleaned prior to and between each use. All on-site equipment will be decontaminated and allowed to air dry before leaving the site. Decontamination maybe accomplished using an approved cleaner, water, and steam. Subcontractors will be responsible for decontamination of their own equipment used during field operations, as well as disposal of the decontamination fluids.

7.2 Personnel Decontamination

All site personnel should minimize contact with contaminants. All disposable PPE will be disposed of as solid waste. Non-disposal PPE must be decontaminated, particularly the safety boots. Any PPE that cannot be decontaminated should be disposed of along with waste generated from field operations.

Personnel shall wash and remove PPE prior to leaving the site. At a minimum, gross removal of contaminants from the PPE, removal of the PPE, and washing of hands (if washing facilities are located onsite) shall be required upon exiting the work area.

During emergencies, the need to quickly respond to an accident or injury must be weighed against the risk to the injured party from chemical exposure. It may be that the time lost or additional handling of an injured person during the decontamination process may cause greater harm to the individual than from the exposure that would be received by undressing that person without proper decontamination. The decision must be made by the SSO.

8.0 EMERGENCY RESPONSE PLAN (ERP)

Specific emergency contact information and applicable directions to the nearest medical facility can be found in the Front of this HASP. In the event that an emergency situation occurs, protect yourself and all personnel on site and those working under your direction and then contact appropriate site and AEI representatives that are referenced in the front and also found in **Table 2**.

8.1 General Emergency guidelines are as follows:

8.1.1 First Aid Procedures

Each field project should have a first aid kit available for use. The contents of which should be based the treatment of the following potential injuries: major wounds, minor wounds (cuts and abrasions), minor burns and eye injuries including protective gloves, breathing barrier, eyewash solutions, and bandages. Since each workplace is unique, additional first aid products should be selected to augment required contents based on the work being conducted.

If an employee is injured, general first aid will be administered. If safety concerns or hazardous conditions are still present, the individual shall be moved to avoid further injury or risk. In the event that an employee is injured in a contaminated area, general first aid will be administered and then the employee will be moved to the support zone for decontamination (if applicable), additional first aid, and preparation for transportation, giving due consideration to which risk will be greater; the spread of contamination or the health/safety of the individual.

8.1.2 Fire Procedures

In the event of a fire, the client contact and/or the local firefighting authorities shall be immediately notified. If it is safe, feasible, and site personnel have been trained to use a fire extinguisher, attempt to extinguish the fire. Upon depletion of one fire extinguisher and/or no training has been provided, all personnel shall evacuate the area and await local fire fighters.

8.1.3 Spill Procedures

If warranted, before any work is initiated at the site, applicable local, state, and/or Federal Emergency Response Authorities will be identified by the preparer of this HASP. In the event of a spill, the client contact shall be immediately notified. If possible and feasible, attempts should be made to contain the spill. If it is determined by consultation with the PM and Client contact that there is no apparent threat to the population, arrangements should be made with a commercial cleanup company to mitigate the spill.

The NYSDEC Spill Hotline phone number (800-457-7362) should be contacted regarding any on-site spills.

8.1.4 Uncovering an Underground Service (Intact)

- Stop work; remove tools if safe to do so.
- Clear all persons from the scene.
- Without entering the excavation, try to identify the service, using the following color guide:

Black	⬛	Electricity
Red	🟥	Electricity – some 11kVA cables
Blue	🟦	Water
Yellow	🟨	Gas
Grey	▒	Telecoms
Green	🟩	Cable TV / Data
White	⬜	Proposed Drilling/Excavation

Note that the above colors relate to recently installed services so therefore ASSUME THAT ANY PIPE THAT IS NOT COLORED IS LIVE! Also, note that the AEI Subsurface Clearance Policy included as Appendix E uses a different color scheme for marking temporary utilities.

- Contact the site contact/relevant utility for guidance.
- Contact the PM/Director and SSO.

8.1.5 Striking an Underground Electrical/Telecom Cable

- Stop work, remove tools ONLY if safe to do so (operator seats in excavators are normally electrically isolated ALTHOUGH OTHER PARTS MAY BE LIVE IF STILL IN CONTACT WITH A LIVE CABLE).
- Evacuate the immediate area.
- In the event of injuries provide first aid and summon medical assistance.
- Contact the site contact.
- Contact the PM and SSO.
- Contact the electricity/telecom provider, as directed by site contact and/or PM.
- Do not allow anyone to enter the area of the excavation until the electricity provider has made the cable safe.

8.1.6 Striking a Pressurized Gas Pipeline

- Stop work, leave tools in-place but shut off any running equipment, including engines.
- Evacuate the immediate area.
- Ensure there are no sources of ignition in the area.
- Contact the site contact.
- Contact the PM and SSO.
- Contact the pipeline owner, as directed by site contact and/or PM.
- Do not re-enter the immediate area until safe to do so.

8.1.7 Striking a Pressurized Water Main

- Stop work, remove tools if safe to do so, and if necessary and safe to do so, confine jetting water, if appropriate.
- Evacuate immediate area and inform site personnel.
- Ensure that water flowing away is not creating potential hazards (e.g., electrical shorting, flooding, contaminant migration etc.) and where possible warn those likely to be affected.
- Contact the site contact.
- Contact the PM and SSO.
- Contact the pipeline owner, as directed by site contact and/or PM.
- Do not re-enter the immediate area until safe to do so.

8.2 Incident Reporting

With respect to incidents, the following types of EHS incidents are to be reported to the PM or Principal in Charge, and local office health and safety officer:

- All employee injuries and illnesses that include first aid, doctor/hospital visits which may or may not involve restricted work and/or lost time;
- Incidents and exposures, such as spills or other unplanned releases to the environment or nonconformance to operating procedures;
- All evacuations (false or real);
- Any Property damage;
- Near miss incidents which could have resulted in an injury, an accident, environmental impact or significant loss of facilities;
- Public/third party liability - Incidents that involve injury, illness or property damage due to the actions of any non-AEI employee arising out of, or in connection with the Firm's contracted scope of work, operations, products, or premises.

The PM or Principal in Charge will then notify the Safety Director via email (safetyfirst@aeiconsultants.com) and the appropriate forms will be completed and submitted via this email, in accordance with the Injury, Illness and Near Miss Reporting Procedure **(Appendix D).**

9.0 HEALTH AND SAFETY PLAN FIELD TEAM SIGNATURES

Personnel working on site will sign below attesting that the HASP has been made available and reviewed by the individual prior to entry into the site.

I have read, understood, and agree with the health and safety protocols presented in the Health and Safety Plan (HASP) and the information discussed in the health and safety briefing. I also understand that noncompliance with the HASP may result in dismissal from the site.

Printed Name	**Date**	**Company**	**Signature**

10.0 SAFETY MEETING CHECKLIST

The Site Supervisor/PM/SSO will discuss the following with all field personnel conducting work as part of this HASP, as applicable.

Date and Time of Meeting:

Conducted By:

CHECK ALL TOPICS DISCUSSED:

HASP Content
☐ Chemicals of Concern
☐ Tasks to be Performed
☐ Location of Tasks
☐ Hazards/Risks of Tasks
☐ Site Limitations (e.g., cell phone use)

First Aid
☐ Facilities
☐ Reporting and Records
☐ Treatment of ______________________

Personal Protective Equipment
☐ Glasses, Goggles, and Shields
☐ Hard Hats
☐ Respirators
☐ Gloves
☐ Other ________________________

Emergency Procedures
☐ Communications
☐ Primary Rally Point:
☐ Secondary Rally Point:
☐ Headcount
☐ Hospital Location/Route
☐ PPE/Decon
☐ Other ________________________

Special Tools / Equipment
☐ Chain saws / Chop saws
☐ Other ________________________
☐ Other ________________________

HASP Content
☐ Personnel On-Site (Introductions)
☐ Responsibilities
☐ Monitoring equipment
☐ Other ______________________
☐ Other ______________________

Industrial Sanitation and Hygiene
☐ Drinking water
☐ Restrooms/Porta toilets
☐ Personal Cleanliness

Housekeeping
☐ Waste Containers
☐ Waste Materials
☐ Other ______________________

Fire Prevention
☐ Extinguisher Locations
☐ Designated Smoking Areas
☐ Hot Work
☐ Flammable Liquids Present
☐ Explosives Present
☐ Other ______________________

Vehicles/Heavy Equipment
☐ Transportation of Employees
☐ Operation and Inspection
☐ Preventative Maintenance
☐ Other ______________________

Discussion____
____
____

Appendix A

Hazard Controls and Job Safety Analysis

JSA - SUB-SLAB SOIL GAS TEMPORARY POINT INSTALLATION AND SAMPLING		
Job Steps	Potential Hazards	PREVENTATIVE / CORRECTIVE ACTION
Mark area for drilling	Slips/Trips/Falls	1. Minimize distance from vehicle/ have unobstructed pathway to vehicle and collection points; 2. Mark tripping hazards with spray paint, cones, or caution tape; 3. Observe good housekeeping procedures.
Drill sampling points with hammer drill	Eye Injuries; Dust exposure; Hand injuries; Catch items (clothing); Electric shock; Chemical atmosphere hazard (vapor); Slips/Trips/Falls.	1. Wear proper PPE (safety glasses); 2. Wear proper PPE (respirator / dust mask); 3. Wear proper PPE (leather gloves) 4. Keep hands and fingers out of pinch points/ avoid drill catching on ground and twisting wrist or hand / release drill grip if drill becomes caught / ensure drill is unplugged prior to inserting bit; 5. Tie up or tuck-in all loose clothing/ maintain distance from drill; 6. Inspect power cable for cuts or nicks before use/ use GFCI outlet on power cord / do not use in wet conditions; 7. Monitor air, vapors with Photo-ionization detector (PID).
Measure initial vapor concentration and depth to bottom of hole	Chemical atmosphere hazard (vapors)	1. Monitor air and vapors with PID; 2. Keep face away from opening of hole while collecting measurements.
Set-up of shroud and sampling canister system	1. Hand injuries 2. Chemical atmosphere hazard (vapors) 3. Slips/Trips/Falls	1. Wear proper PPE (leather gloves, nitrile gloves); 2. Keep fingers away from pinch points when installing pump / do not use open blades, use tubing cutter; 3. Monitor air, vapors with PID and helium detector (where applicable); 4. Keep face away from opening of hole while collecting measurements; 5. Mark tripping hazards with spray paint, cones, or caution tape; 6. Observe good housekeeping procedures.
Purge soil gas	Chemical atmosphere hazard (vapors)	1. Monitor air, vapors with PID; 2. Keep face away from exhaust port of PID / helium detector / pump.
Sample collection (opening and closing valves)	Hand injuries	1. Wear proper PPE (leather gloves); 2. Keep fingers away from pinch points.
Sealing sampling holes	Concrete dust; Eye injuries; Back injuries.	1. Wear proper PPE (dust mask); 2. Wear proper PPE (safety glasses); 3. Use proper lifting techniques for lifting of cement bags

The following Control Methods should be implemented for Hazards that were identified as part of the Tasks that will be conducted as part of this project:

B1: Chemical Hazards – AEI personnel, contractors, subcontractors, and visitors shall wear appropriate personal protective equipment (PPE) while performing site activities. At a minimum, equipment shall include safety glasses, steel-toed boots, and hard hats (when overhead work being performed or when overhead hazards exist). Additional PPE requirements will be outlined in the site-specific Health and safety Plan (HASP) and AEI personnel shall familiarize themselves with the appropriate health and safety responses for exposure to known on-site chemicals prior to beginning work at the site. See Attachment A for chemical safety data. Consult with your local Health and Safety Coordinator (SSO) for any personal air monitoring requirements.

B2: **Physical Hazards** – Hazards from floor and wall openings, careless movements, protruding objects, debris, spills, placement of materials on paths or foot traffic areas, present a problem with regards to slips, trips, falls, and puncture wounds.

AEI personnel shall minimize the risk of slips, trips, and falls by keeping the work area clear of excess equipment and cleaning up wet surfaces as soon as possible. In addition, the floor of every workroom shall be maintained in a clean and, as much as possible, a dry condition. Employees should avoid walking through/on wet and/or cluttered surfaces and be conscious of the fact the wet surfaces could be slippery and could cause injury. Spilled materials should be cleaned up immediately.

Personnel should stay alert at all times and if tried or distracted, take this into account when working at the site. To minimize the possibility of injury:

- 8″ sturdy work boots with good tread are required and steel toed boots are recommended.
- Do not run.
- Slide feet when walking on slick/wet surfaces.
- Don’t walk up or down steep embankments/hills if possible. If not possible, walk at an angle when going up/down embankments/hills.
- Don’t carry items that block your vision.
- Use handrails/grips when available and maintain 3-point contact whenever possible.
- Don’t jump down from equipment and look down before you step down.
- Use appropriate fall protection when working at elevation.
- Report any floor openings that are not clearly marked and/or guarded.
- Don’t use ladders/scaffolds during high winds or when ice or snow is on the rungs/work surface.
- Don’t use ladder substitutes like a box or truck fender, and don’t use ladders/scaffolding that is not in good conditions.
- Keep paths and work areas clear of tools, equipment, boxes, cords, etc. Tape or secure cords, wires, etc. to minimize trip/fall hazard.
- If a protruding object cannot be moved, make sure the object can be easily seen or guard/pad the object if possible.
- Use ancillary lighting such as flashlights and headband lights when necessary.

Sufficient illumination should be provided in all areas at all times. Employees should notify the responsible person of conditions where there is an absence of sufficient natural and/or permanent artificial light.

Emergency exit doors will be kept free of any obstacles at all times. Any employee finding an emergency door blocked should immediately report the condition and correct it when possible. Exit lights and signs will also be maintained in proper condition at all times and immediately reported if deficient.

B3: Mechanical Hazards – Working within the vicinity of operating drill rigs poses unique safety situations such as high pressure hazards from hoses, pipes or the well, and gas releases. Also, other hazards may be present such as falls from elevation, electrical contact, and improper machine guarding. AEI personnel shall not attempt to operate equipment they are not familiar with and/or are not equipped with protection devices. Personnel shall familiarize themselves with the equipment being utilized on site, and shall at a minimum, know how to stop or turn off the equipment. Although AEI personnel do not operate or have control over the operation of drilling equipment, it is every employees responsibility to recognize potential or existing hazards related to drill rigs, and to walk away from any unsafe operations.

Depending upon the work to be done by AEI personnel; a preliminary site field survey may need to be performed prior to AEI involvement in drilling operations. The survey should include verification that utilities and any hazardous buried material or structures have been located and marked and that the nearest emergency facility has been identified. It may also include information on safe access to the drilling areas, hazards on-site, location of a clean water source and weather conditions and related shelter areas.

Employee Restrictions and Responsibilities

Under no circumstances will an AEI employee operate a drilling rig, a portion thereof, or any piece of contractor equipment. In addition, employees will not:

- Guide a drill rig to a drill location, assist in the movement of equipment, or participate in the movement or breaking down of any portion of the rig.
- Climb on the rig, stand too close to the rig (especially its moving parts), stand below or close to a pipe hoist, walk on drilling rods or casing, or walk on the edge of a mud pit.
- Watch a driller arc-weld.
- Smoke while at a drilling rig site.
- Refuel an engine while it is still running or hot, siphon gasoline, or park near a rig exhaust.
- Wear loose fitting clothing or PPE near the drill rod or stem.

AEI employees will not place tools, meters, etc. in a position that could create a fall, trip or slip hazard. As much as is possible, employees will work with the appropriate site personnel to ensure the area in the vicinity of the drill rig is clean, orderly and free of slip, trip and fall hazards.

If the drilling is being done at hazardous waste site, the PPE requirements will be forwarded as noted in the site health and safety plan. Clean water will be kept available for decontamination, washing, and dust control. Kneeling, lying in, or sitting on contaminated ground or materials must be avoided or a protective barrier must be used. Avoid or minimize handling of contaminated materials.

Non-powered hand trucks should be used whenever feasible to move heavy objects, objects with poor hand holds or large bulky objects. Some things to consider are:

- Keep the center of gravity of the load as low as possible, and place heavy objects below lighter ones.
- Place loads where the weight of the load will be carried by the axle, not the handles, and where it will not slip, shift of fall during movement.
- Load only to height to allow a clear view ahead. Only walk backwards with a hand truck in specific instances such as when going up an incline.
- When going down an incline the hand truck should be in front of the operator and when going up an incline, it should be downhill from the operator.
- Move the hand truck at a safe speed.

B4: Traffic/Heavy Equipment Safety - AEI personnel should, under no circumstances, operate or ride on heavy equipment which is being used by a subcontractor. Site personnel will maintain a safe distance of at least 20 feet or more, depending on circumstances and directives, from all heavy equipment in operation. If activities warrant closer proximities to operating equipment, personnel will don brightly colored vests and a second person will stand watch to keep him/her out of the path of equipment while performing the required activity. Eye contact with the equipment operator will be maintained.

Heavy Equipment can represent a substantial hazard to workers. The following procedures should be followed when heavy equipment is in use:

- Employees will not handle or attempt to operate power tools or motorized vehicles without proper training.
- Use common sense. Do no assume that the equipment operator is keeping track of your whereabouts. Never walk directly in back of, or to the side of, heavy equipment without the operator’s knowledge.
- All heavy equipment must be shut down during refueling.
- Maintain visual contact of moving equipment at all times.
- Establish hand signal communication when verbal communication is difficult.
- All heavy equipment shall have backup alarms of some type.
- Use chains, hoist, straps, and any other equipment to safely aid in moving heavy materials.
- Never use a piece of equipment unless you are familiar with its operation. This applies to heavy as well as light equipment (i.e. steam cleaners, hand tools, etc.).
- Be sure that no underground or overhead power lines, sewer lines, gas lines, or telephone lines, will present a hazard in the work area.
- Restrict all non-essential people out of the work area.
- Prohibit loose-fitting clothing or loose long hair around moving machinery.
- Instruct equipment operators to report any abnormalities such as equipment failures, unusual odors, etc.
- Implement an ongoing maintenance program for all tools and equipment. Inspect all tools and moving equipment regularly to ensure that parts are secured and intact. Promptly repair or replace any defective items.
- Store tools in clean, secure areas so that they will not be damaged, lost, or stolen.
- When an equipment operator must negotiate in tight quarters, provide a second person to ensure adequate clearance.
- All heavy equipment must be properly leveled and supported prior to use.
- Heavy equipment and trucks will be operated in specific site control zones and marked traffic lanes.

- Materials, tools, or other objects will not be thrown, tossed, or dropped. Always hand off or lower items as needed.

Working Near Railroads - In the event that work activities are conducted near and/or adjacent to railroad tracks, the following procedures will be implemented:

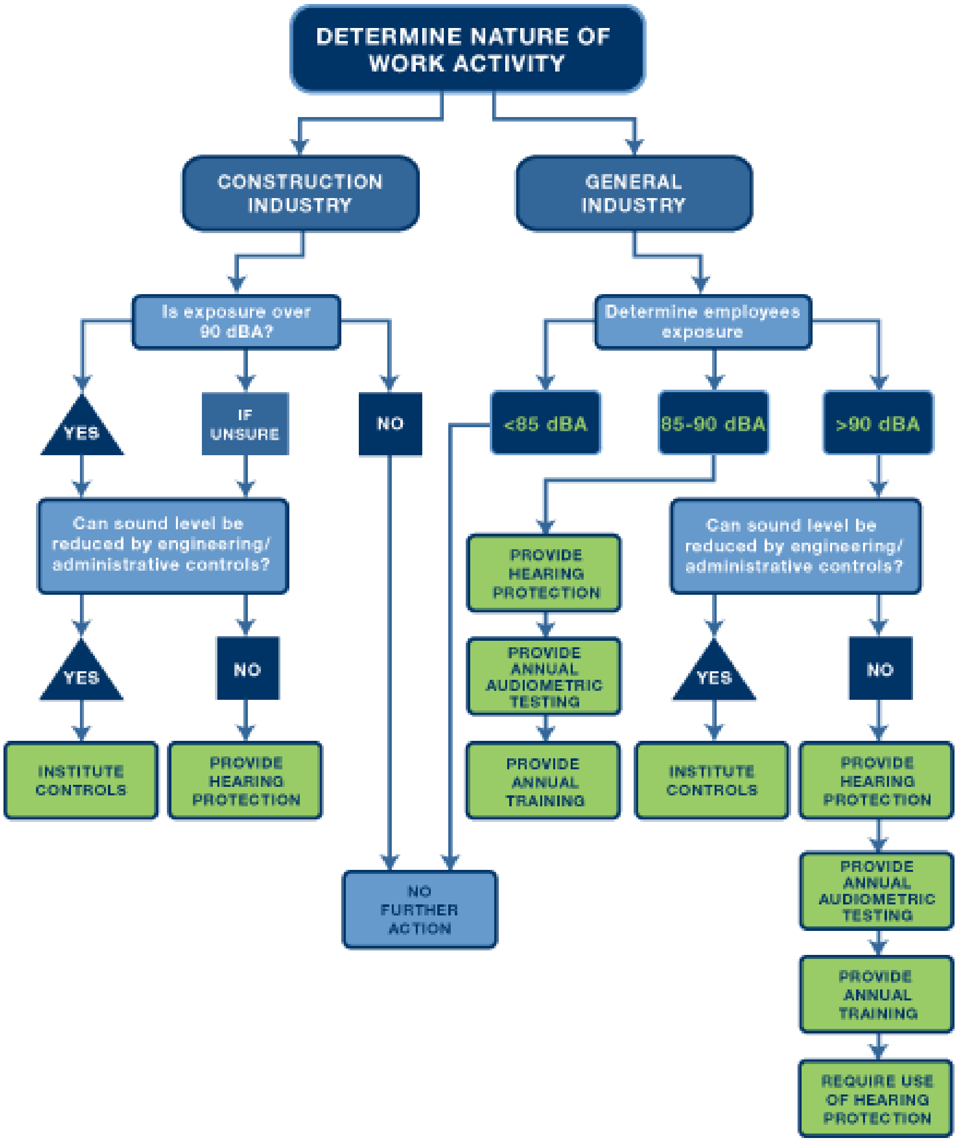
- The hazards of working near and/or adjacent to railroads will be included in job briefings prior to work activity commencing and subsequently when the activity changes;
- Mounting, dismounting, or crossing over moving locomotives or cars is prohibited;
- Employees will be alert for the movement of cars, locomotives, or equipment at any time, in either direction, on any track and will remain at least 25 feet from the end of standing cars, equipment, or locomotives, except when proper protection is provided (e.g., a flagman is present or the track is taken out of service by the proper authority, prior to starting any work on or about the tracks);
- Employees will not cross over coupled, moving freight cars; take refuge under any car, equipment, or locomotive; attempt to mount, dismount, or cross over moving equipment.

B5: Electrical Hazards – Properly ground all electrical equipment. Avoid standing in water when operating electrical equipment. Ground fault outlets or adapters shall be used for any electrical equipment. Apparatus, tools, equipment, and machinery will not be repaired while in operation. Lockout/Tagout (LOTO) procedures will be implemented when necessary. If equipment must be connected by splicing wires, electrical work must be performed by a licensed and competent electrician.

B6: Fire and Explosion Hazards – The presence of petroleum and solvent contaminated material presents a potential fire hazard. Smoking and use of open flame will be prohibited. The use of non-sparking tools and equipment will be implemented if conditions warrant. Where the potential of fire exists, AEI will provide portable fire extinguishers. Where applicable, all fire extinguishers shall be mounted no higher and no lower than 4 feet (1.22 m) from the floor and/or shall be readily accessible for use, where applicable. All fire extinguishers shall be maintained as follows:

- Fully charged and in operable condition
- Clean and free of defects
- Readily accessible at all times

B7: Acoustical Hazards – Hearing protection will be worn by all personnel operating or working within the vicinity of equipment when noise is sufficient to interfere with general conversation at a normal speaking volume; when noise levels exceed 85dBA; and/or when manufacturers' requirements indicates that it's usage is mandatory. Personal hearing protectors, such as earplugs or earmuffs, may be used to reduce the amount of noise exposure while the above control measures are being evaluated or if such controls fail to reduce the exposure levels to below the PELs.



Any condition where a person must shout to be heard from a distance of 3 feet, a hazardous noise level may be present. Under these conditions, personnel must be protected through the use of appropriate hearing protective devices.

Hearing protection shall be worn:

- In any situation where normal conversation cannot be heard at a distance of 3 feet regardless of the source of the noise or where noise levels as measured with approved noise monitoring equipment is above 85 dBA.
- When operating gasoline or electric powered machinery.
- When working within 25 feet of operating heavy equipment (earth working equipment, etc.) as working around this type of equipment can result in exposure to hazardous levels of noise (levels greater than 90 dBA).

B8: Ventilation/Oxygen Deficiency Hazards – AEI personnel shall ensure that ventilation is increased to the maximum extent possible and that equipment generating combustion exhaust is vented to the exterior of the building in which they are performing work. If direct air monitoring readings suggest an oxygen deficiency and/or the build-up of harmful substances, take measures to increase work zone ventilation or evaluate alternatives but be prepared to immediately leave the area.

B9: Heat Stress – Heat stress can be a significant hazard, especially for workers wearing protective clothing. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and in the prevention of heat stress incidents.

Workers will be encouraged to immediately report any heat-related problems that they experience or observe in fellow workers. Any worker exhibiting signs of heat stress and exhaustion should be made to rest in a cool location and drink plenty of water. Emergency help by a medical professional is required immediately for anyone exhibiting symptoms of heat stroke, such as red, dry skin, confusion, delirium, or unconsciousness. Heat stroke is a life threatening condition that must be treated by competent medical authority.

ACGIH screening criteria for heat stress exposure in degrees Celsius for an 8-hour work day 5 days per week with conventional breaks will be used in determining safe exposure for acclimatized and acclimatized employees.

Allocation of Work in a Work/Rest Cycle	**Acclimatized**				**Action Limit (Unacclimated)**			
	Light	**Moderate**	**Heavy**	**Very Heavy**	**Light**	**Moderate**	**Heavy**	**Very Heavy**
75-100%	31.0 (87.8F)	28.0 (82.4F)	--	--	28.0 (82.4F)	25.0 (77F)	--	--
50-75%	31.0 (87.8F)	29.0 (84.2F)	27.5 (81.5)	--	28.5 (83.3F)	26.0 (78.8F)	24.0 (75.2F)	--
25-50%	32.0 (89.6F)	30.0 (86F)	29.0 (84.2F)	28.0 (82.4F)	29.5 (85.1F)	27.0 (80.6F)	25.5 (77.9)	24.5 (76.1F)
0-25%	32.5 (90.5F)	31.5 (88.7F)	30.5 (86.9F)	30.0 (86F)	30.0 (86F)	29.0 (84.2F)	28.0 (82.4F)	27.0 (80.6F)

Heat Stress Prevention

Whenever possible or within the control of AEI, engineering controls should be utilized to protect workers from heat related hazards. For example, isolation from the heat source, ventilation such as open windows, fans or other methods of creating air flow, and heat shielding such as awnings or umbrellas.

Appropriate work practices can also lessen the chances of heat related hazards. Some of these include:

a. Water intake should be about equal to the amount of sweat produced (i.e., drinking 5-7 ounces of water every 15-20 minutes). Electrolyte fluids may also be necessary.
b. Whenever possible, gradual exposure to heat is preferred to allow the body's internal temperature to actuate to the working conditions.
c. Whenever possible, adjust the work schedule to reduce risk of heat stress. For example, postpone nonessential or heavier work to the cooler part of the day and perform work in the shade if portable.
d. Rotate personnel to reduce the amount of time spent working in direct sun and heat.
e. Increase the number and/or duration of rest breaks, and whenever possible, rest break areas should be in a cool area and as close to the work area as is feasible.

Wear appropriate PPE when necessary, such as thermally conditioned clothing, self-contained air conditioning in a backpack, and plastic jackets/vests with pockets that can be filled with dry ice or ice. However, based on the type of work being done, where work is being performed, or other required PPE, these options may be prohibited or make the use of this PPE impossible or impractical.

Heat-Related Illnesses

***Heat Stress**:* This is the mildest heat-related illness, but prompt action may prevent it from turning into a more severe heat-related illness. Symptoms include irritability, lethargy, significant sweating, headache, or nausea. The following guidance can be used in the identification and treatment of heat related illness.

Heat Stress First Aid:

- Take victim to a protected (e.g., shaded, cool) area, remove any excess protective clothing, and provide cool fluids.
- If an air-conditioned spot is available, this is an ideal break location.
- Once the victim shows improvement he/she may resume working, however the work pace and practices (e.g., does fluid intake need to be increased) should be moderated to prevent recurrence of the symptoms.

Heat Exhaustion: Usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Symptoms include pale, clammy skin, and profuse sweating, vomiting, and the bowels may move involuntarily. The pulse is weak and fast, breathing is shallow. Fainting can occur.

Heat Exhaustion First Aid:

- Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling – you do not want the victim to shiver).
- Call a physician or emergency service, or transport the victim to medical care.
- Remove all protective outerwear.
- If the victim is conscious, it may be helpful to give him/her sips of water.

Heat Stroke: Heat stroke is a severe medical condition requiring first aid and emergency treatment by a medical professional as death can occur without appropriate care. Heat Stroke represents the collapse of the body’s cooling mechanisms. As a result, body temperatures often rise to between 105 – 110 F. As the victim progresses toward heat stroke symptoms include hot and usually dry, red and spotted skin, headache, dizziness, nausea, mental confusion, delirium, possible convulsions and loss of consciousness.

Heat Stroke First Aid:

- Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling – you do not want the victim to shiver).
- Summon emergency medical help to provide on-site treatment and transportation to a medical facility.
- Remove all protective outerwear and loosen personal clothing.
- Apply cool wet towels, ice bags, etc. to the head, armpits, and thighs. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place the victim in a tub of cool water.

Skin Hazards

Sunburn and prickly heat are both symptoms of skin irritation/damage produced through exposure to sunlight and operating in hot work environments.

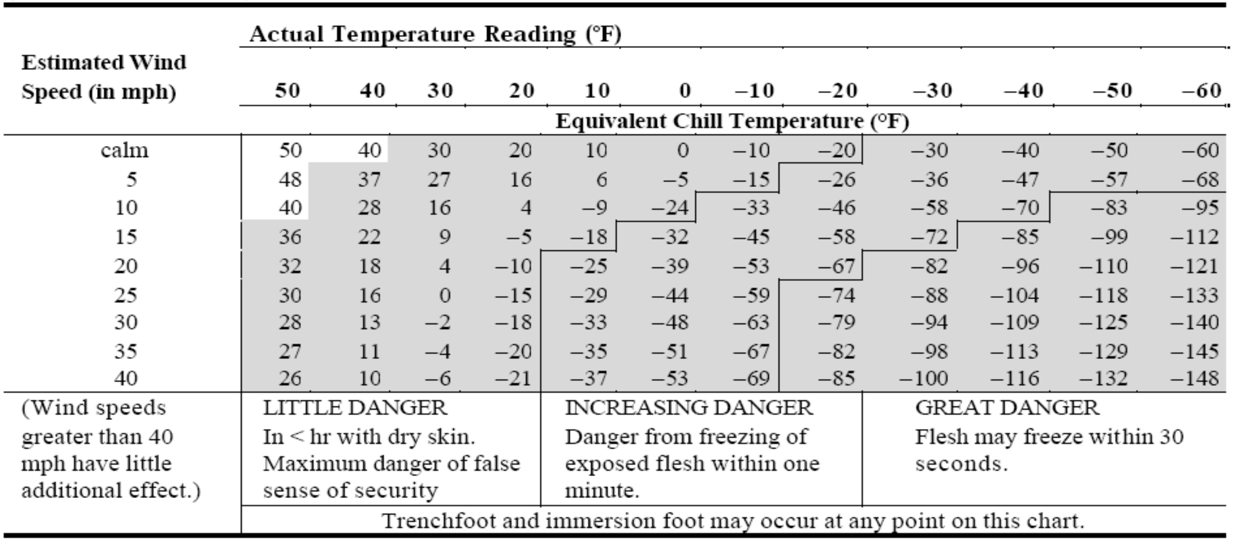
- Protect exposed skin with an appropriate sunscreen. A sunscreen with a sun protection factor (SPF) of 15 or greater is required for work in the sun with reapplication at breaks and lunch.
- Heat rash, also known as prickly heat, can be prevented by the application of a hydrophobic, water repellent barrier cream such as Kerodex 71.

B10: Cold Stress - The four conditions that cause cold-related stress are low temperatures, high/cool winds (wind chill), dampness, and cold water. One or any combination of these factors can cause cold-related hazards. Cold stress, including frostbite and hypothermia, can result in severe health effects.

A dangerous situation of rapid heat loss may arise for any individual exposed to high winds and cold temperatures. Major risk factors for cold-related stresses include:

- Wearing inadequate or wet clothing increases the effects of cold on the body.
- Taking certain drugs or medications such as alcohol, nicotine, caffeine, and medication that inhibits the body's response to the cold or impairs judgment.
- Having a cold or certain diseases, such as diabetes, heart, vascular, and thyroid problems, may make a person more susceptible to the winter elements.
- Being male increases a person's risk to cold-related stresses. Men experience far greater death rates due to cold exposure than women, perhaps due to inherent risk-taking activities, body-fat composition, or other physiological differences.
- Becoming exhausted or immobilized, especially due to injury or entrapment, may speed up the effects of cold weather.
- Aging -- the elderly are more vulnerable to the effects of harsh winter weather.

TABLE 2. Cooling Power or Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)*



Estimated Wind Speed (in mph)	Actual Temperature Reading (°F) 50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
5	48	37	27	16	6	−5	−15	−26	−36	−47	−57	−68
10	40	28	16	4	−9	−24	−33	−46	−58	−70	−83	−95
15	36	22	9	−5	−18	−32	−45	−58	−72	−85	−99	−112
20	32	18	4	−10	−25	−39	−53	−67	−82	−96	−110	−121
25	30	16	0	−15	−29	−44	−59	−74	−88	−104	−118	−133
30	28	13	−2	−18	−33	−48	−63	−79	−94	−109	−125	−140
35	27	11	−4	−20	−35	−51	−67	−82	−98	−113	−129	−145
40	26	10	−6	−21	−37	−53	−69	−85	−100	−116	−132	−148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute.				GREAT DANGER Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

▨ Equivalent chilll temperature requiring dry clothing to maintain core body tempearture above 36°C (96.8°F) per cold stress TLV

Cold Stress Prevention

Engineering controls should be utilized whenever possible to protect workers from cold related hazards. For example, on-site heat sources, heated shelters, work areas shielded from drafty or windy conditions, and the use of thermal insulating material on equipment handles.

Effects arising from cold exposure will be minimized by the following control measures:

- Personnel will be trained to recognize cold stress symptoms.
- Field activities will be curtailed or halted if the equivalent chill temperature is below 20 F.
- As much as possible, work that exposes personnel to the cold will be done during the warmest hours of the day.
- Inactivity in cold conditions will be kept to a minimum.
- Frequent short breaks in warm, dry shelters will be taken.
- Vehicles will be equipped with supplies in case the vehicle becomes inoperable (e.g., blanket, dry clothing, water, food, a shovel, etc.

The following PPE will be provided during work in cold environments:

- Workers will be provided with insulated dry clothing when the equivalent chill temperature is less the 30 F.
- Feet, hands, the face, and the head should be protected (40% of the body’s heat can be lost when the head is exposed).
- Foot and hand wear may also need to be waterproof.
- Clothing should be layered so that adjustments can be made to changing environmental temperatures and conditions. For example, an outer layer to break the wind, a middle layer that will absorb sweat and retain insulation when wet, and an inner layer that allows ventilation.

Cold-Related Illness

Hypothermia: Hypothermia occurs when the body temperature falls to a level where normal muscular and cerebral functions are impaired. Although it usually occurs in freezing air and water temperatures, it can occur in any climate if a person's internal body temperature falls below normal. Symptoms should not be ignored, and a supervisor should be notified as soon as hypothermia is suspected.

Initially, symptoms may include shivering, an inability to do complex motor functions, sluggishness and mild confusion as the body temperature drops to around 95 F. As the body temperature falls, speech may become slurred, and behavior may be irrational, simple motor functions may be difficult to do and a state of "dazed consciousness" may exist. In severe state (below 90 F), heart rate, blood flow, and breathing will slow. Unconsciousness and full heart failure can occur.

Hypothermia First Aid:

On land:

- Call for emergency, and then help move the victim (unless other injuries prohibit their being moved) to a warm, dry area and replace wet clothing with warm, dry clothing or a blanket. Move the person carefully because movement can increase the irritability of the heart.
- If the person is conscious and lucid, warm liquids can be provided, but never alcohol or caffeinated drinks. If possible, have them to move their arms and legs to create muscle heat.
- If the person is unconscious or unable to assist, place warm bottles/packs in the person's arm pits, groin, neck and head areas.
- Do not rub the person's body or place them in warm water.

In water:

- Call for emergency help and get the victim out of the water. Move them carefully because movement can increase the irritability of the heart.
- If it is you in the water, do not swim unless a floating object or person can be reached quickly as swimming uses the body's heat and reduces survival time by about 50%.
- If you are in the water, conserve body heat by folding arms across the chest, keeping thighs together, bending knees and crossing ankles, if another person is in the water with you, huddle together.
- If you are in the water, do not remove clothing-button, buckle, zip, and tighten collars, cuffs, shoes, and hoods as the water trapped next to the body provides a layer of insulation that may slow the loss of heat.

Frostbite: Frostbite occurs when the skin literally freezes, and deep frostbite can affect deeper tissues such as tendons and muscles. Frostbite usually occurs when temperatures drop below 30 F, but wind chill effects can cause frostbite at above-freezing temperatures. The ears, fingers, toes, cheeks, and nose are the most commonly affected body parts. Initially, symptoms include an uncomfortable sensation of coldness. Tingling, stinging or an aching feeling of the exposed area is followed by numbness. Frostbitten areas appear white and cold to the touch and with deeper frostbite, the area becomes numb, painless, and hard, and can turn black.

Frostbite First Aid:

- Seek medical attention as soon as possible and treat any existing hypothermia first.
- Warm liquid can be provided, but not alcohol or caffeinated drinks such as tea and coffee.
- Do not rub the affected areas, but cover them with dry, sterile gauze or soft, clean bandages.
- Do not try rewarming the affected area if you have not been specifically trained to do so and/or if there is a chance the affected area will get cold again.

Trench Foot: Trench Foot is caused by a continuous exposure to a wet, cold environment. Symptoms include tingling and/or itching sensation, burning pain and swelling and, in more extreme cases, blisters.

Trench Foot First Aid:

- Seek medical attention as soon as possible and move the victim to a warm, dry area.
- Affected tissue can be treated with careful washing and drying, slight elevation. Do not try rewarming the affected area if you have not been specifically trained to do so.

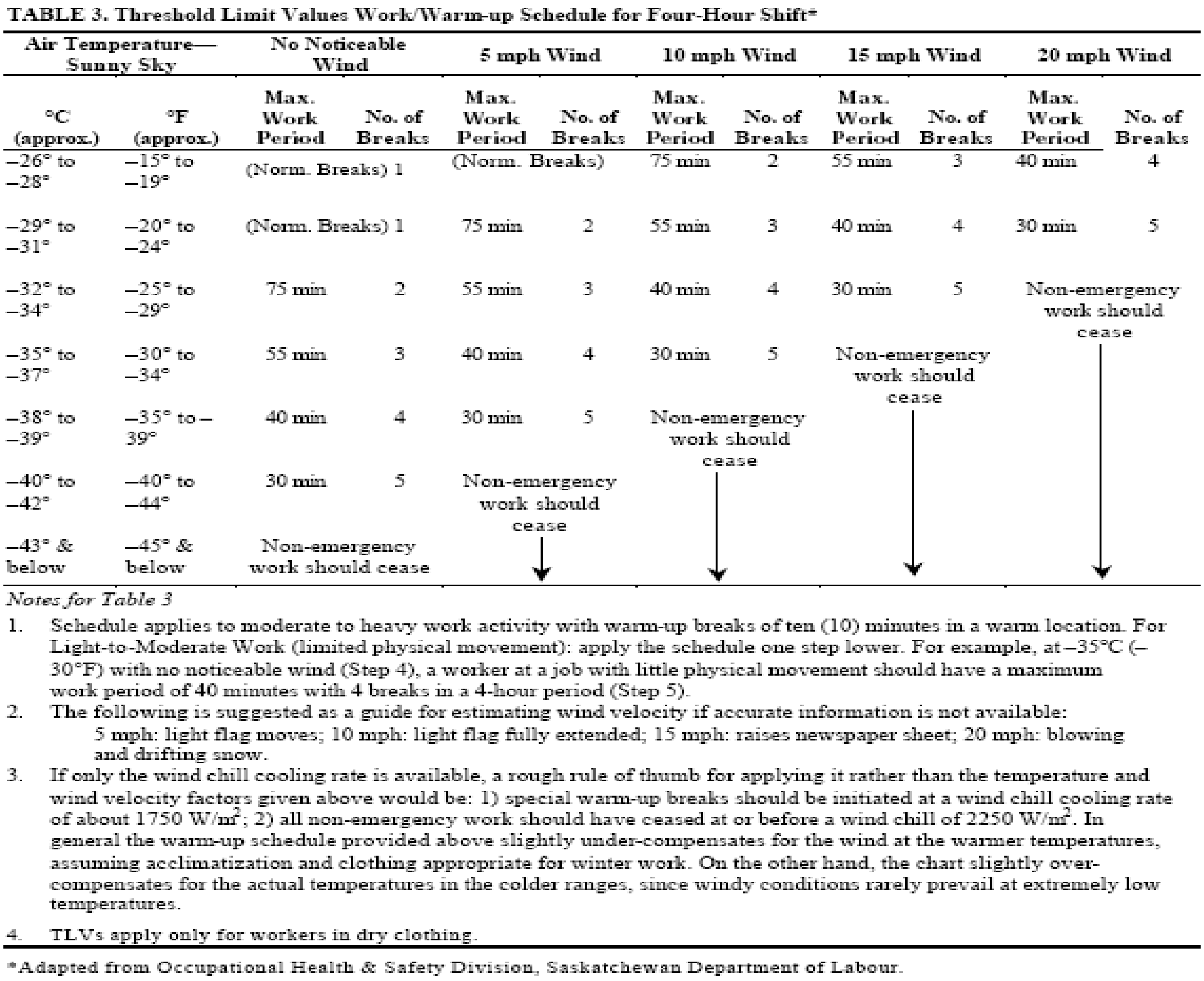


TABLE 3. Threshold Limit Values Work/Warm-up Schedule for Four-Hour Shift*

Air Temperature—Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
–26° to –28°	–15° to –19°	(Norm. Breaks)	1	(Norm. Breaks)		75 min	2	55 min	3	40 min	4
–29° to –31°	–20° to –24°	(Norm. Breaks)	1	75 min	2	55 min	3	40 min	4	30 min	5
–32° to –34°	–25° to –29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
–35° to –37°	–30° to –34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease		↓	
–38° to –39°	–35° to –39°	40 min	4	30 min	5	Non-emergency work should cease		↓		↓	
–40° to –42°	–40° to –44°	30 min	5	Non-emergency work should cease		↓		↓		↓	
–43° & below	–45° & below	Non-emergency work should cease		↓		↓		↓		↓	

Notes for Table 3

1. Schedule applies to moderate to heavy work activity with warm-up breaks of ten (10) minutes in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at –35°C (–30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).
2. The following is suggested as a guide for estimating wind velocity if accurate information is not available:
   5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.
3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be: 1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m^2; 2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m^2. In general the warm-up schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges, since windy conditions rarely prevail at extremely low temperatures.
4. TLVs apply only for workers in dry clothing.

*Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labour.

B11: Insect Bites and Stings - Care will be taken by all site workers to avoid stinging or biting insects such as ticks, spiders, bees, wasps, hornets, and yellow jackets. Workers allergic to any particular insect sting or bite should seek medical attention if stung or bitten and may need to carry emergency medicine prescribed by their doctor.

Care should always be taken to avoid these insects and increased vigilance is necessary during high infestation seasons, when opening protective casings of monitoring wells, and when walking through areas of heavy vegetation or areas known to be infested.

To minimize the chance of bites/stings:

- Wear appropriate PPE such as light colored clothing so you can see insects, long pants tucked into boots, long sleeves when possible, a hat, and gloves if you are cutting brush or need to handle or move vegetation.
- Check your body and clothing for insects, shower after work and wash/dry clothes at as high temperature as possible.
- Don't swat at insects and don't eat in areas where there are insects.
- Avoid sweet smelling personal hygiene products and, unless contraindicated by the work being performed (e.g., sampling, data collection), wear EPA approved repellants such as those containing DEET.

Black Widow Spider

Brown Recluse Spider

Spider bites generally cause only localized reactions such as swelling, pain, and redness. However, bites from a Black Widow or Brown Recluse, or if you are allergic to spiders, can cause symptoms that are more serious.

First Aid for spider bites:

- Clean the bite area with soap and water or alcohol and place a cold pack over the bite area.
- If nausea, vomiting, difficulty breathing, or swallowing occurs, medical attention should be sought immediately.

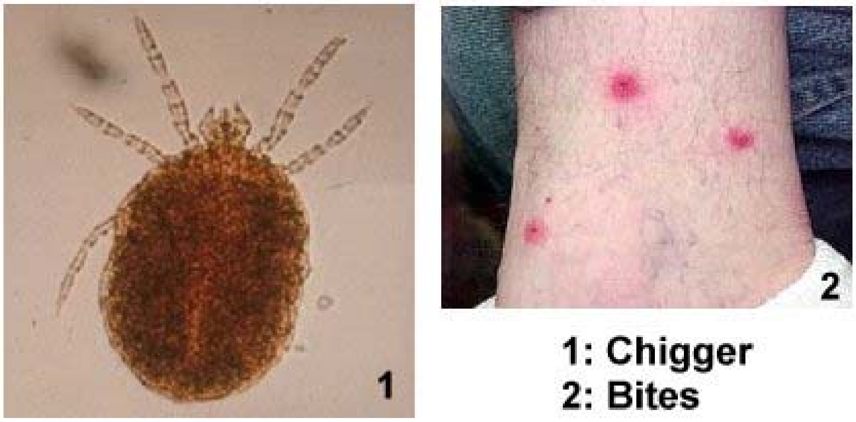
Tick

Removing a tick

Ticks are common, especially in the warmer weather months and may carry diseases such as Rocky Mountain Spotted Fever and Lyme disease.

First Aid for tick bites:

- Use a fine tipped tweezers, grasp tick firmly as close to skin as possible and pull the body away from skin. Avoid crushing the body and don't twist.
- If parts of the tick remain in the skin, don't be alarmed as the mouth will dislodge as skin sloughs off.
- Wash area with soap and water and apply antiseptic or antibiotic ointment to prevent infection.
- If unexplained symptoms develop such as severe headaches, fever, or rash within 10 days of the bite, seek medical attention.



1: Chigger
2: Bites

Chiggers are tiny, s-legged wingless organisms that grow up to become a type of mite. They are found in tall grass and weeds and their bites cause severe itching.

First Aid for chiggers:

- Reduce discomfort and prevent infection
- The affected area should be kept clean by washing with soap and water
- A hydrocortisone cream, antihistamine, or local anesthetic may be of value in reducing the itching
- The wounds should not be scratched, if possible
- If signs of infection occur, consult your physician

Bees and wasps belong to the phylum Arthropod family, and they are crucially important to the pollination of plants, specifically flowers, fruits, and vegetables. A sting from a bee or wasp will cause itching, irritation, redness and/or swelling at the sting site.

First Aid for bee stings:

- Remove the stinger as quickly as possible - venom continues to enter the skin from the stinger for 45 to 60 seconds following a sting
- Wash the wound
- Apply ice for swelling and pain
- If the sting occurs on the neck or mouth, seek medical attention immediately, swelling in these areas may cause suffocation

A small percentage of people are allergic to stings and a sting can be fatal, caused by a disruption to breathing and circulatory systems called anaphylactic shock. If the sting is followed by severe symptoms, seek medical attention immediately. Allergic people should never be alone for outdoor activities since help may be needed for prompt emergency treatment. Allergic people should have an identification bracelet as well as carry something like an “EpiPen” for immediate treatment for anaphylactic shock.

Fire ants are a variety of stinging ants with over 280 species worldwide. A colony produces large mounds in open areas, and feeds mostly on young plants, seeds, and insects. They nest in the soil, often near moist areas such as river banks and pond edges. Unlike other ants which bite and then spray acid on the wound, fire ants bite only to get a grip and then sting, injecting toxic alkaloid venom. This results in a painful stinging sensation, similar to what a fire burn feels like.

First Aid for fire ant bites:

- Move rapidly away from the nest
- Quickly remove or kill ants on skin and clothing to prevent further stings

- Wash the area gently with soap and water to rid the skin of any venom, and disinfect bite with alcohol
- Place cool cloth or ice cloth on sites for 15 minutes, and to relieve pain, dab the area with calamine lotion, a cortisone or oral antihistamine (e.g. benadryl) to help with swelling
- Do not scratch the blister because this can lead to infection
- Allergic response is rare, but symptoms are difficulty breathing, light headedness, and weakness. Immediate medical attention is required

Snakes serve as an important role as predators in the ecosystem, and help maintain populations of rodents and other prey.

First Aid for venomous snake bites:

- Wash and immobilize the injured area, keeping it lower than the heart if possible
- Seek medical attention immediately
- DO NOT apply ice, cut the wound, or apply a tourniquet
- Do not wash, cut, or suck the bite
- Remain calm
- Remove jewelry or other items that may be affected by rapid swelling of affected body parts
- Try to identify the type of snake: note color, size, patterns, and markings
- The bite will be painful and have two distinct puncture wounds
- If venom is injected there will be burning and swelling

Water Moccasin (aka cotton mouth)

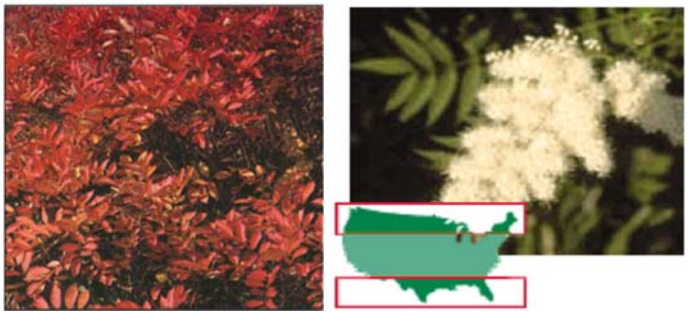
Rattlesnake

Coral Snake

Copperhead

B12: Poisonous Plants – Plants poison on contact, through ingestion, or by absorption or inhalation. They cause painful skin irritations upon contact and can cause internal poisoning when eaten.

Poison Ivy



Poisonous Sumac

Giant Hogweed

First Aid for poisonous plants:

- Wash exposed areas with cold running water as soon as you can
- When possible, wash your clothing
- Relieve itching by taking cool showers and applying an anti-itch medications or hydrocortisone
- The rash is often arranged in streaks or lines where you brushed against the plant
- In a few days, the blisters become crusted and take 10 days or longer to heal
- If the reaction is severe or worsens, seek medical attention

B13: Personal Safety - If it deemed that a work site is in an area where an employee's personal safety may be at risk from potential criminal acts, the risks will be evaluated and determine what steps can be taken to minimize the risk. Resources such as the client, local law enforcement officials, Park or Wildlife Service, and Animal Control will be utilized as necessary to ensure the safest possible work environment. For example, local law enforcement can be made present or make frequent drive-bys while work is being done, outside security can be hired, and work can occur only during certain times of the day or work may not proceed at all. Some general guidelines are provided here, but each situation is different and actions must be taken based on the specifics of each.

In areas of risk such as these, employees will communicate via cell phones or 2-way radios, and will check-in at predetermined times throughout each workday. If employees do not call in, the team will be contacted, and if unsuccessful, local law enforcement will be notified. If while on the project site, and despite the other precautions set forth, an employee feels that their personal safety is at risk, they shall cease work and immediately report their concerns so that appropriate steps can be taken as described above.

B14: Working Alone and Working in Isolated Areas - Whenever possible, employees will not work alone in isolated areas. If the isolated area involved hiking/walking into areas that are unmarked or if there is potential to become directionally disoriented (e.g., not trails, unmarked trails, forested or highly vegetated areas), employees will be trained on the use of a compass and trail/topography maps and if necessary, will take wilderness safety training. The employee will work with the Park/Wildlife service on what emergency planning if necessary (e.g., unexpected weather, animal attack, and search/rescue).

Communicating through cell phones or 2-Way Radios will be utilized whenever possible. Employees will check-in at predetermined times throughout each workday and if employees do not call in, the team will attempt to be contacted. If contacting the employees is unsuccessful, the appropriate authorities will be notified. In addition, and especially if communication is not possible during the day, the planned start and estimated finish times for the day will be communicated, and employees will check in at the end of the work day.

If employees will be moving from isolated area to isolated area, there will be established beginning and ending locations, planned start and estimated finish times, and planned routes that will be followed throughout the day. Employees will not deviate from this schedule without first contacting the appropriate personnel. It may also be necessary to notify the client, law enforcement, or Park/Wildlife officials of these schedules.

Local authorities should be contacted about any hunting season that may be in session, and if it is possible that hunters may be present in the area in which AEI personnel will be working. If so, employees will wear brightly colored hardhats/hats and reflective vests, will not work before dusk, and work will end 30 minutes before dusk.

If this is not possible to complete work during day light hours, employees will wear appropriate reflective apparel and have appropriate lighting, such as portable lighting, flashlights, or headlamps as appropriate for the activity being conducted. Personal security will be assessed and measures taken as discussed above if appropriate.

B15: Severe Weather

Severe weather conditions include high winds, electrical storms, and heavy rain. At a minimum, all work outdoors will cease during these events. When lightning is spotted, site personnel should use the following steps to avoid injury:

- Workers should note the flash-boom ratio (i.e., count the seconds after the lightning was seen until the thunder was heard).
- By counting the seconds between seeing lightning and hearing thunder and dividing by 5, you can estimate your distance from the storm (in miles). If the storm is 6 miles away or less (30 seconds between when lightning was seen and thunder was heard) workers must stop work and take shelter.
- If the storm is more than 6 miles away (greater than 30 seconds between lightning and thunder), the site supervisor should monitor the storm and be prepared to cease work if the storm approaches an unsafe distance. Since storms can travel at varying speeds and the amount of time at takes to cease and secure operations will also vary, so prudent judgment should be exercised when storms are in the vicinity and/or developing (e.g., darkening skies, increasing wind speeds, etc.).
- Workers should not stay in exposed areas (outdoors on the ground, on a roof, in an aerial lift, on a steel truss, on an ungrounded steel structure, in a golf cart, un-sided building, etc.) after lightning has been witnessed. All personnel must move to a safe location.
- Workers should wait 30 minutes from the last sight of lightning or sound of thunder before returning to work.
- Those required to travel from one building to another during the 30 minute wait time should do so only by enclosed vehicle.
- Once the 30 minute wait time period has elapsed and no additional lightning or thunder has been seen or heard, individuals may resume normal work.

B16: Aboveground and Underground Utilities - Various forms of underground and aboveground utility lines or pipes (carrying water, wastewater, gas, and or electricity) may be encountered during work activities. Prior to the start of intrusive activities, all utilities must be located and measurements must be instituted to avoid contact with these structures in accordance with the procedures outlined in the site-specific HASP. All utility lines and piping will be identified and rendered controlled (though lockout/tagout procedures) or protected from damage. Work involving machinery with high extensions (backhoes, etc.) will remain at least 6 feet (2.1 meters) from overhead power lines.

B17: Trenching/Excavation - An excavation is any manmade cut, cavity, trench, or depression in an earth surface, formed by earth removal. A trench is narrow excavation (in relation to its length) made below the surface of the ground. The following safe operating guidelines apply to open trenches or excavations exceeding four (4) feet in depth **or** of any depth if in unstable soil conditions.

- Excavated materials will be stored and retained at least 2 feet from the edge of the excavation. This procedure must be observed even when excavation/trench entry will not occur.

- Trees, boulders, and other surface encumbrances that create a hazard will be removed or made safe before excavation is begun.
- Special precautions will be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation.
- Except in hard rock, excavations below the level of the base of the footing of any foundation or retaining wall will not be permitted, unless the wall is underpinned and all other precautions have been taken to ensure the stability of the adjacent walls.
- Excavations will be inspected at least daily, or more often as conditions warrant, by a competent person to ensure that changes in temperature, precipitation, shallow groundwater, overburden, nearby building weight, vibrations, or nearby equipment operation has not caused weakening of sides, faces, and flows. Before an employee enters an excavation greater than four (4) feet in depth (or less if soil is deemed unstable by a competent person), the atmosphere must be tested to ensure that an oxygen deficient or hazardous atmosphere does not exist. If the concentration of any airborne contaminant exceeds one-half its permissible exposure limit (PEL) or other applicable occupational exposure limit (OEL), the airborne oxygen concentration is less the 19.5 percent, or explosivity exceeds ten percent of the lower explosive limit (LEL), then no personnel shall be permitted to enter the excavation until such engineering controls or other hazard controls are instituted to eliminate or control the hazard.
- Diversion ditches, dikes, or other suitable means will be used to prevent water from entering an excavation and for drainage of the excavation.
- When mobile equipment is used or allowed adjacent to excavations, stop logs, or barricades will be installed. The grade will always be away from the excavation.
- A means of egress (ladder, ramps, stairways, etc.) shall be accessible at any location inside the excavation without requiring more than 25 feet of lateral travel distance.
- Dust conditions during excavation will be kept to a minimum. Wetting agents shall be used when appropriate.
- Field personnel shall not enter any excavation, without specific direction, for any reason except to rescue injured individuals who have fallen into the excavation.
- All excavations will be marked and protected at all times to ensure site personnel, visitors, or unauthorized personnel do not enter without permission or fall into the trench.
- Personnel will work in pairs when working around an excavation of 2′ or more.

B18: Water Safety - All personnel and visitors when immediately near water (i.e., within 4 feet/1.22 meter), over water, wadding in water or on any vessel, where the danger of drowning exists, must wear a USCG approved personal floatation device (PFD). This PFD must be properly secured to the wearer. The PFD must be free of all defects including rips, tears, stress, and fading, and be kept clean and free of excessive dirt and oil. However, several factors are relevant to determining whether a danger of drowning exists. These include the type of water body (i.e., a pool, a river, and a canal), depth, presence, or absence of a current, height above the water surface, and the use of fall protection when working above a water body.

Depending on the factors present, there are some circumstances where a drowning hazard could exist where workers are near or over water that is relatively shallow (i.e., less than 2 feet (0.6meters) in depth). For example, where workers are not using fall protection and are 10 feet above a river, a worker may fall and be knocked unconscious. Without the use of a life jacket or buoyant work vest, a worker in such a scenario could drown.

A life ring equipped with 90 feet of solid braid polycarbonate line, or equivalent must close to the working area and accessible for use. This includes activities being be on board all vessels and kept readily available.

USCG boating safety guidelines or equivalent should be adhered to when operating a boat during sampling activities. Boats must be equipped with the required running lights for night-time or poor visibility conditions. Boats must be equipped with an anchor and alternate means of locomotion (e.g., extra motor, floatable oars).

B19: Ergonomics – Lifting, carrying and lowering objects represents a potential physical hazard to AEI personnel. Therefore, it is every employee's responsibility to realistically evaluate the object to determine if the weight exceeds the employee's ability to lift, lower, or carry it. To eliminate or minimize the risk of lifting hazards, utilize proper techniques, such as keeping the back straight and legs bent. Objects should always be lifted, lowered and carried as close to the body as possible. If the equipment cannot be lifted in this manner, it is too heavy to lift alone. Call other personnel, or use a mechanical device for aid in lifting. Mechanical aids like hand trucks and carts or the buddy system should be used to move heavy objects, objects with poor handgrips or large bulky objects. Some other things to consider:

- Evaluate the object for the presence of any physical hazards such as pinch points, sharp or jagged edges, burrs or rough and slippery surfaces.
- The route in which the object will be moved should be free from obstructions, which could cause difficulty in moving the object.
- Asses other hazards such as stairs before you move the object and consider smaller loads with multiple trips as a safe alternative
- If an object is stored at a level higher than five feet, or on the floor, an appropriate mechanical device may be necessary to move the object.
- Recognized lifting hazards should be designed out of the work process whenever possible.

Proper lifting and lowering techniques should be followed even if the object or material to be lifted is of lighter weight. Keep the objects as close to the body as possible and:

- Establish a firm footing with feet at approximately shoulder width and one foot slightly ahead of the other. This posture will aid in keeping good balance and will establish a stable lifting base.
- Always bend at the knees, not at the waist when lifting or lowering an object.
- Obtain a good secure grip on the object.
- When beginning to lift, tighten your stomach muscles and use your les to lift the object, as leg muscles are generally stronger than back muscles.
- Lift slowly and smoothly.
- If you need to turn as you lift, do not twist at the waist, but instead pivot with the feet.

When lowering the object, reverse the procedure.

B20: Power Tools – Tools can be hazardous when improperly used since these types of tools utilize energy: Electric, liquid fuel, hydraulic, pneumatic, and powder-actuated. The following precautions will be taken by employees to prevent injury:

- Power tools will always be operated within their design limitations, and only by employees who have been appropriately trained in the use, operation, and proper handling of such tools.
- Guards are not to be removed or rendered inoperative.
- Eye protection, gloves, and safety footwear are recommended during operation.
- Store tools in an appropriate dry location when not in use.
- Work only in well illuminated locations.
- Tools will not be carried by the cord or hose, and cords or hoses will not be yanked to disconnect it from the receptacle.
- Cords and hoses will be kept away from heat, oils, and sharp edges or any other source that could result in damage.
- Tools will be disconnected when not in use, before servicing, and when changing accessories such as blades, bits, and cutters.
- Observers will be kept at a safe distance at all times from the work area.
- Tools will be maintained in a clean manner, and properly maintained in accordance with the manufacturer's guidelines. Periodic inspection of hand and portable power tools should occur.
- Ensure that the work area is kept clean to maintain proper footing and good balance.
- Ensure that proper apparel is worn. Loose clothing, ties, or jewelry can become caught in moving parts.
- Tools that are damaged will be removed from service immediately and tagged "Do Not Use".

Appendix B

Material Safety Data Sheets

Chemical/Physical Properties

Check if Present	Material (CAS #)	Water Solubility [a]	Specific Gravity	Flash Point (°F)	Vapor Pressure [d]	LEL UEL	Cal/OSHA PEL- TWA [f]	IDLH Level [h]	Odor Threshold Geometric mean [i] (ppm)
Volatile Organic Compounds (VOCs)									
☐	Acetic acid (64-19-7)	Miscible	1.05	103	11 mm	4.0% 19.9%	10 ppm	50 ppm	0.074 (d)
☐	Acetone (67-64-1)	Miscible	0.79	0	180 mm	2.5% 12.8%	500 ppm	2,500 ppm	62 (d) 130 (r)
☐	Acrolein (107-02-8)	40%	0.84	-15	210 mm	2.8% 31%	C 0.1 ppm Skin	2 ppm	1.8 (d)
☐	Acrylonitrile (107-13-1)	7%	0.81	30	83 mm	3% 17%	2 ppm Skin	85 ppm Ca	1.6 (d)
☐	Benzene (71-43-2)	0.07%	0.88	12	75 mm	1.2% 7.8%	1 ppm Skin	500 ppm Ca	61 (d) 97 (r)
☐	Bromodichloro-methane (75-27-4)	4500 mg/l	1.98	--	50 mm	Non-flam	None established	None determined	--
☐	Bromoform (75-25-2)	0.10%	2.89	--	5 mm	Non-flam	0.5 ppm Skin	850 ppm	1.3 [j]
☐	Bromomethane (74-83-9)	2%	1.73	--	1.9 atm	10% 16.0%	1 ppm	250 ppm Ca	80 [j]
☐	Carbon Tetrachloride (56-23-5)	0.05%	1.6	--	91 mm	Non-flam	2 ppm Skin	200 ppm Ca	252 (d)
☐	Chlorobenzene (108-90-7)	0.05%	1.11	82	9 mm	1.3% 9.6%	10 ppm	1000 ppm	1.3 (d)
☐	2-Chloroethyl-vinyl Ether (110-75-8)	0.02%	1.05	61	27 mm	--	None established	None determined	--
☐	Chloroethane (75-00-3)	0.60%	0.92	-58	1000 mm	3.8% 15.4%	100 ppm Skin	3800 ppm	4.2 [j]
☐	Chloroform (67-66-3)	0.50%	1.48	--	160 mm	Non-flam	2 ppm	500 ppm Ca	192 (d)
☐	Chloromethane (74-87-3)	0.50%	0.92	--	4310 mm	8.1% 17.4%	5 ppm	2000 ppm Ca	10 [j]
☐	Dibromo-chloromethane (124-48-1)	2700 mg/l	2.5	--	76 mm	--	None established	None Determined	--
☐	Dibutyl phthalate (84-74-2)	0.001% (77°F)	1.05	315	0.00007 mm	0.5% --	5 mg/m^3	4,000 mg/m^3	--
☐	1,2-Dichlorobenzene (95-50-1)	0.01%	1.3	151	1 mm	2.2% 9.2%	25 ppm Skin	200 ppm	--
☐	1,1-Dichloroethane (75-34-3)	0.60%	1.18	2	182 mm	5.4% 11.40%	100 ppm	3,000 ppm	--
☒	1,1-Dichloroethylene (DCE) (75-35-4)	0.04%	1.21	-2	500 mm	6.5% 15.5%	1 ppm	None determined	190 [j]
☐	1,2-Dichloroethane (107-06-2)	0.90%	1.24	56	64 mm	6.2% 16%	1 ppm	50 ppm Ca	26 (d) 87 (r)
☐	1,2-Dichloroethylene (540-59-0)	0.40%	1.27	36-39	180-265 mm	5.6% 12.8%	200 ppm	1,000 ppm	17 - 170 [k]
☐	1,2-Dichloropropane (78-87-5)	0.30%	1.16	60	40 mm	3.4% 14.5%	75 ppm	400 ppm Ca	0.26 (d) 0.52 (r)
☐	1,3-Dichloropropene (542-75-6)	0.20%	1.2	77	28 mm	5.3% 14.5%	1 ppm Skin	None Determined Ca	1 [j]
☐	Bis-(2-Ethylhexyl)-phthalate (DEHP) (117-81-7)	0.00%	0.99	420	<0.01 mm	-- 0.3%	5 mg/m^3	5,000 mg/m^3 Ca	--
☐	Diethyl phthalate (84-66-2)	0.10%	1.12	322	0.002 mm	-- 0.7%	5 mg/m^3	None Determined	--
☐	Dinitrotoluene (DNT) (25321-14-6)	Insoluble	1.32	404	1 mm	-- --	0.15 mg/m^3 Skin	50 mg/m^3 Ca	--
☐	Endrin (72-20-8)	Insoluble	1.7	--	0.00001 mm	--	0.1 mg/m^3 Skin	2 mg/m^3	--

Check if Present	Material (CAS #)	Water Solubility [a]	Specific Gravity	Flash Point (°F)	Vapor Pressure [d]	LEL UEL	Cal/OSHA PEL- TWA [f]	IDLH Level [h]	Odor Threshold Geometric mean [i] (ppm)
☐	Ethyl benzene (100-41-4)	0.01%	0.87	55	7 mm	0.8% 6.7%	100 ppm	800 ppm	2.3 [j]
☐	Hydrazine (302-01-2)	Miscible	1.01	99	10 mm	2.9% 98%	0.01 ppm Skin	50 ppm Ca	3.7 (d)
☐	Methyl ethyl ketone (MEK) (78-93-3)	28%	0.81	16	78 mm	1.4% 11.4%	200 ppm	3000 ppm	16 (d) 17 (r)
☐	Methyl tert-butyl ether (MTBE) (1634-04-4)	5.1 g/100ml	0.7	-18	245 mm	1.6% 8.4%	40 ppm	None determined	0.32 – 0.47mg/m^3 [l]
☐	Methylene chloride (75-09-2)	2%	1.33	--	350 mm	13% 23%	25 ppm	2,300 ppm Ca	160 (d) 230 (r)
☐	Phenol (108-95-2)	9% (77°F)	1.06	175	0.4 mm	1.8% 8.6%	5 ppm Skin	250 ppm	0.06 (d)
☐	1,1,2,2-Tetrachloroethane (79-34-5)	0.30%	1.59	--	5 mm	Non-flam	1 ppm Skin	100ppm Ca	7.3 (d)
☒	Tetrachloroethylene (PCE) (127-18-4)	0.02%	1.62	--	14 mm	Non-flam	25 ppm	150 ppm Ca	47 (d) 71 (r)
☐	Toluene (108-88-3)	0.07% (74°F)	0.87	40	21 mm	1.1% 7.1%	50 ppm Skin	500 ppm	1.6 (d) 11 (r)
☐	1,1,1-Trichloroethane (71-55-6)	0.40%	1.34	--	100 mm	7.5% 12.5%	350 ppm	700 ppm	390 (d) 710 (r)
☐	1,1,2-Trichloro-ethane (79-00-5)	0.40%	1.44	--	19 mm	6% 15.5%	10 ppm Skin	100 ppm Ca	--
☐	1,2,4-Trichlorobenzene (120-82-1)	0.003%	1.45	222	1 mm	2.5% 6.6% (302 °F)	C 5 ppm	None Determined	3 [j]
☒	Trichloroethylene (TCE) (79-01-6)	0.1% (77°F)	1.46	--	58 mm	8% 10.5%	25 ppm	1,000 ppm Ca	82 (d) 110 (r)
☐	Trichlorofluoromethane (75-69-4)	0.1% (75°F)	1.47	--	690 mm	Non-flam	C 1,000 ppm	2000 ppm	--
☐	1,1,2-Trichloro-1,2,2-trifluoroethane (76-13-1)	0.02%	1.56	--	285 mm	-- --	1,000 ppm	2,000 ppm	--
☐	1,2,4-Trimethylbenzene (95-63-6)	0.006%	0.88	112	1 mm	0.9% 6.4%	25 ppm	None determined	2.4 (d)
☐	Vinyl Chloride (75-01-4)	0.1% (77°F)	0.09	--	3.31 atm	3.6% 33%	1 ppm Skin	None Determined Ca	--
☐	Xylene (o, p, m, mix) (1330-20-7)	Slightly soluble	0.86-0.88	81-90	7-9 mm	0.9% 7%	100 ppm	900 ppm	20 (d) 40 (r)
Metals									
☐	Aluminum metal and oxide (as Al)	[b]	2.7	--	0 mm	[e]	10 mg/m^3 (respirable)	None determined	--
☐	Antimony (7440-36-0)	[b]	6.69	--	0 mm	[e]	0.5 mg/m^3	50 mg/m^3	--
☐	Arsenic (inorganic compounds, as As)	[b]	5.73	--	0 mm	[e]	0.010mg/m^3	5 mg/m^3 Ca	--
☐	Arsenic (organic compounds, as As)	Properties vary depending upon the specific organic arsenic compound.					0.2mg/m^3	None determined	--
☐	Barium chloride(as Ba) (10361-37-2)	38%	3.86	--	low	Non-flam	0.5 mg/m^3	50 mg/m^3	--
☐	Barium nitrate (as Ba) (10022-31-8)	9%	3.24	--	Low	[e]	0.5 mg/m^3	50 mg/m^3	--
☐	Beryllium and compounds (as Be)	[b]	1.85	--	0 mm	[e]	0.2 □g/m^3	4 mg/m^3 Ca	--
☐	Cadmium dust (as Cd)	[b]	8.64	--	--	[e]	0.005 mg/m^3	9 mg/m^3 Ca	--

Check if Present	Material (CAS #)	Water Solubility [a]	Specific Gravity	Flash Point (°F)	Vapor Pressure [d]	LEL UEL	Cal/OSHA PEL- TWA [f]	IDLH Level [h]	Odor Threshold Geometric mean [i] (ppm)
☐	Chromium (III) compounds (as Cr)	[b]	Properties vary depending upon the specific compound.				0.5 mg/m^3	25 mg/m^3	--
☐	Cobalt metal dust and fume (as Co) (7440-48-4)	Insoluble	8.92	--	0 mm	[e]	0.02 mg/m^3	20 mg/m^3	--
☐	Copper dust and mist (as Cu)	[b]	8.94	--	0 mm	[e]	1 mg/m^3	100 mg/m^3	--
☐	Lead	Insoluble	11.34	--	0 mm	[e]	0.05 mg/m^3	100 mg/m^3	--
☐	Manganese, Fume and compounds (as Mn) (7439-96-5)	Insoluble	7.2	--	0 mm	Comb-ustible	0.2 mg/m^3	500 mg/m^3	--
☐	Mercury compounds (as Hg) Except alkyl compound	[b]	13.6	--	0.0012 mm	[e]	0.025 mg/m^3 Skin	10 mg/m^3	--
☐	Molybdenum (7439-98-7)	[b]	10.28	--	0 mm	Comb-ustible	10 mg/m^3 3 mg/m^3 (resp.)	5,000 mg/m^3	--
☐	Nickel and other compounds (as Ni)	[b]	8.9	--	0 mm	[e]	1 mg/m^3	10 mg/m^3 Ca	--
☐	Selenium (7782-49-2)	Insoluble	4.28	--	0 mm	Comb-ustible	0.2 mg/m^3	1 mg/m^3	--
☐	Silver, metal dust, and soluble compounds (as Ag)	[b]	10.49	--	0 mm	[e]	0.01 mg/m^3	10 mg/m^3	--
☐	Thallium (soluble compounds, as Ti)	[b]	Properties vary depending upon the specific compound.				0.1 mg/m^3 Skin	15 mg/m^3	--
☐	Vanadium pentoxide dust and Fume (1314-62-1)	0.8%	3.36	--	0 mm	[e]	0.05 mg/m^3 (Respirable)	35 mg/m^3	--
☐	Zinc oxide (1314-13-2)	[b]	5.61	--	0 mm	[e]	5 mg/m^3	500 mg/m^3	--
Miscellaneous									
☐	Ammonia (7664-41-7)	34%	--	--	8.5 atm	15% 28%	25 ppm	300 ppm	17 (d)
☐	Asbestos (1332-21-4)	Insoluble	--	--	0 mm	Non-flam	0.1 fibers/cc	None determined	--
☐	Chromic Acid and chromates (1333-82-0)	63%	2.7	--	Very low	Non-flam	0.005 mg/m^3	15 mg/m^3 Ca	--
☐	Cyanide (as CN)	--	--	--	--	Non-flam	5 mg/m^3 Skin	--	--
☐	DDT (50-29-3)	Insoluble	0.99	162-171	0.0000002 mm	--	1 mg/m^3 Skin	500 mg/m^3 Ca	--
☐	Diesel Fuel #2 (68476-34-6)	Insoluble	0.81-0.90	130	--	0.6-1.3 6-7.5	None established	None determined	--
☐	Fluorides, as F	--	--	--	--	--	2.5 mg/m^3	None determined	--
☐	Gasoline (8006-61-9)	Insoluble	0.72-0.76	-45	38-300 mm	1.4% 7.6%	300 ppm	Ca None determined	--
☐	Kerosene (8008-20-6)	Insoluble	0.81	100-162	5 (100°F)	0.7% 5.0%	200 mg/m^3[g] Skin	None determined	--
☐	Naphthalene (91-20-3)	0.00%	1.15	174	0.08 mm	0.9% 5.9%	10 ppm	250 ppm	0.038 (d)
☐	PCB (42% chlorine) (53469-21-9)	Insoluble	1.39	--	0.001 mm	Non-flam	1 mg/m^3 Skin	5 mg/m^3 Ca	--
☐	PCB (54% chlorine) (11097-69-1)	Insoluble	1.38	--	--	Non-flam	0.5 mg/m^3 Skin	5 mg/m^3 Ca	--

Check if Present	**Material (CAS #)**	**Water Solubility [a]**	**Specific Gravity**	**Flash Point (°F)**	**Vapor Pressure [d]**	**LEL UEL**	**Cal/OSHA PEL- TWA [f]**	**IDLH Level [h]**	**Odor Threshold Geometric mean [i] (ppm)**
☐	Phosphorus (yellow) (7723-14-0)	0.00%	1.82	--	0.03 mm	-- --	0.1 mg/m^3	5 mg/m^3	--
☒	Polycyclic Aromatic Hydrocarbons (PAH)	Properties vary depending upon the specific compound. Listed in NIOSH as Coal Tar Pitch Volatiles					0.2 mg/m^3	80 mg/m^3 Ca	--

SITE-SPECIFIC SUBSTANCES

(Add hazardous property information on any substances that are of concern at the site but are not listed above as an attachment to this HASP. (e.g., SDS)).

EXPLANATIONS AND FOOTNOTES:

[a] Water solubility is expressed in different terms in different references. Many references use the term "insoluble" for materials that will not readily mix with water, such as gasoline. However, most of these materials are water soluble at the part per million or part per billion level. Gasoline, for example, is insoluble in the gross sense, and will be found as a discrete layer on top of the ground water. But certain gasoline constituents, such as benzene, toluene, and xylene, will also be found in solution in the ground water at the part per million or part per billion levels.

[b] Solubility of metals depends on the compound in which they are present.

[c] Several chlorinated hydrocarbons exhibit no flash point in a conventional sense, but will burn in the presence of high energy ignition source or will form explosive mixtures at temperatures above 200 °F.

[d] Expressed as mm Hg under standard conditions.

[e] Explosive concentrations of airborne dust can occur in confined areas.

[f] Cal/OSHA Time-weighted Average (TWA) Permissible Exposure Limits (PELs) except where noted in g. The substances designated by "Skin" in the PEL column may be absorbed into the bloodstream through the skin, the mucous membranes and/or the eye, and contribute to the overall exposure. “C” notation indicates the number given is a ceiling value.

[g] TLV-TWA adopted by the American Conference of Governmental Industrial Hygienists (ACGIH). Currently, there is no Cal/OSHA PEL.

[h] The substances with a “Ca” notation in the IDLH column are considered to be potential occupational carcinogens by NIOSH.

[i] Odor thresholds values extracted from “*ODOR THRESHOLDS for Chemicals with established Occupational Health Standards*”, American Industrial Hygiene Association, 1997.

(d) Odor detection threshold: Lowest concentration at which a stimulus is being detected.

(r) Odor recognition threshold: Lowest concentration at which a definite odor character is detected.

[j] Values extracted from the U.S. Environmental Protection Agency Technology Transfer Network, Air Toxics website. URL: www.epa.gov/ttn/atw/, 2006

[k] Value extracted from “*HESIS Guide to Solvent Safety*” California Department of Health Services, 2004. URL: http://www.dhs.ca.gov/ohb/HESIS/solv_cht.htm

[l] Value extracted from “*Chemical Summary For Methyl-Tert-Butyl Ether”,* U.S. Environmental Protection Agency, Office Of Pollution Prevention and Toxics, August 1994. URL: http://www.epa.gov/chemfact/s_mtbe.txt

ADDITIONAL CHEMICAL DESCRIPTIONS:

The following chemical descriptions are to be used for chemicals that may be present at the Site. Each chemical description includes physical and odor recognition characteristics, the health effects associated with exposure, and exposure limits expressed as an 8-hour time-weighted average (TWA). Provided are federal Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs; located in 29 CFR 1910.1000); California OSHA (Cal/OSHA) PELs (located in 8 CCR 5155); and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs). Short-term exposure limits (STELs) are shorter concentrations that must not be exceeded over a specified period of time (generally 15 minutes). Ceiling concentrations are limits that must not be exceeded during any part of the workday. These are expressed in parts per million (ppm), milligrams per cubic meter (mg/m3), or fibers per cubic centimeter (f/cc), as appropriate.

Odor thresholds cannot be used as the primary indicator for changing gas and vapor cartridges as a result of the OSHA standard, 29 CFR 1910.134. The program administrator and designated representative(s), using objective data and information, must establish chemical cartridge change schedules if a gas or vapor cartridge does not have an end-of-service life indicator. Odor thresholds can be a useful secondary or backup indicator for cartridge change-out. The primary references for odor threshold information were VOCBASE and an American Industrial Hygiene publication. The method of defining and determining odor thresholds varies widely, therefore, caution must be used in relying upon odor threshold as a warning of potentially hazardous exposure.

For sites outside California, Cal/OSHA PELs are included as an additional reference.

Safety data sheet

SECTION 1. Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Code:	**RHH-023**
Product name	**Tetrachloroethene**
INDEX number	**602-028-00-4**
EC number	**204-825-9**
CAS number	**127-18-4**

1.2. Relevant identified uses of the substance or mixture and uses advised against

Intended use	**reference material and/or laboratory reagent**

1.3. Details of the supplier of the safety data sheet

Name	**ULTRA Scientific, Inc.**		
Full address	**250 Smith Street**		
District and Country	**02852**	**N. Kingstown**	**(RI)**
		USA	
	Tel.	**401-294-9400**	
	Fax	**401-295-2330**	
e-mail address of the competent person responsible for the Safety Data Sheet	**wleary@ultrasci.com**		
Product distribution by	**ULTRA Scientific, Inc.**		

1.4. Emergency telephone number

For urgent inquiries refer to	**US: (800) 424-9300** **Outside US: (703) 527-3887**

SECTION 2. Hazards identification.

2.1. Classification of the substance or mixture.

The product is classified as hazardous pursuant to the provisions set forth in EC Regulation 1272/2008 (CLP) (and subsequent amendments and supplements). The product thus requires a safety datasheet that complies with the provisions of EC Regulation 1907/2006 and subsequent amendments.
Any additional information concerning the risks for health and/or the environment are given in sections 11 and 12 of this sheet.

2.1.1. Regulation 1272/2008 (CLP) and following amendments and adjustments.

Hazard classification and indication:

Carc. 2	H351
Skin Irrit. 2	H315
Skin Sens. 1	H317
Aquatic Chronic 2	H411

2.1.2. 67/548/EEC and 1999/45/EC Directives and following amendments and adjustments.

Danger Symbols:	Xn-N
R phrases:	Carc. Cat. 3 40-51/53

The full wording of the Risk (R) and hazard (H) phrases is given in section 16 of the sheet.

SECTION 2. Hazards identification. ... / >>

2.2. Label elements.

Hazard labelling pursuant to EC Regulation 1272/2008 (CLP) and subsequent amendments and supplements.

Hazard pictograms:

Signal words: Warning

Hazard statements:

H351	Suspected of causing cancer.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statements:

P201	Obtain special instructions before use.
P273	Avoid release to the environment.
P280	Wear protective gloves / protective clothing / eye protection / face protection.
P302+P352	IF ON SKIN: Wash with plenty of soap and water.
P308+P313	IF exposed or concerned: Get medical advice / attention.

INDEX. 602-028-00-4

2.3. Other hazards.

Information not available.

SECTION 3. Composition/information on ingredients.

3.1. Substances.

Contains:

Identification.	**Conc. %.**	**Classification 67/548/EEC.**	**Classification 1272/2008 (CLP).**
PERCHLOROETHYLENE *CAS. 127-18-4* *EC. 204-825-9* *INDEX. 602-028-00-4*	100	Carc. Cat. 3 R40, N R51/53	Carc. 2 H351, Skin Irrit. 2 H315, Skin Sens. 1 H317, Aquatic Chronic 2 H411

The full wording of the Risk (R) and hazard (H) phrases is given in section 16 of the sheet.

T+ = Very Toxic(T+), T = Toxic(T), Xn = Harmful(Xn), C = Corrosive(C), Xi = Irritant(Xi), O = Oxidizing(O), E = Explosive(E), F+ = Extremely Flammable(F+), F = Highly Flammable(F), N = Dangerous for the Environment(N)

3.2. Mixtures.

Information not relevant.

SECTION 4. First aid measures.

4.1. Description of first aid measures.

EYES: Remove contact lenses, if present Wash immediately with plenty of water for at least 15 minutes, opening the eyelids fully. If problem persists, seek medical advice

SKIN: Remove contaminated clothing. Wash immediately with plenty of water. If irritation persists, get medical advice/attention. Wash contaminated clothing before using it again.

INHALATION: Remove to open air. In the event of breathing difficulties, get medical advice/attention immediately.

INGESTION: Get medical advice/attention. Induce vomiting only if indicated by the doctor. Never give anything by mouth to an unconscious person, unless authorised by a doctor.

4.2. Most important symptoms and effects, both acute and delayed.

For symptoms and effects caused by the contained substances, see chap. 11.

4.3. Indication of any immediate medical attention and special treatment needed.

Information not available.

SECTION 5. Firefighting measures.

5.1. Extinguishing media.

SUITABLE EXTINGUISHING EQUIPMENT

The extinguishing equipment should be of the conventional kind: carbon dioxide, foam, powder and water spray.

UNSUITABLE EXTINGUISHING EQUIPMENT

None in particular.

5.2. Special hazards arising from the substance or mixture.

HAZARDS CAUSED BY EXPOSURE IN THE EVENT OF FIRE

Do not breathe combustion products.

5.3. Advice for firefighters.

GENERAL INFORMATION

Use jets of water to cool the containers to prevent product decomposition and the development of substances potentially hazardous for health. Always wear full fire prevention gear. Collect extinguishing water to prevent it from draining into the sewer system. Dispose of contaminated water used for extinction and the remains of the fire according to applicable regulations.

SPECIAL PROTECTIVE EQUIPMENT FOR FIRE-FIGHTERS

Normal fire fighting clothing i.e. fire kit (BS EN 469), gloves (BS EN 659) and boots (HO specification A29 and A30) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).

SECTION 6. Accidental release measures.

6.1. Personal precautions, protective equipment and emergency procedures.

Block the leakage if there is no hazard.

Wear suitable protective equipment (including personal protective equipment referred to under Section 8 of the safety data sheet) to prevent any contamination of skin, eyes and personal clothing. These indications apply for both processing staff and those involved in emergency procedures.

6.2. Environmental precautions.

The product must not penetrate into the sewer system or come into contact with surface water or ground water.

6.3. Methods and material for containment and cleaning up.

Collect the leaked product into a suitable container. Evaluate the compatibility of the container to be used, by checking section 10.

Absorb the remainder with inert absorbent material.

Make sure the leakage site is well aired. Check incompatibility for container material in section 7. Contaminated material should be disposed of in compliance with the provisions set forth in point 13.

6.4. Reference to other sections.

Any information on personal protection and disposal is given in sections 8 and 13.

SECTION 7. Handling and storage.

7.1. Precautions for safe handling.

Before handling the product, consult all the other sections of this material safety data sheet. Avoid leakage of the product into the environment. Do not eat, drink or smoke during use. Remove any contaminated clothes and personal protective equipment before entering places in which people eat.

7.2. Conditions for safe storage, including any incompatibilities.

Store only in the original container. Store the containers sealed, in a well ventilated place, away from direct sunlight. Keep containers away from any incompatible materials, see section 10 for details.

7.3. Specific end use(s).

Information not available.

SECTION 8. Exposure controls/personal protection.

8.1. Control parameters.

Regulatory References:

United Kingdom	EH40/2005 Workplace exposure limits. Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations (as amended).
Éire	Code of Practice Chemical Agent Regulations 2011.
OEL EU	Directive 2009/161/EU; Directive 2006/15/EC; Directive 2004/37/EC; Directive 2000/39/EC.
TLV-ACGIH	ACGIH 2012

PERCHLOROETHYLENE

Threshold Limit Value.

Type	Country	TWA/8h		STEL/15min	
		mg/m3	ppm	mg/m3	ppm
WEL	UK	345	50	689	100
OEL	IRL	170	25	678	100
TLV-ACGIH		170	25	678	100

Legend:
(C) = CEILING ; INHAL = Inhalable Fraction ; RESP = Respirable Fraction ; THORA = Thoracic Fraction.

8.2. Exposure controls.

As the use of adequate technical equipment must always take priority over personal protective equipment, make sure that the workplace is well aired through effective local aspiration.
Personal protective equipment must be CE marked, showing that it complies with applicable standards.
Provide an emergency shower with face and eye wash station.
HAND PROTECTION
Protect hands with category III work gloves (see standard EN 374).
The following should be considered when choosing work glove material: compatibility, degradation, failure time and permeability.
The work gloves' resistance to chemical agents should be checked before use, as it can be unpredictable. The gloves' wear time depends on the duration and type of use.
SKIN PROTECTION
Wear category II professional long-sleeved overalls and safety footwear (see Directive 89/686/EEC and standard EN ISO 20344). Wash body with soap and water after removing protective clothing.
EYE PROTECTION
Wear airtight protective goggles (see standard EN 166).
RESPIRATORY PROTECTION
If the threshold value (e.g. TLV-TWA) is exceeded for the substance or one of the substances present in the product, use a mask with a type A filter whose class (1, 2 or 3) must be chosen according to the limit of use concentration. (see standard EN 14387). In the presence of gases or vapours of various kinds and/or gases or vapours containing particulate (aerosol sprays, fumes, mists, etc.) combined filters are required.
Respiratory protection devices must be used if the technical measures adopted are not suitable for restricting the worker's exposure to the threshold values considered. The protection provided by masks is in any case limited.
If the substance considered is odourless or its olfactory threshold is higher than the corresponding TLV-TWA and in the case of an emergency, wear open-circuit compressed air breathing apparatus (in compliance with standard EN 137) or external air-intake breathing apparatus (in compliance with standard EN 138). For a correct choice of respiratory protection device, see standard EN 529.
The emissions generated by manufacturing processes, including those generated by ventilation equipment, should be checked to ensure compliance with environmental standards.
Product residues must not be indiscriminately disposed of with waste water or by dumping in waterways.

SECTION 9. Physical and chemical properties.

9.1. Information on basic physical and chemical properties.

Appearance		liquid	
Colour		colourless	
Odour		Not available.	
Odour threshold.		Not available.	
pH.			
Melting point / freezing point.		-22	°C.
Initial boiling point.		121	°C.
Boiling range.		Not available.	
Flash point.	>	60	°C.

SECTION 9. Physical and chemical properties. ... / >>

Evaporation Rate	Not available.
Flammability of solids and gases	Not available.
Lower inflammability limit.	Not available.
Upper inflammability limit.	Not available.
Lower explosive limit.	Not available.
Upper explosive limit.	Not available.
Vapour pressure.	13 mmHg
Vapour density	N/A
Relative density.	1.600 Kg/l
Solubility	Not available.
Partition coefficient: n-octanol/water	Not available.
Auto-ignition temperature.	Not available.
Decomposition temperature.	Not available.
Viscosity	Not available.
Explosive properties	Not available.
Oxidising properties	Not available.

9.2. Other information.

VOC (Directive 1999/13/EC) :	100.00 % - 1,600.00 g/litre.
VOC (volatile carbon) :	14.47 % - 231.56 g/litre.

SECTION 10. Stability and reactivity.

10.1. Reactivity.

There are no particular risks of reaction with other substances in normal conditions of use.

TETRACHLOROETHYLENE: incombustible, however it decomposes above 150°C. Decomposition also occurs due to the action of UV rays and moisture.

10.2. Chemical stability.

The product is stable in normal conditions of use and storage.

10.3. Possibility of hazardous reactions.

No hazardous reactions are foreseeable in normal conditions of use and storage.

TETRACHLOROETHYLENE: risk of explosion on contact with: alkaline metals, aluminium, alkaline hydroxides, sodium amide. May react violently on contact with: strong bases, strong oxidising agents, alkaline earth metals, light metals, metal powders and zinc oxide.

10.4. Conditions to avoid.

None in particular. However the usual precautions used for chemical products should be respected.

10.5. Incompatible materials.

Information not available.

10.6. Hazardous decomposition products.

TETRACHLOROETHYLENE: hydrogen chloride, phosgene, chlorine, ethane tetrachloride, other toxic chlorine compounds.

SECTION 11. Toxicological information.

11.1. Information on toxicological effects.

This product must be handled carefully because of its possible carcinogenic effects. Anyway, currently available data do not allow us to comprehensively assess this product.
Acute effects: contact with skin may cause: irritation, erythema, edema, dryness and chapped skin. Vapour inhalation may slightly irritate the upper respiratory trait. Ingestion may cause health disorders, including stomach pain and sting, nausea and sickness.
Upon contact with skin, this product causes sensitization (dermatitis). Dermatitis derives from skin irritation on the areas which repeatedly come into contact with the sensitizing agent. Cutaneous lesions may include: erythemas, edemas, papules, vesicles, pustules, scurvies, ulcerations and exudative phenomena, whose intensity varies according to illness seriousness and affected areas.
Erythemas, edemas and exudative phenomena prevail during the acute phase. Scurfy skin, dryness, ulcerations and skin thickening prevail during the chronic phase.

TETRACHLOROETHYLENE: has a toxic effect on the central and peripheral nervous system, liver, kidneys and heart. Mucous membranes and skin are affected by its irritant effect.

PERCHLOROETHYLENE

LC50 (Inhalation).	4000 ppm/4h Rat

SECTION 12. Ecological information.

This product is dangerous for the environment and is toxic for aquatic organisms. In the long term, it have negative effects on acquatic environment.

12.1. Toxicity.

PERCHLOROETHYLENE

EC50 - for Crustacea.	18 mg/l/48h Daphnia magna

12.2. Persistence and degradability.

TETRACHLOROETHYLENE:not easily biodegradable.

12.3. Bioaccumulative potential.

TETRACHLOROETHYLENE: low bioaccumulation potential (log Ko/w>3).

12.4. Mobility in soil.

TETRACHLOROETHYLENE: slightly mobile in soil.

12.5. Results of PBT and vPvB assessment.

On the basis of available data, the product does not contain any PBT or vPvB in percentage greater than 0,1%.

12.6. Other adverse effects.

Information not available.

SECTION 13. Disposal considerations.

13.1. Waste treatment methods.

Reuse, when possible. Product residues should be considered special hazardous waste. The hazard level of waste containing this product should be evaluated according to applicable regulations.
Disposal must be performed through an authorised waste management firm, in compliance with national and local regulations.
Avoid littering. Do not contaminate soil, sewers and waterways.
Waste transportation may be subject to ADR restrictions.
CONTAMINATED PACKAGING
Contaminated packaging must be recovered or disposed of in compliance with national waste management regulations.

SECTION 14. Transport information.

These goods must be transported by vehicles authorized to the carriage of dangerous goods according to the provisions set out in the current edition of the Code of International Carriage of Dangerous Goods by Road (ADR) and in all the applicable national regulations.
These goods must be packed in their original packagings or in packagings made of materials resistant to their content and not reacting dangerously with it. People loading and unloading dangerous goods must be trained on all the risks deriving from these substances and on all actions that must be taken in case of emergency situations.

SECTION 14. Transport information. ... / >>

Road and rail transport:

ADR/RID Class: 6.1 UN: 1897
Packing Group: III
Label: 6.1
Nr. Kemler: 60
Limited Quantity. 5 L
Tunnel restriction code. (E)
Proper Shipping Name: TETRACHLOROETHYLENE

Carriage by sea (shipping):

IMO Class: 6.1 UN: 1897
Packing Group: III
Label: 6.1
EMS: F-A, S-A
Marine Pollutant. NO
Proper Shipping Name: TETRACHLOROETHYLENE

Transport by air:

IATA: 6.1 UN: 1897
Packing Group: III
Label: 6.1
Cargo:
Packaging instructions: 663 Maximum quantity: 220 L
Pass.:
Packaging instructions: 655 Maximum quantity: 60 L
Proper Shipping Name: TETRACHLOROETHYLENE

SECTION 15. Regulatory information.

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture.

Seveso category. 9ii

Restrictions relating to the product or contained substances pursuant to Annex XVII to EC Regulation 1907/2006.
Product.
Point. 3

Substances in Candidate List (Art. 59 REACH).
None.
Substances subject to authorisarion (Annex XIV REACH).
None.
Substances subject to exportation reporting pursuant to (EC) Reg. 649/2012:
None.

Substances subject to the Rotterdam Convention:
None.

Substances subject to the Stockholm Convention:
None.

Healthcare controls.
Workers exposed to this chemical agent must not undergo health checks, provided that available risk-assessment data prove that the risks related to the workers' health and safety are modest and that the 98/24/EC directive is respected.

15.2. Chemical safety assessment.

No chemical safety assessment has been processed for the mixture and the substances it contains.

SECTION 16. Other information.

Text of hazard (H) indications mentioned in section 2-3 of the sheet:

Carc. 2	Carcinogenicity, category 2
Skin Irrit. 2	Skin irritation, category 2

SECTION 16. Other information. ... / >>

Skin Sens. 1	Skin sensitization, category 1
Aquatic Chronic 2	Hazardous to the aquatic environment, chronic toxicity, category 2
H351	Suspected of causing cancer.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H411	Toxic to aquatic life with long lasting effects.

Text of risk (R) phrases mentioned in section 2-3 of the sheet:

Carc. Cat. 3	Carcinogenicity, category 3.
R40	LIMITED EVIDENCE OF A CARCINOGENIC EFFECT.
R51/53	TOXIC TO AQUATIC ORGANISMS, MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT.

LEGEND:
- ADR: European Agreement concerning the carriage of Dangerous goods by Road
- CAS NUMBER: Chemical Abstract Service Number
- CE50: Effective concentration (required to induce a 50% effect)
- CE NUMBER: Identifier in ESIS (European archive of existing substances)
- CLP: EC Regulation 1272/2008
- DNEL: Derived No Effect Level
- EmS: Emergency Schedule
- GHS: Globally Harmonized System of classification and labeling of chemicals
- IATA DGR: International Air Transport Association Dangerous Goods Regulation
- IC50: Immobilization Concentration 50%
- IMDG: International Maritime Code for dangerous goods
- IMO: International Maritime Organization
- INDEX NUMBER: Identifier in Annex VI of CLP
- LC50: Lethal Concentration 50%
- LD50: Lethal dose 50%
- OEL: Occupational Exposure Level
- PBT: Persistent bioaccumulative and toxic as REACH Regulation
- PEC: Predicted environmental Concentration
- PEL: Predicted exposure level
- PNEC: Predicted no effect concentration
- REACH: EC Regulation 1907/2006
- RID: Regulation concerning the international transport of dangerous goods by train
- TLV: Threshold Limit Value
- TLV CEILING: Concentration that should not be exceeded during any time of occupational exposure.
- TWA STEL: Short-term exposure limit
- TWA: Time-weighted average exposure limit
- VOC: Volatile organic Compounds
- vPvB: Very Persistent and very Bioaccumulative as for REACH Regulation.

GENERAL BIBLIOGRAPHY

1. Directive 1999/45/EC and following amendments
2. Directive 67/548/EEC and following amendments and adjustments
3. Regulation (EC) 1907/2006 (REACH) of the European Parliament
4. Regulation (EC) 1272/2008 (CLP) of the European Parliament
5. Regulation (EC) 790/2009 (I Atp. CLP) of the European Parliament
6. Regulation (EC) 453/2010 of the European Parliament
7. Regulation (EC) 286/2011 (II Atp. CLP) of the European Parliament
8. Regulation (EC) 618/2012 (III Atp. CLP) of the European Parliament
9. The Merck Index. - 10th Edition
10. Handling Chemical Safety
11. Niosh - Registry of Toxic Effects of Chemical Substances
12. INRS - Fiche Toxicologique (toxicological sheet)
13. Patty - Industrial Hygiene and Toxicology
14. N.I. Sax - Dangerous properties of Industrial Materials-7, 1989 Edition
15. ECHA website

Note for users:

SECTION 16. Other information. ... / >>

The information contained in the present sheet are based on our own knowledge on the date of the last version. Users must verify the suitability and thoroughness of provided information according to each specific use of the product.

This document must not be regarded as a guarantee on any specific product property.

The use of this product is not subject to our direct control; therefore, users must, under their own responsibility, comply with the current health and safety laws and regulations. The producer is relieved from any liability arising from improper uses.

Provide appointed staff with adequate training on how to use chemical products.

SAFETY DATA SHEET

Trichloroethylene

Airgas
an Air Liquide company

Section 1. Identification

GHS product identifier : Trichloroethylene

Chemical name : trichloroethylene

Other means of identification : trichloroethene; Ethene, 1,1,2-trichloro-; Ethene, trichloro-; Trichlorethylene; Ethylene, trichloro-

Product use : Synthetic/Analytical chemistry.

Synonym : trichloroethene; Ethene, 1,1,2-trichloro-; Ethene, trichloro-; Trichlorethylene; Ethylene, trichloro-

SDS # : 001206

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
GERM CELL MUTAGENICITY - Category 2
CARCINOGENICITY - Category 1
AQUATIC HAZARD (LONG-TERM) - Category 3

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Causes serious eye irritation.
Causes skin irritation.
May cause cancer.
Suspected of causing genetic defects.
Harmful to aquatic life with long lasting effects.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves. Wear eye or face protection. Wear protective clothing. Avoid release to the environment. Wash hands thoroughly after handling.

Response : IF exposed or concerned: Get medical attention. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.

Storage : Store locked up.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Section 2. Hazards identification

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : trichloroethylene

Other means of identification : trichloroethene; Ethene, 1,1,2-trichloro-; Ethene, trichloro-; Trichlorethylene; Ethylene, trichloro-

CAS number/other identifiers

CAS number : 79-01-6

Product code : 001206

Ingredient name	%	CAS number
trichloroethylene	100	79-01-6

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : No known significant effects or critical hazards.

Section 4. First aid measures

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:, pain or irritation, watering, redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:, irritation, redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst. This material is harmful to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
halogenated compounds
carbonyl halides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions	: Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill	: Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
Large spill	: Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures	: Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Avoid release to the environment. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.
Advice on general occupational hygiene	: Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
Conditions for safe storage, including any incompatibilities	: Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

trichloroethylene	**ACGIH TLV (United States, 3/2016).** STEL: 25 ppm 15 minutes. TWA: 10 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 1080 mg/m³ 15 minutes. STEL: 200 ppm 15 minutes. TWA: 270 mg/m³ 8 hours. TWA: 50 ppm 8 hours. **OSHA PEL Z2 (United States, 2/2013).** AMP: 300 ppm 5 minutes. CEIL: 200 ppm TWA: 100 ppm 8 hours.

Section 8. Exposure controls/personal protection

Appropriate engineering controls	: If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.
Environmental exposure controls	: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures	: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
Eye/face protection	: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection	: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Other skin protection	: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state	: Liquid. [Watery liquid.]
Color	: Colorless.
Molecular weight	: 131.38 g/mole
Molecular formula	: C2-H-Cl3
Boiling/condensation point	: 86.7°C (188.1°F)
Melting/freezing point	: -84.8°C (-120.6°F)
Critical temperature	: Not available.
Odor	: Characteristic.
Odor threshold	: Not available.
pH	: Not available.
Flash point	: Not available.
Burning time	: Not applicable.
Burning rate	: Not applicable.
Evaporation rate	: 6.39 (butyl acetate = 1)
Flammability (solid, gas)	: Not available.

Section 9. Physical and chemical properties

Lower and upper explosive (flammable) limits	: Lower: 8% Upper: 10.5%
Vapor pressure	: 9.9 kPa (74.256033302 mm Hg) [room temperature]
Vapor density	: 4.5 (Air = 1)
Specific Volume (ft ^{3}/lb)	: 0.6849
Gas Density (lb/ft ^{3})	: 1.46
Relative density	: 1.5
Solubility	: Not available.
Solubility in water	: 1.1 g/l
Partition coefficient: n-octanol/water	: 2.53
Auto-ignition temperature	: 410°C (770°F)
Decomposition temperature	: Not available.
SADT	: Not available.
Viscosity	: Dynamic (room temperature): 0.58 mPa·s (0.58 cP)

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: No specific data.
Incompatible materials	: No specific data.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
trichloroethylene	LC50 Inhalation Vapor LD50 Dermal LD50 Oral	Rat Rabbit Rat	140700 mg/m³ >20 g/kg 4920 mg/kg	1 hours - -

IDLH : 1000 ppm

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
trichloroethylene	Eyes - Moderate irritant	Rabbit	-	24 hours 20 milligrams	-
	Skin - Severe irritant	Rabbit	-	24 hours 2 milligrams	-

Sensitization

Not available.

Section 11. Toxicological information

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
trichloroethylene	-	1	Reasonably anticipated to be a human carcinogen.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.
Inhalation : No known significant effects or critical hazards.
Skin contact : Causes skin irritation.
Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:, pain or irritation, watering, redness
Inhalation : No specific data.
Skin contact : Adverse symptoms may include the following:, irritation, redness
Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.
Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.
Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.
Mutagenicity : Suspected of causing genetic defects.

Section 11. Toxicological information

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
trichloroethylene	Acute EC50 95000 µg/l Marine water	Algae - Skeletonema costatum	96 hours
	Acute EC50 36.5 mg/l Fresh water	Algae - Chlamydomonas reinhardtii - Exponential growth phase	72 hours
	Acute LC50 20 mg/l Marine water	Crustaceans - Elminius modestus	48 hours
	Acute LC50 18 mg/l Fresh water	Daphnia - Daphnia magna	48 hours
	Acute LC50 3100 µg/l Fresh water	Fish - Jordanella floridae - Juvenile (Fledgling, Hatchling, Weanling)	96 hours
	Chronic EC10 12.3 mg/l Fresh water	Algae - Chlamydomonas reinhardtii - Exponential growth phase	72 hours
	Chronic NOEC 10 mg/l Fresh water	Daphnia - Daphnia magna	21 days

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	LogP$_{ow}$	BCF	Potential
trichloroethylene	2.53	17	low

Mobility in soil

Soil/water partition coefficient (K$_{OC}$) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 13. Disposal considerations

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Trichloroethylene; Ethene, trichloro-	79-01-6	Listed	U228

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1710	UN1710	UN1710	UN1710	UN1710
UN proper shipping name	TRICHLOROETHYLENE	TRICHLOROETHYLENE	TRICHLOROETHYLENE	TRICHLOROETHYLENE	TRICHLOROETHYLENE
Transport hazard class(es)	6.1  	6.1  	6.1  	6.1  	6.1 
Packing group	III	III	III	III	III
Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 100 lbs / 45.4 kg [8.2147 gal / 31.096 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 60 L **Cargo aircraft** Quantity limitation: 220 L **Special provisions** IB3, N36, T4, TP1, T1	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.26-2.36 (Class 6). **Explosive Limit and Limited Quantity Index** 5	-	-	**Passenger and Cargo Aircraft**Quantity limitation: 60 L **Cargo Aircraft Only** Quantity limitation: 220 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 2 L

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Special precautions for user : **Transport within user’s premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 5(a)2 final significant new use rules**: trichloroethylene

TSCA 8(a) CDR Exempt/Partial exemption: Not determined

TSCA 12(b) one-time export: trichloroethylene

United States inventory (TSCA 8b): This material is listed or exempted.

Clean Water Act (CWA) 307: trichloroethylene

Clean Water Act (CWA) 311: trichloroethylene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
trichloroethylene	100	No.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	trichloroethylene	79-01-6	100
Supplier notification	trichloroethylene	79-01-6	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

Section 15. Regulatory information

Ingredient name	**Cancer**	**Reproductive**	**No significant risk level**	**Maximum acceptable dosage level**
trichloroethylene	Yes.	Yes.	14 µg/day (ingestion) 50 µg/day (inhalation)	No.

International regulations

International lists

National inventory

Australia	: This material is listed or exempted.
Canada	: This material is listed or exempted.
China	: This material is listed or exempted.
Europe	: This material is listed or exempted.
Japan	: This material is listed or exempted.
Malaysia	: This material is listed or exempted.
New Zealand	: This material is listed or exempted.
Philippines	: This material is listed or exempted.
Republic of Korea	: This material is listed or exempted.
Taiwan	: This material is listed or exempted.

Canada

WHMIS (Canada) : Class D-1B: Material causing immediate and serious toxic effects (Toxic).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class D-1B: Material causing immediate and serious toxic effects (Toxic).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

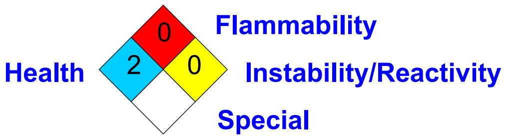
Hazardous Material Information System (U.S.A.)

Health	*	2
Flammability		0
Physical hazards		0

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



Section 16. Other information

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
Skin Irrit. 2, H315 Eye Irrit. 2A, H319 Muta. 2, H341 Carc. 1, H350 Aquatic Chronic 3, H412	Expert judgment Expert judgment Expert judgment Expert judgment Expert judgment

History

Date of printing : 11/21/2016

Date of issue/Date of revision : 11/21/2016

Date of previous issue : No previous validation

Version : 0.01

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

◤ **Indicates information that has changed from previously issued version.**

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SAFETY DATA SHEET

Creation Date 04-Feb-2010 **Revision Date** 23-Jan-2018 **Revision Number** 6

1. Identification

Product Name	**1,2-Dichloroethane**
Cat No. :	**AC113360000; AC113360010; AC113360025; AC113360250; AC113361000**
CAS-No	107-06-2
Synonyms	Ethylene dichloride; EDC
Recommended Use	Laboratory chemicals.
Uses advised against	Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 3
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system, Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Harmful if swallowed

Causes skin irritation
Causes serious eye irritation
Toxic if inhaled
May cause respiratory irritation
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Wear eye/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician
Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Ethylene dichloride	107-06-2	>95

4. First-aid measures

General Advice	Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms and effects	Breathing difficulties. May cause cardiac arrhythmia. May cause central nervous system depression: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	Water may be ineffective
Flash Point	13 °C / 55.4 °F
Method -	No information available
Autoignition Temperature	440 °C / 824 °F
Explosion Limits	
Upper	15.9 vol %
Lower	6.2 vol %
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Keep product and empty container away from heat and sources of ignition. Thermal decomposition can lead to release of irritating gases and vapors.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO_2) Hydrogen chloride gas Phosgene

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	**Flammability**	**Instability**	**Physical hazards**
3	3	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Remove all sources of ignition. Take precautionary measures against static discharges.

Environmental Precautions Should not be released into the environment. See Section 12 for additional ecological information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not ingest. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Take precautionary measures against static discharges.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Ethylene dichloride	TWA: 10 ppm	(Vacated) TWA: 1 ppm (Vacated) TWA: 4 mg/m³ Ceiling: 100 ppm (Vacated) STEL: 2 ppm (Vacated) STEL: 8 mg/m³ TWA: 50 ppm	IDLH: 50 ppm TWA: 1 ppm TWA: 4 mg/m³ STEL: 2 ppm STEL: 8 mg/m³	TWA: 10 ppm TWA: 40 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. Tightly fitting safety goggles. Face-shield.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	sweet
Odor Threshold	400 ppm
pH	No information available
Melting Point/Range	-35 °C / -31 °F
Boiling Point/Range	81 - 85 °C / 177.8 - 185 °F
Flash Point	13 °C / 55.4 °F
Evaporation Rate	6.5 (Butyl Acetate = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.9 vol %
Lower	6.2 vol %
Vapor Pressure	65 mmHg @ 29 °C
Vapor Density	3.4
Specific Gravity	1.250
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	440 °C / 824 °F
Decomposition Temperature	No information available
Viscosity	0.8 mPa s at 20 °C
Molecular Formula	C2 H4 Cl2
Molecular Weight	98.96

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.
Incompatible Materials	Strong oxidizing agents, Bases, Alkali metals
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrogen chloride gas, Phosgene
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ethylene dichloride	625 mg/kg (Rat) 413 mg/kg (Mouse)	2800 mg/kg (Rabbit)	28.79 mg/L (Rat) 1h 7.8 mg/l (Rat) 4h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	Irritating to eyes, respiratory system and skin
Sensitization	No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Ethylene dichloride	107-06-2	Group 2B	Reasonably Anticipated	Not listed	X	Not listed

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed May cause central nervous system depression: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Ethylene dichloride	EC50: = 166 mg/L, 96h static (Desmodesmus subspicatus) EC50: > 433 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 110 - 123 mg/L, 96h flow-through (Pimephales promelas) LC50: 230 - 710 mg/L, 96h flow-through (Lepomis macrochirus) LC50: = 225 mg/L, 96h static (Oncorhynchus mykiss)	Not listed	EC50: 140 - 190 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Ethylene dichloride	1.45

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Ethylene dichloride - 107-06-2	U077	-

14. Transport information

DOT

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

TDG

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

IATA

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

IMDG/IMO

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Ethylene dichloride	X	X	-	203-458-1	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Component	TSCA 12(b)
Ethylene dichloride	Section 4

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Ethylene dichloride	107-06-2	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Ethylene dichloride	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Ethylene dichloride	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Ethylene dichloride	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Ethylene dichloride	107-06-2	Carcinogen	10 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Ethylene dichloride	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Y
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Serious risk, Grade 3

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 04-Feb-2010
Revision Date 23-Jan-2018
Print Date 23-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

End of SDS

SAFETY DATA SHEET

Vinyl Chloride

Airgas
an Air Liquide company

Section 1. Identification

GHS product identifier : Vinyl Chloride

Chemical name : vinyl chloride

Other means of identification : chloroethylene; Ethene, chloro-; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); Vinyl chloride monomer; Monochloroethylene; Monochloroethene; Ethylene monochloride; VCM; VC

Product type : Gas.

Product use : Synthetic/Analytical chemistry.

Synonym : chloroethylene; Ethene, chloro-; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); Vinyl chloride monomer; Monochloroethylene; Monochloroethene; Ethylene monochloride; VCM; VC

SDS # : 001067

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : FLAMMABLE GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas
CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (liver) - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May cause frostbite
May displace oxygen and cause rapid suffocation.
May cause cancer.
May cause damage to organs through prolonged or repeated exposure. (liver)

Precautionary statements

General : Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves. Wear eye or face protection. Wear protective clothing. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Do not breathe gas.

Section 2. Hazards identification

Response : Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Store locked up. Protect from sunlight. Store in a well-ventilated place.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Hazards not otherwise classified : In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : vinyl chloride

Other means of identification : chloroethylene; Ethene, chloro-; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); Vinyl chloride monomer; Monochloroethylene; Monochloroethene; Ethylene monochloride; VCM; VC

Product code : 001067

CAS number/other identifiers

CAS number : 75-01-4

Ingredient name	%	CAS number
vinyl chloride	100	75-01-4

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Section 4. First aid measures

Eye contact	No specific data.
Inhalation	No specific data.
Skin contact	No specific data.
Ingestion	No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician	Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
Specific treatments	No specific treatment.
Protection of first-aiders	No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media	Use an extinguishing agent suitable for the surrounding fire.
Unsuitable extinguishing media	None known.

Specific hazards arising from the chemical	Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.
Hazardous thermal decomposition products	Decomposition products may include the following materials: carbon dioxide carbon monoxide halogenated compounds
Special protective actions for fire-fighters	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.
Special protective equipment for fire-fighters	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel	Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For emergency responders	If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Do not get in eyes or on skin or clothing. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Use only non-sparking tools. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Do not breathe gas. Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F). Store locked up. Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
vinyl chloride	**ACGIH TLV (United States, 3/2017).** TWA: 1 ppm 8 hours. **OSHA PEL (United States, 6/2016).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. **OSHA PEL 1989 (United States, 3/1989).** STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours.

Appropriate engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Section 8. Exposure controls/personal protection

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Gas. [COLORLESS GAS OR LIQUID (BELOW 7 F) WITH A PLEASANT ODOR AT HIGH CONCENTRATIONS. [NOTE: SHIPPED AS A LIQUEFIED COMPRESSED GAS.]

Color : Colorless.

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Melting point : -153.8°C (-244.8°F)

Boiling point : -13.4°C (7.9°F)

Critical temperature : 158.45°C (317.2°F)

Flash point : Closed cup: -78°C (-108.4°F)
Open cup: -78°C (-108.4°F)

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 3.8%
Upper: 29.3%

Section 9. Physical and chemical properties

Vapor pressure	: Not available.
Vapor density	: 2.2 (Air = 1)
Specific Volume (ft ^{3}/lb)	: 6.25
Gas Density (lb/ft ^{3})	: 0.16129 (21.1°C / 70 to °F)
Relative density	: Not applicable.
Solubility	: Not available.
Solubility in water	: 1.1 g/l
Partition coefficient: n-octanol/water	: 1.38
Auto-ignition temperature	: 472°C (881.6°F)
Decomposition temperature	: Not available.
Viscosity	: Not applicable.
Flow time (ISO 2431)	: Not available.
Molecular weight	: 62.5 g/mole
Aerosol product	
Heat of combustion	: -18924336 J/kg

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.
Incompatible materials	: Oxidizers
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Section 11. Toxicological information

Classification

Product/ingredient name	OSHA	IARC	NTP
vinyl chloride	+	1	Known to be a human carcinogen.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
vinyl chloride	Category 2	Not determined	liver

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : May cause damage to organs through prolonged or repeated exposure.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Section 11. Toxicological information

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
vinyl chloride	1.38	-	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Vinyl chloride; Ethene, chloro-	75-01-4	Listed	U043

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1086	UN1086	UN1086	UN1086	UN1086
UN proper shipping name	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED

Section 14. Transport information

Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Additional information

DOT Classification : **Reportable quantity** 1 lbs / 0.454 kg. Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.
Limited quantity Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: 150 kg.
Special provisions 21, B44, T50

TDG Classification : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
Explosive Limit and Limited Quantity Index 0.125
ERAP Index 3000
Passenger Carrying Road or Rail Index Forbidden

IATA : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: 150 kg.

Special precautions for user : **Transport within user’s premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 8(a) CDR Exempt/Partial exemption**: Not determined

Clean Water Act (CWA) 307: vinyl chloride

Clean Air Act (CAA) 112 regulated flammable substances: vinyl chloride

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

Section 15. Regulatory information

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	vinyl chloride	75-01-4	100
Supplier notification	vinyl chloride	75-01-4	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

⚠ **WARNING**: This product can expose you to Vinyl chloride, which is known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

Ingredient name	No significant risk level	Maximum acceptable dosage level
Vinyl chloride	Yes.	-

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS)**: This material is listed or exempted.
Japan inventory (ISHL): This material is listed or exempted.

Malaysia : This material is listed or exempted.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Taiwan : This material is listed or exempted.

Thailand : Not determined.

Turkey : This material is listed or exempted.

Section 15. Regulatory information

United States : This material is listed or exempted.

Viet Nam : Not determined.

Section 16. Other information

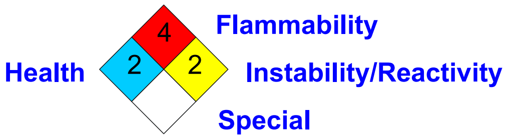
Hazardous Material Information System (U.S.A.)

Health	*	2
Flammability		4
Physical hazards		2

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

National Fire Protection Association (U.S.A.)



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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 1	Expert judgment
GASES UNDER PRESSURE - Liquefied gas	Expert judgment
CARCINOGENICITY - Category 1	Expert judgment
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (liver) - Category 2	Expert judgment

History

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Key to abbreviations :
ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

Section 16. Other information

References : Not available.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Appendix C

Subsurface Clearance Policy

AEI Consultants

June 2013
Revised July 2019

San Francisco HQ

Atlanta

Chicago

Costa Mesa

Dallas

Denver

Los Angeles

Miami

New York

Phoenix

Portland

San Jose

SUBSURFACE CLEARANCE POLICY

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National Presence
Regional Focus
Local Solutions

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AEI Consultants

1.0 INTRODUCTION

Underground utility identification and clearance is critical to every site on which AEI investigates, drills at, or does any underground excavating construction for these reasons:

1. Knowledge of underground line location is vital for safe operations.
2. Many states have laws that require all excavators, contractors, and other parties to notify utility companies before beginning excavation on public property.
3. The prior location of these lines by the utility companies and utility locating specifically reduces AEI's liability should lines be mis-located and damaged during drilling or excavation.

2.0 POLICY

All field staff are required to follow AEI's Subsurface Clearance Policy for drilling and excavating activities. AEI's policy for subsurface clearance is listed for different sites in the AEI Borehole Clearance Policy Chart (Table 1). The borehole clearance methods are detailed in Section 3.4. In addition, the following apply to drilling at all sites:

- Project Kick-Off Meeting (Section 3.1)
- Permits (if necessary), access agreements (if necessary), and notification (Section 3.2)
- Health and Safety Plan (Section 3.3)

Ultimately no subsurface excavations, drilling, trenching or other subsurface intrusive work should be undertaken by an AEI employee without **strict adherence** to this policy. Effectively, the employee managing the subsurface utility locates for a project must ensure that every effort has been made as specified in this protocol to locate and avoid utilities. If there is any remaining uncertainty regarding the utility locations the employee should not proceed with the work, and must then involve AEI's Site Mitigation Division Leader, AEI's Director of Risk Management and Corporate H&S Director to resolve the remaining uncertainties before work can commence.

2.1 Restricted Areas

Restricted areas are those areas where work would likely result in a utility strike and should be identified in the field by onsite field personal. In order to assist our staff, the below areas are included as restricted areas. Other restricted areas may exist in the field and field personal should discuss the field scenario with management. Borings are **NOT** to be advanced in these areas:

Specific to Underground Storage Tanks

- Within 10 feet from the top of an active underground storage tank (UST) or inactive UST > 2,000 gallons (Figure 1)
- Within 10 feet from the edge of a dispenser (Figure 1)
- Within 5 feet from the edge of a dispenser canopy (Figure 1)

- Between USTs and dispensers and/or 7 feet of the location of known or suspected product lines (Figure 1)
- Within 5 feet of the edge of any inactive UST of a capacity of < 2,000-gallons
- **Note that some petroleum companies may have their own safe distance guidelines, some of which may be more restrictive and must be followed. Please check prior to drilling.**

Other

- Within 6 feet of any high-pressure gas line, fiber optic cable, or water main
- Within 10 feet of overhead power lines (25kV and higher), or 5 feet for lower voltage lines (such as typical service lines to a building), unless appropriate line insulation wrapping has been installed by a utility or authorized private utility firm.
- Within 2 feet of any utility identified onsite except for landscape irrigation lines

2.2 Refusal Conditions During Hand Clearing

Hand clearing methods (e.g. hand augering) are detailed in Section 3.4.5. The following details the policy as it relates to hand clearing.

- Only a moderate amount of force should be used with hand clearing. Excessive force should not be used to advance a hand auger.
- If an obstruction is found, the boring and cuttings should be examined. Other tools may be used to break up an obstruction as long as that obstruction is determined to not be a potential utility. Signs of a potential utility include the presence of fill material (non-native material), utility tape, pea gravel.
- If an indication of a potential utility is present, then the boring location should be moved and direct clearing should be attempted again.
- If, after 3 tries, the boring cannot be cleared to a depth of at least 5 feet or to the depth of the deepest suspected utility, then the boring location should be reviewed by a senior professional. Only a senior professional may decide to drill without clearing the boring to a depth of at least 5 feet or to the depth of the deepest suspected utility.
- If an actual utility is identified in the hole, the procedure in Section 2.3 should be followed.

2.3 Encountering Utilities

If a utility is encountered either during clearing activities or during drilling, the following procedure should be following:

1. Immediately cease all drilling activities.
2. **If there is an immediate hazard, the area should be evacuated and the applicable emergency services listed in the Health and Safety Plan should be contacted.**
3. Immediately contact a project supervisor to notify them of the situation.
4. If there is no immediate hazard:
    - Attempt to identify the type of utility which was encountered.

  - Attempt to identify if the utility was just encountered or is actually damaged.
  - If the utility was encountered but not damaged, such as the uncovering of a utility during hand clearing, then the boring and utility location should be noted, marked on the ground with the appropriate color paint, and the boring should be backfilled. A new boring could then be attempted in an alternate location following the procedure in Section 3.0 if it can be safely sited.
  - If the utility was damaged or was potentially damaged, the boring location should be secured and the project supervisor should be consulted. Depending on the type of utility, further actions may include contacting the utility directly, uncovering the utility and subsequent repairs.

All utility strikes are to be reported immediately to the project supervisor, Director of Site Mitigation, the Director of Health and Safety (via **safetyfirst@aeiconsultants.com**), and the Regional Director of the State where the work is occurring. Failure to report utility damage will be considered a breach of professional conduct and may be subject to disciplinary action.

3.0 SUBSURFACE CLEARANCE

The purpose of this section is to provide guidance to protect underground facilities, owners of these facilities, the environment, and workers when conducting drilling or other below-ground exploration or invasive activities. Risks can be minimized though not eliminated when proper clearance procedures are followed. Underground facilities include, but are not limited to:

- Underground Utilities
  - Fiber Optic Lines
  - Storm Drains
  - Sanitary Sewer Lines
  - Electrical Lines
  - Natural Gas Lines
  - Landscape Irrigation Lines
  - Local Drainage Lines
  - Municipal or Private water lines
  - Facility process equipment/pipe runs
  - Manholes
- Overhead Utilities
  - Electrical Lines
  - Telephone Lines
- Underground Storage Tanks
  - Fuel (Gasoline, Diesel, Heating Oil) Tanks, Chemical Tanks
  - Waste Oil Tanks
  - Septic Tanks
  - Sumps, Clarifiers
- Underground vaults or other equipment

3.1 Project Kick-Off Meeting

At the inception of every project and prior to any fieldwork, a Project Kick-Off Meeting must be held and the Project Kick-Off Meeting (PKOM) checklist should be completed (Appendix A). During the meeting, the clearance of each boring location should be reviewed along with this policy.

3.2 Permits, Access, and Notification

- Proper drilling permits must be obtained prior to drilling from the local permitting agency, if applicable.
- Access must be obtained for the drilling locations and access agreements or permits may be needed depending on the site and the situation.
- The client and the onsite contact must be notified prior to any drilling activities.

3.3 Health and Safety Plan

Ensure that a site-specific Health and Safety Plan (HASP) is created and that the HASP is kept onsite at all times. The HASP should include contact numbers and a map to the nearest hospital. The HASP must also include the Job Safety Analysis (JSA) for Borehole Clearance and incident reporting forms. The HASP and JSA must be reviewed each day prior to the start of work in a "Tailgate" safety meeting.

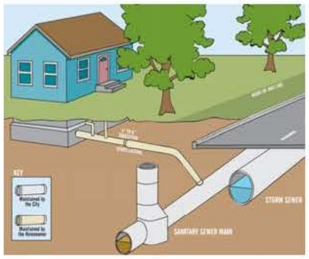
3.4 Borehole Clearance Methods

Some of the tasks involved in choosing the locations of borings can take place in the office. It is important to gather all the relevant information about each site to assist in identifying hazards. It should be noted that multiple lines of evidence are required to properly clear boreholes and that none of the individual pieces of information below constitute clearance.

3.4.1 Visual Check for Utilities

Minimizing the risk for striking an underground utility involves not only utilizing appropriate equipment, but also evaluating site-specific lines of evidence. Visible lines of evidence of a potential utility can include poles, ground surface depressions, enclosures, pedestals (including new cables found within the pedestals), valves, meters, cleanouts/risers, and manholes. A visual check for utilities should always be conducted, particularly where utilities deeper than five (5) feet or non-metallic construction (i.e., vitrified clay or PVC sewage drain pipe) are suspected.

Many utilities can be identified by observing the features on the site. Many utilities have a surface feature such as a manhole, utility box, spigot, or even a sign. Basements of on-site buildings should be inspected for sewer lines, water lines, or conduits penetrating the walls to evaluate potential the depth and alignment of exterior piping runs. Trenches may be identified by observing the cut lines in concrete. Other trenches may be identified by linear depression in asphalt. Overhead utilities may be identified through a visual inspection. Equipment including drilling rigs, excavators, and other equipment must be considered in relation to the overhead utilities. Drillers will not drill in close proximity to overhead lines.



3.4.2 Public Utility Notification

Public utility notification is required for all subsurface investigations. As such:

- If required, perform a field visit and perform a mark-out of the area using white paint prior to calling the public utility notification service (may be required in some states).
- Contact the local public utility notification service and notify them of the planned work. These agencies go under different names in different states (811, DigSafe, One-Call, Underground Services Alert, etc.). This process usually takes 48 to 72 hours.
- Be prepared to give the service the name and address of the site; the nearest cross-street; and the date of the intended excavation and/or drilling.
- The service will furnish you with a reference number for the project. Record this number and the expiration date for future referral on the PKOM form.
- Ask and record the list of companies notified by the service for your project. Note that you may need to call the local municipality to have them mark the water and sewer lines.

The American Public Works Association (APWA) Uniform Color Codes for temporary marking of underground utilities are listed below:

COLOR		**UTILITY**
⬜	White	Proposed Excavation
🟥	Red	Electric Power Lines, Cables, Conduit and Lighting Cables
🟧	Orange	Communication, Alarm or Signal Lines, Cables Or Conduit
🟪	Purple	Reclaimed Water, Irrigation and Slurry Lines
▨	Pink	Temporary Survey Markings
🟨	Yellow	Gas, Oil, Steam Petroleum or Gaseous Materials
🟦	Blue	Potable Water
🟩	Green	Sewers and Drain Lines

3.4.3 Review of Utility Maps

If work is to be performed in the public right-of-way such as a street, then maps should be obtained of the utilities in the street from the local Public Works Department. These maps may include:

- Maps of the sewer system.
- Maps of the storm water system.
- Maps of the public water system (if owned by the City).

If work is to be performed on private properties, then attempts should be made to obtain maps or information of the onsite utilities. It is helpful to interview individuals who may have historical information. Private utility information may be obtained from the client, the property owner, the property manager, or the building engineer. The type of information which may be obtained includes:

- Maps and figures showing underground and aboveground equipment, piping, utilities and/or any surface or subsurface hazards,
- Historic site information (maps, photos, files),
- Site as-built drawings,
- Easement maps,
- Historic plot plans,
- Previous site investigations,
- Fire insurance plans,
- Tank dip charts, and
- Elevations and coordinates maps.

3.4.4 Private Utility Locating

Typically, public utility agencies will not mark out utilities on private property. As such, an independent utility locating company is recommended to locate utilities onsite. As described in Section 3.4.5 below, AEI personnel may use portable concrete scanning equipment per manufacturer instructions for limited clearing of potential utilities embedded in slabs. No single utility location instrument can detect all types of utilities, and an experienced independent utility locating company employs a variety of instruments for this purpose. AEI personnel should be onsite with the independent utility locating company in order to ensure that the locations to be cleared are properly located. The following are some of the methodologies associated with locating utilities onsite:

Ground Penetrating Radar
Ground penetrating radar (GPR) is used for investigating features such as buried drums, tanks, pipes, or other metallic objects. Locating rebar in concrete or detection of voids beneath concrete

or asphalt is also a popular GPR application. GPR operates on the principle that electromagnetic waves emitted from a transmitter antenna are reflected from buried objects having different electrical properties than the host material. The signals detected at the receiver antenna are recorded and provide a detailed cross section of the subsurface that is similar in appearance to a seismic reflection record. The depth of penetration of the radar pulse is controlled by site conditions and the frequency of the antenna chosen.

For utility locating, depth is usually limited to 10 feet or less to ensure safe drilling operation. Transducers exist that can penetrate to greater depths, but these use a lower frequency. Lower frequency means lower resolution, and narrow objects like utilities cannot be seen. Some things to consider when evaluating GPR:

- Closely spaced survey lines are required to locate small objects,
- A relatively smooth surface is also necessary, and
- GPR is not as effective where the ground surface is paved with highly reinforced concrete due to interference from the presence of the metal rebar.
- Interference is also prevalent if surface structures are immediately adjacent to the area.

Ground Penetrating Radar

Pipe Tracing

A pipe and cable locator and tracer can be used to detect and trace metallic utilities, utility tracing wires, or warning tapes. In pipe and cable tracing mode, the transmitter can be coupled by direct contact (conductively) to exposed portions of a metallic pipe, cable, or wire; or by simple proximity (inductively) to a subsurface metallic utility with known location and orientation. The transmitter remains stationary and energizes or excites the metallic utility to be traced with a signal that can be traced at the ground surface using the mobile receiver wand or probe.

To use the transmitter in the most effective manner, all metallic pipes to be traced must be available for connection directly to the transmitter. The inductive mode is not as effective. Also, the detection is limited to metallic objects and is not useful for plastic, ceramic, or fiberglass utilities.

Pipe Tracing

Metal Detector

A deep focused metal detector acts as a pipe and cable locator and tracer to detect and trace metallic utilities, utility tracing wires, or warning tapes. In pipe and cable search mode, the instrument is essentially a deep-sensing metal detector that detects any highly electrically conductive material (metals) by creating an electromagnetic field with a transmitting coil. A receiving coil at a fixed separation from the transmitter measures the field strength. As the instrument is swept along the ground surface, subsurface metallic bodies distort the transmitted field. The change in field strength or orientation is sensed by the receiver and triggers an audible alarm and deflection of an analog meter. The instrument can nominally detect a 2-inch metal pipe to a depth of 8 feet and a 10-inch metal pipe to a depth of 14 feet. This technique's effectiveness is limited to metallic objects. It is not useful for plastic, ceramic, or fiberglass utilities.

Metal Detector

Electromagnetic Tracing

The electromagnetic technique locates buried materials having a high conductance. This method is commonly used to locate underground storage tanks (UST), buried manhole covers or any subsurface objects with a large ferrous metal content.

Alternating electromagnetic waves generated at the surface are induced into the ground during the survey. When the waves pass through a conducting body, they induce an alternating electrical current in the conductive materials. These currents become the source of secondary magnetic fields, which can be detected at the surface. The strength of the field is directly proportional to the average conductivity of the subsurface materials. Limitations of this technique that can adversely affect the electromagnetic measurements include power lines and metal debris.

Electromagnetic Tracing

Vibrocator

Vibrocators are used to detect and trace fluid-filled, non-metallic utilities (for example, PVC or concrete water lines). A vibrocator system involves a low-frequency pressure wave generator (called a transonde), which is attached to a faucet, hydrant, or other available fitting. The transonde produces a continuous vibration or throbbing in the pipe. This vibration can be detected at the ground surface with a sensitive geophone or ground motion detector tuned to the transonde-generated frequency. There are two limitations of this technology. One is that all non-metallic pipes to be traced must be available for connection directly to the transmitter. The second is that excessive energy imparted to the pipe may cause damage to the pipe.

Vibrocator

The current technology cannot assure a 100% detection of every underground utility lines and pipes. No matter who or what method is used to locate underground utilities, never take their exact location for granted.

3.4.5 Concrete Scanning

For projects that entail drilling through concrete slabs for the purpose of installing sub-slab vapor probes or hand clearing/sampling soil underlying the slab, a portable ground-penetrating radar may be used to evaluate potential utilities, rebar, etc., embedded in the concrete. A GSSI StructureScan™ Mini HR all-in-one high-resolution ground penetrating radar unit (and other equivalent devices) is designed for this purpose. This portable device is able to locate ferrous and non-ferrous targets (rebar, stainless steel, plastic conduit) in real-time. If anomalies are identified at a proposed drilling location, additional scanning should be performed in proximity to the proposed vapor location in an attempt to identify a location free of targets. If an area in the slab cannot be found that is free of targets, then the drilling work cannot not continue. Concrete scanners must be operated in accordance with manufacturer's instructions, and cannot not be used as a substitute for private utility locate contractors for evaluating exterior utilities, USTs, etc.

3.4.6 Direct Clearing Options

Hand Clearing

Hand clearance involves the actual removal of soil from the ground and **is required along with geophysical survey at certain Sites (i.e., active gasoline stations), as presented on Table 1**. At other sites, hand clearing or geophysical methods, in conjunction with evaluating other lines of evidence, as described above, is appropriate for clearing subsurface utilities. Prior to drilling, borings which are planned to a depth of five (5) feet or more must be evaluated for potential utilities as described above in Section 3.4.4, and directly cleared to a depth of at least five (5) feet. For borings planned to a depth of less than 5 feet, the borings should be cleared to their total depth. Borings should be directly cleared to a diameter which is as wide as the widest tool to be placed in the boring (e.g. borings to be drilled with 8-inch augers should be cleared to 8-inches in diameter).

Hand augering involves the advancement of a hand-driven auger tool into the ground. The hand auger includes different bits which can be used depending on the type of soil such as sand or clay. Hand augering is typically used to create holes which are between 2 and 4 inches in diameter and these holes are then typically used to advance direct-push drilling equipment.

The hand auger tool should be advanced into the subsurface by using even downward and twisting pressure. Hand augering works best in moderately consolidated soils without large gravels.

Only a moderate amount of force should be used. Excessive force should not be used to advance a hand auger.

Vacuum Clearing

Vacuum clearance technology uses compressed air to break soil structure and allow for removal of the soil. Both dry and wet applications of these technologies can be performed. Both methods have inherent problems associated with compromising the borehole for collection of environmental samples. Typically, dry air knifing and vacuum extraction are preferred where soil samples must be collected in the top 5 feet of profile. Water jetting or wet vacuuming may also compromise future collection of groundwater samples, so is usually selected for boreholes advanced for remediation wells only. Vacuum clearance is recommended at all active gasoline service stations.

4.0 GASOLINE SERVICE STATIONS

Drilling activities at gasoline service stations are of particular importance to borehole clearance. The locations of underground features such as utilities and underground storage tanks may not be obvious from a quick look at a station. An outline of a typical gas station is provided as Figure 1 and photos of the underground features are provided in Appendix B.

AEI requires that both private utility clearance and hand clearing be performed prior to any projects involving gasoline service stations. The use of vacuum clearance is recommended at all active gasoline service stations and can be utilized instead of hand clearing. *Note that petroleum companies may have specific policies regarding drilling activities at service stations that may be more stringent than those presented herein*. Obtain the proper information prior to drilling.

5.0 EXCAVATIONS AND TRENCHES

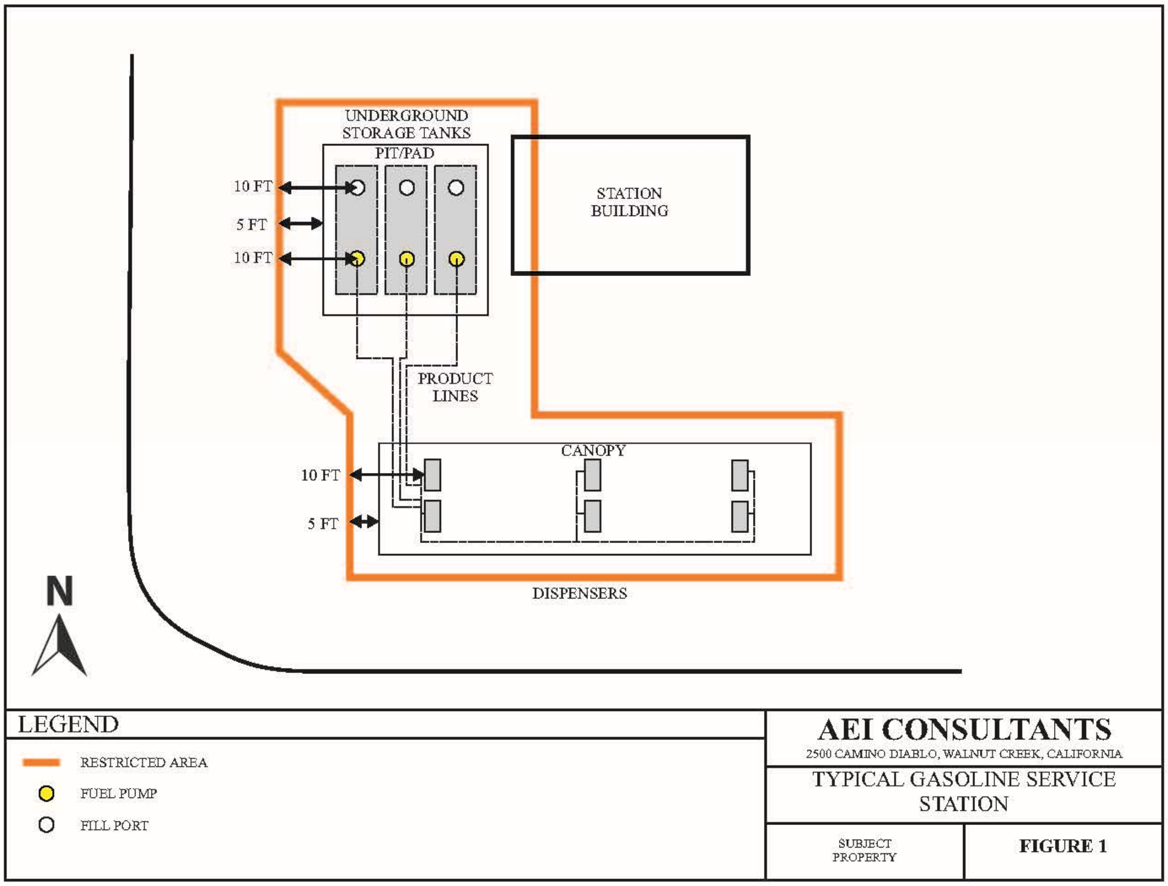
Clearance methods for excavations and trenches are similar to those for boreholes as detailed in Section 3.0. Clearance for excavations and trenches must be planned on a case-by case basis. Utilities which run through an excavation must be identified and deactivated prior to the excavation. Hand clearing using hand tools is required to expose any potential utilities within an excavation.

6.0 LEGAL ASPECTS

29 CFR1926.651(b)(1) requires that "the estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation."

29 CFR1926.651(b)(2) requires that utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided that the employer does so with caution, and provided that detection equipment or other acceptable means to locate utility installations are used.

FIGURE


UNDERGROUND
STORAGE TANKS
PIT/PAD
10 FT
5 FT
10 FT
STATION
BUILDING
PRODUCT
LINES
CANOPY
10 FT
5 FT
DISPENSERS
N
LEGEND
RESTRICTED AREA
FUEL PUMP
FILL PORT
AEI CONSULTANTS
2500 CAMINO DIABLO, WALNUT CREEK, CALIFORNIA
TYPICAL GASOLINE SERVICE STATION
SUBJECT PROPERTY
FIGURE 1

TABLE

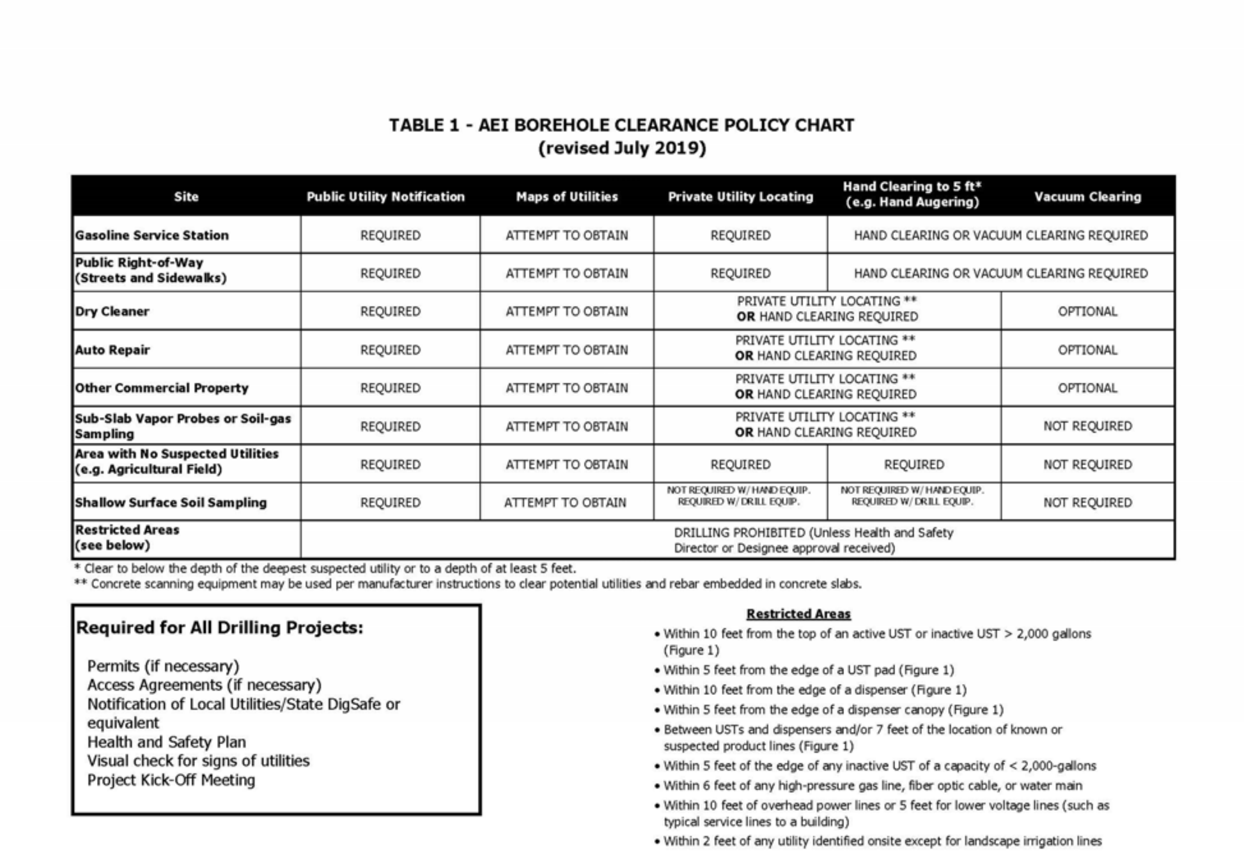


TABLE 1 - AEI BOREHOLE CLEARANCE POLICY CHART
(revised July 2019)

Site	Public Utility Notification	Maps of Utilities	Private Utility Locating	Hand Clearing to 5 ft* (e.g. Hand Augering)	Vacuum Clearing
Gasoline Service Station	REQUIRED	ATTEMPT TO OBTAIN	REQUIRED	HAND CLEARING OR VACUUM CLEARING REQUIRED	
Public Right-of-Way (Streets and Sidewalks)	REQUIRED	ATTEMPT TO OBTAIN	REQUIRED	HAND CLEARING OR VACUUM CLEARING REQUIRED	
Dry Cleaner	REQUIRED	ATTEMPT TO OBTAIN	PRIVATE UTILITY LOCATING ** **OR** HAND CLEARING REQUIRED		OPTIONAL
Auto Repair	REQUIRED	ATTEMPT TO OBTAIN	PRIVATE UTILITY LOCATING ** **OR** HAND CLEARING REQUIRED		OPTIONAL
Other Commercial Property	REQUIRED	ATTEMPT TO OBTAIN	PRIVATE UTILITY LOCATING ** **OR** HAND CLEARING REQUIRED		OPTIONAL
Sub-Slab Vapor Probes or Soil-gas Sampling	REQUIRED	ATTEMPT TO OBTAIN	PRIVATE UTILITY LOCATING ** **OR** HAND CLEARING REQUIRED		NOT REQUIRED
Area with No Suspected Utilities (e.g. Agricultural Field)	REQUIRED	ATTEMPT TO OBTAIN	REQUIRED	REQUIRED	NOT REQUIRED
Shallow Surface Soil Sampling	REQUIRED	ATTEMPT TO OBTAIN	NOT REQUIRED W/ HAND EQUIP. REQUIRED W/ DRILL EQUIP.	NOT REQUIRED W/ HAND EQUIP. REQUIRED W/ DRILL EQUIP.	NOT REQUIRED
Restricted Areas (see below)	DRILLING PROHIBITED (Unless Health and Safety Director or Designee approval received)				

* Clear to below the depth of the deepest suspected utility or to a depth of at least 5 feet.
** Concrete scanning equipment may be used per manufacturer instructions to clear potential utilities and rebar embedded in concrete slabs.

Required for All Drilling Projects:

Permits (if necessary)
Access Agreements (if necessary)
Notification of Local Utilities/State DigSafe or equivalent
Health and Safety Plan
Visual check for signs of utilities
Project Kick-Off Meeting

Restricted Areas

- Within 10 feet from the top of an active UST or inactive UST > 2,000 gallons (Figure 1)
- Within 5 feet from the edge of a UST pad (Figure 1)
- Within 10 feet from the edge of a dispenser (Figure 1)
- Within 5 feet from the edge of a dispenser canopy (Figure 1)
- Between USTs and dispensers and/or 7 feet of the location of known or suspected product lines (Figure 1)
- Within 5 feet of the edge of any inactive UST of a capacity of < 2,000-gallons
- Within 6 feet of any high-pressure gas line, fiber optic cable, or water main
- Within 10 feet of overhead power lines or 5 feet for lower voltage lines (such as typical service lines to a building)
- Within 2 feet of any utility identified onsite except for landscape irrigation lines

APPENDIX A

Phase II Project Kick-off Meeting (P-KOM) Checklist

To be conducted in person and/or via telephone within 24 hours of project award.

Project Number: ___________
Client: ___________
Due Date: ___________
P-KOM Meeting Date / Time ____ / ______

Attendees:
Project Manager: __________
Sr. PM/ Register Professional: __________
Others: __________
____

Who initiated the project and who will perform this investigation? (Attendees)

- ☐ Who is the sales person / account manager? ________
- ☐ Who is the project manager? ________
- ☐ Who will perform the fieldwork? ________
- ☐ Who prepared the 1) scope of work 2) proposal, 3) cost estimates? ________
- ☐ Who is/are the senior author(s) [SA1, SA2, Registered Professional]? ________

Why are we performing this investigation?

- ☐ Are we working for the buyer, the seller, dept/equity, or the current property owner?
- ☐ Is the refinance, new loan, foreclosure, development, etc.?
- ☐ Is the site an active open environmental case?
- ☐ Who are the other interested parties?
- ☐ What are the client-specific requirements?
- ☐ What are the reporting requirements? Is the client aware?

What is/are the issue(s) we are investigating?

- ☐ What is the site history?
- ☐ How did we get to this point?

How will we perform this investigation?

- ☐ Are we performing a geophysical survey?
- ☐ Are we collecting samples? If so, at what depths and where?
- ☐ Are we performing a file review/peer review?
- ☐ Are permits required? Do we need an inspector?
- ☐ How will we perform utility clearance?
- ☐ What are the main health and safety issues?
- ☐ HSP Prepared?

Where is the site located?

- ☐ How far is it from the office?

- ☐ How do we obtain access for the site?
- ☐ Should site personnel be contacted immediately?
- ☐ Are there limitations for the site or for the investigation locations?

When must the project be complete?

- ☐ When is the client expecting data? Updates? Client communications expectations and who is responsible [__________ is responsible for direct client communications]
- ☐ When should the fieldwork be completed?
- ☐ When must the samples be turned in? Will we need to expedite the samples?
- ☐ When is the report due?
- ☐ When will we invoice the project? At the beginning, middle, or the end?

BOREHOLE CLEARANCE

LOCATION	Public Utility Notification	Maps of Utilities	Private Utility Locating	Hand Clearing to 5 ft (e.g. Hand Augering)	Vacuum Clearing

APPENDIX B

1. Construction of a gasoline service station showing the Underground Storage Tanks and product lines

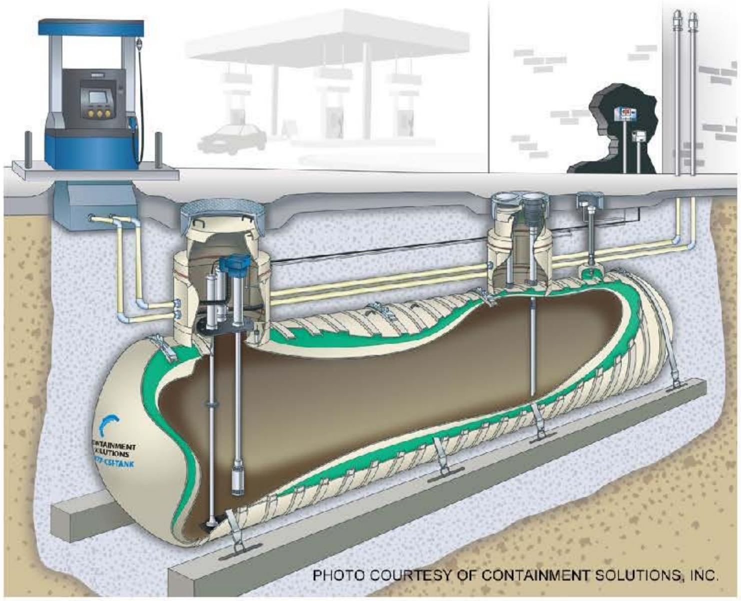


PHOTO COURTESY OF CONTAINMENT SOLUTIONS, INC.

2. Diagram of an Underground Storage Tank

Appendix D

Injury, Illness and Near Miss Reporting Procedure

MEMORANDUM

TO: All AEI Staff

FROM: Kathleen Baxter, Interim Director of Health and Safety
Holly Neber, CEO

SUBJECT: **Injury, Illness and Near Miss Reporting Procedure**

DATE ISSUED: June 21, 2017

In an effort to continue to update our employees, AEI is providing this memorandum to all employees to help direct them on injuries, or other near miss incidents. This memorandum should help clarify and outline the steps consistent with our Corporate Health and Safety Manual for reporting an injury, illness or near miss.

1. In the event that you sustain an injury on a project site, please seek immediate and proper attention to the injury or illness. For emergencies dial 911. AEI personnel must seek medical attention for serious injuries.

2. AEI Personnel **must** immediately report all work-related injuries and illnesses and near miss incidents to their supervisor/manager.

3. The supervisor or manager must report the incident to the Corporate Health and Safety Director,Human Resources Representative, Craig Hertz, and Holly Neber immediately via email (safetyfirst@aeiconsultants.com). These representatives can help answer any questions.

4. The injured person must fill out the **Employee's Report of Injury Form.**

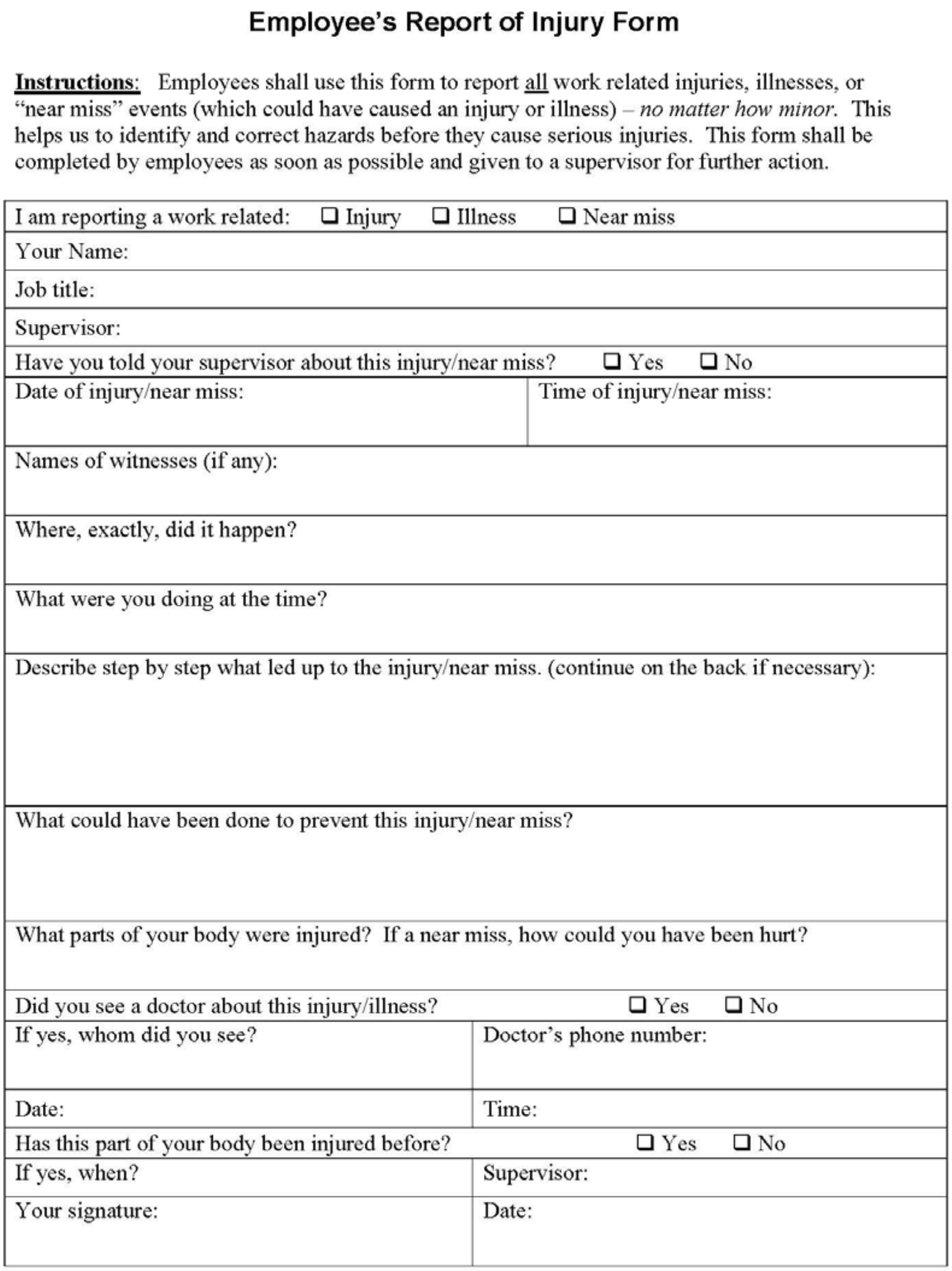
5. The supervisor/manager must fill out **IIPP FORM 3: Incident Investigation Report.**

6. If applicable, the following forms must also be completed: **IIPP FORM 1: Report of Unsafe Condition or Hazard and IIPP FORM 2: Hazard Correction Report.** If these forms are not applicable, then it must be indicated on Form 3.

7. Should an injury or illness require medical attention, required forms must be submitted to Human Resources Representative, who will complete the required forms for Workers Compensation. Our Workers Compensation provider is The Hartford.

8. A copy of all forms must be returned to the Corporate Health and Safety Director and Human Resources Representative (safetyfirst@aeiconsultants.com) on the first full day back to work from the injury.

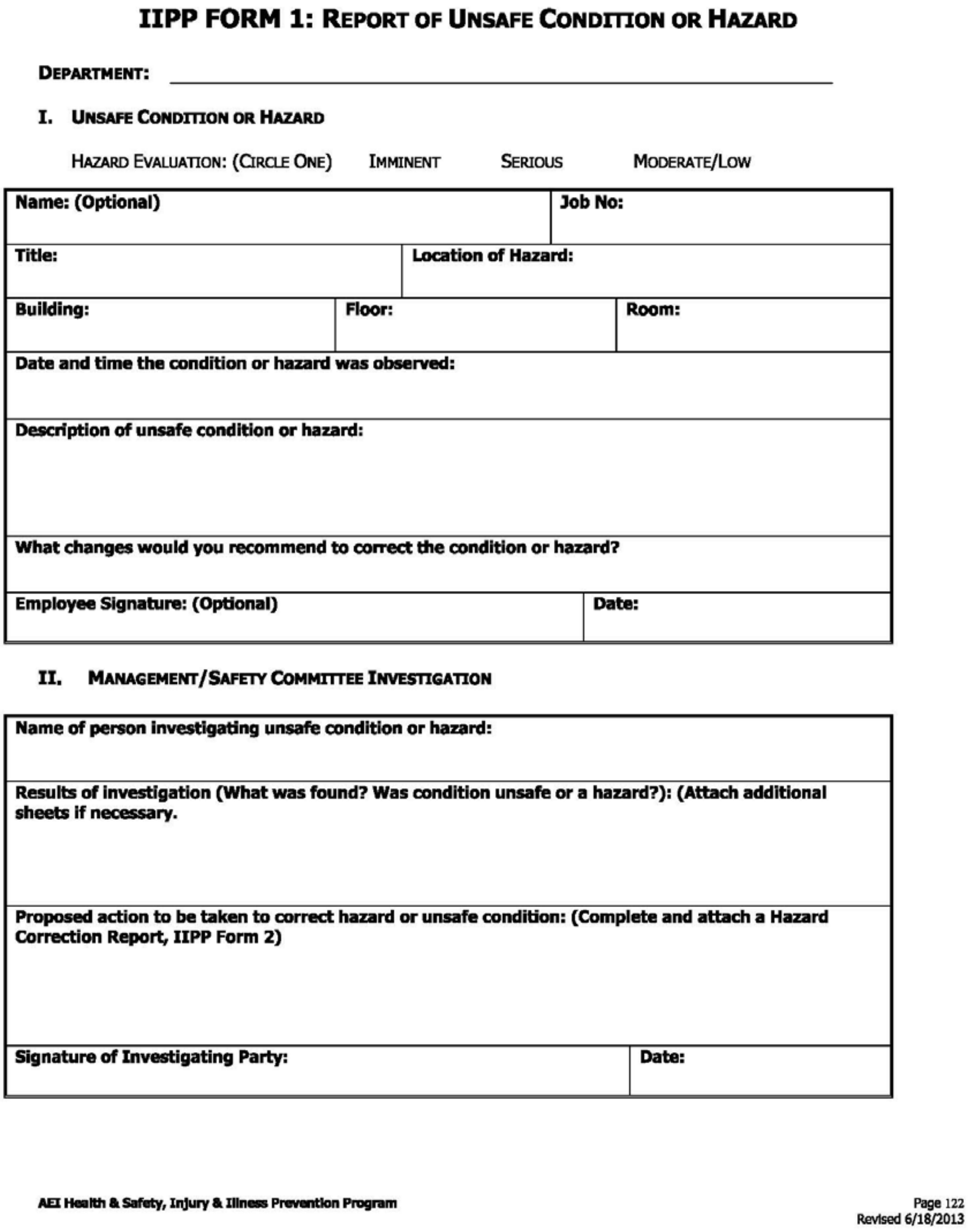
Attached to this memorandum are key personnel and contact numbers, and the three Injury and Illness Prevention Program (IIPP) forms. A copy of the Safety Manual and Injury and Illness Prevention Program can be found on the P:drive (Operations/Health and Safety/Safety Manual and IIPP), along with the forms described herein.



Employee's Report of Injury Form

<u>Instructions</u>: Employees shall use this form to report <u>all</u> work related injuries, illnesses, or "near miss" events (which could have caused an injury or illness) – *no matter how minor*. This helps us to identify and correct hazards before they cause serious injuries. This form shall be completed by employees as soon as possible and given to a supervisor for further action.

I am reporting a work related: ☐ Injury ☐ Illness ☐ Near miss	
Your Name:	
Job title:	
Supervisor:	
Have you told your supervisor about this injury/near miss? ☐ Yes ☐ No	
Date of injury/near miss:	Time of injury/near miss:
Names of witnesses (if any):	
Where, exactly, did it happen?	
What were you doing at the time?	
Describe step by step what led up to the injury/near miss. (continue on the back if necessary):	
What could have been done to prevent this injury/near miss?	
What parts of your body were injured? If a near miss, how could you have been hurt?	
Did you see a doctor about this injury/illness? ☐ Yes ☐ No	
If yes, whom did you see?	Doctor's phone number:
Date:	Time:
Has this part of your body been injured before? ☐ Yes ☐ No	
If yes, when?	Supervisor:
Your signature:	Date:



IIPP FORM 1: REPORT OF UNSAFE CONDITION OR HAZARD

DEPARTMENT: ____

I. UNSAFE CONDITION OR HAZARD

HAZARD EVALUATION: (CIRCLE ONE) IMMINENT SERIOUS MODERATE/LOW

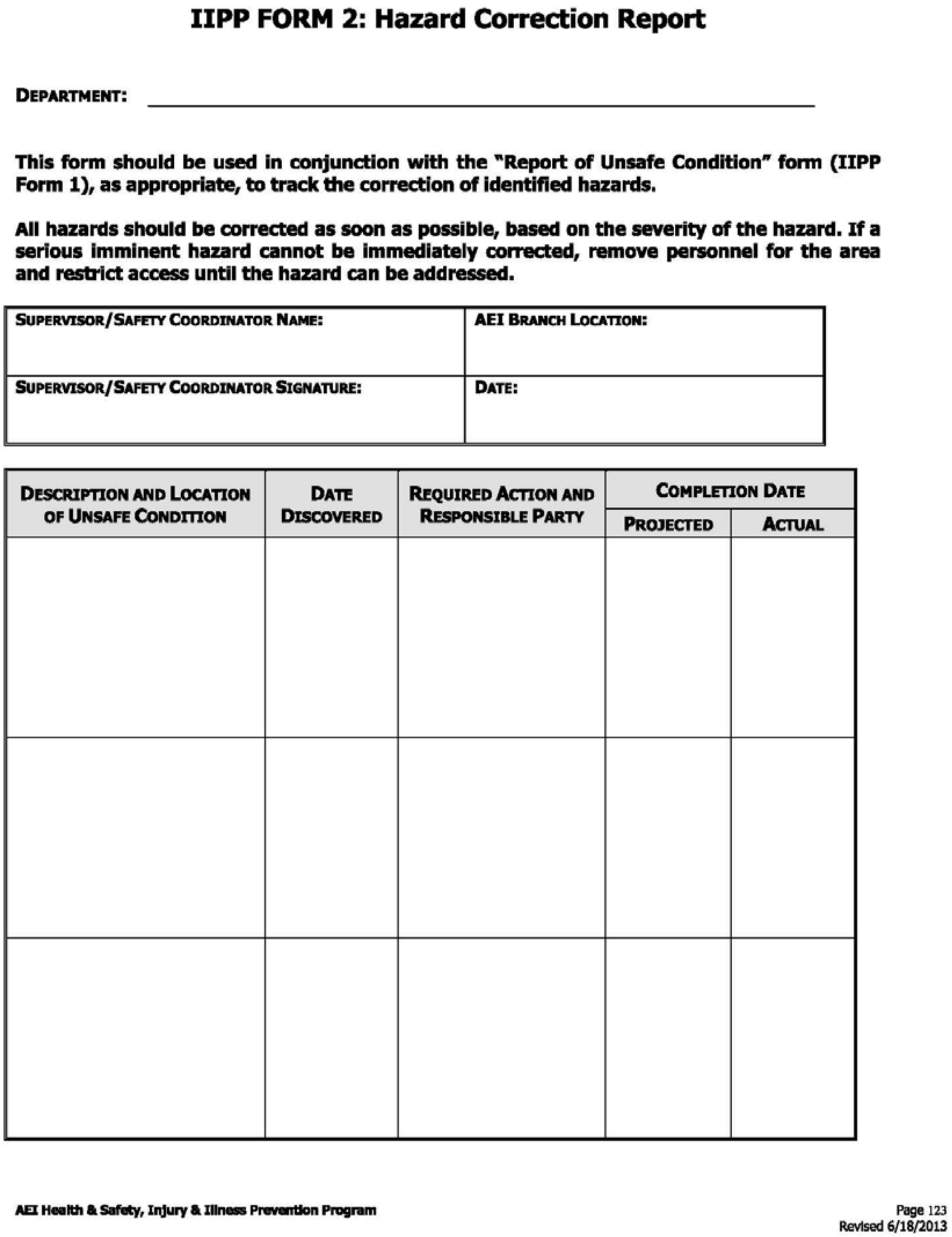
Name: (Optional)		**Job No:**
Title:	**Location of Hazard:**	
Building:	**Floor:**	**Room:**
Date and time the condition or hazard was observed:		
Description of unsafe condition or hazard:		
What changes would you recommend to correct the condition or hazard?		
Employee Signature: (Optional)		**Date:**

II. MANAGEMENT/SAFETY COMMITTEE INVESTIGATION

Name of person investigating unsafe condition or hazard:	
Results of investigation (What was found? Was condition unsafe or a hazard?): (Attach additional sheets if necessary.	
Proposed action to be taken to correct hazard or unsafe condition: (Complete and attach a Hazard Correction Report, IIPP Form 2)	
Signature of Investigating Party:	**Date:**

AEI Health & Safety, Injury & Illness Prevention Program

Page 122
Revised 6/18/2013



IIPP FORM 2: Hazard Correction Report

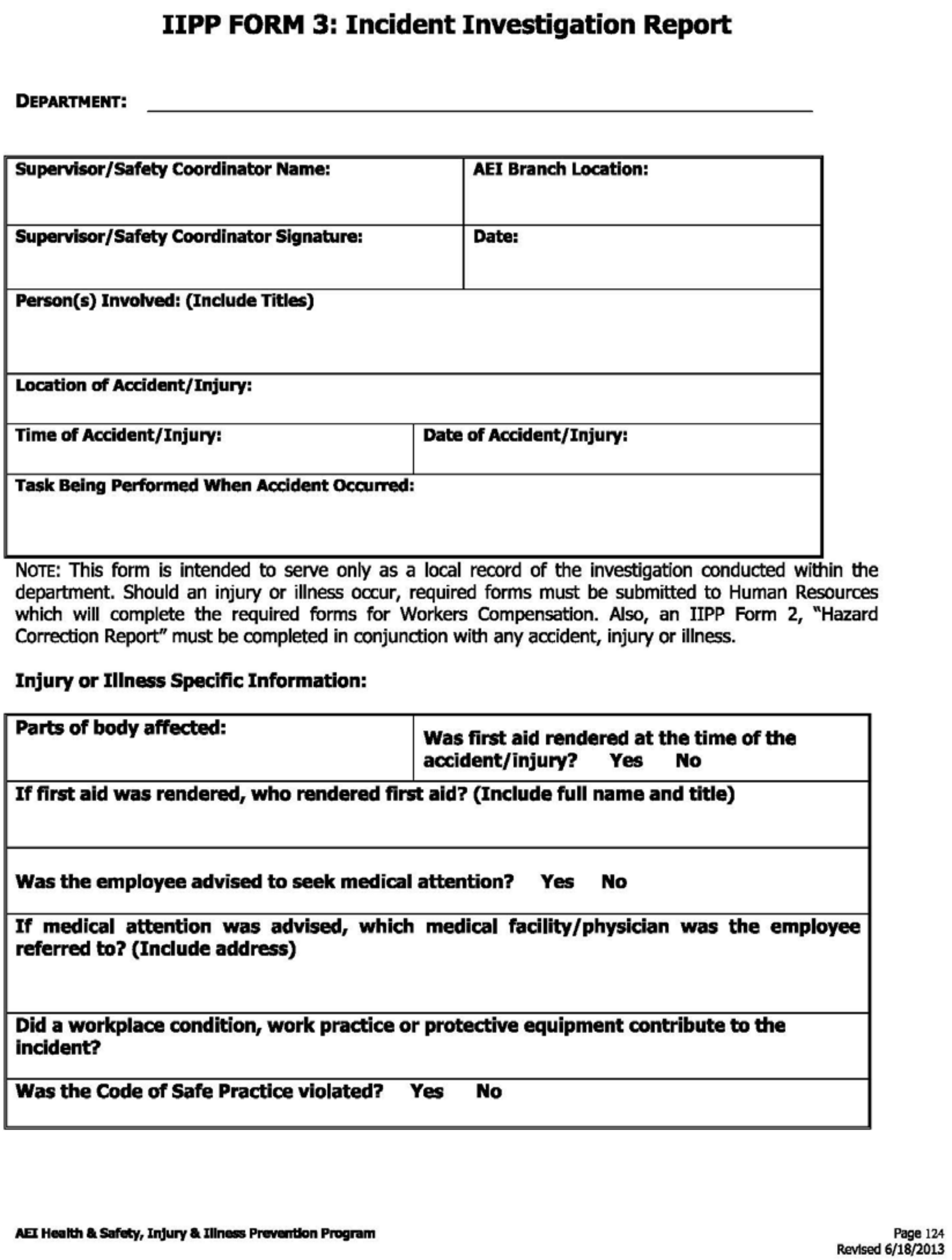
DEPARTMENT: ______________________________

This form should be used in conjunction with the "Report of Unsafe Condition" form (IIPP Form 1), as appropriate, to track the correction of identified hazards.

All hazards should be corrected as soon as possible, based on the severity of the hazard. If a serious imminent hazard cannot be immediately corrected, remove personnel for the area and restrict access until the hazard can be addressed.

SUPERVISOR/SAFETY COORDINATOR NAME:	**AEI BRANCH LOCATION:**
SUPERVISOR/SAFETY COORDINATOR SIGNATURE:	**DATE:**

DESCRIPTION AND LOCATION OF UNSAFE CONDITION	DATE DISCOVERED	REQUIRED ACTION AND RESPONSIBLE PARTY	COMPLETION DATE	
			PROJECTED	ACTUAL



IIPP FORM 3: Incident Investigation Report

DEPARTMENT: ______________________________

Supervisor/Safety Coordinator Name:	**AEI Branch Location:**
Supervisor/Safety Coordinator Signature:	**Date:**
Person(s) Involved: (Include Titles)	
Location of Accident/Injury:	
Time of Accident/Injury:	**Date of Accident/Injury:**
Task Being Performed When Accident Occurred:	

NOTE: This form is intended to serve only as a local record of the investigation conducted within the department. Should an injury or illness occur, required forms must be submitted to Human Resources which will complete the required forms for Workers Compensation. Also, an IIPP Form 2, "Hazard Correction Report" must be completed in conjunction with any accident, injury or illness.

Injury or Illness Specific Information:

Parts of body affected:	**Was first aid rendered at the time of the accident/injury? Yes No**
If first aid was rendered, who rendered first aid? (Include full name and title)	
Was the employee advised to seek medical attention? Yes No	
If medical attention was advised, which medical facility/physician was the employee referred to? (Include address)	
Did a workplace condition, work practice or protective equipment contribute to the incident?	
Was the Code of Safe Practice violated? Yes No	

Will an additional Code of Safe Practice be needed? Yes No **If so, state it:**
Has IIPP Form 1 been completed: Yes No **Has IIPP Form 2 been completed: Yes No**
If No, why were IIPP Form 1 and 2 not completed:
Solution to avoid future incidents:

Appendix E

COVID-19 Precautions

AEI Consultants

Updated October 2020

COVID-19 Precautions
for Site Inspections & Field Activity

Protecting the health of our staff and clients, their families, and that of our community is our primary concern. We are committed to doing our part to slow the spread of the virus through modifications to our business operations.

SITE INSPECTIONS/FIELD ACTIVITY PRECAUTIONS: Utilize social distancing and hygiene protocols.

- Prior to going to the site, review the **COVID-19 Daily Self Checklist** (attached). If you reply YES to any of the questions, STAY HOME. Call your manager so that the client can be informed.
- Review the **Screening Questions Checklist** (attached) with your site contact, prior to starting work. If the site contact replies YES to any of the questions, do not proceed and call your manager to determine how to proceed.
- A mask must be worn at all times when onsite.
- Maintain a distance of 6 feet between you and site contact, and anyone else onsite.
- Bring hand sanitizer to site inspections and be cautious of what you touch. If you wear gloves or not, be sure to sanitize your field tools (i.e., pens, clipboards, etc.) after use before leaving the site. Remember it's not just your health, but the health of the people who remain in the building after you have toured the site.
- Make sure the site contact is aware that you are wearing PPE (personal protective equipment; masks and gloves) for precautionary measures only and is not indicative that you are ill.
- Do not enter overcrowded spaces.
- Wash your hands often, with soap and water, particularly before and after inspections.
- Use hand sanitizer or no-rinse cleansing foams when soap and water are not available.
- Avoid touching your eyes, nose and mouth (wearing disposable gloves is a tactile and visual reminder to avoid touching your face).
- Shoe coverings are generally not necessary; however, if entering residential units, consider sanitizing the bottom of your shoes between units.

TRAVELING FOR SITE WORK:

- Review latest information on COVID-19 cases and trends. https://coronavirus.jhu.edu/us-map, allows you to look at data for states and counties.
- Wash hands regularly and stay at least 6 feet away from people, particularly those who are coughing or sneezing. Sanitize frequently.
- Wear a mask in public settings where social distancing is not possible to maintain. Compliance with local/requirements.
- Comply with instructions from local authorities where you are traveling. Comply with any local restrictions on travel, movement or large gatherings.

COVID-19 Daily Self Checklist

AEI
Consultants

COVID-19 DAILY SELF CHECKLIST

Review this COVID-19 Daily Self Checklist **each day before reporting to work (office or field).**

If you reply YES to any of the questions below, STAY HOME and follow the steps below:

- Call your manager and, if you have a site visit/field work call your manager and
- Email safetyfirst@aeiconsultants.com

If you start feeling sick during the workday, follow the steps above.

Do you have a fever (temperature over 100.4°F) without having taken any fever reducing medications?

☐ Yes ☐ No

Do you have any of the following symptoms:

Cough?
☐ Yes
☐ No

Shortness of Breath?
☐ Yes
☐ No

Chills?
☐ Yes
☐ No

Muscle Pain?
☐ Yes
☐ No

Sore Throat?
☐ Yes
☐ No

New loss of taste/smell?
☐ Yes
☐ No

Have you experienced any gastrointestinal symptoms such as nausea, vomiting, or diarrhea?

☐ Yes ☐ No

Have you, or anyone you have been in close contact with been diagnosed with COVID-19, or been placed on quarantine for possible contact with COVID-19?

☐ Yes ☐ No

Have you been asked to self-isolate or quarantine by a medical professional or a local public health official?

☐ Yes ☐ No

Screening Questions Checklist

AEI
Consultants

Screening Questions Prior to Entering Facilities Checklist

Review these Screening Questions **prior to entering a facility.**

If the site contact replies YES to any of the questions below, DO NOT ENTER and follow the steps below:

- Call your manager and, if you have a site visit/field work call the client relationship manager and
- Email safetyfirst@aeiconsultants.com

Additional information will be required prior to proceeding and will be determined in the call to those above.

Do you have a fever (temperature over 100.4ºF) without having taken any fever reducing medications?

☐ Yes ☐ No

Have you, or someone that you had close contact with, experienced any of following symptoms in the last 14 days:

Cough?
Muscle Pain?
Gastrointestinal symptoms such as nausea, vomiting, or diarrhea?
Shortness of Breath?
Sore Throat?
Chills?
New loss of taste/smell?

Have you been in close contact with someone who has been diagnosed with COVID-19, or been placed on quarantine for possible contact with COVID-19 within the past 14 days?

☐ Yes ☐ No

Have you been asked to self-isolate or quarantine by a medical professional or a local public health official?

☐ Yes ☐ No

Have you traveled outside the US or to any areas within the US with current travel advisories or restrictions as defined by the CDC? (US Travel advisory information can be found at https://www.cdc.gov/coronavirus/2019-ncov/travelers/map-and-travel-notices.html#travel-1**)**

☐ Yes ☐ No

APPENDIX C

COMMUNITY AIR MONITORING PLAN

Community Air Monitoring Plan (CAMP)

Simchah 325 Yonkers, LLC
BCP Site No. C360184
323-325 Yonkers Avenue
Yonkers, NY 10701

The following Community Air Monitoring Plan (CAMP) will be implemented during the Remedial Investigation to be performed at the Simchah 325 Yonkers, LLC site (Site). Air monitoring will be conducted in accordance with the New York State Department of Health (NYSDOH) *Generic Community Air Monitoring Plan (CAMP).* All air monitoring will be conducted on a real-time basis, using both hand-held field instruments and perimeter air monitoring stations, for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area.

Continuous monitoring will be performed for all ground intrusive activities including boring installations, the break-up and removal of concrete foundations and the excavation of contaminated soil. Periodic monitoring for VOCs and particulates will be required during non-intrusive activities (if required) such as the collection of soil samples from stockpiles or the placement of clean backfill or cover materials. CAMP data will be reported to the NYSDEC and NYSDOH Project Managers on a daily or weekly basis in an easy to read format and include explanations for any exceedance as well as actions implemented and results of those actions; if exceedances of action levels are detected, information regarding CAMP action level exceedances and Corrective Actions taken will be provided to the NYSDEC and the NYSDOH project managers the same business day of occurrence.

This CAMP is not intended for use in establishing action levels for worker respiratory protection that shall be described in the site-specific HASP prepared by the Contractor for the proposed excavations. Rather, its intent is to provide a measure of protection for the downwind community (i.e. off-site receptors including residences and businesses) from potential airborne contaminant releases as a direct result of the proposed remedial work activities. Reliance on this CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, this CAMP will help prevent the remedial construction activities from spreading contamination off-site through the air.

Particulate Monitoring, Response Levels, and Actions

Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations (one placed upwind and one placed downwind). The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

3. All readings will be recorded and provided to State (DEC and NYSDOH) and County Health personnel to review on a daily or weekly basis in an easy to read format.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings will be recorded and be available for State (DEC and NYSDOH) personnel to review on a daily or weekly basis in an easy to read format.

ATTACHMENT 1: SPECIAL CAMP REQUIREMENTS

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 ug/m^3 (micrograms per cubic meter), work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 ug/m^3 or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

Special Requirements for Indoor Work With Co-Located Residences or Facilities

Unless a self-contained, negative-pressure enclosure with proper emission controls will encompass the work area, all individuals not directly involved with the planned work must be absent from the room in which the work will occur. Monitoring requirements shall be as stated above under “Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures” except that in this instance “nearby/occupied structures” would be adjacent occupied rooms. Additionally, the location of all exhaust vents in the room and their discharge points, as well as potential vapor pathways (openings, conduits, etc.) relative to adjoining rooms, should be understood and the monitoring locations established accordingly. In these situations, it is strongly recommended that exhaust fans or other engineering controls be used to create negative air pressure within the work area during remedial activities. Additionally, it is strongly recommended that the planned work be implemented during hours (e.g. weekends or evenings) when building occupancy is at a minimum.

APPENDIX D

CITIZEN PARTICIPATION PLAN

NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan
for
Simchah 325 Yonkers, LLC

July 2020

Site No. C360184

323-325 Yonkers Avenue

Yonkers, NY 10701

Contents

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Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site's investigation and cleanup process.

Applicant: **Simchah 325 Yonkers, LLC ("Applicant")**
Site Name: **Simchah 325 Yonkers, LLC ("Site")**
Site Address: **323-325 Yonkers Avenue, Yonkers, NY 10701**
Site County: **Westchester**
Site Number: **C360184**

1. What is New York's Brownfield Cleanup Program?

New York's Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at: http://www.dec.ny.gov/chemical/8450.html .

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

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- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment

- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process

- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process

- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community

- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The location of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. This location provides convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC web site. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods.
The site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- Residents, owners, and occupants of the site and properties adjacent to the site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the site. See http://www.dec.ny.gov/chemical/61092.html .

Subsequent fact sheets about the site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive site information in paper form. Please advise the NYSDEC site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The flowchart in Appendix D shows how these CP activities integrate with the site investigation

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and cleanup process. The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.

- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

To verify the significant threat status of the site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at
http://www.dec.ny.gov/regulations/2590.html

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Activities	Timing of CP Activity(ies)
Application Process:	
• Prepare site contact list • Establish document repository(ies)	At time of preparation of application to participate in the BCP.
• Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the site contact list should be provided to the public at the same time.
After Execution of Brownfield Site Cleanup Agreement (BCA):	
• Prepare Citizen Participation (CP) Plan	Before start of Remedial Investigation **Note:** Applicant must submit CP Plan to NYSDEC for review and approval within 20 days of the effective date of the BCA.
Before NYSDEC Approves Remedial Investigation (RI) Work Plan:	
• Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan • Conduct 30-day public comment period	Before NYSDEC approves RI Work Plan. If RI Work Plan is submitted with application, public comment periods will be combined and public notice will include fact sheet. Thirty-day public comment period begins/ends as per dates identified in fact sheet.
After Applicant Completes Remedial Investigation:	
• Distribute fact sheet to site contact list that describes RI results	Before NYSDEC approves RI Report
Before NYSDEC Approves Remedial Work Plan (RWP):	
• Distribute fact sheet to site contact list about draft RWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period	Before NYSDEC approves RWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.
Before Applicant Starts Cleanup Action:	
• Distribute fact sheet to site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Applicant Completes Cleanup Action:	
• Distribute fact sheet to site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report • Distribute fact sheet to site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC)	At the time the cleanup action has been completed. **Note:** The two fact sheets are combined when possible if there is not a delay in issuing the COC.

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3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the Site. Additional major issues of public concern may be identified during the course of the Site's investigation and cleanup process.

No major issues of public concern such as potential impacts on nearby public water supply or private water wells, restrictions on community activities, or health concerns are associated with the investigation or cleanup process of the Site at this time.

The portion of the Site within the Brownfield Site Boundary totals approximately 0.23 acres and is improved with one (1) two-story, slab-on-grade building. The Site is currently occupied by BoniClean dry cleaner, Deli Buffet, and a church. Based on a review of historical sources, the Site has been used as a dry cleaner since 1985. Tetrachloroethene (PCE) was detected at the Site in groundwater and soil vapor at concentrations greater than their corresponding, applicable screening levels. The scope of work outlined in the Remedial Investigation Work Plan will further delineate the extent of the impacts resulting from the on-site dry cleaner. Remedial activities that will be proposed in order to remediate the contamination identified during the Remedial Investigation and to protect the community will likely include the installation of a Sub-Slab Depressurization System (SSDS) to remove chlorinated vapors from beneath the building slab of the facility to improve indoor air quality. Proposed remedial actions will depend on the findings of the completed remedial investigation.

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

The Site is located in an area with a sizable Hispanic-American population nearby. Therefore, all future fact sheets will also be available in Spanish.

For additional information, visit: https://statisticalatlas.com/zip/10040/Race-and-Ethnicity

Other potential impacts may be related to noise, odor, or truck-related traffic.

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4. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

The Simchah 325 Yonkers, LLC Site is located on the north side of Yonkers Avenue, in a mixed commercial and residential area of Yonkers, New York, and is bordered by the Fairways at Dunwoodie Golf Course to the north, an adjoining gas station and convenience store to the east followed by vacant, wooded land and Tibbets Creek, Yonkers Avenue followed by Planet Fitness to the south, and the Fairways at Dunwoodie Golf Course to the west. The portion of the Site within the Brownfield Site Boundary totals approximately 0.23 acres and is improved with one (1) two-story, slab-on-grade building. The Site is currently occupied by BoniClean dry cleaner, Deli Buffet, and a church. Additionally, the portions of the exterior of the Site are improved with asphalt-paved parking areas and concrete walkways.

History of Site Use, Investigation, and Cleanup

The Site is currently occupied by BoniClean dry cleaner, Deli Buffet, and a church. Based on a review of historical sources, the Site has been used as a dry cleaner since 1985.

AEI completed a Limited Phase II Subsurface Investigation at the Site on September 26, 2018. The results indicated elevated concentrations of PCE in groundwater, soil vapor, and indoor air at the Site, above the applicable criteria. AEI completed a Supplemental Phase II Subsurface Investigation at the Site on November 27, 2018. The purpose of the investigation was to delineate elevated PCE levels detected in soil vapor near the dry-cleaner tenant space, and the tenant space immediately adjoining the eastern side of the dry-cleaner space. The sub-slab soil vapor sample analytical results indicated that no chlorinated VOCs were detected at concentrations greater than the NYSDOH screening levels in the sub-slab soil vapor samples analyzed during this investigation; however, PCE and trichloroethene (TCE) were detected in the indoor air samples at concentrations greater than the applicable NYSDOH screening levels.

Based on the findings above, vapor intrusion mitigation (i.e. SSDS) was recommended for the dry-cleaning tenant space and tenant space immediately east of the dry-cleaner tenant space; however, the large deli tenant space adjacent further east of that area did not appear to require mitigation. The deli tenant space would likely benefit from improved aboveground/interior ventilation, perhaps through Heating, Ventilation, and Cooling (HVAC) system modifications or other means.

No major issues of public concern such as potential impacts on nearby public water supply or private water wells, restrictions on community activities, or health concerns are associated with the investigation or cleanup process of the Site at this time.

The current owner, Simchah 325 Yonkers, LLC, purchased the Site in 2006 and has been accepted into the BCP program as a Participant, per the acceptance letter from the New York State Department of Environmental Conservation (NYSDEC) dated February 5, 2020.

Plans for further investigation and remediation of the contamination are being developed as described below.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a Participant. This means that the Applicant was the owner of the Site at the time of the disposal or discharge of contaminants. The Participant must evaluate and implement an effective remedy that addresses not only contamination on-site but any contamination that has migrated off-site.

The Applicant in its Application proposes that the Site will be used for restricted commercial purposes.

To achieve this goal, the Applicant will conduct investigation and cleanup activities at the site with oversight provided by NYSDEC. The Brownfield Cleanup Agreement executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant has completed a partial site investigation before it entered into the BCP. For the partial investigation, NYSDEC will determine if the data are useable.

The Applicant will conduct an investigation of the site officially called a "remedial investigation" (RI). This investigation will be performed with NYSDEC oversight. The Applicant must develop a remedial investigation workplan, which is subject to public comment.

The site investigation has several goals:

1) Identify the sources of contamination, the migration pathways, and actual or potential receptors of contaminants
2) Evaluate the amount, concentration, persistence, mobility, and other characteristics of the contamination present
3) Delineate the horizontal and vertical extent of contaminants in all media on the Site
4) Characterize the material beneath the Site
5) Evaluate the potential for contaminant migration and threats to sensitive receptors
6) Provide information to allow for the identification and preliminary evaluation of viable remedial alternatives.

The Applicant submits a draft “Remedial Investigation Work Plan” to NYSDEC for review and approval. NYSDEC makes the draft plan available to the public review during a 30-day public comment period.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a “significant threat,” it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a site when a source of contamination or exposure pathway can be effectively addressed before the site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, NYSDEC will require a 30-day public comment period.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at

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the site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a “Certificate of Completion” (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a “Remedial Work Plan”. The Remedial Work Plan describes the Applicant’s proposed remedy for addressing contamination related to the site.

When the Applicant submits a draft Remedial Work Plan for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the site Decision Document.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a final engineering report that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the site, it will approve the final engineering report. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

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Site Management

The purpose of site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan.

An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering control* is a physical barrier or method to manage contamination. Examples include caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A - Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Kimberly Junkins
Project Manager
NYSDEC – Region 3
Division of Environmental Remediation
21 S. Putt Corners Rd
New Paltz, NY 12561
Email: kimberly.junkins@dec.ny.gov
Tel: (845) 633- 5457

New York State Department of Health (NYSDOH):

Shaun Surani
Project Manager
New York State Department of Health
Bureau of Environmental Exposure Investigation
Empire State Plaza – Corning Tower Room 1787
Albany, NY 12237
Email: BEEI@health.ny.gov
Tel: (518) 402-7860

Locations of Reports and Information

The facility identified below is being used to provide the public with convenient access to important project documents:

Riverfront Library
Yonkers Public Library
1 Larkin Center,
Yonkers, NY 10701
Attn: John Favareau
Phone: (914) 337-1500
Hours: M/W 10-4; T/Th 12-6; F/Sat 12-4

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Appendix B - Site Contact List

Community/Planning Board Contacts

Organization	Representative	Address	Phone/E-mail
Westchester County Executive	George Latimer	900 Michaelian Building 148 Martine Avenue White Plains, NY 10601	(914) 995-2900 CE@westchestergov.com
Westchester County Planning Board Chairperson	Richard Hyman	148 Martine Avenue White Plains, NY 10601	(914) 995-4408 nvv1@westchestergov.com
City of Yonkers Mayor	Mike Spano	City Hall 40 South Broadway Yonkers, NY 10701	(914) 377-6300 Mayor@yonkersny.gov
City of Yonkers Planning Board Chairperson	Roman Kozicky	87 Nepperhan Avenue, Suite 320-322 Yonkers, NY 10701	(914) 220-4900 rkozicky@sumafcu.org

Local News Media

Organization	Address	Phone/E-mail
Yonkers Daily Voice	Unknown	yonkers@dailyvoice.com
Yonkers Voice	Ashburton Avenue Yonkers, NY 10701	(914) 618-5033
News 12 Westchester	6 Executive Plaza Yonkers, NY 10701	(914) 378-4855 news12wc@news12.com
Eyewitness News (abc7)	Unknown	abc7ny@abc.com

Public Water Supplier

Organization	Address	Phone/E-mail
Yonkers Water Bureau	40 South Broadway, Room 311 Yonkers, NY 10701	(914) 377-6270

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Local Schools

Organization	Representative	Address	Phone/E-mail
St Ann's School	Michael Vicario (Principal)	40 Brewster Ave, Yonkers, NY 10701	(914) 965-4333 michael.vicario@archny.org
Yonkers Middle High School	Michael Shapiro (Principal)	150 Rockland Ave, Yonkers, NY 10705	(914) 376-8191 mshapiro@yonkerspublicschools.org
Lincoln High School	Ian Sherman (Principal)	375 Kneeland Ave, Yonkers, NY 10704	(914) 376-8400 isherman1@yonkerspublicschools.org

Document Repository

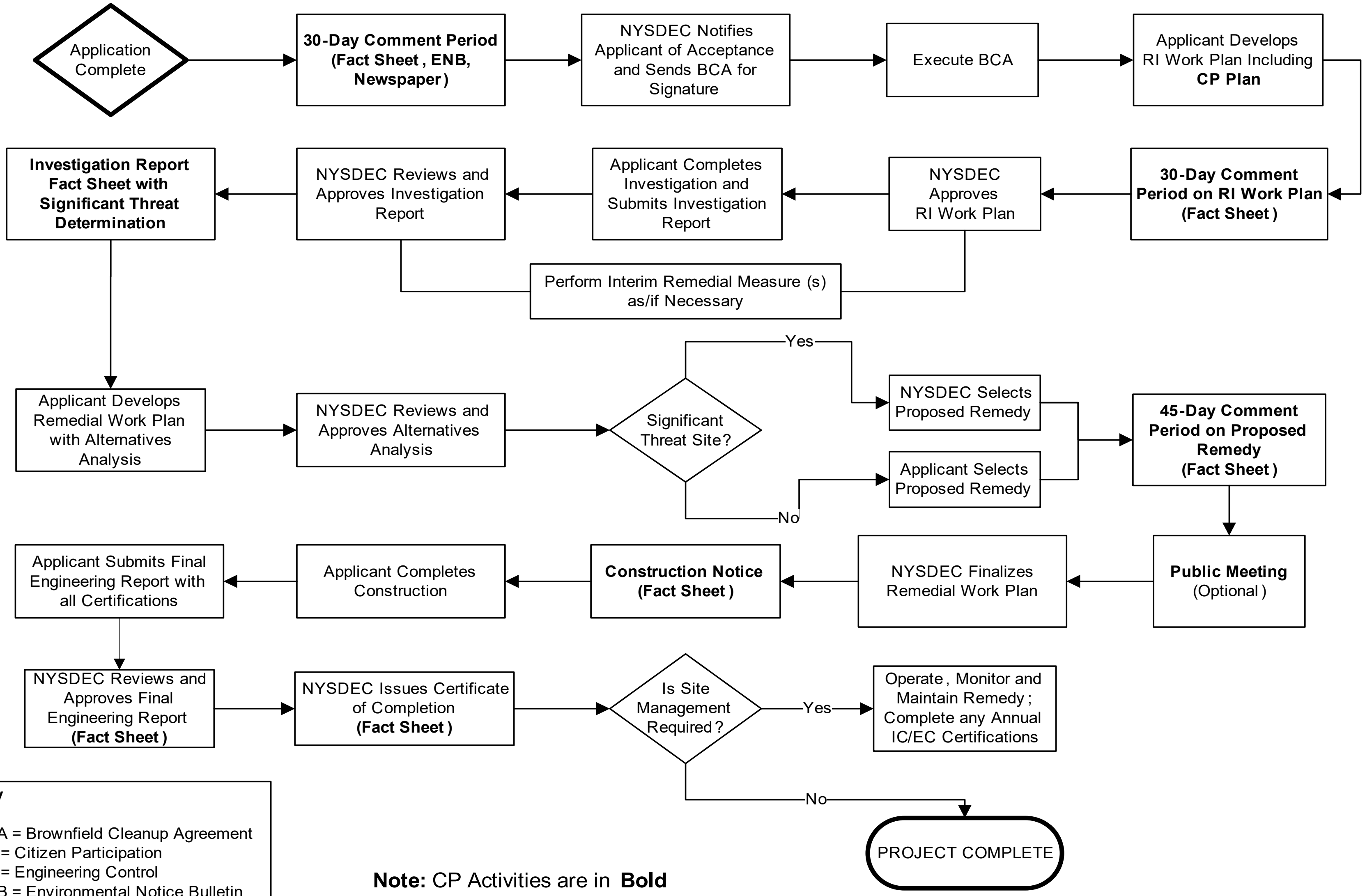
Organization	Address	Phone/E-mail
Riverfront Library – Yonkers Public Library	1 Larkin Center, Yonkers, NY 10701	(914) 337-1500

Appendix C - Site Location Map

EXHIBIT A
SITE MAP

BCP site boundary outlined in red.

Appendix D– Brownfield Cleanup Program Process



Key

BCA = Brownfield Cleanup Agreement
CP = Citizen Participation
EC = Engineering Control
ENB = Environmental Notice Bulletin
IC = Institutional Control
RI = Remedial Investigation

Note: CP Activities are in **Bold**

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Division of Environmental Remediation

Remedial Programs
Scoping Sheet for Major Issues of Public Concern

Instructions

This Scoping Sheet assesses major issues of public concern; impacts of the site and its remedial program on the community; community interest in the site; information the public needs; and information needed from the public.

The information generated helps to plan and conduct required citizen participation (CP) activities, and to choose and conduct additional CP activities, if appropriate. The scoping sheet can be revisited and updated as appropriate during the site's remedial process to more effectively implement the site's CP program.

Note: Use the information as an aid to prepare and update the Major Issues of Public Concern section of the site CP Plan.

General Instructions

- When to prepare: During preparation of the CP Plan for the site. It can be revisited and updated anytime during the site remedial process.
- Fill in site name and other information as appropriate.
- The Scoping Sheet may be prepared by DEC or a remedial party, but must be reviewed and approved by the DER site project manager or his/her designee.

Instructions for Numbered Parts

Consider the bulleted issues and questions below and any others that may be unique or appropriate to the site and the community to help complete the five Parts of this Scoping Sheet. Identify the issue stakeholders in Parts 1 through 3 and adjust the site's contact list accordingly.

Part 1. List Major Issues of Public Concern and Information the Community Wants.

- Is our health being impacted? (e.g. Are there problems with our drinking water or air? Are you going to test our water, yards, sumps, basements? Have health studies been done?)
- There are odors in the neighborhood. Do they come from the site and are they hazardous?
- Are there restrictions on what we may do (e.g. Can our children play outside? Can we garden? Must we avoid certain areas? Can we recreate (fish, hunt, hike, etc. on/around the site?)
- How and when were the site's contamination problems created?
- What contaminants are of concern and why? How will you look for contamination and find out where it is going? What is the schedule for doing that?
- The site is affecting our property values!
- How can we get more information (e.g. who are the project contacts?)
- How will we be kept informed and involved during the site remedial process?
- Who has been contacted in the community about site remedial activities?
- What has been done to this point? What happens next and when?
- The site is going to be cleaned up for restricted use. What does that mean? We don't want redevelopment on a "dirty" site.

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Part 2. List Important Information Needed From the Community, if Applicable.

- Can the community supplement knowledge about past/current uses of the site?
- Does the community have knowledge that the site may be significantly impacting nearby people, properties, natural resources, etc.?
- Are activities currently taking place at the site or at nearby properties that may need to be restricted?
- Who may be interested or affected by the site that has not yet been identified?
- Are there unique community characteristics that could affect how information is exchanged?
- Does the community and/or individuals have any concerns they want monitored?
- Does the community have information about other sources in the area for the contamination?

Part 3. List Major Issues and Information That Need to be Communicated to the Community.

- Specific site investigation or remediation activities currently underway, or that will begin in the near future.
- The process and general schedule to investigate, remediate and, if applicable, redevelop the site.
- Current understanding about the site contamination and effects, if any, on public health and the environment.
- Site impacts on the community and any restrictions on the public's use of the site and/or nearby properties.
- Planned CP activities, their schedule, and how they relate to the site's remedial process.
- Ways for the community to obtain/provide information (document repositories, contacts, etc.).

Part 4. Community Characteristics

a. - e. Obtain information from local officials, property owners and residents, site reports, site visits, "windshield surveys," other staff, etc.

f. Has the affected community experienced other **significant** present or past environmental problems unrelated to this site? Such experiences could significantly affect public concerns and perspectives about the site; how the community will relate to project staff; the image and credibility of project staff within the community; and the ways in which project staff communicate with the community.

g. In its remedial programs, DER seeks to integrate, and be consistent with, environmental justice principles set forth in *DEC Commissioner Policy 29 on Environmental Justice* and *DER 23 – Citizen Participation Handbook for Remedial Programs*. Is the site and/or affected community wholly or partly in an Environmental Justice (EJ) Area? Use the Search feature on DEC's public web site for "environmental justice". DEC's EJ pages define an EJ area, and link to county maps to help determine if the site and/or community are in an EJ area.

h. Consider factors such as:

- Is English the primary language of the affected community? If not, provisions should be considered regarding public outreach activities such as fact sheets, meetings, door-to-door visits and other activities to ensure their effectiveness.
- The age demographics of the community. For example, is there a significant number of senior citizens in the community? It may be difficult for some to attend public meetings and use document repositories. This may suggest adopting more direct interaction with the community with activities such as door-to-door visits, additional fact sheets, visits to community and church centers, nursing homes, etc.
- How do people travel about the community? Would most people drive to a public meeting or document repository? Is there adequate public transportation?

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Part 5. Affected/Interested Public.

Individuals and organizations who need or want information and input can change during the site's remedial process. This need is influenced by real, potential, or perceived impacts of the site or the remedial process. Some people may want information and input throughout the remedial process. Others may participate only during specific remedial stages, or may only be interested in particular issues.

It is important to revisit this question when reviewing this scoping sheet. Knowing who is interested in the site – and the issues that are important to them – will help to select and conduct appropriate outreach activities, and to identify their timing and the information to be exchanged.

Check all affected/interested parties that apply to the site. **Note: Adjust the site's contact list appropriately.** The following are some ways to identify affected/interested parties:

- Tax maps of adjacent property owners
- Attendees at public meetings
- Telephone discussions
- Letters and e-mails to DER, the remedial party, and other agencies
- Political jurisdictions and boundaries
- Media coverage
- Current/proposed uses of site and/or nearby properties (recreational, commercial, industrial)
- Discussions with community organizations: grass roots organizations, local environmental groups, environmental justice groups, churches, and neighborhood advisory groups

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NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

Division of Environmental Remediation

Remedial Programs
Scoping Sheet for Major Issues of Public Concern

Site Name: Simchah 325 Yonkers, LLC
Site Number: C360184
Site Address and County: 323-325 Yonkers Avenue, Yonkers, NY 10701
Remedial Party(ies): Simchah 325 Yonkers, LLC

Note: For Parts 1. – 3. the individuals, groups, organizations, businesses, and units of government identified should be added to the site contact list as appropriate.

Part 1. List major issues of public concern and information the community wants. Identify individuals, groups, organizations, businesses, and/or units of government related to the issue(s) and information needs. **Use this information as an aid to prepare or update the Major Issues of Public Concern section of the site Citizen Participation Plan.**

The Site is located in an Environmental Justice Area. Therefore, all future fact sheets need to be translated into Spanish.

How were these issues and/or information needs identified?
Needs were identified using census data.

Part 2. List important information needed **from** the community, if applicable. Identify individuals, groups, organizations, businesses, and/or units of government related to the information needed.
NA

How were these information needs identified?
NA

Part 3. List major issues and information that need to be communicated **to** the community. Identify individuals, groups, organizations, businesses, and/or units of government related to the issue(s) and/or information.
NA

How were these issues and/or information needs identified?
NA

Part 4. Identify the following characteristics of the affected/interested community. This knowledge will help to identify and understand issues and information important to the community, and ways to effectively develop and implement the site citizen participation plan (mark all that apply):

a. Land use/zoning at and around site:
☒ **Residential** ☐ **Agricultural** ☒ **Recreational** ☒ **Commercial** ☐ **Industrial**

b. Residential type around site:
☐ **Urban** ☒ **Suburban** ☐ **Rural**

c. Population density around site:
☐ **High** ☒ **Medium** ☐ **Low**

d. Water supply of nearby residences:

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☒ **Public** ☐ **Private Wells** ☐ **Mixed**

e. Is part or all of the water supply of the affected/interested community currently impacted by the site?
☐ **Yes** ☒ **No**

Provide details if appropriate:
Residents are provided with their drinking water through the Yonkers Water Bureau.

f. Other environmental issues significantly impacted/impacting the affected community?
☐ **Yes** ☒ **No**

Provide details if appropriate:
NA

g. Is the site and/or the affected/interested community wholly or partly in an Environmental Justice Area?
☒ **Yes** ☐ **No**

h. Special considerations:
☒ **Language** ☐ **Age** ☐ **Transportation** ☐ **Other**

Explain any marked categories in **h:**
All future fact sheets will be translated into Spanish.

Part 5. The site contact list must include, at a minimum, the individuals, groups, and organizations identified in Part 2 of the Citizen Participation Plan under 'Site Contact List'. Are *other* individuals, groups, organizations, and units of government affected by, or interested in, the site, or its remedial program? (Mark and identify all that apply, then adjust the site contact list as appropriate.)

☒ **Non-Adjacent Residents/Property Owners:** Click here to enter text.

☒ **Local Officials:** Click here to enter text.

☒ **Media:** Click here to enter text.

☒ **Business/Commercial Interests:** Click here to enter text.

☐ **Labor Group(s)/Employees:** Click here to enter text.

☐ **Indian Nation:** Click here to enter text.

☒ **Citizens/Community Group(s):** Click here to enter text.

☒ **Environmental Justice Group(s):** Click here to enter text.

☐ **Environmental Group(s):** Click here to enter text.

☒ **Civic Group(s):** Click here to enter text.

☐ **Recreational Group(s):** Click here to enter text.

☐ **Other(s):** Click here to enter text.

Prepared/Updated By: Jordan Farber, AEI Consultants **Date:** 07/01/2020

Reviewed/Approved By: Click here to enter text. **Date:** Click here to enter text.

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APPENDIX E

PROJECT TEAM RESUMES

Jordan Farber – Project Manager, Site Mitigation

Education:

BA, Earth & Environmental Sciences, Wesleyan University, Middletown, CT, 2016
BA, Mathematics, Wesleyan University, Middletown, CT, 2016
Environmental Studies Certificate, Wesleyan University, Middletown, CT, 2016

40-Hour OSHA HAZWOPER Training, OSHA 29 CFR 1910.120(e) (3)
OSHA 10-Hour Construction Safety and Health Training
NJ Transit Roadway Worker/On track Protection Training
Secure Worker Authorization Card (SWAC)

Summary of Experience:

Mr. Farber has four years of experience focusing on environmental investigations including environmental oversight, environmental assessment, remediation, and due diligence projects under NJDEP, NYCDEP, and NYSDEC jurisdiction for commercial, industrial, and residential facilities. Mr. Farber's experience includes, but is not limited to, soil, sediment, air, surface water, and groundwater sampling, oversight of UST removal and temporary and monitoring well installations, soil classification, processing of sample laboratory analyses, and Electronic Data Deliverables (EDDs). He is also proficient in Geographic Information System (GIS), gINT, and Surfer software. Mr. Farber is experienced in calibrating, maintaining, and using various field and laboratory instruments for monitoring levels of contamination. He has experience in the preparation of various environmental technical reports and permitting applications relative to Preliminary and Phase I environmental site assessments and remedial phase investigations throughout New Jersey and New York.

Mr. Farber currently serves as a Project Manager for AEI's Site Mitigation department. His professional experience includes:

- **Lam Gen Redevelopment** – Mr. Farber assisted in the air and dust monitoring and oversight of petroleum-impacted soil excavation and removal at two adjacent properties in Manhattan to facilitate the construction of commercial hotels. Mr. Farber was also responsible for the preparation and submission of the Remedial Action Reports (RARs) for each property.

- **Bio-Enhanced In-Situ Remediation** – Mr. Farber was responsible for conducting multiple Phase II Subsurface Investigations at a site in Buffalo, NY, which included soil, groundwater, and soil vapor sampling along with permanent monitoring well installation. Due to petroleum-impacted groundwater onsite, remediation and further monitoring was proposed under NYSDEC jurisdiction. Mr. Farber was responsible for the planning and use of bio-enhancements in the onsite monitoring wells for rapid bioremediation of the petroleum contaminants. Mr. Farber was also responsible for the preparation and submission of quarterly groundwater monitoring reports.

- **Long Island Railroad (LIRR) Expansion Project** – Mr. Farber was responsible for conducting site visits and assessments and ultimately writing and editing multiple Phase I reports, on behalf of the Gannett Fleming–AECOM Rail Road Expansion Partnership, for multiple properties proposed to be used as garages for commuter parking in order to accommodate increased LIRR activity, as well as additional acquisition properties throughout New York. Mr. Farber also provided technical support for Phase II site investigations.

- **Amtrak, The Hudson Tunnel Project, New Jersey** – The Gateway Trans-Hudson Partnership is a joint venture involving AECOM, WSP/Parsons Brinckerhoff and STV Incorporated tasked to design the new Hudson Tunnel in response to aging infrastructure, increasing commuter patronage, and the need to improve resiliency against storms. Mr. Farber was tasked with completing multiple Preliminary Assessments for various properties in Hudson County, New Jersey.

- **Environmental Investigations, Various Properties throughout East Coast** – Project Manager responsible for general environmental services, involving groundwater, surface water, soil, sediment, indoor/outdoor air, and concrete sampling, and environmental monitoring/oversight including, but not limited to, underground storage tank (UST) removal, soil remediation, air and dust monitoring, and overall compliance monitoring. In addition, Mr. Farber's responsibilities included the preparation and submission of Phase II and regulatory reports.

- **Phase I Investigations, Various Properties throughout New Jersey and New York** – Project Manager responsible for preparation of Phase I Environmental Site Assessment reports. The assessments included on-site physical inspection, off-site usage, federal and state data base searches, and report preparation. The Phase I ESAs were performed in general accordance with the American Society for Testing and Materials (ASTM) Designation E 1527-13 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process.

- **Preliminary Assessment Investigations, Various Properties throughout New Jersey** – Project Manager responsible for preparation of Preliminary Assessment reports. The assessments included on-site physical inspection, on-site usage, federal and state data base searches, and report preparation. The Preliminary Assessment was performed in general accordance with the New Jersey Department of Environmental Protection Site Remediation Program Preliminary Assessment Technical Guidance Version 1.1.

- **GIS Mapping and Analysis** – Mr. Farber has provided GIS mapping and analysis for multiple departments in support of technical reports, including mapping for environmental constraints, hazard mitigation, site buffers, FEMA flood zones, environmental reference maps, contours, and base map preparation for sites.

- **Large Data Organization and Analysis** – Mr. Farber has provided support with the organization, analysis, and graphing of large datasets in Excel. Examples include the organization and graphing of quarterly and annual groundwater sampling data as well as 95% upper confidence limit (UCL) and general percentile analyses.

EDUCATION:

Montclair State University, B.A. Geography w/ conc. in Environmental Studies, May 2009

LICENSES & CERTIFICATIONS:

Certified Hazardous Materials Manager, IHMM
OSHA 40-Hour HAZWOPER Certification
OSHA 10-Hour Construction Safety Certification

EXPERIENCE SUMMARY:

Mr. Cauterucci has over 10 years of experience as an environmental consultant, including managing and executing environmental site investigation and remediation projects throughout the Northeast US and under various state regulatory programs. Project experience includes performance and review of remedial investigations and remediations of Brownfield Cleanup sites; oversight of tank removals, soil excavation and disposal; real estate transfer assessments, hydrogeological site assessments involving petroleum hydrocarbons and chlorinated solvents; the preparation of ASTM Phase I and Phase II site investigation reports, and the design, implementation and operation of sub-slab depressurization systems for the purpose of vapor intrusion mitigation.

Mr. Cauterucci currently serves as Site Mitigation Department Manager for the New York and New Jersey region of AEI's Site Mitigation Department.

REPRESENTATIVE EXPERIENCE

- **Lawrence Shopping Center, Lawrence, NJ.** Project manager in charge of Site Investigation (SI), Remedial Investigation (RI), Remedial Action Work Plan (RAWP), Receptor Evaluations (RE), and Remedial Action (RA), of a shopping center with contaminated soil and groundwater due to a former auto repair operation and current dry cleaning operation. Work conducted through the New Jersey Department of Environmental Protection (NJDEP) under the oversight of a Licensed Site Remediation Professional (LSRP). Site work included the removal of over 600 tons of impacted soil, the installation and monitoring of more than 20 groundwater monitoring wells for horizontal and vertical contaminant delineation, a Membrane Interface Probe (MIP) assessment of chlorinated VOCs, and a Vapor Intrusion (VI) investigation. Remedial Action of chlorinated VOC groundwater contamination through Monitored Natural Attenuation (MNA) with a Classification Exception Area (CEA) along with Remedial Action Outcomes (RAOs) issued for Areas of Concern (AOCs) related to the former auto repair operation.

- **True Value Hardware, Swedesboro, NJ.** Project manager in charge of SI, RI, RAWP, RE, and RA, and post-remedial groundwater monitoring at a former Standard Oil bulk petroleum terminal. Work conducted through the NJDEP under the oversight of a LSRP. Site work included the removal of over 500 tons of impacted soil and 500 linear feet of sub-surface piping, post-excavation soil sampling, and installation and monitoring of onsite and offsite monitoring wells.

- **Gwynedd Valley Technology Center, Lansdale, PA.** Onsite project manager for a vapor intrusion and indoor air investigation and mitigation of a 650,000+ square foot commercial/ industrial building that was formerly an electronics manufacturing facility in Lansdale, Pennsylvania. Vapor intrusion investigation included extensive sub-slab soil vapor and indoor air sampling in a grid pattern throughout the building, with ambient air sampling conducted for comparison purposes. Results from this investigation indicated that elevated VOCs existed beneath the building slab and indoor air levels of chlorinated VOCs were above the EPA screening levels. Responsible for providing oversight of a pilot study in the building to determine the potential area of influence for each vapor extraction point, installation of a Sub-Slab Depressurization (SSD) system consisting of 59 vapor extraction points throughout the interior of the building, and sealing of joints and cracks within the building slab to prevent any preferential pathways from allowing the sub-slab air into the building. Conducts monthly operation and maintenance (O&M) check-ups on the SSD system to ensure it is properly operating. Vapor mitigation contract exceeded $1 million dollars.

- **Sunoco Gas Station, Fairfield, CT.** Project manager in charge of a SI of an operating gas station and auto repair with multiple fueling underground storage tanks (USTs), underground hydraulic lifts, a heating oil UST, closed-in-place waste oil UST, and historic surface spills. Conducted soil and groundwater evaluation of numerous AOCs, installation and monitoring of multiple groundwater monitoring wells, report writing, and preparation of a remedial budget for a potential buyer.

- **Unregulated Heating Oil UST Closure, Mount Olive, NJ.** Project manager in charge of a Phase II in the area of a closed-in-place heating oil UST at a vacant restaurant building in Mount Olive, NJ. Exceedances of NJDEP extractable petroleum hydrocarbon (EPH) standards prompted the removal of the UST and impacted soil, followed by a groundwater investigation in the area of the UST. Prepared Remedial Action Report (RAR) for submittal to the NJDEP Unregulated Heating Oil Tank (UHOT) program and received a No Further Action (NFA) letter for the case.

- **Puratos Industrial Warehouse, Pennsauken, NJ.** Project manager in charge of a Preliminary Assessment (PA) and SI at an industrial warehouse in Pennsauken, NJ. Work was conducted as a requirement of a property transaction under Industrial Site Recovery Act (ISRA) regulations through the NJDEP and under the oversight of a LSRP. Site investigation included the collection of shallow soil samples along an onsite rail line and offsite regional rail line. The AOC related to the rail line and the site received an RAO based on elevated regional rail line contamination and continued use of rail for product shipment and delivery.

David Bausmith, PE – Senior Environmental Project Manager

Education:

University of Pittsburgh, M.S. Civil & Environmental Engineering, April 1997
University of Pittsburgh, B.S. Civil Engineering, April 1993

Licenses & Certifications:

Professional Engineer (PE) – State of New Jersey License No. 41915
Subsurface Evaluator and Underground Storage Tank Install, Closure, Testing – State of New Jersey Certification #635269

Summary of Experience:

Mr. Bausmith has over 19 years of experience as an environmental engineer and consultant, including managing and executing complex environmental site investigation, remediation and Brownfield redevelopment projects throughout the Northeast US. He has managed complex site investigation and remediation/redevelopment projects under various state and federal RCRA and CERCLA regulatory programs, and involving chlorinated and petroleum VOCs, heavy metals, and coal-gasification wastes. He has served as engineer-of-record on numerous soil/groundwater remediation and wastewater treatment systems, and has extensive experience with in-situ remediation technologies. He is a published author of peer-reviewed articles involving in-situ stabilization, sustainable remediation, and Brownfield redevelopment, and served on NJDEP technical committees tasked with developing site remediation guidance documents.

Mr. Bausmith's current duties include senior project management and remedial design for AEI's Eastern Region. His professional experience includes:

- Senior PM and design for a $2.5 million, long-term, in-situ reductive de-chlorination project (biologically-based) at USEPA Superfund Site. Coordinated sustainable remediation techniques with the USACOE and EPA to accelerate cleanup.

- Director of corporate engineering services, including site/civil and remediation system designs. Provided program management and in-situ design on complex chlorinated VOC and hexavalent chromium groundwater remediation projects involving multi-aquifer system over 2-acre plume in active industrial complex in Elizabeth, NJ. Responsible for completing limited-restricted and unrestricted Response Action Outcomes (RAOs).

- Senior PM for on-call environmental investigation and remediation contracts exceeding $3 million for NJ Transit, NJ Turnpike Authority, and NJDOT. Responsible for contract administration, remedial investigation and remediation design associated with petroleum USTs, regulatory approvals and site closure documentation. Corporate representative on steering committees for Federal Environmental Management and New Jersey environmental regulatory programs.

- Senior PM responsible for monitored natural attenuation (MNA) programs involving low-flow sampling techniques in bedrock and unconsolidated aquifers at 100+acre, former wood treating and coal gasification sites. Utilize modeling of chemical concentration trends and biological parameters to verify predicted natural attenuation modeling trends and compliance with cleanup standards.

- Design and field QA engineering on in-situ stabilization and site/civil redevelopment project involving new marine cargo storage facility for the Port Authority of NY/NY. Responsible for all regulatory compliance aspects of projects completed in accordance with the NJAC 7:26E. Project included in-situ soil stabilization 54,000 CY of contaminated soil at a former wood treating facilities with remedial construction costs >$2 million, and leading to No Further Action (NFA) from NJDEP. Design engineer for remedial surface cover using cement-stabilized soil and asphaltic concrete, water supply system, and site drainage system.

- Senior PM and engineer responsible for innovative remedial investigation technologies such as laser-induced-fluorescence (LIF) to investigate subsurface Non-Aqueous Phase Liquids (NAPLs). Experienced in vapor intrusion (VI) testing and assessment, and passive and active VI mitigation systems.

- Senior engineer on design of use of Processed Dredge Material (PDM) as engineered surface cover for former Coke and Coke by-products plant. Responsible for field quality assurance during construction of 4,500 LF slurry wall for partial hydraulic containment, waste pile stabilization, and NAPL recovery.

- Senior engineer on in-situ remediation project involving chemical oxidation of CVOCs using potassium permanganate, and Fenton's reagent. Served as engineer-of-record for groundwater remediation system treating chlorinated and petroleum hydrocarbon-impacted groundwater at three (3) active commercial sites. Treatment technologies included total fluids recovery, oil-water separation, filtration, air stripping, and granular activated carbon.

- Staff engineer responsible for operation, maintenance and optimization of groundwater pump & treat and multi-phase extraction systems. Conducted pilot testing and design of bioventing soil/groundwater treatment system, air sparging systems, and engineering oversight during construction of residential POETS.

- Designer of industrial landfill components including surface cover, landfill gas management systems, leachate management systems, and storm water management systems. Conducted in-situ geotechnical testing and conceptual design of cover system for former coal tar impoundment.

Publications/Presentations:

- Bausmith, David S. and Rossi, Christopher, "Sustainable Remediation – A Case Study", November 16, 2009, Presentation at the EPA National Brownfield Conference, New Orleans, Louisiana.
- Bausmith, David S., "Brownfield Redevelopment and Environmental Considerations", Chapter 17, Land Development Handbook, Third Edition, Dewberry®, McGraw-Hill, 2008.
- Bausmith, David S., "Cementing DNAPLs", Pollution Engineering, November 2002, pp. 20-23.
- Bausmith, David S., "Remediation/Redevelopment of Former Wood Treating Facility Using Chemical Fixation/Stabilization Technology", September 2002, Presentation at the 5th Annual Florida Brownfield Conference, Pensacola, Florida.
- Bausmith, David S., Brourman, M.D., Ting, M., and Zubrow, J.S. "Demonstration of Groundwater Containment Through the Use of Barrier Wall and Surface Cover Systems and Natural Attenuation", Presentation at 2001 International Containment and Remediation Technical Conference and Exposition, Orlando, FL, June 2001.
- Cervenak, D., Bausmith, D., Brourman, M.D., and Mullins, K. (2000) "Stabilization of DNAPL at a New Jersey Brownfield Site", Presentation at Brownfields 2000, Atlantic City, New Jersey.
- Bausmith, D.S., and Neufeld, R.D., "Soil Biodegradation of Propylene Glycol Based Aircraft Deicing Fluids", Water Environment Research, (July/August 1999), Volume 71, No. 4, pp. 459-465.
- Bausmith, D.S., and Neufeld, R.D., "Land Treatment of Aircraft Deicing Fluids", October 1996, Presentation at 96th Annual Water Environment Federation and Technology Conference, Dallas, Texas.
- Bausmith, D.S., Campbell, D., and Vidic, R.D., "In-Situ Air Stripping", Water Environment & Technology, (February 1996), pp. 45-51.

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Philip G. Clark, PE, LSP
President

- Licensed Professional Engineer (Massachusetts, New York, Connecticut, Vermont)
- Licensed Site Professional (Massachusetts Oil and Hazardous Materials Program)
- Licensed Asbestos Designer (New York)

GENERAL PROFESSIONAL QUALIFICATIONS

Consulting engineering for municipal, industrial /commercial, and private clients in the following areas:

- Hazardous waste assessment and remediation
    - Landfill assessment and remediation
    - Hydrocarbon assessment and remediation
    - Industrial facility assessment and remediation
    - Property assessment
    - Asbestos inspection and abatement
    - Indoor air quality assessment
    - Building demolition assessment
- Civil land site design and development
    - Municipal building development and design
    - Commercial and manufacturing building development and design
    - Private property development
    - Bridge replacement design
    - Landfill site assessment
    - Water treatment facility design
- Water supply design
    - Water system rehabilitation
    - Water treatment and distribution system improvements
    - Groundwater supply well improvements
    - Surface water supply evaluation
    - Water supply operations improvements
- Wastewater/stormwater assessment and design
    - Combined sewer overflow assessment and improvements
    - Wastewater district formation design
    - Industrial wastewater treatment plant improvements
    - Wastewater system design

REPRESENTATIVE PROJECTS

HAZARDOUS WASTE ASSESSMENT AND REMEDIATION

Basement Fuel Oil Above Ground Storage Tank Release (Private Residence)

- Developed response action work plan for excavation and disposal of impacted soils
- Observed, documented and coordinated transportation and disposal of impacted soils
- Developed soil and groundwater subsurface investigation program
- Developed construction plan for installation of sub-slab soil venting system
- Conducted baseline and post remediation indoor air sampling program
- Evaluated sub-slab vapor venting system performance
- Retained and supervised all remediation and building restoration work
- Prepared final closure report, including risk assessment analysis, for submission to Regulatory Agency

Underground Storage Tank (UST) Fuel Oil Release Remediation – Manufacturing Firm

- Initiated Remedial Response Actions and Development of Work Plan
- Interviewed Client Representatives and UST Removal Contractor
- Conducted indoor air sampling program, including preparation of initial site conditions
- Retained remediation contractor and documented impacted soil excavation and removal of liquid water/petroleum
- Developed and executed subsurface soil and groundwater investigation program
- Developed building structural modifications plan to facilitate excavation of impacted soils beneath building
- Conducted basement sub-slab soil vapor evaluation
- Developed sub-slab soil vapor venting system as a risk reduction measure
- Evaluated sub-slab vapor venting system performance
- Prepared final closure report, including risk assessment analysis, for submission to Regulatory Agency

Landfill Remediation – Drum Assessment & Disposal

- Field assessed location of 40 drums containing unknown materials.
- Performed residual sampling and analysis to determine chemical characteristics
- Observed and documented staging of drums and coordinated disposal options
- Prepared closure reports

Hydrocarbon Assessment and Remediation – Major Petroleum Distribution Company

- Environmental and hydrogeologic assessment of site conditions and development of remedial measures for product recovery and groundwater treatment.
- Design, construction and operation of deep-well recovery systems.

- Environmental assessment and remediation of gasoline service stations related to underground storage tank replacement programs.
- Geologic and hydrogeologic assessment of service station sites related to residual hydrocarbon vapors. Included design, construction and operation of vapor recovery and treatment systems.

Industrial Facility Assessment and Remediation – Plastics Manufacturing Division Sale
- Environmental and hydrogeologic assessment of site conditions and development of remedial measures for product recovery and groundwater treatment.
- Implemented design/build remedial measures.

Industrial Facility Assessment
- Assessed historic PCB uses and developed initial site evaluation reports, including work plans for comprehensive site assessment activities.
- Evaluated historic uses of private properties for disposal of PBC fill material and development of field investigation work plans. Assessed field private property field conditions and developed evaluation reports.
- Evaluated river conditions related to PCB contamination and assessed potential natural resource damage claims.

Private Client Property Assessment
- Developed agency-ordered remedial work plan for removal of numerous drums from a 20-acre lake. Retained and supervised subcontractors activities related to identification, removal sampling and disposal of drums found in lake.
- Developed and implemented field sampling program to assess PCB contamination.
- Performed risk evaluation and assessment work associated with residual PCB contamination.

Municipal Client Landfill Assessment
- Developed and implemented agency-ordered environmental assessment of two sanitary landfills. Assessment included evaluation of ambient air, soil gas, soils, surface water and sediment media.
- Performed risk analysis and developed basis of design for risk reduction remedial measures.