WHITE PLAINS FIRE DEPARTMENT DRILL SCHOOL

1402 ORCHARD STREET, WHITE PLAINS, NEW YORK

Site Characterization Work Plan

NYSDEC Site #: 360193
AKRF Project Number: 200217

Prepared for:

The City of White Plains
255 Main Street
White Plains, New York 10601

Prepared by:

AKRF, Inc.
34 South Broadway, Suite 401
White Plains, New York 10601

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CERTIFICATION

I, Marc S. Godick, QEP, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Site Characterization Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Marc S. Godick, LEP		12/24/2020
Name	Signature	Date

1.0 INTRODUCTION

This Site Characterization Work Plan (SCWP) has been prepared by AKRF, Inc. (AKRF) on behalf of The City of White Plains (The City) for the property located at 1402 Old Orchard Street, White Plains, New York (the Site). The legal definition of the Site is City of White Plains Tax ID 120.20-17-1, and the property class is identified as Public Services-Water Supply. The Site is approximately 141 acres, mainly wooded with small streams, and contains the White Plains Fire Department Drill School (FDDS). The FDDS is situated within a 4-acre clearing that is located approximately 500 feet east of White Plains Reservoir #2. The Orchard Street Pump Station (OSPS) property and its facilities, also owned and operated by The City, are located within the western portion of the Site boundary, and south-adjacent to Reservoir #1. Although indicated as separate lots, these lots are included under the same Tax ID number. A Site Location Map is provided as Figure 1, and a Site and Surrounding Properties Plan is provided as Figure 2.

The OSPS property includes four cistern wells approximately 30-feet diameter and 30-feet deep that serve as potable water supply wells for the OSPS. The reservoirs and the cistern wells were used as supplies for drinking water for the City until 2005 and 2006, respectively. The in-city water supplies, (the reservoirs and the shallow wells) are not currently being used due to the microfiltration plant not being operable and the wells found to be under direct influence of surface water requiring additional treatment. The City now purchases all its drinking water from New York City's water supply system. To provide redundancy to the City's primary water supply, the City began to explore the option of a new water treatment plant for the reservoir and well supplies to serve as a redundant supply to the purchased New York City water. As part of the project, water quality sampling was initiated to confirm the water quality and since the water supplies had not been in service, sampling for additional parameters on the Unregulated Contaminant Monitoring Rule were also performed. Samples taken from Reservoirs 1 and 2 in September 2018 showed detection per- and polyfluoralkyl substances (PFAS). The laboratory results indicated that additional investigation was need to address the presence of the PFAS compounds.

Between April and July 2019, The City voluntarily conducted two additional phases of investigation in an effort to determine the source of the PFAS in the reservoirs and groundwater at the OSPS site. The investigation included the collection of groundwater and surface water samples from the OSPS site and the surrounding Reservoir #2 and FDDS property. The results of the investigation indicated that the FDDS was a potential source for the PFAS contamination.

On September 26, 2019, the City met the New York State Department of Environmental Conservation (NYSDEC) to discuss the water withdrawal permit for the in-city water supplies and voluntarily reported the results of the PFAS investigation. The NYSDEC sent a letter to the City on December 4, 2019 identifying the Site as a potential hazardous waste site ("P" site), and a determination was necessary to determine whether hazardous waste had been disposed on the property. The letter indicated that the City could carry out an investigation under a legal agreement with NYSDEC in accordance with subdivision 27-1305(2)(a) of the Environmental Conservation Law (ECL). The City elected to conduct the necessary investigation, and entered in an Order of Consent (CO) between NYSDEC and the City was effective October 1, 2020.

On June 26, 2020, representatives of the City and AKRF Inc. (AKRF) conducted an inspection of the Site in advance of preparing this Site Characterization Work Plan (SCWP). This SCWP describes the procedures to be used to during the field investigation to further define the nature and extent of the identified PFAS plume and determine whether hazardous waste is present at the Site, and if present, whether the waste poses a significant threat to public health or the environment. All investigation work will be completed in accordance with this SCWP, which includes a Quality Assurance Project Plan (QAPP) (Appendix A) and a Health and Safety Plan and Community Air Monitoring Plan (HASP and CAMP) (Appendix B). The Community Air Monitoring Plan (CAMP) detailed in the HASP will be implemented during all subsurface disturbance activities at the Site, including, but not limited to, soil boring advancement, soil, groundwater, sediment, and surface water sampling. CAMP data will be provided to NYSDEC and New York State Department of Health (NYSDOH) on a weekly basis. Any exceedances of CAMP action levels as well as correction measures taken will be reported to the Departments immediately (within 24 hours).

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description and Surrounding Land Use

The Site is comprised of approximately 141 acres of forested land located east-adjacent to Old Orchard Street and Reservoir #2 in North White Plains, New York. The only development within the Site consists of a four-acre clearing that contains several buildings as part of the FDDS. The FDDS area is mainly paved with grass covered areas present on the south side of the clearing. Access to the centrally located FDDS is gained by a paved driveway connected to Old Orchard Street. The site is bounded to the west by Orchard Street and then a City owned property that contains Reservoir #1 and Reservoir #2, to the north and northeast mainly by municipal land owned by the Town of North Castle with some residential properties, to the east by Silver Lake Park (owned by Westchester County) and residential properties, and to the south, southeast, and southwest by residential properties. Reservoir #2 is approximately 500 feet east of the FDDS. The Site includes the OSPS property and its facilities. A Site Plan is provided as Figure 2.

2.2 Site Geology, Hydrogeology, and Subsurface Characteristics

Based on reports compiled by the U.S. Geological Survey (White Plains, NY Quadrangle), the surface topography at the Site is a mix of gentle and steep slopes with several isolated rocky peaks that top out between 340 and 365 feet elevation (National Geodetic Vertical Datum of 1929 and an approximation of mean sea level). Several lower lying ravines are present between the rocky peaks and make up the intermittent streams within the Site. Although sloping can be varied due to the isolated peaks, the Site generally slopes down to the southwest to a low point at the OSPS property at approximately 240 feet elevation.

The sloping terrain across the Site is comprised mainly of exposed schist bedrock with minimal overburden coverage. The FDDS clearing (282 feet elevation) is located in a flatter section of the Site, and is surrounded to the north, east, and west by ridges that are higher in elevation than the clearing and range from approximately 288 to 360 feet elevation. The higher elevation ridges to the north, east, and south gently slope downward to the central portion of the FDDS clearing, and then downward to the southwest to an intermittent stream that is west-adjacent to the FDDS at 274 feet elevation. Thin isolated layers of overburden soils or fill are likely present in the gently sloping, asphalt and grass covered portion of the FDDS area, but the observable areas mainly consisted of exposed rock.

The intermittent stream runs from north to south below FDDS access driveway and empties into East Pond on the southwestern side of the Site. Ponding water was observed north of the FDDS access driveway, but at the time of inspection, the stream had no surface water flow between the access driveway and East Pond. The ponding water area north of the access driveway is shown as a large pond on published maps, but was observed to be more of a stream and wetland area that expands or reduces based on precipitation events. The other streams at the Site were similar in geology and lack of water flow, and also terminated into East Pond. City personnel indicated that precipitation events can quickly generate high flow stream conditions due to the steep terrain and minimal overburden. East Pond drains into Reservoir #2 through two culvert pipes below Old Orchard Street. Based on elevation data and surficial geomorphology, the intermittent stream that runs below the FDDS access driveway is the only Site stream that receives run-off from the FDDS clearing.

The small, flat area on the western side of the Site that lies between the East Pond and the OSPS marks the geologic transition to an overburden area that contain dam piezometers and cistern wells. A large low lying wetland area west of the OSPS is the likely discharge point for area groundwater and is also the settling area for surface flow that is released from Reservoir #2.

2.3 Site History

The fire department training center has been in operation at the Site since approximately 1960. Prior to 1960, the Site was used by the police department for training exercises. Fire department training included live fire training in several different scenarios. The burn building on the eastern side of the clearing allows for multi-floor, realistic live fire training in a scenario where heat and smoke filled rooms can be controlled for safety. Small training fires using vehicles, pallets, and furniture were also utilized to understand and anticipate the burn tendencies for many real fire response situations. The City reported that historical aqueous film-forming foam (AFFF) usage by the fire department for is as follows:

- Mid-1960s to mid-1970s: 3M AFFF
- Mid-1970s to 1998: used 3M AFFF&ATC
- 1998 to June 2014: used Angus AR-FFFP
- June 2014 to present: National Universal Gold AR-AFFF

AFFF was reported to be used sparingly during the training scenarios, due to the cost of using foam versus water, but it was used on occasion. Through interviews with City personnel, near empty barrels of foam and residual foam left in a pump truck after live fire response were reported to be cleaned out and discharged to the ground near the hydrant location on the Site, which is north adjacent to the access road and west adjacent to the stream the runs below the FDDS access driveway at the Site.

2.4 Reservoir/OSPS History

Reservoir 1 and Reservoir 2 were originally constructed in the early 1900s, and have a combined volume of nearly 200 million gallons. The reservoir water supply was initially treated in the 1980's via a 3 million gallon per day (mgd) microstrainer plant located at the OSPS. In the late 1990s, additional filtration was required and a 1.6 mgd microfiltration (MF) membrane plant was constructed at the OSPS. The MF plant operated from 1999 through 2005 until the membranes became fouled and damaged from iron and manganese precipitation, and the MG plant became too costly to operate. The reservoirs were removed as a water supply source for the City in 2005.

The four shallow cistern wells at the OSPS were constructed in the late 1800s to early 1900s. Three of the four cistern wells were used through 2005 as water supply sources without treatment as they produced generally high-quality water. The fourth well was not used due to lower quality water, attributed to its close proximity to the wetlands, and that pesticides were also detected as part of monitoring. Recent testing has documented that the pesticide contamination is no longer present in the fourth well. In 2006, a determination was made by consultants for the City that the cistern wells were groundwater under the direct influence (GWUDI) of surface water. The cistern wells were taken off-line since the City did not have a treatment measures to address GWUDI. The wells are currently permitted by Westchester County Department of Health to be used only for emergencies under the Permit to Operate a Public Water Supply.

Between 2007 and 2018, White Plains drilled three deep test wells located at the OSPS site as possible water supply wells at the OSPS. One of the wells was abandoned, and the necessary equipment (pumps, pipeline, and treatment) has not been installed in the remaining two deep wells. These wells have never been used for potable water supply.

With the reservoirs and cistern wells out of service, the water supply for White Plains comes from a sole source provided by purchasing water from New York City's water supply system through the Kensico-Bronx Pipeline. The pipeline is well over 100 years old. White Plains does not have any water source redundancy at this time. The cost includes excess demand charges during peak usage based on a per capita guideline that has resulted in excess demand charges being incurred up to 6 months out of the year.

In order to provide a much needed back up water supply source, and to avoid excess charges for usage, White Plains is in the process up constructing a new water treatment plant at the OSPS that is capable of treating the combined water from the reservoirs and the shallow wells. The two deep wells are included in the current Water Withdrawal Permit application, however, a treatment system is not being planned at this time as the water quality requires treatment technologies in addition to dissolved air floatation and filtration. The treatment plant for incoming water from the reservoirs and shallow cisterns will be designed to meet current and anticipated state and federal water quality regulations and goals as well as the guidelines set forth in the "Recommended Standards for Water Works" (Ten States Standards, 2018 edition), including planned structural intake upgrades for Reservoir #2.

2.5 PFAS History

PFAS are a group of more than 3,000 manufactured fluorinated organic chemicals that have been produced since the mid-1900s. The unique properties of PFAS (fluid repellency, temperature resistance, and non-stick surfaces) have been used in coatings for clothing, paper products, cookware, for the formulation of firefighting foam, and have been applied in many sectors, including the electronics, aviation, space, automotive, construction, and semiconductor industries. Polytetrafluoroethylene (PTFE) was the first to hit the market as Teflon® in the 1940s as non-stick coatings on pans. Between 1950 and 1960, perfluorooctanoate (PFOA) was developed for use as protective coatings, and perfluorooctane sulfonate (PFOS) was introduced and used as water resistant products and firefighter foam. In the 1980s, perfluorononanoic acid (PFNA) was introduced to the market for use as architectural resins, and fluorotelomers were used as an another option for firefighting foam. The fluorotelomer firefighting foam has been the predominant form of foam used in the 2000s.

Certain PFAS, including the long chain perfluoroalkyl acids (PFAAs), which include PFOA and PFOS, are very mobile, do not readily break down in the environment and bio-accumulate in people. The awareness of PFAS-related health effects has been rapidly evolving in recent years, and in 2016 the Environmental Protection Agency (EPA) issued a Lifetime Health Advisory (LHA) for PFOA and PFOS, and established 70 nanograms per liter (ng/l) or parts per trillion (ppt) for these compounds as the long term exposure criterion. PFOA and PFOS were the focus of PFAS regulation at the start since they were identified as the most widely detected in the environment. Due to emerging health and environmental concerns, there has been a reduction in the manufacturing and use of PFAAs, including PFOA and PFOS, which was phased out of production in the United States between 2002 and 2015.

Although PFAs are used in a wide array of industrial and consumer applications, class B fluorine-containing firefighting foams were often found in the environment due to the extensive need for firefighting support in towns and cities, as well as airports, military bases, refineries, and storage facilities. Firefighting foam includes aqueous film forming foam (AFFF), fluoroprotein (FP) and film forming fluoroprotein foam (FFFP). Even though the long chain PFOS foams were discontinued in 2001 and replaced by the fluorotelomer foams, the long shelf life has allowed for PFOS foams to remain in circulation long after they were discontinued.

Release mechanisms for firefighting foams to the environment have been documented to include low volume releases during storage, transfer, and equipment leakage, moderate discharge from testing, cleaning, and maintaining equipment, and high-volume discharge from fire training and active fire suppression.

In January 2016, New York became the first state in the nation to regulate PFOA as a hazardous substance followed by the regulation of PFOS in April 2016. The regulation requires the proper storage of the substances and limited releases to the environment, and enables the State to use its legal authority and resources of the State Superfund program to advance investigations and cleanups of impacted sites. The Final Rule for PFOA and PFOS became effective on March 3, 2017.

In January 2020, NYSDEC released guidance for sampling and analysis of PFAs compounds under their Part 375 remedial programs. The guidance was revised in February 2020 and was designed to ensure consistency in sampling, analysis, and reporting of PFAs investigations. This guidance was updated again in October 2020 and included preliminary Soil Cleanup Objectives (SCOs) for PFOA and PFOS.

In July 2020, the New York State Public Health and Health Planning Council adopted a health-based Maximum Contaminant Level (“MCL”) of 10 ppt for each of PFOA or PFOS, which was approved and adopted as new drinking water standards on August 26, 2020. Until NYSDEC establishes specific Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS, the PFAS Guidance states that the NYSDEC will determine on a case-by-case basis if PFAS-contaminated media will be subject to remediation.

2.6 Background/Previous Investigations

As reported above, fire suppression foam was used sparingly during training activities at the Site, and residual foam in barrels/pump truck that were remaining after live fire application were rinsed out and discharged to the ground at the hydrant located north adjacent to the access driveway for the Site. In September 2019, a Water Withdrawal Permit Application was submitted to NYSDEC for a new in-City water supply treatment facility at the OSPS that would use water from the adjacent reservoir and the cistern wells. Groundwater sampling conducted as part of the requirements of the withdrawal permit identified PFAS in both water directly from Reservoir 2 and the cistern wells.

In an effort to identify a source for the PFAS identified during permit sampling, Hazen and Sawyer conducted two phases of investigation on behalf of the City in April 2019 and July 2019. The investigation included the collection of surface water samples from a stream system that runs through the Site, East Pond, Reservoir #1 and Reservoir #2, and the wetland area north and west of the OSPS, and the collection of groundwater samples from dam piezometer wells along the southern edge of Reservoir #2, and the four cistern wells located on the OSPS property. The majority of the sample locations were repeated in July 2019 to obtain comparative results.

Appendix C includes figures prepared by Hazen that summarizes the results for both sampling events. In summary, the results were consistent between the April 2019 and July 2019 sampling events. The ranges of total PFAS that were detected are as follows.

- Reservoir #1 – 1.4 to 2.3 ppt
- Upstream of the FDDS – Not detected to 28.5 ppt
- Surface Water adjacent to the FDDS access driveway – 2,460 to 6,700 ppt
- Surface Water in East Pond – 17.2 to 62.8 ppt
- Surface Water in Reservoir #2 – 141 to 144 ppt
- Groundwater at DP-10 (between East Pond and the OSPS) - 111 ppt
- Dam Piezometers – 199 to 325 ppt

- Cistern Wells at the OSPS – 354 to 531 ppt

Based on the results of the investigations, the FDDS was identified as the potential source for PFAS contamination associated with East Pond, Reservoir #2, and the OSPS. As expected with fire suppression foam being the COC, PFOS was detected at a much higher ratio than PFOA (typically by one to two orders of magnitude), and made up a large component of the detected total PFAS concentration. The potential presence of other PFAS compounds will be evaluated as part of additional investigation.

On September 26, 2019, representatives of the City and NYSDEC attended a meeting to discuss the requirements of the water withdrawal permit, and used that opportunity to voluntarily report the results of the PFAS investigation conducted in April and July 2019. The NYSDEC sent a letter to the City on December 4, 2019 identifying the Site as a potential hazardous waste site ("P" site), and a determination was necessary to determine whether hazardous waste had been disposed on the property. The letter indicated that the City could carry out an investigation under a legal agreement with NYSDEC in accordance with subdivision 27-1305(2)(a) of the ECL. On June 26, 2020, representatives of the City and AKRF conducted an inspection of the Site, reviewed the local geology, information related to firefighter training, site activities, materials used, and begin the process of scoping the work outlined in this SCWP in accordance with the CO. The CO between NYSDEC and the City was executed on October 1, 2020.

2.7 Conceptual Site Model

Two potential release mechanisms have been identified at the Site. The first includes the direct discharge of fire suppression foam to the asphalt surface surrounding the burn building and small fire locations during firefighter training. The second includes the reported cleanout out of residual foam that was left over in barrels and the pump truck after fighting live fires. The cleanout took place at the hydrant location north-adjacent to the access driveway to the Site and west-adjacent to the culvert for the stream that runs beneath the access driveway. The rinsed material was reported to be discharged directly to the ground.

Fire suppression foam applied at the Site burn building and on the asphalt surface during training exercises would collect on the asphalt surface and flow downgradient to a grass covered area on the southwestern side of the Site clearing prior to discharging into the stream that runs under the access driveway for the Site. The foam fluid could also infiltrate through cracks in the asphalt, contaminate the thin layer of soil beneath the asphalt, and migrate with infiltrating precipitation down slope (along the bedrock surface beneath the asphalt) toward the stream.

For the used barrel/pump truck cleanout, which took place at the hydrant location in the access driveway, the residual foam would discharge directly to the asphalt surface and flow into the stream that runs beneath the hydrant location.

Both release models converge in the stream just downgradient the access driveway, and flow approximately 450 feet on exposed bedrock or a thin layer of silt over bedrock to East Pond. Surface water from East Pond flows through two large diameter pipes directly into Reservoir #2, and overflow from Reservoir #2 discharges into the low lying wetland west-adjacent to the OSPS. Lateral flow is not expected from this stream channel as it is an topographical low point within exposed bedrock outcrops along each bank.

The land area west-adjacent to East Pond appears to be the on-Site location where enough overburden is present to allow for the existence of an overburden aquifer. Any discharge from the East Pond overburden groundwater would flow west beneath the OSPS to the low lying wetland.

Surface water flow in the intermittent stream between the access driveway and East Pond is in contact with the bedrock surface, or just above the bedrock surface with minimal sediment coverage. Contaminated surface water could infiltrate into any exposed fractures and migrate downward through interconnected fractures and into the bedrock aquifer.

The affected media include any overburden soil in the vicinity of the burn house, soil beneath the asphalt surface in the on-Site clearing, and soil in the grass covered area on the southwestern side of the clearing. Surface water would be affected in the stream located west-adjacent to the site, in East Pond, Reservoir #2, and the wetland west adjacent to the OSPS. Overburden groundwater is not expected to be encountered near the on-Site clearing, but will likely be encountered where the stream reaches East Pond, where groundwater could be affected by an on-Site release from East Pond, through the OSPS, and into the wetland west-adjacent to the OSPS. Bedrock groundwater would be affected by infiltrating surface water from the intermittent stream. It is anticipated that the findings of the investigation would be used to determine if and where an investigation into the bedrock aquifer would be necessary. The conceptual site model will be further developed/refined pending further site investigation.

3.0 FIELD PROGRAM

The Site Characterization (SC) field program is proposed to include the collection of soil, sediment, surface water, and groundwater samples to define the nature and extent of the PFAS source area and resulting contamination plume and determine if hazardous waste is present at the Site, and if present, whether that waste poses a significant threat to public health or the environment. Additionally, the SC will include a preliminary evaluation of groundwater flow and on-Site geologic conditions, determining what contaminants are present in Site media, and fulfilling the Site characterization requirements identified in DER-10. The data collected during the field program will be use to assist with determining the appropriate remedial action, if necessary.

3.1 Field Program Summary

The field sampling scope of work consists of: advancement of soil borings for the collection of soil samples, the collection of co-located stream sediment and surface water samples, and the collection of groundwater samples. Additional surface (0’’-2’’) and near surface (2’’-12’’) samples will be collected at up to six (6) soil boring locations. Surface soil samples (0’’-2’’) will also be collected at the proposed soil boring locations at the FDDS where asphalt cover is not present, beyond the allocated six (6) samples. The proposed sample locations are shown on Figure 4.

The rationale for the proposed sample locations is as follows:

Sample ID	Location	Rationale
SB-1	Northeastern end of on-site clearing/asphalt area	Soil quality upgradient of the burn building and firefighting practice areas
SB-2	Southeastern end of on-site clearing/asphalt area	Soil quality upgradient of the burn building and firefighting practice areas
SB-3	Southwestern end of on-site clearing	Soil quality upgradient of the firefighting practice areas
SB-4	Central portion of on-site clearing/asphalt area	Soil quality downgradient of the burn building and firefighting practice areas
SB-5	Central portion of on-site clearing/asphalt area	Soil quality downgradient of the burn building and firefighting practice areas
SB-6	Central portion of on-site clearing/asphalt area	Soil quality downgradient of the burn building and firefighting practice areas
SB-7	Central portion of on-site clearing/asphalt area	Soil quality downgradient of the burn building and firefighting practice areas
SB-8	Central portion of on-site clearing/asphalt area	Soil quality downgradient of the burn building and firefighting practice areas
SB-9	Central portion of on-site clearing/asphalt area	Soil quality downgradient of the burn building and firefighting practice areas
SB-10	Grass covered area southwest of on-site clearing	Soil quality downgradient of the burn building and firefighting practice areas
SB-11	Grass covered area southwest of on-site clearing	Soil quality downgradient of the burn building and firefighting practice areas
SB-12	Access road west of on-site clearing	Soil quality at reported foam barrel/pump truck cleanout location
SB-13	Access road west of on-site clearing	Soil quality at reported foam barrel/pump truck cleanout location
SB-14	Access road west of on-site clearing	Soil quality at reported foam barrel/pump truck cleanout location
SB-15	Access road west of on-site clearing	Soil quality at reported foam barrel/pump truck cleanout location

Sample ID	Location	Rationale
SB-16	Between the asphalt area and adjacent stream, upgradient of the access road culvert.	Soil quality control point between asphalt clearing and adjacent stream that us upgradient of the firefighting practice areas.
SB-17	Between the asphalt area and adjacent stream, upgradient of the access road culvert.	Soil quality control point between asphalt clearing and adjacent stream that us upgradient of the firefighting practice areas.
SB-18/MW-1	West-adjacent to East Pond	Overburden soil and groundwater quality between East Pond and the OSPS
SB-19/MW-2	East-adjacent to East Pond	Overburden soil and groundwater east of East Pond
SB-20/MW-3	West-adjacent to East Pond	Overburden soil and groundwater quality between East Pond and the OSPS
SED/SW-1	Upgradient of access road culvert	Sediment and surface water quality upgradient of foam barrel/pump truck cleanout location
SED/SW-2	Adjacent to access road culvert	Sediment and surface water quality adjacent to foam barrel/pump truck cleanout location
SED/SW-3	Downgradient of access road culvert	Sediment and surface water quality downgradient of foam barrel/pump truck cleanout location
SED/SW-4	Downgradient of access road culvert	Sediment and surface water quality downgradient of foam barrel/pump truck cleanout location
SED/SW-5	Downgradient of access road culvert	Sediment and surface water quality downgradient of foam barrel/pump truck cleanout location
SED/SW-6	Downgradient of access road culvert	Sediment and surface water quality downgradient of foam barrel/pump truck cleanout location
SED/SW-7	Downgradient of access road culvert	Sediment and surface water quality at East Pond discharge point
SED/SW-8	East Pond	Surface water quality in East Pond
SED/SW-9	East Pond	Surface water quality in East Pond
SED/SW-10	Reservoir #2	Surface water quality in Reservoir #2 at discharge point from East Pond
SED/SW-11	Reservoir #2	Surface water quality in Reservoir #2 at discharge point from East Pond
SED/SW-12	Reservoir #2	Surface water quality in Reservoir #2
DP-2	Existing piezometer at southwest dam border	Groundwater quality between Reservoir #2 and the OSPS
DP-5	Existing piezometer at southwest dam border	Groundwater quality between Reservoir #2 and the OSPS
DP-8	Existing piezometer at southwest dam border	Groundwater quality between Reservoir #2 and the OSPS
DP-10	Existing piezometer between East Pond and the OSPS	Groundwater quality between east pond and the OSPS

Sample ID	Location	Rationale
CW-1	Existing Cistern Well #1 at the OSPS	Groundwater quality at the OSPS
CW-2	Existing Cistern Well #2 at the OSPS	Groundwater quality at the OSPS
CW-3	Existing Cistern Well #3 at the OSPS	Groundwater quality at the OSPS
CW-4	Existing Cistern Well #4 at the OSPS	Groundwater quality at the OSPS

The HASP and CAMP will be implemented during all subsurface disturbance activities included in the field program to be performed at the Site and off-site. CAMP data will be provided to the NYSDEC and NYSDOH on a weekly basis. Any exceedances of CAMP action levels as well as correction measures taken will be reported to the Departments immediately (within 24 hours). The HASP and CAMP are included as Appendix B.

3.2 Sample Handling and Laboratory Reporting

The procedures and guidelines for sample collection are included in the QAPP located in Appendix A. The sampling guidelines are consistent with and have been prepared to meet the revised NYSDEC Guidelines for *Sampling, Analysis, and Assessment of PFAS* (October 2020), which is included in the QAPP for reference. Each sample slated for laboratory analysis will be labeled and placed in laboratory-supplied containers and shipped to the laboratory via courier with appropriate chain of custody documentation in accordance with appropriate EPA protocols to Eurofins TestAmerica in Edison, New Jersey, a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory. The samples designated for PFAS analysis will then be shipped to Eurofins TestAmerica in South Burlington, Vermont, a NYSDOH ELAP-certified laboratory (for PFAS analysis). Each laboratory report will be prepared using Category B deliverables with electronic data deliverables (EDDs) in the latest NYSDEC format. A standard turnaround time will be requested from the laboratory.

Aqueous and solid samples analyzed for 1,4-Dioxane will have reporting limits no higher than 0.35 (micrograms per liter) ug/L and 0.1 milligrams per kilogram (mg/kg), respectively. Likewise, reporting limits for PFOA and PFOS in aqueous and solid samples will be no higher than 2 nanograms per liter (ng/L) and 0.5 micrograms per kilogram (ug/kg), respectively.

3.3 Soil Sampling

A direct-push drill rig with augering capabilities will be used to advance the soil borings SB-1 through SB-20. Soil cores will be collected using stainless steel macrocore piston rod samplers fitted with an internal acetate liner. Soil samples will be inspected by AKRF field personnel for evidence of contamination (e.g., odors, staining), screened for the presence of volatile organics with a photoionization detector (PID) equipped with a 10.6 electron volt (eV) lamp, and logged using the Unified Soil Classification System (USCS). AKRF field personnel will record and document subsurface conditions. The PID will be calibrated in accordance with manufacturer's recommendations prior to sampling.

One soil sample will be collected from each soil boring from the interval that exhibits the most evidence (i.e., PID readings, odors, staining) of contamination. In the absence of contamination, the sample will be collected from the depth zone most likely to contain contamination. Specifically, a shallow soil sample would be collected for laboratory analysis at locations where a surface release is the likely release mechanism (SB-1 through SB-15), whereas a soil sample will be collected at the soil/water interface for locations further downgradient (SB-16 through SB-20). A select set of soil borings (up to six locations) will also include two supplemental surficial samples, including one soil sample for the 0 to 2 inch depth interval (beneath the vegetative layer) and one soil sample from the 2 to 12 inch depth interval. Surface soil samples (0''-2'') will also be collected at the proposed soil boring locations at the FDDS where asphalt cover is not present, beyond the allocated six (6) samples. Additional samples would be collected for laboratory analysis if field observations (e.g., odor, staining, and/or PID readings indicate it is warranted. All sampling equipment (e.g., drilling rods and casing, macro core samplers and probe rods) will be either dedicated or decontaminated between sampling locations.

The samples will be analyzed for emerging contaminants [(1,4-dioxane using EPA Method 8270 by selective ion monitoring (SIM), and the standard list of 21 PFAS compounds using EPA Method 537 (modified)]. A total of 20% of the soil samples will also be analyzed for leachable PFAS by the synthetic precipitation leaching procedure (SPLP), soil pH, clay content, total organic carbon (TOC) and cation exchange capacity. Additional analysis for soil samples collected from SB-1 through SB-4 and SB-11 through SB-14 will include the NYSDEC Part 375 list for volatile organic compounds (VOCs) using EPA Method 8260, semivolatile organic compounds (SVOCs) using EPA Method 8270, polychlorinated biphenyls (PCBs) using EPA Method 8082, pesticides using EPA Method 8081, and metals including mercury and cyanide using Methods 6010/7470/7471.

After the soil boring drilling is complete, soil borings will be filled with hydrated bentonite and patched with to match existing surface conditions. Each soil boring location will be surveyed by a licensed surveyor and incorporated into the existing site map. All investigation derived waste (IDW) associated with drilling soil borings will be managed as described in Section 3.9.

3.4 Sediment/Surface Water Sampling

AKRF field personnel will conduct a field inspection of the intermittent stream that runs from north to south below FDDS access driveway and empties into East Pond on the southwestern side of the Site. Ponding water was observed north of the FDDS access driveway during the June 26, 2020 site visit, but the stream had no surface water flow between the access driveway and East Pond. AKRF will coordinate the inspection to occur after a rain event. Sediment from the bottom of the intermittent stream and a co-located surface water samples will be collected from a location that is upgradient of the access driveway (SED/SW-1), adjacent to the access driveway (SED/SW-2) and at five locations downgradient of the access driveway (SED/SW-3 to SED/SW-7). The sediment samples will be collected with a stainless steel spoon, trowel, or hand auger, and the surface water samplings will be collected with a stainless steel cup. The specific sampling locations will be determined after conducting the field inspection, but will include a distribution that provides for property characterization of the assumed PFAS source area. Two surface water and sediment samples (SED/SW-8 and SED/SW-9) will be collected from East Pond, the discharge point of the intermittent stream, and three surface water and sediment samples (SED/SW-10 through SED/SW-12) will be collected from Reservoir #2. The SED/SW-10 and SED/SW-11 samples will be collected at the culvert pipes that discharge water from East Pond into the reservoir, and SED/SW-12 will be collected from the southwest border of Reservoir #2 at the discharge point to the OSPS property. The samples will be analyzed for emerging contaminants [(1,4-dioxane using EPA Method 8270 SIM, and the standard list of 21 PFAS compounds by EPA Method 537 (modified)], leachable PFAS by SPLP, pH, clay content, TOC, and cation exchange capacity. A total of 20% of the sediment/surface water samples will also be sampled for the NYSDEC Part 375 list for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, PCBs using EPA Method 8082, pesticides using EPA Method 8081, and Target Analyte List (TAL) metals including mercury and cyanide using Methods 6010/7470/7471. The samples designated for additional analysis will be selected in the field based on field screening and logging results.

3.5 Monitoring Well Installation and Well Development

The area west of East Pond is where surficial geology was observed to level off and transition to an area where overburden is expected to be present. This area includes a distribution of dam piezometers (DP-2, DP-5, and DP-8) along Reservoir Road and Old Orchard Street, a dam piezometer west-adjacent to East Pond (DP-10), and cistern wells (CW-1 to CW-4) at the OSPS. These piezometers were sampled as part of the initial investigation completed by Hazen in May and July of 2019, and will be sampled again as part of this investigation. The existing piezometers will be inspected and the depth to water and total depth will be measured to obtain initial data and to determine whether a well screen was installed. A piezometer by definition only has an open bottom of the casing (no well screen), and a determination will be made as to whether each can be used for sampling (as a monitoring well) or limited to gauging in determining groundwater elevations/flow parameters. If the piezometers are not suitable for sampling, then additional replacement monitoring wells will be installed.

Three monitoring wells, MW-1, MW-2, and MW-3, are proposed to be installed in soil borings SB-18, SB-19, and SB-20 respectively, to provide for additional groundwater delineation between East Pond and the OSPS. If additional areas containing saturated overburden are encountered during the investigation, especially in the upgradient area of the fire training center, or if any current piezometers need to be replaced, then additional monitoring wells will be installed. Well installation will include the advancement augers via the direct push unit for the purpose of installing a 2-inch PVC well. The wells will be installed with 10 feet of well screen to a depth of 7 feet into the water table. Morie sand will be backfill around each well screen to a depth of 2 feet above the screen. A bentonite seal will be placed above the sand pack for each well, and the remaining borehole will be filled with bentonite grout. Each monitoring well will be completed using locking gate boxes, flush with grade or stick-up (pending location), and will be developed by pumping until clear, if practicable. The location and elevation of each new monitoring well will be surveyed by a licensed surveyor.

3.6 Groundwater Sampling

Groundwater samples will be collected from existing and any newly installed monitoring wells. Prior to sampling, the depth to water will be measured in each existing on-site and off-site well with a multi-phase interface meter. Groundwater samples will be collected from reach well using low-flow sampling techniques. The groundwater sampling will include analysis for emerging contaminants (1,4-dioxane and PFAS), and sample collection will be conducted in accordance with the prevailing NYSDEC protocols. The QAPP included in Appendix A includes detailed protocols that will be followed for emerging contaminant sample collection, including acceptable materials for equipment and personal protective equipment.

The purge water will be monitored for turbidity and water quality indicators (i.e., pH, dissolved oxygen, oxidation-reduction potential, temperature, and specific conductivity) with measurements collected approximately every five minutes. The criteria for stabilization will be three successive readings within ±10% for pH, temperature, and specific conductivity. Each sample will be analyzed for emerging contaminants [(1,4-dioxane using EPA Method 8270 SIM, and the standard list of 21 PFAS compounds by EPA Method 537 (modified)]. A total of 20% of the groundwater samples will also be sampled for the NYSDEC Part 375 list for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, PCBs using EPA Method 8082, pesticides using EPA Method 8081, and TAL metals including mercury and cyanide using Methods 6010/7470/7471. The laboratory report will be prepared using Category B deliverables and EDDs in the latest NYSDEC format.

3.7 Quality Assurance / Quality Control (QA/QC)

Additional analysis will be included for quality control measures, as required by the Category B sampling techniques. The QA/QC samples for soil and groundwater will include one field blank, one trip blank, one MS/MSD, and one blind duplicate sample at a frequency of one sample per 20 field samples per media. The field blank, blind duplicate, and MS/MSD samples will be analyzed for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, PCBs by EPA Method 8082, pesticides by EPA Method 8081, and metals including mercury and cyanide by Methods 6010/7470/7471, and emerging contaminants [(1,4-dioxane using EPA Method 8270 SIM, and the standard list of 21 PFAS compounds by EPA Method 537 (modified)]. MS/MSD and duplicate samples will be collected at locations for each media where emerging contaminants and TAL/TCL analyses are slated for analysis (as indicated in the QAPP). Field blanks will be collected at a frequency of one field blank per day for each applicable matrix (surface water and groundwater). These samples will be obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers. The QAPP describes the QA/QC protocols and procedures that will be followed during implementation of the SCWP. The QAPP is included as Appendix A. The data will be reviewed by a third-party validator and a Data Usability Summary Report (DUSR) will be prepared to document the usability and validity of the data.

3.8 Decontamination Procedures

All non-dedicated sampling equipment (e.g., submersible/peristaltic pumps and oil/water interface probe) will be decontaminated between sampling locations using the following procedure:

1. Scrub equipment with a bristle brush using a PFC-free water/Simple Green® solution.
2. Rinse with PFC-free water.
3. Scrub again with a bristle brush using a PFC-free water/Simple Green® solution.
4. Rinse with PFC-free water.
5. Rinse with distilled water.
6. Air-dry the equipment.

AKRF will provide documentation that the source of distilled water and the detergent (Simple Green® or alternate) being used for decontamination purposes are PFAS –free prior to the start of work.

3.9 Management of Investigation-Derived Waste (IDW)

Soil cuttings generated by the drilling of soil borings, purge water generated by well development and low flow sampling, will be containerized in properly labeled Department of Transportation (DOT)-approved 55-gallon drums for future off-site disposal at a permitted facility. The drums will be sealed at the end of each work day and labeled with the date, the well or boring number(s), the type of waste (i.e., drill cuttings, decontamination fluids, or purge water) and the name of an AKRF point-of-contact. All drums will be labeled "pending analysis" until laboratory data is available. All IDW will be disposed of or treated according to applicable local, state, and federal regulations. All boreholes will be filled with bentonite chips (hydrated) and restored to its original surface condition. Disposable sampling equipment, including spoons, gloves, bags, paper towels, etc. that come in contact with environmental media will be double bagged and disposed of as municipal trash in a facility trash dumpster as non-hazardous refuse.

4.0 REPORTING REQUIREMENTS

4.1 Site Characterization Report (SCR)

Upon completion of all field work and receipt of laboratory analytical results, a SCR will be prepared that will: document field activities, present field and laboratory data, and discuss conclusions and recommendations drawn from the results of the investigation in accordance with DER-10. Soil boring logs, monitoring well construction logs, well development logs, and DUSRs will be included in the final report. Electronic Data Deliverables (EDDs) will be submitted to NYSDEC.

4.1.1 Description of Field Activities

This section of the SCR will describe the field methods used to characterize the Site conditions, including: sampling techniques; field screening equipment; drilling equipment; monitoring well installation procedures (if needed); and management of IDW.

4.1.2 Soil Boring Assessment

The RSCR will include a section that presents field and laboratory data for soil results. The section will include a description of soil characteristics and figures will be provided that illustrate soil boring locations. Field and laboratory analytical results will be presented in the body of the report, summarized in tables and figures, and the detected concentrations will be compared to regulatory standards and/or guidance values. Soil boring logs and laboratory analytical reports will be provided as attachments.

4.1.3 Sediment and Surface Water Assessment

The SCR will include a section that presents field and laboratory data for the sediment and surface water samples. The section will include a description of sediment and surface water characteristics, and figures will be provided that illustrate their locations. Field and laboratory analytical results will be presented and compared with regulatory standards and/or guidance values, where applicable. Sediment and surface water sampling logs and laboratory analytical reports will be provided as attachments.

4.1.4 Groundwater Assessment

The SCR will include a section that presents field and laboratory data from the groundwater sampling. The section will include a description of groundwater characteristics, including water table elevation contours and estimation of inferred groundwater flow direction, and figures will be provided that illustrate the monitoring well locations. Field and laboratory analytical results will be presented and compared with regulatory standards and/or guidance values. Low-flow groundwater sampling logs and laboratory analytical reports will be provided as attachments.

5.0 SCHEDULE OF WORK

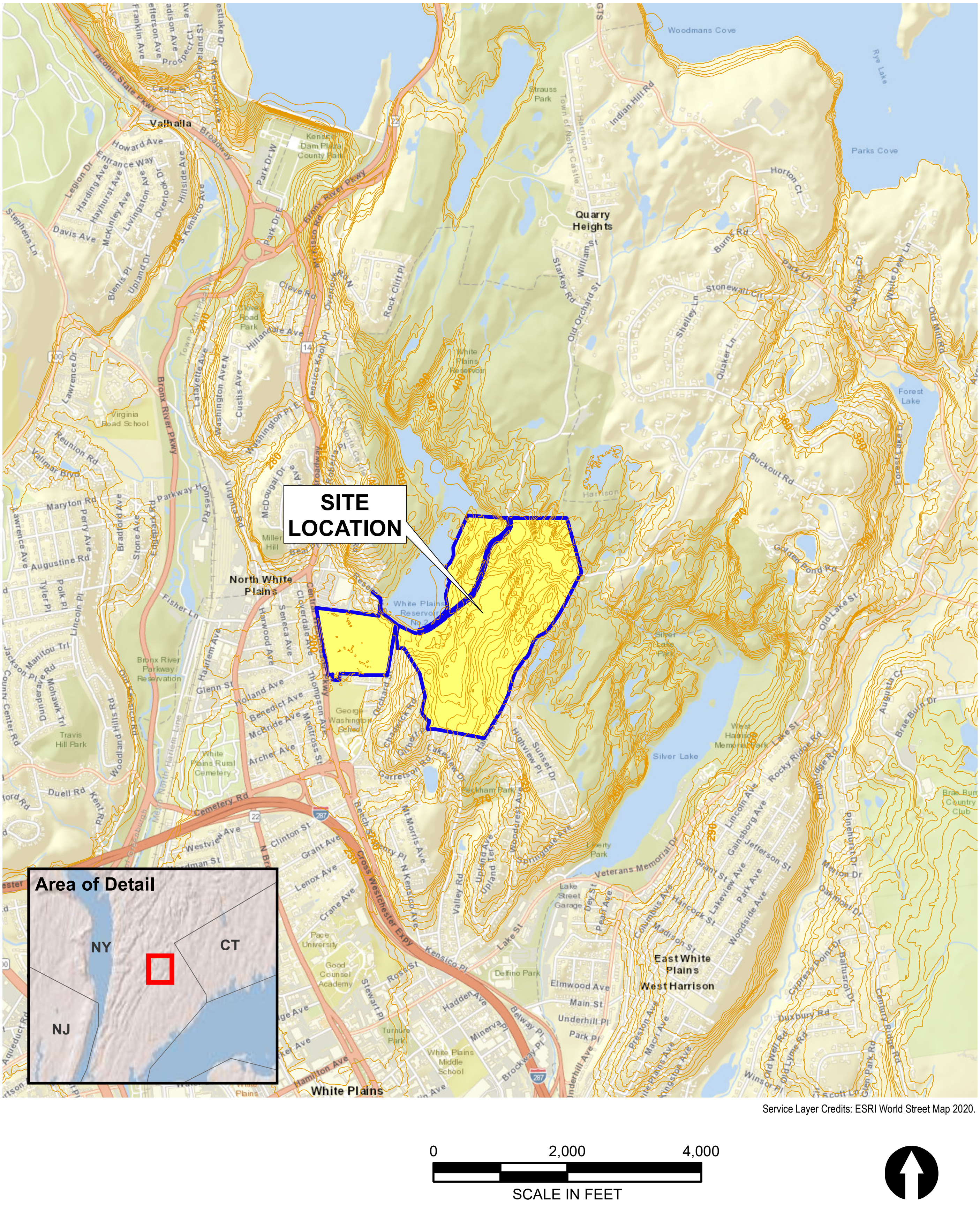
The following tentative schedule has been developed for the project. This schedule is subject to change, is weather dependent based on the need for the collection of surface water and sediment samples, and will be confirm in consultation with NYSDEC.

Activity	**Time To Complete**
Submittal of the Draft SCWP	December 2020
NYSDEC Review, and Submittal of the Final SCWP	December 2020
Site Characterization Field Work is Initiated	January 2020
Site Characterization Field Work is Completed	February 2020
Draft SCR Submitted to NYSDEC	April 2020
Final SCR Submitted to NYSDEC	May 2020
Initiate Remedy Phase	TBD – Based on SC Results

6.0 REFERENCES

1. Sampling, Analysis, and Assessment of PFAS, New York State Department of Environmental Conservation; October 2020.
2. History and Use of PFAS; prepared by the Interstate Technology Regulatory Council; March 2018.
3. PFAS Sampling Results Figures for April 2020 and July 2020, Hazen and Sawyer; July 2019.
4. Notification Letter for Potential Hazardous Waste Disposal Site; New York State Department of Environmental Conservation; December 4, 2019.
5. Water Withdrawal Permit Application for A New Water Withdrawal for Reservoirs and Wells at the Orchard Street Pump Station, The City of White Plains; prepared by Hazen and Sawyer; 2019.

FIGURES



Service Layer Credits: ESRI World Street Map 2020.

34 S. Broadway #401 White Plains, NY 10601

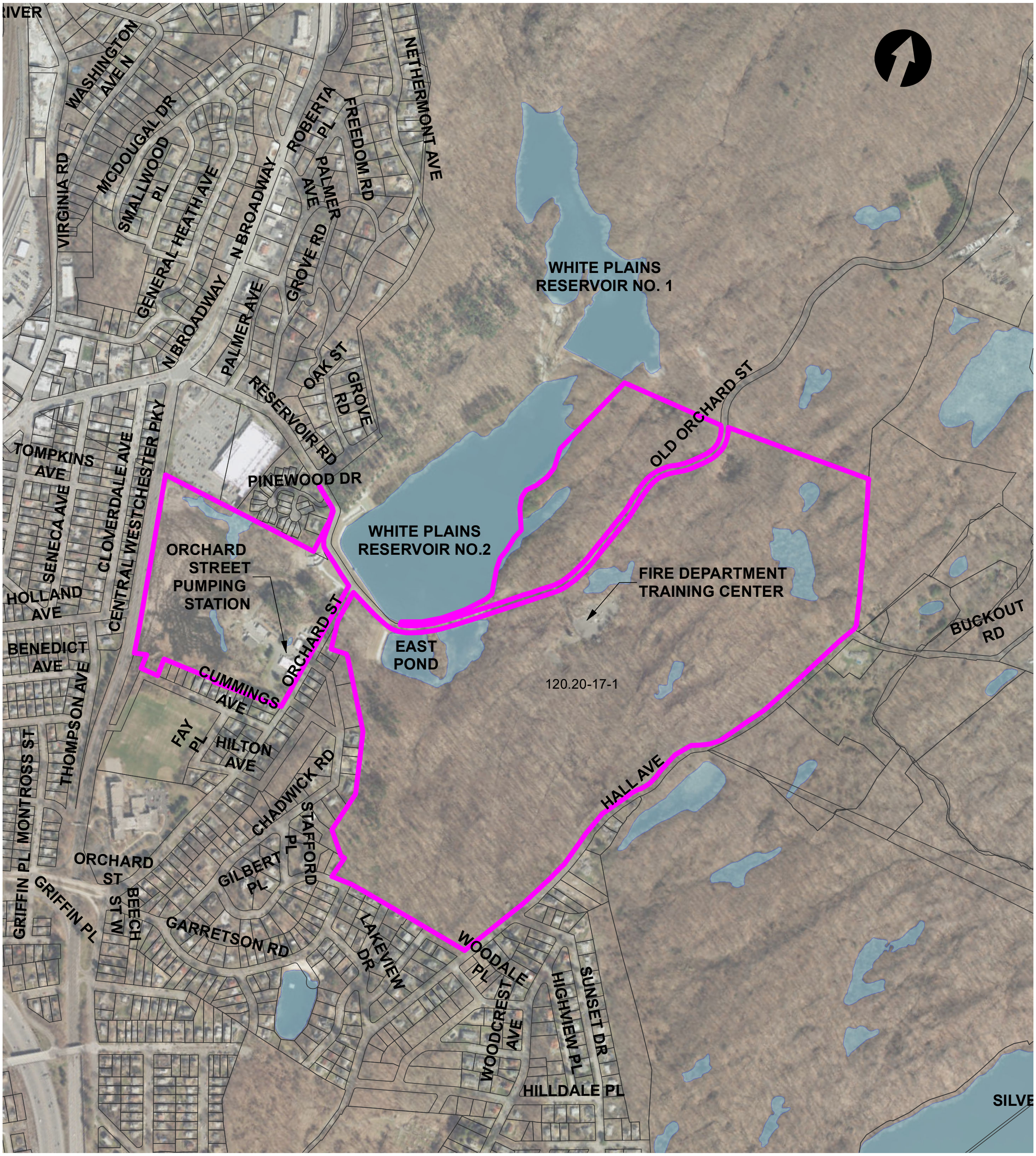
White Plains Fire Department Drill School

White Plains, New York

SITE LOCATION

DATE	PROJECT NO.	FIGURE
12/4/2020	200217	1

©2020 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\200217 Fig 1 Site Location Map.mxd12/4/2020 11:44:55 AM mveilleux



Aerial Source:
2020 ESRI Imagery.

LEGEND

▭ PROJECT SITE BOUNDARY

▭ TAX PARCEL

0 800 1,600
SCALE IN FEET

©2020 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\200217 Fig 2 Site and Surrounding Properties.mxd12/3/2020 8:43:00 AM mveilleux

AKRF
34 S. Broadway #401 White Plains, NY 10601

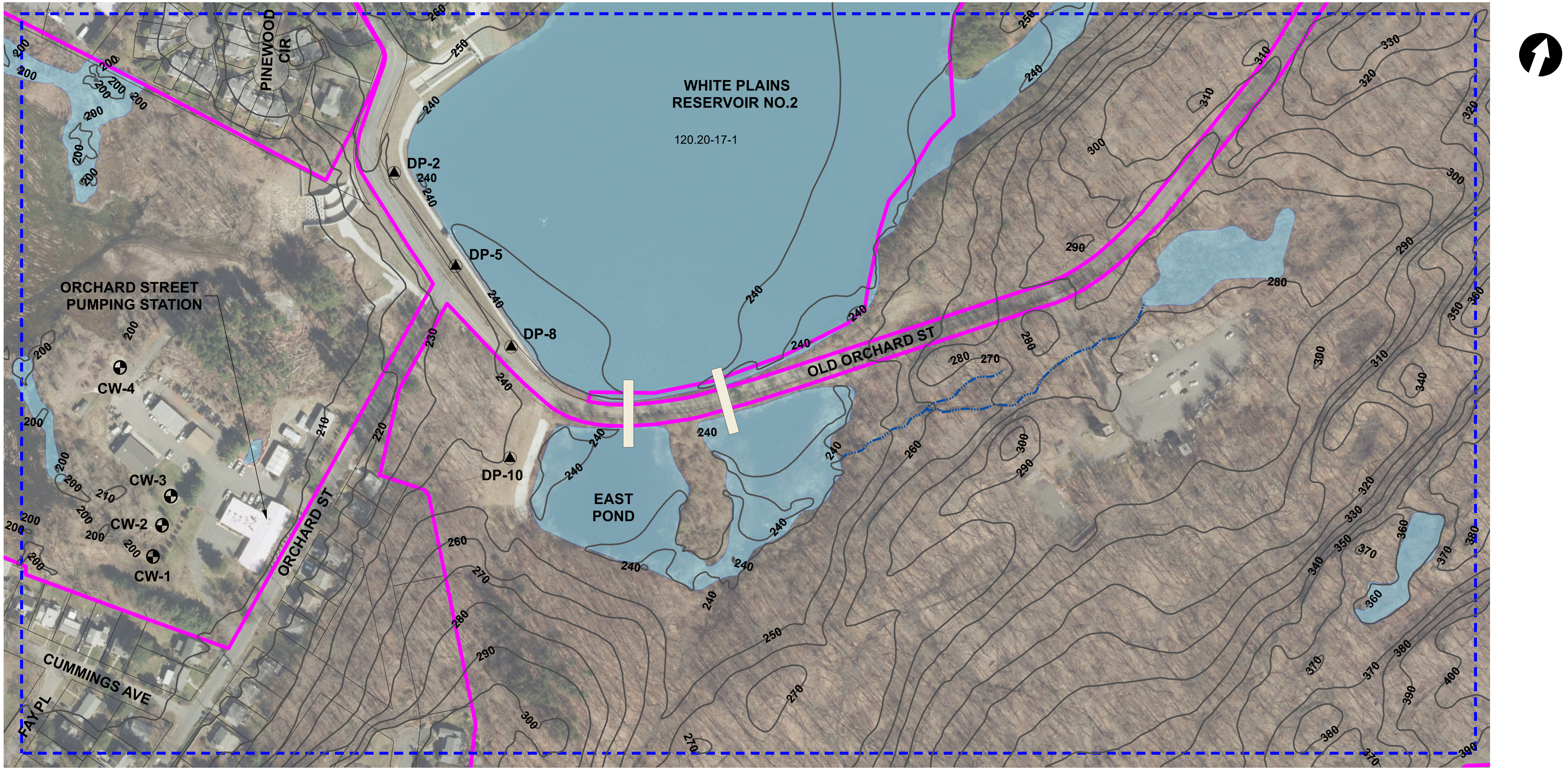
White Plains Fire Department Drill School
White Plains, New York

SITE AND SURROUNDING PROPERTIES PLAN

DATE
12/3/2020

PROJECT NO.
200217

FIGURE
2



Aerial Source:
2020 ESRI Imagery.

LEGEND

- 🟪 PROJECT SITE BOUNDARY
- ⬚ PROJECT STUDY AREA
- ☐ TAX PARCEL
- -·-·- STREAM
- ▲ DAM PIEZOMETER
- ◐ CISTERN WELL
- ▭ CULVERT PIPE

0 200 400

SCALE IN FEET

AKRF

34 S. Broadway #401 White Plains, NY 10601

White Plains Fire Department Drill School

White Plains, New York

PROJECT STUDY AREA

DATE

12/3/2020

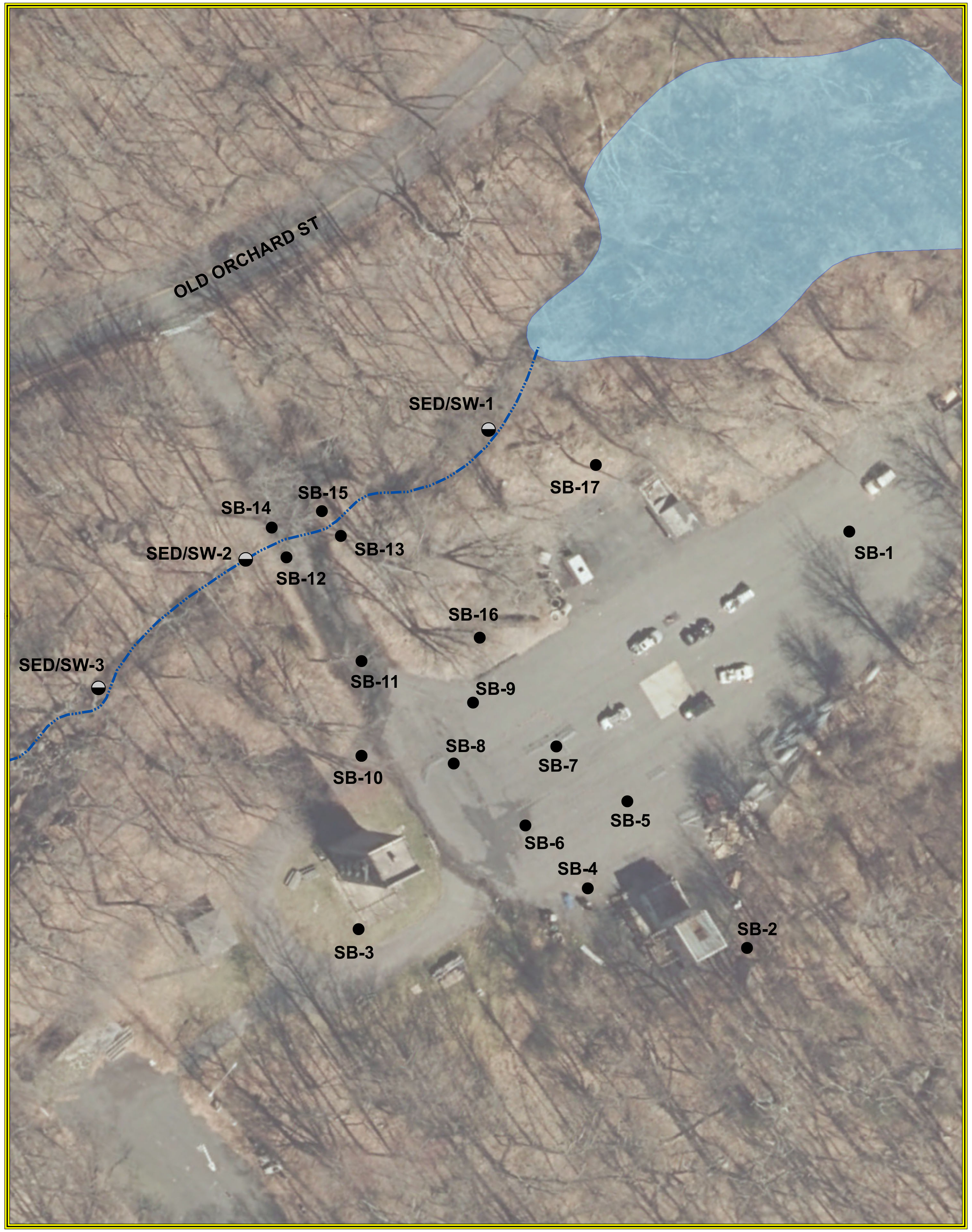
PROJECT NO.

200217

FIGURE

3

©2020 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\200217 Fig 3 Project Study Area.mxd12/3/2020 8:55:52 AM mvellieux



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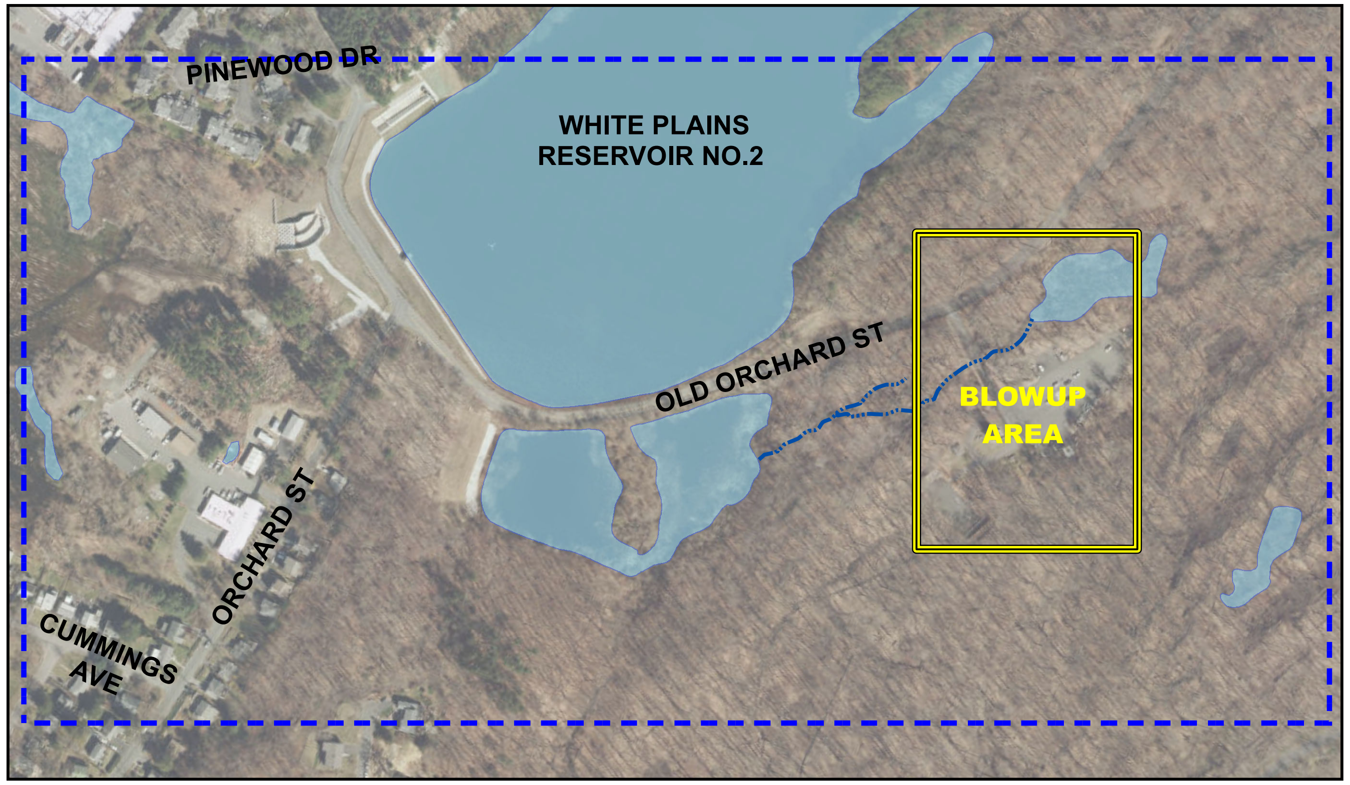


Key Map

Scale: 1" = 400'

LEGEND

- ▭ PROJECT STUDY AREA
- ‐··‐ STREAM
- ● PROPOSED SOIL BORING LOCATION
- ◑ PROPOSED SURFACE WATER SAMPLING LOCATION
- ⊖ PROPOSED SEDIMENT AND SURFACE WATER SAMPLE LOCATION

0 60 120
SCALE IN FEET

AKRF
34 S. Broadway #401 White Plains, NY 10601

White Plains Fire Department Drill School
White Plains, New York

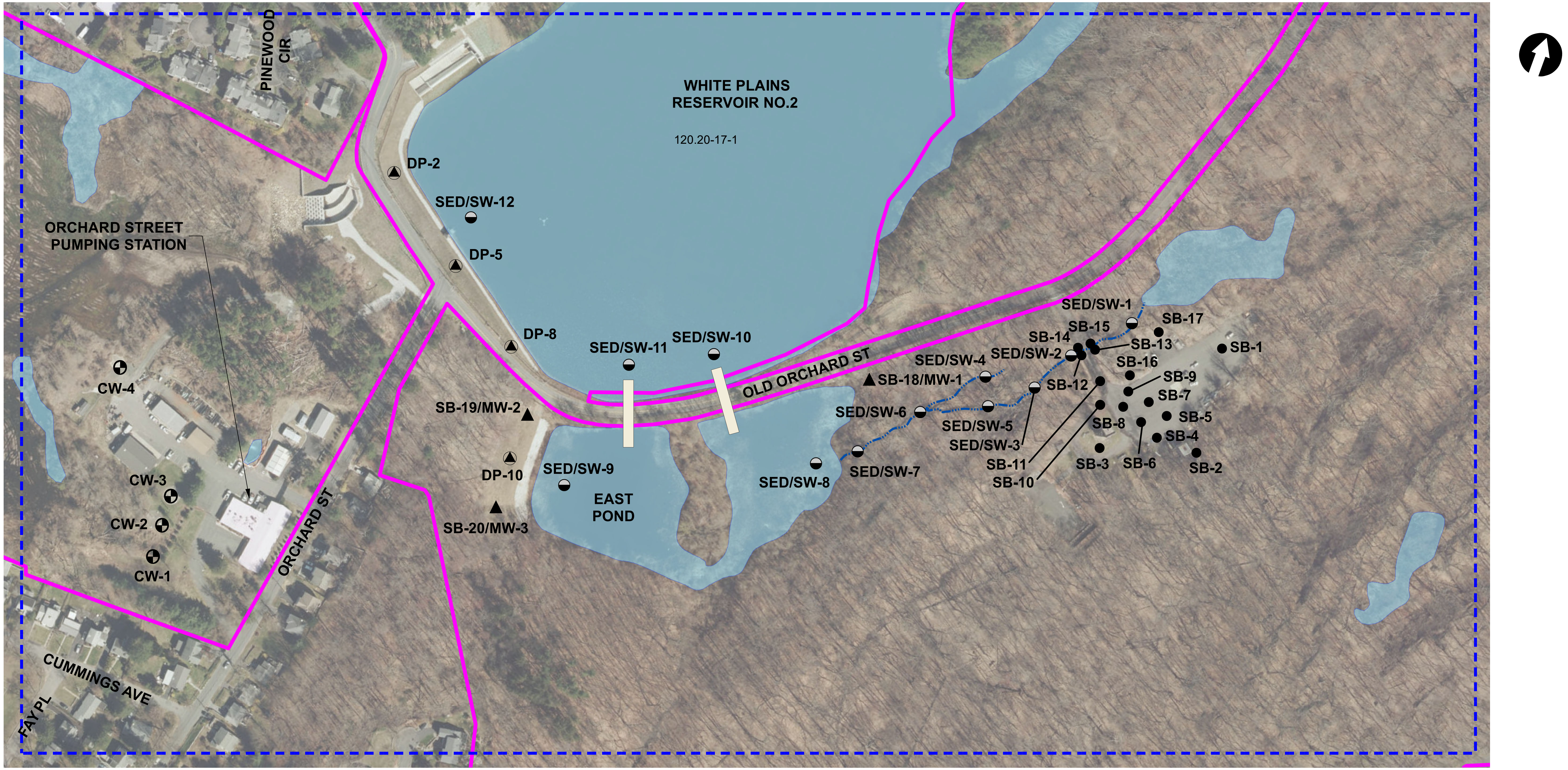
PROPOSED SAMPLING LOCATIONS

DATE
10/20/2020

PROJECT NO.
200217

FIGURE
4A

©2020 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\200217 Fig 4A Proposed Sampling Locations.mxd10/20/2020 3:07:13 PM mveilleux



Aerial Source:
2020 ESRI Imagery.

LEGEND

▭	PROJECT SITE BOUNDARY	●	PROPOSED SOIL BORING LOCATION
⬚	PROJECT STUDY AREA	▲	PROPOSED SOIL BORING/MONITORING WELL LOCATION
-···-	STREAM	◑	PROPOSED SURFACE WATER SAMPLING LOCATION
▲	DAM PIEZOMETER	◒	PROPOSED SEDIMENT AND SURFACE WATER SAMPLE LOCATION
⊕	CISTERN WELL	▭	CULVERT PIPE

0 200 400
SCALE IN FEET

AKRF
34 S. Broadway #401 White Plains, NY 10601

White Plains Fire Department Drill School
White Plains, New York

PROPOSED SAMPLING LOCATIONS

DATE
12/4/2020
PROJECT NO.
200217
FIGURE
4B

©2020 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\200217 Fig 4B Proposed Sampling Locations.mxd12/4/2020 8:37:53 AM mveilleux

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN (QAPP)

WHITE PLAINS FIRE DEPARTMENT DRILL SCHOOL

1402 ORCHARD STREET, WHITE PLAINS, NEW YORK

Quality Assurance Project Plan

NYSDEC Site #: 360193
AKRF Project Number: 200217

Prepared for:

The City of White Plains
255 Main Street
White Plains, New York 10601

Prepared by:

AKRF, Inc.
34 South Broadway, Suite 401
White Plains, New York 10601

NOVEMBER 2020

TABLE OF CONTENTS

TABLES

ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the protocols and procedures that will be followed during implementation of all environmental sampling, including under the Site Characterization Work Plan (SCWP) at the property located at 1402 Old Orchard Street, White Plains, New York (the Site). The legal definition of the Site is City of White Plains Tax ID 120.20-17-1, and the property class is identified as Public Services-Water Supply. The Site is approximately 141 acres, is mainly wooded with small streams, and contains the White Plains Fire Department Drill School (FDDS). The FDDS is situated within a 4-acre clearing that is located approximately 500 feet east of White Plains Reservoir #2. The Orchard Street Pump Station (OCPS) property and its facilities, also owned and operated by The City, are located within the western portion of the Site, and south-adjacent to Reservoir #1.

The scope of the project includes the drilling of soil borings, and the collection of soil, sediment, surface water, and groundwater samples. The goals of the project are to identify the source area for presence of per- and polyfluoralkyl substances (PFAS), delineate the nature and extent of the PFAS plume, and determine whether hazardous waste is present at the Site, and if present, whether the waste poses a significant threat to public health or the environment. The site characterization is being conducted to satisfy the requirements of a New York State Department of Environmental Conservation (NYSDEC) Order of Consent (CO) associated with the Site (NYSDEC Site No. C224234). The objective of this QAPP is to provide for Quality Assurance (QA) and maintain Quality Control (QC) while performing the investigation activities, and adherence to the QAPP will ensure that defensible data will be obtained during all environmental work at the Site. All activities identified in the QAPP will meet and be performed in accordance with DER-10.

2.0 PROJECT TEAM

The project team will be drawn from AKRF professional and technical personnel, and AKRF's subcontractors. All field personnel and subcontractors will have completed a 40-hour training course and updated 8-hour refresher course that meet the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR Part 1910. The following sections describe the key project personnel and their responsibilities.

2.1 PROJECT DIRECTOR

The project director will be responsible for the general oversight of all aspects of the project, including scheduling, budgeting, data management, and field program decision-making. The project director will communicate regularly with all members of the AKRF project team and the NYSDEC to ensure a smooth flow of information between involved parties. Marc Godick will serve as the project director for the RI. Mr. Godick's resume is included in Attachment A.

2.2 QUALITY ASSURANCE/ QUALITY CONTROL (QA/QC) OFFICER

Ms. Rebecca Kinal will serve as the QA/QC officer and will be responsible for adherence to the QAPP. The QA/QC officer will review the procedures with all personnel prior to commencing any fieldwork and will conduct periodic Site visits to assess implementation of the procedures. The QA/QC officer will also be responsible for reviewing Data Usability Summary Reports (DUSRs) for soil analytical results. Ms. Kinal's resume is included in Attachment A.

2.3 PROJECT MANAGER

The project manager will be responsible for directing and coordinating all elements of the RI. The project manager will prepare reports and participate in meetings with the Site owner, and/or the NYSDEC. Bryan Zieroff will serve as the project manager for the RI. Mr. Zieroff's resume is included in Attachment A.

2.4 PROJECT MANAGER ALTERNATE

The project manager alternate will be responsible for assisting the project manager. The project manager alternate will help prepare reports and will participate in meetings with the Site owner, and/or the NYSDEC. Mr. Mark Jepsen will serve as the project manager alternate for the RI. Mr. Jepsen's resume is included in Attachment A.

2.5 FIELD TEAM LEADER,FIELD TECHNICIAN, AND SITE SAFETY OFFICER, AND ALTERNATES

The field team leader will be responsible for supervising the daily sampling and health and safety activities in the field and will ensure adherence to the work plan and Health and Safety Plan (HASP), included in Appendix B of the SCWP. The field team leader will also act as the field technician and Site safety officer (SSO), and will report to the project manager or project manager alternate on a regular basis regarding daily progress and any deviations from the work plan. The field team leader will be a qualified and responsible person able to act professionally and promptly during environmental work at the Site. Mr. Steve Schmid will act as the field team leader. The field team leader alternate is John Sulich of AKRF. Resumes for Mr. Schmid and Mr. Sulich are included in Attachment A.

2.6 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OFFICER

The laboratory QA/QC officer will be responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. The QA/QC officer will track the movement of samples from the time they are checked in at the laboratory to the time that analytical results are issued, and will conduct a final check on the analytical calculations and sign off on the laboratory reports. The laboratory QA/QC officer will be Carl Ambruster of Eurofins TestAmerica Laboratories (TestAmerica), the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP)-certified laboratory being employed for all environmental sampling at the Site. Mr. Ambruster's resume is included in Attachment A.

2.7 LABORATORY DATA VALIDATOR

The laboratory data validator will be responsible for third party data validation and preparation of Data Usability Summary Reports (DUSRs). The third-party laboratory data validator will be Lori Beyer of L.A.B. Validation Corp. Ms. Beyer's resume is included in Attachment A.

3.0 STANDARD OPERATING PROCEDURES (SOPS)

The following sections describe the SOPs for the investigation activities included in the SCWP. These procedures are consistent with the Guidelines for Sampling and Analysis of PFAS, which included in this document for reference as Attachment B. During these operations, safety monitoring will be performed as described in the HASP, included as Appendix B of the SCWP.

3.1 EQUIPMENT

Materials considered acceptable for collecting samples where PFAS is the contaminant of concern (COC) includes stainless steel, high density polyethylene (HDPE), silicone, acetate, and polypropylene. Sampling equipment should not come in contact with aluminum foil, low-density polyethylene (LDPE), glass, polytetrafluoroethylene (PTFE or Teflon™), including sample jars with a PTFE liner under the cap. Field personnel should avoid clothing that contains PTFE, including Gore-Tex®, and any PFAS-related materials used in waterproofing, bug spray, and sunscreen.

3.2 SOIL BORINGS

Soil sampling will consist of advancing soil borings via a direct push drilling rig, or the collection of surface samples using a stainless steel hand auger or trowel.

Twenty soil borings (SB-1 to SB-20) will be completed to characterize subsurface soils and collect soil samples for laboratory analysis. Figure 4 in the SCWP depicts the soil boring locations as well as the locations of existing structures present at the site.

A direct-push drill rig will be utilized as a first option to advance the soil borings. In the event that soil sampling is targeted for a location with difficult access, and considering the release mechanism where shallow soil samples will be targeted for laboratory analysis, pre-cleaned stainless steel hand augers will be used to collect the soil samples.

Soil borings advanced with the direct push drilling rig will include continuous soil sampling until refusal or to a depth of 5 feet below the water table, whichever is shallower. The borings will be completed by advancing a stainless steel macrocore piston rod sampler fitted with an internal acetate liner. Once advanced to the designated drilling depth, the sampler will be retrieved and the acetate liner will be removed from the macrocore and cut lengthwise. When advancing soil borings using a stainless steel hand auger, the auger will be rotated into the ground and advanced to a depth equal to the length of the soil collection tube. The auger will be retrieved, and the soil will be removed from the auger and placed in a stainless steel bowl. Soil samples will then be inspected and logged by AKRF field personnel, as described in Section 4.1.

After the inspection and soil logging, the soil interval that exhibits the most evidence (i.e., PID readings, odors, staining) of contamination will be designated for laboratory analysis. In the absence of contamination, the soil interval designated for laboratory analysis will be the depth zone most likely to contain contamination (e.g. surface/shallow soil would be collected where a surface spill is the suspected release mechanism). Additional samples would be collected for laboratory analysis if field observations (odor and/or staining) and PID readings indicate it is necessary.

All sampling equipment (e.g., drilling rods and casing, macro core samplers, hand augers, and probe rods) will be either dedicated or decontaminated between sampling locations as indicated in Section 3.4 of this document.

After the soil boring drilling is complete, soil borings will be filled with hydrated bentonite and patched to match existing surface conditions. Each soil boring location will be identified by a hand held global positioning system (GPS) unit. All investigation derived waste (IDW) associated with drilling soil borings will be managed as described in Section 3.5.

3.3 GROUNDWATER MONITORING WELL INSTALLATION AND DEVELOPMENT

The area west of East Pond is where surficial geology was observed to level off and transition to an area where overburden is expected to be present. This area includes a distribution of dam piezometers (DP-2, DP-5, and DP-8) along Reservoir Road and Old Orchard Street, a dam piezometer west-adjacent to East Pond (DP-10), and cistern wells (CW-1 to CW-4) at the Orchard Street Pumping Station (OSPS). These wells were sampled as part of the initial investigation completed by Hazen in May and July of 2019, and will be sampled again as part of this investigation. Three monitoring wells, MW-1, MW-2, and MW-3, are proposed to be installed in soil borings SB-18 through SB-20, respectively, to provide for additional groundwater delineation between East Pond and the OSPS. If additional areas containing saturated overburden are encountered during the investigation, or if any current wells need to be replaced, then additional monitoring wells will be installed.

The borings for any new or replacement well will be advanced using 4.25 inch inside diameter augers to install a 2-inch PVC well. After drilling to the desired depth, 2-inch diameter PVC screen 10 feet of 0.02 slot well screen) and casing will be inserted into the hollow stem auger to the target depth of 7 feet into the water table.

The screen interval for the overburden wells will be determined according to the following procedure:

- Measure the depth to water in the open hole using a Solinst® Water Table Meter – Model 101 or equivalent.
- Based on the lithology encountered during sampling, select either a 0.01 or 0.02-slotted well screen.
- Place PVC riser with a 10-foot length of the selected screen size approximately 7 feet into the water table.

Morie sand will be backfill into the borehole and around the screen and casing to a depth of 2 feet above the screen. The annular space around the well riser will be sealed with bentonite extending one to two feet above the sand filter pack and completed with a non-shrinking cement mixture to approximately one foot below grade. Each monitoring well will be completed using either flush to grade locking gate boxes or steel protective riser casings, depending on surface features and access. Following well installation, well development will be completed according to the following procedure:

- Measure the depth to water using an oil/water interface probe and the total depth of the well using a weighted tape. Use these measurements to calculate the length of the water column. Calculate the volume of water in the well using 0.163 volumes per foot of water column (gallons) as the conversion factors for a 2-inch diameter well.
- For the first five minutes of well development, develop the well using a submersible pump and re-circulate the water back into the well to create maximum agitation. This method is intended to remove fines from the sand pack, the adjacent formation and from the well.
- After the first five minutes of well development, develop the well using a submersible pump and discharge the water to five-gallon buckets. Transfer water from the buckets to 55-gallon drums designated for well development water.
- During development, collect periodic samples and analyze for turbidity and water quality indicators (pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.
- Continue developing the well until turbidity is less than 50 nephelometric turbidity units (NTUs) for three successive readings and until water quality indicators have stabilized to within 10% for pH, temperature and specific conductivity for three successive readings, or until three well volumes have been purged from the well.
- If the well is low yielding and will not sustain a constant pumping rate, the well will be developed using a surge bock to remove fines from the sand filter pack, and the well will be pumped until dry. This process will be repeated a minimum of three times or until the well pumps clear.

- Document the volume of water removed and any other observations made during well development in the field logbook or on field data sheets.
- Decontaminate the equipment prior to and following development at each well location as described in Section 3.4 of this QAPP. All well development water, decontamination, and purge water will be containerized in 55-gallon drums and handled as described in the section 3.5 of this QAPP.

The location/elevation of each new PVC well will be surveyed by a New York State licensed surveyor and incorporated into the existing site map.

3.4 DECONTAMINATION OF SAMPLING EQUIPMENT

All sampling equipment (augers, drilling rods, split spoon samplers, hand augers, spoons, probe rods, pumps, etc.) will be either dedicated or decontaminated between sampling locations. Decontamination will be conducted on plastic sheeting (or equivalent) that is bermed to prevent discharge to the ground. The decontamination procedure will be as follows:

1. Scrub equipment with a bristle brush using a PFC-free water/Simple Green® solution.
2. Rinse with PFC-free water.
3. Scrub again with a bristle brush using a PFC-free water/Simple Green® solution.
4. Rinse with PFC-free water.
5. Rinse with distilled water.
6. Air-dry the equipment.

AKRF will provide documentation that the source of distilled water and the detergent (Simple Green® or alternate) being used for decontamination purposes are PFAS –free prior to the start of work.

3.5 MANAGEMENT OF INVESTIGATION DERIVED WASTE (IDW)

IDW will be containerized in New York State Department of Transportation (NYSDOT)-approved 55-gallon drums during the investigation activities. The drums will be sealed at the end of each work day and labeled with the date, the boring location(s), the type of waste (i.e., drill cuttings, purge water), and the name and phone number of an AKRF point-of-contact. All IDW collected into drums will be sampled and disposed of or treated according to applicable local, state, and federal regulations.

4.0 SAMPLING AND LABORATORY PROCEDURES

The sampling of various media as outlined in the SCWP and this Section will include the collection of samples for laboratory analysis of emerging contaminants [1,4-dioxane and perfluorinated compounds (PFCs)]. Whenever emerging contaminants are included in the sampling scope, all samples will be collected in accordance with NYSDEC's published protocols, including the acceptable/specific sampling materials, equipment, and QA/QC requirements. A copy of NYSDEC's protocol and guidance document is included in Appendix B.

4.1 SOIL SAMPLING

The PID will be calibrated in accordance with manufacturer's recommendations prior to sampling.

Soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the Unified Soil Classification System (USCS).
- Describing any evidence of contamination (e.g., staining, sheens, odors)
- Field screen the sample for evidence of contamination (e.g., odors, staining,) using visual and olfactory methods and screen for volatile organic compounds (VOCs) using a photoionization detector (PID) calibrated each day in accordance with the manufacturer’s instructions.
- Collect an aliquot of soil from each proposed sample location, place in laboratory-supplied glassware, label the sample in accordance with Section 4.6.1.1, Table 2 of this QAPP, and place in an ice-filled cooler for shipment to the laboratory.
- Complete the proper chain of custody paperwork and seal the cooler.
- Record sample location, sample depth, and sample observations (evidence of contamination, PID readings, soil classification, etc.) in field log book and boring log data sheet, if applicable.
- Decontaminate any soil sampling equipment between sample locations as described in Section 3.4 of this QAPP.

4.2 SEDIMENT SAMPLING

Sediment samples from the on-site unnamed stream will be collected by use of a hand trowel, an acetate sediment sampling tube, or Wildco hand core sediment sampler depending on the depth of the stream at the sampling location. For deeper stream sections, the core sampler allows for quantitative and qualitative sampling to a specified sediment depth with little disturbance of the sediment water interface. The sediment will be placed in the appropriate laboratory jars. The jars will be sealed and labeled as described in Section 4.8 of this QAPP and place in an ice-filled cooler.

4.3 SURFACE WATER SAMPLING

The surface water samples will be collected with a pre-cleaned cup comprised of materials approved by NYSEC for the collection of samples containing PFAS, including stainless steel, HPDE, PVC, silicone, acetate, or polypropylene. The cup will be rinsed with the site media at the sampling location prior to collecting a sample. The sample will then be collected and poured into the provided laboratory containers.

4.4 MONITORING WELL SAMPLING

For any new monitoring well, groundwater samples will be collected at least one week following well development. Low flow sampling techniques will be used, as described in U.S. EPA’s Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers [EPA 542-S-02-001, May 2002]. Sampling will be conducted according to the following procedure:

- Prepare the sampling area by placing plastic sheeting over the well. Cut a hole in the sheeting to provide access to the well cover.
- Slowly remove the locking cap and immediately measure the vapor concentrations in the well with a PID calibrated to the manufacturer’s specifications.
- Measure the depth to water and total well depth, and check for the presence of non-aqueous phase liquid (NAPL) using an oil/water interface probe. Measure the thickness of NAPL, if

any, and record in field book and well log. Groundwater samples will not be collected from wells containing measurable NAPL.

- Use the water level and total well depth measurements to calculate the length of the mid-point of the water column within the screened interval. For example, for a well where the total depth is 20 feet, screened interval is 10 to 20 feet, and depth to water is 14 feet, the mid-point of the water column within the screened interval would be 17 feet.
- Connect dedicated tubing and/or suitable pump (i.e., bladder pump) that is PFAS-free such that the intake is set at the mid-point of the water column within the screened interval of the well. Connect the discharge end of the tubing to the flow-through cell of a YSI multi-parameter (or equivalent) meter. Connect tubing to the output of the cell and place the discharge end of the tubing in a five-gallon bucket.
- Activate the pump at the lowest flow rate setting of the pump.
- Measure the depth to water within the well. The pump flow rate may be increased such that the water level measurements do not change by more than 0.3 feet as compared to the initial static reading. The well-purging rate should be adjusted so as to produce a smooth, constant (laminar) flow rate and so as not to produce excessive turbulence in the well. The expected targeted purge rate will be approximately 0.5 liters and will be no greater than 3.8 liters/minute.
- Transfer discharged water from the 5-gallon buckets to an on-site 55-gallon drum, as described in Section 3.5.
- During purging, collect periodic samples and analyze for water quality indicators (e.g., turbidity, pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.
- Continue purging the well until turbidity is less than 50 NTU and water quality indicators have stabilized to the extent practicable. The criteria for stabilization will be three successive readings for the following parameters and criteria:

Table 1
Stabilization Criteria

Parameter	Stabilization Criteria
PH	+/- 0.1 pH units
Specific Conductance	+/- 3% mS/cm
ORP/Eh	+/- 10mV
Turbidity	<50 NTU
Dissolved Oxygen	+/- 0.3 mg/l

Notes: mS/cm = millisievert per centimeter
mV = millivolts
NTU = nephelometric turbidity units
mg/l = milligrams per liter

- If the water quality parameters do not stabilize and/or turbidity is greater than 50 NTU within two hours, purging may be discontinued. Efforts to stabilize the water quality for the well must be recorded in the field book, and samples may then be collected as described herein.
- After purging, disconnect the tubing to the inlet of the flow-through cell. Collect groundwater samples directly from the discharge end of the tubing and place into the required

sample containers as described in Section 4.6 of this QAPP. Label the containers as described in Section 4.8.1.1, Table 4 of this QAPP and place in a chilled cooler.

- Once sampling is complete, remove the pump and tubing from the well. Dispose of the sampling materials and PPE in a designated 55-gallon drum. The purge water will be managed as described in Section 3.5 of this QAPP.
- Decontaminate the pump (where necessary), oil/water interface probe, and flow-through cell, as described in Section 3.4 of this QAPP.
- Record all measurements (depth to water, depth to NAPL, water quality parameters, turbidity), calculations (well volume) and observations in the project logbook and field data sheet, if applicable.

4.5 SAMPLE HANDLING

Samples slated for laboratory analysis will be labeled and placed in laboratory-supplied containers and shipped to the laboratory via courier with appropriate chain of custody documentation in accordance with appropriate EPA protocols to Eurofins TestAmerica in Edison, New Jersey and Eurofins TestAmerica in South Burlington, Vermont, NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratories. All samples will be analyzed for emerging contaminants [(1,4-dioxane using EPA Method 8270 by selective ion monitoring (SIM), and the standard list of 21 PFAS compounds using EPA Method 537 (modified)] as documented in Section 4.6, Table 2. Additional analysis will include the following:

- Soil Samples: A total of 20% of the soil samples will also be analyzed for leachable PFAS by the synthetic precipitation leaching procedure (SPLP), soil pH, clay content, total organic carbon (TOC) and cation exchange capacity (CEC). Additional analysis for soil samples collected from SB-1 through SB-4 and SB-11 through SB-14 will include the NYSDEC Part 375 list for volatile organic compounds (VOCs) using EPA Method 8260, semivolatile organic compounds (SVOCs) using EPA Method 8270, polychlorinated biphenyls (PCBs) using EPA Method 8082, pesticides using EPA Method 8081, and metals including mercury and cyanide using Methods 6010/7470/7471.
- Sediment/Surface Water Samples: A total of 20% of the sediment/surface water samples will also be sampled for the NYSDEC Part 375 list for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, PCBs using EPA Method 8082, pesticides using EPA Method 8081, Target Analyte List (TAL) metals including mercury and cyanide using Methods 6010/7470/7471, soil pH, clay content, total organic carbon (TOC) and cation exchange capacity (CEC).

Groundwater Samples: A total of 20% of the groundwater samples will also be sampled for the NYSDEC Part 375 list for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, PCBs using EPA Method 8082, pesticides using EPA Method 8081, and TAL metals including mercury and cyanide using Methods 6010/7470/7471.The laboratory report will be prepared using Category B deliverables and Electronic Data Deliverables (EDDs) in the latest NYSDEC format. A standard turnaround time will be requested from the laboratory.

4.6 LABORATORY METHODS

Table 1 summarizes the laboratory methods that will be used to analyze field samples and the sample container type, preservation, and applicable holding times. Eurofins TestAmerica of Edison, New Jersey and Eurofins TestAmerica in South Burlington, Vermont, NYSDOH ELAP-certified laboratories subcontracted to AKRF, will be used for all chemical analyses in accordance with the Division of Environmental Remediation (DER)-10 2.1(b) and 2.1(f) with Category B Deliverables. PFAS samples will be analyses will be conducted by Eurofins TestAmerica in South Burlington, Vermont, while all remaining parameters will be analyzed by Eurofins TestAmerica of Edison, New Jersey. The laboratories will achieve a minimum detection limit of 0.35 microgram per liter (µg/L) and 0.1 milligrams per kilogram (mg/kg) for 1,4-dioxane in aqueous and solid samples, respectively, and 2 nanograms per liter (ng/L) and 0.5 micrograms per kilogram (µg/kg) for the standard list of 21 PFAS compounds in aqueous and solid samples, respectively.

Table 2
Laboratory Analytical Methods for Analysis Groups

Matrix	Analysis	EPA Method	Bottle Type	Preservative	Hold Time
Soil	Volatile Organic Compounds (VOCs)	8260D	EnCore samplers (3) and 2 oz. plastic jar	≤ 6 ºC	48 hours to extract; 14 days to analyze
	Semivolatile Organic Compounds (SVOCs)	8270E	8 oz. Glass Jar	≤ 6 ºC	14 days to extract; 40 days to analyze
	PCBs	8082	8 oz. Glass Jar	≤ 6 ºC	14 days to extract; 40 days to analyze
	Pesticides	8081	8 oz. Glass Jar	≤ 6 ºC	14 days to extract; 40 days to analyze
	Metals (including mercury and cyanide)	6010/7470/7471	8 oz. Glass Jar	≤ 6 ºC	6 months (28 days for Hg)
	1,4-Dioxane	8270D - Selective Ion Monitoring (SIM)*	8 oz. Glass Jar	≤ 6 ºC	7 days to extract; 40 days to analyze
	Standard List of 21 Per- and Polyfluoroalkyl Substances (PFAS) Compounds	Modified 537	8 oz. Glass Jar	≤ 6 ºC	14 days to extract; 40 days to analyze
	SPLP PFAS	Modified 537	8 oz. Glass Jar	≤ 6 ºC	14 days to extract; 40 days to analyze
	Soil pH	9045D	4 oz. Glass Jar	≤ 6 ºC	Immediate upon receipt
	TOC	Lloyd Kahn	4 oz. Amber Jar	≤ 6 ºC	14 days to extract and analyze
	Clay Content	(Percentage)	(TBD)	(TBD)	(TBD)
	CEC	9081	(TBD)	(TBD)	(TBD)
Sediment	VOCs	8260C	EnCore samplers (3) and 2 oz. plastic jar	≤ 6 ºC	48 hours to extract; 14 days to analyze
	SVOCs	8270D	8 oz. Glass Jar	≤ 6 ºC	14 days to extract; 40 days to analyze

	PCBs	8082	8 oz. Glass Jar	≤ 6 °C	14 days to extract; 40 days to analyze
	Pesticides	8081	8 oz. Glass Jar	≤ 6 °C	14 days to extract; 40 days to analyze
	Metals (including mercury and cyanide)	6010/7470/7471	8 oz. Glass Jar	≤ 6 °C	6 months (28 days for Hg)
	1,4-Dioxane	8270D - Selective Ion Monitoring (SIM)*	8 oz. Glass Jar	≤ 6 °C	7 days to extract; 40 days to analyze
	Standard List of 21 Per- and Polyfluoroalkyl Substances (PFAS) Compounds	Modified 537	8 oz. Glass Jar	≤ 6 °C	14 days to extract; 40 days to analyze
	Soil pH	9045D	4 oz. Glass Jar	≤ 6 °C	Immediate upon receipt
	TOC	Lloyd Kahn	4 oz. Amber Jar	≤ 6 °C	14 days to extract and analyze
	Clay Content	(Percentage)	(TBD)	(TBD)	(TBD)
	CEC	9081	(TBD)	(TBD)	(TBD)
Groundwater and Surface Water	VOCs	8260C	3 40 mL Glass Vials	HCl to pH < 2 and ≤ 6 °C	48 hours to extract; 14 days to analyze
	SVOCs	8270D	2,000 mL Amber Jar	≤ 6 °C	7 days to extract; 40 days to analyze
	PCBs	8082A	2,000 mL Amber Jar	≤ 6 °C	7 days to extract; 40 days to analyze
	Pesticides	8081B	2,000 mL Amber Jar	≤ 6 °C	7 days to extract; 40 days to analyze
	Metals (including mercury and cyanide)	6010/7470/7471	2,000 mL Amber Jar	HNO_3 to pH <2	6 months for metals; 28 days for mercury
	1,4-Dioxane	8270D - Selective Ion Monitoring (SIM)	2 x 250 mL amber bottles	≤ 6 °C	7 days to extract; 40 days to analyze
	Standard List of 21 Per- and Polyfluoroalkyl Substances (PFAS) Compounds	Modified 537	2 x 250 mL plastic HDPE bottles (no Teflon)	≤ 6 °C,	14 days to extract, 28 days to analyze

Notes:
EPA - Environmental Protection Agency
RCRA – Resource Conservation and Recovery Act
HDPE – High Density Poly Ethylene

* - SIM analysis only required if reporting limits are achieved.

4.7 QUALITY CONTROL (QC) SAMPLING

In addition to the laboratory analysis of the samples, additional analysis will be included for QC measures, as required by the Category B sampling techniques. These samples will include a field duplicate, matrix spike/matrix spike duplicate (MS/MSD), equipment blank, and trip blank samples at a frequency of one per 20 field samples collected or per sample digestion group (SDG). QC samples will be analyzed for the same parameters as the accompanying samples, with the exception of any trip blanks, which will be analyzed for the VOC list only.

TABLE 3
FIELD SAMPLE AND QC SAMPLE QUANTITIES

Sample Type	Parameters	EPA Method	Field Samples	QC Samples			
				Duplicate	MS/MSD	Equipment Blank*	Trip Blank
Soil	VOCs	EPA 8260	8	1	1		1
	TCL SVOCs	EPA 8270	8	1	1		
	TAL Metals (including mercury and cyanide)	EPA 6000/7000, EPA 7470/7471	8	1	1		
	Pesticides	EPA 8081	8	1	1		
	PCBs	EPA 8082	8	1	1		
	1,4-Dioxane	EPA 8270 SIM	20	1	1		
	PFAS	EPA 537 M	20	1	1		
	SPLP PFAS	Modified 537	4	1	1		
	Soil pH	9045D	4	1	1		
	TOC	Lloyd Kahn	4	1	1		
	Clay Content	(Percentage)	4	1	1		
	CEC	9081	4	1	1		
Sediment	VOCs	EPA 8260	3	1	1		1
	TCL SVOCs	EPA 8270	3	1	1		
	TAL Metals (including mercury and cyanide)	EPA 6000/7000, EPA 7470/7471	3	1	1		
	Pesticides	EPA 8081	3	1	1		
	PCBs	EPA 8082	3	1	1		
	1,4-Dioxane	EPA 8270 SIM	12	1	1		
	PFAS	EPA 537 M	12	1	1		
	Soil pH	9045D	3	1	1		
	TOC	Lloyd Kahn	3	1	1		
	Clay Content	(Percentage)	3	1	1		
	CEC	9081	3	1	1		
Surface Water	VOCs	EPA 8260	4	1	1		1

	SVOCs	EPA 8270	4	1	1		
	TAL Metals (including mercury and cyanide)	EPA 6000/7000, EPA 7470/7471	4	1	1		
	Pesticides	EPA 8081	4	1	1		
	PCBs	EPA 8082	4	1	1		
	1,4-Dioxane	EPA 8270 SIM	12	1	1	3*	
	PFAS	EPA 537 M	12	1	1	3*	
Groundwater	VOCs	EPA 8260	4	1	1		1
	SVOCs	EPA 8270	4	1	1		
	TAL Metals (including mercury and cyanide)	EPA 6000/7000, EPA 7470/7471	4	1	1		
	Pesticides	EPA 8081	4	1	1		
	PCBs	EPA 8082	4	1	1		
	1,4-Dioxane	EPA 8270 SIM	11	1	1	3*	
	PFAS	EPA 537 M	11	1	1	3*	

Notes:
MS/MSD - matrix spike/matrix spike duplicate
* - equipment blanks for 1,4-dioxane and PFAS will be collected at a minimum frequency of one per day for surface water/groundwater. The actual number of equipment blanks will vary, depending on the duration of the sampling program.

4.8 SAMPLE HANDLING

4.8.1 Sample Identification

All samples will be consistently identified in all field documentation, chain-of-custody (COC) documents, and laboratory reports. All samples will be amended with a collection date at the end of the sample same in a year, month, day (YYYYMMDD) format. Blind duplicate sample nomenclature will consist of the sample type, followed by an “X”; MS/MSD samples nomenclature will consist of the parent sample name, followed by “MS/MSD”; and trip and field blanks will consist of “TB-” and “FB-”, respectively, followed by a sequential number of the trip/field blanks collected within the sample digestion group (SDG). Special characters, including primes/apostrophes (’), will not be used for sample nomenclature.

4.8.1.1. Site Characterization (SC) Sample Identification

Soil, groundwater, sediment, and surface water samples collected during the SC will be identified with “SB-” for soil borings, “DP-” for groundwater monitoring wells, “CW-“ for cistern wells, “SED-” for sediment sampling locations, and “SW-” for surface water sampling locations and the corresponding sampling identification number as outlined in Section 3.1 of the SCWP. Soil samples will also be amended with the sample collection depth interval in parentheses. Table 4 provides examples of the sampling identification scheme for samples collected during the site investigation.

Table 4
SC Sample Nomenclature

Sample Description	Sample Designation
Groundwater sample collected from groundwater dam piezometer well DP-10 on December 1, 2020	DP-10 20201201
Matrix spike/matrix spike duplicate sample of groundwater sample collected from surface water sample SW-1 on December 1, 2020	SW-1 MS/MSD 20201201
Blind duplicate sample of groundwater sample collected from groundwater monitoring well DP-10 on December 1, 2020	MW-X 20170801
Second field blank collected on December 1, 2020	TB-2 20201201
Soil sample collected from soil boring SB-2 between 1 and 2 feet below basement grade on December 1, 2020	SB-2 (1-2) 20201201
Blind duplicate sample of soil sample collected from soil boring SB-2 between 1 and 2 feet below grade on December 1 ,2020	SB-X (1-2) 20201201
Sediment sample collected from location SED-2 on December 1, 2020	SED-2 20201201

4.8.1.2. Waste Classification

Any waste classification samples will be amended with “WC-” and the alphanumeric drum identification. Table 5 provides examples of the sampling identification scheme for proposed waste classification samples and any hotspot or tank excavation samples.

Table 5
Waste Classification Sample Nomenclature

Sample Description	Sample Designation
Waste classification sample collected from Drum 1 on December 1, 2020	WC-D1 20201201

Sample Labeling and Shipping

All sample containers will be provided with labels containing the following information:

- Project identification, including Site name, BCP Site number, Site address
- Sample identification
- Date and time of collection
- Analysis(es) to be performed
- Sampler’s initials

Once the samples are collected and labeled, they will be placed in chilled coolers and stored in a cool area away from direct sunlight to await shipment to the laboratory. All samples will be shipped to the laboratory at least twice per week. At the start and end of each workday, field personnel will add ice to the cooler(s) as needed.

The samples will be prepared for shipment by placing each sample in laboratory-supplied glassware, then wrapping each container in bubble wrap to prevent breakage, and adding freezer packs and/or fresh ice in sealable plastic bags. The COC form will be properly completed by the sampler in ink, and all sample shipment transactions will be documented with signatures, and the date and time of custody transfer. Samples will be shipped overnight (e.g., Federal Express) or transported by a laboratory courier. All coolers shipped to the laboratory will be sealed with mailing tape and a COC seal to ensure that the samples remain under strict COC protocol.

Sample Custody

Field personnel will be responsible for maintaining the sample coolers in a secured location until they are picked up and/or sent to the laboratory. The record of possession of samples from the time they are obtained in the field to the time they are delivered to the laboratory or shipped off-site will be documented on COC forms. The COC forms will contain the following information: project name; names of sampling personnel; sample number; date and time of collection and matrix; and signatures of individuals involved in sample transfer, and the dates and times of transfers. Laboratory personnel will note the condition of the custody seal and sample containers at sample check-in.

4.9 FIELD INSTRUMENTATION

Field personnel will be trained in the proper operation of all field instruments at the start of the field program. Instruction manuals for the equipment will be on file at the Site for referencing proper operation, maintenance, and calibration procedures. The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork. If an instrument fails calibration, the project manager or QA/QC officer will be contacted immediately to obtain a replacement instrument. A calibration log will be maintained to record the date of each calibration, any failure to calibrate and corrective actions taken. The PID will be equipped with a 10.6 electron volt (eV) lamp and will be calibrated each day using 100 parts per million (ppm) isobutylene standard gas in accordance with the manufacturer’s standards.

4.10 QUALITY ASSURANCE (QA)

All soil, sediment, surface water, and groundwater laboratory analytical data will be reviewed by a third-party validator and a Data Usability Summary Report (DUSR) will be prepared to document the usability and validity of the data. The Site Characterization Report (SCR) will include a detailed description of the sampling activities, sampling logs, data summary tables, concentration maps showing sample locations and concentrations, DUSR, and laboratory reports.

ATTACHMENT A

RESUMES OF PROJECT DIRECTOR, PROJECT MANAGER, PROJECT MANAGER ALTERNATE, AND FIELD TEAM LEADER

MARC S. GODICK, LEP

SENIOR VICE PRESIDENT

Marc S. Godick, a Senior Vice President of the firm, has 20 years of experience in the environmental consulting industry. Mr. Godick's broad-based environmental experience includes expertise in remedial investigation, design and implementation of remedial measures, environmental/compliance assessment, litigation support, and storage tank management.

RELEVANT EXPERIENCE

Queens West Development Project, AvalonBay Communities, Queens, NY

Mr. Godick managed one of the largest remediation projects completed to date under the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP). The remedy for the site, which was contaminated by coal tar and petroleum, included the installation of a hydraulic barrier (sheet pile cut off wall), excavation of contaminated soil under a temporary structure to control odors during remediation, a vapor mitigation system below the buildings, and implementation of institution controls. The investigation, remediation design, remedy implementation, and final sign-off (issuance of Certificate of Completion) were completed in two years. Total remediation costs were in excess of $13 million.

Williamsburg Waterfront Redevelopment, RD Management/L&M Equities/Toll Brothers, Brooklyn, NY

The project is one of the largest development projects in the Greenpoint/Williamsburg Rezoning Area, which includes the construction of nearly 1 million square feet of residential and retail space along the Williamsburg waterfront. The site had a variety of industrial uses, including a railyard, junk yard, and waste transfer station. As part of the City's rezoning, the site was assigned an E-designation for hazardous materials. Mr. Godick managed the preparation of the Phase I and II environmental site assessments, remedial action plan (RAP), and construction health and safety plan (CHASP). Mr. Godick obtained NYSDEC closure of an open spill associated with former underground storage tanks at the site. The NYCDEP-approved RAP and CHASP included provisions for reuse of the existing fill material, with the excess being disposed off-site, installation of a vapor barrier below the new buildings, installation of a site cap, and environmental monitoring during the construction activities. Mr. Godick is currently managing the environmental monitoring work that began in 2006. A Notice of Satisfaction has been issued by NYCDEP for the first phase of the development.

BACKGROUND

Education

M.E., Engineering Science/Environmental Engineering, Pennsylvania State University, 1998

B.S., Chemical Engineering, Carnegie Mellon University, 1989

Licenses/Certifications

Licensed Environmental Professional (License # 396) – State of Connecticut – 2003

40 Hour HAZWOPER and Annual Refresher Training, 1990-2008

Supervisors of Hazardous Waste Operations (8 Hour), 1990

Professional Memberships

Chair, Village of Larchmont/Town of Mamaroneck Coastal Zone Management Commission, 1997 - Present

Chair, Westchester County Soil and Water Conservation District, 2005 - Present

Member, NYSDEC Risk-Based Corrective Action (RBCA) Advisory Group for Petroleum-Impacted Sites, 1997

Community Leadership Alliance, Pace University School of Law, 2001

Years of Experience

Year started in company: 2002

Year started in industry: 1990

Landfill Closure & Compost Facility Application, White Plains, NY

Mr. Godick is currently managing the closure of a formal ash landfill, which is currently being utilized as a leaf and yard waste compost facility by the City of White Plains. The remedial investigation included on-site and off-site assessment of soil, groundwater, and soil gas to delineate the extent of methane and solvent contamination associated with the landfill. The landfill closure plan includes provisions for enhancing the existing cap, methane venting, and groundwater treatment for solvent contamination. Mr. Godick also managed the preparation of the compost facility permit application, which required modification to the facility's operations necessary to close the landfill and address other regulatory requirements.

Landfill Redevelopment – RD Management, Orangeburg, NY

Mr. Godick is currently managing the remediation of the former Orangeburg Pipe site under the NYSDEC Voluntary Cleanup Program. The site contains widespread fill material, which has fragments of Orangeburg pipe that is impregnated with asbestos and coal tar. The site is being redeveloped for retail use. The site's closure plan provides for reuse of all fill material on-site and methane mitigation (vapor barrier and passive sub-slab ventilation system) for all new buildings. The fill management activities will include dust and sediment control measures and air monitoring to prevent airborne dust in accordance with a closure plan, stormwater pollution prevention plan (SWPPP), and CHASP. In pervious areas, the site cap will consist of 2 feet of clean fill and a liner in larger areas.

National Grid – Halesite Manufactured Gas Plant Site, Town of Huntington, NY

Mr. Godick managed the remedial design and engineering work associated with remediation of National Grid's former manufactured gas plant (MGP) located in the Town of Huntington. The site is situated in a sensitive location along the waterfront, surrounded by commercial and residential properties, and half the property where the remediation was conducted is a steep slope. The remedy consisted of soil removal, oxygen injection, and non-aqueous phase liquid recovery. Mr. Godick was responsible for the development of the remedial work plans, design/construction documents, landscape architecture, confirmatory sampling, air monitoring, supervision, and preparation of close-out documentation in accordance with NYSDEC requirements.

Site Investigation–7 World Trade Center Substation, Con Edison, New York, NY

Mr. Godick managed the site investigation at the former 7 World Trade Center Substation in an effort to delineate and recover approximately 140,000 gallons of transformer and feeder oil following the collapse of the building. The project involved coordination with several crews, Con Edison, and other site personnel.

Site Investigation–Former Manufactured Gas Plant (MGP) Facilities, Con Edison, New York, NY

Mr. Godick managed site investigations at four former MGP facilities. The investigations at three of the four sites were completed at a Con Edison substation, flush pit facility, and service center, respectively. The details associated with the fourth site are confidential. Site characterizations at the substation and flush pit facility were conducted in preparation of expansion at these locations. The findings from these characterizations were used by Con Edison to make appropriate changes to the design specifications and to plan for appropriate handling of impacted materials and health and safety protocols during future construction activities.

Verizon, Investigation & Remediation, Various Locations, NY, PA and DE

Mr. Godick managed over 50 geologic/hydrogeologic assessments and site remediation projects related to petroleum releases at various facilities. Responsibilities included annual budgeting, day-to-day project management, development and implementation of soil and ground water investigation workplans, ground water modeling, risk evaluation, remedial action work plans, remedial design, system installation, waste disposal, well abandonment, and operation and maintenance. Many of the assessment and remedial projects followed a risk-based approach. Remedial technologies implemented included air sparging, soil vapor extraction, bioremediation, pump and treat, soil excavation, and natural attenuation.

Storage Tank Management, Verizon, Various Locations, NY, PA, DE, and MA

Mr. Godick managed the removal and replacement of underground and aboveground storage tank systems for Verizon in New York, Pennsylvania, Delaware, and Massachusetts. Responsibilities included the management of design, preparation of specifications, contractor bidding, construction oversight, project budget, and documentation. For selected AST sites, managed the development of Spill Control, Contingency and Countermeasures (SPCC) plans.

Brownfield Opportunity Area (BOA) Grant Program Services for the Town of Babylon, Wyandanch, NY

AKRF was retained by the Town of Babylon to prepare a blight study, market study, NYS BOA Step 2 Nomination, an Urban Renewal Plan, and a Generic Environmental Impact Statement (GEIS) as part of a revitalization and redevelopment effort for downtown Wyandanch. Mr. Godick was responsible for overseeing the environmental data collection effort for the 226 brownfields identified in the 105-acre project area, and for identifying strategic sites for which site assessment funding should be sought. He also prepared the Hazardous Materials section of the Wyandanch Downtown Revitalization Plan (which incorporates the Nomination, Urban Renewal Plan, and GEIS), involving a summary of available environmental reports, a review of regulatory records, and limited street-level site inspections.

Alexander Street Urban Renewal Plan, Master Plan, Brownfield Opportunity Area Plan, Yonkers, NY

AKRF was retained by the City of Yonkers to prepare an Urban Renewal Plan, Master Plan, Brownfield Opportunity Area Plan, and a Generic Environmental Impact Statement (GEIS) for a 153 acre industrial area along Alexander Street on the Yonkers Waterfront. Mr. Godick was responsible for the Hazardous Materials sections of the GEIS and Urban Renewal Plan. Mr. Godick managed the environmental data collection effort for the entire study area which involved review and summary of existing environmental reports, a review of regulatory records, and field inspections. The collected information was used to prioritize individual parcels for funding and remediation. The Master Plan for the area called for the development of a mixed-use neighborhood consisting of residential, neighborhood retail, and office space uses with substantial public open space, access to the Hudson River, and marina facilities.

SEMINARS, LECTURES & PUBLICATIONS

“Let Nature Do the Work – Onsite Stormwater Management,” Westchester County Department of Parks, Recreation and Conservation, Fall 2003

“Water Pollution Control and Site Assessments and Audits,” Environmental Health and Safety Issues Course, Building Owners and Managers Institute (BOMI), 1997-1999

“Hydrogeologic and Geological Aspects of Tank Closures and Remedial Action,” Underground Storage Tanks Course, Government Institutes, Summer 1996, Fall 1997

REBECCA KINAL, P.E.

VICE PRESIDENT

Rebecca Kinal has over 20 years of experience in the assessment and remediation of soil and groundwater contamination and other hazardous/non-hazardous waste problems. Ms. Kinal's experience includes environmental due diligence, soil and groundwater investigations, leaking underground storage tank studies, soil gas/vapor intrusion surveys, and oversight of small- and large-scale remediation programs, including design of groundwater remediation systems and vapor mitigation systems. She has directed numerous Phase I and Phase II investigations and remediation programs, many of them in conjunction with commercial/residential developers, law firms, lending institutions, and public agencies. She is experienced in the cleanup of contaminated properties under New York State Brownfield Cleanup Program (BCP) regulations and the New York City "E-designation" program. As a part of this work, her duties have included technical and report review, proposal writing, scheduling, budgeting, and acting as liaison between clients and regulatory agencies, and project coordination with federal, state, and local authorities.

BACKGROUND

Education

M.S., Hydrogeology, Rensselaer Polytechnic Institute, 1995

B.S., Civil Engineering, Lafayette College, 1992

Licenses/Certifications

State of New York, P.E. Registration No. 082046, 2004

Years of Experience

Year started in company: 2000

Year started in industry: 1996

RELEVANT EXPERIENCE

New York City School Construction Authority On-Call Contract for Environmental Consulting Services, Various Sites, NY

Ms. Kinal serves as the project manager for AKRF's on-call hazardous materials consulting contract with the New York City School Construction Authority for over 8 years. For potential new school sites, assignments include initial due diligence, Phase I environmental site assessments, (ESAs) and subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plan, contract specifications, and design drawings. The work has also included conducting indoor air quality testing, vapor intrusion assessments, preparation of specifications, supervision of storage tank removals, and investigation and remediation of spills for existing schools. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours.

USTA National Tennis Center, Queens, NY

AKRF prepared an EIS for the New York City Departments of City Planning (DCP) and Environmental Protection (DEP) as co-lead agencies to analyze the expansion of the National Tennis Center, which includes multiple improvements and construction projects at the USTA campus over several years. As part of the EIS requirements, AKRF prepared a Remedial Action Plan for implementation during the proposed project's construction. In accordance with the RAP, vapor mitigation systems were incorporated into the design for several of the proposed structures at the facility, including two new stadiums, a new transportation center, and several practice court facilities. Ms. Kinal prepared the specifications and design drawings for the vapor mitigation and is providing on-going construction support to review contractor submittals and inspect the vapor barrier and sub-slab depressurization system installations.

Montefiore Medical Center, Various Locations, NY

Ms. Kinal provides due diligence assistance to Montefiore Medical Center (MMC) for the ongoing expansion of their facilities, primarily in the Bronx and Westchester County. She conducts and manages environmental due diligence tasks related to their property transactions, including Phase I Environmental Site Assessments (ESAs), Phase II investigations, and geophysical surveys. She also assists MMC in making decisions with respect to environmental risk issues.

Queens West Development Project, Long Island City, NY

For over 20 years, AKRF has played a key role in advancing the Queens West development, which promises to transform an underused industrial waterfront property into one of largest and most vibrant mixed-use communities just across the East River from the United Nations. AKRF has prepared an Environmental Impact Statement that examines issues pertaining to air quality, land use and community character, economic impacts, historic and archaeological resources, and infrastructure. As part of the project, AKRF also undertook the largest remediation ventures completed to date under the NYSDEC Brownfields Cleanup Program (BCP). Ms. Kinal helped prepare the Remedial Work Plan (RWP) and oversaw the remediation of Parcel 9, a 1.8-acre former industrial site. Remediation includes installation of a sheet pile containment wall, excavation of coal tar- and petroleum-contaminated soil under a temporary structure to control odors during remediation, vapor mitigation for the future buildings, and institutional controls. Upon completion of the remediation activities, Ms. Kinal managed the preparation of a Final Engineering Report (FER) to document the clean-up activities. The NYSDEC issued a Certificate of Completion (COC) for the Parcel 9 site in December 2006. Ms. Kinal continues to oversee post-remediation monitoring and site management activities to ensure that the remedy remains in-place and effective.

Roosevelt Union Free School District, Roosevelt, NY

Ms. Kinal is managing environmental investigation and remediation activities for the sites of three new elementary schools and a new middle school in Roosevelt, New York. Remediation activities include removal/closure of contaminated dry wells and underground petroleum storage tanks, and excavation and off-site disposal of petroleum- and pesticide-contaminated soil.

Proposed NYC Public School Campus, Bronx, NY

Ms. Kinal provided environmental consulting services to the selected environmental remediation contractor for this former manufactured gas plant in the Mott Haven neighborhood of the Bronx, which was remediated under the NYSDEC BCP. These services included: preparation of an in situ sampling plan and excavation plan for waste characterization and disposal; supervision of waste characterization sampling activities; development and implementation of a community air monitoring program during all remediation activities; and daily reporting to the NYC School Construction Authority.

National Grid – Halesite Manufactured Gas Plant Site, Town of Huntington, NY

Ms. Kinal served as the project manager for the remedial design and engineering work associated with remediation of National Grid's former manufactured gas plant (MGP) located in the Town of Huntington. The site is situated in a sensitive location along the waterfront, surround by commercial and residential properties, and half the property where the remediation was conducted is a steep slope. The remedy consisted of soil removal, oxygen injection, and non-aqueous phase liquid recovery. Ms. Kinal developed the remedial work plans, design/construction documents, and managed environmental oversight of the remedial work, including waste characterization and tracking, confirmatory endpoint sampling, air monitoring, and reporting to the NYSDEC. After the remediation work was completed, Ms. Kinal prepared appropriate close-out documentation in accordance with NYSDEC requirements.

Shell Service Station, Millwood, NY

Ms. Kinal planned and oversaw a Phase I Environmental Site Assessment and Phase II Subsurface Investigation of this active gasoline station in northern Westchester County. The Phase I/Phase II investigations were performed for the potential buyer of the property who wished to redevelop it with a more modern service station and convenience store. Ms. Kinal also prepared a conceptual remediation plan to address several areas of petroleum contamination identified during the Phase II. The plan, which was approved by NYSDEC, will be implemented in conjunction with the site redevelopment activities to achieve closure for several spills reported at the site.

Pelham Plaza Shopping Center Site Investigation & Remediation, Pelham Manor, NY

Ms. Kinal managed a Site Investigation at Pelham Plaza, an approximately ten-acre site that formerly contained a manufactured gas plant. The site was investigated under a voluntary clean-up agreement entered into with the NYSDEC by the site owner. The site investigation included advancing over 100 soil borings with continuous soil sampling to bedrock, installing monitoring and recovery wells, and conducting test pitting both indoor and outdoor locations to collect soil and groundwater samples and determine the extent of Non-Aqueous Phase Liquid (NAPL). The investigation also included: soil gas sampling to determine contaminant concentrations in the vapors beneath the foundation of an on-site retail store; sediment sampling in an adjacent creek to identify off-site impacts; and a tidal survey to determine tidal influence on groundwater levels at the site. Ms. Kinal also oversaw on-going interim remedial measures, which include biweekly pumping of recovery wells to remove dense NAPL (DNAPL) from the site subsurface.

Shaws Supermarket Redevelopment Project, New Fairfield, CT

Ms. Kinal managed the Remedial Investigation (RI) for an approximately nine-acre shopping center site that was contaminated by releases from former dry cleaning operations. The site was being redeveloped with a new supermarket and separate retail stores. The investigation included the installation of monitoring wells in the intermediate overburden aquifer and bedrock aquifer, sampling of existing and newly installed wells, geophysical logging in bedrock wells, and pump testing in intermediate and bedrock wells. Ms. Kinal prepared a Remedial Action Work Plan (RAWP) based on results from the RI, which included a groundwater pump and treat system to contain a plume of perchlorethylene (PCE)-contaminated groundwater, and excavation and disposal of contaminated soil in the presumed source area. Following CTDEP approval of the RAWP, Ms. Kinal prepared bid specifications for soil excavation and remediation system installation, and oversaw their implementation. Ms. Kinal also prepared NPDES permit applications for discharges from construction dewatering and the groundwater remediation system, and conducted associated discharge monitoring.

Yankee Stadium, Bronx, NY

Ms. Kinal performed the hazardous materials analysis for the Draft Environmental Impact Statement for the proposed new Yankee Stadium. The analysis included a Phase I Environmental Site Assessment of the entire project area and Subsurface (Phase II) Investigation in areas where environmental conditions were identified. The Phase II investigation included geophysical surveys to search for potential underground storage tanks; and soil, soil gas, and groundwater sampling at over 40 locations to determine potential environmental impacts during and after the proposed construction.

Avalon on the Sound, New Rochelle, NY

Ms. Kinal oversaw environmental investigation and soil remediation during the construction of two luxury high-rise apartment buildings and an associated parking garage. Investigation activities included an electromagnetic survey to search for possible underground storage tanks, and subsurface sampling to characterize soil and groundwater. Remediation activities included removing underground storage tanks, excavating and disposing of soil contaminated with volatile and semi-volatile organic compounds, and collecting end-of-excavation confirmation samples.

Davids Island Environmental Audit, New Rochelle, NY

Ms. Kinal managed the hazardous materials portion of the audit of this undeveloped island site, including a Phase I Environmental Site Assessment (ESA) and Subsurface (Phase II) Investigation in areas where environmental conditions were identified. The Phase II investigation included collecting soil samples from more than 100 locations and analyzing them for targeted compounds, including volatile organic compounds, semi-volatile compounds, metals, pesticides, and polychlorinated biphenyls (PCBs). Ms. Kinal also oversaw an electromagnetic (EM) survey conducted to identify the location of suspected underground storage tanks on the island. Based on soil sample results, Ms. Kinal estimated the volume of contaminated soil requiring remediation and prepared cost estimates for soil excavation and for transportation and disposal of contaminated soil and hazardous materials.

Outlet City Site Investigation, Queens, NY

Ms. Kinal prepared a work plan for remedial investigation of the Outlet City site, a property in Long Island City that was formerly occupied by a manufacturer of industrial cleaners and pharmaceuticals. The site is being investigated and remediated under the NYSDEC voluntary clean-up program. In preparing the work plan, Ms. Kinal evaluated results from several previous investigations and conducted a limited groundwater sampling program to determine future data needs for designing remediation of creosote-contaminated soil and groundwater. The work plan included additional soil and groundwater sampling, a tidal survey to determine tidal influence on groundwater levels, and pilot free product recovery testing. Ms. Kinal also helped design a venting system for an on-site basement and performed exposure calculations for the vented vapors.

Yonkers Waterfront Redevelopment Project, Yonkers, NY

For this redevelopment along Yonkers' Hudson River waterfront, Ms. Kinal supervised the remediation of Parcels H and I that were contaminated with hazardous soil. During the remediation process, she reviewed the subcontractor health and safety plans, delineated the areas of excavation, and oversaw field activities to ensure compliance with the specifications and appropriate regulations. This property was remediated under the NYSDEC Environmental Restoration Program (ERP).

U.S. Post Office Main Vehicle Maintenance Facility, Washington, D.C.

While with another firm, Ms. Kinal designed and supervised the installation of a remediation system to treat petroleum-contaminated groundwater. Ms. Kinal also established O&M and monitoring protocols to ensure efficient operation of the air sparging/soil vapor extraction system, and to monitor contaminant recovery/degradation rates.

Aberdeen Proving Ground Building 4025 Site, Aberdeen, MD

While with another firm, Ms. Kinal provided services for this leaking underground storage tank site, Ms. Kinal planned and oversaw investigation and pilot testing activities to delineate contamination and determine feasible in-situ remediation options. Investigation activities included soil and groundwater sampling using a direct-push (Geoprobe) rig and mobile laboratory. Pilot testing included in-situ respirometry testing, and field testing of bioremediation and free-product recovery technologies.

BRYAN ZIEROFF, LEP

SENIOR HYDROGEOLOGIST

Bryan Zieroff has 15 years of experience in the environmental consulting industry. Mr. Zieroff's experience includes the conceptual design, implementation and reporting of detailed field investigations including assessments of ground-water supplies for residential, municipal and industrial users, and evaluation, monitoring and remediation of soil and ground-water contamination for sites regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), Connecticut's Remediation Standard Regulations, and by the New York State Department of Environmental Conservation's (New York State Department of Environmental Conservation's (NYSDEC)) cleanup programs. These studies include investigations at sites impacted by petroleum products, chlorinated solvents, metals and landfill leachate. Mr. Zieroff's tasks often include characterization of the extent of contamination in soil, ground water, and soil vapor, evaluation of compliance with the established regulatory criteria, and operation and maintenance of remediation systems. Mr. Zieroff's familiarity with various field investigation techniques enhances his management skills.

RELEVANT EXPERIENCE

Gedney Way Leaf and Yard Waste Composting Facility, White Plains, NY

Mr. Zieroff is Project Manager for a remediation and landfill closure project at an existing composting facility. The project included documenting the entire disposal history and completing a site-wide investigation to confirm the extent of a solvent release and to provide data necessary to complete landfill closure. The investigation was required to satisfy the requirements in the NYSDEC DER-10 and 6NYCRR Part 360. After receiving state approval of the Site Investigation Report, the project has moved into the remediation and landfill closure design phase. The remedial design includes the testing and implementation of a chemical oxidation injection program, and landfill closure includes design, state approval, and construction of a landfill cap.

BACKGROUND

Education

B.S., Geological Sciences, The Ohio State University, 1994

Licenses/Certifications

Certified Professional Geologist-American Institute of Professional Geologists, License # CPG-11197

40 Hour HAZWOPER and Annual Refresher Training

Supervisors of Hazardous Waste Operations (8 Hour)

Professional Memberships

American Institute of Professional Geologists

Association of Ground-Water Scientists and Engineers (National Ground Water Association)

Environmental Professionals' Organization of Connecticut (EPOC)

Years of Experience

Year started in company: 2006

Year started in industry: 1995

New City Plaza, New City, NY

Mr. Zieroff is Project Manager for an investigation and remediation project at a former dry cleaning facility. Investigation and remediation at the site currently are being conducted under review of the NYSDEC Brownfield Cleanup Program. Tasks have included preparation and state approval of a Site Investigation Work Plan, Site Quality Assurance Project Plan, Health and Safety Plan, a Community Participation Plan, and completion of the investigation phase of the Brownfield's program. Interim Remedial activities include contamination source removal from soil and installation of a sub-slab depressurization system to address soil vapor. A feasibility study is currently being completed to determine the optimal remedial approach for site-wide remediation.

Orangeburg Pipe Site, Orangeburg, NY

Mr. Zieroff completed a subsurface investigation to determine the extent of soil and groundwater contamination at the former Orangeburg Pipe facility. The investigation results were used to develop a Remedial Action Plan to address solid waste, petroleum contamination, worker safety during site development, and capping requirements to satisfy the NYSDEC Voluntary Remediation Program. The Remedial Action Plan included a Heath and Safety Plan, Community Air Monitoring Plan, and specifications for soil management, a vapor mitigation system and dewatering procedures during the construction of multiple commercial buildings.

Magna Metals Facility, Cortlandt, NY

Mr. Zieroff managed a soil-gas investigation project at an existing commercial warehouse and office building. The project included installation of permanent soil gas sampling points and completion of a sampling program that met the requirements of the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York. Site activities included a pre-sampling investigation with the NYSDOH to document materials storage, air flow specifications, historical uses, site uses and areas of concern for sub-slab and ambient air sampling. The investigation work was being conducted to satisfy the NYSDEC consent order.

Paragon Paint Company Facility, Long Island City, NY

Mr. Zieroff was Project Manager for an investigation and remediation project at a former paint manufacturing facility. The project has included a multiple subsurface investigations to determine the extent of solvent and petroleum contamination at the site. All phases of remediation at the site are being completed under review of the NYSDEC Brownfield Cleanup Program. Tasks include completion and state approval of a Site Investigation Work Plan, Quality Assurance Project Plan, Health and Safety Plan, Community Participation Plan, Remedial Action Plan, and Final Remediation Report.

Pathmark Stores Site, Bronx, NY

Mr. Zieroff completed a Remedial Action Plan, Construction Health and Safety Plan and a Soil Management Plan for a former materials storage facility associated with Manhattan College. The plans were completed to provide worker safety and soil handling guidelines during the construction of a large retail facility and parking garage. Development activities at the site were conducted under oversight of the New York City Department of Environmental Protection (NYCDEP). A Notice of Satisfaction was received after project completion.

Yale and Towne Site, Stamford, CT

Mr. Zieroff provided oversight services for a remediation project at a former industrial site. The site included over 35 buildings and 87 areas of environmental concern that required investigation and remediation. Tasks included providing technical support in understanding the Connecticut regulatory requirements, investigation and remediation costs, and confirmation of appropriate schedules to address the environmental issues during redevelopment of the project site.

Aluminum Company of America (ALCOA) Facility, Guilford, CT

Mr. Zieroff managed a ground-water remediation project at an existing aluminum manufacturing facility. The project included soil, vapor and ground-water sampling to confirm the extent of a solvent release, determination of ground water and aquifer characteristics, operation and maintenance of a ground-water pump-and-treat system and compliance sampling in association with a Connecticut Department of Environmental Protections (CTDEP) consent order.

Coats North America Facility, Watertown, CT

Mr. Zieroff was the Project Manager for site compliance work at an existing synthetic treads facility. The project included an evaluation of activities, chemical uses and waste handling practices to determine areas of environmental concern. Investigations to determine the status of these areas included installation of monitoring wells, soil and ground-water sampling, soil-vapor sampling, liquid storage tank removal and Resource Conservation and Recovery Act (RCRA) closure of waste storage areas. The project activities were completed in compliance with the CTDEP property transfer program.

United Parcel Service, Storm Water Management, 9 Connecticut Facilities

Mr. Zieroff managed the design and implementation of a storm water pollution prevention project at nine United Parcel Service facilities. The project included analysis of drainage areas, determination of sheet flow characteristics and the collection of storm-water discharge samples and SMR reporting in accordance with the CTDEP General Permit for the Discharge of Storm Water.

Meriden Enterprise Center, Meriden, CT

Mr. Zieroff developed and directed a subsurface investigation to determine the nature and extent of contamination related to releases from multiple underground storage tank farms, silverware plating, machining and furniture stripping operations. Project activities included ground-penetrating radar, drilling of test borings, installation of monitoring wells, developing a conceptual site model for the established releases and preparing a report detailing remedial alternatives for the property and owner requirements under the CTDEP Property Transfer Act.

Development properties in Kent, Ridgefield, and Greenwich, CT and Mahopac and Brewster, NY

Mr. Zieroff directed an evaluation and testing program of bedrock water-supply wells to determine long-term yield, impact on local users, and water quality results. The project included compilation of data, construction of hydrographs, determination of aquifer characteristics and reporting.

Bettsville Quarry, Bettsville, OH

Mr. Zieroff directed a pumping test of dewatering wells to determine yield requirements for dewatering a carbonate rock quarry. The dewatering program included a determination of offsite impacts to local ground-water users. Mr. Zieroff developed an offsite monitoring program to document and protect local users during the quarry dewatering process.

Burning Tree Country Club, Greenwich, CT

Mr. Zieroff directed an in-situ percolation test to determine recharge rates for a proposed upgrade to the facility septic system. The project included compilation of slug test data and software analysis to determine K values.

MARK JEPSEN

ENVIRONMENTAL SCIENTIST

Mark Jepsen is an Environmental Scientist in AKRF's Hazardous Materials group. He has a great deal of experience in both environmental science and natural resources, including environmental remediation and consulting, groundwater quality and soil science, hydrology, and geology.

Since Joining AKRF at the beginning of 2014, Mr. Jepsen has overseen a wide variety of environmental investigations. He has performed oversight at large scale construction sites entailing complex remediation techniques. He has performed various Phase I site visits and reports. Additionally, Mr. Jepsen has followed up these Phase I investigations with performing Phase II remedial investigations including soil, groundwater, and soil vapor sampling. Also, Mr. Jepsen has a great deal of experience creating environmental reports discussing results found during the preliminary and supplemental investigations, Remedial Action Work Plans (RAWPs), Construction Health and Safety Plans (CHASP), Remedial Closure Reports, Environmental Bid Specifications and Design Coordination. Mr. Jepsen has a knowledgeable background in environmental issues and challenges pertaining to the New York metropolitan area and technical guidelines. Mr. Jepsen has a great deal of experience working on projects involved with multiple governmental regulators including NYSDEC, NJDEP, NYCDEP, and NYCOER.

Before joining AKRF, Mr. Jepsen worked for Bluestone Environmental Services in Somerset, New Jersey. He was responsible for performing a wide array of field work activities including groundwater sampling, monitoring well gauging, soil sampling, and more for Bluestone's various clients including: ExxonMobil, International-Matex Tank Terminals (IMTT) and various gas stations. He was responsible for maintaining an understanding of large and active remediation sites and dealing with an extensive groundwater monitoring well network, as well as acting as an on-site safety supervisor for all Bluestone employees and subcontractors.

BACKGROUND

Education

B.S., Environmental Science, The Ohio State University, 2012

New Jersey Regulatory Seminars

Combined Sewer Outfalls (CSO) for LSRPs: Remediation Alternatives to Better Manage Storm Water

Certifications

40 Hour OSHA HAZWOPER – annual refresher every year
10 Hour OSHA Construction Training
Gold Certified Brownfield Professional by New York City Office of Environmental Remediation
Transportation Worker Identification Credential (TWIC)
NYSDEC Erosion and Sediment Control Inspector
Boating license

Years of Experience

Date started at AKRF: March 2014
Prior industry experience: Bluestone Environmental Services (NJ) – January 2013 to March 2014

RELEVANT AKRF EXPERIENCE

432 East 14th Street, Environmental Management Specifications, Design Coordination and Pre-Characterization of Soil for Off-site Disposal, New York, NY

Mr. Jepsen supported AKRF's preparation of Environmental Management Specifications and Design Coordination, and collection and laboratory analysis of soil samples to pre-characterize soil beneath the Site for off-site disposal. Mr. Jepsen also performed the Phase II remedial investigation of this site which included soil, groundwater, and soil vapor sampling. Mr. Jepsen was also responsible for construction oversight during the foundation excavation for the proposed building. Following completion of excavation, Mr. Jepsen was responsible for inspecting the vapor barrier system installed as an engineering control for the proposed building. He has also been involved with creating the Remedial Closure Report.

77 Commercial Street, Environmental Services, Greenpoint, NY

Mr. Jepsen supported AKRF's environmental services, including Preparation of a Remedial Investigation (Phase II) Work Plan; Remedial Investigation (RI) and Report; Preparation of a Remedial Action Work Plan (RAWP) and Construction Health and Safety Plan (CHASP); Pre-Characterization of Soil for Off-site Disposal; Environmental Monitoring; Remedial Closure Report; and Environmental Bid Specifications and Design Coordination.

Bronx Pro 2264-2272 Morris Avenue, Environmental Consulting Services, Bronx, NY

Mr. Jepsen is supporting AKRF's environmental consulting services for this site including, Phase I Environmental Site Assessment (ESA) and update, Phase II remedial site investigations and subsurface sampling, ongoing construction oversight and vapor barrier inspections.

Memorial Sloan Kettering Cancer Center Hospital 74th Street, Environmental Services, New York, NY

Mr. Jepsen supported AKRF's environmental services, including construction oversight and air monitoring, groundwater sampling, and monitoring well decommissioning. Also, Mr. Jepsen has overseen large scale UST closure and removal at this site. Mr. Jepsen was responsible for the on-site implementation of AKRF's Remedial Action Work Plan (RAWP) and Construction Health and Safety Plan (CHASP). He has also been involved with creating the Remedial Closure Report.

School Construction Authority, New York, NY

Under an on-call contract, AKRF provides the New York City School Construction Authority (NYCSCA) with hazardous materials consulting services. Mr. Jepsen is involved with various due diligence and environmental assessment projects including Phase I Environmental Site Assessments (ESAs); Phase II (Subsurface) Environmental Site Investigations (soil, groundwater and soil vapor intrusion investigations); Indoor Air Quality (IAQ) Assessments; Underground Storage Tank (UST) and Aboveground Storage Tank (AST) inspections relating to boiler conversions; and peer review of other consultant's due diligence reports.

Indoor Air Quality Monitoring, New York, NY

Mr. Jepsen has performed a variety of indoor air quality investigations and surveys at sites including educational institutions and various residential buildings. Mr. Jepsen performed interviews pertaining to environmental site conditions and background with property owners and operators.

11 Greene Street, Environmental Consulting Services, New York, NY

Investigation and remediation of the Site is being conducted to satisfy NYC Office of Environmental Remediation (NYCOER) requirements under the Voluntary Clean-Up Program (VCP) and CEQR. Mr. Jepsen is supporting AKRF's environmental consulting services for this site including Waste Classification testing and delineation, preparation of a Remedial Investigation (Phase II) Work Plan; Remedial Investigation (RI) and Report; Preparation of a NYCDEP Dewatering Application and Permit; Preparation of a Remedial Action Work Plan (RAWP) and Construction Health and Safety Plan (CHASP); Pre-Characterization of Soil for Off-site Disposal; Environmental Monitoring; and Environmental Bid Specifications and Design Coordination.

3200 Jerome Avenue, Environmental Consulting Services, Bronx, New York

AKRF conducted a Phase I ESA and an Indoor Air Quality Survey of this property in the Bronx during due diligence investigations for the NYCSCA which identified levels of trichloroethene (TCE) in indoor air that exceeded the New York State Department of Health (NYSDOH) standards. NYCSCA subsequently terminated its lease of the site and discontinued its use as a school. Following the termination of NYCSCA's lease of the site, AKRF was retained by the owner to conduct an investigation and cleanup. Mr. Jepsen helped to conduct groundwater sampling requirements set by the NYSDEC as part of the Brownfield Cleanup Agreement for the project site. Mr. Jepsen is supporting the ongoing operations and maintenance of an active sub-slab depressurization system installed beneath the building. Mr. Jepsen has also overseen in-situ chemical oxidation (ISCO) groundwater treatment injection activities performed on-site.

98-100 Franklin Street, Manhattan, NY

AKRF completed a Phase I Environmental Site Assessment (ESA), Phase II ESI, prepared a Remedial Action Work Plan, a NYCDEP Dewatering Application and Permit, and performed soil waste classification sampling (which required the preparation of a NYC Transit Subsurface Investigation Permit to perform the associated soil borings) for the proposed redevelopment for a 29,564-square foot, eight-story mixed-use building with a cellar. As the assistant project manager, Mr. Jepsen coordinated with the client and contactors and performed oversight of on-site remediation activities.

NYSDOT/NYSTA Tappan Zee Hudson River Crossing, Rockland and Westchester Counties, NY

AKRF completed an EIS for this project on a fast-track schedule. Findings of the study were utilized to develop numerous documents prepared to guide the construction team, including a Remedial Action Plan and a Construction Health and Safety Plan for the five-year bridge replacement project. As part of the findings of the study, additional mitigation was required to ensure safety of endangered species inhabiting the Hudson River. Mr. Jepsen has been responsible for captaining and assisting in vessel-based monitoring of endangered species within and surrounding the marine construction zone of the new Tappan Zee Bridge located in Tarrytown and Nyack, NY on the Hudson River.

Previous Experience

International-Matex Tank Terminals (IMTT) and ExxonMobil, Environmental Consulting Services, Bayonne, NJ

Mr. Jepsen was responsible for conducting operations and maintenance of an extensive groundwater monitoring well network at an active storage tank terminal located in Bayonne, NJ. Mr. Jepsen also conducted site investigation field activities; including soil, groundwater sampling, and monitoring well installation. Mr. Jepsen aided with the operation and maintenance of active remedial systems, including oil recovery skimming systems and water treatment and discharge systems. Mr. Jepsen was responsible for maintaining client relationships and acting as an on-site safety supervisor for all Bluestone employees and subcontractors. Mr. Jepsen assisted with relevant compliance reporting requirements, remedial work plans, and general work permitting

Various Gas Stations, Environmental Consulting Services, Various Locations, NJ

Mr. Jepsen conducted site investigation field activities, including groundwater sampling and monitoring well installation at various gas stations with open petroleum spills reported the NJDEP. Mr. Jepsen acted as an on-site safety supervisor for all Bluestone employees and subcontractors. Mr. Jepsen assisted with relevant compliance reporting requirements.

STEPHEN SCHMID

ENVIRONMENTAL SCIENTIST

Stephen Schmid is an Environmental Scientist in AKRF's Hazardous Materials Department with two years of experience. He has experience in Phase I and II site assessments and construction/remediation oversight which have included water, soil and air sampling. Mr. Schmid is a 2011 graduate from the University of New Hampshire, where he studied marine and freshwater biology, and environmental conservation. Prior to joining AKRF Mr. Schmid conducted fieldwork, water sampling and analysis in addition to assisting in a study of lakes in the North Eastern United States.

BACKGROUND

Education

BS Marine & Freshwater Biology, University of New Hampshire, Durham, NH

Minor: Environmental Conservation Studies, University of New Hampshire, Durham, NH

Licenses/Certifications

40 Hour OSHA HAZWOPER

Asbestos Project Monitor, Air Technician and Inspector

Years of Experience

Year started in company: 2012

Year started in industry: 2011

RELEVANT EXPERIENCE

New York City School Construction Authority (SCA), Environmental Consulting Hazardous Materials Services

AKRF has undertaken various assignments under two consecutive hazardous materials on-call contract, including environmental assessment, remedial design, and plumbing disinfection consulting tasks. For potential new school sites, assignments include initial due diligence, Phase I environmental site assessments (ESAs) and multi-media subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plans, design of sub-slab depressurization systems (SSDS) and contract specifications, and construction oversight. The work has also included conducting Phase I ESAs and indoor air quality testing, preparation of specifications, supervision of storage tank removals, and investigation and remediation of spills for existing schools. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours. Mr. Schmid has provided oversight during plumbing disinfections, storage tank removals and spill remediation.

25 Broad Street, Manhattan, NY

AKRF has been contracted by LCOR during the demolition of a residential building on a property which will eventually be redeveloped. AKRF has been responsible for creating and implementing a community air monitoring program during demolition activities. Mr. Schmid has been the on-site monitor responsible for calibrating equipment and monitoring levels of volatile organic compounds and particulate matter for the surrounding area and construction personnel. Reports of the daily activity including data collected throughout the day were prepared for submittal to the client.

164 Kent Avenue, Brooklyn, NY (AKA Northside Piers and 1 North 4th Place)

The project was a multi-phase development consisting of a large waterfront block in the Williamsburg Rezoning Area. The project site has been developed with a mixed-use residential-commercial high rise towers with an esplanade and a pier along the East River. AKRF provided acquisition and development support, including performing Phase I and II environmental site assessments, and preparation of Remedial Action Plans (RAPs) and Construction Health and Safety Plan (CHASPs) for approval by DEP and OER. Mr. Schmid provided assistance with construction oversight during soil handling activities and managing the Community Air Monitoring Plan (CAMP) activities. To date, closure reports have been prepared and occupancy achieved for three of the four buildings.

The Home Depot, Rego Park, NY

AKRF has designed, installed and performed upgrades to an air sparging and soil vapor extraction system being used to remediate tetrachloroethene contamination at this site under the NYSDEC Voluntary Cleanup Program. Mr. Schmid has performed low flow, indoor air and effluent sampling as part of ongoing monitoring activities to assess the progress of the cleanup.

250 North 10th Street, LLC., Residential Redevelopment Site, Brooklyn, NY

AKRF was retained to investigate and remediate this former industrial property in the Williamsburg section of Brooklyn, New York in connection with site redevelopment. The site is approximately 50,000 square feet, and redevelopment included a six story residential building and parking garage. The work was completed to satisfy the requirements of the NYC E-designation Program and NYC Voluntary Cleanup Program (NYC VCP). AKRF completed a Remedial Investigation (RI) to evaluate the nature and extent of site contamination, and developed a Remedial Action Work Plan (RAWP) to properly address site contamination during redevelopment. Remediation included removal of underground storage tanks, more than 7,500 tons of contaminated soil, and installation of a vapor barrier and site cap across the entire property. The remediation was completed under oversight of the NYC Office of Environmental Remediation (OER), and in a manner that has rendered the Site protective of public health and the environment consistent with residential use of the property. Mr. Schmid conducted construction oversight and community air monitoring during the removal of contaminated soil.

AP-Williamsburg, LLC, 50 North 5th Street Development, Brooklyn, NY

AKRF directed the remedial program at a 55,000-square foot site located in the Williamsburg section of Brooklyn, New York. The site had an industrial and manufacturing history for over 100 years that included a barrel making factory, use of kilns, and a carpet and flooring materials warehouse. AKRF completed a Remedial Investigation (RI) to evaluate the nature and extent of site contamination, and developed a Remedial Action Work Plan (RAWP) to properly address site contamination during redevelopment. Remediation included removal of more than 5,000 tons of contaminated soil, and installation of a vapor barrier and sub-slab depressurization system (SSDS) beneath the site building. The remediation was completed in a manner that has rendered the Site protective of public health and the environment consistent with commercial and residential use of the property, and in accordance with the requirements of the NYC OER E-designation program. The site includes a seven story residential apartment building with street level retail space and a parking garage. Mr. Schmid provided oversight and community air monitoring during construction activities.

Gedney Way Leaf and Yard Waste Composting Facility, White Plains, NY

AKRF directed the remediation and landfill closure project at ths existing composting facility. The project included investigation to document disposal history, extent of landfill materials and a solvent plume, preparation of a landfill closure plan, and management of landfill closure and cap construction. The landfill investigation and closure activities were completed to satisfy the requirements of a New York State Department of Environmental Conservation's (NYSDEC) consent order, and were completed in compliance with NYSDEC DER-10 and 6NYCRR Part 360. Mr. Schmid performed construction oversight and low-flow groundwater sampling during construction activities.

NYCEDC Office of Environmental Remediation (OER) On-Call Environmental Consulting Services

- **Second Farms, Bronx, NY**

  AKRF, Inc. was contracted by OER to conduct a subsurface investigation of a 1.12-acre parcel in the Bronx, New York under the United States Environmental Protection Agency (USEPA) Brownfield Assessment Grant program. Mr. Schmid assisted in the investigation which included a geophysical survey and utility mark-outs, and the collection and analysis of soil, groundwater, soil vapor, indoor air and ambient air samples.

- **Former Nelson Foundry, Long Island City, NY**

  AKRF, Inc. was contracted by OER to conduct a subsurface investigation around the perimeter of a former foundry property in Long Island City, New York under the USEPA Brownfield Assessment Grant program. The work included preparation of a rigorous investigation work plan, Quality Assurance Project Plan, and Health and Safety Plan. The investigation will include a geophysical survey and utility mark-outs and the collection and analysis of soil, groundwater, soil vapor, and ambient air samples. The project also requires careful coordination of investigation-derived waste due to lack of on-site storage and daily drum pick-ups. Mr. Schmid conducted low flow sampling for the analysis of groundwater.

Personnel Resume

Carl Armbruster
QA Manager

Qualifications Summary

Mr. Armbruster has over 30 years of experience in the environmental laboratory and engineering industry that includes extensive technical, management/leadership experience in all aspects of the laboratory business. He is an action-oriented manager dedicated to ensuring the laboratory maintains a quality program that holds the highest credentials in PT scores, accreditations and customer satisfaction. His unique experience lends itself to working successfully with employees, managers and clients at all levels.

Professional Experience

Quality Assurance Manager – TestAmerica Edison - 2005 to Present

Mr. Armbruster is responsible for establishing and implementing the quality assurance program at the Edison facility; and for interfacing with the corporate Quality Assurance Director to ensure adherence with the overall Quality Management Plan. He is also responsible for monitoring implementation and compliance with NELAC and TestAmerica's QMP, conducting annual management system audits and data audits, as well as providing regulatory updates and technical support to the Laboratory Director, Operations Manager, Client Services and Sales department.

Project Manager/Assistant Technical Director – STL Edison --2000 to 2005

Laboratory Director − STL Whippany − 1998 to 2000

Account Manager − Clean Harbors Environmental Services − 1997 to 1998

Laboratory Manager − Waste Management Inc., and Chemical Waste Management Inc − 1988 to 1997

Environmental Scientist − ICF Technology − 1987 to 1988

Analytical Chemist − IT Corporation – 1985 to 1987

Analytical Chemist − Hess Environmental Laboratories – 1983 to 1985

Education

- MS in Biology – East Stroudsburg University, 1984
- BS in Environmental Studies - East Stroudsburg University, 1980

Personnel Resume

Melissa Haas
Project Manager II

Qualifications Summary

Ms. Haas has over 20 years of experience in the environmental laboratory industry which includes project management, inorganic chemistry department management, LIMS implementation, human resources, and data reporting. She has a proven ability to handle multiple projects and tasks and a passion for the highest achievable level of quality and customer service.

Professional Experience

Project Manager – TestAmerica - 2012 to Present

Ms. Haas coordinates and manages clients' projects through all phases of the laboratory operations, ensuring fulfillment of TestAmerica's commitments to client requirements and on-time delivery. She maintains communications with clients and account executives and serves as a liaison between clients and laboratory operations to meet clients' needs. She reviews contractual documents and Quality Assurance Project Plans (QAPPs) to ensure certification and laboratory analytical requirements. Ms. Haas assists clients in identifying project requirements and manages project setup on behalf of the laboratory. She also develops business relationships with clients to further enhance client service and sales. She ensures accuracy and on-time delivery of client reports.

Laboratory Information Management (LIMS) Implementor – TestAmerica − 2011 to 2012

Ms. Haas was responsible for method and reference data setup for laboratories that were scheduled to implement the TALS LIMs system. She communicated with laboratory personnel to acquire information about standard operating procedures to ensure that methods and reference data were set up to meet the needs of the laboratory. She also provided on-site support for laboratories during the Go-Live period of the implementation and was the primary lead for the newly developed Certification Module. She trained laboratory and corporate personnel on the specifications of the software. She also provided remote data review assistance for laboratories to aid in the validation of the methods and reference data setup as well as the accuracy of the analysts' review process.

Metals Department Manager – TestAmerica – 2009-2011

Ms. Haas managed the operational activities of the metals department, including managing staff through clearly setting goals and providing performance reviews and feedback. She monitored the daily laboratory workload and ensured resources and staff were in place to complete projects on time. She prepared inorganic chemistry data packages and reviewed data for accuracy while prioritizing work to ensured timely delivery of quality data packages to clients. She oversaw the quality control of the department including demonstration of capabilities, method detection limit studies, SOP updates, audit responses, and performance evaluation responses.

Human Resources Coordinator – TestAmerica – 2007-2009

Ms. Haas provided support to the laboratory and Corporate Human Resources by implementing and administering Human Resources programs and procedures. She advised managers on Human Resources-related issues and managed the interview process for laboratory hires. She also served as a resource to the lab employees with HR-related issues and coordinated employee recognition programs and special events to promote employee satisfaction.

Wet Chemistry Department Manager – TestAmerica – 2001-2007

Ms. Haas managed the operational activities of the wet chemistry department and supervised a staff of eight analysts. She was responsible for data review, training, and quality control for the department. She increased productivity levels by providing key contributions toward automation of laboratory.

Wet Chemistry Analyst – Severn Trent Labs/AEN – 1997-2001

Veterinary Technician− Mobile Veterinary Clinic − 1994-1997

Campus Organizer –NJ Public Interest Research Group − 1990-1993

Education

- Rutgers University, New Brunswick, NJ 1986-1990, Bachelor of Science, Animal Science

L.A.B. Validation Corp., 14 West Point Drive, East Northport, New York 11731

Lori A. Beyer

SUMMARY: General Manager/Laboratory Director with a solid technical background combined with Management experience in environmental testing industry. Outstanding organizational, leadership, communication and technical skills. Customer focused, quality oriented professional with consistently high marks in customer/employee satisfaction.

EXPERIENCE:

1998-Present L.A.B. Validation Corporation, 14 West Point Drive, East Northport, NY
President

- Perform Data Validation activities relating to laboratory generated Organic and Inorganic Environmental Data.

1998-Present American Analytical Laboratories, LLC. 56 Toledo Street, Farmingdale, NY
Laboratory Director/Technical Director

- Plan, direct and control the operation, development and implementation of programs for the entire laboratory in order to meet AAL's financial and operational performance standards.
- Ensures that all operations are in compliance with AAL's QA manual and other appropriate regulatory requirements.
- Actively maintains a safe and healthy working environmental that is demanded by local laws/regulations.
- Monitors and manages group's performance with respect to data quality, on time delivery, safety, analyst development/goal achievement and any other key performance indices.
- Reviews work for accuracy and completeness prior to release of results to customers.

1996-1998 Nytest Environmental, Inc. (NEI) Port Washington, New York
General Manager

- Responsible for controlling the operation of an 18,000 square foot facility to meet NEI's financial and operational performance standards.
- Management of 65 FTEs including Sales and Operations
- Ensure that all operations are in compliance with NEI's QA procedures
- Ensures that productivity indicators, staffing levels and other cost factors are held within established guidelines
- Maintains a quantified model of laboratory's capacity and uses this model as the basis for controlling the flow of work into and through the lab so as to ensure that customer requirements and lab's revenue and contribution targets are achieved.

1994-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York
Technical Project Manager

- Responsible for the coordination and implementation of environmental testing programs requirements between NEI and their customers
- Supervise Customer Service Department
- Assist in the development of major proposals
- Complete management of all Federal and State Contracts and assigned commercial contracts
- Provide technical assistance to the customer, including data validation and interpretation
- Review and implement Project specific QAPP's.

1995-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York
Corporate QA/QC Officer

- Responsible for the implementation of QA practices as required in the NJDEP and EPA Contracts
- Primary contact for NJDEP QA/QC issues including SOP preparation, review and approval
- Responsible for review, verification and adherence to the Contract requirements and NEI QA Plan

1992-1994 Nytest Environmental, Inc. (NEI) Port Washington, New York
Data Review Manager

- Responsible for the accurate compilation, review and delivery of analytical data to the company's customers. Directly and effectively supervised a department of 22 personnel.
- Managed activities of the data processing software including method development, form creation, and production
- Implement new protocol requirements for report and data management formats
- Maintained control of data storage/archival areas as EPA/CLP document control officer

1987-1991 Nytest Environmental, Inc. (NEI) Port Washington, New York
Data Review Specialist

- Responsible for the review of GC, GC/MS, Metals and Wet Chemistry data in accordance with regulatory requirements
- Proficient with USEPA, NYSDEC, NJDEP and NEESA requirements
- Review data generated in accordance with SW846, NYSDEC ASP, EPA/CLP and 40 CFR Methodologies

1986-1987 Nytest Environmental, Inc (NEI) Port Washington, New York
GC/MS VOA Analyst

EDUCATION:

1982-1985 State University of New York at Stony Brook, New York; BS Biology/Biochemistry
1981-1982 University of Delaware; Biology/Chemistry
5/91 Rutgers University; Mass Spectral Data Interpretation Course, GC/MS Training
8/92 Westchester Community College; Organic Data Validation Course
9/93 Westchester Community College; Inorganic Data Validation Course

Westchester Community College
Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

ORGANIC DATA VALIDATION COURSE (35 HOURS)

Dr. John Samuelian

Date AUGUST 1992

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

Westchester Community College
Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

INORGANIC DATA VALIDATION

Instructor: Dale Boshart

Date MARCH 1993

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

July 8, 1992

Ms. Elaine Sall
Program Coordinator
Westchester Community College
Valhalla, NY 10595-1698

Dear Elaine,

Thank you for your letter of June 29, 1992. I have reviewed the course outline for organic data validation, qualifications for teachers and qualifications for students. The course that you propose to offer would be deemed equivalent to that which is offered by EPA. The individuals who successfully complete the course and pass the final written exam would be acceptable to perform the task of organic data validation for the Department of Environmental Conservation, Division of Hazardous Waste Remediation.

As we have discussed in our conversation of July 7, 1992, you will forward to me prior to the August course deadline, the differences between the EPA SOW/90 and the NYSDEC ASP 12/91. You stated these differences will be compiled by Mr. John Samulian.

I strongly encourage you to offer an inorganic data validation course. I anticipate the same list of candidates would be interested in an inorganic validation course as well, since most of the data to be validated consists of both organic and inorganic data.

Thank you for you efforts and please contact me if I can be of any further assistance.

Sincerely,

Maureen P. Serafini

Maureen P. Serafini
Environmental Chemist II
Division of Hazardous Waste
Remediation

The Professional Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

October 2, 1992

Ms. Lori Beyer
3 sparkill Drive
East Northport, NY 11731

Dear Ms. Beyer:

Congratulations upon successful completion of the Organic Data Validation course held August 17 - 21, 1992, through Westchester Community College, Professional Development Center. This course has been deemed by New York State Department of Environmental Conservation as equivalent to EPA's Organic Data Validation Course.

Enclosed is your Certificate. Holders of this Certificate are deemed competent to perform organic data validation for the New York State DEC Division of Hazardous Waste Remediation.

The Professional Development Center at Westchester Community College plans to continue to offer courses and seminars which will be valuable to environmental engineers, chemists and related personnel. Current plans include a TCLP seminar on November 17th and a conference on Environmental Monitoring Regulations on November 18th.

We look forward to seeing you again soon at another environmental program or event. Again, congratulations.

Very truly yours,

Passing Grade is 70%
Your Grade is 99%

Elaine Sall
Program Coordinator

ES/bf

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

The Professional Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

June 21, 1993

Dear Ms. Beyer:

Enclosed is your graded final examination in the Inorganic Data Validation course you completed this past March. A score of 70% was required in order to receive a certificate of satisfactory completion. Persons holding this certificate are deemed acceptable to perform Inorganic Data Validation for the New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation.

I am also enclosing a course evaluation for you to complete if you have not already done so. The information you provide will greatly aid us in structuring further courses. We wish to make these course offerings as relevant, targeted and comprehensive as possible. Your evaluation is vital to that end.

Congratulations on your achievement. I look forward to seeing you again at another professional conference or course. We will be co-sponsoring an environmental monitoring conference on October 21, 1993 with the New York Water Pollution Control Association, Lower Hudson Chapter, at IBM's Yorktown Heights, NY site. Information regarding this event will be going out in August.

Very truly yours,

Elaine Sall

Elaine Sall
Program Coordinator

ES/bf

Enclosures

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

ATTACHMENT B

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION – GUIDELINES FOR SAMPLING AND ANALYSIS OF PFAS – OCTOBER 2020

NEW YORK STATE OF OPPORTUNITY.
Department of Environmental Conservation

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC’s Part 375 Remedial Programs

October 2020

Table of Contents

October 2020

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

ERRATA SHEET for

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Routine Analysis, page 9	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533."	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	"In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils."	9/15/2020
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
	part of the remedy selection process in accordance with Part 375 and DER-10.		
Soil Sample Results, page 10	"The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase."	"Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. " [Guidance Value Table] "PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. "	9/15/2020
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
	If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	
Footnotes	None	[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. [2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

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Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected.

Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix F) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

Currently, New York State Department of Health’s Environmental Laboratory Approval Program (ELAP) does not offer certification for PFAS in matrices other than finished drinking water. However, laboratories analyzing environmental samples for PFAS (e.g., soil, sediments, and groundwater) under DER’s Part 375 remedial programs need to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533. Laboratories should adhere to the guidelines and criteria set forth in the DER’s laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids). Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist.

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.[1]

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below. In addition, further assessment of water may be warranted if either of the following screening levels are met:

a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or
b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values.

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[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater[2]	1.1	3.7

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

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[2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP-approved lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an “Analytical Methods/Quality Assurance Summary Table” specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by LC-MS/MS for PFAS using methodologies based on EPA Method 537.1
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment

- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation’s Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation’s Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled “General Fish Handling Procedures for Contaminant Analysis” (Ver. 8).

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

   1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

   2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

   3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

   1. Project and Site Name.

   2. DEC Region.

   3. All personnel (and affiliation) involved in the collection.

   4. Method of collection (gill net, hook and line, etc.)

   5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

   1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

   2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

   3. Date collected.

   4. Sample location (waterway and nearest prominent identifiable landmark).

   5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate “Age” column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish’s tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **<u>The Bureau of Ecosystem Health will supply the bags.</u>** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

No materials containing Teflon.
No Post-it notes.
No ice packs; only water ice or dry ice.
Any gloves worn must be powder free nitrile.
No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
Wash hands after handling any food containers or packages as these may contain PFCs. Keep pre-wrapped food containers and wrappers isolated from fish handling.
Wear clothing washed at least six times since purchase.
Wear clothing washed without fabric softener.
Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name ____ DEC Region _____________

Collections made by (include all crew) ____

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☐Trawling ☐Seining ☐Angling ☐Other ______________________________

Preservation Method: ☐Freezing ☐Other _______________________ Notes (SWFDB survey number): _____________________________

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, ______________________________, of ____ collected the
(Print Name) (Print Business Address)

following on ____________________, 20____ from ____
(Date) (Water Body)

in the vicinity of ____
(Landmark, Village, Road, etc.)

Town of ______________________________________, in ________________________________ County.

Item(s) ____

____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on __________________________________, 20______.

____ ___________________________

Signature Date

I, _________________________________, received the above mentioned sample(s) on the date specified and assigned identification number(s) ____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_____________________________________ __________________

Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	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
	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

Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) developed the following guidelines for laboratories analyzing environmental samples for PFAS under DER programs. If laboratories cannot adhere to the following guidelines, they should contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov prior to analysis of samples.

Isotope Dilution

Isotope dilution techniques should be utilized for the analysis of PFAS in all media.

Extraction

For water samples, the entire sample bottle should be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

For samples with high particulates, the samples should be handled in one of the following ways:

1. Spike the entire sample bottle with isotope dilution analytes (IDAs) prior to any sample manipulation. The sample can be passed through the SPE and if it clogs, record the volume that passed through.
2. If the sample contains too much sediment to attempt passing it through the SPE cartridge, the sample should be spiked with isotope dilution analytes, centrifuged and decanted.
3. If higher reporting limits are acceptable for the project, the sample can be diluted by taking a representative aliquot of the sample. If isotope dilution analytes will be diluted out of the sample, they can be added after the dilution. The sample should be homogenized prior to taking an aliquot.

If alternate sample extraction procedures are used, please contact the DER remedial program chemist prior to employing. Any deviations in sample preparation procedures should be clearly noted in the case narrative.

Signal to Noise Ratio

For all target analyte ions used for quantification, signal to noise ratio should be 3:1 or greater.

Blanks

There should be no detections in the method blanks above the reporting limits.

Ion Transitions

The ion transitions listed below should be used for the following PFAS:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
N-EtFOSAA	584 > 419
N-MeFOSAA	570 > 419

Branched and Linear Isomers

Standards containing both branched and linear isomers should be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. As more standards become available, they should be incorporated in to the method. All isomer peaks present in the standard should be integrated and the areas summed. Samples should be integrated in the same manner as the standards.

Since a quantitative standard does not exist for branched isomers of PFOA, the instrument should be calibrated using just the linear isomer and a technical (qualitative) PFOA standard should be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers should be integrated in the samples and quantitated using the calibration curve of the linear standard.

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated for each target analyte and the ratio compared to standards. Lab derived criteria should be used to determine if the ratios are acceptable.

Reporting

Detections below the reporting limit should be reported and qualified with a J qualifier.

The acid form of PFAS analytes should be reported. If the salt form of the PFAS was used as a stock standard, the measured mass should be corrected to report the acid form of the analyte.

Appendix I - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report. Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 14 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R^2 value greater than 0.990.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects
R^2 >0.990	J flag detects and UJ non detects
Low-level calibration check <50% or >150%	J flag detects and UJ non detects
Mid-level calibration check <70% or >130%	J flag detects and UJ non detects

Initial Calibration Verification

An initial calibration verification (ICV) standard should be from a second source (if available). The ICV should be at the same concentration as the mid-level standard of the calibration curve.

ICV recovery <70% or >130%	J flag detects and non-detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated from the standards for each target analyte. Lab derived criteria should be used to determine if the ratios are acceptable. If the ratios fall outside of the laboratory criteria, qualify results as an estimated maximum concentration.

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Branched and Linear Isomers

Observed branched isomers in the sample that do not have a qualitative or quantitative standard should be noted and the analyte should be qualified as biased low in the final data review summary report. Note: The branched isomer peak should also be present in the secondary ion transition.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

ATTACHMENT C

SOIL GAS PURGE VOLUME CALCULATIONS

APPENDIX B

HEALTH AND SAFETY PLAN (HASP) AND COMMUNITY AIR MONITORING PLAN (CAMP)

WHITE PLAINS FIRE DEPARTMENT DRILL SCHOOL

1402 ORCHARD STREET, WHITE PLAINS, NEW YORK

Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP)

NYSDEC Site #: 360193
AKRF Project Number: 200217

Prepared for:

The City of White Plains
255 Main Street
White Plains, New York 10601

Prepared by:

AKRF, Inc.
34 South Broadway, Suite 401
White Plains, New York 10601

NOVEMBER 2020

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1.0 INTRODUCTION

The project site (Site) is located at 1402 Old Orchard Street, White Plains, New York. The legal definition of the Site is City of White Plains Tax ID 120.20-17-1, and the property class is identified as Public Services-Water Supply. The Site is approximately 141 acres, is mainly wooded with small streams, and contains the White Plains Fire Department Drill School (FDDS). The FDDS is situated within a 4-acre clearing that is located approximately 500 feet east of White Plains Reservoir #2. The Orchard Street Pump Station (OCPS) property, also owned and operated by The City, is west-adjacent to the southern portion of the Site, and south-adjacent to Reservoir #1.

The subsurface investigation will include the drilling of soil borings installation of monitoring wells, and the collection of soil, sediment, and groundwater samples. This environmental Health and Safety Plan (HASP) has been developed for implementation during site investigation activities conducted by all personnel on-site, both AKRF employees and others. This HASP does not discuss routine health and safety issues common to general construction/excavation, including but not limited to slips, trips, falls, shoring, and other physical hazards.

The fire department training center has been in operation at the Site since approximately 1960. Prior to 1960, the Site was used by the police department for training exercises. Fire department training included live fire training in several different scenarios. The burn building on the eastern side of the clearing allows for multi-floor, realistic live fire training in a scenario where heat and smoke filled rooms can be controlled for safety. Small training fires using vehicles, pallets, and many types of furniture were also utilized to understand and anticipate the burn tendencies for many life situations. Firefighter foam was reported to be used on a limited basis during the training scenarios, and water collected while cleaning used foam barrels was discharged to the ground. This HASP identifies the hazards of concern, the specific chemicals associated with the Site-specific hazards, and measures to provide protection from exposure to the hazards during the investigation work.

All AKRF employees are directed that all work must be performed in accordance with the Company's Generic HASP and all OSHA applicable regulations for the work activities required for the project. All project personnel are furthermore directed that they are not permitted to enter Permit Required Confined Spaces (as defined by OSHA). For issues unrelated to contaminated materials, all non-AKRF employees are to be bound by all applicable OSHA regulations as well as any more stringent requirements specified by their employer in their corporate HASP or otherwise. AKRF is not responsible for providing oversight for issues unrelated to contaminated materials for non-employees. This oversight shall be the responsibility of the employer of that worker or other official designated by that employer.

Supplemental COVID-19 procedures are outlined in Appendix A, which shall be adhered to during work-related commute and on-site activities, as applicable.

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

Check all that apply		
(**X**) Organic Chemicals	(**X**) Inorganic Chemicals	( ) Radiological
( ) Biological	( ) Explosive/Flammable	( ) Oxygen Deficient Atm
(**X**) Heat Stress	(**X**) Cold Stress	( ) Carbon Monoxide
(**X**) Per- and Polyfluoroalkyl Substances (PFAS)		
Comments: No personnel are permitted to enter permit confined spaces.		

2.1.2 Physical Characteristics

Check all that apply		
(**X**) Liquid	(**X**) Solid	( ) Sludge
(**X**) Vapors	( ) Unknown	( ) Other
Comments:		

2.1.3 Hazardous Materials

Check all that apply					
Chemicals	**Solids**	**Sludges**	**Solvents**	**Oils**	**Other**
( ) Acids	( ) Ash	( ) Paints	( ) Halogens	( ) Transformer	( ) Lab
( ) Caustics	( ) Asbestos	( ) Metals	( ) Petroleum	( ) Other DF	( ) Pharm
( ) Pesticides	( ) Tailings	( ) POTW	( ) Other	( ) Motor or Hydraulic Oil	( ) Hospital
(**X**) Petroleum	( ) Other	( ) Other		(**X**) Gasoline	( ) Rad
( ) Inks				(**X**) Fuel Oil	( ) MGP
( ) PCBs					( ) Mold
(**X**) Metals					( ) Cyanide
(**X**) PFAS					
( )Other: VOCs & SVOCs					

2.1.4 Chemicals of Concern

Chemicals	REL/PEL/STEL	Health Hazards
PFAS	None established at this time.	Initial studies are inconclusive, but there is indication that the liver is the most sensitive target, with some association to increased uric acid levels, blood cholesterol, and high blood pressure.
Benzene	REL = 0.1 ppm PEL = 1 ppm STEL = 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude, dermatitis; bone marrow depression, potential occupational carcinogen.
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia (skin tingling or numbness); dermatitis; liver, kidney damage.
Ethylbenzene	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Xylenes	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, poor coordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Naphthalene	REL = 10 ppm PEL = 10 ppm	Irritation eyes; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage.
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; [potential occupational carcinogen]
Fuel Oil	REL = 350 mg/m^3 PEL = 400 ppm	Nausea, irritation – eyes, hypertension, headache, light-headedness, loss of appetite, poor coordination; long-term exposure – kidney damage, blood clotting problems; potential carcinogen.
Lead	REL= 0.1 mg/m^3 PEL= 0.05 mg/m^3	Weak, lassitude, insomnia; facial pallor, pale eye, anorexia, low-weight, malnutrition, constipation, abdominal pain, colic; anemia; gingival lead line; tremors, paralysis wrists and ankles; encephalopathy; kidney disease; irritation eyes; hypotension.
Comments: REL = NIOSH Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit ppm = parts per million mg/m^3 = milligrams per cubic meter		

2.2 Designated Personnel

AKRF will appoint one of its on-site personnel as the Site Safety Officer (SSO). This individual will be responsible for the implementation of the HASP. The SSO will have a 4-year college degree in occupational safety or a related science/engineering field, and experience in implementation of air monitoring and hazardous materials sampling programs. Health and safety training required for the SSO and all field personnel are outlined in Section 2.3 of this HASP.

2.3 Training

All personnel who enter the work area while intrusive activities are being performed will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards. In addition, all personnel will have up-to-date 8-hour refresher training. The training will allow personnel to recognize and understand the potential hazards to health and safety. All field personnel must attend a training program, whose purpose is to:

- Make them aware of the potential hazards they may encounter;
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety;
- Make them aware of the purpose and limitations of safety equipment; and
- Ensure that they can safely avoid or escape from emergencies.

Each member of the field crew will be instructed in these objectives before he/she goes onto the Site. A site safety meeting will be conducted at the start of the project. Additional meetings shall be conducted, as necessary, for new personnel working at the Site.

2.4 Medical Surveillance Program

All AKRF and subcontractor personnel performing field work involving subsurface disturbance at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). A physician's medical release for work will be confirmed by the SSO before an employee can begin site activities. The medical release shall consider the type of work to be performed and the required PPE. The medical examination will, at a minimum, be provided annually and upon termination of hazardous waste site work.

2.5 Site Work Zones

During any activities involving subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, ensure that proper protective equipment is donned, and provide an area for decontamination.

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support is the zone area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may changed by SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Task	Exclusion Zone	CRZ	Support Zone
Soil Borings/Sampling Locations/ Monitoring Wells	**10 ft from Drilling Equipment, Sampling Locations or Well Location**	**25 ft from Drilling Equipment, Sampling Locations, or Well Location**	**As Needed**
Comments: Control measures such as "caution tape" and/or traffic cones will be placed around the perimeter of the work area when work is being done in a public area.			

2.6 Air Monitoring

The purpose of the air monitoring program is to identify any exposure of the field personnel to potential environmental hazards associated with the documented soil and groundwater contamination. Results of the air monitoring will be used to determine the appropriate response action, if needed.

2.6.1 PFAs Compounds

Although there are currently no State or Federally-approved air monitoring procedures for PFAS compounds, ambient particulate methods are under development by the EPA. For the purpose of conducting this investigation, particulate monitoring in the work space will be conducted as a protective measure. An MIE 1000 Personal DataRam or equivalent will be used to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM10). The dust monitor will be capable of calculating 15-minute running average concentrations and equipped with an audible alarm to indicate exceedance of action levels.

2.6.2 Volatile Organic Compounds

A photoionization detector (PID) will be used to perform air monitoring during soil disturbance activities to determine airborne levels of total VOCs. The PID will be calibrated at the start of the work day with a 100 ppm isobutylene standard.

2.6.3 Work Zone Air Monitoring

Real time air monitoring will be performed with the MIE 1000 (or equivalent) and PID. Measurements will be taken prior to commencement of work and continuously during the work, as outlined in the following table. Measurements will be made as close to the workers as practicable and at the breathing height of the workers. The SSO shall set up the equipment and confirm that it is working properly. His/her designee may oversee the air measurements during the day. The initial measurement for the day will be performed before the start of work and will establish the background level for that day. The final measurement for the day will be performed after the end of work. The action levels and required responses are listed in the following table.

Instrument	Action Level	Response Action
MIE 1000	100 µg/m^3 above background	Dust suppression measures
	150 µg/m^3 above background	Stop work. Continue dust suppression and resume when readings are below 150 µg/m^3.
PID	Less than 5 ppm in breathing zone	Level D or D-Modified
	Between 5 ppm and 50 ppm	Level C
	More than 50 ppm	Stop work. Resume work when readings are less than 50 ppm.
Notes: ppm = parts per million, µg/m^3 = micrograms per cubic meter		

2.6.4 Community Air Monitoring Plan

The intrusive portion of the investigation consists of only shallow soil borings, monitoring well installation, and soil, groundwater, sediment, and surface water sampling, which has a low potential of generating significant vapors or contaminant-laden particulate and will be conducted on an isolated portion of City property that is a minimum of approximately 1,000 feet to the nearest residential property. Consequently, community air monitoring will be conducted based on the results of work zone monitoring. In the event that an Action Level is documented in the work zone, as listed in Section 2.6.3, community air monitoring will be conducted in compliance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP), which would include real-time air monitoring for particulates and volatile compounds at the perimeter of the exclusion zone, as described below.

VOC Monitoring

Periodic monitoring for VOCs will be conducted during non-intrusive activities such as the collection of sediment, surface water, and groundwater samples. Periodic monitoring may include obtaining measurements upon arrival at a location, when purging a sampling point, and upon leaving the location.

Continuous monitoring for VOCs will be conducted during all ground intrusive activities, including drilling, soil sampling, and monitoring well instllation activities. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. VOCs will be monitored continuously at the downwind perimeter of the exclusion zone. Monitoring will be conducted with a PID equipped with an 11.7 eV lamp capable of calculating 15-minute running average concentrations. The following actions will be taken based on organic vapor levels measured:

- If total organic vapor levels exceed 5 ppm above background for the 15-minute average at the exclusion zone perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the exclusion zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the vapor source 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 above background for the 15-minute average.
- If the total organic vapor level is above 25 ppm at the perimeter of the exclusion zone, activities will be shutdown.

More frequent intervals of monitoring will be conducted if required as determined by the SSO. All PID readings will be recorded and available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, will also be recorded.

Dust Monitoring

Continuous monitoring for particulate will be conducted during all soil boring and soil sampling activities, which will involve the measurement of respirable dust. Community air monitoring for dust particulates will be conducted using a MIE 1000 Personal

DataRam or equivalent to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}). The dust monitor will be capable of calculating 15-minute running average concentrations and equipped with an audible alarm to indicate exceedance of action levels. Background readings and any readings that trigger response actions will be recorded in the project logbook, which will be available on site for NYSDOH and/or NYSDEC review. If the downwind particulate concentrations are greater than 100 micrograms per cubic meter ($\mu g/m^3$) above background (upwind concentrations), and no other obvious source is apparent, then it will be assumed that the elevated particulate concentrations are a result of site activities. In such instances, dust suppression measures will be implemented and monitoring will be continued. Work will be allowed to continue with dust suppression if downwind particulate levels do not exceed 150 $\mu g/m^3$ above the background (upwind concentration) and provided that no visible dust is migrating from the work area. If particulate levels persist at 150 $\mu g/m^3$ above the background, work must be stopped until dust suppression measures bring particulate levels to below 150 $\mu g/m^3$ above background.

Major Vapor Emission Response Plan

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work Site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or vapor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the exclusion zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 foot zone).

If either of the following criteria is exceeded in the 20 foot zone, then the Major Vapor Emission Response Plan shall automatically be implemented:

- Sustained organic vapor levels approaching 1 ppm above background for a period of more than 30 minutes; or
- Organic vapor levels greater than 5 ppm above background for any time period.

Upon activation, the following activities shall be undertaken as part of the Major Vapor Emission Response Plan:

- The NYSDEC, NYSDOH, and local police authorities will be immediately contacted by the SSO and advised of the situation;
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the SSO; and
- All emergency contacts will go into effect as appropriate.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review.

2.7 Personal Protection Equipment

The personal protection equipment required for various kinds of site investigation tasks are based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear."

AKRF field personnel and other site personnel shall wear, at a minimum, Level D personal protective equipment. The protection will be based on the air monitoring described in Section 2.6.

LEVEL OF PROTECTION & PPE		Soil Boring/Water Sampling
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft of drill rig) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft of drill rig) (**X**) Nitrile Gloves (**X**) Tyvek for drill operator if NAPL present	Yes
Level C ***(in addition to Level D)*** (**X**) Half-Face Respirator OR (**X**) Full Face Respirator ( ) Full-Face PAPR	( ) Particulate Cartridge ( ) Organic Cartridge (**X**) Dual Organic/ Particulate Cartridge	If PID > 10 ppm (breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breathe or any odors detected).		

2.8 General Work Practices

To protect the health and safety of the field personnel, field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the Site. These areas will be designated by the SSO.
- Workers must wash their hands thoroughly on leaving the work area and before eating, drinking, or any other such activity.
- The workers should shower as soon as possible after leaving the Site. Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat/cold stress.

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

The field crew will be equipped with emergency equipment, such as a first aid kit and disposable eye washes. In the case of a medical emergency, the SSO will determine the nature of the emergency and he/she will have someone call for an ambulance, if needed. If the nature of the injury is not serious, i.e., the person can be moved without expert emergency medical personnel, he/she should be taken to a hospital by on-site personnel. Directions to the hospital are provided below, and a hospital route map is attached.

3.1 Hospital Directions

Hospital Name:	White Plains Medical Center
Phone Number:	(914) 681-0600
Address/Location:	Davis Avenue at east Post Road, White Plains, NY 10601 The entrance to the Emergency Room is on Maple Avenue, just east of Davis Avenue
Directions:	Exit site and turn LEFT on Old Orchard Street Turn LEFT onto onramp for Central Westchester Parkway Merge LEFT onto I-287 East Take Exit 8W on right Turn LEFT at end of exit at stoplight onto Bloomingdale Road Turn Right onto Maple Ave Turn Right onto Davis Ave Turn Right into Hospital entrance

3.2 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF	Marc Godick	Project Director	914-922-2356
	Bryan Zieroff	Project Manager	914-922-2382 (office) 203-246-1566 (cell)
	Steven Schmid	Site Safety Officer (SSO)	646-388-9567 (office) 614-560-5425 (cell)
	John Sulich	Alternate SSO	914-922-2373 (office) 914-552-7694 (cell)
City of White Plains Department of Public Works	Rick Hope (Primary	Commissioner	914-422-1222 (office) 914-471-2999 (cell)
City of White Plains Department of Public Works	Udomlug Nok Siriphonlai (Secondary)	1st Deputy Commissioner	914-422-1212 (office) 914-450-5588 (cell)
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGMENTS OF HASP

APPROVAL

Signed: ______________________________ Date: ______________________________

AKRF Project Manager

Signed: ______________________________ Date: ______________________________

AKRF Health and Safety Officer

Below is an affidavit that must be signed by all workers who enter the Site. A copy of the HASP must be on-site at all times and will be kept by the SSO.

AFFIDAVIT

I,________________________(name), of______________________________(company name), have read the Health and Safety Plan (HASP) for the White Plains Fire Department Drill School site. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the Site.

Signed: _________________________ Company: _______________________ Date: _________
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Signed: _________________________ Company: _______________________ Date: _________
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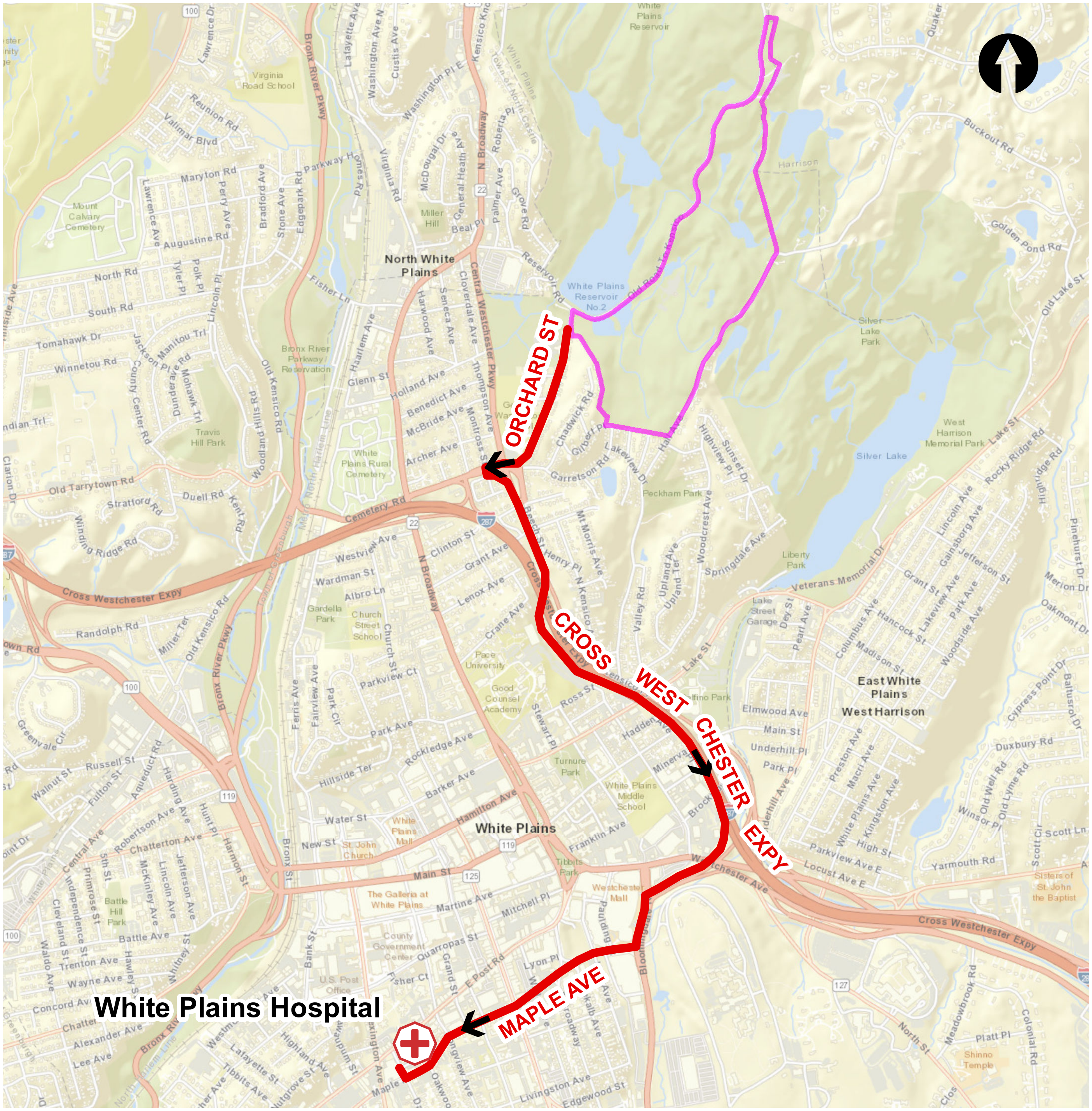
FIGURE 1

HOSPITAL ROUTE MAP



Service Layer Credits: ESRI World Street Map 2020

White Plains Hospital
41 E. Post Road
White Plains, NY 10601
(914) 681-0600

LEGEND

□ PROJECT SITE BOUNDARY

⊕ HOSPITAL LOCATION

← ROUTE TO HOSPITAL

0 2,000 4,000
SCALE IN FEET

AKRF
34 S. Broadway #401 White Plains, NY 10601

White Plains Fire Department Drill School
White Plains, New York

HOSPITAL ROUTE MAP

DATE
10/2/2020

PROJECT NO.
200217

FIGURE
1

©2020 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\200217 Hospital Route Map.mxd10/2/2020 2:19:08 PM mveilleux

APPENDIX A

SUPPLEMENTAL REQUIREMENTS FOR COVID-19

ON-SITE AND OFF-SITE PROCEDURES TO LIMIT CONTAMINATION AND POTENTIAL SPREAD OF COVID-19

Sources: **CDC - COVID-19 Spread and Prevention Information; OSHA - Workplace Preparation Guidance; CDC - Guidance on Extended Use/Limited Reuse of Respiratory Protection**

1) Maintain minimum 6-foot separation from others whenever possible (social distancing). The virus is thought to spread mainly from person-to-person, between people who are in close contact, through respiratory droplets produced when an infected person coughs or sneezes.
2) Wash your hands frequently with soap and water. Wash for at least 20 seconds and, if no soap is present, use a hand sanitizer that contains at least 60% alcohol.
3) Wear nitrile gloves whenever possible and be especially mindful of touching common surfaces.
4) Disinfect commonly touched surfaces frequently, and items frequently used in public immediately upon returning home.
5) Face Coverings and Masks:
   a) On-site: Wear a cloth face covering or mask at all times when there is no issue with maintaining social distancing. N95/KN95 masks or respirators should be reserved for situations where social distancing on-site is difficult or impossible. Appropriate circumstances for donning an N95/KN95 mask or respirator on-site include, but are not necessarily limited to, going inside the Site trailer; and/or entering, exiting, or traversing the Site if proper social distancing cannot be achieved. This tiered approach will help maintain the supply of N95/KN95 masks so they are available for the highest risk scenarios.
   b) Off-site During Work-related Commute: The CDC now recommends wearing cloth face coverings in public settings where other social distancing measures are difficult to maintain (https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html). A mask or cloth face covering should worn during your commute to and from the site if you are unable to achieve proper social distancing. Appropriate times to wear a mask or cloth face covering include, but are not necessarily limited to, walking on crowded sidewalks, traveling in a shared vehicle, and/or if you are required to enter an occupied indoor space to acquire supplies for the site.
6) Wear safety glasses or goggles at all times while on-site and some form of eye covering (e.g., sunglasses, prescription and non-prescription glasses, or safety glasses) should be considered when commuting.
7) Avoid touching your face (eyes, nose, and mouth).
8) Cover your nose and mouth when coughing, sneezing, etc./ cough into elbow.
9) Do not spit.
10) Try to take your temperature regularly.
11) Talk to your supervisor if you, your friends or family members that you live with or spend time with have displayed symptoms of COVID-19, tested positive, or are afflicted with even the common cold/flu.
12) Talk to your supervisor if anyone you know at the site tested positive for the COVID-19.
13) Follow any additional health & safety protocols required at the site or elsewhere.

APPENDIX B

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

Perfluoroalkyls - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about perfluoroalkyls. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure can occur from ingesting contaminated food or drinking water or breathing contaminated air. Treated carpets can be an important source of exposure for children. Studies in humans suggest an association between increases in blood cholesterol and higher PFOA or PFOS blood levels. High blood levels of PFOA and PFOS may also be associated with increased uric acid levels and liver damage.

What are perfluoroalkyls?

Perfluoroalkyls are a family of human-made chemicals that do not occur naturally in the environment. The two perfluoroalkyls which were made in the largest amounts in the U.S. are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS).

Perfluoroalkyls have been used in surface protection products such as carpet and clothing treatments and coating for paper and cardboard packaging. They have also been used in fire-fighting foams. Companies have stopped production or have begun changing manufacturing practices to reduce releases and the amounts of these chemicals in their products.

What happens to perfluoroalkyls when they enters the environment?

- Perfluoroalkyls can be found in air, soil, and water after release from the manufacture, use, and disposal of products that contain these chemicals, and during the manufacturing process. They may also be formed in the environment when other related chemicals break down.
- They break down very slowly in air, but fall to the ground within days to weeks.
- They do not break down in water or soil and may be carried over great distances.

How might I be exposed to perfluoroalkyls?

- Exposure to perfluoroalkyls is widespread. PFOA, PFOS, perfluorononanoic acid (PFNA), and perfluorohexane sulfonic acid (PFHxS) have been detected in 95-100% of samples of people's blood in 1999-2000 and 2003-2004. More recent monitoring data still show widespread exposure; however, the levels of these substances in people's blood appear to be declining.
- You may be exposed to perfluoroalkyls from the air, indoor dust, food, water, and various consumer products. Food is expected to be the most important source of exposure to perfluoroalkyls such as PFOA and PFOS. Human breastmilk may contribute to the exposure of infants since perfluoroalkyls have been detected in breast milk.
- Carpets treated with perfluoroalkyls can be an important source of exposure for children.
- Workers in facilities that make or use perfluoroalkyls can be exposed to higher amounts and have increased levels of these chemicals in their blood. Some communities near facilities where PFOA and PFOS were previously manufactured were exposed to high levels of these substances in drinking water.

How can perfluoroalkyls affect my health?

A large number of human studies have examined possible relationships between levels of perfluoroalkyls in blood and adverse health effects. It is difficult to interpret these results because they are not consistent; some studies have found an effect and others have not found the same effect. Even though some studies have found associations between serum perfluoroalkyl levels and adverse health effects, it does not mean that perfluoroalkyls caused these effects; they may be due to other factors not considered by researchers. The available human studies suggest that increases in blood cholesterol levels are associated with higher PFOA or PFOS blood levels. There is also some indication that serum PFOA or PFOS may be associated with increased uric acid levels, which may be associated with an increased risk of high blood pressure. PFOA or PFOS exposure may also cause liver damage.

Perfluoroalkyls

Humans and animals react differently to PFOA and PFOS and not all effects observed in rats and mice may occur in humans. The liver appears to be the most sensitive target in animals ingesting perfluoroalkyls. Studies in mice found that the immune system is a sensitive target of PFOA and PFOS.

How likely are perfluoroalkyls to cause cancer?

There is no conclusive evidence that perfluoroalkyls cause cancer in humans. Some increases in prostate, kidney, and testicular cancers have been seen in individuals exposed to high levels. These results should be interpreted cautiously because the effects were not consistently found and most studies did not control for other potential factors such as smoking.

Rats that ingested PFOA and PFOS for a long time developed tumors. However, some scientists believe that based on the way this happens in rats and the differences between rats and humans, humans should not be expected to get cancer. Others believe that it is possible for perfluoroalkyls to cause cancer in humans.

The International Agency for Research on Cancer and the Department of Health and Human Services have not yet evaluated the carcinogenicity of perfluoroalkyls. The EPA has begun an evaluation.

How can perfluoroalkyls affect children?

No associations between serum PFOA and birth defects were observed in children of mothers living in an area with high PFOA in the water. Some studies of the general population and people living near a PFOA manufacturing facility have found that higher levels of serum PFOA or PFOS are associated with lower infant birth weights. However, the decrease in birth weight is small and may not affect the infant's health. A study of children exposed to high levels of PFOA in drinking water found increases in blood cholesterol, which is similar to the findings in adults.

Birth defects, delayed development, and early deaths have been observed in mouse and rat pups exposed to PFOA or PFOS, but not in animals exposed to perfluorobutyric acid (PFBA) or PFHxS. Scientists believe that some of the effects observed in rats and mice exposed to PFOA or PFOS may not be relevant to humans.

How can families reduce the risk of exposure to perfluoroalkyls?

- Families may choose to use consumer products that do not contain perfluoroalkyls.
- Families whose tap or well water that contains perfluoroalkyls may choose to drink or cook with bottled water or to install activated carbon water filters.

Is there a medical test to show whether I've been exposed to perfluoroalkyls?

Perfluoroalkyls can be measured in blood, but this is not a routine test that can be performed in a doctor's office. Mean serum concentrations of 3.07 and 9.32 μg/L of PFOA and PFOS, respectively, were measured in blood samples from members of the U.S. general population in 2009-2010.

Members of a community whose drinking water was contaminated with PFOA from a nearby industrial facility had a mean serum PFOA concentration of 83.6 μg/L in 2005. Fluorochemical product workers had mean serum PFOA and PFOS levels of 1,760 and 1,320 μg/L, respectively.

The presence of perfluoroalkyls in your blood may indicate that you have been exposed to and absorbed these chemicals into your body. However, it does not necessarily mean that you will suffer adverse health effects.

Has the federal government made recommendations to protect human health?

The EPA has established a provisional drinking water advisory for PFOA and PFOS of 0.4 and 0.2 μg/L, respectively.

References

This ToxFAQs™ information is taken from the 2015 Toxicological Profile for Perfluoroalkyls (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

- Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.
- Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.
- Naphthalene can become weakly attached to soil or pass through soil into underground water.
- In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.
- Naphthalene does not accumulate in the flesh of animals or fish that you might eat.
- 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

- Breathing low levels in outdoor air.
- Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.
- Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.
- Drinking water from contaminated wells.
- Touching fabrics that are treated with moth repellents containing naphthalene.
- Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs.

Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

☐ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

☐ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

☐ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

☐ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

☐ Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

Agency for Toxic Substances and Disease Registry ToxFAQs September 1996

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- ☐ Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- ☐ Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- ☐ Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- ☐ Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- ☐ Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- ☐ Using a home kerosene heater or stove, or using fuel oils at work.
- ☐ Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- ☐ Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- ☐ Touching soil contaminated with fuel oils.
- ☐ Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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BENZENE
CAS # 71-43-2

Agency for Toxic Substances and Disease Registry ToxFAQs September 1997

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 813 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is benzene?
(Pronounced bĕn′zēn′)

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

☐ Industrial processes are the main source of benzene in the environment.

☐ Benzene can pass into the air from water and soil.

☐ It reacts with other chemicals in the air and breaks down within a few days.

☐ Benzene in the air can attach to rain or snow and be carried back down to the ground.

☐ It breaks down more slowly in water and soil, and can pass through the soil into underground water.

☐ Benzene does not build up in plants or animals.

How might I be exposed to benzene?

☐ Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.

☐ Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.

☐ Air around hazardous waste sites or gas stations will contain higher levels of benzene.

☐ Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.

☐ People working in industries that make or use benzene may be exposed to the highest levels of it.

☐ A major source of benzene exposures is tobacco smoke.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men.

Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How likely is benzene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Is there a medical test to show whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood, however, since benzene disappears rapidly from the blood, measurements are accurate only for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mgL). The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an 8-hour workday, 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Chromosomes: Parts of the cells responsible for the development of hereditary characteristics.

Metabolites: Breakdown products of chemicals.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Benzene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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ETHYLBENZENE
CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs **June 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?
(Pronounced ĕth′ əl bĕn′ zēn′)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

☐ Ethylbenzene moves easily into the air from water and soil.

☐ It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.

☐ Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.

☐ In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.

☐ In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

☐ Breathing air containing ethylbenzene, particularly in areas near factories or highways.

☐ Drinking contaminated tap water.

☐ Working in an industry where ethylbenzene is used or made.

☐ Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

❑ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

❑ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

❑ Toluene does not usually stay in the environment long.

❑ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

❑ Working with gasoline, kerosene, heating oil, paints, and lacquers.

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults.
Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

❑ Use toluene-containing products in well-ventilated areas.

❑ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

Is there a medical test to show whether I've been exposed to toluene?

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

XYLENE

CAS # 1330-20-7

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. This substance has been found in at least 658 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

(Pronounced zī′lēn)

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. You can smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and begin to taste it in water at 0.53–1.8 ppm.

Chemical industries produce xylene from petroleum. It's one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- ☐ Xylene has been found in waste sites and landfills when discarded as used solvent, or in varnish, paint, or paint thinners.
- ☐ It evaporates quickly from the soil and surface water into the air.
- ☐ In the air, it is broken down by sunlight into other less harmful chemicals.
- ☐ It is broken down by microorganisms in soil and water.
- ☐ Only a small amount of it builds up in fish, shellfish, plants, and animals living in xylene-contaminated water.

How might I be exposed to xylene?

- ☐ Breathing xylene in workplace air or in automobile exhaust.
- ☐ Breathing contaminated air.
- ☐ Touching gasoline, paint, paint removers, varnish, shellac, and rust preventatives that contain it.
- ☐ Breathing cigarette smoke that has small amounts of xylene in it.
- ☐ Drinking contaminated water or breathing air near waste sites and landfills that contain xylene.
- ☐ The amount of xylene in food is likely to be low.

How can xylene affect my health?

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How likely is xylene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans.

Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.

Is there a medical test to show whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 10 ppm of xylene in drinking water.

The EPA requires that spills or accidental releases of xylenes into the environment of 1,000 pounds or more must be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum level of 100 ppm xylene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also recommend exposure limits of 100 ppm in workplace air.

NIOSH has recommended that 900 ppm of xylene be considered immediately dangerous to life or health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Evaporate: To change from a liquid into a vapor or a gas.

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for xylenes (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ August 2007

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

❑ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
❑ When lead is released to the air, it may travel long distances before settling to the ground.
❑ Once lead falls onto soil, it usually sticks to soil particles.
❑ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

❑ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.
❑ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.
❑ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.
❑ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child’s mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❏ Avoid exposure to sources of lead.

❏ Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.

❏ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❏ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❏ If your home contains lead-based paint or you live in an area contaminated with lead, wash children’s hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I’ve been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (μg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 μg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 μg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

APPENDIX C

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: ____________ Project Name/Number: ______________________

Report Date: ____________ Project Manager Name: ______________________

Summary of any violations of procedures occurring that week:

____

____

____

Summary of any job related injuries, illnesses, or near misses that week:

____

____

____

____

Summary of air monitoring data that week (include and sample analyses, action levels exceeded, and actions taken):

____

____

____

Comments:

____

____

____

Name: ____________________ Company: ____________________

Signature: ____________________ Title: ____________________

INCIDENT REPORT FORM

Date of Report: ______________________________

Injured: ______________________________

Employer: ______________________________

Site: ____________________ Site Location: ____________________

Report Prepared By: ____________________ ____________________
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

___Injury
__ Property Damage
__ On-site Equipment
__ Mechanical
___ Illness
___ Fire
___ Motor Vehicle
___ Spill
___ Near Miss
___ Chemical Exposure
___ Electrical
___ Other

DATE AND TIME OF ACCIDENT/INCIDENT: Narrative report of Accident/Incident: Identify: 1) actions leading to or contributing to the accident/incident; 2) the accident/incident occurrence; and 3) actions following the accident/incident.

____
____
____
____
____
____
____
____
____
____

WITNESS TO ACCIDENT/INCIDENT:

Name:	____________	Company:	____________
Address:	____________	Address:	____________
Phone No.:	____________	Phone No.:	____________
Name:	____________	Company:	____________
Address:	____________	Address:	____________
Phone No.:	____________	Phone No.:	____________

INJURED - ILL:

Name: ____________________

SSN: ____

Address: ____________________

Age: ____

Length of Service: ____________________

Time on Present Job: ______________________________

Time/Classification: ____

SEVERITY OF INJURY OR ILLNESS:

____ Disabling

____ Medical Treatment

___ Non-disabling

___ First Aid Only

___ Fatality

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: ________________________________

NATURE OF INJURY OR ILLNESS: ____

____

____

____

CLASSIFICATION OF INJURY:

__ Abrasions

__ Bites

__ Blisters

__ Bruises

__ Chemical Burns

__ Cold Exposure

__ Concussion

__ Lacerations

_____ Dislocations

_____ Faint/Dizziness

_____ Fractures

_____ Frostbite

_____ Heat Burns

_____ Heat Exhaustion

_____ Heat Stroke

____ Punctures

____ Radiation Burns

____ Respiratory Allergy

____ Sprains

____ Toxic Resp. Exposure

____ Toxic Ingestion

____ Dermal Allergy

Part of Body Affected: ____

Degree of Disability: ____

Date Medical Care was Received: ____

Where Medical Care was Received: ____

Address (if off-site): ____

(If two or more injuries, record on separate sheets)

PROPERTY DAMAGE:

Description of Damage: ______________________________

____

Cost of Damage: $ ______________________________

ACCIDENT/INCIDENT LOCATION: ______________________________

ACCIDENT/INCIDENT ANALYSIS: Causative agent most directly related to accident/incident (Object, substance, material, machinery, equipment, conditions)

____

____

____

____

Was weather a factor?:______________________________

____

Unsafe mechanical/physical/environmental condition at time of accident/incident (Be specific):

____

____

____

Personal factors (Attitude, knowledge or skill, reaction time, fatigue):

____

____

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

____

____

Modifications:

____

Was injured using required equipment?:

____

____

If not, how did actual equipment use differ from plan?:

____

____

ACTION TAKEN TO PREVENT RECURRENCE: (Be specific. What has or will be done? When will it be done? Who is the responsible party to insure that the correction is made?

ACCIDENT/INCIDENT REPORT REVIEWED BY:

SSO Name Printed SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

Signature Title

Signature Title

Signature Title

ACCIDENT/INCIDENT FOLLOW-UP: Date:

Outcome of accident/incident:

Physician’s recommendations:

Date injured returned to work:

Follow-up performed by:

Signature Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

APPENDIX D

EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communication. If this is the case, a transmission that indicates an emergency will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communications is not available, the following air-horn and/or hand signals will be used:

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATHE!

Hand gripping throat

LEAVE AREA IMMEDIATELY, NO DEBATE!

(No Picture) Grip partner's wrist or place both hands around waist

NEED ASSISTANCE!

Hands on top of head

OKAY! – I'M ALL RIGHT!

- I UNDERSTAND!

Thumbs up

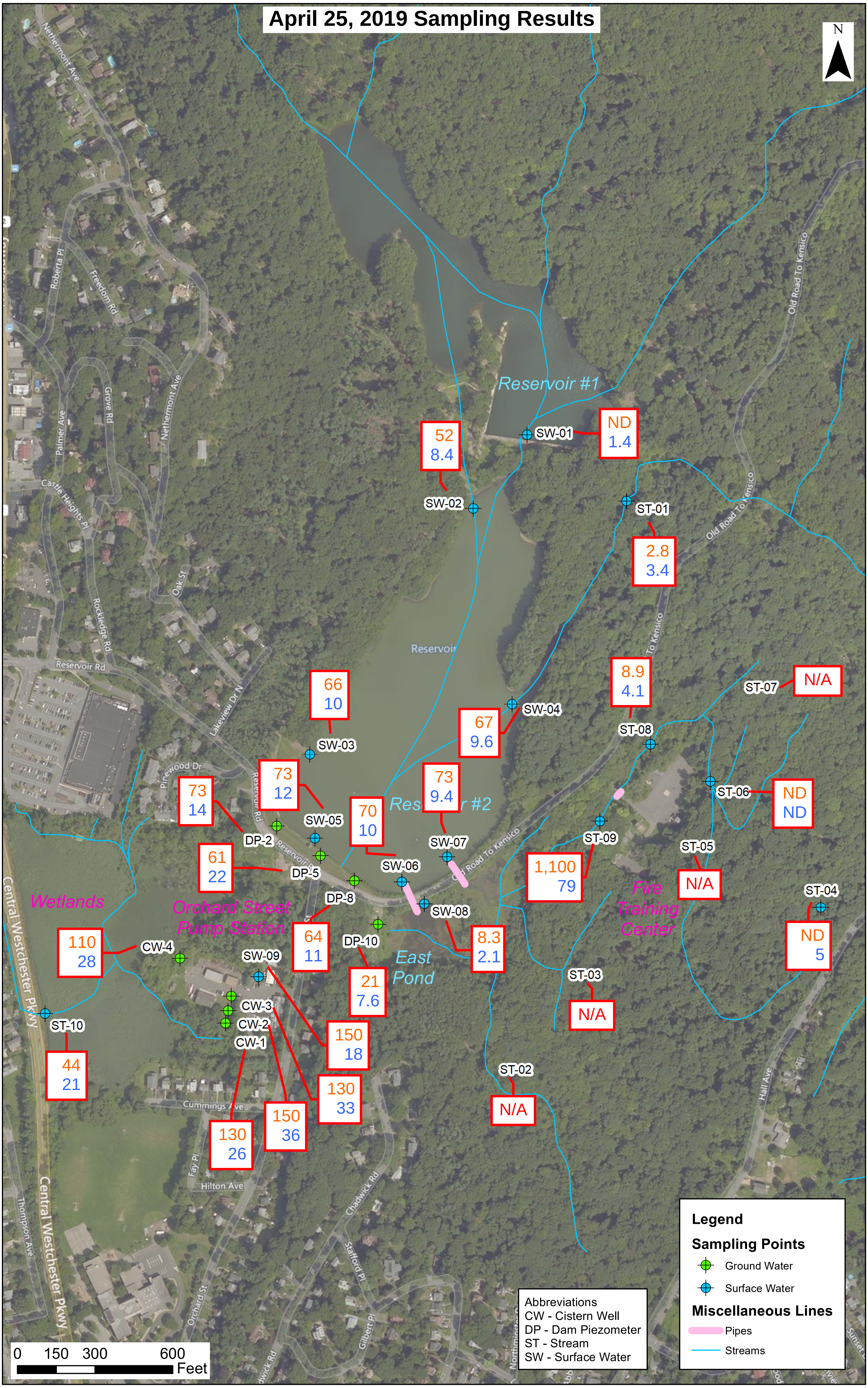
NO! - NEGATIVE!

Thumbs down

APPENDIX C

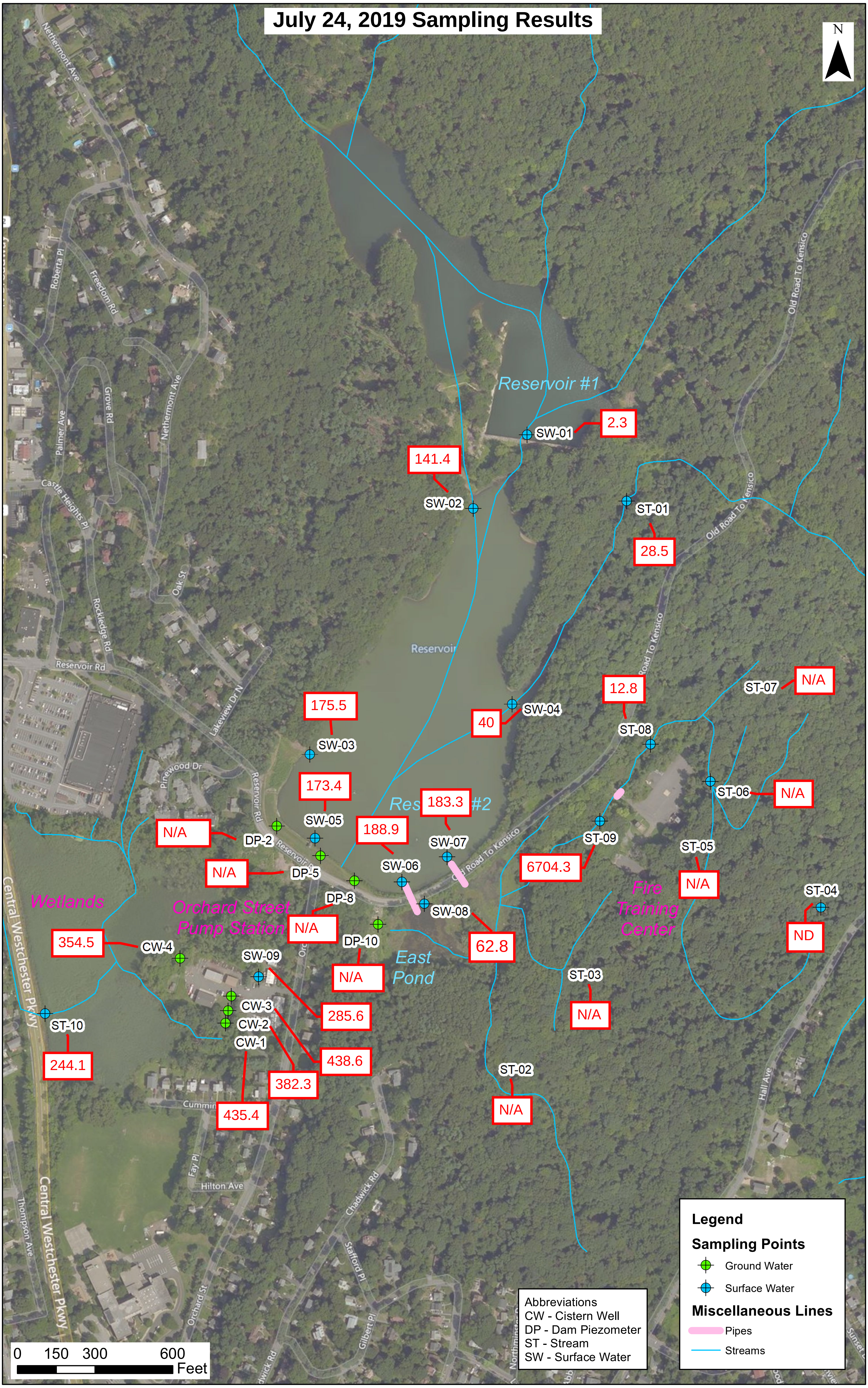
INVESTIGATION FIGURES PREPARED BY HAZEN AND SAWYER

PFOS and PFOA in parts per trillion (ppt)



Total PFASs in parts per trillion (ppt)

July 24, 2019 Sampling Results



Abbreviations
CW - Cistern Well
DP - Dam Piezometer
ST - Stream
SW - Surface Water

PFOS and PFOA in parts per trillion (ppt)

July 24, 2019 Sampling Results