MOVE YOUR ENVIRONMENT FORWARD

REMEDIAL INVESTIGATION WORK PLAN

714 Baldwin Street Site - Site # 808041
714 Baldwin Street
City of Elmira, Chemung County, New York

Prepared For:

Contract# D009808, Work Assignment No. 17
New York State Department of Environmental Conservation
Division of Environmental Remediation
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1.0 INTRODUCTION

On November 19, 2020, HRP Associates, Inc. (HRP) was authorized to complete this New York State Department of Environmental Conservation (NYSDEC) Work Assignment (WA) No. 17 (D009808-17) for Remedial Investigation (RI) at the 714 Baldwin Street Site (Site), located at 714 Baldwin Street, City of Elmira, Chemung County, New York. The scope of work for the RI portion of the Work Assignment, discussed herein, was developed based on HRP's review of the 2008 Site Characterization Report (SCR) as well as discussions and planning with NYSDEC staff.

1.1 Purpose and Objectives

This site-specific RI Work Plan describes the details of the scope of work, including all proposed field activities, laboratory analyses, and data QA/QC evaluation that will be associated with the RI at the 714 Baldwin Street Site. This document is intended to supplement information provided in the NYSDEC-approved *Generic Field Activities Plan for Work Assignments*, completed by HRP on August 8, 2019.

The purpose of the RI is to characterize on-site environmental media and work to define the nature and extent of the suspected on-site source(s) of groundwater contamination associated with the 714 Baldwin Street Site. In accordance with DER-10 *Technical Guidance for Site Investigation and Remediation (May 2010),* the primary objectives of the RI scope of work are to:

- Delineate the areal and vertical extent of contaminants in all media at or emanating from the Site;
- Determine the surface and subsurface characteristics of the Site, including topography, geology, and hydrogeology, including depth to groundwater and groundwater flow gradients;
- Identify the sources of contamination, the migration pathways, and actual or potential receptors of contaminants on or through air, soil, bedrock, sediment, groundwater, surface water, utilities, and structures at the Site, without regard to property boundaries;
- Determine all actual and potential adverse impacts to fish and wildlife resources using the Fish and Wildlife Resource Impact Analysis (FWRIA) Decision Key included in DER-10 Appendix 3c;
- Collect and evaluate all data necessary to evaluate the actual and potential threats to public health and the environment; and
- Collect the data necessary to evaluate any release to an environmental medium and develop remedial alternative(s) to address the release.

1.2 Site Description and Background Information

The 714 Baldwin Street Site (#808041), located at 714 Baldwin Street, City of Elmira, Chemung County, New York, (**Figure 1**) is the focus of this investigation. The Site consists of a 0.75-acre property which includes a 6,000-square foot warehouse and a small gravel driveway (**Figure 2**).

The Site is zoned for light industrial use, and surrounding properties include industrial, commercial, and residential uses. At present the areas surrounding the property include:

North: Vacant former junk yard followed by commercial properties;
South: Mixed residential and commercial use, including a residence, All Saint's Church and the Ernie Davis Community Center;
East: Dickson Street and a vehicle maintenance shop owned and operated by the Elmira City School District. The Diamond Cleaners Site (Site #808030), a Class 2 inactive hazardous waste site associated with the release of chlorinated volatile organic compounds (VOCs), is located approximately 300 feet east of the Site.
West: Baldwin Street, Clemens Center Parkway, and a paper and plastic packaging manufacturing plant;

The Site is connected to the municipal water supply and serviced by the municipal sanitary sewer. No records of septic systems at the Site have been identified in available records.

Site history was detailed in the Site Characterization Report (SCR) prepared by MACTEC Engineering and Consulting, P.C. and dated January 2008. The SCR indicates that the Site was occupied by Allen's Cash Paint Company by the year 1931. A 1931 Sanborn map indicated that aboveground gasoline storage tanks existed on norther portion of the property at that time. In 1981 the property was sold to Associated Linen Services, Inc., which became Associated Textile Rental Services, Inc. (ATRS) in 1986. According to the historic property ID cards, ATRS used the Site as a uniform and linen distributing center and fueled transportation trucks on-site.

In 1992, the property was sold by ATRS to National Service Industries, Inc. which later sold the property to G&K Services Linen Co. in 1997. Later property transfers include sales to TTSI Services Acquisition (1998), 714 Baldwin, LLC (2011), and the current property owner, Julian Raven (2014). Records from the City of Elmira Code Enforcement Department indicate the building has been vacant since at least 2006. It is not clear from the records obtained when linen storage and distribution operations ceased at the Site.

1.3 Site Geology and Hydrogeology

The Site and surrounding area are relatively flat topographically and located within a floodplain formed by the confluence of the Newtown Creek to the west of the Site, and the Chemung River to the south of the Site.

Surficial geology at the Site is mapped as oxidized, non-calcareous, fine sand to gravel (Caldwell et. al., 1986) and bedrock geology is mapped as shale and siltstones associated with the Upper Devonian West Falls Group (Fisher et al., 1970). According to the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Web Soil Survey, 100% of the Site area is mapped as Howard gravely silt loam, with 0 to 3 percent slopes.

During the SCR, on-site soil borings were sampled continuously to a maximum depth of 20 feet below grade (ft bg) using a Geoprobe® drill rig and the direct-push method. Select boring locations used for monitoring wells were completed to a maximum depth of 30 ft bg using a hollow stem auger (HSA). No soil was sampled or logged below 20 ft bg. Soil boring logs from the SCR indicate the upper 4 to 5 feet of subsurface soils consist of well-graded gravel and are underlain by at least 10 to 12 feet of clay. Bedrock was noted at only one of the thirty-seven (37) borings completed for the SCR at a depth of 16 ft bg, with no recovery.

The Site is located over the Elmira-Horseheads-Big Flats Primary Water Supply Aquifer, an overburden aquifer which supplies drinking water to residents of the City of Elmira. The closest operational public water supply wells are located along the shore of the Chemung River, approximately 1.2 miles southwest of the Site. During the SCR, groundwater was encountered at depths of approximately 13 to 15 ft bg within the Site boundaries. Groundwater in off-site wells was encountered at depths ranging from approximately 5 to 14 ft bg. Slug tests performed as part of the SCR indicated an average hydraulic gradient of 0.0011 feet per foot (ft/ft) and an average groundwater flow velocity of 15 feet per year. Based on topography, groundwater is expected to flow to the south toward the Chemung River, however groundwater elevation data from the SCR, groundwater was determined to flow west-southwest across the Site.

1.4 Areas of Concern

Based upon investigations conducted to date, the primary contaminants of concern at the Site include tetrachoroethene (PCE) and trichoroethene (TCE). TCE (32 ppm) detected in soil samples collected on the east side of the Site, significantly exceeds the soil cleanup objectives (SCO) for unrestricted use (0.47 ppm). PCE (2.7 ppm) detected in soil samples collected on the east side of the Site, slightly exceeds the SCO for unrestricted use (1.3 ppm). On and off-site groundwater sampling has also revealed that concentrations of PCE (4,300 ppb) and TCE (200 ppb) detected in groundwater samples significantly exceed NYS Class GA groundwater standards (5 ppb). A sub-slab vapor sample collected in the vacant warehouse on-site indicates that both PCE (1,310 ug/m^3) and TCE (14,472 ug/m^3) are present under the Site building at levels that may require mitigation. Based on the findings of the previous investigations, and discussion with NYSDEC and NYSDOH, the following areas of concern (AOCs), were identified and require further investigation to fully characterize thenature and extent of the contamination and to evaluate potential pathways of exposure.

- PCE and TCE present in various media at concentrations exceeding groundwater standards and SCOs south of the onsite building have not been fully characterized.
- Soil vapor intrusion (SVI) exposure pathways have not been investigated in the area south of the Site.

Additional AOCs warranting further characterization may be identified during the implementation of the RI.

2.0 REMEDIAL INVESTIGATION (RI) SCOPE OF WORK

This scope of work has been designed to gather data to evaluate each project objective listed in **Section 1.1**. The following sections provide specifics regarding the scope of work developed under this NYSDEC-approved Work Assignment (D009808-17) in support of a Remedial Investigation at the 714 Baldwin Street (#808041).

2.1 Preliminary Activities

As part of the scope of work, the following documents have been prepared under this Work Assignment:

- Project-specific Work Plan (this document) to accompany the generic Field Activities Plan (FAP),
- Site-specific Health and Safety Plan (HASP) (included as **Appendix A** of this Work Plan),
- Generic Quality Assurance Project Plan (QAPP).

These NYSDEC-approved generic FAP, HASP, and QAPP are on file with the NYSDEC. The site-specific elements are provided below.

2.1.1 Work Plan

This RI Work Plan has been prepared for use in performing the Remedial Investigation and will serve as the "site-specific FAP". This RI Work Plan identifies the components of the Remedial Investigation and a description of the tasks to be performed including the specific methods or procedures that will be used to conduct the field sampling. A proposed project schedule is included in **Section 4.1** of this RI Work Plan.

2.1.2 Health and Safety Plan

A site-specific Health and Safety Plan is provided in **Appendix A**. The site-specific HASP provides guidance to maximize health and safety of on-site workers during RI work- specific tasks including media sampling, installation of wells, surveying and other field related activities. Included in the site-specific HASP is a Community Air Monitoring Plan (CAMP) that details procedures for air monitoring during intrusive activities. The CAMP will be implemented during intrusive activities, described in **Section 2.2.2** of this Work Plan. The generic HASP has guidelines for health and safety supervision, air monitoring, medical monitoring, personal protective equipment, site controls, safe work practices and decontamination, etc.

2.1.3 Quality Assurance Project Plan

A site-specific Quality Assurance Project Plan (QAPP) has been prepared and is included in **Section 3** of this RI Work Plan. The site-specific QAPP was prepared as a supplement to the Generic QAPP with necessary site-specific information. Deviations from the protocols specified in the QAPP will be subject to the NYSDEC approval.

The Generic QAPP provides general information related to QA/QC procedures associated with the collection and analysis of samples of environmental media and includes specific representative standard operating procedures (SOPs) applicable to sample handling and field instrumentation use. Information provided in the Generic QAPP includes definitions and generic goals for data quality and required types and quantities of QA/QC samples. The procedures address field documentation; sample handling, custody, and shipping; instrument calibration and maintenance; auditing; data reduction, validation, and reporting; corrective action requirements; and QA/QC reporting specific to the analyses performed by the laboratories that are used for analysis of environmental media collected under Standby Contract No. D009808.

All laboratory analytical work will be performed by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) approved laboratory certified in all categories of Contract Laboratory Protocol (CLP) and Solid and Hazardous Waste analytical testing. A Data Usability Summary Report (DUSR) will be included in the Remedial Investigation Report (RIR) for each round of analytical work. Category B deliverables will be retained in the project files and available for full data validation by a qualified, independent third party.

2.2 Investigation, Environmental Sampling, and Implementation

The RI will include the components described below and will consist of subsurface/intrusive characterization. The RI will consist of characterizing and sampling of the subsurface soil, soil gas, and groundwater to meet project objectives. The number and type of samples to be collected is discussed below and summarized on **Table 1**. The field investigation tasks for the 714 Baldwin Street Site are listed below in the order that they are expected to be completed:

1. Underground Utility Identification and Clearance using Ground-Penetrating Radar (GPR)
2. Subsurface Soil Investigation (soil boring installation and sampling)
3. Groundwater Characterization (monitoring well installation and sampling)
4. Characterization and Disposal of Investigation Derived Waste
5. Soil Vapor Intrusion Investigation (air and soil vapor sampling)
6. Analytical Data Quality Evaluation
7. Base Map Development and Site Survey

2.2.1 Underground Utility Clearance and Ground Penetrating Radar (GPR)

Prior to implementing any intrusive activities, a utility clearance will be conducted. HRP will rely upon multiple lines of evidence to ensure to the maximum extent practicable that subsurface features are identified prior to commencement of intrusive work.

HRP will mark sampling locations prior to installation and contact public utility clearance services to mark out the utilities prior to the survey. The drilling contractor will request utility mark outs through NYS Code Rule 753/Dig Safe System. The dig safe system is limited to public right-of ways and will only identify utilities entering private property rather than utilities present on-site.

HRP requests that a knowledgeable party (client/site owner) provide all available site utility information prior to the survey or drilling activities and that, if possible, a knowledgeable site person to clear each boring location prior to drilling.

HRP will utilize a qualified subcontractor to conduct a GPR survey to attempt to locate any privately underground structures or utilities within the Site property boundaries to ensure boring areas are clear of obstructions and identify any other potential AOCs. The GPR survey area is depicted on **Figure 2**.

GPR is a non-destructive and non-intrusive geophysical exploration technique that uses radar waves to detect subsurface objects, such as tanks, drums and piping. The GPR is also capable of detecting discontinuities in the subsurface materials indicative of excavated and backfilled areas, such as those associated with possible (underground storage tank) UST graves. The objective of performing this survey is not only make subsurface investigation as safe as possible for the field staff while protecting utilities, but also to identify possible sources and migration pathways (utility corridors, etc.). All anomalies identified during the GPR survey will be marked out in the field.

If necessary, the upper five feet at all boring locations will be cleared of any underground utilities by non-mechanical means, such as a hand-digging methods.

2.2.2 Subsurface Characterization

In an effort to assess the nature of subsurface soil at the Site, the unconsolidated soils at the Site will be evaluated at representative locations. It is anticipated that any soil cuttings will be containerized and labelled in 55-gallon drum(s) for proper disposal, if any evidence of contamination is noted during the investigation. Further discussion of investigation derived waste is discussed in **Section 2.2.5**. These proposed testing locations are provided on **Figure 2**; exact locations may vary based on the results from the GPR survey.

2.2.2.1. Advancement of Exploratory Soil Borings

Up to seven (7) soil borings will be advanced using direct-push methods to a depth of approximately 20 ft bg or refusal, whichever comes first. During soil boring installation continuous soil samples will be collected for observation. Specifically, HRP will collect data to determine the characteristics of the overburden material at the Site and the distribution of contamination in on and off-site soils. Based on boring logs from the SCR, and the surficial geology of the Site, it is not anticipated that bedrock will be encountered in borings completed to a maximum depth of 20 ft bg.

Soil samples will be collected with macrocore sampler at 5-foot intervals. All soil samples will be screened for volatile organic vapors using a photo-ionization detector (PID), and any evidence of contamination will be noted and used for selection of soil samples. One (1) soil sample will be collected from each soil boring and submitted for laboratory analysis of Target Compound List (TCL) VOCs+10 by EPA Method 8260

Duplicate and matrix/matrix spike duplicates will be collected at a frequency of 1 per 20 samples.

Trip blanks will be submitted at a frequency of one per cooler per day if analysis for VOCs is included in the sampling set within the cooler.

Soil borings will be installed on the north and east sides of the Site building and south of the Site property boundary on the neighboring vacant lot. Additionally, two soil borings will be installed within the Site building, through the foundation slab. The soil boring locations are shown on **Figure 2**.

2.2.2.2. Soil Sample Collection and Handling Procedures

Soil samples will be collected directly above the water table or at an interval that is impacted based on physical observation (above or below the water table), olfactory observations, and/or elevated PID readings.

Nitrile gloves will be worn at all times by personnel collecting and handling the samples. All non-disposable equipment and tooling used for sampling will be properly decontaminated between sampling locations and intervals. Decontamination procedures are described in **Section 2.2.4**. Soil samples will be collected using clean laboratory-supplied, appropriate containers (as listed in **Table 1**) and will be preserved on ice in coolers during field sampling activities. Target samples will then be submitted for laboratory analysis, and contingency samples will be stored at proper temperatures, as listed in **Table 1**, pending follow-up analysis as necessary. Duplicate and matrix/matrix spike duplicates will be collected at a frequency of 1 per 20 samples. Additional information related to methodology and materials used for soil sampling is provided in Section 14 of the Generic FAP, on file with the NYSDEC.

2.2.3 Groundwater Characterization

For the purpose of evaluating groundwater quality and to obtain groundwater flow information, two (2) new groundwater monitoring wells are proposed for installation as part of the RI, to supplement the existing network of groundwater monitoring wells on the Site. The proposed locations were selected based on the presence of chlorinated VOC concentrations south of the Site building encountered during SCR groundwater sampling, the locations of existing monitoring wells, and the southerly topographic gradient and expected groundwater flow direction. The locations of existing and proposed monitoring wells are presented on **Figure 2**.

2.2.3.1. Monitoring Well Installation

A hollow-stem auger drilling rig will be advanced through the overburden materials and used to set shallow overburden monitoring wells, which are anticipated to be completed at a depth of 20 ft. bg. The wells will ultimately be designed and installed such that the well screen will intersect the observed water table elevation. As discussed in **Section 2.2.2.1**, the target depth and construction of these wells will be dependent on the subsurface conditions encountered in the field.

Unless significantly elevated VOC concentrations are observed indicating that alternative materials such as stainless steel be used, monitoring wells are to be constructed of 2-inch diameter, Schedule 40 PVC solid well pipe riser and a ten-foot PVC 10-slot screen that will be positioned to intercept the water table. Depending on the location of the well, it will be finished with either a 4-foot stick-up protective casing, or a flush mounted protective cover. All equipment will be appropriately decontaminated between sampling locations, as described in **Section 2.2.4**. Based on well location, any soil cuttings will be spread either on-site or containerized as discussed in **Section 2.2.5**. Additional drilling activities are described in **Section 2.2.2.1** of this Work Plan.

2.2.3.2. Well Development

Each newly-installed well will be developed a minimum of 24 hours after completion by pumping and surging for 2 hours or until the field parameters stabilize for a minimum of three consecutive readings of 10 percent variability of less. The field parameters include: temperature, pH and specific conductance. In addition, the turbidity of the groundwater must achieve a reading of 50 Nephelometric Turbidity Units (NTUs) or less during the field parameter readings.

All purge water obtained during well development and sampling will be containerized and disposed of in accordance with NYSDEC DER-10. If impacts are observed, the contaminated groundwater will be segregated and handled as described in **Section 2.2.5**. All sampling equipment will be appropriately decontaminated between sampling locations or disposed of after a one-time use.

2.2.3.3. Sampling of Monitoring Wells

Depth to groundwater measurements will be collected from all monitoring wells to the nearest 0.01 foot from the surveyed points (the survey is discussed in **Section 2.2.8**) prior to sampling activities and the data will be used to construct a groundwater contour map to determine the direction of groundwater flow and the hydraulic gradient on the Site. Until deemed unnecessary, in addition to measuring the groundwater level, the wells will be checked for both light and dense non-aqueous phase liquids (LNAPLs and DNAPLs) using an interface probe.

Groundwater samples will be collected from the two (2) newly installed wells a minimum of seven days after well development has been completed. All groundwater samples will be collected in accordance with EPA low-flow groundwater sampling procedures and will be submitted to Eurofins TestAmerica, Inc. (Eurofins), an NYSDOH ELAP and NYSDEC approved laboratory for analysis of Target Compound List VOCs +10 by EPA Method 8260. Additionally, groundwater samples collected from the two newly installed wells will be analyzed for analytes identified by the NYSDEC as “emerging contaminants”: per- and polyfluoroalkyl substances (PFAS) by EPA Method 537.1, and 1,4-Dioxane by EPA Method 8270. Duplicate and matrix/matrix spike duplicates will be collected at a frequency of 1 per 20 samples.

Protocols for the collection and analysis of water samples for per- and polyfluoroalkyl substances (PFAS) will be in accordance with the NYSDEC *Sampling, Analysis, and Assessment of PFAS Under NYSDEC’s Part 375 Remedial Programs, October 2020*. Additional information related to methodology and materials used to sample for PFAS is provided in Section 14 of the Generic FAP on file with NYSDEC.

2.2.4 Decontamination Procedures

Non-dedicated sampling equipment (i.e., submersible pumps, water level indicators, etc.) will be subject to decontamination procedures prior to each sample collected to reduce the potential for cross-contamination, as described in the Generic Field Activities Plan on file with NYSDEC. The decontamination procedures will include the use of a scrub wash with a solution consisting of Alconox® detergent and potable water followed by a rinse with DI water. The decontaminated equipment will be stored in clean environments (i.e., the manufacturer's storage case). Liquinox® will not be used if samples are to be collected for 1,4-dioxane analysis, since Liquinox® may contain a small amount of 1,4-dioxane. The decontaminated equipment will be stored in clean environments (i.e., the manufacturer's storage case). Decontamination fluids will be properly labeled and securely stored in a designated waste-container staging area.

2.2.5 Disposal of Investigation Derived Waste

Investigative derived waste (IDW) that is generated from the subsurface characterization, monitoring wells installation and the development of monitoring wells shall be handled in accordance with NYSDEC DER-10. HRP will be responsible for supplying the equipment and materials necessary for the proper handling and storage of the IDW, such as DOT-approved 55-gallon drums, roll-off containers and/or holding tanks. All containers will be labeled and stored in accordance with applicable NYSDEC regulations.

Soil shall be handled and disposed of in accordance with DER-10. If off-site disposal of IDW is required, it will be disposed of or treated according to applicable local, state, and federal regulations. Soils from the RI may be disposed within the direct-push hole provided the hole will not be used for the installation of a monitoring well (cuttings may be used to backfill holes resulting from soil sampling), the direct-push hole did not penetrate an aquitard nor an aquiclude and backfilling the hole with cuttings will not create a significant path for vertical movement of contaminants. Soil additives (bentonite) may be added to the cuttings to reduce permeability. Six (6) inches of cohesive, compacted soil should be placed over the area of the hole.

The cuttings and spoil from wells and borings which are chemically compatible may be collected and disposed at one on-site location if they cannot be disposed in their respective boreholes. Material that is visually stained, creates high PID measurements, or exhibits strong odors shall be sampled and analyzed to ensure chemical compatibility with other cuttings before placing the materials in a common storage/disposal area if staining is present in the cuttings. Additionally, cuttings which are stored/disposed on-site in bulk (not in containers) shall be monitored for volatile emissions and for fugitive dust emissions. Monitoring instruments available at the Site as determined by the site-specific HASP may generally be sufficient. If any action level specified in the HASP is exceeded, corrective actions such as interim cover, placement in containers, etc., shall be implemented promptly.

It is anticipated that purge water generated during the development of the monitoring wells will require off-site disposal based on the previous Site data. Decontamination fluids will be containerized separately from other RI derived waste, and any decontamination fluids that do not exhibit evidence of contamination will be containerized separately from those exhibiting evidence of contamination.

2.2.6 Soil Vapor Intrusion Investigation

To assess the migration of gaseous vadose zone contamination and evaluate the SVI exposure pathway, an SVI investigation will be performed within the on-site building and in a selection of buildings downgradient from the Site. The SVI investigation will include a total of six (6) sub-slab soil vapor samples, six (6) indoor air samples, and one (1) ambient air sample, each to be collected concurrently during the heating season. One (1) duplicate soil vapor sample, one (1) MS soil vapor sample, and (1) MSD soil vapor sample will be collected for laboratory QA/QC purposes.

The soil gas will be sampled in accordance with the New York State Department of *Health's Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006* (updated May 2017). The general proposed locations of the sampling points are provided on **Figure 2**. Specific locations will be chosen with consultation with the NYSDEC and NYSDOH, with property owners, and as field conditions allow. HRP will install a new sub-slab access point in an adequate location beneath the concrete slab and will use leak detection testing to confirm the competency of the vapor point. Prior to soil vapor sampling, the integrity of the seal will be evaluated using a helium tracer gas. In the event that the probe fails the tightness test, the subsurface probe seal will be modified and the integrity testing repeated.

Indoor and ambient air samples will be collected simultaneous to sub-slab samples, and will be placed at a height corresponding to the average breathing level (i.e. approximately five feet above the ground surface). Collected at a flow rate of less than 0.2 liters/minute, the sampling duration will be at least 24 hours. Soil gas and air samples will be collected in Summa canisters, and analyzed using USEPA Method TO-15. Samples will be submitted to Eurofins, an ELAP-approved laboratory. Prior to sampling, the integrity of the seal will be evaluated using a helium tracer gas. In the event that the probe fails the tightness test, the subsurface probe seal will be modified and the integrity testing repeated. In addition, a chemical inventory of the rooms where samples will be located will be completed prior to sampling.

2.2.7 Analytical Data Quality Evaluation

This RI Work Plan and the associated site-specific QAPP Section detail the data quality objectives and analytical requirements needed for this WA. All quality assurance protocols will be provided in the Generic QAPP.

During the final Work Plan review period, the site-specific QAPP Section and Work Plan will be reviewed and modified according to NYSDEC requirements and comments. Once the plans are finalized, deviations, if required, from protocols specified in the plans will be approved in advance by NYSDEC. As required, the selected analytical laboratory will maintain NYSDOH ELAP certification in all categories of USEPA Contract Laboratory Program (CLP) and Solid and Hazardous Waste analytical testing for the duration of the project.

Eurofins will supply all required data deliverables (USEPA CLP and NYSDEC ASP deliverable format) to enable the data to be validated. All environmental data will be submitted electronically in a specified format named 'NYSDEC' in accordance with the data submission procedures outlined on the NYSDEC's web site (http://www.dec.ny.gov/chemical/62440.html).

Upon receipt of the sample data, the validation contractor will quantitatively and qualitatively validate the laboratory data. The validation of the analytical data will be performed according to the protocols and QC requirements of the analytical methods, the *National Functional Guidelines for Organic Data Review, January 2017* and the *National Functional Guidelines for Inorganic Data Review January 2017*, and the reviewer's professional judgment.

2.2.8 Base Map Development and Site Survey

The subject property and surrounding areas will be surveyed by a New York State licensed land surveyor. The field survey will include establishing project horizontal control and the collection of planimetric features for the development of 2D mapping. Subsequently, a base map of the Site will be developed using Computer Aided-Design (CAD) software that will be utilized to place all sampling locations from previous on-site and off-site investigations. The sample locations will be placed on the base map by geo-referencing previous figures into the local CAD coordinate system, and will include all monitoring wells, soil borings, and soil vapor points.

Upon completion of the investigation fieldwork, a survey will be conducted in order to properly locate all sampling points such as monitoring wells, soil borings, soil vapor intrusion samples, and any other sample locations. The elevations of all monitoring well casings will be established to within an accuracy of plus or minus 0.01 feet based on an arbitrary local vertical benchmark. A notch will be etched in all interior casings, or a permanent black mark, to provide a reference point for all future groundwater elevation measurements.

2.3 Remedial Investigation Report

2.3.1 Electronic Data Delivery

In addition to appropriate data summary tables and boring logs included in the report, all environmental data will be submitted electronically in a specified Electronic Data Deliverable (EDD) format named in accordance with the data submission procedures outlined on the NYSDEC's web site (http://www.dec.ny.gov/chemical/62440.html).

2.3.2 Remedial Investigation Report

The Remedial Investigation Report (RIR) will be prepared as part of this work assignment following completion of the field activities. The RIR will provide a description of the field activities, present data collected during field characterization, present a physical description of the Site including geology and hydrogeology, and provide an analysis and interpretation of the available data in the context of existing Site conditions. The report will include tabulated laboratory analytical results, Site maps and a discussion of contaminant concentrations, including a comparison to NYSDEC Standards, Criteria and Guidelines as described in Section 3.14 of DER-10 and in accordance with New York State Department of Health guidelines for human health exposure assessment as described in Appendix 3B of DER-10 to support each conclusion of the RI.

The RIR prepared as part of this assignment will also provide a data validation/usability evaluation, identification and location of contaminants, assessment of potential contaminant migration pathways, impact on human and environmental receptors, and conclusions regarding the significance of the findings. The proposed work will provide delineation and extent of contamination, if present, at the Site. The results of the RI will assist the NYSDEC in determining if the conditions at the Site warrant further action or if a no further action designation may be recorded.

The submitted report will include the report text, appropriate tables, figures, photographs, data summary tables, and boring logs in a PDF format on a compact disc. The electronic file will contain ‘bookmarks’. In addition, one hard copy of the report will be sent.

3.0 SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN

This site-specific Quality Assurance Project Plan (QAPP) has been prepared as a companion Section to accompany the Generic QAPP for the standby subcontract prepared by HRP for the New York State Department of Conservation (NYSDEC) under Standby Contract No. D009808. The purpose of the QAPP is to specify QA/QC procedures for the collection, analysis, and evaluation of data that will be legally and scientifically defensible.

3.1 Site-specific Sampling

Soil, groundwater, and air samples will be collected during this RI. Detailed sampling procedures are detailed in Section 4.0 of the Generic QAPP. Matrix types, number of samples (including QA/QC) and analytical details are summarized in **Table 1** (follows text). Proposed sample locations are depicted on **Figure 2.**

3.1.1 PFAS Sampling

Sampling for PFAS will occur at the Site during the planned activities covered in this Work Plan. Specific requirements for field sampling procedures including precautions to be taken, pump and equipment types, decontamination procedures, and a list of approved materials to be used during sampling for PFAS compounds are included in Section 14.1 of HRP's Generic Field Activities Plan (FAP), on file with NYSDEC. Only regular ice will be used in the transport of samples being analyzed for PFAS.

The PFAS compounds will be analyzed by methods based on EPA Method 537.1. Specific PFAS compounds to be analyzed include:

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
	Perfluorooctanesulfonic 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

Group	Chemical Name	Abbreviation	CAS Number
	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

The minimum method achievable Reporting Limits for PFAS will be less than or equal to 2 ng/l (part per trillion [ppt]) for aqueous samples.

The laboratory Minimum Detection Limits as provided by Test-America for the PFAS compounds to be analyzed are as follows:

Analyte Description	MDL	Units
	Aqueous	
M2-6:2 FTS		ng/l
M2-8:2 FTS		ng/l
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	1.50	ng/l
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	1.70	ng/l
Perfluorobutanesulfonic acid (PFBS)	0.490	ng/l
Perfluorobutanoic acid (PFBA)	1.00	ng/l
Perfluorodecanesulfonic acid (PFDS)	0.900	ng/l
Perfluorodecanoic acid (PFDA)	0.770	ng/l
Perfluorododecanoic acid (PFDoA)	0.590	ng/l
Perfluoroheptanesulfonic acid (PFHpS)	0.950	ng/l
Perfluoroheptanoic acid (PFHpA)	0.910	ng/l
Perfluorohexanesulfonic acid (PFHxS)	0.800	ng/l
Perfluorohexanoic acid (PFHxA)	0.760	ng/l
Perfluorononanoic acid (PFNA)	0.270	ng/l
Perfluorooctanesulfonamide (PFOSA)	10.0	ng/l
Perfluorooctanesulfonic acid (PFOS)	0.610	ng/l
Perfluorooctanoic acid (PFOA)	0.810	ng/l
Perfluoropentanoic acid (PFPeA)	0.630	ng/l
Perfluorotetradecanoic acid (PFTeA)	0.920	ng/l
Perfluorotridecanoic acid (PFTriA)	0.600	ng/l
Perfluoroundecanoic acid (PFUnA)	0.780	ng/l

The laboratory SOP for PFAS analysis is attached (included as **Appendix B** of this Work Plan).

3.1.2 1,4-Dioxane Sampling

Sampling for 1,4-dioxane will occur at the Site during the planned activities covered in this Work Plan. Specific requirements for field sampling procedures include precautions to be taken, pump and equipment types, detailed decontamination procedures, a prohibition on using Liquinox, and approved materials only to be used for 1,4-dioxane are included in Section 14.2 of HRP's Generic Field Activities Plan.

The minimum method achievable Reporting Limits for 1,4-dioxane will be less than or equal to 0.35 µg/l (ppb) for aqueous samples.

Laboratory provided specifics for 1,4-dioxane sampling MDLs and RLs is as follows:

Method	Analyte	Matrix	MDL	RL
8270D SIM	1,4-Dioxane	Water	0.1 µg/l	0.2 µg/l

3.2 Data Quality Assessment and Usability

Data quality objectives for the 714 Baldwin Street Site are focused on the characterization of releases of hazardous substances impacting environmental media at the Site and the downgradient study area.

To achieve these objectives, QA/QC measures will be implemented throughout the RI investigation to provide input as to the validity and usability of data generated through soil, groundwater, soil vapor and indoor air sampling. The procedures for data QA/QC management includes field documentation; sample handling, custody, and shipping; instrument calibration and maintenance; auditing; data reduction, validation, and reporting; corrective action requirements; and QA reporting specific to the analyses performed by the laboratory under subcontract to HRP. **Table 2** lists the sample containers, preservation, and holding time requirements for the parameters specific to this Site. This table will be referenced by field personnel.

For all data generated during the RI, a Category B Data package and DUSR will be prepared to provide a thorough evaluation of analytical data utilizing third-party data validation. Analytical Quality Associates, Inc. (AQA) will be the third-party data validator for this project. AQA's qualifications are included in **Appendix C.**

4.0 PROJECT MANAGEMENT

HRP has the responsibility of the overall management of this project and will respond to any NYSDEC requests. A proposed project schedule, key milestones, key project personnel, and project-specific subcontractors follow.

4.1 Project Schedule and Key Milestones

The proposed project schedule for this work assignment is outlined below. Key milestones are identified to monitor work progress. The following milestones will be applicable for this project:

		Est. Start Date
• Milestone 1:	RI WA Field Activity Plan development	Completed
• Milestone 2:	NYSDEC review of all site-specific plans	February 2021
• Milestone 3:	Soil vapor point installation and sampling (to be completed during heating season)	February/March 2021
• Milestone 4:	Installation and sampling of soil borings	March/April 2021
• Milestone 5:	Installation and sampling of monitoring wells	March/April 2021
• Milestone 5:	Removal of any investigation-derived waste	April 2021
• Milestone 7:	Completion of Data Validation	Summer 2021
• Milestone 8:	RIR submission	Summer 2021

Preparation for the soil vapor sampling (Milestone 3) will begin within 1-2 weeks of NYSDEC review and approval of all site-specific plans to ensure the sampling is completed before the end of the month of March and within the heating season. Soil and groundwater sampling will be conducted concurrently with soil vapor sampling, contingent upon availability of subcontractors. Soil, groundwater, and soil vapor samples will be submitted for laboratory analysis within 24 hours of field collection, and laboratory results can generally be expected within 10 days of submission. Any investigation-derived waste generated from the Site during the RI will be scheduled with the contractor to be removed within 1 week of the completion of Milestone 5, sampling of the monitoring wells. The timeframe of pickup and removal of this waste (Milestone 6) will be determined by the contractor upon scheduling. Data validation (Milestone 7) will begin upon receipt of the first set of laboratory results, and will continue to be submitted for validation as the results are received from the laboratory. Data validation is expected within a four week timeframe. Milestone 7 will not be considered complete until data from the off-site soil vapor intrusion investigation has been validated. The RIR (Milestone 8) will be submitted as a draft report within 60 days after HRP receives the last round of analytical data from the laboratory. A second draft RIR will be submitted, if needed, within two weeks after the data validation company has reviewed the final analytical submitted for the investigation. A final version of the RIR will be submitted within two weeks after the DEC Project Manager’s comments on both draft reports are received by HRP.

4.2 Key Project Personnel

A list of the project personnel of the prime consultant and subcontractors responsible for performance of the investigation has been submitted to the NYSDEC for approval. Primary project staffs are listed in the table below. Resumes for key project personnel are included in **Appendix C**.

Personnel	Company	Title for this Work Assignment	Responsibility
Mark Wright PG, CSP (Project Manager)	HRP Associates, Inc. (Prime Consultant)	Project Manager	Overall management of the WA
Mark Wright PG, CSP (Project Manager)	HRP Associates, Inc.	Office Health & Safety Manager	Approval of HASP and responsible for overall health and safety issues with the WA
Michael Varni (Senior Project Geologist)	HRP Associates, Inc.	Corporate QA/QC Officer	Responsible for QA/QC on the WA
Patrick Montuori (Senior Project Consultant)	HRP Associates, Inc.	Field Manager and Site Health & Safety Officer	Responsible for the on-site sampling and investigative tasks

Subcontractors for this project will include:

- Survey – Fagan Engineers, Inc.
- GPR – GPRS, Inc.
- Drilling – NW Contracting, Inc.
- Laboratory –Eurofinsto provide all media sample analyses.
- Data Validation – Analytical Quality Associates, Inc.
- Company to dispose of any investigation-derived waste (contingent upon analytical results).

5.0 REFERENCES

Caldwell, D.H., et.al., 1986, Surficial Geologic Map of New York, New York State Museum – Geological Survey, Map and Chart series No. 40

Fisher, D.W., et. al., 1970, Geologic Map of New York, New York State Museum and Science Service, Map and Chart Series No. 15.

New York State Department of Environmental Conservation, Division of Environmental Remediation, DER-10 Technical Guidance for Site Investigation and Remediation, May 2010.

New York State Department of Environmental Conservation, Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs, October 2020

New York State Department of Health, Center for Environmental Health, Bureau of Environmental Exposure Investigation, Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006, Updated May 2017.

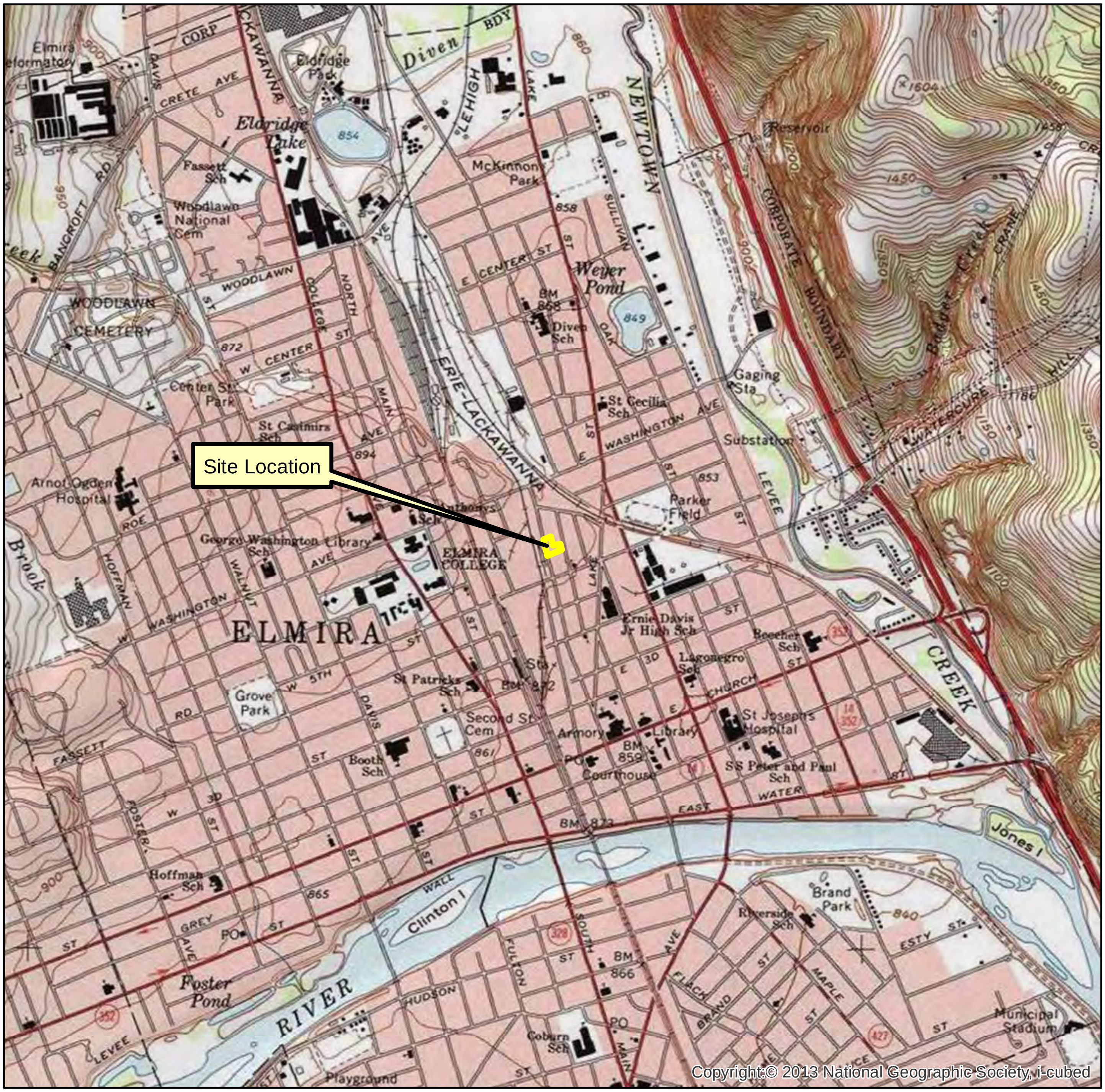
Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. http://websoilsurvey.sc.egov.usda.gov/. Accessed [1/24/2021].

United States Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, National Functional Guidelines for Inorganic Data Review, January 2017.

United States Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation, National Functional Guidelines for Organic Data Review, January 2017.

FIGURES

Path: S:\Data\NYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\ELMIRA\714 BALDWIN STREET, ELMIRA, NY\DEC1017P3\GIS\Figure 1 - Site Location.mxd



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0 1,000 2,000 4,000 6,000 8,000
Feet

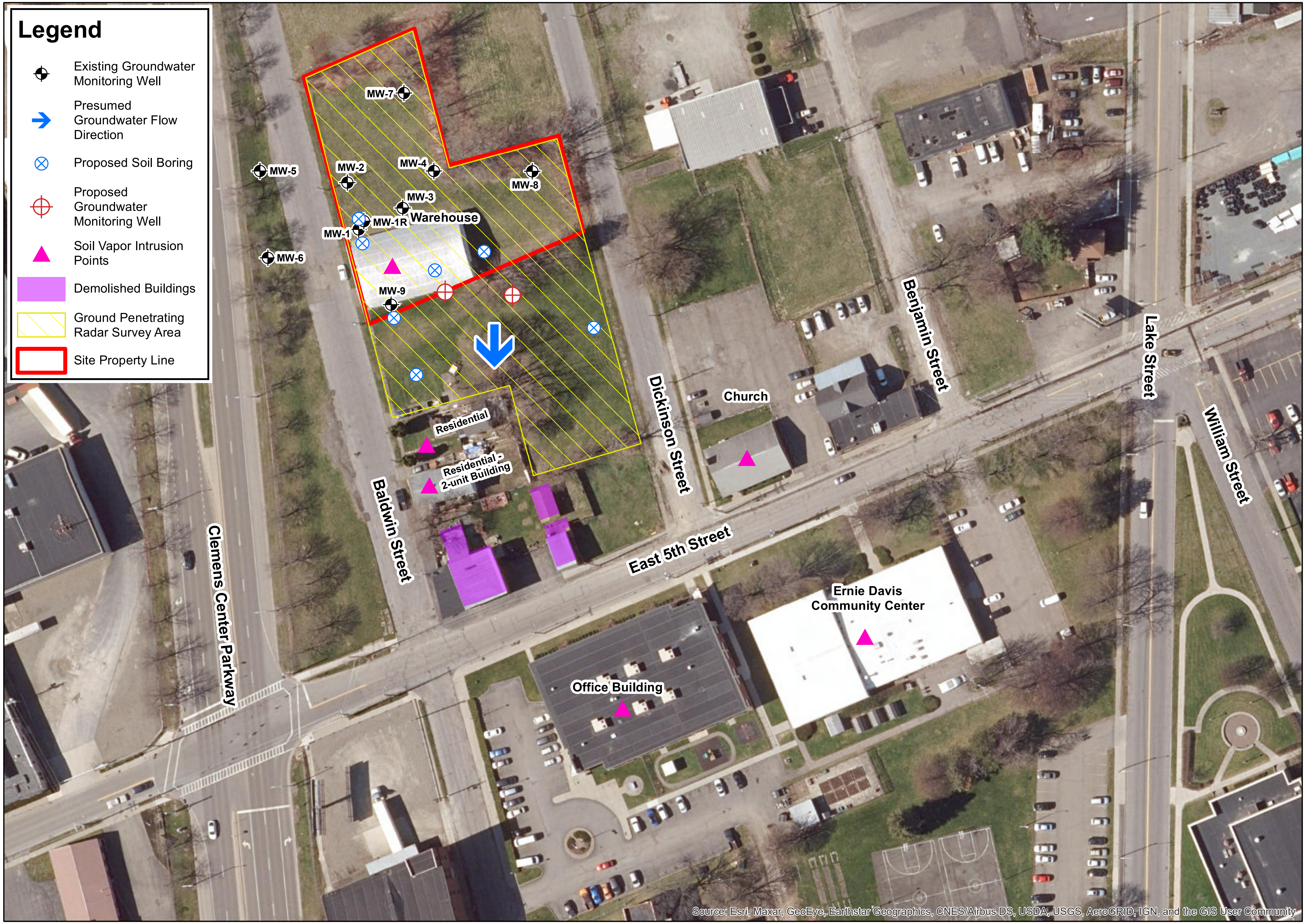
1 inch = 2,000 feet

N

USGS Quadrangle Information
Quad ID: 42076-A7
Name: Elmira, New York
Date Rev: 1969
Date Pub: 1971

Figure 1
Site Location
714 Baldwin Street Site (Site#808041)
714 Baldwin Street
City of Elmira,
Chemung County, New York
HRP # DEC1017.P3
Scale 1" = 2,000'

HRP
MOVE YOUR ENVIRONMENT FORWARD
ONE FAIRCHILD SQUARE
SUITE 110
CLIFTON PARK, NY 12065
(518) 877-7101
HRPASSOCIATES.COM



Legend

- ⊕ Existing Groundwater Monitoring Well
- → Presumed Groundwater Flow Direction
- ⊗ Proposed Soil Boring
- ⊕ Proposed Groundwater Monitoring Well
- ▲ Soil Vapor Intrusion Points
- 🟪 Demolished Buildings
- ▨ Ground Penetrating Radar Survey Area
- 🟥 Site Property Line

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Path: S:\Data\NY\NYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\ELMIRA\714 BALDWIN STREET, ELMIRA, NY\DEC1017P3\GIS\Proposed Investigation Locations.mxd

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HRPASSOCIATES.COM

↑ North

0 40 80 Feet

Revisions		
No.	Date	

Designed By: PM

Drawn By: BOB

Reviewed By: MEW

Issue Date: 02/02/2021

Project No: DEC1017.P3

Sheet Size: 11x17

Proposed Investigation Locations

714 Baldwin Street Site
(Site#808041)
714 Baldwin Street
City of Elmira,
Chemung County, New York

Figure No.

2

TABLES

Table 1
Sampling Summary
Remedial Investigation

714 Baldwin Street Site
NYSDEC Site # 808041
714 Baldwin Street
Elmira, New York

Activity/ Matrix	Number of Sample Locations	Proposed Sample Locations	Number of Samples to be Collected	Analyses
Soil Boring Sampling/ Soil	7	Within Site building (sub-slab), North of Site building, East of Site building, Property south/downgradient of Site	7	VOCs+10 by EPA Method 8260
Monitoring Well Sampling/ Groundwater	2	2 proposed well locations on property south of the Site, with 1 selected for duplicate, MS, MSD	5	VOCs+10 by EPA Method 8260 PFAS by EPA Method 537.1 1,4-Dioxane by EPA Method 8270
Vapor Intrusion Investigation/ Soil Vapor and Air	6	Soil Vapor (6 locations with 1 selected for dupliacte, MS, MSD	9	VOCs by EPA Method TO-15
		Indoor Air (6 locations)	6	
		Outdoor Air (1 location)	1	

Acronym List:
PFAS: Per- and Polyfluoroalkyl Substances
VOCs: Volatile Organic Compounds

MOVE YOUR ENVIRONMENT FORWARD

Table 2
Analytical Methods/Quality Assurance Summary
Remedial Investigation

714 Baldwin Street Site
NYSDEC Site # 808041
714 Baldwin Street
Elmira, New York

					Containers per Sample			**Preservation Requirements**			
Parameter	**Matrix**	**Number of Samples (including Field QC)**	**Preparation Method**	**Analytical Method**	**No.**	**Size**	**Type**	**Temp.**	**Light Sensitive**	**Chemical**	**Maximum Holding Time**
SOIL											
VOCs by GC/MS	Soil/Sediment	7	5035A	SW-846 Method 8260B	3 vials	40 ml vials,	glass vials	2-6º C	No	MeOH/	14 days
					1 jar	any size jar	clear glass jar			sodium bisulfate/ freezing	
GROUNDWATER											
VOCs by GC/MS	Aqueous	2	5035	SW-846 Method 8260B	3	40 ml	glass vial	2-6º C	No	HCL	14 days
PFAS	Aqueous	23	NA	Modified Method 537.1	3	250 ml	polypropylene	2-6º C	No	trizma	14/28 days
1,4-Dioxane	Aqueous	23	NA	SW-846 Method 8270 SIM	2	500 ml	amber glass	2-6º C	Yes	NA	7 days
SOIL VAPOR, AIR											
VOCs	Soil Vapor, Air	16	NA	EPA TO-15	1	6-Liter	summa canister	NA	No	NA	30 days (summa canister)

Acronym List:
GC: Gas Chromatography
HCL: Hydrochloric Acid
MeOH: Methanol
MS: Mass Spectometry
NA: Not Applicable
PFAS: Per- and Polyfluoroalkyl Substances
VOCs: Volatile Organic Compounds

APPENDIX A

Site-Specific Health and Safety Plan

MOVE YOUR ENVIRONMENT FORWARD

SITE-SPECIFIC HEALTH AND SAFETY PLAN (HASP)

714 Baldwin Street Site
714 Baldwin Street
City of Elmira, Chemung County, New York
DEC Site # 808041

Prepared For:

Ms. Dana Nieder
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

Contract #D009808-17

Prepared By:

HRP Associates, Inc.
1 Fairchild Square, Suite 110
Clifton Park, NY 12065

HRP #: DEC1017.P3

Issued On: February 19, 2021

Addendum Number	Date Issued	Reason For Modification

Disclaimer

HRP Associates does not guarantee the health or safety of any person entering this site. Due to the potential hazards of this site and the activity occurring thereon, it is not possible to discover, evaluate, and provide protection for all possible hazards which may be encountered. Strict adherence to the health and safety guidelines set forth herein will reduce, but not eliminate, the potential for injury at this site. The health and safety guidelines in this plan were prepared specifically for this site for use and should not be used on any other site.

CERTIFICATION

This Addendum to HRP's Generic Health and Safety Plan has been prepared under the supervision of, and has been reviewed by, a Certified Safety Professional (CSP) certified by the Board of Certified Safety Professionals.

Mark Wright

Mark Wright, CSP
BCSP # 31277

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Figures

Tables

Appendices

1.0 EMERGENCY CONTACTS/PLANNING

The Health and Safety Officer will coordinate the entry and exit of response personnel in the event of an emergency. The following information, including directions to the nearest hospital shall be posted at the Site. When contacting the local authorities, be sure to provide: your name, facility name, full address, telephone number, and the nature of the emergency.

Emergency Phone Numbers
915 East Market Street, Elmira, NY

Emergency Contact	Phone Number
Fire, Ambulance, Police Emergency:	911
Elmira Police Department (routine calls):	607-735-8600
Elmira Fire Department (routine calls):	607-737-5714
St. Joseph's Hospital (Elmira):	607-733-6541
Poison Control Center:	1-800-222-1222
DEC spills hotline:	1-800-457-7362
National Response Center:	800-424-8802
Project Manager: Mark Wright	203-308-0983
Site Safety Officer: Patrick Montuori	845-531-9490
NYSDEC Project Manager: Briana Scharf	518-402-5987
NYSDEC Contract Manager: Dana Nieder	518-402-9713

Map and directions to the following medical facilities are provided in **Figure 3**:

- **St. Joseph's Hospital -** located at 555 St. Joseph's Blvd, Elmira, NY (approximately 0.6 miles from the work site)

First Aid, Fire Protection, Emergency Response Equipment Storage Locations

First Aid Kit:	In Vehicle
Fire Extinguisher:	In Vehicle
Eye Wash (Bottle):	In Vehicle
Hand Washing Station	In Vehicle

A Safety and Logistics Planning call will be held prior to conducting any intrusive activities at the site. Representatives from HRP and each subcontractor will attend the call to discuss logistical and safety challenges general to the scope of work and specific to the Site. This call is documented on the Safety and Logistics Planning Call Log in **Appendix A.**

2.0 INTRODUCTION

2.1 Purpose and Scope

This Health and Safety Plan (HASP) addresses the health and safety practices that will be employed by HRP Associates, Inc. personnel and our subcontractors participating in the REMEDIAL INVESTIGATION (RI) that will be performed at the site. The RI will be comprised of several tasks to evaluate the environmental condition of the Site and the surrounding area, including installation of soil borings, monitoring wells, and soil vapor points to collect soil, groundwater, and soil vapor samples.

This HASP has been developed in accordance with HRP's Generic Safety and Health Program as required under OSHA's Hazardous Waste Operations Standard (29 CFR 1910.120). This Plan has been developed to establish minimum standards necessary for onsite investigation activities to protect the health and safety of HRP personnel. HRP site personnel have received the required level of training and field experience as required under subpart (e) of the Standard, and have received medical examinations in accordance with HRP's medical surveillance program as required under subpart (f) of the Standard. No other personnel will be permitted in the Exclusion Zone unless they have received training and medical surveillance under the Standard.

HRP personnel and associated contractors shall be familiar with this HASP prior to conducting proposed site work. This plan must be present on site and be available for reference/inspection when the subject site work is being conducted.

2.2 Site Information and Areas of Environmental Concern

2.2.1 Site Information and Description

Site Name:	714 Baldwin Street Site
Site Address:	714 Baldwin Street, Elmira, NY 14901
Site Contact:	Briana Scharf
Phone Number:	518-402-5987

2.3 Background and Project Description

The 714 Baldwin Street Site (#808041), located at 714 Baldwin Street, City of Elmira, Chemung County, New York, (**Figure 1**) is the focus of this investigation. The Site consists of a 0.75-acre property which includes a 6,000 square foot warehouse and a small gravel driveway. The site is currently vacant but has been previously occupied by Allen's Cash Paint Company and Associated Textile Rental Services (ARTS). The area surrounding the Site consists of residential, commercial, and industrial land uses. Approximately 300 feet east of the Site lies the Diamond Cleaners Site a Class 2 inactive hazardous waste site, Site No. 808030.

A groundwater investigation report dated April 2006, and a Site Characterization Report dated January 2008, identified chlorinated Volatile Organic Compound (VOC) impacts to soil, soil vapor and groundwater at the Site. Data from these investigations indicated that these substances are present at levels that exceed the applicable Standards, Criteria, and Guidance (SCG). The proposed RI to be performed in conjunction with this HASP will work to define the degree and extent of the groundwater plume, as well as characterize the soils across the Site.

2.3.1 Personnel Designations

The following personnel are designated to perform the stated project activities and to ensure that the requirements of this HASP are met. The same person may fill more than one role, and/or serve as an alternate in the absence of the designated team member.

The following personnel are designated to perform the stated project activities and to ensure that the requirements of this HASP are met. The same person may fill more than one role, and/or serve as an alternate in the absence of the designated team member. All subcontractors must have received the required level of training and field experience as required under subpart (e) of OSHA 29 CFR 1910.120 and OSHA 29 CFR 1926.65 for Hazardous Waste Operations and Emergency Response (HAZWOPER).

Project Team Member	Responsibilities and Tasks
Patrick Montuori (or Qualified Alternate Safety Officer)	HSO – HRP Associates, Inc. - Ensuring all site work is being performed in accordance with HRP Associates, Inc. Safety Program, as well as in accordance with local, state and federal regulations. - Directing and implementing HRP's HASP. - Reviewing the Subcontractor's HASP and being aware of the hazards detailed therein. - Conduct a job orientation meeting and routine safety meetings for HRP Associates, Inc. employees and subcontractors, as applicable. - Provide copies of these inspections, recordkeeping/personnel logs to the engineer/contractor as required. - Ensuring all project personnel have been adequately trained in the recognition and avoidance of unsafe conditions. - Authorizing Stop Work Orders that shall be executed upon the determination of an imminent health and safety concern, and will notify the appropriate contacts upon issuance of this order. - Authorizing work to resume, upon approval from the Contractor. - Directing activities, as defined in the HRP's and the Contractor's written HASP, during emergency situations. - Providing personnel monitoring where applicable. - Ensuring that adequate personal protective equipment and first aid supplies are available. - Ensure site security, to the extent practicable. - Ensure accident victims are promptly cared for, and the incident is investigated and properly reported.
Mark Wright (Site Supervisor/ Project Manager) **Jessica Kruczek (Alternate Site Supervisor)**	Site Supervisor/Project Manager – HRP Associates, Inc. - Monitor and assist the site Health and Safety officer. - Maintain appropriate rules, regulations and codes at the job site. - Provide advance safety planning for all activities through the use of scheduling and administrative controls. - Obtain site-specific health and safety information and communicate that information with the appropriate personnel (i.e. contractors, client, etc.) - Report all injuries, illnesses and other incidents to the Director of Safety. - Ensure all HRP personnel are trained and qualified to perform site work.
Site Workers (Subcontractors)	**Site Workers** - Read and work in accordance with this HASP. - Report all unsafe work practices to the HSO. - Report all incidents, including near-misses to the HSO. - Work in a safe manner. - Provide Designated Competent Person
A complete list of HRP employee and subcontractor responsibilities (as applicable) can be found in the HRP Generic Health and Safety Plan. 1 A list of site workers will be maintained in the Personnel Log (**Appendix B**) 2 Supervisors Investigation Report included as (**Appendix C**)	

3.0 AREAS OF ENVIRONMENTAL CONCERN

3.1 Scope of Work

In general, the work to be performed by HRP and HRP's subcontractors consists of investigative methods to evaluate the environmental condition of the Site. The RD Design fieldwork for this task includes the following subtasks:

- Call in Underground Utility Clearance through NYS Code Rule 753/Dig Safe System.
- Complete a Ground Penetrating Radar (GPR) survey to locate utilities and/or obstructions in the ground that may affect the locations of test trenches and/or monitoring wells.

Soil Borings

- Install up to seven (7) soil borings using a direct push drilling method.
- Collect one (1) soil sample from each soil boring.

Groundwater

- Install up to two (2) groundwater monitoring wells.
- Monitoring wells will be developed after their completion. Each well will be developed by pumping and surging approximately five (5) well volumes, or until the field parameters stabilize for a minimum of three consecutive readings of 10 percent variability or less. All groundwater obtained during well development and sampling will be disposed of in accordance to DER-10.
- Groundwater sampling will occur at minimum of one week after development has been completed. A complete synoptic round of water levels will be taken prior to the start of groundwater sampling. Groundwater samples will be collected in accordance with low-flow groundwater sampling procedures.

Soil Vapor

- Install up to six (6) soil vapor points.
- Collect six (6) soil vapor samples, six (6) indoor air samples, and (1) outdoor ambient air sample.

Additional information is provided in the Site Specific Work Plan prepared for this Site under separate cover.

4.0 HAZARD ANALYSIS

The project hazard analysis below identifies the hazards that are anticipated to be encountered by the project team.

Physical Hazards Present	☐ Electricity ☒ Trips/Falls/Floor openings ☒ Holes/Pits ☒ Inclement weather ☒ Heat ☒ Cold ☐ Vibration ☐ Flying particles	☐ Ionizing radiation ☐ Non-Ionizing radiation ☐ Lasers ☒ Overhead hazards ☒ Noise ☐ Visible dust ☐ Falling objects ☐ Other ________________
Health/Chemical Hazards Present [1]	☐ Dust/Fumes/Particulates ☐ Flammable/Combustible ☐ Compressed gas ☐ Explosive ☐ Water reactive ☐ Unstable ☒ Contact with contaminated media	☐ Oxidizer ☐ Corrosive ☐ Toxic ☐ Highly Toxic ☐ Irritant ☐ Sensitizer ☐ Carcinogen/Mutagen ☐ Other ________________
Environmental/Equipment Hazards Present	☒ Heavy machinery ☒ Drilling ☐ Water operations ☐ Mobile equipment ☐ Road work ☐ Railroad work ☐ Forklifts ☒ Power tools ☐ Welding ☐ Gas cylinders ☒ Overhead/underground utilities	☐ Trenching/excavation ☐ Elevated heights/man lifts ☐ Scaffolding ☐ Ladders ☐ Confined spaces ☐ Energized equipment ☐ Overhead hazards ☒ Drums/container handling ☒ Insects/rodents/snakes ☐ Biological hazards ☐ Other ________________
Personal Safety Considerations	☐ Security Issues ☐ Remote setting ☐ Employees working alone ☐ Limited lighting	☐ Off hour shifts ☐ Dangerous wildlife/animals ☐ Limited cell phone service ☐ Other ________________
[1] **Table 1** (following the text of this HASP) provides a list of chemical substances for reference, along with odor threshold, permissible exposure limit (PEL), threshold limit value (TLV), OSHA ceiling, IDLH concentration, route of exposure and symptoms of acute exposure, if any.		

Details of specific hazards associated with individual tasks will be discussed in the Daily Job Brief Record (**Appendix D**).

4.1 Hazard Analysis Summary/Minimization

HRP's Corporate Health & Safety Plan (in conjunction with this HASP) will be cross-referenced in order to obtain the safe work practice procedures for mitigating and preventing project site hazards identified in the table above. Job site hazard prevention and minimization information can be found in Section 3 of HRP's Generic Health & Safety Plan.

Confined Spaces

Only properly trained HRP personnel are authorized to enter confined spaces. Confined space entry may be performed by subcontractors who have the proper training and experience to conduct this work. Confined space entry is not anticipated during the RI.

Excavations

It is HRP's policy to ensure that for excavation projects the subcontracted environmental contractor will provide a competent person to perform daily and as needed inspections of excavation sites. This policy will be conveyed through the subcontract agreement with the environmental contractor. At a minimum HRP will provide our employees involved with construction projects with awareness level training regarding excavation hazards and notify the subcontracted firm if any obvious excavation safety hazard exists during the course of on-site activities.

Chemical Hazards

Hazardous chemicals known or suspected to be onsite are listed in **Table 1** (follows text). **Table 1** includes Chemical name, odor threshold OSHA PEL, ACGIH TLV, OSHA STEL, IDLH Concentrations, routes of exposure and symptoms of acute exposure. Chemicals likely to be encountered during site work are highlighted.

4.2 Changes in Conditions or Scope

Should conditions or the scope of work described herein change significantly; a HASP Addendum will be completed.

4.3 Monitoring Procedures

Air monitoring will be used to determine the concentrations of various chemicals while working in the exclusion zone to evaluate worker exposure to contaminated media. In order to determine potential health hazards and to determine the level of personal protection needed during sampling activities within the areas of concern, a Photoionization Detector (PID) will be periodically operated to monitor air quality for the purpose of ensuring minimal exposure to volatile organic compounds. Monitoring of atmospheres adjacent to on-going excavations and around the treatment area shall also be conducted with a PID.

The following environmental monitoring instruments/procedures shall be used on-site at the specified intervals:

Instrument/Procedure	**Sampling Interval**
Photoionization Detector (PID) in the breathing zone	Periodically as deemed by HSO

Background ambient air levels will be established outside the exclusion zone prior to commencement of site work. Ambient air sampling will occur in the breathing zone of site workers for comparison to the action levels (described below). Additionally, air sampling will be conducted in the vicinity of any intrusive exploration (i.e. near excavations, trenches, etc.) to determine if any contaminants are present.

The following *Action Levels* will be used:

Instrument	Action Level	Level of Protection or Action Required
PID	No reading above background	▪ No action required. ▪ Continue PID monitoring. ▪ (Modified) Level D protection.
PID	Up to 5 ppm above background	▪ Evacuate exclusion zone. ▪ Recheck levels after 15 minutes. ▪ If levels are sustained, reassess. ▪ Use engineering controls to lower breathing zone vapors. ▪ Level C protection (at the HSO direction).
PID	>5 ppm above background	▪ Evacuate exclusion zone. ▪ Recheck levels after 15 minutes. ▪ Use engineering controls to lower breathing zone vapors. ▪ If levels are sustained, contact Safety Manager, and re-evaluate HASP.

When an action level is equaled or exceeded, the work area should be evacuated and the area re-tested with the sampling device. If the appropriate action level continues to be exceeded, the HSO will have to assess the use of engineering controls to lower vapor levels or availability of required increased personal protection equipment before authorizing re-entry.

Calibration of all instruments will occur at least once per day, when in use. An equipment calibration log is included in **Appendix E.**

Community Air Monitoring

To ensure the protection of receptors surrounding the site HRP has developed and will implement a Community Air Monitoring Program (CAMP), which requires real time monitoring of volatile organics and dust during the remedial investigation. The CAMP, included as **Appendix F** will be implemented during all intrusive activities.

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. 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.

If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than the background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work may continue with dust suppression techniques provided that no visible dust is migrating from the work area.

If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work will 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.

5.0 ENGINEERING CONTROL MEASURES/GENERAL SAFETY

5.1 Air Monitoring

In order to determine potential health hazards and to determine the level of personal protection needed during drilling, excavation and sampling activities within the areas of concern, a PID will be periodically operated to monitor air quality for the purpose of ensuring minimal exposure to volatile organic compounds. Please refer to Section 4.2 of this plan for specific air monitoring procedures/action levels.

5.2 Protective Zones

Prior to commencement of work in area of suspected contamination, protective zones specific for each phase of the Plan will be established by the HSO if necessary prior to the start of field work. The purpose of the protective zones is to prevent potential cross-contamination of adjacent areas as well as to protect project personnel from exposure to contaminated areas.

Protective zones shall be delineated as follows:

- Exclusion Zone: This is the contaminated area in which intrusive activities are performed. The "Area of Environmental Concern" (AOEC) is located within this area. A single access point for entrance and exit should be established and maintained, if possible. This zone should be delineated from the Contaminant Reduction Zone via perimeter cones or caution tape, or other applicable method. Work areas are shown on **Figure 2**. The Exclusion Zone delineation and any necessary modifications will be based on site conditions.

- Contaminant Reduction Zone: This zone is a transition zone located between the Exclusion Zone and the Support Zone and is utilized to decontaminate personnel and equipment.

- Support Zone: This zone will be utilized by equipment and vehicle storage and will be kept free of contaminated material. The HSO will determine the location of this zone. In the event of a site evacuation, the rally point will be on the northern side of the on-site warehouse building (**Figure 2**). The designated rally point may be relocated by the HSO based on project or site conditions. All site workers will be notified of any relocation prior to implementation.

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

6.1 Level of Protection

As identified in Section 4.0, the overall health and safety risk associated with chemical hazards for HRP and associated contractors is considered significant. This is primarily due to the moderate concentrations of chemical contaminants expected based on minimal contact personnel will have with any potentially contaminated media. Therefore, the minimal level of protection for HRP personnel during the conduct of all the environmental work performed at the site will be Level D PPE, and will generally consist of the PPE listed below:

- Steel toe/shank work boots
- Hard hat, as necessary
- Safety vest, as necessary
- Coveralls/tyvek, as necessary
- Safety glasses/goggles/face shield, as necessary
- Hearing protection, as necessary

If site conditions warrant, an upgrade to Level C PPE may be required (refer to Section 4.2 for the appropriate *Action Levels*) then the contractors will make Level C personal protective equipment (PPE) readily available. Level C PPE generally includes:

- Full face, air purifying respirator with organic vapor cartridges
- Same as Level D, but also includes tyvek taped pant/boot and glove/shirt

If it is determined protection beyond Level C is required, HRP will re-evaluate the HASP as well as the site conditions, and will revise the HASP as required. The following table provides a summary of the minimum level of PPE required on site:

Description	**Level of Protection [1]**	
	D	**C**
Body		
Work Clothes	R	R
Chemical Protective Suit (Tyvek)	O	R
Visibility Vest	O [2]	O [2]
Apron	O	O
Fall Protection	O [2]	O [2]
Head		
Hard Hat	R	R
Head Warmer	O	O
Eyes & Face		
Safety Glasses	R	R
Goggles (based on hazard)	O	R
Face Shield	O	O
Ears		
Plugs or Muffs	R [2]	R [2]
Hands & Arms		
Work Gloves	R	O [2]

Description	Level of Protection [1]	
	D	C
Chemical Resistant Gloves (Nitrile)	O	R
Insulated Gloves	O	O
Foot		
Work Boots/Steel Toe Boots	R	R
Chemical Resistant Boots	O	O
Disposable Boot Covers	O	O
Respiratory Protection [3]		
½ Mask Air Purifying Respirator (APR) or Full face APR	NA	R
Dust Protection	O	NA
Powered APR	NA	NA
SCBA/Supplied Air Respirator	NA	NA

R = Required, **O** = Optional, **NA** = Not Applicable

[1] The level of protection identified here does not include the necessary equipment for entering confined spaces. Refer to Moran Environmental Recovery's Safety Manual Confined Space Program for atmospheric sampling protocols and breathing and rescue equipment necessary for those operations.

[2] The use of this PPE may or may not be required depending on site conditions/location and will be addressed at the time of task assignment by the HSO.

[3] Respiratory protection necessary to protect against VOC, dusts/particulates and not oxygen deficient atmospheres.

The following table provides a general description of potential field activity tasks to be performed and associated (recommended) PPE. The use of this PPE may or may not vary depending on site conditions and will be addressed at the time of task assignment by the HSO.

Task Description	Invasive (Y/N)	Protection Level
Site Mobilization - Surveying, fence and barrier installation, hay bale installation, decon and work zone set up, soil staging areas preparation	N	Level D
Soil, Water, and Soil Vapor Sampling - Drilling, sampling, soil moving as needed.	Y	Modified Level D or Level C – Respirator as needed based on monitoring. Eye protection required during collection of any liquid sample
Soil Excavation, Staging and Load-Out	Y	Modified Level D – or Upgrade to Level C dependent on monitoring
Decontamination - Truck dry sweeping, decon pressure wash of equipment, PPE change out	Y	Modified Level D – or Upgrade to Level C dependent on monitoring
Waste Management - Soil load-out for off-site disposal, water removal for disposal, PPE disposal	Y	Modified Level D – or Upgrade to Level C dependent on monitoring
Site Control (Exclusion, Decontamination, Support Zones)	N	Modified Level D – or Upgrade to Level C dependent on monitoring
Communications - Use of hand signals, backup alarms, and voice	N	NA
Site Restoration	Y	Level D

7.0 DECONTAMINATION

7.1 Decontamination Procedures

All personnel and equipment leaving the exclusion zone must be properly cleaned and decontaminated. When there is evidence of chemical contamination during the site operations, all personnel will be decontaminated under the direction of the HSO. Clean-up and/or decontamination of personnel shall consist of washing off excessively soiled PPE with a disinfectant detergent scrub and water. At the very least, all personnel should wash their hands and face before leaving the exclusion zone. After washing, all disposable clothing (tyvek, gloves, etc.) will be removed and placed in a double lined plastic bag.

Sampling tools and any other non-disposable items will be decontaminated between sampling points, and at the direction of HRP personnel, to prevent cross-contamination of work areas or environmental samples, as applicable.

7.2 Emergency Decontamination

If immediate medical attention is required in an emergency, decontamination will be performed after the victim has been stabilized. If a worker has been exposed to an extremely toxic or corrosive material, then emergency decontamination will consist of flushing with copious amounts of water. If the victim cannot be decontaminated because it will interfere with emergency medical aid being administered, then the victim should be wrapped with plastic or other available items (i.e. an uncontaminated coverall) to reduce potential contamination of other personnel or medical equipment.

If a site worker has been overcome by heat related illness, then any protective clothing should be removed immediately. In the case of non-medical emergency evacuation, decontamination should be performed as quickly as possible, unless instant evacuation is necessary to save life or prevent injury.

7.3 Personal Hygiene

All employees will be required to wash hands and face prior to eating, smoking, drinking and going to the bathroom. Workers will be required to remove contaminated PPE and clothing prior to leaving the Contaminant Reduction Zone. All field personnel should avoid contact with potentially contaminated substances such as puddles, pools, mud, etc.

Additional personal hygiene requirements, intended to prevent the spread of the novel corona virus to site workers will be in effect during site activities. These procedures include mobile handwashing stations and the requirement for site workers to wear face coverings. Additional details are included in **Appendix G**.

8.0 EMERGENCY ACTION PLAN/SPILL RESPONSE

In the event of a worker injury, fire, explosion, spill, flood, or other emergency that threatens the safety and health of site workers, the following procedure will be followed:

1. If the emergency originates within the work area covered by this Plan, the HRP HSO shall act as the Emergency Coordinator. The emergency evacuation signal is an air horn or a loud yell. All emergency situations (including worker injuries, no matter how small) will be reported to the HSO, who will determine the appropriate emergency response, up to and including evacuation. Only the HSO may initiate evacuation of the work area. The HSO will be responsible for reporting any emergency situation to the appropriate authorities, using a telephone or other appropriate method.

2. In the case of an evacuation, site workers will exit the site along the safest route(s) and assemble with team members at a safe rally point. Those workers in the Exclusion Zone will follow the emergency decontamination procedures outlined in Section 7.2. Accounting of all site personnel will be conducted by the HSO using the personnel log at a location determined by the HSO.

3. HRP personnel are not permitted to participate in handling the emergency. Fire and medical emergencies will be handled by the local fire department and ambulance service. In the case of a spill of hazardous materials the NYSDEC will be contacted.

   In addition, the HSO/Project Manager must advise the site contact that the New York Spill Hotline should be contacted and, if the spill quantity is greater than the Reportable Quantity (RQ) under CERCLA and/or SARA, the National Response Center (NRC) and Local Emergency Planning Committee should also be contacted. If the spill begins to flow overland and threatens to contaminate a storm drain or surface water, HRP personnel may attempt to contain and isolate the spill using any available resources, but only if, in the judgment of the HSO, such action will not expose the workers to dangerous levels of hazardous substances and is necessary to preserve life or property. In the event that a spill of material of any amount threatens to reach navigable waters, the NRC shall be contacted.

4. Once initial emergency procedures to protect worker safety and health have been addressed, and control of emergency has been completed, the HSO will complete an Investigation Report and submit this form to the appropriate personnel (HRP and/or client contact).

5. All site workers will be familiarized with the above procedures during the pre-entry briefing to be conducted before site work begins.

9.0 TRAINING/MEDICAL SURVEILLANCE

9.1 Training Requirements

All HRP and HRP subcontractor personnel who enter the work zone and/or Exclusion Zone must have successfully completed the 40-hour or 24-hour training requirement outlined in 29 CFR 1910(e). If the 40-hour or 24-hour training of any person occurred more than 12 months prior to commencement of work, then that person must have attended an 8-hour refresher course within the 12 months prior to commencement of work. If respirators are in use in the Exclusion Zone, then all personnel must have undergone respirator training and a fit test within the last 12 months. Training certificates and records for HRP employee(s) are on file at HRP. All other contractors will be required to supply written proof of training before being allowed into the Exclusion Zone.

9.2 Pre-Entry Briefing

Prior to commencement of work in an area of suspected contamination, HRP's Health and Safety Officer will conduct a pre-entry briefing with on-site contractors, which will include the following:

- Name of the HSO and person responsible for the visitor log.
- Description of the parcel as well as location of emergency telephones and the location/boundaries of the Exclusion Zone, Contamination Reduction Zone, and Support Zone, if established.
- Review of hospital locations and directions.
- Review of tasks to be conducted within the parcel by the site workers.
- Review of the Emergency Action Plan and rally point, including the nearest emergency communications and telephone numbers.
- The nature, level, and degree of anticipated hazards (physical and chemical) involved in the site work.
- Required personal protective equipment.
- Decontamination procedures.

The HSO should also, at this time, ensure that all on-site HRP and HRP subcontractor personnel have read the HASP and signed the last page of the original (Section 11.0). If additional information on the site becomes available, the HSO will call additional briefings as necessary.

9.3 Morning Safety (Tailgate) Meeting

The HRP HSO will conduct a safety overview meeting at the beginning of each workday on the site. The meeting will be given in addition to any tailgate meetings that the subcontractor conducts. A summary of the meeting topics signed by the personnel attending the meeting is included in **Appendix D**.

9.4 Medical Surveillance

All HRP and HRP subcontractor personnel entering the Exclusion Zone must have had a physical within the 12 months prior to commencement of site work. A physician's written opinion regarding fitness for work for each employee including work limitations, if any, is on file at HRP, as applicable. A written opinion for all other site personnel must be supplied prior to commencement of site work to the HRP HSO. Any work limitations for site personnel, or relevant medical information (i.e. allergic reactions to medication) should be included in this Plan.

10.0 AUTHORIZATIONS

Personnel authorized to enter the Exclusion Zone include the personnel listed in Section 2.4. Persons not listed in Section 2.4 may enter the Exclusion Zone only if the appropriate training and medical fitness certifications have been supplied to either the HRP Project Manager or Health and Safety Manager and the HSO or his/her designee on site has approved site entry. All personnel entering or leaving the Exclusion Zone must sign in and sign out with the recordkeeper.

11.0 FIELD TEAM REVIEW

All HRP personnel shall sign below after reading this HASP and shall agree with the following statement:

> *"I have read and understand this site specific Health and Safety Plan.*
> *I will comply with the provisions set forth therein."*

Printed Name	Signature	Date

12.0 APPROVALS

This plan meets the minimum requirements of 29 CFR 1910.120 and 29 CFR 1929.65 and has been written for specified site conditions, dates, and personnel, and must be amended if conditions change. By their signature, the undersigned certify that this HASP is approved and will be utilized during activities at the project.

Patrick Montuori
Patrick Montuori — On-Site Health and Safety Officer
02/19/21 — Date

Mark Wright
Mark Wright, PG, CHIMM, CSP — Project Manager
02/19/21 — Date

Mark Wright
Mark Wright — Office Health and Safety Manager
02/19/21 — Date

Subcontractor:

I have been provided a copy of this HASP for review.

______________________________ ______________
[name] Date

Representing ____

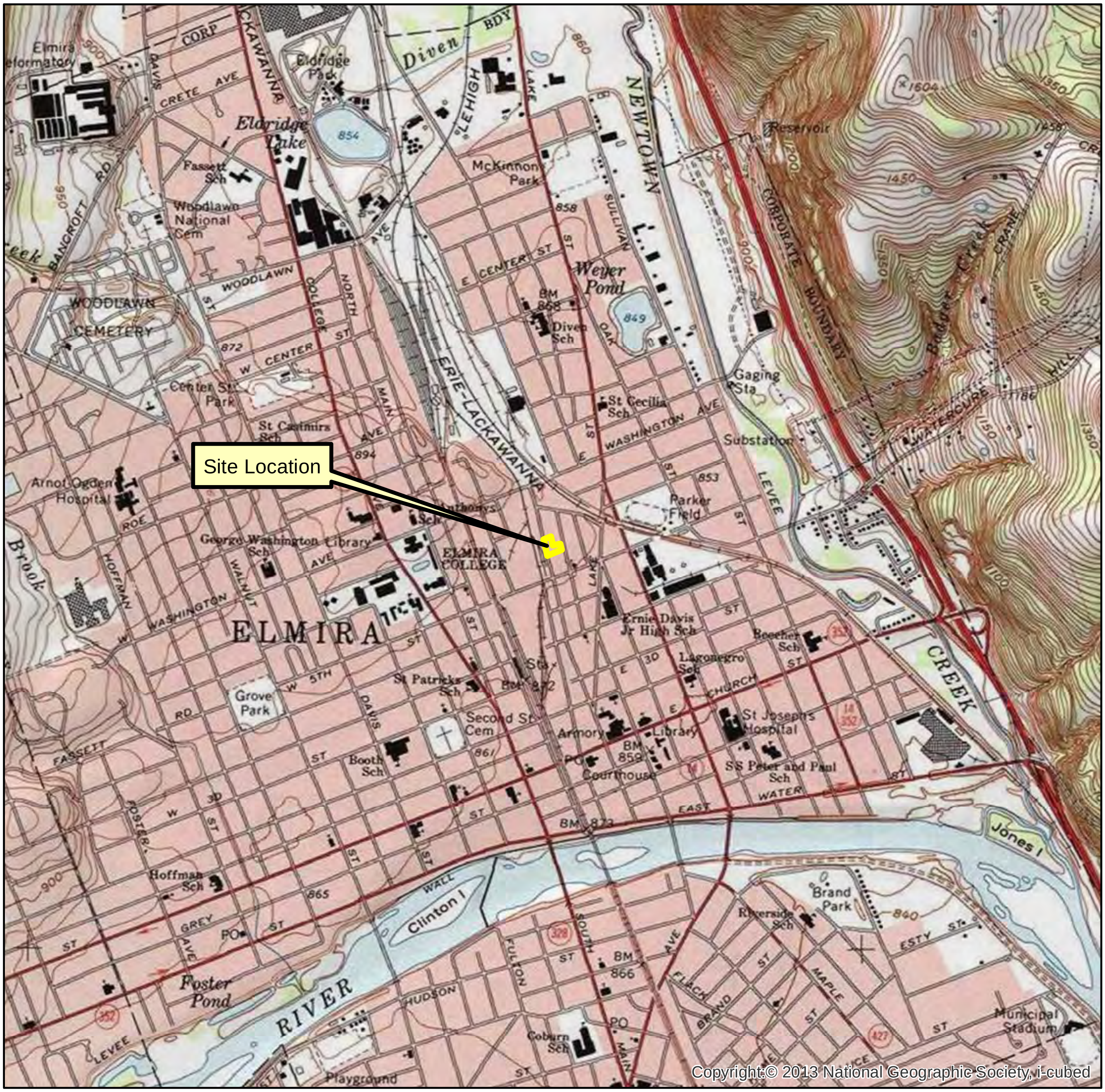
The Designated Competent person representing [subcontractor] at the site will be

______________________________.

Any alternate Competent Person will be noted in the Daily Job Brief Record (**Appendix D**).

ADDITIONAL APPROVALS (or Re-Approvals)	
Name:	**Date:**

FIGURES



0 1,000 2,000 4,000 6,000 8,000

Feet

1 inch = 2,000 feet

N

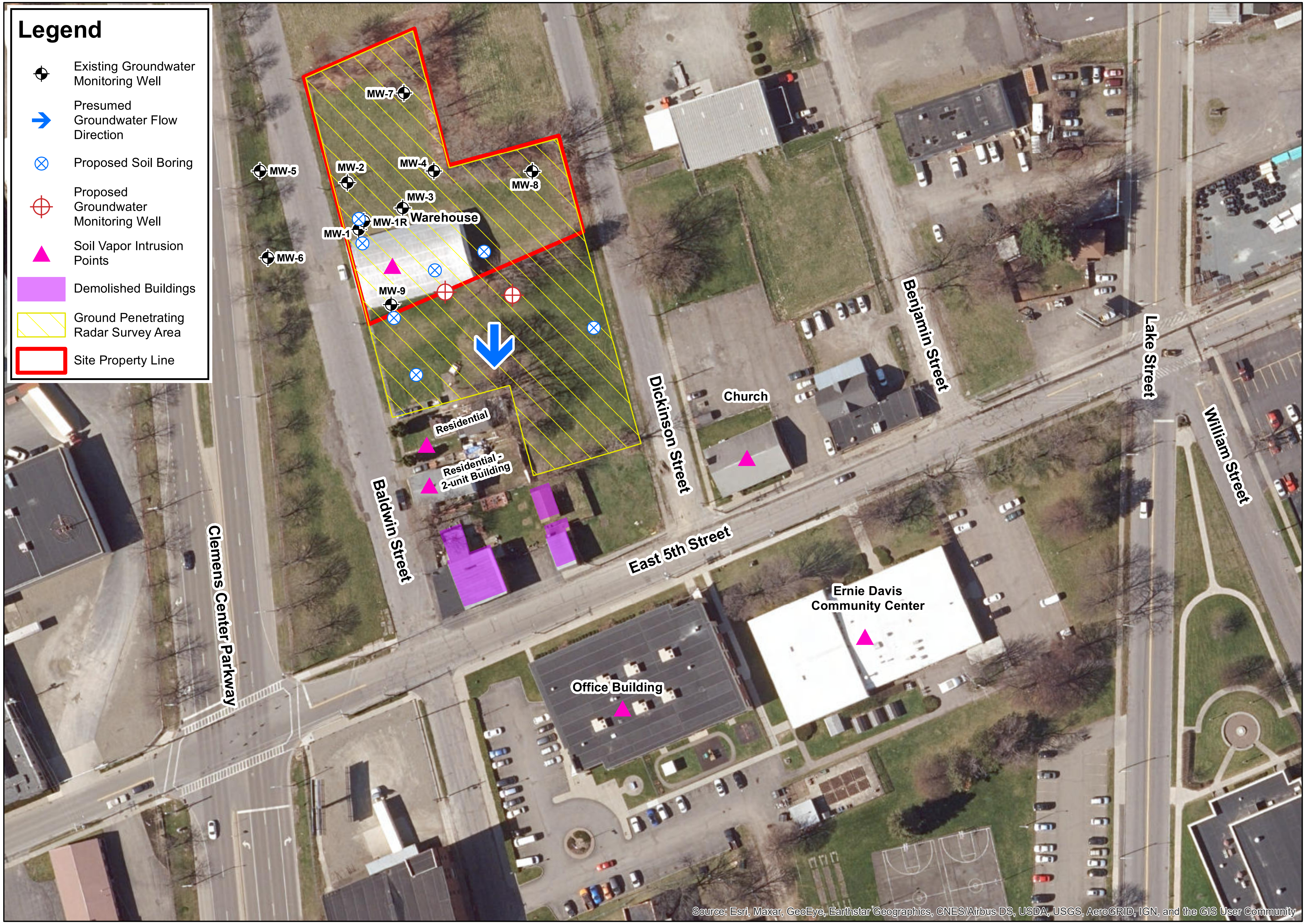
USGS Quadrangle Information
Quad ID: 42076-A7
Name: Elmira, New York
Date Rev: 1969
Date Pub: 1971

Figure 1
Site Location
714 Baldwin Street Site (Site#808041)
714 Baldwin Street
City of Elmira,
Chemung County, New York
HRP # DEC1017.P3
Scale 1" = 2,000'

HRP
MOVE YOUR ENVIRONMENT FORWARD

ONE FAIRCHILD SQUARE
SUITE 110
CLIFTON PARK, NY 12065
(518) 877-7101
HRPASSOCIATES.COM

Path: S:\Data\NNYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\ELMIRA\714 BALDWIN STREET, ELMIRA, NY\DEC1017P3\GIS\Figure 1 - Site Location.mxd



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

HRP
MOVE YOUR ENVIRONMENT FORWARD

ONE FAIRCHILD SQUARE
SUITE 110
CLIFTON PARK, NY 12065
(518) 877-7101
HRPASSOCIATES.COM

North

0 40 80
Feet

Revisions					
No.	Date				

Designed By: PM

Drawn By: BOB

Reviewed By: MEW

Issue Date: 02/02/2021

Project No: DEC1017.P3

Sheet Size: 11x17

Proposed Investigation Locations

714 Baldwin Street Site
(Site#808041)
714 Baldwin Street
City of Elmira,
Chemung County, New York

Figure No.
2

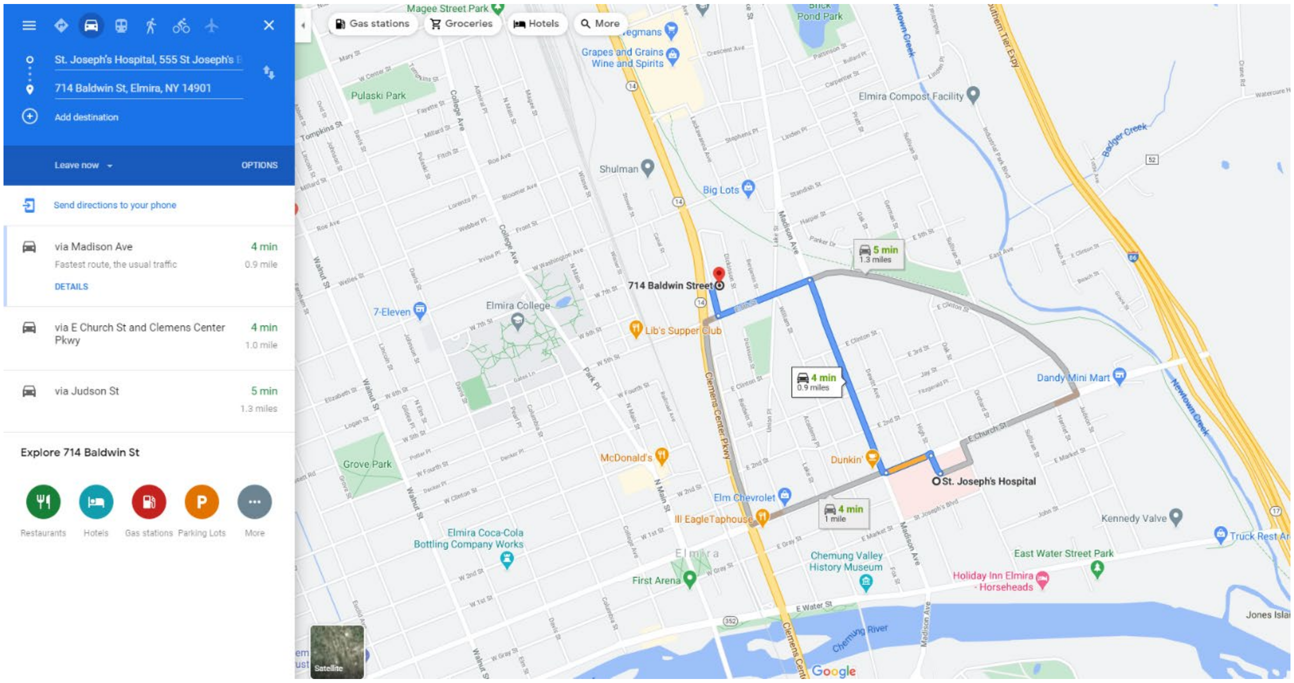
Path: S:\Data\NNYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\ELMIRA\714 BALDWIN STREET, ELMIRA, NY\DEC1017P3\GIS\Proposed Investigation Locations.mxd

Figure 3: Route and Map to Nearest Hospital and Medical Center

Directions to St. Joseph's Hospital

Total Estimated Time: 4 minutes
Total Estimated Distance: 0.9 miles

End at St. Joseph's Hospital
555 St. Joseph's Blvd, Elmira, NY


St. Joseph's Hospital, 555 St Joseph's B
714 Baldwin St, Elmira, NY 14901
Add destination

Leave now
OPTIONS

Send directions to your phone

via Madison Ave Fastest route, the usual traffic DETAILS	4 min 0.9 mile	
via E Church St and Clemens Center Pkwy	4 min 1.0 mile	
via Judson St	5 min 1.3 miles	

Explore 714 Baldwin St

TABLES

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]
1,1,1 Trichloroethane	44 ppm	350 ppm	350 ppm	---	700 ppm	Inh, Ing, Con	Head, Lass, CNS, Derm
1,1,2-Trichloroethane	---	10 ppm	10 ppm	----	[100 ppm]	Inh, Ing, Abs, Con	Eyes, Nose Irrit, Resp Irrit, CNS, Liver, Kidney Damage, Derm, [Carc]
1,2,4 Trimethylbenzene 1,3,5 Trimethylbenzene		25 mg/m^3	25 ppm	25 mg/m^3	ND	Inh, Ing, Con	Irrit Eyes, Skin, Nose, Throat, Resp Sys, Bron, Hyprochronic Anemia, Head, Drow, Ftg, Dizz, Nau, Inco, Vomit, Conf, Chemical Pneu (aspir lig)
1,1′ Biphenyl	0.0062 mg/m^3	0.2 ppm	0.2 ppm	---	100 mg/m^3	Inh	
1,1-Dichloroethane	120 ppm	100 ppm	100 ppm	---	3,000 ppm	Inh, Ing, Con	CNS Depres, Skin Irrit, Liver, Lung and Kidney Damage
1,1-Dichloroethylene***	500 ppm	---	5 ppm	---	---	Inh, Con	CNS depress, Resp, [Carc]
1,2-Dichlorobenzene	50 ppm	50 ppm	25 ppm		200 ppm	Inh, Ing, Abs, Con	Irrit, Resp
1,2-Dichloroethylene	26-87 ppm	200 ppm	200 ppm	---	1,000 ppm	Inh, Ing, Con	Vomit, Irrit Eyes, Resp Sys; CNS Depres
1,2-Dichloropropane	130-190 ppm	75 ppm	75 ppm	---	[400 ppm]	Inh, Con, Ing	Eye irritation, Drow, light-headedness; irritated skin, [Carc]
1,3-Dichlorobenzene	---	----	---	----	---	----	----
1,4-Dichlorobenzene	20 ppm	75 ppm	10 ppm	----	[150 ppm]	Inh, Ing	[Carc], Eye Irrit, swelling around eye, headache, nausea, vomiting
1-Methylnaphthalene	0.02 ppm	---	---	---	---	---	---
2,4-Dichlorophenol	1.4007 mg/m^3	---	---	---	---	---	---
2,4-Dimethylphenol	0.001 mg/m^3	---	---	---	---	---	---
2-Methylnaphthalene	0.01 ppm	---	---	---	---	---	---
2-Methylphenol (o-cresol) [skin]	1.4 mg/L	5 ppm	5 ppm	---	250 ppm	Inh, Abs, Ing, Con	Confusion, depression, Resp Fail; difficulty breathing, irregular rapid respiration, weak pulse; skin, eye burns; dermatitis

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]
3, 3'-Dichlorobenzidine	---	None	**---**	---	---	Inh, Abs, Ing, Con	Sens, Derm, Head, Dizz, Burns, GI Upset, [Carc]
4-Isopropyltoluene	---	---	---	---	---	Con, Inh, Ing	Defat, Eryt
Acenephthene	0.5048 mg/m^3	---	---	---	---	---	---
Acenaphthylene	---	---	---	---	---	---	---
Acetone	47.5 mg/m^3	1,000 ppm	500 ppm		2,500 ppm	Ing, Inh, Con	Head, Dizz; Irrit Eyes, Nose, Throat; Derm, CNS, Depress, Derm
Acetonitrile	70 mg/m^3	40 ppm	20 ppm	---	500 ppm	Inh, Ing, Abs, Con	Asphy; Nau, Vomit; Chest Pain; Weak, Stupor, Convuls; Eye Irrit
Aldrin	---	0.25 mg/m^3	0.25 mg/m^3	---	25 mg/m^3	Inh, Abs, Ing, Con	Head, Dizz, Nau, Vomit, Mal, Myo, [Carc]
Anthracene (Coal Tar Pitch)	---	0.2 mg/m^3			[80 mg/m^3]	Inh, Con	Derm, bron, [carc]
Antifreeze		50 ppm	100 mg/m^3 (aerosol)	---	ND	Inh, Ing, Con	Irrit Eyes, Skin, Nose, Throat, Nau, Vomit, Abdom Pain, Lass, Dizz, Stup, Conv, CNS, Depres, Skin Sen
Arsenic	----	0.010 mg/m^3	0.01 mg/m^3	----	[5 mg/m^3]	Abs, Inh, Con, Ing	Derm; GI; Resp Irrit; ulceration of nasal septum; Resp, Irrit, Hyper Pig of Skin, [Carc]
Barium (elemental)	---	0.5 mg/m^3	0.5 mg/m^3		50 mg/m^3 (barium components)	Inh, Ing, Con	Resp. Irrit, GI, Muscle Spasm, Eye Irrit, Slow Pulse; skin burns
Benzene*	4.7 ppm	1 ppm	0.5 ppm	5 ppm	[500 ppm]	Inh, Ing, Abs, Con	Irrit Eyes, Nose, Throat; Head, Nau, Derm, Ftg, Anor, Lass, [Carc]
Benzo(a)anthracene (coal tar pitch)	---	0.2 mg/m^3			[80 mg/m^3]	Inh, Con	[Carc], Derm, Bron
Benzo(a)pyrene (coal tar pitch)	---	0.2 mg/m^3	---		[80 mg/m^3]	Inh, Con	[Carc], Derm, Bron
Benzo(b)fluoranthene (coal tar pitch)	---	0.2 mg/m^3	---		[80 mg/m^3]	Inh, Con	[Carc], Derm, Bron

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]
Benzo(g,h,i)perylene (coal tar pitch)	---	0.2 mg/m^3			[80 mg/m^3]	Inh, Con	[Carc], Derm, Bron
Benzo(k)fluoranthene (coal tar pitch)	---	0.2 mg/m^3			[80 mg/m^3]	Inh, Con	[Carc], Derm, Bron
Bis (2-ethylhexyl) Phthalate**	N/A	5 mg/m^3	5 mg/m^3	10 mg/m^3	[5,000 mg/m^3]	Inh, Ing, Con	[Carc], Irrit Eyes
Cadmium (dust)	---	0.005 mg/m^3	Lowest concentration feasible 0.01 mg/m^3	---	[9 mg/m^3]	Inh, Ing	CNS, Resp, Irrit, Vomit, Cough, Head, Chills, Nau, Diarr, Pulm Edema, Dysp, Chest Tight, [Carc]
Carbazole	---	---	---	---	---	Inh	---
Carbon disulfide	0.1-0.2 ppm	20 ppm	1 ppm	30 ppm	500 ppm	Inh, Abs, Ing, Con	Diz, Head,Ftg, Ner, anorexia, trembling hands, loss of fine motor coord, gastritis, eye, skin burns, Derm
Carbon Tetrachloride***	21.4 ppm	10 ppm	5 ppm	25 ppm	[200 ppm]	Inh, Abs, Con, Ing	CNS Depres, Nau, Vomit, Irrit, Irrit Eyes, Skin, Drow, Dizz, [Carc]
Chlorobenzene***	0.98 mg/m^3	75 ppm	10 ppm	---	1,000 ppm	Inh, Ing, Con	Irrit, Drow, CNS, Depres, Eyes, Skin, Nose, Inco.
Chloroform***	85 ppm	50 ppm	10 ppm	50 ppm	[500 ppm]	Inh, Ing. Con, Abs	Dizz, Dullness, Nau, Head, Ftg, Irrit Eyes, Skin, Conf, [Carc]
Chromium	---	1 mg/m^3	0.5 mg/m^3	---	250 mg/m^3	Inh, Ing, Con	Irrit Eyes, Sens Derm
Chrysene (coal tar pitch)		0.2 mg/m^3	---		[80 mg/m^3]	Inh, Con	Derm, Bron, [Carc]
Cis-1-2-Dichloroethylene	---	200 ppm	200 ppm	----	1000 ppm	Inh, Con, Ing	Irrit Eyes, Resp, CNS Depress
Copper (dusts and mists) (fumes)		1 mg/m^3 0.1 mg/m^3	1 mg/m^3 0.2 mg/m^3	----	100 mg/m^3	Inh, Ing, Con	Vomit, Derm, CNS, Irrit, Derm, Nau, Taste (metallic)
Cyanide	0.9 mg/m^3	5 mg/m^3	5 mg/m^3 (10 min)	5 mg/m^3	25 mg/m^3	Inh, Ing, Abs, Con	Weak, Head, Nau, Conf, Cyan
Cyclohexane	25 ppm	300 ppm 1050 mg/m^3	100 ppm	---	1300 ppm	Inh, Ing, Abs	Irrit Eyes, Derm, Resp, Som, Narco, Coma

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]
Dibenzo(a,h)anthracene						Inh, Ing	
Dichloromethane	540 mg/m^3	25 ppm	50 ppm	125 ppm	[2,300 ppm]	Inh, Abs, Ing, Con	Irrit Eyes, Skin, lass, drow, dizz, Numb, tingl, Nau, [Carc]
Diethylphthalate**	---	None	5 mg/m^3	---	N.D.	Inh, Ing, Con	Irrit Eyes, Skin, Nose, Throat, Head, Dizz, Nau, Lac, Possible Polyneur, Vestibular Dysfunc, Pain, Numb, lass, Spasms in Arms and Legs
Di-n-octylphthalate	---	---	---	---	---	Inh, Ing, Con	---
Dimethylpthalate	---	5 mg/m^3	5 mg/m^3	---	2,000 mg/m^3	Inh, Ing, Con	Irrit, Resp, Abdom
Ethyl Benzene*	8.7 mg/m^3	100 ppm	100 ppm	125 ppm	700 ppm	Inh, Abs, Con	Head. Irrit, Derm, Narc., Irrit Eyes, Skin; Coma
Fluoranthene		0.2 mg/m^3	0.2 mg/m^3			Ing, Inh	[Carc]
Fluorine*	6 mg/m^3	0.1 ppm	1 ppm	2 ppm	25 ppm	Inh, Con	
Fuel Oil/#2	----	----	300 ppm	----		Inh, Abs, Ins, Con	Irrit Eyes, Skin, Derm, Head, Ftg, Blurred Vision, Dizz, Conf
Ideno(1,2,3-cd)pyrene		0.2 mg/m^3				Ing, Inh	
Isopropylbenzene	0.012 ppm	50 ppm	50 ppm	75 ppm	900 ppm		Irrit Eyes, Derm, Muc Memb, Head, Narco, Coma
Lead (inorganic forms and dust as Pb)****		0.05 mg/m^3	0.05 mg/m^3		100 mg/m^3	Inh, Ing, Con	Irrit, Cns, Vomit, Narco, Weak, Pall, Insom, Lass, Abdom, Constip
Mercury (organic alkyl compounds) [skin]		0.01 mg/m^3	0.01 mg/m^3	0.03 mg/m^3	2 mg/m^3	Inh, Abs, Ing, Con	Irrit Eyes, Skin; Cough & Chest Pain, Bron Pneu, Tremor, Insom, Irrty, Indecision, Head, Ftg, Weak, Stomatitis, Salv, GI Dist, Anor, Low-wgt, Ataxia

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]
Mercury (compounds)	----	0.1 mg/m^3	0.025 mg/m^3	0.1 mg/m^3	10 mg/m^3	Inh, Abs, Ing, Con	Irrit Eyes, Skin; Cough & Chest Pain, Bron Pneu, Tremor, Insom, Irrty, Indecision, Head, Ftg, Weak, Stomatitis, Salv, GI Dist, Anor, Low-wgt, Ataxia
Methanol	13.1150 mg/m^3	200 ppm	200 ppm	---	6,000 ppm	Inh, Abs, Ing, Con	Irrit Eyes, Skin, Resp, Head, drow, dizz, Nau, Vomit, vis dist, Optic, derm
Methyl Ether	----	----	---	----	---	Inh	Poison
Methyl Ethyl Ketone (2-Butanone)***	0.7375 mg/m^3	200 ppm	200 ppm	300 ppm	3,000 ppm	Inh, Con, Ing	Irrit Eyes, Skin, Nose, Throat, Head, Dizz, Vomit, Derm
Methylene Chloride	540 mg/m^3	25 ppm	50 ppm	125 ppm	[2,300 ppm]	Inh, Ing, Con, Abs	Ftg, Weak, dizz, drow, Numb, Tingle [carc], Irrit Eyes, Skin, Nau
Mineral Spirit	20 ppm	500 ppm	100 ppm	---	20,000 mg/m^3	Inh, Ing, Con	Irrit Eyes, Nose, Throat, Dizz, Derm, Chemical pneu
Methyl tert butyl ether (MTBE)	---	---	50 ppm	---		Inh, Abs	
Naphtha	0.86 ppm	100 ppm	400 ppm	---	1,000 ppm	Inh, Con, Ing	Light Head, Drow, Irrit, Derm, Irrit Eyes, Skin, Nose
Naphthalene*	0.084 ppm	10 ppm	10 ppm	15 ppm	250 ppm	Inh, Abs, Ing, Con	Eye irritation; headache; confusion, excitement, malaise (vague feeling of ill-being); nausea, vomiting, abdominal pain; irritated bladder; profuse sweating; renal shutdown; dermatitis
Nickel (metal)	---	1 mg/m^3	1.5 mg/m^3	---	[10 mg/m^3]	Inh, Ing, Con	Head, Verti, Nau, Vomit, Pain, Cough, Weak, Convuls, Delirium, Pneu, ,[Carc]
Nitrobenzene	0.0235 mg/m^3	1 ppm	1 ppm	---	200 ppm	Inh, Abs, Ing, Con	Irrit Eyes, Skin, Anoxia, Derm, Anem, Methem

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]
n-Butylbenzene	---	---	---	---	---	---	---
n-Propylbenzene	---	---	---	---	---	---	---
PCBs 42% chlorine (Aroclor 1242)	---	1 mg/m^3 (skin)	1 mg/m^3 (skin)	---	[5 mg/m^3]	Inh, Abs, Ing, Con	Irrit Eyes, Chloracne, Liver Damage [carc]
PCBs 54% chlorine (Aroclor 1254)	---	0.5 mg/m^3 (skin)	0.5 mg/m^3 (skin)	---	[5 mg/m^3]	Inh, Abs, Ing, Con	Irrit Eyes; Chloracne, Liver Damage [carc]
Petroleum Distillates	---	500 ppm	100 ppm		[1,100 ppm]	Inh, Ing, Con	Dizz, Drow, Head, Dry Skin, Nau, Irrit Eyes, Nose, Throat, [Carc]
Phenanthrene (Coal Tar Pitch)		0.2 mg/m^3	0.2 mg/m^3		[80 mg/m^3]	Inh, Con	Derm, bron, (carc)
Phenol**	0.1786 mg/m^3	5 ppm	5 ppm	---	250 ppm	Inh, Abs, Ing, Con	Irrit Eyes, Nose, Throat, Anor, Low Wgt, Weak Musc Ache, Pain, Dark Urine, Cyan, Liver, Kidney Damage, Skin, Burns, Derm, Ochronosis, Tremor, Convuls, Twitch
Pyrene		0.2 mg/m^3			[80 mg/m^3]	Inh, Con	[Carc]
Sec-Butylbenzene	---	---	---	---	---	---	---
Selenium	N/A	0.2 mg/m^3	0.2 mg/m^3	Unknown	1 mg/m^3	Inh, Ing, Con	Irrit, Head, Fever, Chills, Skin/Eye Burns, Metallic Taste, GI, Dysp, Bron
Silver (metal and soluble compounds as Ag)	----	0.01 mg/m^3	Metal = 0.1 mg/m^3 Soluble 0.01 mg/m^3		10 mg/m^3	Inh, Ing, Con	Blue-gray Eyes, Nasal Septum, Throat, Skin; Irrit, Ulcer, Skin, GI Dist
Tetrachloroethylene (a.k.a. perchloroethylene)***	4.68 ppm	100 ppm	25 ppm	200 ppm	[150 ppm]	Inh, Ing, Con, Abs	Irrit Eyes, Skin, Nose, throat, Resp. Nau, flush face, Neck, dizz, inco, head, drow, eryth, [Carc]

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]
Toluene*	2.14 ppm	200 ppm	50 ppm	300 ppm	500 ppm	Inh, Abs, Ins, Con	Resp, Irrit, Ftg, Conf, Dizz, Head, Derm, Euph, Head, Dilated Pupils, Lac, Ner, Musc FTg, Insom, Pares, Derm, lass
Petroleum Distillates (naphtha)	10 ppm	100 ppm	400 ppm	---	1,000 ppm	Con, Inh, Ing	---
Trans-1,2-Dichloroethylene	0.3357 mg/m^3	200 ppm	200 ppm	---	1,000 ppm	Inh, Con	Irrit, Resp, CNS depress
Trichloroethylene***	21.4 ppm	100 ppm	50 ppm	200 ppm	[1,000 ppm]	Inh, Con, Abs, Ing	Head, Vert, Nau, Vomit, Derm, Vis Dist, Tremors, Som, Nau, Irrit Eyes, Skin, Card Acc., Ftg, [Carc]
Trichlorofluoromethane	28 mg/m^3	1,000 ppm	1,000 ppm		2,000 ppm	Inh, Con, Ing	Inco, trem, derm, card, asph, frost
Trichlorotrifluoroethane	45 ppm	1,000 ppm	1,000 ppm	1,250 ppm	2,000 ppm	Inh, Con, Ing	Irrit Skin, throat, Drow, Derm, CSN, Depress
Vinyl Chloride***	10-20 ppm	1 ppm	1 ppm	5 ppm	ND	Inh, Con	Lass, Abdom, Gi Bleeding; Hepatomegaly; Pallor or Cyan of Extremities; Liq: Frostbite; [Carc]
VM&P Naphtha (petroleum naphtha)	---	---	300 ppm	---	ND	Con, Ing, Inh	Irrit Eyes, Nose, Throat, Dizz, drow, head, nau, dry skin, chem. Pneumonitis
ene*	4.5 mg/m^3	100 ppm	100 ppm	150 ppm	900 ppm	Inh, Ing, Abs, Con	Dizz, Drow, Irrit, Excite, Nau, Vomit, Eyes, Skin, Nose, Throat
Zinc (oxide)	---	5 mg/m^3	2 mg/m^3	---	500 mg/m^3	Inh	Dry Throat, Cough, Chills, Tight Chest, Blurred Vision
4,4' DDD	---	---	---	---	---	Ing, Inh, Con	---
4,4' DDE	---	---	---	---	---	Ing, Inh, Con	---
4,4' DDT	5.0725 mg/m^3	1 mg/m^3	1 mg/m^3	---	[500 mg/m^3]	Inh, Abs, Ing, Con	Irrit Eyes, Skin, Pares, Tongue, Lips, Face, Trem, Anxi, Dizz, Conf, Mal, Head, Lass, Conv, Paresi Hands, Vomit, [Carc]

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]
Aldrin		0.25 mg/m^3	0.25 mg/m^3	---	[25 mg/m^3]	Inh, Abs, Ing, Con	Head, Dizz, Nau, Vomit, Mal, Myo [Carc]
Chlordane [skin]	0.0084 mg/m^3	0.5 mg/m^3	0.5 mg/m^3		[100 mg/m^3]	Inh, Abs, Ing, Con	Blurred vision, confusion, delirium, cough; abdominal pian, nausea, vomiting diarrhea; irritability, tremor, convulsions [Carc]
EDB	76.8 mg/m^3	20 ppm		30 ppm	[100 ppm]	Inh, Abs	Resp. Irr, Eye Irr. [Carc]
Endosulfan I Endosulfan II	---	0.1 mg/m^3	0.1 mg/m^3	---	N.D.	Inh, Abs, Ing, Con	Irrit, Skin, Nau, Conf, Agit, Flush, Dry, Trem, Conv, Head
Endosulfan Sulfate		---	0.1 mg/m^3	---	---	Ing, Con	---
Endrin	1.8 x 10^{-2} ppm	0.1 mg/m^3	0.1 mg/m^{-3}	---	2 mg/m^3	Inh, Abs, Ing, Con	Epil Conv, Stup, Head, Dizz, Abdom, Nau, Vomit, Insom, Agress, Conf, Drow, Lass, Anor
Endrin Aldehyde	1.8 x 10^{-2} ppm	---	---	---	---	Inh, Con	---
Endrin Ketone	---	---	---	---	---	---	---
Heptachlor	0.02 ppm	0.5 mg/m^3	0.05 mg/m^3	---	[35 mg/m^3]	Inh, Abs, Ing, Con	In animals, Trem, Conv, [Carc]
Heptachlor epoxide	0.02 ppm	---	0.05 mg/m^3	---	---	Ing, Inh	Trem, Conv, [Carc]
Hydrogen Cyanide(Hydrocyanic Acid)	0.9 mg/m^3	10 ppm (11 mg/m^3)	4.7 ppm	4.7 ppm	50 ppm	Con, Inh, Ing, Abs	Asphy & death at high levels; Weak, Head, Conf, Nau, Vomit, Incr. Rate and Depth of Respiration or Respiration Slow and Gasping

TABLE 1
CHEMICAL HAZARDS KNOWN OR SUSPECTED ON-SITE

CONTAMINANT	ODOR THRESHOLD	OSHA PEL[1]	TLV (ACGIH)	OSHA CEILING[2] /STEL	IDLH CONC.	ROUTES OF EXPOSURE	SYMPTOMS OF ACUTE EXPOSURE[3]

NOTES

* = Constituent found in ETPH
**=Constituent found in Acid/Base/Neutral Extractable Compounds
***=Constituent found in Volatile Organic Compounds
****=Constituent found in Leaching Lead

[1] PEL = Permissible Exposure Limit. If no PEL is available, then the NIOSH Threshold Limit Value (TLV) should be used, if available.
[2] Ceiling limit or Short Term Exposure Limit (STEL), if available. Again, the NIOSH TLV may be used if no OSHA standard exists.
[3] Abbreviations are contained on the next page

[ ] = Potential Occupational Carcinogen
ND = Not Been Determined

ABBREVIATIONS

abdom = Abdominal
abs = Absorption
aggress = Aggressiveness
agit = Agitation
anor = Anorexia
anos = Anosmia (loss of the sense of smell)
Anxi = anxiety
anem – Anemia
aspir = Aspiration
asph – asphyxia
bron = Bronchitis
bron pneu = Bronchitis pneumonitis
[carc] = Potential occupational carcinogen
Card = Cardiac arrhythmias
CNS = Central nervous system
conf = Confusion
constip = Constipation
con = Skin and/or eye contact
conv = Convulsions
corn = Corneal
cyan = Cyanosis
defat = Defatting
depres = Depressant/Depression
derm = Dermatitis
diarr = Diarrhea
dist = Disturbance
dizz = Dizziness
drow = Drowsiness
dry = Dry mouth
dysp = Dyspnea (breathing difficulty)
emphy = Emphysema
epil-conv = Epileptiform convulsions
eryth = Erythema
euph = Euphoria
fib = Fibrosis
frost = frostbite
ftg = Fatigue
flush = Flushing
GI = Gastrointestinal
head = Headache
hyperpig = Hyperpigmentation
inco = Incoordination
ing = Ingestion
inh = Inhalation
inj = Injury
insom = Insomnia
irrit = Irritation
irrty = Irritability
lac = Lacrimination (discharge of tears)
lass = Lassitude (weakness, exhaustion)
li-head = Lightheadedness
liq = Liquid
low-wgt = Weight loss
mal = Malaise (vague feeling of discomfort)
malnut = Malnutrition
methem = Methemoglobinemia
myo = Myochonic (jerks of limbs)
mg/m = milligrams/cubic meter
muc memb = Mucous membrane
mus ftg = Muscle fatigue
narco = Narcosis
nau = Nausea
ner = Nervousness
numb = Numbness
optic = Optic nerve damage (blindness)
pall = Facial pallor
parap = Paralysis
ppm = Parts per million
pares = Paresthesia
paresi = Paresis
peri neur = Peripheral neuropathy
pneu = Pneumonitis
prot = Proteinuria
pulm = Pulmonary
peri neur = Peripheral neuropathy
pneu = Pneumonia
prot = Proteinuria
pulm = Pulmonary
repro = Reproductive
resp = Respiratory
skin sen = skin sensitization
salv = Salvation
som = Somnolence (sleepiness unnatural drowsiness)
subs = Substernal (occurring beneath the sternum)
stup = Stupor
sys = System
tingle = tingle limbs
trem – Tremors
verti = Vertigo
vis dist = Visual disturbance
vomit = Vomiting
weak = Weakness

APPENDIX A

Safety and Logistics Planning Call Log

Safety and Logistics Call Log
DEC808032

Date of Call ____________________
Work Assignment Number / Task ____________________
DEC Site Name and Number ____________________

Names of Attendees (and phone #s):

HRP		Subcontractors	
HRP PM	__________	Driller Contact	__________
HRP SSO	__________	Utility Survey	__________
HRP Other	__________	Surveyor	__________
HRP Other	__________	Construction	__________
HRP Other	__________	Other	__________
DEC DEC PM	__________	Other	__________
DEC Other	__________		__________

Brief Description Scope of Work (Task Specific): Use additional forms for additional tasks.

Logisitics:

Date of Work: ____________________
Time to Meet: ____________________
Site Contact (phone): ____________________
Notification of Site Contact made by: ____________________
Describe any unusal site-specific conditions/logistics here (if any): ____________________

		Notes below as needed:
Water Needed? Source Confirmed?	Y / N	__________
Electricity Needed? Source Confirmed?	Y / N	__________
Water Storage Needed?	Y / N	__________
Water Discharges? Permits Needed/Attained?	Y / N	__________
Air Monitoring - CAMP?	Y / N	__________

Will there be intrusive work? Y / N __________
Locations marked in the field? Y / N __________
NYS Code Rule 753/Dig Safe System: Ticket Number: __________
Confirmed that mark-out complete? Y / N

Anticipated Subsurface Conditions (Geology, Utilites, etc.): __________
Anticipated Depth to Groundwater: __________
Will NAPL/Product be Present: Y / N Describe: __________

Will there be any other parties entering the work zones? Describe control measures:

Lab and Equipment:

Equipment: Y / N PID IP Water Level Indicator CAMP Pumps controllers Survey Eq. GPS
Other:

Lab Analytical Required: Y / N VOCs SVOCs Metals PFAS 1,4D PCBs Pest/Herb
Other:

Media Tested: Soil Sediment Groundwater Surface Water Sub-slab[soil] Vapor Indoor Air
Notes of sample collection methods:

Bottle Order Received/ Checked? Y / N
How will samples be conveyed to lab?
Sample TAT? Standard 24 hr TAT 48 hr TAT Other:

Review Site - Specific Hazards (per Site-Specific HASP to be provided prior to all parties):

Site Constituents of Concern: VOCs SVOCs PFAS 1,4-Dioxane
(circle) HVOCs
AVOCs

metals pesticides herbicides
Asbestos PCBs
Lead Other:
Biologicals

Site Setting: Urban Suburban Unoccupied
Traffic Bystanders Crime Plants Animals Vectors
Overhead Utilities Underground Utilities Large Equipment
High Voltage Flood/Tidal Limited Access
Confined Spaces

Task-Specific Chemicals and Hazards (describe):
PPE Level (circle): D C B A Modifications:
Glove types: Face covering needed? Y/ N
Other specialty PPE:

Safe to Work Alone: Y / N
Other Precautions: Y / N Describe:

COVID 19 Protocols to be Observed: Y / N

Waste Containment:

How/ where will materials be contained, labelled, stored, or disposed?

Miscellaneous:

APPENDIX B

Personnel Log

PERSONNEL LOG

Name	Representing	Date	Time In	Time Out

APPENDIX C

Supervisor’s Investigation Report

INCIDENT REPORT

Section 1.0: Complete By Employee <u>and</u> Project Manager

(provide to Human Resources Manager)

Incident Case No. ______

Employee Name: Employee Title/Position:	Age: Sex: □ Female □ Male	Time employee began work: Date of Incident: Time of Incident:	Weather Conditions: Date of Report: Time Report Completed:
Department: Office Location: Supervisor:			

Employee Address: Street: City/Town: Zip Code: Phone Number:	Location of Incident: Address: City/Town: State:

Type of Incident:

□ Motor Vehicle Accident or □ Near Miss or □ Injury occurred during routine work

□ Company or □ Personal Vehicle?

First-Aid performed on-site? Yes / No

Other Medical Attention Provided? Yes / No

Time lost from work? Yes / No Number of Hours: or Number of Days:

If injuries occurred, list names and describe nature, degree, and body part injured: Number of injured:_____

1.

2.

3.

4.

Complete Section 3.0

WITNESS STATEMENT: WHAT HAPPENED AND WHAT WAS THE EMPLOYEE DOING BEFORE THE INCIDENT OCCURRED? WHAT WAS THE EMPLOYEE DOING WHEN THE INCIDENT OCCURRED? WHAT WAS THE EMPLOYEE DOING AFTER THE INCIDENT OCCURRED?	Describe what took place? Who was at fault for vehicle accidents, citation? Was power equipment involved, if so, describe?

WHAT WAS THE NATURE OF THE INJURY OR ILLNESS?	Tell us the body part that was affected and how it was affected – be specific Examples: strained lower back; chemical burn on hand
WHAT WAS THE ROOT CAUSE OF THE INCIDENT? List other individual involved in Section 3. COULD INCIDENT HAVE BEEN AVOIDED? HOW?	Get all the facts by studying the Job and situation involved. Question by use of WHY - WHAT – WHERE – WHEN – WHO – HOW Were there other factors (e.g., noise, ventilation, illumination, fatigue, age, medical conditions) that contributed to the accident?
WAS TRAINING FOR THE WORK ACTIVITY PROVIDED: TYPE: DATES:	WERE WARNING SIGNS OR LABELS POSTED:
WHAT SHOULD BE DONE? HOW CAN INCIDENT BE AVOIDED IN THE FUTURE?	WAS PERSONAL PROTECTIVE EQUIPMENT USED? NEEDED: AVAILABLE: CONTRIBUTED TO INJURY:
WHAT HAVE YOU DONE THUS FAR?	Take or recommend action, depending upon your authority. Follow up – was action effective?
HOW WILL THIS IMPROVE OPERATIONS?	OBJECTIVE Eliminate job hindrances

Completed by:	Reviewed by:	Date

Section 2.0: Complete By Supervisor or Human Resources Manager

Name: Role (witness, observer, injured, participant, etc.):	Address: Phone Number
Name: Role:	Address: Phone Number
Name: Role:	Address: Phone Number
Name: Role:	Address: Phone Number
Name: Role:	Address: Phone Number
Name: Role:	Address: Phone Number

Section 3.0: Corrective Actions (To be Completed by OHSM and CHSO)

Are corrective actions warranted? □ Yes □ No If so, proceed with corrective action list

Corrective Actions. List long term actions to be taken as a result of incident (use additional sheets if needed)	How was the corrective action implemented?	Target date of completion

OHSM Name:	CHSO Name:
OHSM Signature:	CHSO Signature:

End of incident report. Section 4.0 is to be completed and maintained by the Human Resources Department.

Section 4.0: Complete By Human Resources Manager

Incident Report Case No. ______________

The information on this page is considered CONFIDENTIAL and must be treated as such. This page will only be available to Human Resources Department or the employee's supervisor.

Insured Name:	Employee Hire Dates: Start at Company: Current Position:
Policy Number:	Is employee a company: Owner, Officer, Neither.
Employee Soc. Sec. No.:	Marital Status: Spouse Name:
Was Employee Pay Interrupted, or paid in full for time:	Employee Pay Period: Weekly, Bi-Weekly, Monthly, Other (specify)
Employee Compensated by hourly or salary? Wage Information: (tips, bonuses, commission)	Typical No. of hours worked per day____, hours per week____. Typical Start of day time___________, end of day time_________.
Date of Stop Work: Date Returned to Work:	How often has employee visited doctor/hospital?
Doctor: Authorized by Co.: Y / N Street: City/Town: Zip Code: Phone Number: Authorized by Co.: Y / N	Hospital: Street: City/Town: Zip Code: Phone Number: Authorized by Co.: Y /N
Was the employee treated in an emergency room? ☐ Yes ☐ No	Was employee hospitalized overnight as an in-patient? ☐ Yes ☐ No If so, for how many days? __________

APPENDIX D

Daily Job Brief Record

JOB BRIEF RECORD

Person Conducting

Site Name/Address

HRP Client Name/Job #

Client Contact/Phone

HRP H&S Rep.

HRP Supervisor

Date/Time

Number Attending

Weather

Designated Competent Person: ______________________________

Description of Work: ______________________________

____

____

____

Attendees (use additional sheets as needed):

Name	Company	Signature

Emergency Telephone Numbers

FIRE / POLICE / AMBULANCE: 911

Hospital Name & Location: ______________________________

NYSDEC Spill Line: 1-518-457-7362

National Response Center: 800-424-8802

CBYD: 800-922-4455

Health & Safety Manager: Mark Wright: 203-308-0983

HAZARDS

☐ Toxic
☐ Corrosive
☐ Flammable
☐ Combustible
☐ Reactive
☐ Path Waste
☐ Asbestos
☐ Extreme Cold/Heat
☐ Drains/Sumps
☐ Sharp Objects
☐ Drilling in Soil
☐ Lighting
☐ Slips/Trips/Falls
☐ Lead
☐ Soil Excavation
☐ Tank Excavation
☐ Trenching
☐ Floor Holes
☐ Working on/near Water
☐ Underground/Overhead Utilities
☐ Vehicle Traffic
☐ Hot Work
☐ Vac Truck
☐ Ladders
☐ Noise
☐ Lifting
☐ Powerwashing
☐ Elevated Work Area
☐ Live Electrical Circuits
☐ Pneumatic Tools
☐ Drum Handling
☐ Abrasive Blasting

PERSONAL SAFETY

☐ Supplied Air Respirator
☐ Fully Encapsulating Suit
☐ Overboots
☐ Safety Glasses
☐ Reflective Vests
☐ Hearing Protection
☐ SAR w/Egress Bottle
☐ Flash Suit
☐ Lifebelt/Lanyard
☐ Chemical Goggles
☐ Eye Wash
☐ Evacuation Plan
☐ SCBA
☐ NOMEX (flam resistant)
☐ Hardhats
☐ Face Shield
☐ Safety Shower
☐ Communications
☐ Air Purifying Respirator Cartridge: ______________
☐ Protected Coveralls, Type: ______________
☐ Outer Gloves, Type: ______________
☐ Inner Gloves, Type: ______________
☐ First Aid Kit
☐ Properly Sloped Excavation/ Trench
☐ PFD's
☐ Ventilation

FIRE SAFETY

☐ Fire Extinguishers
☐ Equipment Grounded & Bonded
☐ Smoking Area Designated Location: ______________________
☐ Fire Hose Laid Out
☐ Hot Work Permit
☐ Non-Sparking Tools
☐ Fire Blanket
☐ Eliminate Ignition Sources
☐ Alarm Box in Area, Location: ______________________
☐ Explosion-Proof Equipment
☐ Area Kept Wet

ISOLATE EQUIPMENT

☐ Establish Exclusion Zone/Traffic Cones
☐ Stop Transfers
☐ GFCIS
☐ Work Signs
☐ Caution Tape Area
☐ Temporary Fencing

ELECTRICAL EQUIPMENT

☐ LockOut/TagOut
☐ Equipment Grounded
☐ Non-Conductive Tools
☐ FR Suits/Coveralls

AIR MONITORING

Type of Meter: ______________________ Date last calibrated: ______________

SUBSTANCE	LEVEL B MAX.	ACTION LEVEL/LEVEL C MAX.	LEVEL D MAX.

Health & Safety Comments / Topics & Safety Rules Reviewed / Questions / Concerns:

____

____

____

____

____

____

Contaminants of Concern: ____

HEALTH & SAFETY SIGNATURE: ______________________________ Date: ______________

Is there a Site-Specific or Generic Health & Safety Plan available on-site? Yes ☐ No ☐

☐ HAZARD ZONES NOT APPLICABLE, GENERAL WORK AREA

Level D ☐ Modified Level D ☐ Level C ☐

Anything above Level C, foreman should use a Confined Space Permit/Form.

Note: HOT WORK requires a hot work permit and minimum 20# fire extinguisher. Foreman or HSM must record at least one contaminant of concern above. Toxic plants may be considered a COC if no chemical hazards are expected.

LEVEL C
Respirator Type: ____

Name	Zone	Time In	Time Out	Decon Type

Before performing Level C work, ALL employees must review HRP's Respiratory Protection Program - a copy of which must be on-site along with a HASP.

APPENDIX E

Equipment Calibration Log

EQUIPMENT CALIBRATION LOG

Instrument	Calibration Date	Calibrated By

APPENDIX F

Community Air Monitoring Plan

Community Air Monitoring Plan

714 Baldwin Street, City of Elmira, Chemung County, New York

This Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress during remedial activities at the site. The CAMP is not intended for use in establishing action levels for workers respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

Reliance on the CAMP should not preclude simple, common sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Depending on the nature of known or potential contaminants at the site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary.

Continuous monitoring will be required for all ground intrusive activities. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil samples. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuing monitoring may be required during sampling activities.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. 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.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than the background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work may continue with dust suppression techniques provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work will 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/m^3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for State (DEC and DOH) personnel to review.

VOC Monitoring, Response Levels, and Actions

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. The monitoring work will be performed using a photo ionization detector (PID) equipped with a 10.2 eV bulb. The PID 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.

- 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.

- 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 will be halted, the source of the 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.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown.

All 15-minute readings will be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

APPENDIX G

COVID-19 Health and Safety Guidelines

COVID19
SITE SPECIFIC HASP ADDENDUM

This addendum will remain in effect until what time the CDC, NIAID, and/or Surgeon General guidance is provided that removes the heightened awareness of social distancing, hand washing, and other protocols in response to COVID-19.

NECESSARY ADDITIONAL SUPPLIES

- Hand sanitizer (minimum 60% alcohol)
- Squeeze bottles of water (if no running water at job site)
- Soap
- Disinfectant (for tools, vehicles, common areas, etc.)
- Caution tape, cones or similar to set up social distancing boundaries as needed

EMPLOYEE HEALTH PROTECTION – ZERO TOLERANCE

The following applies to both HRP employees and contracted staff working on behalf of the HRP or the client.

- ZERO TOLERANCE FOR SICK WORKERS REPORTING TO WORK. IF YOU ARE SICK, STAY HOME! IF YOU FEEL SICK, GO HOME! IF YOU SEE SOMEONE SICK, SEND THEM HOME!
- If you are exhibiting any of the symptoms below, you are to report this to your supervisor (via phone, text or email) right away, and head home from the job site or stay home if already there.

  If you notice a co-worker showing signs or complaining about such symptoms, he or she should be directed to their supervisor (via phone, text or email) and asked to leave the project site immediately.

  COVID-19 Typical Symptoms:
    - Fever
    - Cough
    - Shortness of Breath
    - Sore Throat
    - Loss of taste or smell
- Prior to starting a shift, each employee will verbally self-certify to their supervisor that they:
    - Have no signs of a fever or a measured temperature above 100.3 degrees or greater, a cough or trouble breathing within the past 24 hours.
    - Have not had “close contact” with an individual diagnosed with COVID-19. “Close contact” means living in the same household as a person who has tested positive for COVID-19, caring for a person who has tested positive for COVID-19, being within 6 feet of a person who has tested positive for COVID-19 for about 15 minutes, or coming in direct contact with secretions (e.g., sharing utensils, being coughed on) from a person who has tested positive for COVID-19, while that person was symptomatic.
    - Have not been asked to self-isolate or quarantine by their doctor or a public health official.
    - These self-certifications may be documented at the request of the site owner
- Workers that are working in a confined space or inside a closed building envelope will have to be temperature screened by a Medical Professional or designated individual. Such screening shall be performed out of public view to respect privacy and results are kept private.
- Employees exhibiting symptoms or unable to self-certify should be directed to leave the work

site and seek medical attention and applicable testing by their health care provider. They are not to return to the work site until cleared by a medical professional.

GENERAL ON-THE-JOB GUIDANCE TO PREVENT EXPOSURE & LIMIT THE TRANSMISSION OF THE VIRUS

All Job Sites

- No touching or direct contact with other individuals, including handshaking.
- Wash hands often with soap and water for at least 20 seconds or alternatively when soap and water are not available, use an alcohol-based hand sanitizer with at least 60% ethanol or 70% isopropanol
- A "No Congregation" policy is in effect, individuals must implement social distancing by maintaining a minimum distance of 6-feet from all other individuals
- Avoid face to face meetings – critical situations requiring in-person discussion must follow social distancing
- Conduct all meetings via conference calls, if possible. Do not convene meetings of more than 10 people. Recommend use of cell phones, texting, web meeting sites and conference calls for project discussion
- Be sure to use your own water bottle, and do not share
- To avoid external contamination, bring food from home
- Maintain Social Distancing separation during breaks and lunch.
- To avoid sharing germs, please clean up after yourself. DO NOT make others responsible for moving, unpacking and packing up your personal belongings
- If you or a family member is feeling ill, stay home!

Multi-person job sites (i.e. HRP and subcontractors, etc.)

- Contractor and Field Offices are to be locked down to all but authorized personnel
- Each jobsite should develop cleaning and decontamination procedures that are posted and shared (if multi-person job site). These Procedures must cover all areas including trailers, gates, equipment, vehicles, etc. and shall be posted at all entry points to the sites, and throughout the project site.
- All individual work crew meetings/tailgate talks should be held outside and follow social distancing
- Please keep all crews a minimum of 6' apart at all times to eliminate the potential of cross contamination
- At each job briefing/tool box talk, employees are asked if they are experiencing any symptoms, and are sent home if they are
- Each jobsite should have laminated COVID-19 safety guidelines and handwashing instructions (last page of this addendum)
- All restroom facilities/porta-potties should be cleaned and handwashing stations must be provided with soap, hand sanitizer and paper towels
- All surfaces should be cleaned at least twice a day, including desk, work stations, door handles, laptops, etc.
- All common areas and meeting areas are to be regularly cleaned and disinfected at least once a day but preferably twice a day

- Single person job sites (just one HRP employee, no subs, vendors, etc.)
  - It is that person's responsibility to clean and disinfect all tools and reusable supplies upon return to the office

  - Cover coughing or sneezing with a tissue, then throw the tissue in the trash and wash hands, if no tissue is available then cough into your elbow
  - Avoid touching eyes, nose, and mouth with your hands

WORK SITE RISK PREVENTION PRACTICES

- At the start of each shift, confirm with all employees that they are healthy.
- All employees will be required to wear gloves (either latex or cut resistant depending on the task at hand)
- Use of eye protection is required (Safety glasses or googles at a minimum with or without face shields).
- In work conditions where required social distancing is impossible to achieve, affected employees shall be supplied PPE including as appropriate a standard face covering, gloves, and eye protection.
- All employees shall drive to work site/parking area in a single occupant vehicle. No one should ride together in the same vehicle
- When entering a machine or vehicle which you are not sure you were the last person to enter, make sure that you wipe down the interior and door handles with disinfectant prior to entry
- In instances where it is possible, workers should maintain separation of 6’ from each other per CDC guidelines.
- Multi person activities will be limited where feasible (two person lifting activities)
- Large gathering places on the site such as shacks and break areas will be eliminated and instead small break areas will be used with seating limited to ensure social distancing.
- Contact the cleaning person for your office trailer or office space and ensure they have proper COVID- 19 sanitation processes. Increase their cleaning visits to daily
- Clean all high contact surfaces a minimum of twice a day in order to minimize the spread of germs in areas that people touch frequently. This includes but is not limited to desks, laptops and vehicles

Wash Stations: All sites without ready access to an indoor bathroom or running water MUST install Wash Stations or provide other means for handwashing

- Install hand wash stations with hot water, if possible, and soap at fire hydrants or other water sources to be used for frequent handwashing for all onsite employees.
- All onsite workers must help to maintain and keep stations clean
- If a worker notices soap or towels are running low or out, immediately notify supervisors
- Garbage barrels will be placed next to the hand wash station for disposal of tissues/towels
- If no other alternative exists, bring squeeze bottles with water and soap (only authorized for single employee job sites)

Please Note: This document is not intended to replace any formalized procedures currently in place within the site specific HASP or any job related contracts.

Where this guidance does not meet or exceed the standards put forth by the state, municipality, site owner, contractor or subcontractor, everyone shall abide by the most stringent procedure.

A site-specific COVID-19 Officer (also known as the Health and Safety Officer) shall be designated for every site.

Print and post at each job site

COVID-19/ Health and Safety Officer Name: ____________________________

Phone Number: ____

Wash your hands often with soap and warm water, or use an alcohol-based hand sanitizer.

Avoid touching your eyes, nose and mouth.

Cover your mouth when you cough or sneeze. Use a tissue or your inner elbow, not your hands.

Clean things that are frequently touched (like doorknobs and countertops) with household cleaning spray or wipes.

Stay home if you are sick and avoid close contact with others.

Think ahead about how to take care of yourself and your loved ones. Visit **mass.gov/KnowPlanPrepare** for preparedness tips.

Any issue of non-compliance with these guidelines shall be a basis for pausing the work. The Health and Safety Officer will address corrective actions with the subcontractor. Any additional issues of non-conformance may be subject to action against the subcontractor's prequalification and certification status.

APPENDIX H

Safety Data Sheets
(for chemicals brought to the site)

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), 29CFR1910/1200 and GHS Rev. 3

Effective date: 12.08.2015 **Revision** : 12.10.2015

Trade Name: Alconox

1 Identification of the substance/mixture and of the supplier

1.1 Product identifier

Trade Name: Alconox
Synonyms:
Product number: Alconox

1.2 Application of the substance / the mixture : Cleaning material/Detergent

1.3 Details of the supplier of the Safety Data Sheet

Manufacturer	**Supplier**
Alconox, Inc. 30 Glenn Street White Plains, NY 10603 1-914-948-4040	Not Applicable

Emergency telephone number:
ChemTel Inc
North America: 1-800-255-3924
International: 01-813-248-0585

2 Hazards identification

2.1 Classification of the substance or mixture:

In compliance with EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments.

Hazard-determining components of labeling:

Tetrasodium Pyrophosphate
Sodium tripolyphosphate
Sodium Alkylbenzene Sulfonate

2.2 Label elements:

Skin irritation, category 2.
Eye irritation, category 2A.

Hazard pictograms:

Signal word: Warning

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Additional information: None.

Hazard description
Hazards Not Otherwise Classified (HNOC): None

Information concerning particular hazards for humans and environment:
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

Classification system:
The classification is according to EC regulation No. 1272/2008, 29CFR1910/1200 and GHS Rev. 3 and amendments, and extended by company and literature data. The classification is in accordance with the latest editions of international substances lists, and is supplemented by information from technical literature and by information provided by the company.

3 Composition/information on ingredients

3.1 **Chemical characterization** : None

3.2 **Description** : None

3.3 **Hazardous components (percentages by weight)**

Identification	Chemical Name	Classification	Wt. %
CAS number: 7758-29-4	Sodium tripolyphosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	12-28
CAS number: 68081-81-2	Sodium Alkylbenzene Sulfonate	Acute Tox. 4; H303 Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	8-22
CAS number: 7722-88-5	Tetrasodium Pyrophosphate	Skin Irrit. 2 ; H315 Eye Irrit. 2; H319	2-16

3.4 **Additional Information** : None.

4 First aid measures

4.1 **Description of first aid measures**

General information: None.

After inhalation:
Maintain an unobstructed airway.
Loosen clothing as necessary and position individual in a comfortable position.

After skin contact:
Wash affected area with soap and water.
Seek medical attention if symptoms develop or persist.

After eye contact:
Rinse/flush exposed eye(s) gently using water for 15-20 minutes.
Remove contact lens(es) if able to do so during rinsing.
Seek medical attention if irritation persists or if concerned.

After swallowing:
Rinse mouth thoroughly.
Seek medical attention if irritation, discomfort, or vomiting persists.

4.2 Most important symptoms and effects, both acute and delayed

None

4.3 Indication of any immediate medical attention and special treatment needed:

No additional information.

5 Firefighting measures

5.1 Extinguishing media

Suitable extinguishing agents:

Use appropriate fire suppression agents for adjacent combustible materials or sources of ignition.

For safety reasons unsuitable extinguishing agents : None

5.2 Special hazards arising from the substance or mixture :

Thermal decomposition can lead to release of irritating gases and vapors.

5.3 Advice for firefighters

Protective equipment:

Wear protective eye wear, gloves and clothing.
Refer to Section 8.

5.4 Additional information :

Avoid inhaling gases, fumes, dust, mist, vapor and aerosols.
Avoid contact with skin, eyes and clothing.

6 Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures :

Ensure adequate ventilation.
Ensure air handling systems are operational.

6.2 Environmental precautions :

Should not be released into the environment.
Prevent from reaching drains, sewer or waterway.

6.3 Methods and material for containment and cleaning up :

Wear protective eye wear, gloves and clothing.

6.4 Reference to other sections : None

7 Handling and storage

7.1 Precautions for safe handling :

Avoid breathing mist or vapor.
Do not eat, drink, smoke or use personal products when handling chemical substances.

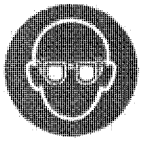
7.2 Conditions for safe storage, including any incompatibilities :

Store in a cool, well-ventilated area.

7.3 Specific end use(s):

No additional information.

8 Exposure controls/personal protection



8.1 Control parameters :

7722-88-5, Tetrasodium Pyrophosphate, OSHA TWA 5 mg/m3.

8.2 Exposure controls

Appropriate engineering controls:

Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling.

Respiratory protection:

Not needed under normal conditions.

Protection of skin:

Select glove material impermeable and resistant to the substance.

Eye protection:

Safety goggles or glasses, or appropriate eye protection.

General hygienic measures:

Wash hands before breaks and at the end of work.
Avoid contact with skin, eyes and clothing.

9 Physical and chemical properties

Appearance (physical state, color):	White and cream colored flakes - powder	**Explosion limit lower**: **Explosion limit upper**:	Not determined or not available. Not determined or not available.
Odor:	Not determined or not available.	**Vapor pressure at 20°C**:	Not determined or not available.
Odor threshold:	Not determined or not available.	**Vapor density**:	Not determined or not available.
pH-value:	9.5 (aqueous solution)	**Relative density**:	Not determined or not available.
Melting/Freezing point:	Not determined or not available.	**Solubilities**:	Not determined or not available.
Boiling point/Boiling range:	Not determined or not available.	**Partition coefficient (n-octanol/water)**:	Not determined or not available.
Flash point (closed cup):	Not determined or not available.	**Auto/Self-ignition temperature**:	Not determined or not available.
Evaporation rate:	Not determined or not available.	**Decomposition temperature**:	Not determined or not available.

Flammability (solid, gaseous):	Not determined or not available.	**Viscosity:**	a. Kinematic: Not determined or not available. b. Dynamic: Not determined or not available.
Density at 20°C:	Not determined or not available.		

10 Stability and reactivity

10.1 Reactivity : None

10.2 Chemical stability : None

10.3 Possibility hazardous reactions : None

10.4 Conditions to avoid : None

10.5 Incompatible materials : None

10.6 Hazardous decomposition products : None

11 Toxicological information

11.1 Information on toxicological effects :

Acute Toxicity:

Oral:

: LD50 > 5000 mg/kg oral rat - Product .

Chronic Toxicity: No additional information.

Skin corrosion/irritation:

Sodium Alkylbenzene Sulfonate: Causes skin irritation. .

Serious eye damage/irritation:

Sodium Alkylbenzene Sulfonate: Causes serious eye irritation .

Tetrasodium Pyrophosphate: Rabbit - Risk of serious damage to eyes .

Respiratory or skin sensitization: No additional information.

Carcinogenicity: No additional information.

IARC (International Agency for Research on Cancer): None of the ingredients are listed.

NTP (National Toxicology Program): None of the ingredients are listed.

Germ cell mutagenicity: No additional information.

Reproductive toxicity: No additional information.

STOT-single and repeated exposure: No additional information.

Additional toxicological information: No additional information.

12 Ecological information

12.1 Toxicity:

Sodium Alkylbenzene Sulfonate: Fish, LC50 1.67 mg/l, 96 hours.
Sodium Alkylbenzene Sulfonate: Aquatic invertebrates, EC50 Daphnia 2.4 mg/l, 48 hours.
Sodium Alkylbenzene Sulfonate: Aquatic Plants, EC50 Algae 29 mg/l, 96 hours.
Tetrasodium Pyrophosphate: Fish, LC50 - other fish - 1,380 mg/l - 96 h.
Tetrasodium Pyrophosphate: Aquatic invertebrates, EC50 - Daphnia magna (Water flea) - 391 mg/l - 48 h.

12.2 Persistence and degradability: No additional information.

12.3 Bioaccumulative potential: No additional information.

12.4 Mobility in soil: No additional information.

General notes: No additional information.

12.5 Results of PBT and vPvB assessment:

PBT: No additional information.

vPvB: No additional information.

12.6 Other adverse effects: No additional information.

13 Disposal considerations

13.1 Waste treatment methods (consult local, regional and national authorities for proper disposal)

Relevant Information:

It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities. (US 40CFR262.11).

14 Transport information

14.1 UN Number: ADR, ADN, DOT, IMDG, IATA	None
14.2 UN Proper shipping name: ADR, ADN, DOT, IMDG, IATA	None
14.3 Transport hazard classes: ADR, ADN, DOT, IMDG, IATA	**Class:** None **Label:** None **LTD. QTY:** None

US DOT
Limited Quantity Exception: None

Bulk:	**Non Bulk:**
RQ (if applicable): None	**RQ (if applicable):** None
Proper shipping Name: None	**Proper shipping Name:** None
Hazard Class: None	**Hazard Class:** None
Packing Group: None	**Packing Group:** None
Marine Pollutant (if applicable): No additional information.	**Marine Pollutant (if applicable):** No additional information.

	Comments: None	**Comments:** None
14.4	**Packing group:** ADR, ADN, DOT, IMDG, IATA	None
14.5	**Environmental hazards** :	None
14.6	**Special precautions for user:**	None
	Danger code (Kemler):	None
	EMS number:	None
	Segregation groups:	None

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.

14.8 Transport/Additional information:

Transport category:	None
Tunnel restriction code:	None
UN "Model Regulation":	None

15 Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture.

North American

SARA

Section 313 (specific toxic chemical listings): None of the ingredients are listed.
Section 302 (extremely hazardous substances): None of the ingredients are listed.

CERCLA (Comprehensive Environmental Response, Clean up and Liability Act) Reportable Spill Quantity: None of the ingredients are listed.

TSCA (Toxic Substances Control Act):

Inventory: All ingredients are listed.
Rules and Orders: Not applicable.

Proposition 65 (California):

Chemicals known to cause cancer: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for females: None of the ingredients are listed.

Chemicals known to cause reproductive toxicity for males: None of the ingredients are listed.

Chemicals known to cause developmental toxicity: None of the ingredients are listed.

Canadian

Canadian Domestic Substances List (DSL):
All ingredients are listed.

EU

REACH Article 57 (SVHC): None of the ingredients are listed.

Germany MAK: Not classified.

Asia Pacific

Australia

Australian Inventory of Chemical Substances (AICS): All ingredients are listed.

China

Inventory of Existing Chemical Substances in China (IECSC): All ingredients are listed.

Japan

Inventory of Existing and New Chemical Substances (ENCS): All ingredients are listed.

Korea

Existing Chemicals List (ECL): All ingredients are listed.

New Zealand

New Zealand Inventory of Chemicals (NZOIC): All ingredients are listed.

Philippines

Philippine Inventory of Chemicals and Chemical Substances (PICCS): All ingredients are listed.

Taiwan

Taiwan Chemical Substance Inventory (TSCI): All ingredients are listed.

16 Other information

Abbreviations and Acronyms: None

Summary of Phrases

Hazard statements:

H315 Causes skin irritation.
H319 Causes serious eye irritation.

Precautionary statements:

P264 Wash skin thoroughly after handling.
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352 If on skin: Wash with soap and water.
P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P321 Specific treatment (see supplemental first aid instructions on this label).
P332+P313 If skin irritation occurs: Get medical advice/attention.
P362 Take off contaminated clothing and wash before reuse.
P501 Dispose of contents and container as instructed in Section 13.

Manufacturer Statement:

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

NFPA: 1-0-0

HMIS: 1-0-0

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.2
Revision Date 02/24/2014
Print Date 11/13/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name	:	Distilled water
Product Number	:	07-6061
Brand	:	Katayama OEM Partner
REACH No.	:	A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.
CAS-No.	:	7732-18-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052

1.4 Emergency telephone number

Emergency Phone #	:	+1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	H2O H_2O
Molecular Weight	:	18.02 g/mol
CAS-No.	:	7732-18-5
EC-No.	:	231-791-2

No ingredients are hazardous according to OSHA criteria.
No components need to be disclosed according to the applicable regulations.

4. FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled
If not breathing give artificial respiration

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

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5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2 Special hazards arising from the substance or mixture

no data available

5.3 Advice for firefighters

no data available

5.4 Further information

The product itself does not burn.

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6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

For personal protection see section 8.

6.2 Environmental precautions

no data available

6.3 Methods and materials for containment and cleaning up

Wipe up with absorbent material (e.g. cloth, fleece).

6.4 Reference to other sections

For disposal see section 13.

---

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

No special storage conditions required.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice.

Personal protective equipment

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Respiratory protection
No special protective equipment required.

Control of environmental exposure
Prevent product from entering drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	6.0 - 8.0 at 25 °C (77 °F)
e)	Melting point/freezing point	0.0 °C (32.0 °F)
f)	Initial boiling point and boiling range	100 °C (212 °F) - lit.
g)	Flash point	not applicable
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapour pressure	no data available
l)	Vapour density	no data available
m)	Relative density	1.000 g/cm3 at 3.98 °C (39.16 °F)
n)	Water solubility	completely miscible
o)	Partition coefficient: n-octanol/water	no data available
p)	Auto-ignition temperature	no data available
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information

no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

no data available

10.4 Conditions to avoid

no data available

10.5 Incompatible materials

no data available

10.6 Hazardous decomposition products

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

no data available

Inhalation: no data available

Dermal: no data available

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

no data available

Specific target organ toxicity - single exposure

no data available

Specific target organ toxicity - repeated exposure

no data available

Aspiration hazard
no data available

Additional Information
RTECS: ZC0110000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
no data available

12.2 Persistence and degradability
not applicable

12.3 Bioaccumulative potential
no data available

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Taking into account local regulations the product may be disposed of as waste water after neutralisation.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	

New Jersey Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.2 Revision Date: 02/24/2014 Print Date: 11/13/2016

SAFETY DATA SHEET

1. Identification

Product identifier: SODIUM BISULFATE

Other means of identification
Product No.: 7432, 3534

Recommended use and restriction on use

Recommended use: Not available.
Restrictions on use: Not known.

Manufacturer/Importer/Supplier/Distributor information

Manufacturer
Company Name: Avantor Performance Materials, Inc.
Address: 3477 Corporate Parkway, Suite 200
Center Valley, PA 18034
Telephone:
Customer Service: 855-282-6867
Fax:
Contact Person: Environmental Health & Safety
e-mail: info@avantormaterials.com

Emergency telephone number:
24 Hour Emergency: 908-859-2151

Chemtrec: 800-424-9300

2. Hazard(s) identification

Hazard classification

Health hazards

Serious eye damage/eye irritation	Category 1

Label elements

Hazard symbol:

Signal word: Danger

Hazard statement: Causes serious eye damage.

Precautionary statement

Prevention: Wear eye protection/face protection.

Response: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/physician.

Other hazards which do not result in GHS classification: None.

3. Composition/information on ingredients

Mixtures

Chemical identity	Common name and synonyms	CAS number	Content in percent (%)*
SODIUM BISULFATE (HYDRATED FORM)		10034-88-5	90 - 100%

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. First-aid measures

General information: Get medical advice/attention if you feel unwell. Show this safety data sheet to the doctor in attendance.

Ingestion: Rinse mouth thoroughly. Get medical attention if symptoms occur.

Inhalation: Move to fresh air. Get medical attention if symptoms occur.

Skin contact: Wash skin thoroughly with soap and water. Get medical attention if irritation persists after washing.

Eye contact: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.

Most important symptoms/effects, acute and delayed

Symptoms: Causes serious eye damage.

Indication of immediate medical attention and special treatment needed

Treatment: Treat symptomatically.

5. Fire-fighting measures

General fire hazards: No unusual fire or explosion hazards noted.

Suitable (and unsuitable) extinguishing media

Suitable extinguishing media: Use fire-extinguishing media appropriate for surrounding materials.

Unsuitable extinguishing media: Avoid water in straight hose stream; will scatter and spread fire.

Specific hazards arising from the chemical: During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters

Special fire fighting procedures: Move containers from fire area if you can do so without risk. Use water spray to keep fire-exposed containers cool. Cool containers exposed to flames with water until well after the fire is out.

Special protective equipment for fire-fighters:	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures:	Keep unauthorized personnel away. Use personal protective equipment. See Section 8 of the MSDS for Personal Protective Equipment.
Methods and material for containment and cleaning up:	Sweep up and place in a clearly labeled container for chemical waste. Clean surface thoroughly to remove residual contamination.
Notification Procedures:	Prevent entry into waterways, sewer, basements or confined areas. Inform authorities if large amounts are involved.
Environmental precautions:	Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling:	Use personal protective equipment as required. Avoid contact with eyes, skin, and clothing. Avoid inhalation of dust. Wash thoroughly after handling.
Conditions for safe storage, including any incompatibilities:	Keep containers tightly closed. Store in cool, dry place. Store in a well-ventilated place.

8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

None of the components have assigned exposure limits.

Appropriate engineering controls	No data available.

Individual protection measures, such as personal protective equipment

General information:	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Eye/face protection:	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection:	Use suitable protective gloves if risk of skin contact.
Other:	Wear suitable protective clothing.
Respiratory protection:	In case of inadequate ventilation, use respiratory protection.
Hygiene measures:	Provide eyewash station and safety shower. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing to remove contaminants. Discard contaminated footwear that cannot be cleaned.

9. Physical and chemical properties

Appearance	
Physical state:	Solid
Form:	Crystals or powder.
Color:	Colorless
Odor:	Odorless
Odor threshold:	No data available.
pH:	1.4
Melting point/freezing point:	58 °C
Initial boiling point and boiling range:	No data available.
Flash Point:	No data available.
Evaporation rate:	No data available.
Flammability (solid, gas):	No data available.
Upper/lower limit on flammability or explosive limits	
Flammability limit - upper (%):	No data available.
Flammability limit - lower (%):	No data available.
Explosive limit - upper (%):	No data available.
Explosive limit - lower (%):	No data available.
Vapor pressure:	No data available.
Vapor density:	No data available.
Relative density:	2.1 (20 °C)
Solubility(ies)	
Solubility in water:	670 g/l
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	No data available.
Auto-ignition temperature:	No data available.
Decomposition temperature:	No data available.
Viscosity:	No data available.
Other information	
Molecular weight:	138.08 g/mol

10. Stability and reactivity

Reactivity:	No dangerous reaction known under conditions of normal use.
Chemical stability:	Material is unstable under normal conditions.
Possibility of hazardous reactions:	Hazardous polymerization does not occur. The substance is hygroscopic and will absorb water by contact with the moisture in the air.
Conditions to avoid:	Contact with incompatible materials. Moisture. Avoid conditions which create dust.
Incompatible materials:	Strong bases.
Hazardous decomposition products:	Sulfur dioxide gas may be liberated from the product.

11. Toxicological information

Information on likely routes of exposure

Ingestion:	May cause irritation of the gastrointestinal tract.

Inhalation:	May cause irritation to the respiratory system.
Skin contact:	May cause irritation.
Eye contact:	Causes serious eye damage.

Information on toxicological effects

Acute toxicity (list all possible routes of exposure)

Oral

Product:	No data available.

Dermal

Product:	No data available.

Inhalation

Product:	No data available.

Repeated dose toxicity

Product:	No data available.

Skin corrosion/irritation

Product:	May cause skin irritation.

Serious eye damage/eye irritation

Product:	Causes serious eye damage.

Respiratory or skin sensitization

Product:	Not a skin sensitizer.

Carcinogenicity

Product:	This substance has no evidence of carcinogenic properties.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
No carcinogenic components identified

US. National Toxicology Program (NTP) Report on Carcinogens:
No carcinogenic components identified

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):
No carcinogenic components identified

Germ cell mutagenicity

In vitro

Product:	No mutagenic components identified

In vivo

Product:	No mutagenic components identified

Reproductive toxicity

Product:	No components toxic to reproduction

Specific target organ toxicity - single exposure

Product:	No data available.

Specific target organ toxicity - repeated exposure

Product:	No data available.

Aspiration hazard

Product:	Not classified

Other effects:	None known.

12. Ecological information

Ecotoxicity:

Acute hazards to the aquatic environment:

Fish

Product:	No data available.

Aquatic invertebrates

Product:	No data available.

Chronic hazards to the aquatic environment:

Fish

Product:	No data available.

Aquatic invertebrates

Product:	No data available.

Toxicity to Aquatic Plants

Product:	No data available.

Persistence and degradability

Biodegradation

Product:	There are no data on the degradability of this product.

BOD/COD ratio

Product:	No data available.

Bioaccumulative potential

Bioconcentration factor (BCF)

Product:	No data available on bioaccumulation.

Partition coefficient n-octanol / water (log Kow)

Product:	No data available.

Mobility in soil:	The product is water soluble and may spread in water systems.
Other adverse effects:	The product components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

13. Disposal considerations

Disposal instructions:	Discharge, treatment, or disposal may be subject to national, state, or local laws.
Contaminated packaging:	Since emptied containers retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number:	UN 3260
UN proper shipping name:	Corrosive solid, acidic, inorganic, n.o.s.(SODIUM BISULFATE)
Transport hazard class(es)	
Class(es):	8
Label(s):	8
Packing group:	III
Marine Pollutant:	No

IMDG

UN number:	UN 3260
UN proper shipping name:	CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S.(SODIUM BISULFATE)
Transport hazard class(es)	
Class(es):	8
Label(s):	8
EmS No.:	F-A, S-B
Packing group:	III
Marine Pollutant:	No

IATA

UN number:	UN 3260
Proper Shipping Name:	Corrosive solid, acidic, inorganic, n.o.s.(SODIUM BISULFATE)
Transport hazard class(es):	
Class(es):	8
Label(s):	8
Marine Pollutant:	No
Packing group:	III

15. Regulatory information

US federal regulations

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

None present or none present in regulated quantities.

CERCLA Hazardous Substance List (40 CFR 302.4):

None present or none present in regulated quantities.

Superfund amendments and reauthorization act of 1986 (SARA)

Hazard categories

☒ Acute (Immediate) ☐ Chronic (Delayed) ☐ Fire ☐ Reactive ☐ Pressure Generating

SARA 302 Extremely hazardous substance

None present or none present in regulated quantities.

SARA 304 Emergency release notification

None present or none present in regulated quantities.

SARA 311/312 Hazardous chemical

Chemical identity	Threshold Planning Quantity

SARA 313 (TRI reporting)

None present or none present in regulated quantities.

Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)

None present or none present in regulated quantities.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):

None present or none present in regulated quantities.

US state regulations

US. California Proposition 65

No ingredient regulated by CA Prop 65 present.

US. New Jersey Worker and Community Right-to-Know Act

No ingredient regulated by NJ Right-to-Know Law present.

US. Massachusetts RTK - Substance List

No ingredient regulated by MA Right-to-Know Law present.

US. Pennsylvania RTK - Hazardous Substances

No ingredient regulated by PA Right-to-Know Law present.

US. Rhode Island RTK

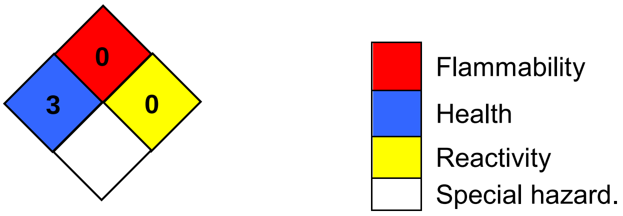
No ingredient regulated by RI Right-to-Know Law present.

Inventory Status:

Australia AICS:	On or in compliance with the inventory
Canada DSL Inventory List:	On or in compliance with the inventory
EINECS, ELINCS or NLP:	On or in compliance with the inventory
Japan (ENCS) List:	Not in compliance with the inventory.
China Inv. Existing Chemical Substances:	On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI):	Not in compliance with the inventory.
Canada NDSL Inventory:	Not in compliance with the inventory.
Philippines PICCS:	On or in compliance with the inventory
US TSCA Inventory:	On or in compliance with the inventory
New Zealand Inventory of Chemicals:	On or in compliance with the inventory
Japan ISHL Listing:	Not in compliance with the inventory.
Japan Pharmacopoeia Listing:	Not in compliance with the inventory.

16.Other information, including date of preparation or last revision

NFPA Hazard ID



Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe

Issue date: 05-16-2014

Revision date:	No data available.
Version #:	1.0
Further information:	No data available.

Disclaimer:

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APPENDIX B

PFAS Laboratory SOP

Title: Per- and Poly-fluorinated Substances (PFAS) in Water, Soils, Sediments and Tissue

[Method 537 (Modified), PFAS by LCMSMS]

Approvals (Signature):

	Kristine Dusablon
Don Dawicki Laboratory Director	Kristine Dusablon Quality Assurance Manager
Matth Kirk	M Fausel
Matthew Kirk Operations Manager / EHS Coordinator	Mark Fausel Department Supervisor

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Facility Distribution No. Electronic **Distributed To: Facility Intranet**

1.0 Scope and Application

This SOP describes the laboratory procedure for the preparation and analysis of per- and polyfluorinated substances using liquid chromatography/tandem mass spectrometry (LC/MS/MS).

Program specific requirements are not included in this SOP. The details of program specific requirements are specified in other laboratory work instructions relevant to the program.

1.1 Analytes, Matrices, and Reporting Limits

This procedure is amenable with water, soil, sediment and tissue sample matrices.
The list of target compounds that may be determined from this procedure is provided below. Table 1 presents the compounds along with their associated reporting limits (RL).

Compound Name	Abbreviation	CAS #
Perfluoroalkylcarboxylic acids (PFCAs)		
Perfluoro-n-butanoic acid (Perfluoro-n-butyric acid)	PFBA	375-22-4
Perfluoro-n-pentanoic acid	PFPeA	2706-90-3
Perfluoro-n-hexanoic acid	PFHxA	307-24-4
Perfluoro-n-heptanoic acid	PFHpA	375-85-9
Perfluoro-n-octanoic acid	PFOA	335-67-1
Perfluoro-n-nonanoic acid	PFNA	375-95-1
Perfluoro-n-decanoic acid	PFDA	335-76-2
Perfluoro-n-undecanoic acid	PFUdA (PFUnA)	2058-94-8
Perfluoro-n-dodecanoic acid	PFDoA	307-55-1
Perfluoro-n-tridecanoic acid	PFTrDA	72629-94-8
Perfluoro-n-tetradecanoic acid	PFTeDA (PFTA)	376-06-7
Perfluoro-n-hexadecanoic acid	PFHxDA	67905-19-5
Perfluoro-n-octadecanoic acid	PFODA	16517-11-6
Perfluorinated sulfonic acids (PFSAs)		
Perfluoro-1-butanesulfonic acid	PFBS	375-73-5
* Perfluoro-1-pentanesulfonic acid	PFPeS	2706-91-4
Perfluoro-1-hexanesulfonic acid	PFHxS	355-46-4
Perfluoro-1-heptanesulfonic acid	PFHpS	375-92-8
Perfluoro-1-octanesulfonic acid	PFOS	1763-23-1
* Perfluoro-1-nonanesulfonic acid	PFNS	68259-12-1
Perfluoro-1-decanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Perfluorinated sulfonamides (FOSA)		
Perfluoro-1-octanesulfonamide	FOSA	754-91-6
Perfluorinated sulfonamidoacetic acids (FOSAA)		
N-ethylperfluoro-1-octanesulfonamidoacetic acid	EtFOSAA	2991-50-6
N-methylperfluoro-1-octanesulfonamidoacetic acid	MeFOSAA	2355-31-9
Fluorotelomer sulfonates (FTS)		
* 1H,1H,2H,2H-perfluorohexanesulfonic acid *(4:2)*	4:2 FTS	757124-72-4
1H,1H,2H,2H-perfluorooctanesulfonic acid *(6:2)*	6:2 FTS	27619-97-2

1H,1H,2H,2H-perfluorodecanesulfonic acid *(8:2)*	8:2 FTS	39108-34-4
1H,1H,2H,2H-perfluorododecane sulfonic acid (10:2)	10:2 FTS	120226-60-0
Fluorinated Replacement Chemicals		
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
4,8-dioxa-3H-perfluorononanoic acid	DONA	919005-14-4
9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	F53B Major (9Cl-PF3ONS)	756426-58-1
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	F53B Minor (11Cl-PF3OUdS)	763051-58-1

Abbreviations in parenthesis are the abbreviations listed in Method 537, where they differ from the abbreviation used by the laboratory's LIMS.
***Indicates the analyte is not certified in any state or program.**
Analytes with secondary certification in NJDEP can be found in Appendix D.

The working range of the method is listed below. The linear range can be extended by diluting the extracts.

Matrix	Nominal Sample Size	Reporting Limit	Working Range
Water	250 mL	2.0 ng/L - 20 ng/L	2.0 ng/L - 400 ng/L
Soil/Sediment	5 g	0.2 µg/Kg–2.0 µg/Kg	0.2 µg/Kg-40 µgKg
Tissue	1 g	1.0 µg/Kg–10 µg/Kg	1.0 µg/Kg–200 µg/Kg

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in the Quality Assurance Manual.

2.0 Summary of Method

Water Samples: Water samples are extracted using a solid phase extraction (SPE) cartridge. PFAS are eluted from the cartridge with an [redacted] solution.

Soil/sediment/tissue samples are extracted with a [redacted] solution using a TCLP tumbler operating at [redacted] The mixture is centrifuged to reduce the amount of solid transferred when decanting the solvent. The solvent extract is exchanged to water using nitrogen blowdown, then the aqueous extract is extracted using a solid phase extraction (SPE) cartridge. PFAS are eluted from the cartridge with an ammonium hydroxide/methanol solution.

The final [redacted] extracts are analyzed by LC/MS/MS operated in electrospray (ESI) negative ion mode. PFAS are separated from other components on a C18 column with a solvent gradient program [redacted] and methanol.

An isotope dilution technique is employed with this method for the compounds of interest. The isotope dilution analytes (IDAs) consist of carbon-13 labeled analogs, oxygen-18 labeled analogs, or deuterated analogs of the compound of interest, and they are spiked into the samples at the time of extraction. This technique allows for the correction for analytical bias encountered when analyzing more chemically complex environmental samples. The isotopically labeled compounds are chemically similar to the compounds of concern and are therefore affected by sample-related interferences to the same extent as the compounds of concern. Compounds that do not have an identically labeled analog are quantified by the IDA method using a closely related labeled analog.

Quantitation by the internal standard method is employed for the IDA analytes/recoveries. Peak response is measured as the area of the peak.

This SOP is based on the following reference methods:

- US EPA, "Method 537 - Determination of Selected Perfluorinated alkyl acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometery (LC/MS/MS)", Version 1.1, September 2009.
- Method ISO 25101, "Water quality – Determination of perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) – Method for unfiltered samples using solid phase extraction and liquid chromatography/mass spectrometry", First Edition, 2009-03-01, International Organization for Standardization, Technical Committee ISO/TC 147, Water Quality, Subcommittee SC 2, Physical, chemical and biochemical methods.

If the laboratory's SOP is modified from the reference method, a list of method modifications along with technical justification may be found in Section 16. Modifications to this SOP may be applied on a project specific basis to meet project data quality objectives. Project specific modifications are documented in the project record.

3.0 Definitions

Refer to the Laboratory's Quality Assurance Manual (QAM) for the Glossary of Terms, Definitions and Acronyms except as follows.

Definitions of terms used in this SOP may be found in Appendix A.

4.0 Interferences

PFAS have been used in a wide variety of manufacturing processes, and laboratory supplies should be considered potentially contaminated until they have been tested and shown to be otherwise. The materials and supplies used during the method validation process have been tested and shown to be clean. These items are listed below in Section 6.

To avoid contamination of samples, standards are prepared in a ventilation hood in an area separate from where samples are extracted.

PTFE products can be a source of PFOA contamination. The use of PTFE in the procedure should be avoided or at least thoroughly tested before use. Polypropylene (PP) or polyethylene (PE, HDPE) products may be used in place of PTFE products to minimize PFOA contamination.

Standards and samples are injected from polypropylene autosampler vials with polyethylene screw caps once. Multiple injections may be performed on Primers when conditioning the instrument for analysis.

Random evaporation losses have been observed with the polyethylene caps causing high IDA recovery after the vial was punctured and sample re-injected. For this reason, it is best to inject standards and samples once in the analytical sequence.

Teflon-lined screw caps have detected PFAS at low concentrations. Repeated injection from the same Teflon-lined screw cap have detected PFNA at increasing concentration as each repeated injection was performed, therefore, it is best to use polyethylene screw caps.

Volumetric glassware and syringes are difficult to clean after being used for solutions containing high levels of PFAS. These items should be labeled for use only with similarly concentrated solutions or verified clean prior to re-use. To the extent possible, disposable labware is used.

Both branched and linear isomers of PFOS, PFOA, PFHxS, PFBS, EtFOSAA and MeFOSAA can potentially be found in the environment, based upon scientific literature. If multiple isomers are present for one of these PFAS, these adjacent peaks are either completely resolved or not resolved but with a profound deflection that can be resolved during peak integration. The later of the peaks matches the retention time of the single labeled PFAS peak. In general, earlier peaks are branched isomers and are not a result of peak splitting, and all the chromatographic peaks observed in the standard and/or sample must be integrated and the areas included.

When reference standards of technical mixtures of specific PFAS area available, they should be used to ensure that all appropriate peaks are included during peak integration (at this time, only PFOS, PFOA, PFHxS, EtFOSAA and MeFOSAA are available as technical mixtures). Refer to Section 7, Reagents, for the available technical mixtures utilized by this SOP.

In an attempt to reduce PFOS bias, it is required that m/z 449>80 transition be used as the quantitation transition.

Per the Certificate of Analysis for labeled perfluorohexadecanoic acid (13C2-PFHxDA) produced by Wellington Laboratories, the stock standard contains roughly 0.3% of native perfluorohexadecanoic acid. The laboratory utilizes a weighted linear regression that is not forced through the origin for the calibration of native perfluorohexadecanoic acid to account for this contribution from its labeled IDA.

5.0 <u>Safety</u>

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001), Radiation Safety Manual and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

Preliminary toxicity studies indicate that PFAS could have significant toxic effects. In the interest of keeping exposure levels as low as reasonably achievable, PFAS must be handled in the laboratory as hazardous and toxic chemicals.

Exercise caution when using syringes with attached filter disc assemblies. Application of excessive force has, upon occasion, caused a filter disc to burst during the process.

Laboratory procedures such as the use of pipets and transferring of extracts represent a significant potential for repetitive motion or other ergonomic injuries. Laboratory associates performing these procedures are in the best position to realize when they are at risk for these types of injuries. Whenever a situation is found in which an employee is performing the same repetitive motion, the employee shall immediately bring this to the attention of their supervisor, manager or the EH&S staff. The task will be analyzed to determine a better means of accomplishing it.

Eye protection that satisfies ANSI Z87.1 (as per the Eurofins TestAmerica Corporate Safety Manual), a laboratory coat and nitrile gloves must be worn while handling samples, standards, solvents and reagents. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately.

Perfluorocarboxylic acids are acids and are not compatible with strong bases.

The use of vacuum systems presents the risk of imploding glassware. All glassware used during vacuum operations must be thoroughly inspected prior to each use. Glass that is chipped, scratched, cracked, rubbed or marred in any manner must not be used under vacuum. It must be removed from service and replaced.

The HPLC and MS/MS have areas of high voltage. Depending on the type of work involved, the instrument should be turned off or disconnected from its source of power prior to extensive maintenance.

5.2 Primary Materials Used

Table 2 lists those materials used in this procedure that have a serious or significant hazard rating along with the exposure limits and primary hazards associated with that material as identified in the SDS. **NOTE: This list does not include all materials used in the method.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the SDS for each material before using it for the first time or when there are major changes to the SDS.

6.0 Equipment and Supplies

Catalog numbers listed in this SOP are subject to change at the discretion of the vendor. Analysts are cautioned to be sure equipment used meets the specification of this SOP.

6.1 Miscellaneous

- 15 mL polypropylene test tubes with screw caps, Fisherbrand 05-539-5 or equivalent.
- 250-mL HDPE wide-mouth bottles with screw caps (ESS 0250-1901-).
- Analytical balance capable of weighing to the nearest 0.01g, and checked for accuracy each day it is used in accordance with BR-GT-008.
- SPE Vacuum manifold, 24-port, [redacted] or equivalent.
- 1/8” OD Poly siphon lines, 30” long for sample loading.
- SPE Adaptor Caps for 1, 3, and 6 mL SPE Tubes, Polyethylene, [redacted], or equivalent.
- SPE Stopcocks, Polyethylene and Polypropylene, [redacted], or equivalent.
- Stainless steel solvent guide needles, [redacted], or equivalent.
- Heavy-Wall filter flask, Fisherbrand 4000mL, [redacted], or equivalent.
- TCLP tumbler, [redacted] for extraction of soil, sediment and tissue samples.
- Glass-Col ZipVap 24-port extract concentrator.

- Polypropylene Syringe, 10 mL with luer-lok or luer slip tips, [redacted] or equivalent.
- Volumetric Syringes, Class “A” (25µL, 50µL 100µL, and 500µL), Hamilton or equivalent.
- Automatic Pipettor, Finnpette, 1-5mL.
- Polypropylene autosampler vials, 300µL, 700µL and 2mL with polyethylene screw caps.
- Waters Oasis [redacted] or equivalent, for the extraction of PFAS from aqueous samples.
- Waters Oasis [redacted] or equivalent, for the cleanup of soils.
- 250mL Poly bottles containing 1.25g of Trizma Pre-Set Crystals, used for batch QC for samples received with Trizma preservation.
- 50mL graduated polypropylene centrifuge tubes. [redacted] or equivalent.
- 500ml Polyethylene wash bottle
- 4, 6, and 12ml Class A Volumetric Pipette
- Graphitized carbon (Envi-Carb™ or equivalent)
- Miscellaneous laboratory apparatus (beakers, test tubes, volumetric flasks, pipettes, etc). These should be disposable wherever possible, or marked and segregated for high-level versus low-level use.

6.2 Analytical System

Liquid Chromatography/Tandem Mass Spectrometer (LC/MS/MS)-as described below. The use of a column heater is required to maintain a stable temperature throughout the analytical run. Data is processed using Chrom Peak Review, version 2.1 or equivalent.

- SCIEX LC/MS/MS

  This system consists of a [redacted] HPLC interfaced with a [redacted]. The instrument control and data acquisition software is [redacted] [redacted]r equivalvent.

  [redacted] HPLC equipped with [redacted] and [redacted] or equivalent. [redacted] Column Oven.

  [redacted], or equivalent.

  PFAS Isolator column. [redacted]. These are plumbed between the pump’s mixing valve and the autosampler to minimized the HPLC-based PFAS background from injection-based PFAS.

7.0 <u>Reagents and Standards</u>

7.1 Reagents

All reagents must follow traceability guidelines found in SOP BR-QA-002.

- Ammonium acetate Stock Solution[redacted]
- [redacted] ammonium acetate eluent.. [redacted]

- Ammonium hydroxide, concentrated, JT Baker or equivalent.
- Ammonium hydroxide (NH_4OH) ([redacted] of Methanol. Volume prepared may be adjusted based on usage/need.
- Potassium hydroxide pellets, 87% purity, JT Baker P250-1 or equivalent.
- Potassium hydroxide (KOH), [redacted]
- Reagent Water, house reverse-osmosis reagent water ("PFAS-Free" via in-house testing).
- Hexane, Ultra-Resi Analyzed, JT Baker or equivalent.
- Methanol, HPLC JT Baker or equivalent.
- Sodium hydroxide, pellets, JT Baker or equivalent.
- Sodium hydroxide (NaOH), [redacted]
- Acetonitrile, Optima Grade, Fisherbrand or equivalent.

7.2 Standards

Purchase high purity, technical grade solids (96% or greater) or certified solutions from commercial vendors. Standard materials are verified compared to a second source material at the time of initial calibration. The solid stock material is stored at room temperature or as specified by the manufacturer or vendor. If solid material is used for preparing a standard, stock standard solutions are prepared from the solids and are stored at 4 ± 2°C. Stock standard solutions should be brought to room temperature before using. Standards are monitored for signs of degradation or evaporation. Standard solutions must be replaced at least annually from the date of preparation.

Per the Certificate of Analysis for labeled perfluorohexadecanoic acid (13C2-PFHxDA) produced by Wellington Laboratories, the stock standard contains ~0.3% of native PFHxDA. This equates to roughly 0.30 ng/L or 0.015 ug/Kg of PFHxDA expected in all samples and blanks.

As of this writing, only PFOS, PFOA, PFHxS, MeFOSAA and EtFOSAA are commercially available as technical mixtures. These reference standards of the technical mixtures for these specific PFAS are used to ensure that all appropriate peaks are included during peak integration.

PFBS, PFHxS, PFHpS, PFOS, PFDS, and many other PFAS are not available in the acid form, but rather as their corresponding salts, such as sodium or potassium. The standards are prepared and corrected for their salt content according to the equation below.

$$\text{Mass}_{acid} = \text{Measured Mass}_{salt} \times \text{MW}_{acid} / \text{MW}_{salt}$$

Where: MW_{acid} is the molecular weight of PFAA

MW_{salt} is the molecular weight of the purchased salt.

For example, the molecular weight of PFOS is 500.1295 and the molecular weight of NaPFOS is 523.1193. Therefore, the amount of NaPFOS used must be multiplied by a factor of 0.956 to account for the amount of PFOS in the final solution.

While PFAS standards commercially purchased are supplied in glass ampoules, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene or HDPE containers.

Prepare calibration and working standards by diluting a known volume of stock standard in an appropriate solvent to the final volume needed to achieve the desired concentration. The recommended formulation for each standard used in this procedure is provided in Appendix B along with the recommended source materials, expiration dates and storage conditions.

A technical (qualitative) grade PFOA standard is analyzed initially, then after initial calibration when a new column is installed or when significant changes are made to the HPLC parameters. This solution is used as a reference for the PFOA isomers (branched and linear) retention times.

A second source solution for PFAS is purchased from the same vendor; the PFC-MXB contains most of the target analytes in this mixture and is used as an ICV. For those compounds not available in this mixture or are not available from another vendor, a second analyst may prepare a second source standard from the same source as the ICAL to produce an ICV. The recommended concentration of the ICV standard should be in the mid-range of the calibration curve. The concentration may be adjusted if the initial calibration levels are changed or altered. The IDA and ISTD are added at a fixed concentration (2.5 ng/mL in extract).

7.3 Extraction Spiking Solutions

PFAS LCS/Matrix Spike Solution, 400 ng/mL

The PFAS spike solution is prepared by diluting all PFAS to produce a solution containing each PFAS at a concentration of 400 ng/mL in methanol.

PFAS High Level LCS Solution, 1000 ng/mL

The PFAS spike solution is prepared by diluting all PFAS to produce a solution containing each PFAS at a concentration of 1000 ng/mL in methanol.

PFAS Isotope Dilution Analyte Solution, 1000 ng/mL

The PFAS-IDA solution is prepared by diluting all labeled PFAS to produce a solution containing each IDA compound at a concentration of 1000 ng/mL in methanol.

Internal Standard Solution, $^{13}C_2$-PFOA, 2500 ng/mL

The internal standard solution is prepared by diluting the stock 50 µg/mL $^{13}C_2$-PFOA 20-fold in methanol.

See Appendix B for analyte lists and concentrations.

8.0 Sample Collection, Preservation, Shipment and Storage

The laboratory does not perform sample collection so these procedures are not included in this SOP, sampling requirements may be found in the published reference method.

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Minimum Sample Size	Preservation	Holding Time[1]	Reference
Water	250 mL HDPE Bottle	250 mL	0-6°C, Trizma (5g/L) (if from a known	14 days from collection	Method 537

			chlorinated source)		
Soil/Sediment	4/8 oz HDPE wide-mouth container	100 g	0-6°C	14 days from collection	SW-846 Organic Methods
Extract	700 µL Polypropylene (PP) Vial with HDPE Screw cap	NA	0-6°C	40 days from extraction	NJDEP guidance

Extraction holding time is calculated from date of collection. Analytical holding time is determined from date of extraction.

Unless otherwise specified by client or regulatory program, after analysis, samples and extracts are retained for a minimum of 30 days after provision of the project report and then disposed of in accordance with applicable regulations.

9.0 Quality Control

Sample QC

When samples contain the preservative Trizma, all associated QC must be treated with the same preservative.

Initial Demonstration of Capability (IDOC) and Method Detection Limit (MDL) studies described in Section 12 must be acceptable before analysis of samples may begin.

Batches are defined at the sample preparation step. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence.

The laboratory prepares the following sample QC for each extraction batch (an extraction batch is limited to a maximum of 20 field samples of the same matrix processed using the same procedure and reagents within the same time period):

QC Item	Frequency	Acceptance Criteria
Method Blank (MB)	1 per extraction batch	See Table 3
Laboratory Control Sample (LCS)	1 per extraction batch (Spiking Level rotates between Low, Medium and High on a batch-by-batch basis)	See Table 3
LCS Duplicate (LCSD)	1 per extraction batch whenever insufficient sample is available for an MS/MSD/DU	See Table 3
*Matrix Spike (MS/MSD)	1 per extraction batch (if sufficient sample is available)	See Table 3
*Sample Duplicate (SD)	DW-1 per extraction batch (if sufficient sample is available); Non-DW matrices- client request if sufficient sample is available	See Table 3
Field Reagent Blank, FRB	Per client set of samples	See Table 3

*An NCM must be applied if there is insufficient volume for a MS/MSD or duplicate.

Instrument QC

The following instrument QC is performed:

QC Item	Frequency	Acceptance Criteria
Initial Calibration (ICAL)	Initially, when CCV fails and after major instrument maintenance	See Table 3
Initial Calibration Blank (ICB)	Immediately after ICAL	See Table 3
Second Source Verification (ICV)	Immediately after ICB	See Table 3
Continuing Calibration Verification (CCV)	Beginning, end and after every 10 field samples. Alternate between ICAL Levels 4 and 5 (in order) throughout sequence	See Table 3
Continuing Calibration Verification Low (CCVL)	Immediately prior to Level 4 CCV at beginning of every non-ICAL analytical sequence	See Table 3
Isotope Dilution Analytes (IDA)	Added to Every injection (Standards, QC and Field Samples) at the same concentration	See Table 3

10.0 Procedure

One-time procedural variations are allowed only if deemed necessary in the professional judgment of a supervisor to accommodate variation in sample matrix, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a Non-Conformance Memo (NCM). The NCM process is described in more detail in SOP BR-QA-016. The NCM shall be filed in the project file and addressed in the case narrative. ***Any deviations from this procedure identified after the work has been completed must be documented in an NCM, with a cause and corrective action described.***

10.1 Water Sample Preparation

Visually inspect samples for the presence of settled and/or suspended sediment. If the amount of sediment is so great that the SPE cartridge will clog before the majority of the sample has eluted, filter the water sample through a glass fiber filter [redacted] or equivalent). Gravity or vacuum can be used to pass the sample through the filter. Prepare a filtration blank and LCS with any samples requiring filtration. File an NCM noting the need for filtration.

> <u>Warning: The use of a vacuum system creates the risk of glassware implosion. Inspect all glassware prior to use. Glassware with chips, scratches, rub marks or cracks must not be used.</u>

Due to the high surface activity of the analytes, filtration should be regarded as a last resort. All samples will be spiked with IDA prior to filtration (if enough sample is available, perform an MS on each sample); this will allow any losses caused by filtration to be monitored and corrected for.

NOTE: for samples which full volume extraction is not possible, care MUST be taken to ensure the actual sample volume that is both spiked and extracted are documented in the sample worksheet notes.

Prepare two 250 mL aliquots of HPLC-grade water for the method blank and LCS.

Rotate the LCS concentration with each batch.

-Low Level LCS (50-150 %R), spike with 0.50 mL of PFAS LOQV solution. This will result in sample concentrations at the method Reporting Limit.

-Medium Level LCS (70-130 %R), spike with 0.025 mL (25 µL) of the PFAS LCS/Matrix Spike solution (Section 7.2). This will result in a sample concentration of 40 ng/L.

-High level LCS (70-130 %R), spike at 0.05mL (50uL) of the PFAS High Level LCS Spike solution (Section 7.2). This will result in a sample concentration of 200 ng/L.

Spike the MS/MSD (if available volume) with 0.025 mL (25 µL) of the PFAS LCS/Matrix Spike solution (Section 7.2). This will result in a sample concentration of 40 ng/L. NCM if there is insufficient volume to perform the MS/MSD.

Add [redacted] of the PFAS-IDA solution (Section 7.2) into each sample and QC sample, for a fixed concentration of 2.5 ng/mL in extract.

Due to the surface active nature of the PFAS analytes, it is necessary to extract the entire sample as well as the container walls to maximize recovery. It is therefore ideal to receive full 250 mL HDPE bottles for each sample (and MS/MSD if sufficient volume is received) so the entire sample can be processed from that container.

Weigh each container to determine its pre-extraction mass (Gross Weight). Spike each container in the batch with PFAS-IDA solution. Spike the LCS and LCSD (or MS/MSD, if available volume) with PFAS LCS/Matrix solution. Shake to mix the contents. After the extraction has been completed, allow the container to completely dry (uncapped). Replace the cap and reweigh the container to determine the container mass (Tare Weight). The sample volume extracted can be determined by subtracting the Tare Weight from the Gross Weight. These calculations are captured in the PFAS water sample prep module (TALS Method 3535_IVWT and 25101_2009_SPE).

10.1.1 Solid Phase Extraction (SPE) of Aqueous Samples

Condition the SPE cartridges [redacted]) by passing the following without drying the column.

WARNING: The use of a vacuum system creates the risk of glassware implosion. Inspect all glassware prior to use. Glassware with chips, scratches, rub marks or cracks must not be used.

Wash with 5.0 mL of [redacted]l.

Wash with 5.0 mL of [redacted]. Close valve when ~ 1 mL remains on top to keep column wet. After this step, the columns should not go dry until the completion of loading and rinsing samples.

Appropriately label the SPE cartridges.

Add a poly siphon line to an adapter which has been firmly inserted into the SPE cartridge and place the other end of the line into the corresponding sample container.

Turn on the vacuum and pull the entire sample volume (minimum of 250 mL) through the cartridge at rate of approximately [redacted].

Stop the sample elution when ~0.1 mL remains. Add ~5 mL of water to the SPE column and restart the elution to complete the loading process. The added water volume ensures there are no small sample droplets remaining that may be clinging to the wall of the SPE cartridge.

After the sample and water rinse has passed through the cartridge, allow the cartridge to completely dry with vacuum (this could take up to 90 minutes). The cartridge should return to a uniform color. NOTE: Remove and replace each cartridge during the drying process to ensure any water droplets that may be in the flow path are eliminated.

10.1.2 SPE Column Wash of Aqueous Samples with Hexane

Add [redacted] to each SPE column and let the column become fully saturated with solvent. Close the stopcock and allow the column to soak for five minutes, then elute to waste.

Load a second [redacted] and elute to waste (without a soaking period).

Allow the column to dry with vacuum for 5 to 10 minutes. Columns must be dried thoroughly before continuing. The cartridge should return to a uniform color. Wipe any remaining water droplets from the bottom of the stainless steel guide needles using a fresh Kimwipe for each needle prior to proceeding to the next step.

10.1.3 SPE Elution of Aqueous Samples

Note: the use of glass should be avoided where able. However, disposable glass pipettes have a much narrower opening, which is necessary to reduce spillage during the following transfer steps.

Place labeled 15 mL polypropylene test tubes containing [redacted] of Reagent Water as receiving tubes in the SPE manifold.

Rinse the dried sample bottles with [redacted] and transfer to the corresponding SPE cartridge using a disposable glass pipet (NOTE: the sample container has molded ridges in the neck that can trap up to 0.5mL of the solvent rinsate; make sure to tip the container slightly to draw the rinsate out of the ridges). Allow the solution to soak the cartridge for 5 minutes and then elute into the 15 mL collection tube.

Repeat the sample bottle rinse to cartridge elution process with a [redacted] (without the soaking period) The total collection should be approximately 10 mL. Adjust to 10 mL with methanol.

10.1.4 Sample Cleanup with Graphitized Carbon (Optional)

NOTE: If this step is to be performed, do not add the [redacted] to the receiving tubes prior to extract collection. Add [redacted] of graphitized carbon to each sample extract and QC extracts to aid in the removal of organic interferences. Shake vigorously and then let sit for 10 minutes. Centrifuge each sample for 2 minutes at 1000 rpm. Decant the solvent layer into a new 15mL centrifuge tube containing 2 mL of Reagent Water and swirl to mix. Adjust the volume to 10 mL with methanol.

10.1.5 Internal Standard Addition

Add [redacted] internal standard to each extract and vortex to mix well.

Transfer a portion of the extract to a labeled 300µL polypropylene autosampler vial (6 drops or approximately 60µL). Archive the rest of the extract in the event the sample needs re-injection and/or dilution.

Seal the vials with polyethylene screw caps. Note: Teflon lined caps may not be used due to detection of low level concentration of PFAS.

10.2 Soil Sample Preparation

Visually inspect soil samples for homogeneity. Weigh a representative 5 g aliquot of soil, sediment or 1 g of tissue sample into a 50 mL centrifuge tube. Weigh additional sample amounts for the matrix spike and matrix spike duplicate analyses if they are requested and enough sample mass is available. Weigh 5 g aliquots of Ottawa sand or 0.1 g of oil for the MB and LCS samples.

Spike the LCS and MS/MSD (if requested) with 25 µL LCS/Matrix Spike Solution. This will result in a sample concentration of 2.0 ng/g (1.0 ng/mL ext).

Add [redacted] of IDA PFC Spiking Solution into each sample and QC sample, for a fixed concentration of 2.5 ng/mL in the final sample vial.

Cap the sample tubes and allow the spikes to settle into the sample matrix. Gently shake the bottles to mix the spike into the matrix.

Add [redacted] to each sample. Cap each sample and shake lightly to confirm container is sealed.

Place all samples in the prep batch into the TCLP tumbler and tumble for 3 hours.

After removing the samples from the tumbler, gently shake each container to confirm the solid material has settled to the bottom of the centrifuge tube, then place in a sonic bath for 12 hours.

Centrifuge each sample at 3500 rpm for 15 minutes.

Transfer the supernate (solvent) to a second, labeled 50 mL centrifuge tube containing 2 mL of Reagent Water.

Slowly add [redacted] to original 50 mL extraction tube. Pour the 2 mL of solvent rinse into the second labeled tube to complete the quantitative transfer.

Place extracts in the ZipVap set to 60 C for ~3 hours with nitrogen flow just strong enough to gently ripple the surface of the extracts. The concentration step is complete when the final volume either gets below 2 mL or maintains at the same level after consecutive checks a 5 minute intervals (this may be due to sample-based moisture contributing to the amount of water in the extract). Remove the sample from the ZipVap when the concentration has completed and allow the extracts to cool.

Adjust the volume of each sample's extract to 15 mL with Reagent Water and add 75 uL of Glacial Acetic Acid to neutralize the solution to pH 6-8. If the extracts contain suspended solids, centrifuge them at 3500 rpm for 15 minutes.

10.2.1 Solid Extract Cleanup by SPE

Condition the SPE cartridges [redacted] by passing the following without drying the column.

Wash with [redacted] with [redacted]. Wash with a second [redacted] followed by a second [redacted]. Close valve when ~ 0.5 mL remains on top to keep column wet. After this step, the columns should not go dry until the completion of loading and rinsing samples.

Appropriately label the SPE cartridges.

Pour each aqueous sample extract into its corresponding SPE cartridge until it is filled. Turn on the vacuum and open the stopcock to load the sample onto the cartridge. Add the remaining extract to the cartridge before it goes dry and stop the flow just before all of the sample has been drawn into the media. [redacted] to the 50 mL centrifuge tube to rinse the tube and complete the quantitative transfer. Pour this rinse into the SPE cartridge and open the stopcock to load the rest of the rinsate onto the cartridge. The added water volume ensures there are no small sample droplets remaining that may be clinging to the wall of the SPE cartridge. Set the centrifuge tubes aside and allow them to completely dry.

After the sample and water rinse has passed through the cartridge, allow the cartridge to completely dry with vacuum (this could take up to 30 minutes). The cartridge should return to a uniform color. NOTE: Remove and replace each cartridge during the drying process to ensure any water droplets that may be in the flow path are eliminated.

10.2.2 SPE Column Wash of Solid Extracts with Hexane

Add [redacted] of hexane to each SPE column and let the column become fully saturated with solvent. Close the stopcock and allow the column to soak for five minutes, then elute to waste.

Load a second [redacted] of hexane and elute to waste (without a soaking period).

Allow the column to dry with vacuum for 5 to 10 minutes. Columns must be dried thoroughly before continuing. The cartridge should return to a uniform color. Wipe any remaining water droplets from the bottom of the stainless steel guide needles using a fresh Kimwipe for each needle prior to proceeding to the next step.

10.2.3 SPE Elution of Solid Extracts

Place labeled 15 mL polypropylene test tubes containing [redacted] as receiving tubes in the SPE manifold.

Rinse the dried sample tubes with [redacted] and transfer to the corresponding SPE cartridge. Allow the solution to soak the cartridge for 5 minutes and then elute into the 15 mL collection tube.

Repeat sample bottle rinse to cartridge elution process with [redacted] (without the soaking period) The total collection should be approximately 10 mL. Adjust to 10 mL with methanol.

10.2.4 Sample Cleanup with Graphitized Carbon (Optional)

NOTE: If this step is to be performed, do not add the [redacted] to the receiving tubes prior to extract collection. Add [redacted] of graphitized carbon to each sample extract and QC extracts to aid in the removal of organic interferences. Shake vigorously and then let sit for 10 minutes. Centrifuge each sample for 2 minutes at 1000 rpm. Decant the solvent layer into a new 15mL centrifuge tube containing 2 mL of Reagent Water and swirl to mix. Adjust the volume to 10 mL with methanol.

10.2.5 Internal Standard Addition

Add [redacted] internal standard to each extract and vortex to mix well.

Transfer a portion of the extract to a labeled 300µL polypropylene autosampler vial (6 drops or approximately 60µL). Archive the rest of the extract in the event the sample needs re-injection and/or dilution.

Seal the vials with polyethylene screw caps. Note: Teflon lined caps may not be used due to detection of low level concentration of PFAS.

10.3 Instrument Operating Conditions

Suggested operating conditions are listed below for the [redacted] LCMS system:

<table>
<tr><th colspan="6">Recommended Instrument Operating Conditions</th></tr>
<tr><td colspan="6"><i>HPLC Conditions (Shimadzu HPLC)</i></td></tr>
<tr><td>Column (Column temp = 45°C)</td><td colspan="5">Phenomenex Gemini C18 3um, 3.0mm x 100mm</td></tr>
<tr><td>Mobile Phase Composition</td><td colspan="5">A=20mM Ammonium Acetate (90/10 water/methanol)
B=Methanol</td></tr>
<tr><td rowspan="8">Gradient Program</td><td>Time</td><td>%A</td><td>%B</td><td>Curve</td><td>Flow Rate mL/min.</td></tr>
<tr><td>[redacted]</td><td>[redacted]</td><td>[redacted]</td><td>6</td><td>0.60</td></tr>
<tr><td>[redacted]</td><td>[redacted]</td><td>[redacted]</td><td>6</td><td>0.60</td></tr>
<tr><td>[redacted]</td><td>[redacted]</td><td>[redacted]</td><td>6</td><td>0.60</td></tr>
<tr><td>[redacted]</td><td>[redacted]</td><td>[redacted]</td><td>6</td><td>0.60</td></tr>
<tr><td>[redacted]</td><td>[redacted]</td><td>[redacted]</td><td>6</td><td>0.60</td></tr>
<tr><td>[redacted]</td><td>[redacted]</td><td>[redacted]</td><td>6</td><td>0.60</td></tr>
<tr><td colspan="5">Maximum pressure limit = 5,000 psi</td></tr>
<tr><td>Injection Size</td><td colspan="5">[redacted]</td></tr>
<tr><td>Run Time</td><td colspan="5">[redacted]</td></tr>
<tr><td colspan="6"><i>Mass Spectrometer Interface Settings</i> [redacted]</td></tr>
<tr><td>MS Interface Mode</td><td colspan="5">[redacted]</td></tr>
<tr><td>Ionspray (volts)</td><td colspan="5">-[redacted]</td></tr>
<tr><td>Declustering Potential-DP (volts)</td><td colspan="5">[redacted]</td></tr>
<tr><td>Entrance Potential-EP (volts)</td><td colspan="5">[redacted]</td></tr>
</table>

Source Temp (TEM)	[redacted]
Curtain Gas (CUR)	[redacted]
Collision Gas (CAD)	[redacted]
Ion Source Gas 1 (GS1)	[redacted]
Ion Source Gas 2 (GS2)	[redacted]
Collision Energy-CE (volts)	[redacted]
Collision Cell Exit Potential-CXP (volts)	[redacted]

Recommended Instrument Operating Conditions

Mass Spectrometer Scan Settings [redacted]

Compound	Comments	Reaction (MRM)	Dwell (sec)	DP(v)	EP(v)	CE(v)	CXP(v)
PFBA	Native analyte	212.9 > 169.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
13C4 PFBA	IDA	217.0 > 172.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFPeA	Native analyte	262.9 > 219.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
13C5 PFPeA	IDA	267.9 > 223.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFBS	Native analyte	298.9 > 80.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFBS_2	Native analyte	298.9 > 99.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
13C3 PFBS	IDA	301.9 > 80.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFHxA	Native analyte	313.0 > 269.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFHxA_2	Native analyte	313.0 > 119.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
13C2 PFHxA	IDA	315.0 > 270.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
4:2FTS	Native analyte	327.0 > 307.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
M2-4:2FTS	IDA	329.0 > 81.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFPeS	Native analyte	349.0 > 80.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFPeS_2	Native analyte	349 > 99.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
HFPO-DA	Native analyte	329.1 > 285	0.011	[redacted]	[redacted]	[redacted]	[redacted]
13C3 HFPO-DA	IDA	332.1 > 287	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFHpA	Native analyte	363.0 > 319.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFHpA_2	Native analyte	363.0 > 169.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
13C4 PFHpA	IDA	367.0 > 322.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFHxS	Native analyte	399.0 > 80.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFHxS_2	Native analyte	399.0 > 99.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
18O2 PFHxS	IDA	403.0 > 84.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
DONA	Native analyte	377 > 251	0.011	[redacted]	[redacted]	[redacted]	[redacted]
DONA_2	Native analyte	377 > 85	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFOA	Native analyte	413.0 > 369.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFOA_2	Native analyte	413.0 > 169.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
13C2 PFOA	Internal Std	415.0 > 370.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
13C4 PFOA	IDA	417.0 > 372.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
6:2FTS	Native analyte	427.0 > 407.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
M2-6:2FTS	IDA	429.0 > 81.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFHpS	Native analyte	449.0 > 80.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFHpS_2	Native analyte	449.0 > 99.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFNA	Native analyte	463.0 > 419.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]
PFNA_2	Native analyte	463.0 > 169.0	0.011	[redacted]	[redacted]	[redacted]	[redacted]

13C5 PFNA	IDA	468.0 > 423.0	0.011	[redacted]
PFOS	Native analyte	499.0 > 80.0	0.011	[redacted]
PFOS_2	Native analyte	499.0 > 99.0	0.011	[redacted]
9Cl-PF3ONS	Native analyte	531 > 351	0.011	[redacted]
13C4 PFOS	IDA	503.0 > 80.0	0.011	[redacted]
PFDA	Native analyte	513.0 > 469.0	0.011	[redacted]
PFDA_2	Native analyte	513.0 > 169.0	0.011	[redacted]
13C2 PFDA	IDA	515.0 > 470.0	0.011	[redacted]
8:2FTS	Native analyte	527.0 > 507.0	0.011	[redacted]
M2-8:2FTS	IDA	529.0 > 81.0	0.011	[redacted]
PFNS	Native analyte	549.0 > 80.0	0.011	[redacted]
PFNS_2	Native analyte	549.0 > 99.0	0.011	[redacted]
MeFOSAA	Native analyte	570 > 419.0	0.011	[redacted]
d3-MeFOSAA	IDA	573.0 > 419.0	0.011	[redacted]
11Cl-PF3OUdS	Native analyte	631 > 451	0.011	[redacted]
FOSA	Native analyte	498.0 > 78.0	0.011	[redacted]
13C8 FOSA	IDA	506.0 > 78.0	0.011	[redacted]
PFUdA	Native analyte	563.0 > 519.0	0.011	[redacted]
PFUdA_2	Native analyte	563.0 > 169.0	0.011	[redacted]
13C2 PFUdA	IDA	565.0 > 520.0	0.011	[redacted]
EtFOSAA	Native analyte	584.0 > 419.0	0.011	[redacted]
d5-EtFOSAA	IDA	589.0 > 419.0	0.011	[redacted]
PFDS	Native analyte	599.0 > 80.0	0.011	[redacted]
PFDS_2	Native analyte	599.0 > 99.0	0.011	[redacted]
PFDoA	Native analyte	613.0 > 569.0	0.011	[redacted]
PFDoA_2	Native analyte	613.0 > 169.0	0.011	[redacted]
13C2 PFDoA	IDA	615.0 > 570.0	0.011	[redacted]
10:2FTS	Native analyte	627 > 607	0.011	[redacted]
PFDoS	Native analyte	699 > 80	0.011	[redacted]
PFDoS_2	Native analyte	699 > 99	0.011	[redacted]
PFTrDA	Native analyte	663.0 > 619.0	0.011	[redacted]
PFTrDA_2	Native analyte	663.0 > 169.0	0.011	[redacted]
PFTeDA	Native analyte	713.0 > 669.0	0.011	[redacted]
PFTeDA_2	Native analyte	713.0 > 169.0	0.011	[redacted]
13C2 PFTeDA	IDA	715.0 > 670.0	0.011	[redacted]
PFHxDA	Native analyte	813 > 769	0.011	[redacted]
PFHxDA_2	Native analyte	813 > 169	0.011	[redacted]
13C2 PFHxDA	IDA	815 > 770	0.011	[redacted]
PFODA	Native analyte	913 > 869	0.011	[redacted]
PFODA_2	Native analyte	913 > 169	0.011	[redacted]

Recommended Instrument Operating Conditions

Retention Times & Quantitation ([redacted])

Native Compounds	Typical Native RT (minutes)	IS analog	Typical IDA RT (minutes)	Quantitation Method
PFBA	[redacted]	13C4 PFBA	[redacted]	Isotope Dilution
PFPeA	[redacted]	13C5 PFPeA	[redacted]	Isotope Dilution
PFBS	[redacted]	13C3 PFBS	[redacted]	Isotope Dilution
4:2FTS	[redacted]	M2-4:2FTS	[redacted]	Internal Standard
PFHxA	[redacted]	13C2 PFHxA	[redacted]	Isotope Dilution
PFPeS	[redacted]	13C3 PFBS	[redacted]	Internal Standard
HFPO-DA	[redacted]	13C3 HFPO-DA	[redacted]	Isotope Dilution
PFHpA	[redacted]	13C4 PFHpA	[redacted]	Isotope Dilution
PFHxS	[redacted]	18O2 PFHxS	[redacted]	Isotope Dilution
DONA	[redacted]	13C4 PFOS	[redacted]	Internal Standard
6:2FTS	[redacted]	M2-6:2FTS	[redacted]	Isotope Dilution
PFOA	[redacted]	13C4 PFOA	[redacted]	Isotope Dilution
PFHpS	[redacted]	13C4 PFOS	[redacted]	Internal Standard
PFNA	[redacted]	13C5 PFNA	[redacted]	Isotope Dilution
PFOS	[redacted]	13C4 PFOS	[redacted]	Isotope Dilution
9Cl-PF3ONS	[redacted]	13C4 PFOS	[redacted]	Internal Standard
8:2FTS	[redacted]	M2-8:2FTS	[redacted]	Isotope Dilution
PFDA	[redacted]	13C2 PFDA	[redacted]	Isotope Dilution
PFNS	[redacted]	13C4 PFOS	[redacted]	Internal Standard
MeFOSAA	[redacted]	d3-MeFOSAA	[redacted]	Isotope Dilution
11Cl-PF3OUdS	[redacted]	13C4 PFOS	[redacted]	Internal Standard
EtFOSAA	[redacted]	d5-EtFOSAA	[redacted]	Isotope Dilution
PFDS	[redacted]	13C4 PFOS	[redacted]	Internal Standard
PFUdA	[redacted]	13C2 PFUdA	[redacted]	Isotope Dilution
FOSA	[redacted]	13C8 FOSA	[redacted]	Isotope Dilution
PFDoA	[redacted]	13C2 PFDoA	[redacted]	Isotope Dilution
10:2FTS	[redacted]	M2-8:2FTS	[redacted]	Internal Standard
PFDoS	[redacted]	13C4 PFOS	[redacted]	Internal Standard
PFTrDA	[redacted]	13C2 PFTeDA	[redacted]	Internal Standard
PFTeDA	[redacted]	13C2 PFTeDA	[redacted]	Isotope Dilution
PFHxDA	[redacted]	13C2 PFHxDA	[redacted]	Isotope Dilution
PFODA	[redacted]	13C2 PFHxDA	[redacted]	Internal Standard

Note: clients must be notified when the quantitation of an analyte is performed using an Internal standard. Changes to these IDA/ISTD associations may be necessary when sources of IDAs are updated: this may include additions as new IDAs become available, or subtractions if IDAs are unavailable.

10.4 Instrument Tuning

Instrument tuning is done initially when the method is first developed and thereafter as needed to maintain the sensitivity and selectivity of the method. Tuning is done by infusing each individual compound (native and IDA) into the MS/MS electrospray probe. The responses for the parent and daughter ions for each compound are observed and optimized for sensitivity and resolution. Mass assignments are reviewed and calibrated if necessary. The mass assignments must be within ± 0.5 amu of the values shown in the table above.

10.5 Instrument Calibration

Perform initial calibration with a minimum of five calibration standards before any sample analysis (initial method set-up), whenever a new column is installed, when significant instrument maintenance has been performed, and when the CCV does not meet acceptance criteria. Significant instrument maintenance includes installing a new column, changing the proportioning valve, or changing components of the MS/MS system. A new calibration is not required following minor maintenance.

With the exception of the circumstances delineated in policy CA-Q-P-003, it is not acceptable to remove points from a calibration curve. In any event, at least five points must be included in the calibration curve. Average Response Factor and linear fit calibrations require five points, whereas Quadratic (second order) calibrations require six points. The same injection volume must be used for all injections (standards and extracts).

Calibration is by average response factor, linear fit, or by quadratic fit. Quadratic fit is used for the analyte if the response is non-linear.

For average response factor (RFa), the relative standard deviation (RSD) for all compounds quantitated by isotope dilution must be < 20% for the curve to be valid.

For average response factor (RFa), the relative standard deviation (RSD) for all compounds quantitated by internal standard (i.e. those compounds that do not have corresponding isotopically labeled analogs) must be < 25% for the curve to be valid.

For linear fit, the intercept of the line must be less than ½ the reporting limit, and the coefficient of determination (r2) must be greater than or equal to 0.990 for the curve to be considered valid (or the correlation coefficient (r) > 0.995).

Evaluation of Calibration Curves

The following requirements must be met for any calibration to be used:

-Response must increase with increasing concentration.

-The absolute value of the intercept of a regression line (linear or non-linear) at zero response must be less than the reporting limit.

-There should be no carryover at or above 1/2 MRL after a high CAL standard.

-The low cal. point must recover to within 50-150%, and all others must recover to within 70-130%.

If these criteria are not met, instrument conditions and standards will be checked, and the ICAL successfully repeated before continuing.

Weighting of Calibration Points

In linear and quadratic calibration fits, the points at the lower end of the calibration curve have less absolute variance than points at the high concentration end of the curve. This can cause severe errors in quantitation at the low end of the calibration. Because accuracy at the low end of the curve is very important for this analysis, it is preferable to increase the weighting of the lower concentration points. 1/concentration or 1/x weighting is encouraged. Visual inspection of the line fitted to the data is important in selecting the best fit.

10.6 Initial Calibration

Prepare the working calibration standards using the recommended formulations given in Appendix B ensuring the lowest calibration standard for each analyte is equal to or below the established RL. Unless otherwise specified on a project basis, use calibration levels 1 to 6 to establish the calibration curve for each analyte.

Prime the instrument by analyzing a minimum of 4 “primer” solutions consisting of 80/20 methanol/water. In general, an HPLC contains components made from PTFE, which enable the pumps to work with many types of organic solvents. Despite efforts to remove as much PTFE as possible, certain components cannot be replaced and contribute PFAS. The longer the system remains idle, the more PFAS that is yielded. Therefore these primers serve to reduce and stabilize the amount of PFAS that are contributed. Immediately following the primers is a Blank, the ICAL sequence (run in ascending order of Level 1 to Level 6), the ICB, the ICV and the first analytical window of extracts (up to 10 field samples). The data is acquired using Sciex’s Analyst 1.6.

The Chrom Review data system generates calibration data by generating relative response factors (RRFs) based on the response of the target analyte and its corresponding Isotope Dilution Analyte (or Internal Standard) as well as their injection concentrations to ultimately generate Mean Response Factors. All analytes calibrated using IDA must have RSD values < 20%, all analytes calibrated using ISTD must have RSD values < 25%. The IDA compounds are also calibrated using an external RF model using response and concentration. The IDA RSD must be < 50%. Alternatively, a linear regression curve of concentration vs. peak area for each analyte relative to their corresponding IDA/ISTD and their concentrations calculates the correlation coefficient with 1/concentration weighting. The calibration must have a correlation coefficient (r) ≥ 0.995 ($r^2 \geq 0.990$). If criteria are not met, correct the problem and repeat calibration. Further analysis may not proceed without valid calibration.

10.7 Initial Calibration Blank (ICB)

Immediately following the ICAL, a calibration blank is analyzed that consists of an injection of [redacted] fortified with IDA solution at 50 ng/mL

The result for the calibration blank must be less than the reporting limit.

If the ICB is greater than the reporting limit then the source of contamination must be identified and any necessary cleaning completed, and then the instrument should be recalibrated.

10.8 Second Source Calibration Verification (ICV)

Following the ICAL and the ICB, an ICV standard obtained from a different source or vendor than the ICAL standards is analyzed. This ICV standard is a mid-range standard.

The recovery for the ICV must meet the appropriate following criteria:

The native analyte must be within or equal to 70-130% for all native analytes quantitated by isotope dilution.

The native analyte must be within or equal to 70-130% for all native analytes quantitated by internal standard (i.e. those compounds that do not have corresponding isotopically labeled analogs).

The IDA recovery must be within or equal to 50-150%.

See Table 3 for corrective actions in the event that the ICV does not meet the criteria above.

10.9 Continuing Calibration Verification (CCV)

Analyze a CCV at the beginning of a run, the end of a run, and after every 10 samples to determine if the calibration is still valid. The exception is after an acceptable curve and ICV are run 10 samples can be analyzed before a CCV is required. The CCVs are usually at the mid-level range of the curve and should vary throughout the run. The curve and ICV do not need to be run every day. To start an analytical run a CCV can be analyzed and if it meets acceptance criteria a run can be started. In addition, the low standard in the curve must be analyzed and must be within ± 50% of the expected value.

The recovery for the CCV standards must be equal to or within 70-130% (50-150% for low level standards) for all natives quantitated by isotope dilution and for all natives quantitated by internal standard. The recovery for the IDA must be within or equal to 70-130% of the true value.

If this is not achieved, the instrument has drifted outside the calibration limits. If the CCV fails again following minor maintenance, the instrument must be recalibrated.

10.10 Isotope Dilution Analytes (IDA)

The IDA solution is added to each field and QC sample at the time of extraction, as described in Section 10.1. As described in Section 7, this solution consists of isotopically labeled analogs of the analytes of interest.

IDA recoveries are flagged if they are outside of the acceptance limits. Quantitation by isotope dilution generally precludes any adverse effect on data quality due to IDA recoveries being outside of the acceptance limits as long as the signal-to-noise ratio is greater than 10:1.

> Evaluate data quality for usability, flag and submit a non-conformance memo for any analytes outside of the recovery criteria, and report if data is deemed not adversely effected.
>
> Re-extraction of samples should be performed if the signal-to-noise for any IDA is less than 10:1 or if the IDA recoveries fall below 10%.
>
> Re-extraction may be necessary under other circumstances when data quality has been determined to be adversely affected.

10.11 Troubleshooting:

Check the following items in case of calibration failures:

Evaluate the failure to determine whether it affects all of the compounds in the ICAL equally. If one ICAL point appears low or high, reprep the curve and rerun, as the error was most likely prep-based. If only a subset of the analytes are affected, check the integration and chromatography to see if there are anomalies; if justifiable, correct the integration so it is consistent with the other ICAL levels.

If there are no peaks for all compounds or no peaks after a specific retention time, ensure that the HPLC pump is pumping properly; it may have shut down due to overpressure or has a leak. If the pump has shut down, confirm it is primed and replace the in-line filter. If the pressure climbs above expected levels, changing the guard column and even analytical column may be necessary. It's best to chase high pressure sources from the pump forward (ie the post-pump in-line filter, isolator column, post-autosampler in-line filter, guard column, analytical column and MSMS inlet. If the pump is still pumping, check the system pressure. If it is lower than expected, check for leaks. Start with all connections, then move on to pump seals, especially if there are wide variations in pressure when pumping the same solvents at the same flow rates. If the pump is still pumping and the pressure is normal, check to make sure the MSMS is still functioning properly. Most issues with the MSMS system will be noted by the instrument software.

If there are peaks for all analytes, evaluate the peak shapes by comparing them to the ICAL chromatography. If the peaks have changed (shorter and wider), a new guard column may improve peak shape and bring the system back into compliance. If a new column is necessary, a new ICAL will be needed.

Preventive and routine maintenance is described in the table below

HPLC/MS/MS Preventative Maintenance
As Needed: Change pump seals. Change in-line filters in autosampler (HPLC). Check/replace in-line frit if excessive pressure or poor performance. Replace column if no change following in-line frit change. Replace fused silica tube in ESI interface. Clean lenses. Clean skimmer. Ballast rough pump 30 minutes.
Daily (When in use) Check solvent reservoirs for sufficient level of solvent. Verify that pump is primed, operating pulse free. Check needle wash reservoir for sufficient solvent. Verify capillary heater temperature functioning. Verify vaporizer heater temperature. Verify rough pump oil levels. Verify turbo-pump functioning. Verify nitrogen pressure for auxiliary and sheath gasses. Verify that multiplier is functioning.

10.12 Sample Analysis

Place the field and QC samples in a sequence that begins with the calibration standards followed by the analysis of QC samples, field samples and continuing calibration verification standards (CCVs).

An example analytical sequence that includes initial calibration (ICAL) is provided below.

Injection Number	Lab Description
1	Primer 1
2	Primer 2
3	Primer 3

Injection Number	Lab Description
4	Primer 4
5	Blank
6	Calibration Level 1
7	Calibration Level 2
8	Calibration Level 3
9	Calibration Level 4 (ICIS)
10	Calibration Level 5
11	Calibration Level 6
12	ICB
13	ICV
14	T-PFOA
15	MB
16	LCS
17-26	(up to) 10 Field samples
27	CCV L4
28-37	(up to) 10 Field samples
38	MS
39	MSD
40	CCV L5
41	MB
42	LCS
43-52	(up to) 10 Field samples
53	CCV L4
54-63	(up to) 10 Field samples
65	MS
66	MSD
67	CCV L5

An example analytical sequence without ICAL:

Injection Number	Lab Description
1	Primer 1
2	Primer 2
3	Primer 3
4	Primer 4
5	CCB
6	CCVL (LOQV)
7	CCVIS (L4)
8	MB
9	LCS
10-19	(up to) 10 Field samples
20	CCV L5
21-30	(up to) 10 Field samples
31	MS
32	MSD
33	CCV L4
34	MB
35	LCS

36-45	(up to) 10 Field samples
46	CCV L5
47-56	(up to) 10 Field samples
57	MS
58	MSD
59	CCV L4

Enter the sample ID's into the data acquisition program in the order the samples were placed in the autosampler and initiate the analytical sequence.

11.0 Corrective Action

When an out-of-control situation occurs that is not delineated in this corrective action table or the corrective actions listed do not adequately address the circumstances, a Corrective Action Report (CAR) (NCM), etc., must be developed (see SOP BR-QA-016) and the analyst must use his/her best analytical judgment and available resources to determine the corrective action to be taken. The out-of-control situation may be caused by more than one variable. The analyst should seek the assistance of his/her immediate supervisor, QA manager or other experienced staff if they are uncertain of the cause of the out-of-control situation. The analysis must not be resumed until the source of the problem and an in-control status is re-established. All samples associated with the out-of-control situation must be reanalyzed after in-control status has been re-established or if authorization is received from the supervisor or QA Manager for release with data qualification.

12.0 Calculations / Data Reduction

12.1 Qualitative Identification

The data processing system identifies the target analytes by comparing the retention time of the peaks to the retention times of the initial calibration standards. The retention times of PFAS with labeled standards must be the same as that of the labeled IDA's to within 0.05 min. For PFAS with no labeled standards, the RT must be within ± 0.3 minutes of the CCVIS standards. *Note: The IS RT and native RT may be offset by 0.02 to 0.04 minutes.*

12.2 Quantitative Identification

The ICAL established in Section 10.10 is used to calculate concentrations for the extracts. The data processing system determines on-column concentration. Final results are calculated by the laboratory's LIMS information system (TALS).

Dilute and reanalyze samples whose results exceed the calibration range. The diluted analysis should result in a determination within the upper half of the calibration curve.

Check the results of samples analyzed immediately after high concentration samples (those with results above calibration range) for signs of carry-over. Reanalyze all samples suspected of carry-over.

12.3 Calculations

See Appendix C.

12.4 Data Review

Refer to laboratory SOP BR-QA-019 for additional instruction on the requirements for data review. The following sections summarize the general procedure as described in the data review SOP.

12.5 Primary Review

Review the chromatography and quantitation in the data processing system to confirm quantitative and qualitative identification of each target analyte. Perform and document manual integrations only if needed per the instructions in corporate policy CA-Q-S-002, Acceptable Manual Integration Practices.

Upload the data files to TALS and process the batch. Enter job information into the batch editor and add the standards and reagent additions to the worksheet, if necessary. Review the results against acceptance criteria. If acceptance criteria are not met, perform corrective action or make arrangements for corrective action with another analyst.

Set results to primary, secondary, acceptable or rejected. Set results to be reported to a status of primary and secondary. Set results that meet criteria but will not be reported to acceptable. Set results that do not meet criteria to rejected, to prevent inadvertent reporting of data.

Verify that all appropriate QC were performed and acceptable. If insufficient volume is received (MS, MSD, FRB, etc…) document in an NCM. Record all instances where acceptance criteria are not met in a nonconformance memo (NCM).

Verify that all project requirements or program specific requirements were followed. If not, immediately notify the project manager to determine an appropriate course of action. Record decisions made in the data review checklist.

Set the batch to 1st level review. Complete the data review checklist and make arrangements for secondary review by a peer analyst.

12.6 Secondary Data Review (Performed by Peer Analyst)

Record review using the data review checklist.

Verify that all project requirements or program specific requirements were followed. If not, consult with the primary analyst to determine cause. Any decisions made should be recorded on the data review checklist and retained as part of the analytical record.

Review the TALS batch editor to verify ancillary information for the work performed is filled in.

Verify that that the procedures in this SOP were followed. If discrepancy between the SOP and the analytical record is found, consult with the primary analyst to determine the source of the discrepancy. Resolve the discrepancy and verify any modifications to the SOP are properly documented and were approved by laboratory management. Record all SOP deviations in an NCM.

Spot-check ~15% of samples in the batch to verify quantitative and qualitative identification.

If manual integrations were performed:

- Review each manual integration to verify that the integration is consistent and compliant with the requirements specified in SOP CA-Q-S-002.

- Check to ensure an appropriate technical reason code is provided for each manual integration. Acceptable technical reason codes are provided in SOP CA-Q-S-002.

- If an error is suspected, the reviewer must consult with the analyst that performed the integration to determine if a correction is necessary. Input from the Technical Manager (TM), Department Manager (DM), or QA Manager (QAM) may be sought as necessary. **The reviewer may not reintegrate except in those circumstances approved by laboratory management**, such as when the analyst that performed the integration is on vacation. If re-integration is performed by the reviewer, the reviewer is now considered the "primary analyst" and the re-integration is subject to the same review and documentation requirements as the original integration.

Verify acceptance criteria were met. If not, verify that corrective actions were performed and the nonconformance was documented with an NCM. Review the NCM to verify the form is filled out and the requisite information has been included in the internal comments tab. If corrective action was not performed and the failure not documented, consult with the primary analyst to determine cause. Consult with the primary analyst and department management to determine what actions should be taken, then follow-through with the decision made.

Run the QC checker and fix any problems found. Run and review the deliverable for gross error such as missing data. Fix any problems found.

When review is complete set the method chain to lab complete. Complete the data review checklist and forward associated paperwork to report/project management.

12.7 Data Reporting & Record Retention

The specifications for data reporting are set by the project manager and are performed by TALS using the formatter selected by the PM. The type of deliverable is also set by the PM based on various deliverable options in the TALS system. The formatters and deliverables are programmed into TALS by corporate IT staff and cannot be modified locally.

The following sections describe the default reporting scheme set for this method in TALS:

Data is retained, managed and archived as specified in laboratory SOP BR-QA-014 Laboratory Records.

13.0 Method Performance

13.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. An initial method detection limit study is performed in accordance with SOP BR-QA-005. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method or program requirements require a greater frequency.

13.2 Demonstration of Capabilities

All personnel are required to perform an initial demonstration of proficiency (IDOC) on the instrument they will be using for analysis prior to testing samples. On-going proficiency must be demonstrated annually. IDOCs and on-going proficiency demonstrations are conducted as follows.

13.2.1 Four aliquots of the QC check sample are analyzed using the same procedures used to analyze samples, including sample preparation. The concentration of the QC check sample can be equivalent to a mid- level calibration.

13.2.2 Calculate the average recovery and standard deviation of the recovery for each analyte of interest.

13.2.3 If any analyte does not meet the acceptance criteria, the test must be repeated. Only those analytes that did not meet criteria in the first test need to be evaluated. TNI 2016 requires consecutive passing results. Repeated failure for any analyte indicates the need for the laboratory to evaluate the analytical procedure and take corrective action.

13.2.4 Until the IDOC is approved by the QA Manager (or designee); the trainer and trainee must be identified in the batch record.

13.3 Training Requirements

The Group Leader is responsible for ensuring that this procedure is performed by an associate who has been properly trained in its use and has the required experience. A new analyst must be working under documented supervision prior to approval of the IDOC. Documentation that a new analyst is performing under supervision must be entered into the batch record (View Batch Information) until that analyst’s IDOC has been approved by the QA Manager (or designee). See requirements for demonstration of analyst proficiency in SOP BR-QA-011.

14.0 Pollution Control

It is Test America’s policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Safety Manual for “Waste Management and Pollution Prevention.”

15.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to BR-EH-001. The following waste streams are produced when this method is carried out.

- Vials containing sample extracts: Satellite Container: 30 gallon poly barrel located under GC-Semi prep hood.
- Solvent Waste: Satellite Container: 5 gallon poly carboy located under LCMSMS.

16.0 References / Cross References

- Cheryl Moody, Wai Chi Kwan, Johnathan W. Martin, Derek C. G. Muir, Scott A. Mabury, “Determination of Perfluorinated Surfactants in Surface Water Samples by Two Independent Analytical Techniques: Liquid Chromatography/Tandem Mass Spectrometry and 19FNMR,” Analytical Chemistry 2001, 73, 2200-2206.
- John Giesy et al., “Accumulation of Perfluorooctane Sulfonate in Marine Mammals”, Environmental Science & Technology, 2001 Vol. 35, No. 8, pages 1593-1598.
- U.S. EPA, “Residue Chemistry Test Guidelines, OPPTS 860.1340, Residue Analytical Method”, EPA 712-C-95-174, August 1995.
- STL Denver White Paper DEN-W-LC-002, “Method Validation Study for Analysis of Ammonium Perfluorooctanoate in Soil Matrices by High Performance Liquid Chromatography/Mass Spectrometry (HPLC/MS/MS)”, Mark Dymerski, September 5, 2003.
- STL Denver White Paper DEN-W-LC-003, “Addendum A to Method Validation Study for Analysis of Ammonium Perfluorooctanoate in Soil Matrices by High Performance Liquid Chromatography/Mass Spectrometry (HPLC/MS/MS)”, Mark Dymerski, August 6, 2003.
- STL Denver White Paper DEN-W-LC-004, “Method Validation Study for Analysis of Perfluorooctanoic Acid in Waters by High Performance Liquid Chromatography/Tandem Mass Spectrometry (HPLC/MS/MS)”, Mark Dymerski, January 26, 2005.
- Waters application note; “Acquity UPLC System for Quantifying Trace Levels of Perfluorinated Compounds with an Acquity PFC Analysis Kit”, Peter J. Lee, Evan T. Bernier, Gordon T. Fujimoto, Jeremy Shia, Michael S. Young, and Alice J. Di Gloia, Waters Corporation, Milford, MA. USA.
- Method ISO 25101, “Water quality – Determination of perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) – Method for unfiltered samples using solid phase extraction and liquid chromatography/mass spectrometry”, First Edition, 2009-03-01, International Organization for Standardization, Technical Committee ISO/TC 147, Water Quality, Subcommittee SC 2, Physical, chemical and biochemical methods.
- US EPA, “Method 537 - Determination of Selected Perfluorinated alkyl acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometery (LC/MS/MS)”, Version 1.1, September 2009, J.A. Shoemaker, P.E. Grimmett, B.K. Boutin, EPA Document #: EPA/600/R-08/092.
- Laboratory SOP BR-QA-005 *Procedures for the Determination of Limits of Detection (LOD), Limits of Quantitation (LOQ) and Reporting Limits (RL).*
- Laboratory SOP BR-QA-011 *Employee Training*
- Laboratory SOP BR-EH-001 *Hazardous Waste*
- Laboratory SOP BR-QA-014 *Laboratory Records*
- Laboratory SOP BR-QA-006 *Procedures & Documentation Requirements for Manual Integration*
- Laboratory Quality Assurance Manual (QAM)
- Corporate TestAmerica SOP CA-Q-S-002 *Manual Integrations*.

17.0 Method Modifications

Modification Number	Method Reference	Modification & Technical Justification
1	Section 7.2	Method 25101 specifies that the values reported for PFOA and PFOS shall be the linear isomer only. In keeping with the dictates of USEPA 537 and other US conventions, the laboratory reports both the branched (when present) and linear isomers as a single value for these compounds.
2	Section 10.1	A different SPE cartridge, Waters OASIS WAX, is used for the extraction process. As a result, solvents and elution procedures are different.
3	Section 10.1	The samples are fortified with a greater number of labeled analytes (most analytes have labeled versions) prior to extraction.
4	Section 10.5	The HPLC Column, Eluents and gradient conditions have changed.
5	Section 10.5	For non-drinking water matrices, the analyte list has expanded. The number of labeled analytes has also expanded to improve quantitation.
6	Table 1	The reporting limits have changed to a consistent value.
7	Appendix B	Calibration levels have been changed so all levels have the same analyte concentration.

18.0 Attachments

- Table 1: Routine Compound List and LOQ
- Table 2: Primary Materials Used
- Table 3: QC Summary & Recommended Corrective Action
- Table 4: Control Limits
- Appendix A: Terms and Definitions
- Appendix B: Standard Preparation Tables
- Appendix C: Equations

19.0 Revision History (all revision history must be retained in this SOP)

Revision 6.0

- Updated cover page dates, copyright information, and signatories
- Throughout: Added support for soil, sediment and tissue matrices.
- Throughout: Removed reference to analysis using Waters instrumentation.
- Throughout: Removed reference to final extract concentration for aqueous samples.
- Section 1.1: Update Fluorotelomer sulfonates (FTS) to report acid forms
- Section 11.0: Added corrective action requirement as it is a corporate requirement to include.

Revision 5.0

- Updated cover page dates, copyright information, and signatories
- Throughout: removed references to drinking water. Will add back if adopted.
- Throughout: removed solid extraction/analysis verbiage missed in previous revision.
- Throughout: revised formatting to be consistent
- Throughout: added PFHxDA, PFODA, PFDoS, 10:2FTS, HFPO_DA, DONA, F53BMajor, and F53B Minor as additional analytes and IDAs
- Section 4.0: added interference information about $^{13}C_2$-PFHxDA
- Section 6.1: updated to include additional laboratory apparatus information
- Section 6.2: updated to include additional instrument and more detail for existing instrument
- Section 7.1: added more detail to reagent information and the addition of Ammonium acetate and Ammonium hydroxide
- Section 7.2: added PFHpS and PFDS as other PFAS not available in the acid form. Added the IDA and ISTD are added at a fixed concentration and removed the low level reference
- Section 9.1 added a NCM must be added for MS/MSD
- Section 10.1: removed the low level spike reference and added the PFAS-IDA solution is added to each sample and QC sample in concentrated extract and non-concentrated extracts
- Section 10.2: In the previous version of this SOP, the “Note” was removed and replaced with “Warning: The use of a vacuum system creates the risk of glassware implosion. Inspect All glassware prior to use. Glassware with chips, scratches, rub marks or cracks must not be used.”
- Section 10.2: changed wording to clarify addition of poly siphon line into the SPE cartridge
- Section 10.3: removed to keep test tube as keep and added “Note: If the extracts will note be concentrated, use [redacted] for the second bottle rinse so the final volume is approximately 8mL.”
- Section 10.5: added sample cleanup with graphitized carbon section
- Section 10.6: added wording to have [redacted] of reagent water to the 10mL extract at this time
- Section 10.7: updated wording
- Section 10.8: added operating system for new instrument and added more detail for existing instrument
- Section 10.17: updated sample analysis to include calibration currently in use
- Table 1 and Table 4: updated to include additional analytes and IDAs
- Appendix A: updated terms and definitions from body of SOP
- Appendix B: updated to include additional analytes and IDAs

Revision 4.0

- Updated cover page dates, copyright information, and signatories
- Headers: removed TestAmerica logo and added Eurofins logo
- Throughout: removed references to drinking water. Will add back if adopted.
- Throughout: revised formatting to be consistent
- Section 1.1: added note about addition of Appendix D, removed NJDEP as PAB
- Section 10.1.3: added note about the use of glass pipettes

- Section 10.3: In a previous version of this SOP, Table "Recommended Instrument Operating Conditions" incorrectly referenced PFTrDA as Isotope Dilution, so this was corrected to Internal Standard and added note to contact clients for ISTD quantitation.
- Removed verbiage regarding soil LOQ from Note on Table 1.
- Added Appendix D: NJDEP secondary certified analytes list

Revision 3.0

- Updated cover page dates and signatories
- Section 10.1: added note for handling incomplete volume extraction process
- Section 18: added previous revision history back into SOP
- Throughout: updated QC criteria from EPA 537 r1.1 that was missed in previous revision
- Throughout: removed solid extraction/analysis verbiage missed in previous revision.
- Throughout: updated calibration to include criteria from EPA 537 r1.1 and to include the 9 calibration points currently in use.
- Throughout: minor formatting updates

Rev 2.1:

- Updated cover page dates and signatories
- Section 8: added preservation requirements for DW samples.
- Throughout: updated QC criteria to match EPA537 rev1.1
- Throughout: removed references to solid and tissue extraction/analysis.

Rev 2.0

- Updated cover page and signatories
- Section 8: added preservation requirements for DW samples.
- Throughout: included verbiage that Non-drinking water matrices are not certified under PAB.
- Throughout: separated DW and non-DW limits and QC requirements.
- Throughout: minor formatting and typographical corrections.
- Tables 3 & 4: updated limit to meet EPA 537 criteria.
- Appendix A: updated terms and definitions from body of SOP

Rev 1.0

- Extended analyte list to 21 native compounds and 18 IDAs.
- Altered concentration step in extract preparation by employing a reagent water keeper instead of concentrating to dryness.
- Incorporated use of internal standard for IDA recovery calculation.

Revision 0.0: 05/19/2017

- New SOP based on USEPA method 537

Previous revisions are retained by the QA department.

Table 1: Routine Compound List & Limit of Quantitation (LOQ)

Compound Name	Abbreviation	CAS #	Water (ng/L)	Soil/ Sediment (ug/Kg)	Tissue (ug/Kg)
Perfluoroalkylcarboxylic acids (PFCAs)					
Perfluoro-n-butanoic acid	PFBA	375-22-4	2.0	0.20	1.0
Perfluoro-n-pentanoic acid	PFPeA	2706-90-3	2.0	0.20	1.0
Perfluoro-n-hexanoic acid	PFHxA	307-24-4	2.0	0.20	1.0
Perfluoro-n-heptanoic acid	PFHpA	375-85-9	2.0	0.20	1.0
Perfluoro-n-octanoic acid	PFOA	335-67-1	2.0	0.20	1.0
Perfluoro-n-nonanoic acid	PFNA	375-95-1	2.0	0.20	1.0
Perfluoro-n-decanoic acid	PFDA	335-76-2	2.0	0.20	1.0
Perfluoro-n-undecanoic acid	PFUdA	2058-94-8	2.0	0.20	1.0
Perfluoro-n-dodecanoic acid	PFDoA	307-55-1	2.0	0.20	1.0
Perfluoro-n-tridecanoic acid	PFTrDA	72629-94-8	2.0	0.20	1.0
Perfluoro-n-tetradecanoic acid	PFTeDA	376-06-7	2.0	0.20	1.0
Perfluoro-n-hexadecanoic acid	PFHxDA	67905-19-5	2.0	0.20	1.0
Perfluoro-n-octadecanoic acid	PFODA	16517-11-6	2.0	0.20	1.0
Perfluorinated sulfonic acids (PFSAs)					
Perfluoro-1-butanesulfonic acid	PFBS	375-73-5	2.0	0.20	1.0
Perfluoro-1-pentanesulfonic acid	PFPeS	2706-91-4	2.0	0.20	1.0
Perfluoro-1-hexanesulfonic acid	PFHxS	355-46-4	2.0	0.20	1.0
Perfluoro-1-heptanesulfonic acid	PFHpS	375-92-8	2.0	0.20	1.0
Perfluoro-1-octanesulfonic acid	PFOS	1763-23-1	2.0	0.20	1.0
Perfluoro-1-nonanesulfonic acid	PFNS	68259-12-1	2.0	0.20	1.0
Perfluoro-1-decanesulfonic acid	PFDS	335-77-3	2.0	0.20	1.0
Perfluoro-1-dodecanesulfonic acid	PFDoS	79780-39-5	2.0	0.20	1.0
Perfluorinated sulfonamides (FOSA)					
Perfluoro-1-octanesulfonamide	FOSA	754-91-6	2.0	0.20	1.0
Perfluorinated sulfonamidoacetic acids (FOSAA)					
N-ethylperfluoro-1-octanesulfonamidoacetic acid	EtFOSAA	2991-50-6	20.0	2.0	10.0
N-methylperfluoro-1-octanesulfonamidoacetic acid	MeFOSAA	2355-31-9	20.0	2.0	10.0
Fluorotelomer sulfonates (FTS)					
1H,1H,2H,2H-perfluorohexane sulfonate *(4:2)*	4:2 FTS	757124-72-4	20.0	2.0	10.0
1H,1H,2H,2H-perfluorooctane sulfonate *(6:2)*	6:2 FTS	27619-97-2	20.0	2.0	10.0
1H,1H,2H,2H-perfluorodecane sulfonate *(8:2)*	8:2 FTS	39108-34-4	20.0	2.0	10.0
1H,1H,2H,2H-perfluorododecane sulfonate*(10:2)*	10:2 FTS	120226-60-0	20.0	2.0	10.0
Fluorinated Replacement Chemicals					
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6	4.0	0.40	2.0
4,8-dioxa-3H-perfluorononanoic acid	DONA	919005-14-4	2.0	0.20	1.0
9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	F53B Major (9Cl-PF3ONS)	756426-58-1	2.0	0.20	1.0
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	F53B Minor (11Cl-PF3OUdS)	763051-58-1	2.0	0.20	1.0

NOTE: The LOQ values may vary. The Water LOQ is based on a 250mL nominal sample volume.

Table 2: Primary Materials Used

Material[1]	Hazards	Exposure Limit[2]	Signs and Symptoms of Exposure
Acetic Acid (3-2-1)	Corrosive Poison Flammable	10 ppm-TWA 15 ppm-STEL	Contact with concentrated solution may cause serious damage to the skin and eyes. Inhalation of concentrated vapors may cause serious damage to the lining of the nose, throat, and lungs. Breathing difficulties may occur.
Ammonium Hydroxide (3-0-0)	Corrosive Poison	50 ppm-TWA	Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage to the upper respiratory tract. Symptoms may include sneezing, sore throat or runny nose. Contact with skin can cause irritation or severe burns and scarring with greater exposures. Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent damage, including blindness. Brief exposure to 5000 PPM can be fatal.
Hexane (2-3-0)	Flammable Irritant	500 ppm-TWA	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.
Hydrochloric Acid (3-0-1)	Corrosive Poison	5 ppm (Ceiling)	Can cause pain and severe burns upon inhalation, ingestion, eye or skin contact. Exposure to concentrated solutions may cause deep ulcerations to skin, permanent eye damage, circulatory failure and swallowing may be fatal.
Methanol (2-3-0)	Flammable Poison Irritant	200 ppm (TWA)	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Potassium Hydroxide (3-0-1)	Corrosive Poison		Severe irritant. Can cause severe burns upon inhalation, ingestion, eye or skin contact. Exposure to concentrated solutions may cause severe scarring of tissue, blindness, and may be fatal if swallowed.
Potassium Persulfate (2-0-1-OX)	Oxidizer	None	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Causes irritation to skin and eyes. Symptoms include redness, itching, and pain. May cause dermatitis, burns, and moderate skin necrosis.

[1] Always add acid to water to prevent violent reactions.
[2] Exposure limit refers to the OSHA regulatory exposure limit.

Table 3: QC Summary, Acceptance Criteria and Recommended Corrective Action (EPA537)

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
6-Point Calibration (5 point minimum for CF and Linear Regression) (ICAL)	Before sample analysis, when CCVs indicate calibration is no longer valid; after major instrument maintenance	CF = RSD ≤ 20% (compounds calibrated via IDA) CF = RSD ≤ 25% (compounds calibrated using “near-IDA” compounds) CF = RSD ≤ 50% (IDA standards using ISTD) Each cal pt. = +/-30%Rec. (+/-50%Rec for cal low pt.) Linear Regression: $r^2 \geq 0.990$	Correct problem and repeat initial calibration.
IDA Response	Every injection contains the IDA analytes	Non-DW matrices: Standards: 50-150% recovery Field samples: 50-150% recovery (poor responding IDAs: 25-150%) (reportable if >10x S/N ratio and >10% ICAL RF)	Standard failures must be investigated to determine the cause of the failure. Recalibration may be required. Samples with recoveries outside acceptance limits must be evaluated for data usability. Re-extraction may be necessary if data quality has been adversely affected.
IS Response	Every injection contains the IS analyte	ICAL Standards: Area of individual points must not deviate by more than 50% of ICAL mean area response Samples following ICAL: 50-150% of ICAL mean response Ongoing CCV: 50-150% of ICAL mean response Post-CCV Samples: Area must be within 50-150% of most recent CCVIS (daily opening CCV)	Standard failures must be investigated to determine the cause of the failure. Recalibration may be required. Sample failures may be matrix related and should be evaluated to determine if the data quality has been adversely affected.
Initial Calibration Blank (ICB)	Immediately following the ICAL	Non-DW: < RL for all target analytes	Determine source of interference/contamination, eliminate it and recalibrate.
Second Source Standard Verification (ICV)	Prior to the analysis of samples. Generally immediately after the ICB.	+/-30 for analytes, IS, and SUR.	Correct problem and verify second source standard. If that fails, repeat calibration.
Continuing Calibration Verification (CCV)	Beginning of each analytical sequence, every ten field samples and at the end of each analytical sequence. Alternate between levels 3, 4 and 5.	+/-30%	Rerun any samples analyzed before and after the failing CCV. Take corrective action; if subsequent CCV analyses fail, recalibrate instrument.
Continuing Calibration Verification-Low (CCVL)	Beginning of each analytical sequence that is not preceded by an ICAL to show LOQ is still valid.	CF = 50-150% (ISTD targets) IDA 50-150%	Stop sample acquisition. Take corrective action; if subsequent CCV analyses fail, recalibrate instrument.
Method Blank	One per extraction batch of 20 or fewer samples	Non-DW: < RL for all target analytes	Reprocess MB and associated samples if any target analyte in the MB is at or above the RL, greater than 1/10 the amount detected in any sample or 1/10 the regulatory limit, whichever is greater. If the target is not greater than the RL in the samples associated with an unacceptable method blank, the data may be reported with appropriate qualifiers. If insufficient sample is available to reprocess, report data with appropriate qualifiers.
Laboratory Control Sample	One per extraction batch of 20 or fewer samples (rotate between Low, Med, High)	%R within control limits. See Table 4	Reprep and reanalyze samples for failed analytes. If reanalysis is not possible due to insufficient sample volume, report data with appropriate data qualifiers.

QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
Matrix Spike / Matrix Spike Duplicate	One set per extraction batch when sufficient sample volume is provided	%R within control limits. See Table 4	Evaluate to determine if there is a matrix effect or analytical error. If analytical error, reanalyze or reprocess as appropriate.
Sample Duplicate	One per extraction batch of 20 or fewer samples	RPD within control limits. See Table 4	Evaluate data to determine source for error. If analytical error is suspected, reanalyze or reprocess as appropriate.
Field Reagent Blank	Per client sample set	Non-DW: < RL for all target analytes	Analysis only required if samples contain target analytes at or above the RL. If analytes are present in the FRB at >1/3 RL, all samples must be recollected and re-analyzed.

Table 4: LCS and MS/MSD Control Limits*

Analyte	Water (Low Level) %R	Water (Med-High Level) %R	RPD
Perfluorobutanoic acid (PFBA)	50-150	70-130	20
Perfluoropentanoic acid (PFPeA)	50-150	70-130	20
Perfluorobutanesulfonic acid (PFBS)	50-150	70-130	20
Perfluorohexanoic acid (PFHxA)	50-150	70-130	20
Perfluoropentanesulfonic acid (PFPeS)	50-150	70-130	20
Perfluoroheptanoic acid (PFHpA)	50-150	70-130	20
Perfluorohexanesulfonic acid (PFHxS)	50-150	70-130	20
Perfluorooctanoic acid (PFOA)	50-150	70-130	20
Perfluoroheptanesulfonic acid (PFHpS)	50-150	70-130	20
Perfluorononanoic acid (PFNA)	50-150	70-130	20
Perfluorooctanesulfonic acid (PFOS)	50-150	70-130	20
Perfluorodecanoic acid (PFDA)	50-150	70-130	20
Perfluorononanesulfonic acid (PFNS)	50-150	70-130	20
Perfluoroundecanoic acid (PFUdA)	50-150	70-130	20
Perfluorodecanesulfonic acid (PFDS)	50-150	70-130	20
Perfluorooctanesulfonamide (FOSA)	50-150	70-130	20
Perfluorododecanoic acid (PFDoA)	50-150	70-130	20
Perfluorododecanesulfonic acid (PFDoS)	50-150	70-130	20
Perfluorotridecanoic acid (PFTrDA)	50-150	70-130	20
Perfluorotetradecanoic acid (PFTeDA)	50-150	70-130	20
Perfluorohexadecanoic acid (PFHxDA)	50-150	70-130	20
Perfluorooctadecanoic acid (PFODA)	50-150	70-130	20
1H,1H,2H,2H Perfluorohexanesulfonate (4:2FTS)	50-150	70-130	20
1H,1H,2H,2H Perfluorooctanesulfonate (6:2FTS)	50-150	70-130	20
1H,1H,2H,2H Perfluorodecanesulfonate (8:2FTS)	50-150	70-130	20
1H,1H,2H,2H Perfluorododecanesulfonate (10:2FTS)	50-150	70-130	20
N-Methyl Perfluorooctane sulfonamidoacetic acid (N-MeFOSAA)	50-150	70-130	20
N-Ethyl Perfluorooctane sulfonamidoacetic acid (N-EtFOSAA)	50-150	70-130	20
Hexafluoropropylene oxide dimer acid	50-150	70-130	20
4,8-dioxa-3H-perfluorononanoic acid	50-150	70-130	20
9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	50-150	70-130	20
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	50-150	70-130	20

**The limits in this table are those in effect as of the published date of this SOP. The %R limits are specified by EPA 537r1.1 in sections 9.33, 9.36, and 9.37. The RPD the lab uses is more strict than those referenced in EPA 537 r1.1. If the lab makes changes to any of these limits, the updated limits will be no less strict than those specified in EPA537.*

Appendix A: Terms and Definitions

PFCAs: Perfluorocarboxylic acids
PFSAs: Perfluorinated sulfonic acids
FOSA: Perfluorinated sulfonamide
PFOA: Perfluorooctanoic acid
PFOS: Perfluorooctane sulfonate
PTFE: Polytetrafluoroethylene (e.g., Teflon®)
SPE: Solid phase extraction**.**
PP: Polypropylene
PE: Polyethylene
HDPE: High density polyethylene
AFFF: Aqueous Film Forming Foam
IDA: Isotope dilution analytes
Acceptance Criteria: specified limits placed on characteristics of an item, process or service defined in requirement documents.
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.
Analyte: The specific chemicals or components for which a sample is analyzed. (EPA Risk Assessment Guide for Superfund, OSHA Glossary).
Batch: environmental samples that are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation/digestion batch is composed of one to 20 environmental samples of similar matrix, meeting the above criteria. An analytical batch is composed of prepared environmental samples (extracts, digestates and concentrates), which are analyzed together as a group.
Calibration: a set of operations that 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 the standards.
Calibration Curve: the graphical relationship between the known values or a series of calibration standards and their instrument response.
Calibration Standard: A substance or reference used to calibrate an instrument.
Continuing Calibration Verification (CCV): a single or multi-parameter calibration standard used to verify the stability of the method over time. Usually from the same source as the calibration curve.
Corrective Action: the action taken to eliminate the cause of an existing nonconformity, defect or other undesirable occurrence in order to prevent recurrence.
Data Qualifier: a letter designation or symbol appended to an analytical result used to convey information to the data user. (Laboratory)
Demonstration of Capability (DOC): procedure to establish the ability to generate acceptable accuracy and precision.
Holding Time: the maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.
Initial Calibration: Analysis of analytical standards for a series of different specified concentrations used to define the quantitative response, linearity and dynamic range of the instrument to target analytes.
Intermediate Standard: a solution made from one or more stock standards at a concentration between the stock and working standard. Intermediate standards may be certified stock standard solutions purchased from a vendor and are also known as secondary standards.

Laboratory Control Sample (LCS): a blank matrix spiked with a known amount of analyte(s) processed simultaneously with and under the same conditions as samples through all steps of the procedure.

Matrix Spike (MS): a field sample to which a known amount of target analyte(s) is added.

Matrix Spike Duplicate (MSD): a second replicate matrix spike

Method Blank (MB): a blank matrix processed simultaneously with and under the same conditions as samples through all steps of the procedure. Also known as the preparation blank (PB).

Method Detection Limit (MDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which relative uncertainty is ±100%. The MDL represents a range where qualitative detection occurs. Quantitative results are only produced in this range and qualified with the proper data reporting flag when a project requires this type of data reporting.

Non-conformance: an indication, judgment, or state of not having met the requirements of the relevant specification, contract or regulation.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves.

Preservation: refrigeration and/or reagents added at the time of sample collection to maintain the chemical, physical, and/or biological integrity of the sample.

Quality Control Sample (QC): a sample used to assess the performance of all or a portion of the measurement system.

Reporting Limit (RL): the level to which data is reported for a specific test method and/or sample.

Stock Standard: a solution made with one or more neat standards usually with a high concentration. Also known as a primary standard. Stock standards may be certified solutions purchased from a vendor.

Surrogate: a substance with properties that mimic the analyte of interest but that are unlikely to be found in environmental samples.

Appendix B: Standard Preparation Tables

The standard formulations contained in this appendix are recommended and are subject to change. If the concentration of the stock standard is different than those noted in this table, adjust the standard preparation formulation accordingly. Unless otherwise specified, prepare the standard solutions in methanol using Class A volumetric glassware and Hamilton syringes and assign an expiration date of 1 year from date of preparation unless the parent standard expires sooner; then use the earlier date. See laboratory SOP BR-QA-002 *Standard Preparation* for further guidance. For stock standards solutions made from neat material, assign an expiration date of 2 years from the date of formulation.

Stock Standard Solutions

PFAS LCS/Matrix Spike Solution 1000 ng/mL

Parent Standard	Vendor	Component	Stock Standard Conc (µg/mL)	Volume Added (µL)	Final Volume (mL)	Final Conc (ng/mL)
PFBA	Wellington Laboratories Code: PFBA	Perfluorobutanoic acid	50	200	10	1000
PFPeA	Wellington Laboratories Code: PFPeA	Perfluoropentanoic acid	50	200		1000
PFBS	Wellington Laboratories Code: L-PFBS	Perfluorobutanesulfonic acid	44.2	200		884
PFHxA	Wellington Laboratories Code: PFHxA	Perfluorohexanoic acid	50	200		1000
PFPeS	Wellington Laboratories Code: L-PFPeS	Perfluoropentanesulfonic acid	46.9	200		938
PFHpA	Wellington Laboratories Code: PFHpA	Perfluoroheptanoic acid	50	200		1000
PFHxSK	Wellington Laboratories Code: br-PFHxSK	Perfluorohexanesulfonic acid	45.5	200		910
PFOA	Wellington Laboratories Code: PFOA	Perfluorooctanoic acid	50	200		1000
PFHpS	Wellington Laboratories Code: L-PFHpS	Perfluoroheptanesulfonic acid	47.6	200		952
PFNA	Wellington Laboratories Code: PFNA	Perfluorononanoic acid	50	200		1000
PFOS	Wellington Laboratories Code: br-PFOSK	Perfluorooctanesulfonic acid	46.4	200		928
PFDA	Wellington Laboratories Code: PFDA	Perfluorodecanoic acid	50	200		1000
PFNS	Wellington Laboratories Code: L-PFNS	Perfluorononanesulfonic acid	48.0	200		960
PFUdA	Wellington Laboratories Code: PFUdA	Perfluoroundecanoic acid	50	200		1000
PFDS	Wellington Laboratories Code: L-PFDS	Perfluorodecanesulfonic acid	48.2	200		964
FOSA	Wellington Laboratories Code: FOSA-I	Perfluorooctane sulfonamide	50	200		1000
PFDoA	Wellington Laboratories Code: PFDoA	Perfluorododecanoic acid	50	200		1000
PFDoS	Wellington Laboratories Code: L-PFDoS	Perfluorododecanesulfonic acid	48.4	200		968
PFTrDA	Wellington Laboratories Code: PFTrDA	Perfluorotridecanoic acid	50	200		1000
PFTeDA	Wellington Laboratories Code: PFTeDA	Perfluorotetradecanoic acid	50	200		1000
PFHxDA	Wellington Laboratories Code: PFHxDA	Perfluorohexadecanoic acid	50	200		1000
PFODA	Wellington Laboratories Code: PFODA	Perfluorooctadecanoic acid	50	200		1000
4:2FTS	Wellington Laboratories Code: 4:2FTS	1H,1H,2H,2H-perfluorohexane sulfonate (4:2)	46.7	200		934
6:2FTS	Wellington Laboratories Code: 6:2FTS	1H,1H,2H,2H-perfluorooctane sulfonate (6:2)	47.4	200		948

8:2FTS	Wellington Laboratories Code: 8:2FTS	1H,1H,2H,2H-perfluorodecane sulfonate (8:2)	47.9	200		958
10:2FTS	Wellington Laboratories Code: 10:2FTS	1H,1H,2H,2H-perfluorododecane sulfonate (10:2)	48.2	200		964
NMeFOSAA	Wellington Laboratories Code: br-NMeFOSAA	N-methyl Perfluorooctane sulfonamidoacetic acid	50	200		1000
NEtFOSAA	Wellington Laboratories Code: br-NEtFOSAA	N-ethyl Perfluorooctane sulfonamidoacetic acid	50	200		1000
HFPO-DA	Wellington Laboratories Code: HFPO-DA	Hexafluoropropylene oxide dimer acid	50	200		1000
DONA	Wellington Laboratories Code: NaDONA	4,8-dioxa-3H-perfluorononanoic acid	47.1	200		942
9Cl-PF3ONS	Wellington Laboratories Code: 9Cl-PF3ONS	9-Chlorohexadecafluoro-3-oxanone-1-sulfonate	46.6	200		932
11Cl-PF3OUdS	Wellington Laboratories Code: 11Cl-PF3OUdS	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonate	47.1	200		942

Solvent: Methanol

PFAS-IDA Solution (Surrogate) 1000 ng/mL

Parent Standard	Vendor	Component	Stock Standard Conc (µg/mL)	Volume Added (µL)	Final Volume (mL)	Final Conc (ng/mL)
13C4 PFBA	Wellington Laboratories Code: MPFBA	$^{13}C_4$-Perfluorobutanoic acid	50	200	10	1000
13C5-PFPeA	Wellington Laboratories Code: MPFPeA	$^{13}C_5$-Perfluoropentanoic acid	50	200		1000
13C3-PFBS	Wellington Laboratories Code: M3PFBS	$^{13}C_3$-Perfluorobutanesulfonic acid	46.5	200		930
13C2 PFHxA	Wellington Laboratories Code: MPFHxA	$^{13}C_2$-Perfluorohexanoic acid	50	200		1000
13C4 PFHpA	Wellington Laboratories Code: M4PFHpA	$^{13}C_4$-Perfluoroheptanoic acid	50	200		1000
18O2 PFHxS	Wellington Laboratories Code: MPFHxS	$^{18}O_2$-Perfluorohexanesulfonic acid	47.3	200		946
13C4 PFOA	Wellington Laboratories Code: MPFOA	$^{13}C_4$-Perfluorooctanoic acid	50.0	200		1000
13C5 PFNA	Wellington Laboratories Code: MPFNA	$^{13}C_5$-Perfluorononanoic acid	50.0	200		1000
13C4 PFOS	Wellington Laboratories Code: MPFOS	$^{13}C_4$-Perfluorooctanesulfonic acid	47.8	200		956
13C2 PFDA	Wellington Laboratories Code: MPFDA	$^{13}C_2$-Perfluorodecanoic acid	50.0	200		1000
13C8 FOSA	Wellington Laboratories Code: M8FOSA-I	$^{13}C_8$-Perfluorooctane sulfonamide	50.0	200		1000
13C2 PFUdA	Wellington Laboratories Code: MPFUdA	$^{13}C_2$-Perfluoroundecanoic acid	50.0	200		1000
13C2 PFDoA	Wellington Laboratories Code: MPFDoA	$^{13}C_2$-Perfluorododecanoic acid	50.0	200		1000
13C2 PFTeDA	Wellington Laboratories Code: MPFTeDA	$^{13}C_2$-Perfluorotetradecanoic acid	50.0	200		1000
13C2 PFHxDA	Wellington Laboratories Code: MPFHxDA	$^{13}C_2$-Perfluorohexadecanoic acid	50.0	200		1000
M2-4:2FTS	Wellington Laboratories Code: M2-4:2FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-$^{13}C_2$]-hexane sulfonate (4:2)	46.7	200		934
M2-6:2FTS	Wellington Laboratories Code: M2-6:2FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-$^{13}C_2$]-octane sulfonate (6:2)	47.5	200		950
M2-8:2FTS	Wellington Laboratories Code: M2-8:2FTS	Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-$^{13}C_2$]-decane sulfonate (8:2)	47.9	200		958
d3-NMeFOSAA	Wellington Laboratories Code: d3-M-MeFOSAA	N-methyl-d_3-perfluoro-1-octane sulfonamidoacetic acid	50.0	200		1000
d5-NEtFOSAA	Wellington Laboratories Code: d5-M-EtFOSAA	N-ethyl-d_5-perfluoro-1-octane sulfonamidoacetic acid	50.0	200		1000

M3HFPO-DA	Wellington Laboratories Code: M3HFPO-DA	$^{13}C_3$-Hexafluoropropylene oxide dimer acid	50.0	200		1000

Solvent: Methanol

PFAS Internal Standard Stock Solution 5000 ng/mL

Parent Standard	Vendor	Component	Stock Standard Conc (µg/mL)	Volume Added (µL)	Final Volume (mL)	Final Conc (ng/mL)
13C2 PFOA	Wellington Laboratories Code: M2PFOA	$^{13}C_2$-Perfluorooctanoic acid	50.0	400	4	5000

Solvent: Methanol

PFAS Internal Standard Spiking Solution 2500 ng/mL

Parent Standard	Vendor	Component	Stock Standard Conc (µg/mL)	Volume Added (µL)	Final Volume (mL)	Final Conc (ng/mL)
13C2 PFOA	Wellington Laboratories Code: M2PFOA	$^{13}C_2$-Perfluorooctanoic acid	50.0	200	4	2500

Solvent: Methanol

PFAS-IDA-IS Calibration Standards Level 1-Level 6

ICAL Level	Vol of PFAS LCS/Matrix Spike (µL)	Nominal Conc of PFAS (ng/mL)	Vol of PFAS-IDA Solution (µL)	Conc of IDA (ng/mL)	Vol of 5ppm PFAS-IS Stock Solution (µL)	Conc of IS (ng/mL)	Vol of Water (µL)	Vol of 80/20 MeOH/H2O (µL)	Final Vol (mL)
1	4	1.0	200	50	40	50	51	3745	4.0
2	2	2.0	50	50	10	50	13	935	1.0
3	16	5.0	160	50	32	50	44	2980	3.2
4	72	20.0	180	50	36	50	63	3285	3.6
5	160	50.0	160	50	32	50	80	2800	3.2
6	240	200	60	50	12	50	75	825	1.2

The solvent is 80/20 Methanol/Water.

Appendix C: Equations

Initial Calibration Curve Evaluation:

The linear curve uses the following function:

Equation 1

$$y = bx + c$$

Where:

$$y = \frac{\text{Area (analyte)}}{\text{Area (IS)}} \times \text{Concentration (IS)}$$

x = concentration
b = slope
c = intercept

The quadratic curve uses the following function:

Equation 2

$$y = ax^2 + bx + c$$

Where y, x, b, and c are the same as above, and a = curvature.

The external standard method uses the following equation:

Equation 3

$$ResponseFactor = \frac{Peak\ Area}{Concentration\ of\ Solution(ng/mL)}$$

Equation 4

$$\text{Concentration, ng/mL} = \frac{y - c}{b}$$

Equation 5

$$\text{Concentration, ng/mL} = \frac{-b + \sqrt{b^2 - 4a(c - y)}}{2a}$$

Where:

$$y = \frac{\text{Area (analyte)}}{\text{Area (IS)}} \times \text{Concentration (IS)}$$

x = concentration
a = curvature
b = slope
c = intercept

Water Sample Result Calculation:

Equation 6

$$\text{Concentration, ng/L} = \frac{C_{ex} V_t}{V_o}$$

Where:

C_{ex} = Concentration measured in sample extract (ng/mL)
V_t = Volume of total extract (mL)
V_o = Volume of water extracted (L)

IDA Recovery Calculation:

Equation 8

$$\%\,\mathrm{Recovery} = \frac{A_t Q_{is}}{A_{is} Q_t RRF_{IDA}} X100$$

Where ng/g = µg/kg and:

RF_{IDA} = Response Factor for IDA compound
A_t = Area response for IDA compound
A_{IS} = Area Response for IS compound
Q_{IS} = Amount of IS added
Q_t = Amount of IDA added

Calibration Factor (CF_x) =

$$\frac{\text{Peak area or height}_{(x)}}{\text{Standard concentration}_{(\mu g/L)}}$$

Mean Calibration Factor ($\overline{CF}$) =

$$\frac{\sum_{i=1}^{n} CF_i}{n}$$

where: n = number of calibration levels

Standard Deviation of the Calibration Factor (SD) =

$$\sqrt{\frac{\sum_{i=1}^{n}\left(CF_i - \overline{CF}\right)2}{n-1}}$$

where: n = number of calibration levels

Percent Relative Standard Deviation (RSD) of the Calibration Factor =

$$\frac{SD}{\overline{\overline{CF}}} \times 100\%$$

Percent Difference (%D) =

$$\frac{CF_v - \overline{CF}}{\overline{\overline{CF}}} \times 100\%$$

where: CF_v = Calibration Factor from the Continuing Calibration Verification (CCV)

Percent Drift =

$$\frac{\text{Calculated Concentration} - \text{Theoretical Concentration}}{\text{Theoretical Concentration}} \times 100\%$$

Percent Recovery (%R) = $\frac{C_s}{C_n} \times 100\%$

where: C_s = Concentration of the Spiked Field or QC Sample
C_n = Nominal Concentration of Spike Added

Percent Recovery (%R) for MS/MSD = $\frac{C_s - C_u}{C_n} \times 100\%$

where: C_s = Concentration of the Spiked Sample
C_u = Concentration of the Unspiked Sample
C_n = Nominal Concentration of Spike Added

Relative Percent Difference (%RPD) = $\frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)} \times 100\%$

where: C_1 = Measured Concentration of First Sample
C_2 = Measured Concentration of Second Sample

Sample Concentration

Extract

$C_{extract}$ (µg/L) = $\frac{\text{Peak Area (or Height)}}{\overline{\text{CF}}}$

Note: The concentrations of the 3-5 peaks chosen for quantificaton is calculated and the average is then taken for final calculation.

Appendix D: Analytes applied for Secondary Certification with NJDEP

Compound Name	Abbreviation	CAS #
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	PFUdA (PFUnA)	2058-94-8
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA (PFTA)	376-06-7
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluorooctanesulfonic acid	PFOS	1763-23-1

APPENDIX C

Resumes of Key Project Personnel

PROJECT MANAGER

MARK E. WRIGHT, PG, CSP, CHMM

ROLE AND RESPONSIBILITY

As a Project Manager for this contract, Mr. Wright will be responsible for the administration of work required by the Work Assignment. The management of each work assignment may include development of work scope and cost assessments, procurement of supporting subcontractors and/or consultants, coordination of work scope items from resource management to scheduling and implementation. Mr. Wright will work with the Quality Assurance Officer to develop site-specific quality assurance plans, as pertinent to the Work Assignment and will act as the primary point of contact for each assigned project.

IDENTIFIED WORK ELEMENTS EXPERIENCE

- Site Characterization
- Phased Remedial Investigation/Feasibility Study (RI/FS)
- Soil Vapor Intrusion (SVI) Investigations
- Site Response Activities/Interim Remedial Measures (IRM)
- Site Management (SM)
- Analytical Quality Assurance/Quality Control Activities (QA/QC)
- Citizen Participation (CP) Activities
- Health and Safety Plan (HASP) Development
- Potentially Responsible Parties (PRP) and Third-Party Oversight

SUMMARY OF QUALIFICATIONS

Mr. Wright has over 13 years of experience in conducting environmental investigations. Mr. Wright is experienced in all phases of environmental investigation projects, including Completing the initial Site Characterization Investigation, Completing Remedial Investigations and Feasibility studies, Soil Vapor Intrusion Studies, the selection and implementation of Interim Remedial Measures, the development and implementation of Quality Assurance Project Plans, the development and implementation of site specific Health and Safety Plans, participation in Citizen participation activities, implementation of Site Management Plans, and Third Party Oversight.

Mr. Wright has completed a diverse array of site investigations including investigations into groundwater contamination in various media including, overburden, fractured bedrock, and competent bed rock as well as the interaction between different aquifers. Mr. Wright has used investigation data to develop conceptual site models, including groundwater flow and contaminant transport, the completion of Aquifer testing to establish aquifer characteristics, the implementation of geophysical techniques and the uploading of data to EQuIS. In addition to completing investigatory step during projects Mr. Wright develops and tracks project budgets and other project management elements. Mr. Wright has provided these services on a number of projects for governmental, municipal, commercial and industrial clients.

Mr. Wright's areas of expertise include Site Characterizations and Remedial Investigations. Mr. Wright specializes in the investigation of contaminated groundwater plumes, including source area investigations, plume degree and extent and the identification of potential receptors of contaminated groundwater.

NSPE LEVEL

VI

EDUCATION

- BS, Water Resources, State University of New York Collage at Oneonta, 2003

PROFESSIONAL REGISTRATIONS/ CERTIFICATIONS

- PG, #693, NY
- Certified Safety Professional (#31227)
- Certified Hazardous Materials Manager (#173260)

PROFESSIONAL ORGANIZATIONS

- Environmental Professionals Organization of Connecticut
- National Ground Water Association

TRAINING

- OSHA 40 Hour Health and Safety for Hazardous Waste Site
- OSHA 8 Hour Supervisor of Hazardous Waste Operation

BASE OFFICE LOCATION

Clifton Park, NY

EXPERIENCE

MANAGEMENT OF INACTIVE HAZARDOUS WASTE, HAZARDOUS SUBSTANCE AND PETROLEUM SPILL SITES

Site Management of Petroleum Spill and Hazardous Waste Site, NYSDEC Contract D006130, North Lawrence Oil Dump Site, North Lawrence, NY

Served as a Senior Project Geologist for the NYSDEC North Lawrence Oil Dump Site. Responsibilities included implementation of the Site Management Plan, including monitored natural attenuation groundwater sampling, landfill gas monitoring and site inspections; the development of sampling reduction plans to eliminate several wells from the sampling program, oversight groundwater monitoring well decommissioning for a portion of the groundwater monitoring network. Analysis of groundwater sampling results and preparation of Periodic Review Reports. Services were completed in 2015.

Site Characterization of Petroleum Spill and Hazardous Waste Site, NYSOGS Contract SA 953, Fishkill Correctional Facility, Beacon, NY

Mr. Wright served as a Project Manager for this NYSOGS project to conduct an environmental sampling program during the development of the bid documents for the replacement of three 100,000 gallon AST at the boiler house of the correctional facility. Responsibilities included working with NYSOGS Project Managers on the development of a Site Characterization Plan, coordination with DOCs personnel to clear security requirements, oversight of the use of ground penetrating radar prior to initiating a soil boring program, field oversight of the installation of soil borings to identify areas of environmental impact from the historic use of the area as a tank farm, and the use of lead based paint on the system pipiing, identifying areas of lead paint using XRF equipment and collecting samples of building materials for the presence of PCBs. Information collected during the site characterization was used define the volumes of soil to be removed during the replacement of three 100,000 gallon AST at the boiler house of the correctional facility.

Site Characterization of Petroleum Spill and Hazardous Waste Site, NYSOGS, Contract SA 953, Otisville Correctional Facility, Building 165, Otisville, NY

Mr. Wright served as a Project Manager for this NYSOGS project to conduct a Site Characterization, in accordance with DER-10, during removal of a 1,000 gallon UST at building 165 of the correctional facility. Responsibilities included budget and scope development, field oversight of UST contractors conducting the removal, screening environmental media uncovered during the removal to identify a release of product to the environment, spill reporting, coordination with OGS field Engineer to approve and execute an immediate environmental remedial excavation, collection of environmental samples in coordination with OGS field Engineers and NYSDEC Spill Engineers, with NYSDEC requirements, completion of UST closure report, including request to close the spill, follow-up with NYSDEC to ensure spill was closed meeting standards.

Site Characterization of Petroleum Spill and Hazardous Waste Site, NYSOGS, Contract SA 953, DOT Region 9 Maintenance Sub-Headquarters, Schenevus, NY

Mr. Wright served as a Project Manager for this NYSOGS project to conduct a Site Characterization, in accordance with DER-10 during removal of a 1,000 and a 4,000 gallon UST at the DOT facility. Responsibilities, budget and scope development, field oversight of UST contractors conducting the removal, screening environmental media uncovered during the removal to identify a release of product to the environment, spill reporting, coordination with OGS field Engineer to approve and execute an immediate environmental remedial excavation, coordination with UST contractors to segregate and stockpile impacted soils, Coordination with OGS project Engineer and DEC spill manager to secure approval for onsite treatment and reuse of contaminated soil, collection of environmental samples in accordance with NYSDEC requirements, completion of UST closure report, including request to close the spill, follow-up with NYSDEC to ensure spill was closed meeting standards.

Aquifer Testing in support of Groundwater Withdrawal Permit, Kraft Foods, Campbell, NY

Served as Project Manager for the completion of an aquifer testing program in support of a Groundwater Withdrawal Permit approval from the Susquehanna River Basin Commission, Responsibilities included development of Aquifer Test Plan, obtaining general permit from the ACOE for weir construction, planning and oversight of installation of monitoring well network, public notifications for testing, coordination with neighboring property owners to conduct monitoring on their property, data collection, data analysis, including the calculating of aquifer flow parameters and long term stability of the proposed water withdrawal as well as permit form completion and submittal.

Emerging Contaminants Sampling, Balchem Corporation, Slate Hill, NY

Served as a Project Manager for the development and implementation of a emerging contaminates sampling program at a Class 04 State Superfund Program Site. Responsibilities included reviewing historic data to create a sampling plan for PFAS and 1,4-dioxane in the two groundwater aquifers on-site, submittal of the plan to the NYSDEC project manager for approval,

EXPERIENCE

development of a field sampling plan and training program to ensure that cross contamination was avoided during sampling, oversight of the sampling program and data analysis and reporting. Services were completed in 2018.

Site Management, Phased Remedial Investigation/Feasibility Study of Petroleum Spill and Hazardous Waste Site, Brownfields Site, Ulster County, NY
Served as a Project Manager for the completion of a Remedial Investigation/Feasibility Study and site management of a brownfield clean-up program of an inactive waste disposal site in Ulster County, NY. Project responsibilities included working under the supervision of the NYSDEC Project Manager to review historical data and using that data to aide in the development of a Remedial Investigation strategy, development of a field activities plan, development of a site specific health and safety plan, and coordination with the NYSDOH, NYSDEC and site owners to identify and investigate all potential receptors of subsurface contamination in the area that could impact human health and the environment. Specialized tasks performed during the investigation include: Interpretation of Ground Penetrating Radar (GPR) Electromagnetic Survey(EM) data to identify the location of subsurface anomalies indicative of disposal areas, Completion of soil vapor intrusion evaluation, including the evaluation of sampling network based on interpretation of geologic data, the use of passive gas sample network, and evaluation of passive soil gas data to identify potential groundwater contamination source areas, oversight of test pit installation in order to horizontally delineate subsurface contamination. oversight of soil boring installation to delineate contamination horizontally and vertically, the installation and sampling of a monitoring well network, the development of remedial alternatives, and the development and implementation of ad Site management Plan for the selected remedial strategy of monitored natural attenuation.

Site Characterization of Petroleum Spill and Hazardous Waste Site, NYSDEC Contract D006130 Site Characterization McCall Place, Newburgh, NY
Served as a Senior Project Geologist for the Site Characterization completed at the NYSDEC McCall Place Site. The Site Characterization was completed to identify the source of chlorinated solvents detected in private drinking water wells located along McCall Place. Proect responsibilities included working with NYSDEC Project Manager to review historical data and using that data to aide in the development of a Site Characterization strategy, development of a field activities plan, development of a site specific health and safety plan, and coordination with the NYSDOH, NYSDEC and area residents to identify and investigate all potential receptors of subsurface contamination in the area that could impact human health and the environment. Specialized tasks performed during the investigation include: The use of passive soil gas sampling and ground penetrating radar to identify potential hazardous waste disposal areas; the planning and oversight of the installation of an area wide groundwater monitoring well network, interpretation of groundwater flow and contaminant concentration data development and maintenance of conceptual site model, and the upload of project data to the NYSDEC EQuIS sever. The results of the site characterization identify three distinct plumes of chlorinated solvents in the area of the site, however a specific source area could not be identified.

Phased Remedial Investigation/Feasibility Study, Site Response Activities/Interim Remedial Measures of Petroleum Spill and Hazardous Waste Site, NYSDEC Contract D006130, Barthelmes Manufacturing Site, Rochester, NY
Served as a Senior Project Geologist for the Remedial Investigation/Feasibility Study, including Interim Remedial Measures, completed at the NYSDEC Barthelmes Manufacturing Site. The Remedial Investigation/Feasibility Study was completed to define the degree and extent of subsurface contamination related to the historic use of the site as a manufacturing facility. Project responsibilities included working with NYSDEC Project Manager to review historical data and using that data to aide in the development of a Remedial Investigation strategy, development of a field activities plan, development of a site specific health and safety plan, and coordination with the NYSDOH, NYSDEC and site owners to identify and investigate all potential receptors of subsurface contamination in the area that could impact human health and the environment. Specialized tasks performed during the investigation include: the completion of an Interim Remedial Measure to remove source material contributing to a chlorinated solvent groundwater plume. The IRM consisted of the removal of soil from under the slab on grade foundation of the building. Other task included the evaluation of an existing groundwater monitoring well network, planning and oversight of the installation additional groundwater monitoring wells to supplement the existing monitoring well network, interpretation of groundwater flow and contaminant concentration data, development and maintenance of conceptual site model to identify the source and potential receptors of subsurface contamination including evaluating hydrogeologic conditions for use in the evaluation of potential remedial actions, and the upload of project data to the NYSDEC EQuIS sever.

SENIOR PROJECT CONSULTANT

PATRICK W. MONTUORI

IDENTIFIED WORK ELEMENTS EXPERIENCE

- Site Characterization
- Phased Remedial Investigation/Feasibility Study (RI/FS)
- Soil Vapor Intrusion (SVI) Investigations
- Remedial Design (RD)
- Site Response Activities/Interim Remedial Measures (IRM)
- Site Management (SM)
- Analytical Quality Assurance/Quality Control Activities (QA/QC)
- Citizen Participation (CP) Activities
- Health and Safety Plan (HASP) Development
- Potentially Responsible Parties (PRP) and Third-Party Oversight

SUMMARY OF QUALIFICATIONS

Mr. Montuori is an environmental consultant with four (4) years of experience involving a wide range of environmental and geologic projects. Mr. Montuori provides expertise in the field of site characterization, remedial investigation, and remediation of petroleum and chlorinated solvent impacted sites. He has prepared site management plans, site investigation work plans, remedial action work plans, Phase I and II environmental site assessments, health and safety plans, and Underground Storage Tank (UST) closure reports, and water supply studies. Mr. Montuori has managed remedial excavations, subsurface investigations, groundwater and soil vapor monitoring events, groundwater injections, and soil vapor extraction pilot testing. His responsibilities at HRP Associates include project management, environmental sampling, field oversight, data interpretation, and report preparation.

PROJECT EXPERIENCE

Remedial Action Implementation – Former Landfill BCP Site, Westchester County, NY – 2017-2020

As Project Geologist, conducted oversight, field work, and reporting related to the implementation of a Remedial Action Work Plan on a NYSDEC Brownfield Cleanup Program (BCP) site. Responsibilities included: remedial excavation oversight, excavation end-point soil screening and sampling, and community air monitoring program (CAMP) implementation; construction oversight, pilot, and start-up testing of a soil vapor extraction (SVE) system and two sub-slab depressurization (SSD) systems, including collection of air quality and vacuum performance data; groundwater well installation and monitoring; planning and conducting in-situ application of emulsified vegetable oil (EVO) and zero valance iron (ZVI) for treatment of chlorinated volatile organic compounds (VOCs) in groundwater; installation oversight of a vegetated site cap; presenting at monthly community meetings; correspondence and coordination with NYSDEC; preparation of progress reports, work plans, and documentation related to the site management plan (SMP) and final engineering report (FER).

Remedial Investigation– Former Retail Petroleum Station and Autobody BCP Site, Westchester County, NY – 2020

As Project Geologist, conducted a multi-stage remedial investigation according to the work plan approved under the NYSDEC BCP. Responsibilities included: Locating, installing, logging, and sampling soil borings; oversight of drilling contractor during installation of groundwater monitoring wells; installation and sampling of soil vapor points; conducting groundwater sampling, including sampling for per-and polyfluoroalkyl substances (PFAS) using the low-flow method; coordination and implementation of a site CAMP; coordination of on-site containment and removal of

NSPE LEVEL

IV

EDUCATION

- Bachelors of Science, Geological Sciences, State University of New York at Plattsburgh, 2016

TRAINING

- OSHA - 40-Hour HAZWOPER Health and Safety Training
- OSHA - 8-Hour HAZWOPER Annual Refresher Training
- OSHA - 30-Hour Construction Training
- OSHA - 10-Hour Construction Training

TECHNICAL TRAINING

- USCS Soil Classification
- Low-Flow Sampling
- Air and Soil Vapor Monitoring
- Geologic Cross-Section Preparation
- Contour Mapping
- CAMP Monitoring and Data Management
- Pressure Transducer-Data Logger Water Level Monitoring

BASE OFFICE LOCATION

Clifton Park, NY

EXPERIENCE

investigation derived waste.

Site Management Plan Development and Implementation - Former Dry Cleaner Inactive Hazardous Waste Site, Putnam County, NY – 2017-2020
As Project Geologist, developed an SMP for a site at which the drinking water supply aquifer was impacted by chlorinated solvents. Responsibilities included: on and off-site groundwater monitoring and sampling; sampling and maintenance of site engineering controls, including drinking water point of entry treatment (POET) systems and an SSD system; preparation of the SMP and periodic review reports (PRRs); coordination with NYSDEC and the client (site owner) to ensure project objectives were completed within budget.

Community Drinking Water Monitoring – Residential Fuel Oil Spill Site, Westchester County, NY – 2020
As Project Geologist, conducted quarterly sampling events of potable wells in a residential neighborhood where the groundwater aquifer was impacted by a fuel oil underground storage tank (UST) spill. Responsibilities included: developing a sampling plan in coordination with NYSDEC; oversight of POET system installation; conducting quarterly sampling of homeowner POET systems and wells.

Quarterly Groundwater and Air Monitoring – Commercial Chlorinated Solvent Spill Site, Westchester County, NY – 2019-2020
As Project Geologist, conducted quarterly fieldwork and reporting at a commercial site in the NYSDEC spills program where groundwater was contaminated with chlorinated VOCs. Responsibilities included: planning and executing quarterly groundwater sampling events; conducting indoor air and soil vapor sampling; preparing quarterly reports communicating findings and recommendations to NYSDEC.

In-Situ Groundwater Treatment and Monitoring – Residential Fuel Oil Spill Site, Atlantic County, NJ - 2020
As Project Geologist, managed the cleanup and monitoring of a leaking fuel oil underground storage tank (UST). Due to inaccessibility of contaminated soils under the house a combination of surfactant groundwater injections and enhanced fluid recovery (EFR) events were utilized to remove free-phase product and dissolved fuel oil constituents from groundwater beneath the site. Responsibilities included: planning and execution of surfactant injections; groundwater monitoring and sampling; and correspondence with the homeowner and NJDEP.

Water Supply Study – Commercial Shopping Center, Putnam County, NY – 2017
As Project Geologist, planned and executed two simultaneous 24-hour pumping tests to determine if two newly installed supply wells could meet project demands with minimal impacts to the surrounding aquifer. Responsibilities included: installing pressure transducer data loggers; calculating flow rate using a flow totalizer and by measuring volume with a bucket; monitoring water level using data logger readings and by taking manual measurements with electronic interface tape; collection of drinking water samples; reporting including hydrograph preparation, calculation of water level stabilization and water level after 180 days of pumping; correspondence with county health department.

SENIOR PROJECT GEOLOGIST (STAFF)

MICHAEL A. VARNI, LEP

IDENTIFIED WORK ELEMENTS EXPERIENCE

- Site Characterization
- Phased Remedial Investigation/Feasibility Study (RI/FS)
- Soil Vapor Intrusion (SVI) Investigations
- Analytical Quality Assurance/Quality Control Activities (QA/QC)
- Citizen Participation (CP) Activities
- Health and Safety Plan (HASP) Development
- Potentially Responsible Parties (PRP) and Third-Party Oversight

SUMMARY OF QUALIFICATIONS

Mr. Varni has over 10 years of experience in environmental assessment and site investigation. He has performed these services for a number of governmental, municipal, commercial, industrial and private clients. Specifically, Mr. Varni has been responsible for Phase I Environmental Site Assessments at small- to large-scale commercial and industrial facilities. In all cases, the specific manufacturing processes were analyzed and waste streams were defined to identify all potential sources and releases of contaminants to the environment. Mr. Varni has performed numerous Phase II and Phase III investigations involving drilling and test pit supervision, monitoring well installation, and sampling of soils, groundwater, and soil vapor. Mr. Varni has performed numerous site remediation oversight projects including soil excavation, groundwater treatment systems, and vapor extraction systems.

Remedial Actions, West Hartford, CT

This project involved the cleanup and redevelopment of a former large engine break and drill chuck manufacturer contaminated with PCBs, petroleum, and chlorinated solvents. The project involved demolition of the existing industrial building, followed by removal of subslab piping and drainage structures, and finally remediation of soils to achieve compliance with both state and federal regulations. Mr. Varni's responsibilities included supervision of remediation contractors conducting soil excavation, field monitoring and sampling of soil and groundwater, field monitoring of dust and weather conditions according to a project specific remediation and health and safety plan, coordination with construction and remediation crews, and data management and analysis. The project culminated in a successful Brownfields-type redevelopment of the property into a retail shopping center.

Phase I Environmental Site Assessments

- Inspection of a wide variety of commercial and industrial facilities and properties to identify specific site environmental conditions and concerns
- Interviewing site contacts and municipal, state, and federal officials to determine current and former site use and environmental concerns
- Historical research into current and former land use and regulatory history through review of aerial photographs and other published sources and state and local agency records
- Review of published geologic data to determine site setting including surficial and bedrock geology, and groundwater and surface water, and other environmental factors to evaluation contaminant migration potential.

Phase II and III Subsurface Investigations

- Identification of potential contamination sources at sites due to present and historical land uses
- Collection, description, and interpretation of split spoon sediment samples

NSPE LEVEL

VII

EDUCATION

- MS, Geology, University of Maryland, College Park, Maryland, 2002
- BS, Environmental Earth Science, Eastern Connecticut State University, Willimantic, Connecticut, 1999

TRAINING

- OSHA 40 Hour Hazardous Waste Operations & Emergency Response
- OSHA 8 Hour Refresher Hazardous Waste Operations & Emergency Response

PUBLICATIONS

- The effect of rising atmospheric oxygen on carbon and sulfur isotope anomalies in Neoproterozoic Johnnie Formation, Death Valley, USA. Kaufman, A. J., Corsetti, F.A., and Varni, M.A.

BASE OFFICE LOCATION

Farmington, CT

ANALYTICAL QUALITY ASSOCIATES, INC.
STATEMENT OF QUALIFICATIONS

(888) 678-5447 ▪ PO Box 21987, Albuquerque, NM 87154 ▪ www.aqainc.net

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I. COMPANY OVERVIEW

Analytical Quality Associates, Inc. (AQA) is a **small business that provides analytical chemistry support services nationwide** to ensure technical validity and the legal defensibility of chemical analysis data for our clients. Headquartered in Albuquerque, New Mexico, with locations in Colorado and Nevada, our fundamental business objective is to exceed our clients' expectations with exemplary technical quality, customer service, and cost competitiveness.

We have assembled a dedicated staff of **over 30 professional analytical chemists with an average of over 21 years of experience** in environmental analytical chemistry, data validation, and related fields. AQA's employees have managed quality assurance departments; supervised organic, inorganic, wet chemistry, and radiochemistry departments at production analytical laboratories; and managed the sample management office (SMO) for a federal government environmental restoration project. Our chemists are the authors of the National Nuclear Security Administration (NNSA) Service Center's *Model Data Validation Procedure* and *Model Statement of Work for Analytical Laboratories*. Several AQA chemists have developed and implemented laboratory analytical procedures. In fact, two of our chemists co-authored an LC/MS/MS perchlorate method development paper that was published in *Analytical Chemistry* and, to a substantial degree, became the foundation for modern perchlorate analysis.

YOUR ENVIRONMENTAL DATA QUALITY EXPERTS

With this depth of experience, AQA has been awarded contracts performing third party data validation and related services that support cleanup activities at **five major DOE sites**, including Sandia and Los Alamos National Laboratories. Our support services have also extended to working with several large and small business partners on their **Air Force Center for Engineering and the Environment (AFCEE), Naval Facilities Engineering Command (NAVFAC), U.S. Army Corps of Engineers (USACE), and private industry contracts**. Our clients also include local Native American pueblos where we perform data validation and data management services, as well as help to resolve analytical chemistry technical issues and help author and review technical documents. Additionally, our chemists have developed internal data validation training course materials for the **U.S. Environmental Protection Agency (EPA)** and performed data validation, senior chemist support, and laboratory auditing services with the U.S. Geological Survey (USGS).

AQA's primary service is third-party data validation of all common environmental analytical chemistry methods in the **organic, inorganic, and radiochemical** areas, as well as the less common techniques such as high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS) and liquid chromatography/tandem mass spectrometry (LC/MS/MS). Our senior chemists are very familiar with the analytical methodologies employed across the entire spectrum of environmental analytical chemistry. We are experienced with the instrumentation, analytical methodologies, quality assurance protocols, quality control requirements, and data reporting specifications that are typically applicable in work performed for the federal government.

The level of rigor in our data validation services depends upon the client and the applicable data quality objectives. Much of our data validation is performed according to procedures based upon the EPA Contract Laboratory Program National Functional Guidelines. This typically includes examination of chains of custody, calibration curves, analytical batch quality control, and surrogate or tracer data as well as verification of calculations. For many of our clients, we also routinely review chromatographic data, manual integrations, and mass spectral "fits" to reference spectra. **The data validation procedure can easily be customized to client's specifications and is always designed to meet their quality objectives**.

AQA provides laboratory oversight, quality assurance, and auditing services to government programs. Our auditors have conducted **laboratory audits since 1996**; have experience in performing electronic data audits; and maintain certifications with the American Society for Quality (ASQ). Our staff members have directed the implementation of ISO 17025 and the National Environmental Laboratory Accreditation Conference (NELAC) Standard, ultimately achieving NELAC accreditation for commercial laboratories. Our auditing staff also includes individuals who have been trained to audit laboratories for the U.S. Department of Energy Consolidated Audit Program (DOECAP) and the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) using these guidelines. In addition, we conduct audits within our client organizations, as requested, and provide support in other areas to enhance the quality and cost effectiveness of analytical data acquired by the facilities.

The following sections highlight the capabilities and experience of AQA and our staff. AQA is committed to bringing exemplary service and the highest level of technical knowledge available to all our clients and their projects.

II. PROFESSIONAL SERVICES OFFERED

DATA VALIDATION

Third party data validation is the primary focus of AQA's services, and our company has many experienced environmental scientists dedicated to this task. AQA performs a truly independent review of the analytical data since our firm has formal procedures specifically aimed at avoiding organizational conflict of interest (OCI), and scrutinizes every project for potential OCI. Because of this policy, we make certain that our firm is not affiliated with any of the interested parties involved in any of our projects. Because the data review is performed by AQA, our clients and their stakeholders are assured that there was no bias of any kind in determining the quality of the data.

Data validation is often performed using client-specified criteria. If no criteria are specified, AQA uses internal data validation procedures that are based upon the EPA National Functional Guidelines or develops new criteria based on the client's needs. Formal validation reports are issued for each data package. At a minimum, these reports identify any data of questionable quality, recommend the specific data qualifiers to be applied, and explain the qualification criteria used.

The level of data validation performed is also dependent upon the client. It can be as simple as a cursory data review for package completeness and basic quality control (QC) checks or it may include full review of raw data, calibration, independent calculation checks, and transcription error checks, among other parameters.

AQA's chemists have developed an Electronic Data Review (EDR) software application that can be used to perform basic QC checks as well as review sample and analytical holding times among other parameters. It is completely customizable to the client-specified evaluation criteria. What makes it unique is that it also has a customizable electronic data deliverable (EDD) output, so that the client can import the reviewed data, with qualifiers applied, directly into their database without any conversion of the EDD. This saves time and money. It also can be a useful preliminary tool when a high level of data validation is required. It significantly reduces the data validator's time performing review of routine QC results and holding times.

As a convenience to our clients, AQA has an easy-to-use data transfer system utilizing file transfer protocol (FTP) that allows large data files to be securely uploaded to our server. This expedites the data validation process by eliminating the need to break up data for mail or email and avoids using less secure large file web transfer sites.

DATA MANAGEMENT

AQA has scientists who are experienced in Access, SQL, and other common database languages and have manipulated data (creating tables, queries, and reports), downloaded data from a variety of formats, and produced reports using numerous custom programs. Our data management personnel are experienced in Visual Basic as well as several other programming languages and will be able to support program requirements for potential software modifications. In addition to working with existing environmental database programs, our firm has the ability to create custom programs, libraries, spreadsheets, and reports.

AQA can provide clients with assistance in all aspects of data management. We can build tables, queries, and reports in existing databases (such as ADR/EDMS) for site-specific risk assessments and other project use. Technical assistance is available for setting up libraries within ADR/EDMS for risk screening. If needed, detailed documentation of database programs and instructions can be produced.

LABORATORY AUDITS AND OVERSIGHT

Audits are a formal process for evaluating laboratory compliance with clearly defined requirements and industry-standard practices. AQA performs laboratory audits according to pre-set schedules that are determined by our clients (routine audits) or are in response to significant non-conformances or trends that are identified (surveillance and follow-up audits). Our audits are conducted using a client-approved audit worksheet that defines the scope of the audit. The worksheet generally describes the areas to be evaluated; however, if our auditors encounter additional issues of concern that may impact the quality of the analytical process, the audit scope can be expanded to cover those issues.

AQA normally issues a formal audit report within 14 days of completion, and laboratories are typically expected to submit responses within 30 days thereafter. An audit is considered closed upon acceptance of a corrective action plan; however, audit-related corrective actions that are not completed prior to audit closure are tracked by AQA to completion. Notification of audit closure is accomplished via letter or electronic mail (e-mail), with copies to all concerned persons.

On-site data package assessments (DPAs) are a formal process for evaluating laboratory data defensibility, including compliance with quality control, quality assurance, record keeping, and data reporting requirements. DPAs are performed according to pre-set schedules that are determined by the client (routine DPAs) or are initiated in response to non-conformances or identified trends.

DPAs are conducted at laboratories during normal working hours using worksheets that were developed to cover common data defensibility issues and client reporting requirements. As with audit reports, AQA normally issues DPA reports within 14 days of the site visit, and laboratories are expected to submit responses within 30 days thereafter.

LABORATORY NON-CONFORMANCES AND CORRECTIVE ACTIONS

AQA will intervene and/or mediate in the routine corrective action process on our clients' behalf. This can become necessary when the complexity, significance, or initial laboratory response to a situation demands it. We verify the efficacy of corrective actions and track those corrective actions to closure. In addition, we verify implementation, as necessary, via laboratory on-site visits. The on-site verifications are done during the next scheduled audit, during the next scheduled DPA, or by scheduling an interim surveillance, as appropriate.

In the course of data validation, AQA routinely requests corrective actions for missing information or reporting errors associated with individual data packages. Unless client protocol differs, these corrective action requests will be issued directly to the laboratory by the project lead via e-mail. Data package corrective action requests are tracked in the data validation tracking system.

DESK AUDITS

A desk audit is a document review that is not conducted at the laboratory. Desk audits performed by AQA generally include the laboratory quality assurance plan (QAP) and/or analytical standard operating procedures. Desk audits are normally done when the laboratory being examined does not support the client in a broad enough context to warrant an on-site audit. As a result, only specific methods or areas are examined. Desk audit reports may include recommendations that the laboratory submit corrective action plans.

PROCESS EVALUATION

Upon client request, AQA will evaluate the client's own internal processes. The client generally determines the scope of the activity prior to the evaluation. Reports regarding the review of client operations may be formal or informal, according to the specific needs of the client. For all reports concerning reviews of client internal operations, the client determines the report format, scope, and distribution.

TECHNICAL SUPPORT

AQA's technical support includes:

- Assisting with unusual analytical needs or demanding data quality objectives
- Evaluating analytical methods
- Evaluating dataset adequacy for program data quality objectives
- Evaluating client or regulatory guidance documents
- Preparing status reports regarding external organizations (typically laboratories)
- Providing specific, technical information that could affect data collection
- Performing reviews of internal client documents (e.g., a site radiological characterization document)
- Participating in special studies requested by the client
- Conducting seminars on defensibility and various sample management-related topics
- Evaluating sampling procedures and practices

Reports for technical support activities may be formal documents, e-mail memoranda, or simple verbal communication.

TECHNICAL AND QUALITY DOCUMENT PREPARATION

AQA staff members have extensive capability and experience in the preparation of a wide range of technical and quality documents. AQA staff members have written data validation standard operating procedures for the Pantex Plant, Sandia National Laboratories (SNL), the Los Alamos National Laboratory (LANL) Water Quality and Hydrology Group (ENV-WQH), and the National Nuclear Security Administration (NNSA) Service Center Analytical Management Program (AMP). In addition, our chemists wrote the NNSA Service Center's *Model Statement of Work for Analytical Laboratories*. The LANL Environmental Characterization and Remediation Group (ENV-ECR), LANL ENV-WQH, all SNL programs, and the Pantex Plant weapons facility have now adopted that document as the standard to govern analytical chemistry data acquisition and reporting. Other guidance documents developed by our staff include the NNSA Service Center AMP laboratory audit worksheet, the laboratory on-site DPA worksheet, and ancillary NNSA Service Center policies such as those governing vendor information sharing and payment reduction practices.

In addition, AQA staff members have participated in developing and reviewing sample management documents for our clients. These include Quality Assurance Plans, sampling and analysis plans, records-management procedures, and other documents.

PROFESSIONAL TRAINING

The guidance documents written by AQA chemists are designed to enhance both the technical validity and the legal defensibility of chemical analysis data. In addition to providing guidance for analytical laboratories, we conduct seminars and other on-site training for client organizations that are responsible for environmental monitoring, restoration, and waste management. Seminar topics include inorganic, organic, and radionuclide analytical chemistry; data defensibility; sampling; SMO management; data management; and auditing.

EXPERT WITNESS AND LITIGATION SUPPORT

AQA's experience with legal defensibility issues is not limited to classroom instruction; we have three employees who have supported law firms in criminal and civil litigation. We also prepare targeted defensibility assessments for client organizations and can perform electronic audits of GC and GC/MS data.

III. STAFF QUALIFICATIONS

At AQA, we are very proud of our outstanding technical personnel who have consistently met the needs of our government and private industry clients. We fully understand the requirements and needs of federal programs and have been successful assisting a variety of clients with their data validation needs.

AQA project personnel are chosen based on their experience in the tasks required by the client. **All our data validators are experienced scientists**. Most are also expert report planners, writers, and evaluators.

The staff experience table on this page highlights the years of analytical chemistry, data validation, and auditing experience that many of our senior staff has accumulated. Following this table are resumes of key corporate personnel who lead AQA to provide quality, responsive services.

ANALYTICAL QUALITY ASSOCIATES, INC. **KEY PERSONNEL EXPERIENCE**		**General Organics**	**Inorganics / Gen Chemistry**	**Radiochemistry**	**Quality Assurance**	**DOE**	**DOD**	**EPA Functional Guidelines**	**DOECAP**	**NELAC**	**Other Govt.**
Key Staff	**Years' Experience**	**Laboratory Experience**				**Data Validation Experience**			**Auditing Experience**		
MARK MINTEER *President*	26		♦	♦	♦	♦	♦	♦		♦	♦
MARY DONIVAN *QA Mgr / Sr. Validator / PM*	34		♦		♦	♦	♦	♦			
NANCY CARPENTER *Sr. Validator / DOECAP Auditor*	29		♦		♦	♦	♦	♦	♦		
EYDA HERGENREDER *Sr. Validator*	36		♦			♦	♦	♦			
ELLEN MCENTEE *Sr. Validator / PM*	23	♦	♦	♦		♦	♦	♦			
JEANNE PETERSON *Sr. Validator / PM*	27	♦	♦			♦	♦	♦			

Mark Minteer
President, Analytical QA Specialist

Education
BS, Physics, Magna Cum Laude, Mesa State College, Grand Junction, CO, 1990

Registrations / Certifications / Affiliations

- American Chemical Society
- Society of Physics Students/Sigma Pi Sigma and National Physics Honor Society

President and Analytical QA Specialist, Analytical Quality Associates, Inc., Albuquerque, NM, 1999 – Present. In addition to supporting the NNSA Service Center AMP discussed in the sections below, Mr. Minteer provides technical support for analytical chemistry and related quality assurance to AQA's private industry clients and the DOE complex nationally. Mr. Minteer conducts seminars on technical and quality assurance topics related to environmental analytical chemistry, and he assists clients in communication with regulators and citizen groups.

Technical Support Lead, National Nuclear Security Administration Service Center Analytical Management Program, Albuquerque, NM, 1995 – Present. Mr. Minteer provides technical support to the NNSA Service Center AMP. In that capacity, he developed the NNSA Service Center AMP uniform analytical chemistry laboratory audit program and continues to lead laboratory audits as necessary. Mr. Minteer assists the NNSA Service Center AMP in technical assessments of NNSA Service Center facility SMO practices and procedures, and wrote the NNSA Service Center AMP policy statements for responsible laboratory performance information sharing and payment reduction practices. In addition, he has written a technically detailed companion handbook for the NNSA Service Center audit program. Mr. Minteer has also completed the NELAP training course "Tools for Detecting Improper, Unethical, and Illegal Laboratory Practices."

Expert Witness/Litigation Support, 09/1994-12/1994, 05/1996-02/1997, and 05/2003-07/2003. Mr. Minteer provided expert witness reviews and technical support in both criminal and civil cases for the following law firms and organizations:

Dolan and Domenici, P.C., Albuquerque, NM
Goldfarb, Sturman, and Averbach, Encino, CA
Sandia National Laboratories, Albuquerque, NM

Analytical QA Specialist, AGRA E&E (DOE contractor), Albuquerque, NM, 1991 - 1999. Mr. Minteer was the analytical chemistry/data management group leader and quality assurance specialist on the Uranium Mill Tailings Remedial Action (UMTRA) Project (6/91 to 5/96). Mr. Minteer provided technical direction to UMTRA Project subcontract analytical laboratories, administered the laboratory performance evaluation program, and had responsibility for all aspects of analytical data acquisition and management. He developed the UMTRA Project's subcontractor chemical analysis program and wrote a Statement of Work (SOW) that ensured technical and legal defensibility for project chemical analyses. In addition, Mr. Minteer developed the analytical laboratory audit program for the UMTRA Project and personally led the laboratory systems audits. Mr.

Minteer was also a contributing author for several UMTRA Project documents outside the analytical chemistry area, including the Quality Assurance Implementation Plan and Chemical Hygiene Plan.

Mr. Minteer subsequently provided analytical quality assurance and technical advisory services under contract directly to LANL, SNL, the Pantex Plant, and the NNSA Service Center. He was also a technical advisor to the NNSA Service Center AMP, a group that consolidates some aspects of NNSA Service Center analytical services and the associated technical and quality assurance oversight. In support of the AMP, Mr. Minteer was the primary author of a model SOW that details the technical, quality assurance, and reporting requirements for analytical chemistry, asbestos testing, and geotechnical testing. That SOW has been implemented essentially verbatim at SNL, LANL, and the Pantex Plant.

Mr. Minteer was also the Quality Assurance Manager for the Albuquerque office of AGRA E&E. In that capacity, Mr. Minteer assisted with the development of quality assurance plans for certain AGRA E&E client projects and provided quality assurance oversight for those projects. In addition, Mr. Minteer assisted AGRA E&E staff with technical support for projects involving analytical chemistry.

Analytical Chemist, DOE Grand Junction Projects Office Analytical Chemistry Laboratory, Grand Junction, CO, 1986 – 1991. Mr. Minteer has five years experience in the DOE Grand Junction Projects Office analytical chemistry laboratory, including four years managing the UMTRA quality control water sample project. Quality control activities outside the UMTRA project include control charting, aqueous and solid control sample preparation, and data quality assessment according to CLP requirements, SW-846, and Grand Junction Projects Office laboratory protocols for general inorganic chemistry and radiochemistry. Analytical techniques employed include various wet chemistry techniques, cold vapor AA, ICP-MS, and ICP-AES. He also performed asbestos analysis by phase contrast microscopy and silica analysis by X-ray diffraction.

Publications

Minteer, M.; Smith, K.; and Zietz, P. 1994. "Statistical Evaluation of Newly Acquired Environmental Chemical Analysis Data as a Validation Tool for the Uranium Mill Tailings Remedial Action (UMTRA) Project," *Technology and Programs for Radioactive Waste Management and Environmental Restoration,* Vol. 2, Proceedings of the Symposium on Waste Management, Tucson, AZ, February 27 - March 3, 1994, p. 1371 - 1377.

Minteer, M.; Winkler, P.; Wyatt; B.; Moreland, S.; Johnson, J.; and Winters, T. 2007. "Reliability of Using ^{238}U/^{235}U and ^{234}U/^{238}U Ratios from Alpha Spectrometry as Qualitative Indicators of Enriched Uranium Contamination." *Health Physics: The Radiation Safety Journal*, Volume 92 (5), pp 488-495. Philadelphia, PA: Lippincott Williams & Wilkins.

Winkler, P.; Minteer, M.; and Willey, J. 2004. "Analysis of Perchlorate in Water and Soil by Electrospray LC/MS/MS." *Analytical Chemistry*, Volume 76 (2), pp 469-473. Washington, D.C.: American Chemical Society.

Mary Donivan

Quality Assurance Manager / Project Manager / Senior Data Validator

Education
BS, Biology, Regis College, Denver, CO, 1977

Ms. Donivan has more than 30 years of diversified atomic spectroscopy experience and extensive knowledge of EPA SW-846 and CLP protocols, including over 10 years of data validation experience. Her experience includes the analysis of hazardous waste samples, brines and other difficult sample matrices.

Quality Assurance Manager/Sr. Data Validator, Analytical Quality Associates, Inc., Albuquerque, NM, 02/2004 – present.

Quality Assurance Manager. As Quality Assurance Manager, Ms. Donivan is responsible for providing quality assurance support to client organizations, including quality assurance document preparation, assessment of client processes and procedures, tracking performance trends for client organizations and their subcontract laboratories, and gap analysis of client organization procedures against external requirements. Ms. Donivan is also responsible for providing internal quality assurance support to management; ensures compliance with client contract requirements; manages internal quality documents and records; directs training of personnel; plans and executes internal audits; and reviews non-conformances, including disposition and corrective actions.

Senior Data Validator, Analytical Quality Associates, Inc., Albuquerque, NM, 02/2004 – Present. Ms. Donivan is responsible for performing validation of soil, sediment, and groundwater sample data for organic, inorganic, and radiological parameters. Her experience includes validation in support of the LANL WQH and ER projects, as well as the CH2M Hill SPRU, LANL CST, and Chanute AFB projects. Her responsibilities include producing data validation reports; performing peer reviews; and entering data. Ms. Donivan has also worked on special projects such as revising a selenium hydride procedure in order to maintain compliance with NPDES requirements.

Group Leader, Metals Analysis Group, Wastern, Inc., 1996 – 2002; Teledyne Brown Engineering, 2002 – 2003; under contract to the DOE Grand Junction Projects Office. Ms. Donivan was responsible for supervising and training other personnel within the inorganic analysis group; prioritizing work; reviewing all data produced by the group; operating and maintaining the ICP-AES, ICP-MS, and AA instrumentation for analysis of metals in soil, water, brine and air filter samples using EPA SW-846 and CLP procedures; writing and reviewing analytical procedures; and maintaining the inorganic standards inventory database.

Scientist, Rust Geotech, 1987 – 1996, under contract to the DOE Grand Junction Projects Office. Ms. Donivan was responsible for preparing, analyzing, and reporting environmental samples for inorganic analytes using flame AA, graphite furnace AA, hydride generation AA, ICP-AES, and ICP-MS in accordance with EPA SW-846 and CLP protocols; preparing quality control samples; method development; and reviewing technical procedures. In addition, Ms. Donivan gained experience in alpha spectrometry, wet chemistry, and field sampling.

Analyst, Bendix Field Engineering, 1985 – 1987, under contract to the DOE Grand Junction Projects Office. Ms. Donivan was responsible for analyzing environmental samples for inorganic analytes using flame AA, graphite furnace AA, hydride generation AA, ICP-AES and other techniques.

Laboratory Technician, UNOCAL Shale Oil Project, Parachute, CO, 1983 – 1984. Ms. Donivan was responsible for analyzing process and environmental monitoring waters, and hydrocarbon and oil shale samples using various techniques, including flame AA, GC, HPLC, Fischer Assay, ion-specific electrodes and wet chemistry.

Laboratory Technician, Occidental Oil Shale, Inc., Grand Junction, CO, 1978 – 1983. Ms. Donivan was responsible for analyzing process and environmental monitoring water samples using various techniques, including standard methods of wet chemistry, ion chromatography, and bacteriology.

Jeanne Peterson

Project Manager / Senior Data Validator

Education

BS, Chemistry, Loyola Marymount University, Los Angeles, CA, 1985

Project Manager/Chemist/Senior Data Validator, Analytical Quality Associates, Inc., Albuquerque, NM, 05/2002 - Present. Ms. Peterson is responsible for managing multiple AQA projects and assisting other project managers, as well as performing validation of soil, sediment, biota, and groundwater sample data for organic, inorganic, and radiological parameters. Her responsibilities include preparing data validation procedures for non-routine analyses, including PCB Congeners and biological parameters. She also prepares and reviews validation worksheets and checklists.

Technical Writer/Editor II & III, Bechtel SAIC Company, LLC, Las Vegas, NV, 02/11/2001 – 08/2003; Science and Engineering Associates, Inc., 11/1998 – 2/12, 2001. Yucca Mountain Site Characterization Project, Las Vegas, NV. Ms. Peterson served as project leader as well as coordinating team effort, tracking work, guiding and checking work of co-workers, and assigning incoming editing work. She served as the point of contact for the group and represented the group at management-level meetings.

Organic Supervisor, LAS, Inc. (formerly Lockheed Analytical Services), Las Vegas, NV, 08/1997 – 06/1998. Ms. Peterson supervised approximately 30 employees, which included hiring, terminating, and vacation scheduling; providing technical guidance in all organic areas; and reviewing and providing input on proposals for prospective projects.

GC/MS Technical Lead, LAS, Inc. (formerly Lockheed Analytical Services), Las Vegas, NV, 01/1997 – 08/1997. Ms. Peterson was responsible for the GC/MS semivolatile organic group. She performed semivolatile organic analysis by GC/MS using SW846, CLP, and wastewater EPA protocols and supervised the work and schedules of other chemists.

Senior Scientist, LAS, Inc. (formerly Lockheed Analytical Services), Las Vegas, NV, 1992 – 1996. Ms. Peterson was responsible for semivolatile organic analysis by GC/MS using SW846, CLP, and wastewater EPA protocols. Other responsibilities included task lead for special projects, data review, training of personnel, and sample load management.

GC/MS Group Leader, Del Mar Analytical, Irvine, CA, April 1991 to September 1992. Ms. Peterson was responsible for overseeing the work of three analysts, including data review and volatiles and semivolatiles analysis by EPA methods. She also conducted annual personnel evaluations of analysts within the group.

GC/MS Group/Chemist II, General Chemistry/Chemist II, GC Group/Chemist I, IT Corporation Analytical Services, Cerritos, CA, 1985 – 1991. Ms. Peterson was responsible for the preparation, analysis, and data reporting of solid and liquid environmental samples using various instruments, including GC/MS, IC, HPLC and GC, according to EPA, SW846, and NIOSH methods, as well as various wet chemistry methods.

IV. PROJECT EXPERIENCE

AQA provides ongoing analytical chemistry technical support to major customers such as Los Alamos National Laboratory (LANL), Sandia National Laboratory, the Pantex Plant weapons facility, and the Pueblo of Jemez. Our support functions include formal data validation, day-to-day assistance with analytical chemistry issues, review of the laboratory deliverables, various performance assessment activities, laboratory corrective action tracking, training seminars for Sample Management Office personnel, and desk audits where the desired services are outside the mainstream products of current contract laboratories.

AQA's chemists also routinely evaluate or develop new methods and techniques, assist with efficacy demonstrations, and update the various guidance documents as appropriate. In this way, we help our clients obtain the best and most cost-effective analytical services available under currently accepted guidelines.

AQA staff expertise enables us to identify and develop resolutions to our clients' environmental data reporting concerns. Here are a few examples of how we assisted our customers to solve and eliminate difficult problems and to achieve quality data:

<u>DDT False Positive Results in a Deep Groundwater Aquifer</u>
AQA examined analytical process data and determined the DDT source was preparation contamination. AQA worked with the laboratory to develop cleaning and segregation practices that eliminated the contamination.

<u>Selenium False Positive Results in NPDES Outfall</u>
Client suspected false detections of selenium in regulated wastewater samples. AQA examined the available methodologies and the outfall matrix to determine the appropriate analytical method. Performing analysis by gaseous hydride atomic absorption instead of inductively coupled plasma emission or mass spectrometry provided accurate results and eliminated false positives.

<u>Highly Enriched Uranium (HEU) Study</u>
Concerned citizens groups alleged that several DOE sites were releasing HEU to the environment. AQA developed and proved a theory that demonstrated the DOE sites were not releasing HEU. This has saved the DOE-AL sites thousands of dollars.

<u>Perchlorate in Groundwater</u>
The methodology in use provided false positive results for perchlorate. AQA participated in the development of a method to accurately quantitate perchlorate at sub ppb levels. The development of this method allowed our client to eliminate false positives and increase the reliability of perchlorate results.

A summary of AQA's projects is provided on the following page. AQA project experience includes long term support of government sample management offices as well as support of numerous clients performing on remediation projects and commercial clients. This table highlights our range of client services and our capabilities. AQA has provided services to meet the requirements of a number of regulators as demonstrated in the final section of this table.

Representative Project Experience

Client / Project Site	Dates	Services					Capabilities				Regulators					
		DATA VALIDATION	AUDITS / ASSESSMENTS	QUALITY DOCUMENTATION	TRAINING	PROFESSIONAL SUPPORT	ORGANICS	INORGANICS	RADIOCHEMISTRY	SPECIALTY METHODS*	AFCEE	US NAVY	US ARMY	US DOE / NNSA	US EPA	CITY / COUNTY / STATE
Sandia National Laboratories	Dec 1999 - Present	▲	▲	▲	▲	▲	▲	▲	▲	▲				▲		
Los Alamos National Security	Jul 2000 - Sep 2013	▲	▲	▲	▲	▲	▲	▲	▲	▲				▲		
Consolidated Nuclear Security, LLC	Jan 2001 - Present	▲	▲	▲	▲	▲	▲	▲	▲	▲				▲		
Booz Allen Hamilton / GEITA03 & GEITA05 / REPA4 Northern Indiana Public Service Facility, Chesterton, IN	Aug 2003 - Sep 2012	▲					▲	▲			▲				▲	
CH2M-WG Idaho, Idaho National Laboratory	Nov 2009 - Present	▲					▲	▲	▲					▲		
U.S. Geological Survey	July 2005 – Nov 2009	▲					▲	▲		▲						
CH2M Hill Plateau Remediation Company (CHPRC) / Hanford Site, WA	Jun 2006 - Present	▲				▲	▲	▲	▲					▲		
Navarro-Intera, LLC Nevada Test Site, NV	Jul 2006 – Oct 2017t	▲				▲	▲	▲	▲					▲		
U.S. Army Public Health Command/Army Institute of Public Health	Jun 2011 - Jan 2015	▲					▲	▲					▲			
Science Applications International Corp. (SAIC) / Multiple Sites**	Jul 2007 - Dec 2010	▲				▲	▲	▲		▲	▲		▲			
KEMRON Environmental Services / Multiple Sites***	Jul 2007 - Present	▲				▲	▲	▲					▲		▲	
Clark County Water Reclamation District, NV	Dec 2008		▲													▲
Rule Engineering / Wyoming Refinery Company	Jul 2008 - Feb 2012	▲				▲	▲	▲							▲	▲
AMEC Earth & Environmental / Alameda Point Naval Station, CA	Jan 2009 - Dec 2012	▲										▲				
Cabrera Services, Inc. / Long Beach Naval Complex, CA	Mar 2009 - Jul 2009	▲							▲			▲				

*Dioxins/Furans, PCB Congeners, Perchlorate and High Explosives by LC/MS/MS

**Fort Monroe, VA; Charles E. Kelly Support Facility, PA; Former Greenville AFB, MS; Tinker AFB, OK; Newport Chemical Depot, IN; Naval Air Facility, El Centro, CA (Department of Justice); Camp Grant Rifle Range, New Milford, IL

***Red River Army Depot, TX; Former ARMCO Hamilton Plant Site, OH (EPA); Fort Meade, MD; U.S. Army Reserve Center Pier 23, Tacoma, WA; AK Steel Middletown Works, OH (EPA)

V. CONTACT US

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