Groundwater Interim Remedial Measure Workplan Westchester County Airport White Plains, New York

July 2020

Prepared for: Westchester County
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White Plains, New York 10601

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CERTIFICATION STATEMENT

I, Bernard T. Delaney, Ph.D., P.E., BCEE, certify that I am currently a registered professional engineer in the State of New York and had primary direct responsibility for the implementation of the subject activities. I certify that this Report was completed in conformance with the laws and regulations of the State of New York. I certify that all information and statements in this certification form are true.

060784-1	07/01/2020	
NY Professional Engineer No.	Date	B. Tod Delaney, Ph.D., P.E., BCEE

Introduction

First Environment, Inc. (First Environment) has been retained by the Westchester County Department of Public Works and Transportation (WCDPWT) to prepare an Interim Remedial Measure (IRM) Workplan for shallow groundwater underlying the near surface areas at the Westchester County Airport (the "Airport" or "Site").

This IRM workplan has been prepared in accordance with the provisions of an Order of Consent (CO3-20180308-44) between Westchester County (the County) and the New York State Department of Environmental Conservation (NYSDEC) executed on June 6, 2019 and in response to a NYSDEC letter dated August 7, 2019 requesting an IRM to address elevated levels of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) detected in near surface area shallow groundwater at the Airport. PFOS and PFOA are two of approximately 4,500 man-made chemicals grouped as per- and polyfluoroalkyl substances (PFAS).

The IRM activities will be completed in a phased approach with the first phase involving the collection and evaluation of specific data necessary to evaluate and guide the design of the IRM. The workplan incorporates elements discussed during subsequent teleconferences and email correspondence with the NYSDEC. It is noted that some data collection proposed in the SCWP could provide information that may require additional sampling and data collection to support the IRM. The SCWP activities are being performed concurrent to those in the Groundwater IRM and are not dependent to the site characterization schedule.

The NYSDEC defines an IRM as a discrete set of planned actions for both emergency and non-emergency situations that can be conducted without the extensive investigation and evaluation of a Remedial Investigation/Feasibility Study (RI/FS). However, it is First Environment's opinion that before an effective IRM can be implemented at the Site, it is necessary to define the distribution and extent of PFAS at the source. In addition, it is necessary to determine the PFAS migration pathway and aquifer characteristics that may be controlling that migration in order to design a technically appropriate and effective IRM capable of reducing PFAS at New York Air National Guard (NYANG) Burn Pit (source area) as well as downgradient of the Burn Pit.

The Site is located at 240 Airport Road in White Plains, Westchester County, New York and encompasses approximately 700 acres. The results of prior sampling revealed elevated

concentrations of PFOS and PFOA at the former NYANG Burn Pit. In March 2019, the highest combined PFOA and PFOS concentrations were detected in overburden wells FMW-6 (16,990 parts per trillion (ppt) and FMW-7 (19,047 ppt)). The bedrock monitoring well MW-23, adjacent to the former NYANG Burn Pit, identified PFOA and PFOS combined in August 2018 (441 ppt), October 2019 (543 ppt), and March 2019 (727 ppt). All three wells, FMW-6, FMW-7, and MW-23 are installed immediately adjacent to the former NYANG Burn Pit area which has been identified as the location where PFAS-containing foam was used during aircraft firefighting training exercises. The NYANG was a tenant at the Airport from 1947 to 1983. As part of its operations, the NYANG performed aircraft firefighting training operations on a regular basis at the former Burn Pit area. As noted, the firefighting training exercises were performed at a "Burn Pit" that was located near the NYANG's former hanger (hereafter referred to as the "NYANG Burn Pit") on County property adjacent to the NYANG's leasehold.

The NYANG conducted these exercises from as early as 1968 until 1983 when they vacated the Airport. The NYANG, as part of its firefighting exercises, used Aqueous Film-Forming Foam (AFFF), which historically contained PFAS. Only recently has there been a reduction in the use of PFAS chemicals in AFFF. Post 1983, according to Airport personnel, the Westchester County Airport engaged in Aircraft Fire Fighting Operations using only water as the means for extinguishing any live fire burns. The duration of AFFF use at the NYANG Burn Pit and the fact that the Pit was unlined resulted in groundwater contamination at this location exhibiting the highest concentrations of PFAS at the Site, as described above. Based on this finding, the former NYSANG Burn Pit is believed to be the primary source area for PFAS impacts at the Airport. It is estimated that 90 percent or more of the PFAS mass is present in the shallow soil and groundwater overburden. Although the PFAS mass is only an estimate, the IRM Phase I, combined with the SCWP investigation, will be used to calculate and verify whether this estimate is accurate.

The elements contained in this workplan will be conducted in a phased approach (Phase I and Phase II). As discussed with the NYSDEC, the first phase would involve a more detailed evaluation of the site-specific geology and hydrogeology as well as defining the distribution and extent of total PFAS, PFOS, and PFOA in soil and groundwater, including developing an understanding of the migration pathway from the former Burn Pit source area to the downgradient Airport boundary. The second phase will incorporate the information gained during the Phase I investigation to assess, to the extent practical, reasonable and technically appropriate IRM alternatives to reduce PFOS and PFOA concentrations in shallow groundwater.

It is important to note that the United States Environmental Protection Agency (US EPA) established a drinking water health advisory concentration for combined PFOS/PFOA of 70 ppt. This health advisory level was established based on the EPA's 2016 Health Effects Support Documents. In early 2016, New York, joined by Vermont and New Hampshire, urged the U.S. Environmental Protection Agency (EPA) to acknowledge that PFOA contamination is a national problem that requires consistent federal guidelines. In December 2018, the New York State Department of Health (NYSDOH) announced that the New York State Drinking Water Quality Council has recommended that the Department of Health adopt the nation's most protective Maximum Contaminant Levels (MCLs) for PFOA and PFOS. Specifically, the Council recommended MCLs of 10 ppt for both PFOA and PFOS. In July 2019, the NYDOH proposed adoption of the Council's recommendation for community, non-community, and transient non-community water systems. PFOS and PFOA have been identified in groundwater at the Airport and remain unregulated by the US EPA, which is responsible for setting regulatory limits under the federal Safe Drinking Water Act. It should be noted that neither the EPA nor the NYSDOH have established a remediation standard or action level for PFOA/PFOS in groundwater.

Physical Setting

Site Description/Land Use

The Site is located at 240 Airport Road, White Plains, Westchester County, New York (Figure 1) in a mixed-use area of commercial and residential parcels. To the north of the Site is residential housing located across Airport Road. To the east and south of the Airport across Airport Road are residences and commercial properties, including a golf course. To the west of the Airport is Interstate 684 and Rye Lake, a part of the Kensico Reservoir

About one third of the Airport lies within the Rye Lake watershed while the remainder lies within the Blind Brook watershed. As used in this report, the "Site" refers to the area within the boundaries of the Airport. The Harrison Sub-residency Site is outside of the Project Area (off site) but is included in the discussion since PFAS were identified there in surface and groundwater downgradient from the Airport by TRC in 2018.

In the northern portion, the Site generally slopes to the west toward Rye Lake from the central part of the Site whereas the southern part of the Site slopes to Blind Brook. The Site is largely covered with earthen fill and vegetation with some concrete, runways, asphalt, and/or gravel. The main structures at the Site consist of Airport and tenant buildings of a slab-on-grade construction. The buildings house offices, maintenance, Airport operations and management, lease holders of airlines, and private aircraft.

Topography

The Site is located at 240 Airport Road, White Plains, Westchester County, New York in a mixed-use area of commercial and residential parcels and has been assigned Site No. 360174 by the NYSDEC. The location of the Site is illustrated on the United States Geological Survey (USG S) 7.5-minute Quadrangle (Glenville NY Topographic Quadrangle, 1967, Photo-revised 1981) Map provided as Figure 1.

The topography at the Airport is generally flat and slopes gently to the south. The elevation at the northern end of the Project Area is approximately 425 feet above mean sea level (msl) and slopes to 375 feet above msl at the southern extent of the Airport property. The surface elevation of Rye Lake is approximately 354 feet above msl. This area is comprised primarily of woodlands and includes Route 120 and Interstate 684.

Surface/Stormwater Drainage

The Airport's surface/stormwater collection system was engineered to reduce the amount of runoff into Rye Lake by redirecting the stormwater flow to other parts of the Airport. Currently, stormwater runoff from impervious surfaces, including runways and taxiways, flows into several catch basins from specific areas of the Airport which discharge to Army Corp Wetland Mitigation Basins A and B, or directly to Blind Brook. Each basin is located along the southern boundary of the Airport outside of the Kenisco watershed. Non-aviation operations in the area of the former NYANG discharge water to Rye Lake and Blind Brook through additional stormwater management system discharge outfall locations. All outflows from the Airport drainage system subject to the New York State Pollutant Discharge Elimination System (SPDES) Permit are strictly monitored for compliance, as stated in the Order of Consent between the NYSDEC and Westchester County.

Geology & Hydrogeology

Regional & Site Geology

The geology at the Site consists of shallow overburden soil overlying bedrock. Based on regional maps, the site overburden on site consists of glacial till, although isolated areas of glacial outwash are identified in the vicinity. A site plan depicting attributes of the Site and pertinent site features (including monitoring well locations) is provided as Figure 2.

Based on site observations during this investigation and reports prepared by others for the Site, the unconsolidated overburden consists of topsoil, fill, glacial till, and glacial outwash deposits. The fill consists primarily of reworked native soils consisting of glacial till and outwash. The glacial deposits consist mainly of yellow-brown micaceous sand and cobbles, although lenses of clay and silt are interbedded.

According to a review of the USGS geologic map for the State of New York, the bedrock underlying the Site consists of Manhattan Schist. The Manhattan Schist is thought to belong to the middle Ordovician Tippecanoe or Taconic Sequence. The Inwood Marble, which is more resistant to weathering than the younger Manhattan Schist, underlies the Manhattan Schist which terminates near the west end of the Site near Rye Lake. The Inwood Marble formation belongs to the Cambro-Ordovician Sauk Sequence. Near the contact between the Manhattan Schist and the Inwood Marble, the schistose rocks are reported to include layers of calcite marble.

Groundwater will tend to flow more freely through the sand-rich layers and cobblestones, whereas its movement will be retarded and perched in the clay and silt layers. Bedrock, located below the overburden, is described as Manhattan schist and Hartland formation schist. Based on a review of prior investigations conducted at the Airport, the depth-to-bedrock varies across the Project Area, ranging from approximately 1.5 to 20.0 feet below grade. During previous investigations, First Environment identified weathered schist bedrock at monitoring well location FMW-4 at a depth of 14.1 feet below grade, representing the transition zone between the overburden and the competent bedrock.

Based on the 2001 Site Investigation findings performed by First Environment, the soil around the NYANG Burn Pit consists of approximately 12-15 feet of unconsolidated sand, gravel, and

silt overlying schist bedrock. The area also contains up to seven feet of fill that includes fragments of asphalt, concrete, and angular gravel.

Site Hydrogeology

Groundwater underlying the Site was identified in two units, an unconfined aquifer consisting of unconsolidated soils and the uppermost weathered bedrock and the confined aquifer that is comprised of schist bedrock.[1]

There is a mound that divides groundwater at the Site where the groundwater in the upper water-bearing zone from the northern and southwestern portions of the Project Area flows in a westerly direction toward Rye Lake. Whereas, groundwater in the upper water-bearing zone for the rest of the Project Area flows toward the east and southeast away from Rye Lake. Figure 2 illustrates the shallow groundwater flow patterns.

Within the Project Area, the water table was encountered in the overburden aquifer at depths ranging from 1.5 to 20.0 feet below grade. Based on site observations during field activities, groundwater in the shallow aquifer occurs under unconfined (water table) conditions.

Groundwater within the Manhattan Schist bedrock is expected to occur within planar surfaces including fractures, joints, and faults within the bedrock. The orientation of these planar surfaces, along with the hydraulic gradient and hydraulic conductivity, will dictate groundwater flow direction and velocity within the bedrock, as described below.

Locally, a slight mounding of groundwater was observed at FMW-1R, possibly due to recharge in this area of a topographic high. This is not expected to have a significant impact on site-wide groundwater flow. Groundwater elevations are subject to seasonal variations that may cause slight shifts in the groundwater divide and groundwater flow direction. However, the general groundwater flow pattern in shallow overburden is not expected to vary significantly from that shown on Figure 2.

Water levels measured in monitoring wells on May 19, 2009 by SAIC are similar to those measured in 56 monitoring wells by WSP in August 2018 and March 2019. Depth-to-water measurements generally ranged from 0.25 to 25 feet. The hydraulic gradient (a measure of the

[1] Ref. Fisher, Donald, Y.W. Isachsen and L.V. Richard, 1970, “Geologic Map of New York, Lower Hudson Street,” New York State Museum and Science Service Map and Chart Series No. 15.

slope of the water table surface) is the primary factor affecting groundwater flow direction and one of several factors affecting groundwater flow rate. In 2000, the hydraulic gradients measured by First Environment within the overburden aquifer west of the groundwater divide (flowing towards Rye Lake) ranged from 0.07 ft/ft to 0.03 ft/ft. The hydraulic gradients within the overburden east of the groundwater divide (flowing towards Blind Brook) ranged from 0.02 ft/ft to 0.04 ft/ft, which is similar to those measured by SAIC in 2009 and more recently by WSP in 2019.

In 2000, three monitoring well couplets were located on site, each consisting of a shallow (overburden) well paired with a deeper (bedrock) monitoring well. The monitoring well couplets are FMW-6/FMW-23, FMW-12/FMW-36, and FMW-34/FMW-35. Based on the groundwater elevation measurements collected from these monitoring well couplets, there is an upward hydraulic gradient of 0.05 ft/ft at FMW-6/FMW-23, but a slight downward gradient of 0.012 ft/ft at FMW-34/FMW-35. Based on the hydraulic gradient between the shallow (overburden) and deep (bedrock) hydrologic units, groundwater on site will tend to flow from the shallow water-bearing zone to the deeper bedrock aquifer at FMW-34/FMW-35, but upward at FMW-6/FMW-23. As part of this workplan, additional rounds of groundwater elevation measurements will verify the initial findings discussed above.

PFAS Groundwater Quality

In June 2017, the New York State Department of Health (DOH) sampled raw water intakes and finished water outlets corresponding to several potable wells that service a number of commercial buildings located on New King Street in North Castle, New York. The results of the sampling identified PFAS in these intake and outlet ports, some at concentrations that exceeded the combined action level of 70 ppt for PFOA and PFOS.

In November 2017, WSP's groundwater laboratory results identified PFAS in eight monitoring wells located across the Site. This sampling event was conducted at the request of the NYSDEC to evaluate potential impacts from historic fire training activities conducted by the NYANG which, as noted, was a former tenant who vacated the Site in 1983.

In August 2018, the County voluntarily restarted the semi-annual groundwater monitoring program. In August 2018, WSP sampled 52 monitoring wells. This sampling event was the first full sampling event under the re-started monitoring program and encompassed an expanded list of analytical parameters, including a suite of 21 PFAS compounds as well as 1,4 dioxane.

This event revealed concentrations exceeding the 70 ppt EPA lifetime contaminant health advisory level for combined PFOA and PFOS in 26 of the 52 sampled wells. The monitoring wells with the highest concentrations of PFAS detected in groundwater were in the northern portion of the Site, near the former NYANG Burn Pit.

In March/April 2019, the groundwater was sampled again. In total, 53 monitoring wells across the Site were sampled for PFAS. This event revealed concentrations of PFOS and PFOA exceeding the 70 ppt EPA combined PFOA and PFOS lifetime contaminant health advisory level in 32 of the 53 sampled wells. The 2019 PFAS and VOCs concentrations were of similar concentrations when compared from 2018. The highest PFAS concentrations were detected in samples from shallow monitoring wells screened from 5.0 and 20.0 feet below ground surface (bgs). According to recent studies, including those conducted by the Interstate Technology & Regulatory Council (ITRC), PFAS, due to their hydrophilic and hydrophobic nature, generally seek and concentrate along the water table's air/water interface.

The highest combined PFOA and PFOS concentrations were detected in wells FMW-6 (16,990 ppt) and FMW-7 (19,047 ppt). The bedrock monitoring well MW-23, adjacent to the former NYANG Burn Pit, identified PFOA and PFOS combined in August 2018 (441 ppt), October 2019 (543 ppt), and March 2019 (727 ppt). All three wells, FMW-6, FMW-7, and MW-23 are installed immediately adjacent to the former NYANG Burn Pit area where PFAS containing AFFF was used during fire training exercises. The distribution of PFOA and PFOS combined is identified at shallow monitoring wells in the shallow-water bearing is illustrated in Figure 3. The 2018 and 2019 groundwater sampling were completed by WSP, and the results report completed and submitted to the Airport in July 2019 (Appendix A).

Reliability of Data Overview

All soil, ground, and surface water samples obtained by First Environment through WSP were collected in accordance with the Technical Guidance for Site Investigation and Remediation (NYSDEC DER-10 dated May 2010). After collection, sampling containers were placed into shipping coolers provided by the laboratory and chilled to 4ºC. Each cooler was accompanied by a completed chain-of-custody record. The samples were stored and shipped within 24 hours to York Analytical Laboratories (a State Department of Health (DOH) ELAP-certified laboratory). Laboratory analyses were performed using accepted and current United States Environmental Protection Agency (US EPA) analytical methods. Samples collected for PFAS analysis were analyzed via EPA modified method 537 with Category B deliverables. The data will be provided in an electronic data deliverable (EDD) format under the NYSDEC EQUIS Environmental Data Management System. Data validation of CLP deliverables (Category B) will be performed by a third-party verifier and be reported in a Data Usability Summary Report per NYSDEC DER-10 as specified in the Quality Assurance Project Plan found in Appendix C.

Samples were handled and analyzed in compliance with sample holding times, method detection limits, and precision and accuracy criteria for the analytical method. No significant events or seasonal variations occurred that may have influenced sampling procedures or analytical results.

Health & Safety

Prior to initiating any on-site intrusive activities, First Environment, or its subcontractors, will complete the required public utility mark out and notifications. First Environment's site-specific health and safety plan (HASP) has been prepared in accordance with NYSDEC guidance (DER-10) incorporating the tasks to be completed as outlined in this proposal. The Health & Safety plan also has been updated to include provisions and procedures resulting from COVID-19. The HASP is a requirement of the federal Occupational Safety and Health Administration (OSHA) and is not subject to the approval of NYSDEC (Appendix B).

Quality Assurance Project Plan (QAPP)

Pursuant to NYSDEC guidance, the scope-of-work includes quality assurance procedures to be followed for sampling and analysis. QA/QC procedures required by NYSDEC are to be documented in the QAPP. The minimum requirements for the QAPP for this project include details of:

i. The project scope and project goals as well as how the project relates to the overall site investigation or remediation strategy.

ii. Project organization, including the designation of a project manager, QAO, and field analyst (if field analysis is planned). Resumes of these individuals may be included.

iii. Sampling procedures, data quality usability objectives, and equipment decontamination procedures.

iv. Site map showing sample locations.

v. An "Analytical Methods/Quality Assurance Summary Table"[2] which must include the following information for all environmental, performance evaluation, and quality control samples:

(1) matrix type;
(2) number or frequency of samples to be collected per matrix;
(3) number of field and trip blanks per matrix;
(4) analytical parameters to be measured per matrix;
(5) analytical methods to be used per matrix with minimum reporting requirements; and
(6) number and type of matrix spike and matrix spike duplicate samples to be collected.

The Quality Assurance/Quality Control (QA/QC) procedures were conducted as described in the Quality Assurance Project Plan (QAPP) provided as Appendix C.

Data Validation

The analytical data package from the laboratory will be reviewed by a third party to determine compliance with the NYSDEC requirements. The data will be provided in an electronic data deliverable (EDD) format under the NYSDEC EQUIS Environmental Data Management System.

[2] Currently, there are no standard EPA methods for analyzing PFAS in surface water, non-potable groundwater, wastewater, or solids. For non-drinking water samples, some U.S. laboratories are using modified methods based on EPA Modified Method 537. These modified methods have no consistent sample collection guidelines and have not been validated or systematically assessed for data quality. EPA expects to have a draft method for non-potable groundwater soon. (See EPA/600/F-17/022d, Updated September 2018).

Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) has been developed to measure, evaluate, and control, as necessary, potential fugitive particulates and, if observed, volatile organic compounds (VOC) generated during both ground intrusive and non-intrusive activities. The CAMP was developed using the New York State Department of Health Generic Community Air Monitoring Plan in combination with site-specific information and proposed activities.

Depending on the type of activity, levels of airborne particulates and/or VOCs will be monitored and recorded in real-time at both the upwind and downwind perimeters of the immediate work area. The purpose of the CAMP is to protect the downwind community from potential release of contaminants to the air generated during the activities. The action levels developed by the NYSDOH will be followed as part of the CAMP.

If the recorded levels approach the pre-established action level or if airborne particulates are visually observed migrating off site or towards sensitive receptors, suppression measures will be implemented immediately. Suppression measures may include misting the particulate source with water, use of particulate suppression materials, wetting the work area prior to initiating the activities, or stopping work activities until recorded levels fall below the action level.

Although the measures described above will be undertaken, it is First Environment's belief, based on previous investigations, that air borne contaminants are not anticipated resulting from site investigation. However, as a best practice to safeguard and protect workers and the community, air monitoring will be performed during site activities. A copy of the CAMP is provided in Appendix D.

Scope-of-Work

First Environment has prepared the following scope-of-work in compliance with the NYSDEC Order on Consent executed on June 6, 2019. It also incorporates elements discussed during subsequent teleconferences and email correspondence with the NYSDEC. The IRM will be implemented in a phased approach with the first phase involving the collection and analysis of additional data in the Kenisco watershed necessary to support and develop a technically feasible IRM to the extent practical to prevent or redirect groundwater from entering Rye Lake. About a third of the Airport lies within the Kenisco watershed. The remainder of the property lies within the Blind Brook watershed.

The scope of this investigation focuses on the collection of soil and groundwater data at the NYANG Burn Pit and downgradient of the Burn Pit near the boundary of the Airport. The scope-of-work consists of the following activities:

- The installation and subsequent sampling of seven monitoring wells for PFAS in the shallow overburden. (Note, 7 of the shallow wells also comprise a portion of the 19 monitoring wells proposed as part of the SCWP.)
- Install soil borings in order to obtain site-specific understanding of the hydro-geologic conditions present. To achieve this, First Environment will use a Hydraulic Profiling Tool (Hpt) and Electrical Conductivity (EC) direct sensing probe to determine saturated soil hydraulic conductivities (migration pathways), strata pore pressure, and electrical conductivity (soil type).
- Continuously inspect and characterize the soil recovered from cores.
    - Collect and analyze soil samples for PFAS and total and fractional organic carbon (TOC/FOC).
    - Collect groundwater samples for profiling purposes. Collect and analyze groundwater samples for PFAS and groundwater as well as other water quality parameters including pH, conductivity, Dissolved Oxygen (DO), and Oxidation Reduction Potential (ORP). The samples will be collected at the water table surface and below the water table within higher transmissive zone as determined by the Waterloo Advanced Profiling System. The samples will be submitted for analysis for PFAS.
    - Conduct a round of groundwater sampling at select DEP monitoring wells located off the Airport property, assuming such wells can be identified in good condition.

The scope for this investigation has been developed to obtain the necessary information to evaluate the nature and extent of PFAS in soil and groundwater as well as to identify potential groundwater migration pathways from the Burn Pit to Rye Lake. This information will be used to develop and implement, to the extent practical, one or more Interim Remedial Measures to

reduce PFAS concentrations in groundwater at the Burn Pit as well as locations downgradient of the Burn Pit near the boundary of the Airport.

HPT/EC Technology Overview

The Geoprobe® Systems engineered HPT probe represents the latest development for evaluating subsurface conditions and has significant capabilities combining a Hydraulic Profiling Tool (HPT) to determine saturated soil hydraulic conductivities along with distinguishing soil strata types through measuring variations in electrical conductivities in the subsurface soil. The HPT system collects depth, electrical conductivity, advancement rate, hydraulic pressure, and flow information. The HPT is specifically designed to evaluate subsurface hydraulic properties. While the probe is being advanced through the subsurface using a Geoprobe direct push drill rig, an in-line pressure sensor measures the pressure response of the surrounding soil/groundwater. The ability for water to flow into the formation layers is dependent upon the hydraulic properties of the soil. A low-pressure response would indicate a large, more uniform grain size and the ability to more easily transmit water. Conversely, a high-pressure response would indicate a small grain size and relative inability for the aquifer to transmit water. Pressure and flow rate are both logged versus depth. The HPT tool can therefore be used to identify potential PFAS migration pathways. Similarly, it can provide information to aid in identifying transmissive zones where remedial material could potentially be injected. A more detailed discussion of how the HPT system and the information it can provide has been included in Appendix E.

HPT Data Collection

In order to obtain site-specific hydro-geologic information, a Geoprobe direct push rig will be used to advance the HPT probe to refusal or the top of bedrock. As stated earlier, the HPT system will provide the investigator with site-specific stratigraphic information including depth, electrical conductivity, advancement rate, hydraulic pressure, and flow information. Additional detail regarding each of these parameters is provided below.

- Depth - Data with respect to depth will be collected every 0.05 feet, or 20 points per foot over the length of the boring.
- Electrical Conductivity - Electrical Conductivity (EC) data will be collected in milli-siemens per meter (ms/M). The conductivity of soils is different for each type of media. Finer grained sediments, such as silts or clays, will typically have a higher EC signal whereas coarser grained sediments, sands and gravel will typically have a lower EC signal.
- Rate of penetration (ROP) – ROP is collected in units of feet per minute (ft./min). ROP of the HPT probe can vary due to operator advancement as well as soil types encountered.

- Pressure - Pressure data is collected in pounds per square inch (psi). Pressure is an indication of hydraulic pressure applied to the subsurface by the HPT system. The system collects both the minimum and maximum pressures over each vertical interval.
- Flow - Flow data is collected in milliliters per minute (mL/min). Flow is an indication of the rate water is pumped out of the membrane at the HPT probe. The system collects both the minimum and maximum flow over each vertical interval.
- Estimated Hydraulic Conductivity (est. K) – Hydraulic conductivity, symbolically represented as K, is an *in-situ* property that describes the ease with which water can move through pore spaces or fractures. It is dependent on the intrinsic permeability of the material and on the degree of saturation. With respect to the HPT system, the estimated K values are only applicable to the saturated portion of the formation.

Vertical Aquifer Profiling System

First Environment will utilize the vertical aquifer profiling technology to collect discrete groundwater samples to define the vertical distribution of PFAS in groundwater at the Burn Pit Source Area and downgradient locations near the boundary of the airport. The Waterloo Advanced Profiling System (Waterloo APS™) was developed and tested extensively at the University of Waterloo in Ontario Canada. The components inside the sensing device are Teflon free and are not capable of leaching PFAS into water samples collected by the probe equipment. The Waterloo APS™ is a complete subsurface data collection platform, combining the same high-quality discrete sampling capability with continuous real-time hydro-stratigraphic logging. The profiler uses a hydraulic conductivity profiling system (KPRO), a tool that provides a real-time continuous Index of Hydraulic Conductivity (IK) to determine the stratigraphy and ideal depths for sample collection (see Appendix E).

Figure 4 - Cross Section Vertical Groundwater Profiling

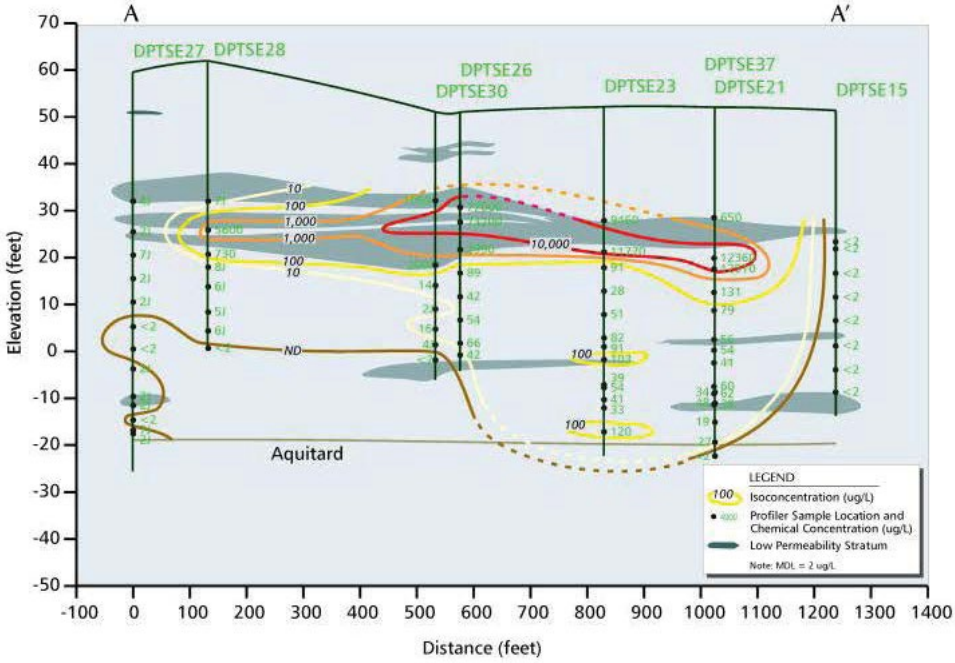


Figure 4 measures real-time hydrostratigraphic profiling in a single push with discrete depth sampling without withdrawing the tool between samples and allows identification of transmissive zones which could serve as PFAS contaminant transport pathways.

NYANG Burn Pit Investigation

On December 22, 1999, the Airport conducted its initial investigation of the NYANG Burn Pit Area. One of the key findings of that investigation was the observation of a sheen that developed on the surface water around the former NYANG Burn Pit when the sediment was disturbed. Based on those initial observations, additional investigative and remedial work aimed at non-PFAS compounds was conducted as described in First Environment's Site Investigation Report and Groundwater Monitoring Program, February 2001.

The analytical results for former monitoring well FMW-5, located inside the NYANG Burn Pit boundary, revealed elevated levels of VOCs as well as SVOCs in groundwater. Due to the elevated levels of VOCs and SVOC identified in the soil and groundwater, four excavation events were completed to address the identified concentrations. At the completion of the remedial excavations, post-excavation samples were collected to document the success of the remedial actions. Approximately 2,800 tons of impacted soil was removed from May 16 to October 20, 2000. The approximate boundaries of the soil removal area (see yellow boundary) are illustrated in Figure 3. As a result of the source removal at the Burn Pit, total VOCs identified shallow groundwater (FMW-6, FMW-7, and FMW-8) ranged from 1 ug/l to 5 ug/l, which is below NYSDEC Standards. The water table has historically been encountered at approximately 3 to 6 feet below grade, but recently measured at depth range from 1.0 to 2.5 feet bgs.

However, in March 2019 the highest combined PFOA and PFOS concentrations were detected in wells FMW-6 (16,990 ppt) and FMW-7 (19,047 ppt). Both of these wells are in the overburden immediately adjacent to the former NYANG Burn Pit area where PFAS containing foam was used. These results suggest that AFFF impacted soil may remain in close proximity to the NYANG Burn Pit. Accordingly, one of the remedial alternatives to be evaluated as part of Phase II will be to assess whether the removal of additional source material is feasible once the extent of PFAS impacted soil has been delineated. Figure 3 illustrates the distribution of PFOA/PFOS detected in the shallow water-bearing zones across the Airport.

Before an IRM can be successfully implemented, it will be important to define the nature and extent of PFAS at the former Burn Pit as well as to characterize the geology and hydrogeology in this area. Since the former NYANG Burn Pit represents the primary source of PFAS at the

Airport, it is necessary to further characterize the horizontal and vertical extent of PFAS distribution in the soil/groundwater to the surface of bedrock.

To further characterize this area, First Environment is proposing to install 20 soil borings along a 100-foot spaced grid, as shown on Figure 5. The exact number of soil borings and groundwater samples collected may change based on the findings identified in the field. First Environment will retain Cascade Drilling to perform the soil borings and use the HPT/EC and Waterloo APS™ profiling technology to evaluate the subsurface. The sample location is based on our review of aerial photographs that identify the location of the former NYANG Burn Pit operations and those areas that potentially received overspray of foam. A First Environment geologist will direct the locations where drilling is to occur as well as log the soil column in accordance with the Unified Soil Classification System (USCS).

First Environment will perform the following:

- Soil will be field-screened using a properly calibrated Photoionization Detector (PID) to bedrock or refusal. If elevated PID readings are identified, a sample will be collected by for analysis for Target Compound List/Target Analyte List (TCL/TAL) +30.
- Collect one soil sample for PFAS analysis as well as total organic carbon TOC/FOC immediately above the water table at 1.0 to 2.0 feet bgs and at a depth of 15.0 feet bgs. Samples will be collected for laboratory analysis at every other soil boring location.
- Select six representative soil sample locations from which to collect a surface soil sample (0 to 6 inches) for PFAS and TOC /FOC analysis. In addition, six samples will be collected for PFAS and TOC analysis from immediately above the bedrock surface at locations closest to the former NYANG Burn Pit
- Two soil samples inside the former Burn Pit will be collected and analyzed for total PFAS and TOC analysis below the backfill area (5-6 feet) and at the overburned bedrock interface.
- Use the HPT/EC and Waterloo APS™ profiling technology to define potential PFAS migration pathways and vertical distribution of PFAS in groundwater. One groundwater sample will be collected at the water table at a depth of approximately 1.0 to 2.0 feet bgs and another at the interval exhibiting the highest vertical K value; and two samples will be collected within the former Burn Pit at soil/bedrock interface. The number of profiling locations will be determined in the field based on observation and specific field findings as they are obtained, although 20 profile locations are currently planned. A minimum of 22 samples are anticipated for collection and submittal to the laboratory for PFAS, TOC, pH, DO, EC, and ORP analysis.

In addition, two shallow monitoring wells will be installed immediately downgradient of the soil boring/HPT EC grid location, as illustrated on Figure 5. The monitoring wells will be constructed using two-inch PVC riser (Schedule 40) together with10 feet of two-inch 0.010 slotted PVC screen. The shallow wells will be installed in such a manner that the screened interval will

bridge the water table with approximately three feet of screening above and seven feet below the average water table. It is anticipated that the monitoring wells will not exceed a total depth of 15.0 feet bgs. Once monitoring wells are installed and developed, groundwater will be sampled and analyzed for PFAS, 1.4 dioxane, and TCL/TAL during the next semi-annual monitoring event.

First Environment will containerize, stage, and characterize purge water from monitoring wells as well as well development water. First Environment is evaluating alternatives with the County for managing collected water containing PFAS. In areas of the Airport that demonstrate PFOA and PFOS groundwater concentration below 10 ppt, generally to the south of the airport away from the former NYSANG burn pit, groundwater will be discharged back in a controlled manner to the ground surface without treatment. First Environment will provide a list of wells to the NYSDEC for approval where such activities would take place.

Upon completion of the well installation, each well will be developed until a sediment-free discharge is achieved. The newly installed monitoring wells and boring locations will be surveyed by a licensed surveyor to horizontal locations and top-of-casing/ground elevation.

Downgradient Investigation

First Environment is also proposing to conduct an investigation of the area downgradient of the Former Burn Pit. The same methodology, as described in the previous section, will be employed for the downgradient assessment of groundwater. Soil samples for PFAS will not be collected because this area is not located in the source area, although FOC/TOC will be collected and analyzed in soil at discrete intervals described below. This data will be used to further evaluate the fate and transport of PFAS in the saturated zone and as a data set to evaluate the injection of colloidal carbon as a possibility in the future.[3] As shown in Figure 6, the downgradient investigation will include the installation of three transects of soil borings (HPT/EC) and Waterloo APS™ profiling and installation of three shallow overburden monitoring wells at the downgradient boundary of the Airport as shown in Figure 6. The installation of shallow wells is being proposed to fill data gaps necessary to further evaluate groundwater conditions and serve as a baseline for IRM performance monitoring.

First Environment will perform the following:

- Collect up to seven soil sample locations for total and factional organic carbon/total organic carbon analysis at three depths:
    - one sample at the water table at approximately 10 feet bgs;
    - one sample at approximately 20.0 ft bgs;
    - one sample at the bedrock overburden interface or at the zone of refusal estimated at a depth of approximately 30.0 to 40.0 feet bgs.
- Soil will be field-screened using a properly calibrated Photoionization Detector (PID) to bedrock or refusal. If elevated PID readings are identified, a sample will be collected by WSP for analysis for Target Compound List/Target Analyte List (TCL/TAL) +30.
- Use the HPT/EC and Waterloo APS™ profiling technology to collect groundwater to define potential PFAS migration pathways and the vertical distribution of PFAS in groundwater at 23 locations. The groundwater samples will be submitted to a laboratory for analysis for PFAS. The number of profiling locations and vertical samples collected may vary as determined in the field based on observation of field data as it is collected:
    - one groundwater sample will be collected at the water table;
    - one sample will be collected at the highest vertical K value.
- Installation of seven shallow monitoring wells as shown in Figure 6.

[3] Rick McGregor, 2018, *In Situ* treatment of PFAS-impacted groundwater using colloidal activated Carbon; Remediation 2018:28: p. 33-41)

Groundwater Monitoring

The seven newly installed monitoring wells will serve to establish a baseline for PFAS water quality at the source area and Airport boundary as well as provide IRM performance monitoring locations. (Note, the same seven proposed wells are included in the SCWP.) Once the monitoring wells have been installed, they will be sampled as part of the semi-annual monitoring event for VOCs, SVOCs, TCL metals, pesticides, PCBs, 1,4 Dioxane and PFAS. In addition, First Environment is proposing to coordinate with the DEP in order to locate and inspect monitoring wells DEP-1 and DEP-3, as shown in Figure 6. If the monitoring wells are located and are determined to be in satisfactory condition, then First Environment will request permission to sample these wells. The samples will be submitted to a laboratory for analysis for PFAS.

All groundwater sampling will be performed by WSP under the direction of First Environment, as described in the QAPP. Once the sample results received by WSP meet quality assurance objectives defined in the QAPP, the results will be forwarded to First Environment and incorporated into First Environment's data evaluation and IRM Phase II report.

Data Evaluation/Visualization Model

First Environment will compile the HPT/EC data into visual renderings of data using the Mining Visualization System (MVS) software developed by CTech Development Corporation (www.ctech.com) utilizing CTech's Earth Volumetric Studio, a three-dimensional (3-D) volumetric Earth Science software system. The cross-sections below are examples of 2-D representations of subsurface HPT/EC data. Figures 7 and 8 are provided to illustrate how HPT/EC visual model can be used to better understand groundwater migration pathways and support the development of a focused IRM.

Figure 7 - Cross Section Electrical Conductivity Analysis of Soil Strata

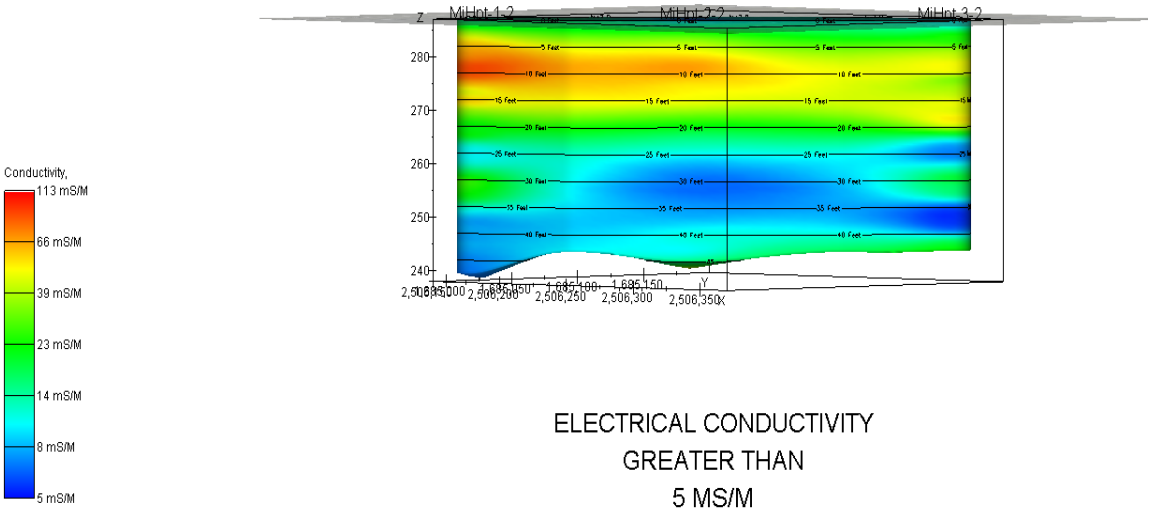


Figure 7. Soil EC in red/yellow illustrates a clay-silty layer whereas the blue shading depicts a sand layer.

Figure 8 - Cross Section Groundwater Pore Pressure of Saturated Zone

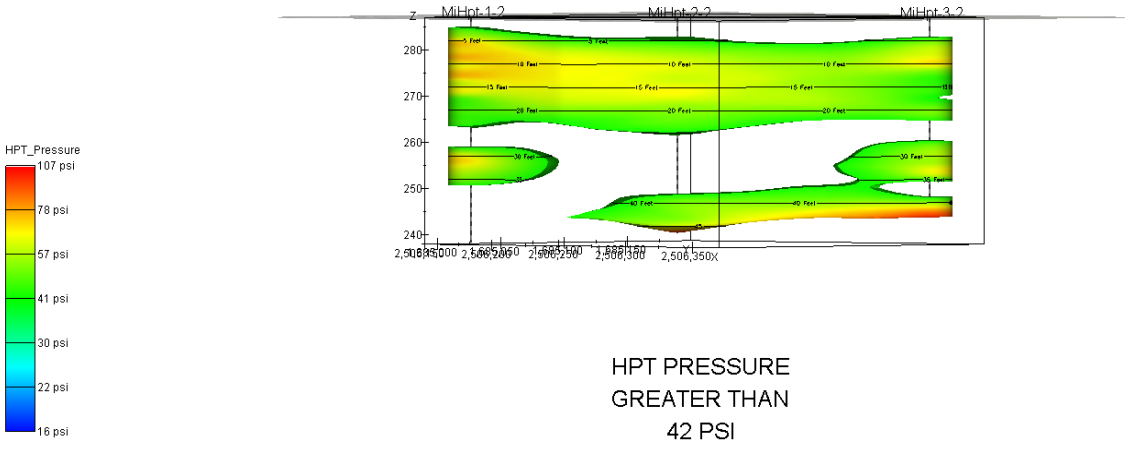


Figure 8 – The same section as Figure 6 above only depicting HPT data. The white layer identifies strata with low pore pressure less than 42 psi, which is indicative of a more transmissive zone capable of easily releasing or accepting fluid.

Remedial Action Alternatives

The alternatives as part of Phase II will be evaluated in accordance with Section 4.3 of the NYSDEC DER-10/Technical Guidance (NYSDEC, 2010). Due to the nature of PFAS migration in groundwater, which usually occurs close to the water table/vadose zone interface, and the fact that the majority of the PFAS has been identified in the shallow aquifer, the IRM will focus on remedial alternatives to address the shallow groundwater.

It should be noted that only a limited number of remedial technologies exist that are capable of remediating or reducing PFAS concentrations in groundwater. Accordingly, First Environment has outlined below the potential remedial alternatives that will be considered to address PFAS in groundwater. These alternatives, and possibly other emerging alternatives, will be evaluated concurrent to the collection of information to determine the feasibility of the IRM technologies listed herein.

Long-term Monitoring

If it is determined, based on information gained at DEP monitoring wells (i.e., DEP1 and DEP3), that PFOA/PFOS are not impacting Rye Lake, then long-term monitoring may represent the most appropriate remedial alternative to ensure protection of human health and the environment. If the data supports this approach and it is agreed to by the NYSDEC, this alternative will consist of monitoring the groundwater at DEP monitoring wells (DEP-1 and DEP-3) along Rye Lake for PFAS. The monitoring would initially be performed on a quarterly basis and then transitioned to annually, as presented in the Remedial Action Work Plan for this Site.

Source Removal

Once Phase I of the Groundwater IRM has been completed and the soil and groundwater data has been evaluated, Phase II can begin to assess/address the PFAS contaminant source area as a component of the IRM in accordance with the hierarchy in 6 NYCRR 375-1.8(c) (source removal and control measures). First Environment will evaluate the reasonableness and technical viability of physically removing the residual source of PFAS impacted soil. If it is deemed appropriate, upon completion of the residual source area removal activities First Environment will install monitoring wells to evaluate the effectiveness of the PFAS source removal action. It is reasonable to conclude that once the PFAS source area has been removed that the concentration of PFAS in groundwater will decrease accordingly. The monitoring would initially be performed on a quarterly basis and then modified to an annual basis, as presented in the Remedial Action Work Plan for this Site.

Injection of Liquid Activated Carbon

Once the Phase I is completed and the source area has been defined and a thorough understanding of the migration pathways has been achieved, First Environment will evaluate the technical viability of injecting PlumeStop™, which is a liquid activated carbon manufactured by Regenesis, to address groundwater at and downgradient of the source area. Based on initial studies regarding the efficacy of using PlumeStop™, it has been determined that PFAS compounds have an affinity to partition out of the aqueous phase and sorb onto the fine particles of activated carbon in PlumeStop™. The injection of PlumeStop™ therefore has the potential to lower the concentration of PFAS in the groundwater at the Site. It should be noted, however, the PFAS will remain adhered to the granular activated carbon and immobilized; therefore, PFAS will not be physically removed from the subsurface. As with the other alternatives, the groundwater at the Site will be monitored to evaluate the effectiveness of PlumeStop™ in decreasing PFAS concentrations in groundwater. It should be noted, however, First Environment will assess all practical remedial technologies to reduce PFAS concentration in groundwater and surface water as well as its migration from the source area.

Groundwater Recovery and Treatment System

Once the Phase I activities have been completed, First Environment will also evaluate the extraction and treatment of groundwater as a means of decreasing PFAS concentrations in groundwater. This alternative would likely include the installation of pumping wells in the source area and/or downgradient along the Airport boundary. If deemed appropriate, the PFAS impacted groundwater would be directed to a centralized treatment system. The extracted groundwater would likely be treated on site using either aqueous phase granular activated carbon or an anionic ion exchange resin (noting that PFOS/PFOA are cationic). The treated water would, in turn, be discharged either to a plumbing connection to the municipal sewer system (along with an appropriate permit) or back to the ground through injection wells. As with the other alternatives, the groundwater at the Site will be monitored to evaluate the effectiveness of groundwater recovery and treatment in decreasing PFAS concentrations in groundwater.

Funnel and Gate System

First Environment will also evaluate whether the installation of an in-situ funnel and gate system is a viable alternative for this site. This would include an assessment if gate/cell should be designed such that the media can be changed out before it reaches PFAS saturation and the basis provided in the IRM design.

The funnel and gate system would consist of installing an impermeable slurry wall or sheet pile which would direct water to a permeable reactive cell (PRC) to treat the groundwater in-situ. The length and orientation of the funnel and gate system is dependent upon the area to be treated, the direction of groundwater flow, and the results of modeling which will ensure that the gate(s)/PRC is of sufficient design to ensure water does not back up and overflow the impermeable wall. As with the other alternatives, the groundwater at the Site will be monitored to evaluate the effectiveness of the funnel and gate system in decreasing PFAS concentrations in groundwater.

IRM Phase II

Once completed, First Environment will produce the IRM Phase II report. The Phase II report will describe the investigation work performed and findings for work activities. First Environment will collaborate with the County and NYSDEC in the development of IRM Phase II. The Phase II will provide a more in-depth description and discussion of remedial measure(s), remedial action goals, implementation, refined schedule, and performance monitoring as described in Table 1.

Schedule

Subsequent to the Department's review and approval of the IRM Workplan, First Environment will begin mobilizing the IRM activities. Upon NYSDEC approval, First Environment will initiate Phase I of the IRM. Once the Phase I is completed, First Environment will develop a refined, and likely expanded, schedule for the implementation of Phase II for NYSDEC approval. Table 1 provides a best estimate to key milestones for the IRM Phase II schedule. Table 2 identifies the sample media, number of samples, sample location, and laboratory analysis samples to be submitted to a New York State Certified Laboratory. In addition, once the workplan is approved by the NYSDEC, First Environment will submit monthly status reports to the NYSDEC and County before the 10th of each month. Each report will provide monthly work activities and findings as well as the upcoming anticipated work activities for the month.

References

Fisher, Donald, Y.W. Isachsen and L.V. Richard, 1970, “Geologic Map of New York, Lower Hudson Sheet”, New York State Museum and Science Service Map and Chart Series No. 15.

Rick McGregor, 2018, *In Situ* treatment of PFAS-impacted groundwater using colloidal activated Carbon; Remediation 2018:28: p. 33-41)

TABLES

TABLE 1

IRM 2020-2021
Work Activity Schedule

Milestone	Estimated Duration	Estimated Completion Date
Staff Gauge Installation	1 day	23 March
DEP-1 and DEP-3 Well Assessment & Permitting	5 days	29 April
Monitoring Well Installations & Well Development	20 days	15 May
Semi-Annual Groundwater Monitoring*	7 days	30 May
Well & Staff Gauge Survey	3 days	1 June
Groundwater IRM Phase I (Burn Pit Field Investigation) (Downgradient Investigation) est. 44 borings	22 days	8 September
Compilation of Data and Analysis	30 days	24 November
Groundwater IRM Phase II Workplan Remedial Action Alternatives Report	30 days	22 December
IRM Design	30 days	19 January
IRM Planning & Mobilization	15 days	9 February
IRM Implementation	30 days	12 March
Performance Monitoring	365 days	Quarterly
IRM Results Report	30 Days	TBD

August 3 Burn pit and downgradient Phase I investigation Start Date

Estimated task durations and completions are tentative and are subject to modification based onsite work, progress, weather delays and other considerations such contractor availability as Airport access. All activities are occurring concurrent to other IRMs and Site Characterization.

Monthly progress reports will provide task initiation date for upcoming monthly activities.

* Semi-annual groundwater sampling conducted by WSP not part of the IRM but included.

Once the IRM Phase I is completed, and data shared and discussed with the NYSDEC, First Environment in coordination with the County and Airport Operations will develop a detailed schedule for the design and implementation of the IRM Phase II.

TBD – To Be Determined

TABLE 2
Summary Table
Sample Location, Media and Laboratory Analyses

Airport Sample Area	No	Soil	Sediment	Ground Water	Surface Water	Laboratory Analysis	Sample Description	Comments
New Monitoring Wells	7			x		VOCs, SVOCs, pesticides, PCBs, metals 1,4 Dioxane, PFAS, Total Organic Carbon (TOC)	7 shallow monitoring wells.	Proposed locations are identified in Figure 6. Once installed, WSP will include the new monitoring wells in the next semi-annual sampling event. These 5 wells are also included in the total 19 wells as part of the SCWP.
NYANG Burn Pit	20	x				PFAS, TOC/FOC	20 soil borings; 100 foot spacing; sample collection from immediately above the water table (1.0 to 2.0 feet bgs); and at 15 feet bgs	Samples will be collected at every boring, analysis will be performed at every other boring – based on those results a determination will be made to analysis the remaining soil samples within the soil boring grid , See Figure 5 references to the sample locations.
NYANG Burn Pit	6	x				PFAS, TOC/FOC	6 soil samples collected from 0 to 6 inches from the surface and immediately above the bedrock.	In total, 12 samples collected for lab analysis. Soil samples will be collected nearest to the former NYANG burn pit.
NYANG Burn Pit	2	x				PFAS, TOC/FOC	2 soil samples will be collected inside the former NYANG burn pit immediately below the backfill at an estimated depth of 5 to 6 feet bgs and at the overburned/bedrock interface.	In total, 4 samples will be collected for laboratory analysis as shown in Figure 5 of the SCWP.
NYANG Burn Pit	20	x				Target Compound List/Target Analyte List	Soil will be continuously screened using a PID at each of the 20 soil borings for the presence of VOCs.	If elevated PID readings are detected in soil, one sample will be collected for laboratory analysis
NYANG Burn Pit	20			x		PFAS, TOC, pH, dissolved oxygen, electrical conductivity, oxidation reduction potential.	At 20 locations groundwater will be collected at the water table (estimated at 1 to 2 feet) and at the highest K value; 2 samples will be collected at the former Burn Pit overburden interface to bedrock.	The exact number of samples submitted for laboratory analysis will be determined in the field. A minimum of 22 samples will be collected not exceeding 40 samples submitted for laboratory analysis. Sample collection will be performed via Waterloo APS.

TABLE 2
Summary Table
Sample Location, Media and Laboratory Analyses

Airport Sample Area	No	Soil	Sediment	Ground Water	Surface Water	Laboratory Analysis	Sample Description	Comments
Downgradient	7	x				TOC/FOC	TOC/FOC in soil will be collected at up to 7 locations immediately above the water table and at 20 feet and the bedrock interface approximate 30 to 40 feet below ground surface.	21 samples total will be collected for laboratory analysis at downgradient borings. The exact boring from which samples will be collected will be a field time decision.
Downgradient	23			x		PFAS, TOC, pH, dissolved oxygen, electrical conductivity, oxidation reduction potential.	Groundwater samples will be collected at the water table and at the interval of highest K value.	The total number of samples collected for laboratory analysis will be determined in the field. The maximum number of samples will not exceed 46 samples submitted to the laboratory. Samples will be collected via Waterloo APS. Downgradient boring/Waterloo APS locations are identified in the IRM Figure 6.
Downgradient	2			x		PFAS, TOC, pH, dissolved oxygen, electrical conductivity, oxidation reduction potential.	If wells DEP-1 and DEP-3 exist and are in satisfactory condition, First Environment will request permission to sample the monitoring wells during the fall semi-annual event.	Downgradient offsite locations are identified at DEP-1 and DEP-3 as shown in Figure 6 of the IRM.

The exact number and location of samples for laboratory analysis maybe subject to change based on field conditions and sampling equipment operation.
Downgradient Sample Locations are defined as those downgradient of the former NYANG Burn Pit.
TBD – To Be Determined
Final sample locations maybe be determined in the field in consultation with the NYSDEC representative.
Soil borings will be advanced continuously to the bedrock or refusal and examined in the field for visual, olfactory, or PID field screening evidence of potential contamination.
Representative.
Groundwater pH, DO, EC, ORP will be submitted and analyzed for laboratory analysis.
TAL = USEPA Target Analyte List inorganic elements and compounds.
TCL = USEPA Target Compound List VOCs, SVOCs, PCBs, and Pesticides, including Tentatively Identified Compounds.
TOC/FOC = Total Organic Carbon and Fractional Organic Carbon.

FIGURES

0 500 1,000 2,000 Feet

1 inch = 2,000 feet

Westchester County Airport, Site No. 360174

United States Geological Survey, Glenville NY Topographic Quadrangle, 1967, Photorevised 1981

FIRST ENVIRONMENT

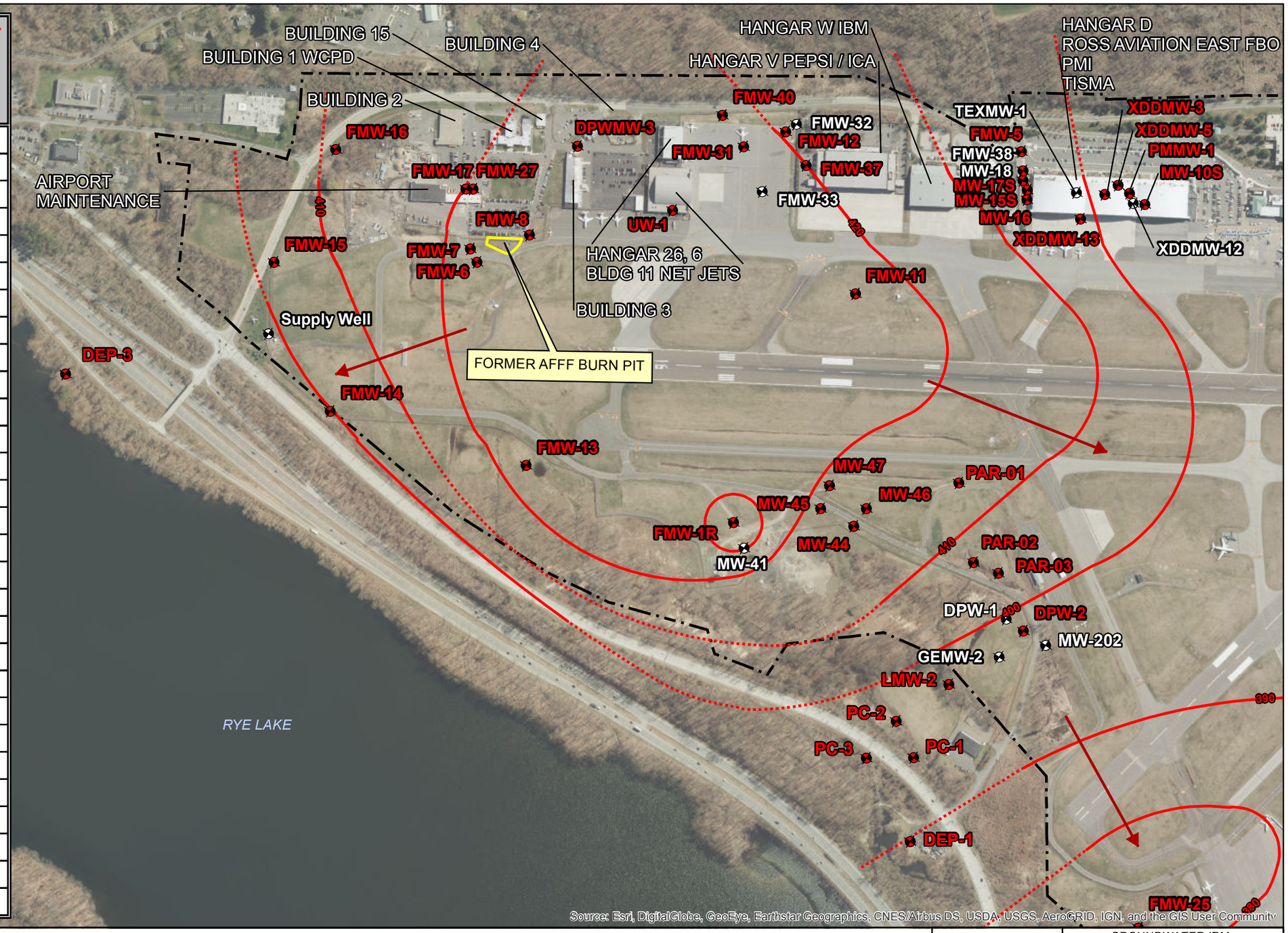
91 Fulton Street
Boonton, New Jersey 07005

GROUNDWATER IRM
WESTCHESTER COUNTY AIRPORT
White Plains, Westchester County, New York
FIGURE 1
SITE TOPOGRAPHIC LOCATION MAP

Revised	Drawn	Checked	Approved	Date
	LS	SG	SG	7/2/2019

I:\WESCHESTER AIRPORT\GIS\Site_Location_Map.mxd

March-April 2019 Sampling Event Well	Shallow Aquifer Groundwater Elevation (ft msl)
DPWMW-3	428
FMW-1R	433.19
FMW-2R	395.77
FMW-3	424.81
FMW-6	422.26
FMW-7	422.5
FMW-8	423.39
FMW-11	423.51
FMW-12	422.47
FMW-13R	421.88
FMW-14	400.36
FMW-15	406.04
FMW-16	411.53
FMW-17	421.25
FMW-24	392.91
FMW-25	370.54
FMW-26	397.06
FMW-27	420.11
FMW-31	419.57
FMW-37	420.04
FMW-39	384.11
FMW-40	421.68
MW-3 (XDDMW-3)	399.05
MW-4 (PMMW-1)	398.81
MW-44	411.94
MW-45	417.47
MW-46	412.54
MW-47	416.44
XDDMW-13	404.59



Legend

- Shallow Groundwater Elevation Contours
- Shallow Groundwater Elevation Contours (Inferred)
- Shallow Groundwater Flow Direction
- Monitoring Well (Shallow)
- Monitoring Well (Not Sampled)
- Property Boundary
- Former AFFF Burn Pit

Westchester County Airport, Site No. 360174

0 125 250 500 Feet

1 inch = 500 feet

N

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91 Fulton Street
Boonton, New Jersey 07005

GROUNDWATER IRM
WESTCHESTER COUNTY AIRPORT
White Plains, Westchester County, New York

FIGURE 2
SHALLOW GROUNDWATER FLOW

Revised	Drawn	Checked	Approved	Date
	LS	SG	SG	3/17/2020

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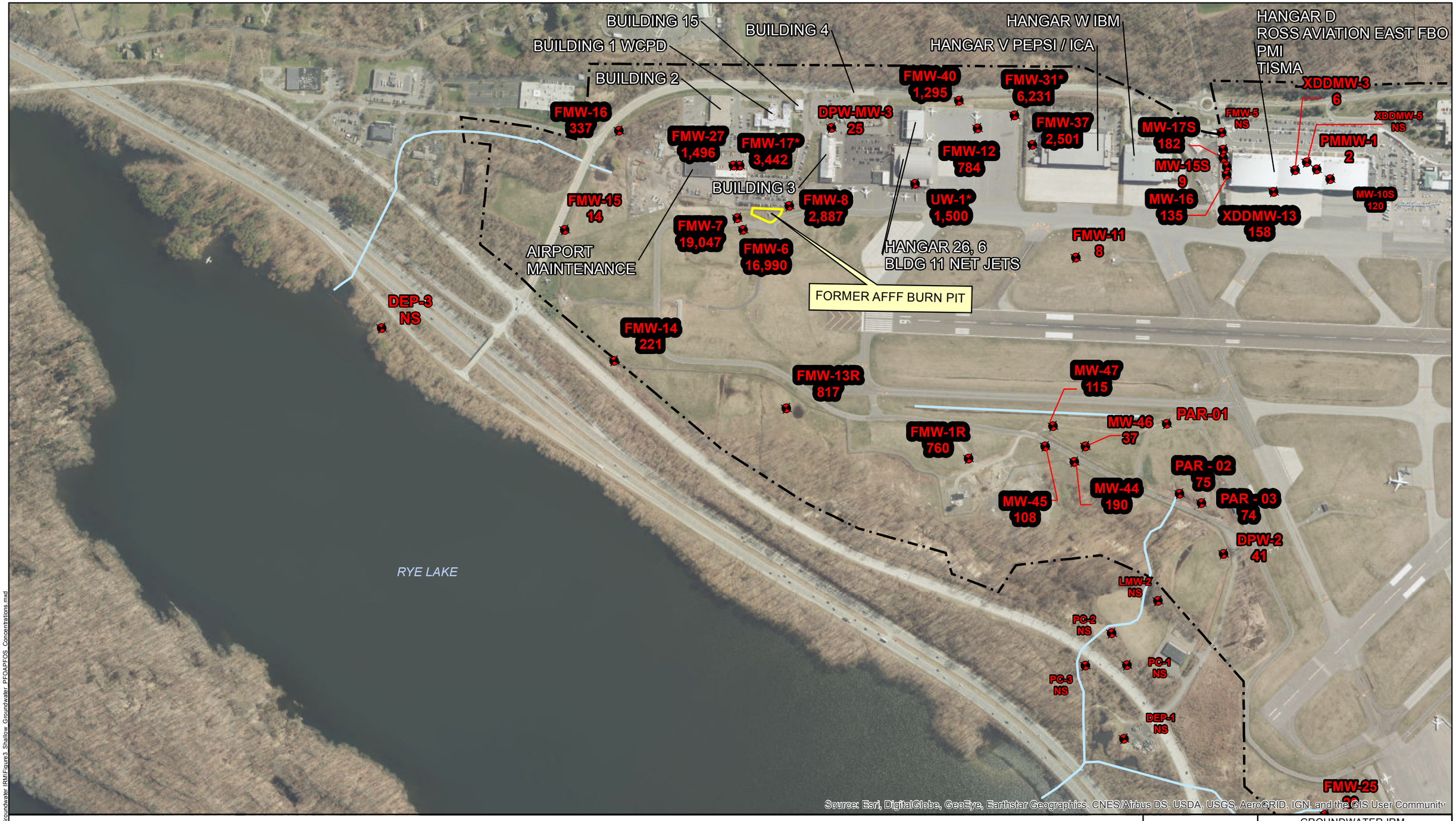

Legend

- Monitoring Well (Shallow)
- 31 / 1,110 / NS — PFOA + PFOS (ppt); Bolded: >70 ppt; Not Sampled
- Former AFFF Burn Pit
- Property Boundary
- Streams (USGS NHD)

Westchester County Airport, Site No. 360174

0 125 250 500 Feet

1 inch = 500 feet

*Note: FMW-17, FMW-23, FMW-31, & UW-1 were resampled in May 2019 due to lab error for March sampling.

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91 Fulton Street
Boonton, New Jersey 07005

GROUNDWATER IRM
WESTCHESTER COUNTY AIRPORT
White Plains, Westchester County, New York
FIGURE 3
SHALLOW GROUNDWATER PFOA/PFOS CONCENTRATIONS (MARCH 2019)

Revised	Drawn	Checked	Approved	Date
	LS	SG	SG	3/17/2020

I:\WESCHESTERAIRPORT\Groundwater IRM\Figure3_Shallow_Groundwater_PFOAPFOS_Concentrations.mxd

Legend

- Proposed Soil Boring Location
- Proposed Monitoring Well (Shallow)
- Proposed Monitoring Well (Deep)
- Monitoring Well (Shallow)
- Monitoring Well (Deep)
- Monitoring Well
- Former AFFF Burn Pit

Westchester County Airport, Site No. 360174

0 20 40 80 Feet

1 inch = 80 feet

N

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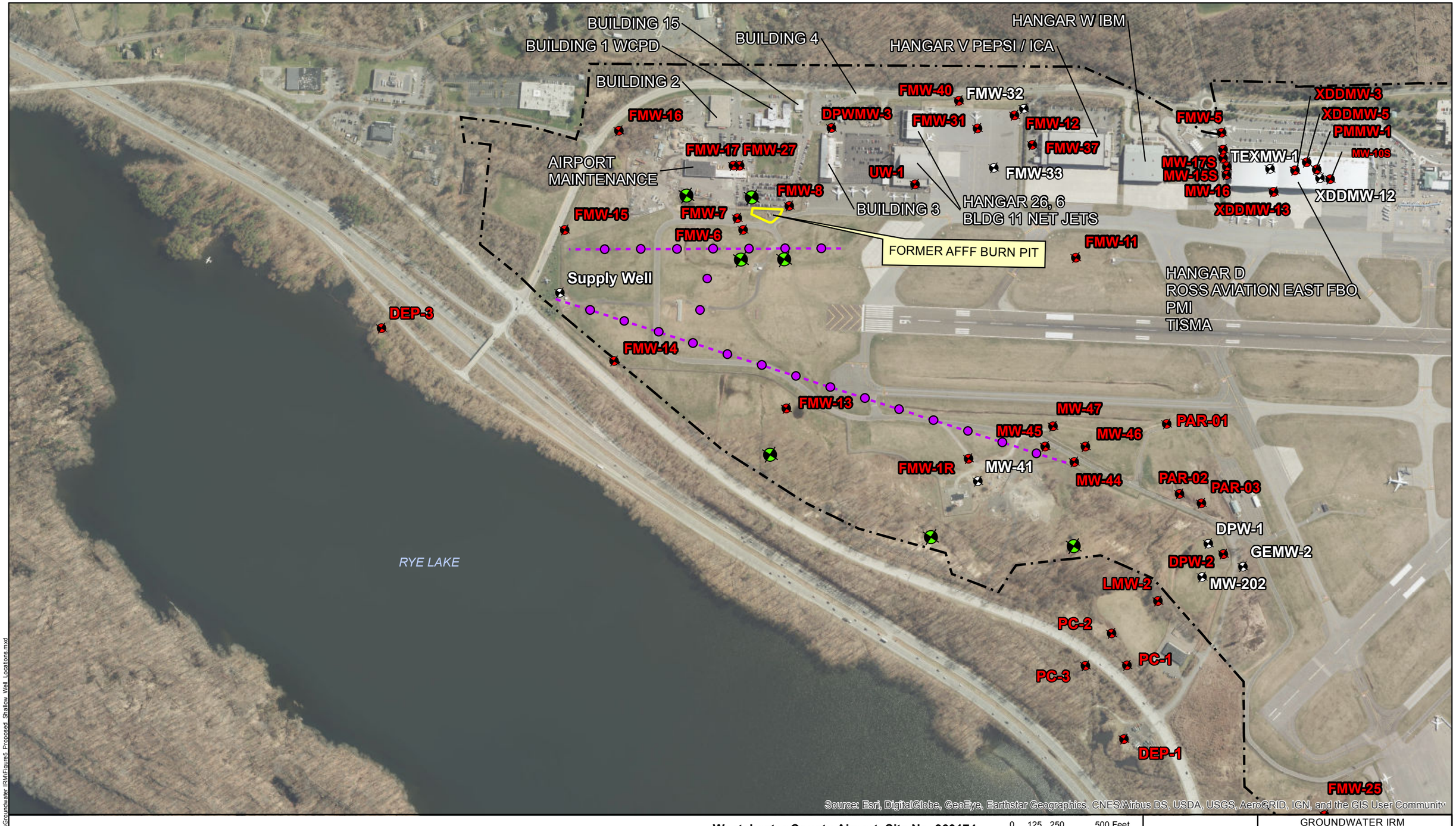
91 Fulton Street
Boonton, New Jersey 07005

GROUNDWATER IRM
WESTCHESTER COUNTY AIRPORT
White Plains, Westchester County, New York
FIGURE 5
PROPOSED NYANG BURN PIT
SOIL SAMPLE LOCATIONS

Revised	Drawn	Checked	Approved	Date
	LS	SG	SG	3/27/2020

J:\WESCHESTER AIRPORT\Groundwater IRM\Figure4_Proposed_NYANG_Burn_Pit_Soil_Sample_Locations.mxd



Legend

- Proposed Soil Borings/HPT Hydraulic Profiling Location
- Proposed Monitoring Well (Shallow)
- Monitoring Well (Shallow)
- Monitoring Well
- Former AFFF Burn Pit
- Property Boundary

Westchester County Airport, Site No. 360174

0 125 250 500 Feet

1 inch = 500 feet

N

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91 Fulton Street
Boonton, New Jersey 07005

GROUNDWATER IRM
WESTCHESTER COUNTY AIRPORT
White Plains, Westchester County, New York

FIGURE 6
PROPOSED DOWNGRADIENT SHALLOW WELL AND SOIL BORING LOCATIONS

Revised	Drawn	Checked	Approved	Date
	LS	SG	SG	3/17/2020

I:\WESCHESTER AIRPORT\Groundwater IRM\Figure5 Proposed Shallow Well Locations.mxd

APPENDIX A

July 8, 2019

Mr. Robert Funicello
Environmental Project Director
Westchester County Dpt, of Environmental Facilities
270 North Ave, 6th Floor
New Rochelle, NY 10805

Via Electronic Transmission

RE: Groundwater Sampling Results
First Semi-Annual Event for 2019

Dear Mr. Funicello:

This letter presents the results of the first semi-annual groundwater sampling event for 2019 which was completed between March 25 and April 1, 2019 at the Westchester County Airport. The sampling was completed as part of a semi-annual groundwater monitoring program that was initiated in August 2018.

The monitoring program was reinstated in response to a November 2017 sampling event that confirmed the presence of per and polyfluoroalkyl substances (PFAS) in several airport monitor wells. The 2017 sampling was completed at the request of the New York State Department of Environmental Conservation (NYSDEC) due to historical fire training activities conducted by the Air National Guard, a former tenant who left the site in 1983. The August 2018 sampling event was the first full sampling event under the reinstated monitoring program and the first to include the site-wide analyses of PFAS in groundwater.

The first 2019 semi-annual sampling event included a total of 53 wells. PFAS were analyzed for in samples collected from all 53 wells. In addition, samples from 39 wells were analyzed for volatile organic compounds (VOCs), samples from 12 wells were analyzed for 1,4-dioxane and samples from six wells were analyzed for glycols. Table 1 lists the sampled wells and associated analytes for each well. VOCs and glycols are related to ongoing airport operations and were analyzed for historically as part of a monitoring program completed between 2001 and 2011. Similar to PFAS, 1,4-dioxane is an emerging groundwater contaminant that is being analyzed for at sites across the State.

The sampling results, which are described in detail below, are consistent with those from 2018 and show the presence of PFAS compounds in all of the sampled wells. The highest concentrations were detected in the northern part of the site, in the vicinity of the former Air National Guard Burn Pitt, which is the suspected source area. 1,4-Dioxane was detected in 5 wells in and around Hangar D. VOC and glycol results are generally consistent with historical data from the 2001 – 2011 monitoring program.

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SAMPLING RESULTS

All wells were sampled with dedicated, disposable, HDPE (PFAS free) bailers. Prior to sampling, the wells were purged of three standing volumes of water, or until dry, using either HDPE bailers or a PFAS-free submersible pump with dedicated HDPE tubing. The samples were collected in laboratory prepared containers and were kept cold until delivery to the laboratory. The samples were analyzed by York Analytical Laboratories of Stratford, CT. The analytical results are summarized on tables 2 - 9 and figures 1 and 2. Copies of the laboratory reports are attached in the Appendix of the electronic version of this report. Category B, ASP deliverables were prepared for each report and are available upon request. Water-level measurements were made in each well prior to sampling. This data was used to calculate groundwater elevations and prepare groundwater contour maps which are presented on table 10 and figures 3 and 4.

Per and Polyfluoroalkyl Substances (PFAS)

PFAS samples were analyzed by EPA Method 537-M which currently includes 21 individual PFAS. As shown on the tables, various PFAS were detected in all sampled wells. Promulgated Federal or State standards do not currently exist for PFAS in groundwater. An EPA recommended guidance value of 70 ppt (parts per trillion, equivalent to nanograms per liter (ng/l)) has been published for the combined concentration of two individual PFAS, Perfluorononanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS). As shown on table 2, the EPA guidance value for PFOA and PFOS was exceeded in 32 of the 53 sampled wells. All 32 of these wells are located on the northern half of the airport (figure 1). The highest PFOA and PFOS concentrations were detected in wells FMW-6 (16,990 ng/l) and FMW-7 (19,047 ng/l). These wells are located in the northern corner of the airport near the former Air National Guard Burn Pitt, which is the suspected PFAS source area (table 4, figure 1).

The individual PFOA and PFOS results are consistent with the total PFAS concentrations for all 21 compounds. The highest total PFAS concentrations were again detected in wells FMW-6 (44,228 ng/l) and FMW-7 (28,424 ng/l) and in wells on the northern half of the airport. Wells in the southern half of the airport had total PFAS concentrations of 223 ng/l or less. As stated previously, standards or guidance for total PFAS concentrations or the other 19 individual compounds do not currently exist. These data are presented on table 5.

The sampled wells included wells completed in the shallow unconsolidated sediments as well as bedrock wells. The highest PFAS concentrations were detected in samples from wells completed in the shallow sediments and generally from wells that were between 10 and 20 feet deep.

Tables 3 and 4 compare PFAS results from the current sampling event to the results from August 2018. The results show similar concentrations for the sampled wells between the two rounds. Wells with the highest concentrations in 2018 (FMW-6, FMW-7 & FMW-31) which are located on the northern half of the airport near the suspected source area, had the highest concentrations again.

However, several wells including FMW-17, FMW-23, FMW-31 and UW-1, had PFAS results that varied significantly in comparison to the 2018 data (table 6). Since this is only the second, full-site sampling round to include PFAS, a strong baseline for comparison does not exist and there were no obvious explanations for the discrepancy. As a result, on May 23, 2019 these wells were resampled for PFAS. In comparing the data (table 6), the May resampling results show concentrations that are more consistent with the 2018 data as opposed to the recent March data.

Based on the resampling results, the laboratory was asked to verify the March 2019 results for these wells, which appeared to be anomalous. After their review, the laboratory confirmed that there was an error in the March PFAS results for these wells. Samples with expected high concentrations require dilution before they are analyzed. In the case of these samples, the dilution factors were incorrectly calculated by the analytical system software. As a result, data from the May resampling event are presented in the summary tables.

1,4-Dioxane

In 2018, samples from six wells were analyzed for 1,4-dioxane as a screening tool to determine if this emerging contaminant is present in groundwater at the airport. The wells were selected to provide results from different areas of the airport property and different hydrogeologic zones. There are no known current or historical activities at the site that would have involved the use of this chemical. However, 1,4-dioxane is used as a stabilizer in the manufacturing of chlorinated solvents and is commonly found at sites contaminated with solvents.

The 2018 sampling detected 1,4-dioxane in one well, XDDMW-11 at a concentration of 4.5 ug/l (micrograms per liter). A groundwater standard for this compound does not currently exist. This well is a bedrock well located on the eastern side of the airport just outside Hangar D. Hangar D has a historical chlorinated solvent problem that is being remediated and monitored by a former tenant.

Based on the 2018 results, 11 different wells plus XDDMW-11 were sampled for 1,4-dioxane as part of the first 2019 sampling round (table 1). Six of the wells, including XDDMW-11, are located in or around Hangar D. The remaining wells are located around different areas of the airport.

The sampling results are summarized on tables 2 and 3 and figure 2. As shown, 1,4-dioxane was detected in five wells including XDDMW-11, all located in or around Hangar D. The detected

concentrations range from 2.5 to 32 ug/l. The highest concentration was detected in MW-7S located inside the Hangar.

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are a class of chemicals that include petroleum constituents and chlorinated solvents that were monitored during the groundwater monitoring program completed between 2001 and 2011. Based on historical data, samples from 39 wells were analyzed for VOCs as part of the first 2019 sampling round (table1). As shown on table 5, VOCs were detected in samples from 26 out of 39 wells. Of those detections, groundwater standards were exceeded in samples from eight wells (table 5). Five of those wells (MW-7S & 7D; MW-10S & 10D and XDDMW-10) are in or adjacent to Hangar D. As noted in the previous section, Hangar D has a historical chlorinated solvent problem that is being remediated and monitored by a former tenant. With the exception of XDDMW-10, the detections in these wells are consistent with historical results. This is the first time solvents were detected above a standard in XDDMW-10, which is outside the Hangar. Cis-1,2-dichloroethylene and 1,1-dichloroethane were detected in the XDDMW-10 sample at 6.6 and 6.2 ug/l, respectively. The standard for these compounds is 5 ug/l.

Two of the remaining three wells in which a standard was exceeded include FMW-14 and FMW-23 (table 5). FMW-14 is located in the northwestern corner of the property. The solvent chlorobenzene was detected in this well at 23 ug/l. FMW-23 is a bedrock well located near the former Air National Guard Burn Pitt. The solvent cis-1,2-dichloroethylene and its degradation product (vinyl chloride) were detected in this well at 280 and 77 ug/l, respectively (table 5). These detections are also consistent with historical data for these wells from the 2001 – 2011 monitoring program.

The last well in which VOCs were detected above standards is FMW-31. This well is located in the northeastern portion of the airport, north of Hangar V. The compound 1,2,4-trimethylbenzene was detected at 11 ug/l; the standard is 5 ug/l. This compound is a petroleum constituent with no history of detections in this well prior to 2018 when it was detected for the first time at 7 ug/l.

As shown on table 5, low concentrations of VOCs were detected below groundwater standards in several wells, primarily in the northeastern part of the airport. Most of the detected VOCs include petroleum constituents and additives such as: benzene, toluene, ethylbenzene, tert-butyl alcohol, carbon disulfide and others. This part of the airport is a paved, high-traffic area and the wells are set flush to grade. The most likely cause of these low-level petroleum detections is surface-water runoff entering the wells through deteriorating pavement and damaged well casings. In 2018, toluene was detected in DPW-MW-3 at 220 ug/l, which was a first-time detection. Resampling of that well three months later showed a concentration of 41 ug/l. The current results for this well show a toluene concentration of

0.65 ug/l (table 5). Inspection of DPW-MW-3, which is completed flush to grade, confirmed that the well casing is cracked at the surface as is the surrounding concrete pad and asphalt pavement. The condition of this well and the rapid concentration decline, likely a result of the removal of water during sampling, supports surface-water infiltration as the source of toluene in this well.

In addition to Hangar D, VOCs have been historically associated with two former Voluntary Cleanup Sites at the airport, the Former Air National Guard Site (V00499) and the Former Hangar B site (V00611). VOC results for wells in these two areas are summarized on tables 7 and 8. At the Air National Guard site, the compounds cis-1,2-dichloroethylene, trans-1,2- dichloroethylene and vinyl chloride had a history of detections above standards in well FMW-34R. All three of these are degradation products of the solvents perchloroethylene (PCE) and trichloroethylene (TCE). Site investigations in 2003 and 2004 found no source area at the Air National Guard site that could be linked to these detections.

Well FMW-34R is believed to have been destroyed; however, seven other wells in this area are included in the sampling program. As shown on table 7, cis-1,2-dichloroethylene and vinyl chloride were detected in one well (FMW-31) and both detections were below the groundwater standard of 5 ug/l.

The Hangar B site was remediated for solvents in 2005. The associated wells in this area were incorporated into the 2001 - 2011 groundwater monitoring program for post-remediation monitoring and lingering detections of MTBE associated with closed NYSDEC Spill No. 98-11689. As shown on table 8, eight wells were sampled in this area. MTBE was detected in four wells below the standard of 10 ug/l. The detected concentrations range between 0.25 and 8.30 ug/l. Site-related solvents were not detected in any of the wells.

Glycols

Ethylene and Propylene Glycol (glycols) are associated with deicing fluid. Historically, glycols have not been detected in groundwater at the airport. In considering the historical data, samples from six wells were selected to be analyzed for glycols (table 1). These wells were selected because they are located near areas where deicing fluid is used or stored. Glycols were not detected in any of these wells (table 2).

Quality Control / Quality Assurance

As part of the sampling protocol, field blanks, trip blanks, duplicates, matrix spike and matrix spike duplicate samples (MS/MSD) were collected. Field and trip blanks were collected daily, all others were collected at a rate of 1 for every 20 samples. Results for the QA/QC samples are included with the laboratory reports in the Appendix. The MS / MSD results show no matrix interference related to detected analytes.

The only field blank detection was toluene at 0.23 ug/l in the sample collected on April 1. The detected concentration was slightly above the minimum detection limit of 0.20 ug/l but was below the 0.50 ug/l Limit of Quantitation and, therefore, is an estimated value. Toluene was detected in only one of the six wells sampled that day, DPWMW-3, at a concentration of 0.65 ug/l (table 5). Toluene has been detected in this well before and as stated in a previous section, it is suspected to be related to surface-water runoff from the surrounding pavement. In considering these results, the detection of toluene in the field blank is not considered significant. The compound methylene chloride was detected in the March 27 and April 1 trip blanks at 1.0 and 1.4 ug/l, respectively. Methylene chloride is a common laboratory contaminant and it was not detected in any of the site samples.

Table 9 presents results for the duplicate samples. Duplicates are duplicated samples submitted to the laboratory with a different sample identification to confirm laboratory accuracy. As shown on table 6, results between the original and duplicated samples were fairly consistent. Results for VOCs, 1,4-dioxane and glycols were all Not Detected in the original and duplicated samples. For PFAS the concentration differences for detected compounds were within 1.0 ng/l in most cases including PFOA and PFOS. One exception is the compound 6:2 FTS in two of the three duplicated PFAS samples, FD-3 and FD-4. For these samples the difference in concentration of 6:2 FTS between the sample and the duplicate ranged between 22 and 36 ng/l. The laboratory confirmed these results and found no analytical errors. Other PFAS in the same samples duplicated accurately indicating that the variation appears to be limited to 6:2 FTS.

Overall the duplicate results show a high level of accuracy in the analytical results, especially for PFAS which are being measured in parts per trillion. While the potential variation in results for 6:2 FTS means those data should be viewed with caution, any such variation would be negligible relative to the high PFAS concentrations detected in most wells and would have zero impact on the PFOA and PFOS concentrations.

Groundwater Flow

Groundwater elevation data are presented on table 10 and figures 3 and 4. Groundwater elevations across the site ranged from a high of 433.19 ft msl (feet above mean sea level) in the northwestern part of the site (FMW-1R), to a low of 370.54 ft msl in the southwestern part of the site (FMW-25). The direction of groundwater flow across the site varies as a result of a major drainage basin divide that runs through the site. Approximately three quarters of the site lies within the Blind Brook Drainage Basin with the remainder, on the western side of the property, lying in the Rye Lake Drainage Basin. Groundwater flow in the Blind Brook basin, in the shallow and bedrock aquifers, is primarily to the southeast. In a small area of the northern part of the site, the flow is northwesterly due to a

groundwater divide in that area (figure 3). Groundwater flow within the Rye Lake basin flows northwest to southwest towards Rye Lake.

The direction of groundwater flow and the observed elevations measured during sampling are relatively consistent with historical groundwater data and show a slight rise in water levels over time. Groundwater elevations in FMW-1R and FMW-25 (wells with the highest and lowest elevations) measured in May 2010 were 430.88 and 369.52 ft msl respectively, compared to the current measurements of 433.19 and 370.54 ft msl.

CONCLUSIONS AND RECOMMENDATIONS

Various PFAS were detected in all sampled wells across the airport. The 70 ng/l EPA guidance value for PFOA and PFOS was exceeded in 32 of 53 sampled wells. The highest concentrations, including all exceedances of the guidance value, were detected in wells located on the northern half of the airport. The overall highest concentrations were detected in wells located in the area of the former Air National Guard Burn Pitt, which is considered the most probable source area. These results are consistent with data from August 2018 which was the first full sampling round for PFAS at the airport.

The compound 1,4-dioxane was detected in 5 out of 12 wells. All 5 of those wells are located in or around Hangar D and four of them also contained chlorinated solvents above standards. 1,4-Dioxane is used as a stabilizer in the manufacturing of chlorinated solvents and it is commonly found at sites contaminated with solvents. Hangar D has a known chlorinated solvent problem currently being managed by a former tenant. These results indicate a relationship between the occurrence of 1,4-dioxane and the solvents associated with Hangar D.

Results for VOCs are generally consistent with historical data from the 2001 – 2011 monitoring program. Groundwater standards were exceeded in eight wells of which all but one are associated with known airport release sites including Hangar D and the Air National Guard Burn Pitt. The one exception is well FMW-31 where 1,2,4-trimethylbenzene (a petroleum constituent) was detected for the first time in 2018 and confirmed in the current round. At this time, the source is unknown, however, the detected concentrations are relatively low. Continued monitoring of this compound in this well is recommended.

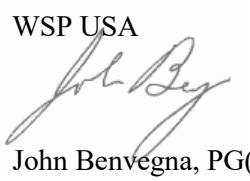
Glycols were not detected in any of the six wells that were sampled for them, which is also consistent with historical data. Glycols should continue to be monitored in select wells based on where deicing fluid is used and stored.

Groundwater elevations and flow directions are consistent with historical data and show a slight rise in water levels over the last nine years.

If you have any questions, please feel free to contact me at (914) 461-2961.

Kind regards,

WSP USA



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TABLES

TABLE 1
WESTCHESTER COUNTY AIRPORT
SAMPLE ANALYTE MATRIX
March - April 2019

Well (BR) = Bedrock Well	PFAS	Volatile Organics	1,4-Dioxane	Glycols*	Well Depth (ft btoc)
BRMW-1 (BR)	X				44.00
BRMW-2 (BR)	X	X			45.75
DPW-2	X	X			11.30
DPWMW-3	X	X			14.00
FMW-1R	X				15.25
FMW-2R	X		X		11.80
FMW-3	X				15.10
FMW-6	X	X	X		10.70
FMW-7	X	X			10.00
FMW-8	X	X			11.00
FMW-11	X	X		X	8.50
FMW-12	X	X			18.78
FMW-13R	X				17.55
FMW-14	X	X			15.45
FMW-15	X				14.90
FMW-16	X	X			15.80
FMW-17	X	X			9.48
FMW-23 (BR)	X	X	X		42.30
FMW-24	X	X			8.50
FMW-25	X	X		X	12.80
FMW-26	X			X	15.80
FMW-27	X	X			11.64
FMW-31	X	X			19.65
FMW-35 (BR)	X	X			57.50
FMW-36 (BR)	X	X			51.50
FMW-37	X	X		X	13.40
FMW-39	X	X	X	X	6.30
FMW-40	X	X			12.70
MW-3 (XDDMW-3)	X	X			17.50
MW-4 (PMMW-1)	X	X			17.50
MW-7S	X	X	X		24.65
MW-7D (XDDMW-7R) (BR)	X	X			45.60
MW-10D (BR)	X	X	X		50.60
MW-10S	X	X	X		32.00
MW-15S	X	X			23.10
MW-16	X				11.10
MW-17S	X				31.70
MW-18	X				14.95
MW-42 (BR)	X	X			58.85
MW-43 (BR)	X	X			67.30
MW-44	X	X	X		18.10
MW-45	X	X			15.00
MW-46	X	X			17.70
MW-47	X	X			17.70
MW-48 (BR)	X	X	X		72.45
MW-49 (BR)	X	X			62.60
PAR - 02	X				10-15
PAR - 03	X				10-15
UW-1	X	X			13.29
WW-1 (BR)	X				62.10
XDDMW-10 (BR)	X	X	X		59.00
XDDMW-11 (BR)	X	X	X	X	41.30
XDDMW-13	X		X		38.60

(ft btoc) Feet Below Top of Casing

*Ethylene and Propylene Glycol

TABLE 2
WESTCHESTER COUNTY AIRPORT
SAMPLING RESULTS SUMMARY [1/]
March - April 2019

Well (BR) = Bedrock Well		Total PFAS (ng/l)	PFOA + PFOS (ng/l)	1,4-Dioxane (ug/l)	Glycols [2/] (mg/l)	Well Depth (ft btoc)
BRMW-1	(BR)	215	62	**	**	44.00
BRMW-2	(BR)	416	**98**	**	**	45.75
DPW-2		198	41	**	**	11.30
DPWMW-3		35	25	**	**	14.00
FMW-1R		1,449	**760**	**	**	15.25
FMW-2R		23	4	ND	**	11.80
FMW-3		223	69	**	**	15.10
FMW-6		44,228	**16,990**	ND	**	10.70
FMW-7		28,424	**19,047**	**	**	10.00
FMW-8		5,223	**2,887**	**	**	11.00
FMW-11		44	8	**	ND	8.50
FMW-12		1,533	**784**	**	**	18.78
FMW-13R		4,342	**817**	**	**	17.55
FMW-14		492	**221**	**	**	15.45
FMW-15		103	14	**	**	14.90
FMW-16		769	**337**	**	**	15.80
FMW-17 *		4,412	**3,442**	**	**	9.48
FMW-23 *	(BR)	1,843	**727**	ND	**	42.30
FMW-24		79	31	**	**	8.50
FMW-25		42	20	**	ND	12.80
FMW-26		28	11	**	ND	15.80
FMW-27		2,464	**1,496**	**	**	11.64
FMW-31 *		10,544	**6,231**	**	**	19.65
FMW-35	(BR)	242	**142**	**	**	57.50
FMW-36	(BR)	164	10	**	**	51.50
FMW-37		4,162	**2,501**	**	ND	13.40
FMW-39		8	5	ND	ND	6.30
FMW-40		2,124	**1,295**	**	**	12.70
MW-3 (XDDMW-3)		90	6	**	**	17.50
MW-4 (PMMW-1)		103	2	**	**	17.50
MW-7S		362	**145**	32	**	24.65
MW-7D (XDDMW-7R)	(BR)	43	14	**	**	45.60
MW-10D	(BR)	247	**82**	5	**	50.60
MW-10S		313	**120**	8.4	**	32.00
MW-15S		18	9	**	**	23.10
MW-16		196	**135**	**	**	11.10
MW-17S		336	**182**	**	**	31.70
MW-18		45	24	**	**	14.95
MW-42	(BR)	612	**203**	**	**	58.85
MW-43	(BR)	596	**210**	**	**	67.30
MW-44		450	**192**	ND	**	18.10
MW-45		166	**108**	**	**	15.00
MW-46		289	37	**	**	17.70
MW-47		341	**115**	**	**	17.70
MW-48	(BR)	334	46	ND	**	72.45
MW-49	(BR)	227	48	**	**	62.60
PAR - 02		306	**75**	**	**	8.05
PAR - 03		314	**74**	**	**	10.75
UW-1 *		1,784	**1,500**	**	**	13.29
WW-1	(BR)	2,559	**854**	**	**	62.10
XDDMW-10	(BR)	103	30	2.5	**	59.00
XDDMW-11	(BR)	544	**118**	3.8	ND	41.30
XDDMW-13		354	**158**	ND	**	38.60

* Indicates well was re-sampled on May 23 2019 for PFAS. See Table 6

1/ See Table 5 for volatile organics and individual PFAS results.

2/ Ethylene and Propylene Glycol in miligrams per liter

(ng/l) - nanograms per liter (equivalent to parts per trillion)

(ug/l) - micrograms per liter (equivalent to parts per billion)

(ft btoc) Feet Below Top of Casing

100 Indicates PFOA + PFOS exceeds EPA Health Advisory Level of 70 ng/l

** = Not Analyzed

ND - Not Detected (see lab reports for detection limits)

TABLE 3
WESTCHESTER COUNTY AIRPORT
PFAS & 1,4-Dioxane Results
2018 and 2019 Comparison

Well (BR) = Bedrock Well		Total PFAS (ng/l)		PFOA + PFOS (ng/l)		1,4-Dioxane (ug/l)		Well Depth (ft btoc)
		August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	
BRMW-1	(BR)	163	215	41	62	**	**	44.00
BRMW-2	(BR)	284	416	64	**98**	**	**	45.75
DPW-2		275	198	38	41	ND	**	11.30
DPWMW-3		37	35	17	25	**	**	14.00
FMW-1R		638	1,449	**299**	**760**	**	**	15.25
FMW-2R		35	23	17	3	**	ND	11.80
FMW-3		128	223	47	69	**	**	15.10
FMW-6		57,390	44,228	**13,700**	**16,990**	**	ND	10.70
FMW-7		31,983	28,424	**14,940**	**19,047**	**	**	10.00
FMW-8		3,104	5,223	**1,390**	**2,887**	**	**	11.00
FMW-11		50	44	14	8	**	**	8.50
FMW-12		1,270	1,533	**594**	**784**	**	**	18.78
FMW-13R		6,400	4,342	**1,190**	**817**	ND	**	17.55
FMW-14		346	492	**123**	**221**	**	**	15.45
FMW-15		305	103	49	14	**	**	14.90
FMW-16		899	769	**390**	**337**	**	**	15.80
FMW-17 *		7,407	4,412	**5,462**	**3,442**	**	**	9.48
FMW-23 *	(BR)	1,735	1,843	**441**	**727**	**	ND	42.30
FMW-24		77	79	41	31	**	**	8.50
FMW-25		36	42	18	20	ND	**	12.80
FMW-26		25	28	17	11	ND	**	15.80
FMW-27		2,280	2,464	**1,380**	**1,496**	**	**	11.64
FMW-31 *		9,519	10,544	**5,070**	**6,231**	**	**	19.65
FMW-35	(BR)	178	242	65	**142**	**	**	57.50
FMW-36	(BR)	625	164	34	10	**	**	51.50
FMW-37		3,674	4,162	**1,910**	**2,501**	**	**	13.40
FMW-39		38	8	13	5	**	ND	6.30
FMW-40		1,337	2,124	**639**	**1,295**	**	**	12.70
MW-3 (XDDMW-3)		93	90	5	6	**	**	17.50
MW-4 (PMMW-1)		108	103	ND	2	**	**	17.50
MW-7S		294	362	**108**	**145**	**	32	24.65
MW-7D (XDDMW-7R)	(BR)	70	43	19	14	**	**	45.60
MW-10D	(BR)	242	247	60	**82**	**	5	50.60
MW-10S		307	313	**101**	**120**	**	8.4	32.00
MW-15S		98	18	36	9	**	**	23.10
MW-16		110	196	**87**	**135**	**	**	11.10
MW-17S		250	336	**114**	**182**	**	**	31.70
MW-18		52	45	21	24	**	**	14.95
MW-42	(BR)	414	612	**117**	**203**	**	**	58.85
MW-43	(BR)	569	596	**170**	**210**	**	**	67.30
MW-44		508	450	**188**	**190**	**	ND	18.10
MW-45		496	166	**230**	**108**	**	**	15.00
MW-46		105	289	33	37	**	**	17.70
MW-47		239	341	**92**	**115**	**	**	17.70
MW-48	(BR)	315	334	38	46	**	ND	72.45
MW-49	(BR)	218	227	41	48	**	**	62.60
PAR - 02		NS	306	NS	**75**	NS	**	8.05
PAR - 03		232	314	54	**74**	**	**	10.75
UW-1 *		2,642	1,784	**2,010**	**1,500**	ND	**	13.29
WW-1	(BR)	1,542	2,559	**320**	**854**	**	**	62.10
XDDMW-10	(BR)	174	103	50	30	**	2.5	59.00
XDDMW-11	(BR)	1,283	544	**480**	**118**	4.5	3.8	41.30
XDDMW-13		494	354	**190**	**158**	**	ND	38.60

* Indicates well was re-sampled to verify March 2019 PFAS results. See Table 6
(ng/l) - nanograms per liter (equivalent to parts per trillion)
(ug/l) - micrograms per liter (equivalent to parts per billion)
(ft btoc) Feet Below Top of Casing
100 Indicates PFOA + PFOS exceeds EPA Health Advisory Level of 70 ng/l
** Not Analyzed
ND - Not Detected (see lab report for detection limits)

TABLE 4
WESTCHESTER COUNTY AIRPORT
PFAS Results by Concentration
2018 - 2019 Comparison

AUGUST 2018			
Total PFAS (ng/l)	**PFOA + PFOS (ng/l)**	**Well (BR) = Bedrock Well**	**Well Depth (ft btoc)**
57,390	**13,700**	FMW-6	10.70
31,983	**14,940**	FMW-7	10.00
9,519	**5,070**	FMW-31	19.65
7,407	**5,462**	FMW-17	9.48
6,400	**1,190**	FMW-13R	17.55
3,674	**1,910**	FMW-37	13.40
3,104	**1,390**	FMW-8	11.00
2,642	**2,010**	UW-1	13.29
2,280	**1,380**	FMW-27	11.64
1,735	**441**	FMW-23 (BR)	42.30
1,542	**320**	WW-1 (BR)	62.10
1,337	**639**	FMW-40	12.70
1,283	**480**	XDDMW-11 (BR)	41.30
1,270	**594**	FMW-12	18.78
899	**390**	FMW-16	15.80
638	**299**	FMW-1R	15.25
625	34	FMW-36 (BR)	51.50
569	**170**	MW-43 (BR)	67.30
508	**188**	MW-44	18.10
496	**230**	MW-45	15.00
494	**190**	XDDMW-13	38.60
414	**117**	MW-42 (BR)	58.50
346	**123**	FMW-14	15.45
315	38	MW-48 (BR)	72.45
307	**101**	MW-10S	32.00
305	49	FMW-15	14.90
294	**108**	MW-7S	24.65
284	64	BRMW-2 (BR)	45.75
275	38	DPW-2	11.30
250	**114**	MW-17S	31.70
242	60	MW-10D (BR)	50.60
239	**92**	MW-47	17.70
232	54	PAR-03	10.75
218	41	MW-49 (BR)	62.60
178	65	FMW-35 (BR)	57.50
174	50	XDDMW-10 (BR)	59.00
163	41	BRMW-1 (BR)	44.00
128	47	FMW-3	15.10
110	**87**	MW-16	11.10
108	ND	MW-4 (PMMW-1)	17.50
105	33	MW-46	17.70
98	36	MW-15S	23.10
93	5	MW-3 (XDDMW-3)	17.50
77	41	FMW-24	8.50
70	19	MW-7D(XDDMW-7R) (BR)	45.60
52	21	MW-18	14.95
50	14	FMW-11	8.50
38	13	FMW-39	6.30
37	17	DPWMW-3	14.00
36	18	FMW-25	12.80
35	17	FMW-2R	11.80
25	17	FMW-26	15.80
NS	NS	PAR-02	8.05

MARCH 2019			
Total PFAS (ng/l)	**PFOA + PFOS (ng/l)**	**Well (BR) = Bedrock Well**	**Well Depth (ft btoc)**
44,228	**16,990**	FMW-6	10.70
28,424	**19,047**	FMW-7	10.00
10,544	**6,231**	FMW-31 *	19.65
5,223	**2,887**	FMW-8	11.00
4,412	**3,442**	FMW-17 *	9.48
4,342	**817**	FMW-13R	17.55
4,162	**2,501**	FMW-37	13.40
2,559	**854**	WW-1 (BR)	62.10
2,464	**1,496**	FMW-27	11.64
2,124	**1,295**	FMW-40	12.70
1,843	**727**	FMW-23 * (BR)	42.30
1,784	**1,500**	UW-1 *	13.29
1,533	**784**	FMW-12	18.78
1,449	**760**	FMW-1R	15.25
769	**337**	FMW-16	15.80
612	**203**	MW-42 (BR)	58.85
596	**210**	MW-43 (BR)	67.30
544	**118**	XDDMW-11 (BR)	41.30
492	**221**	FMW-14	15.45
450	**190**	MW-44	18.10
416	**98**	BRMW-2 (BR)	45.75
362	**145**	MW-7S	24.65
354	**158**	XDDMW-13	38.60
341	**115**	MW-47	17.70
336	**182**	MW-17S	31.70
334	46	MW-48 (BR)	72.45
314	**74**	PAR - 03	10.75
313	**120**	MW-10S	32.00
306	**75**	PAR - 02	8.05
289	37	MW-46	17.70
247	**82**	MW-10D (BR)	50.60
242	**142**	FMW-35 (BR)	57.50
227	48	MW-49 (BR)	62.60
223	69	FMW-3	15.10
215	62	BRMW-1 (BR)	44.00
198	41	DPW-2	11.30
196	**135**	MW-16	11.10
166	**108**	MW-45	15.00
164	10	FMW-36 (BR)	51.50
103	30	XDDMW-10 (BR)	59.00
103	14	FMW-15	14.90
103	2	MW-4 (PMMW-1)	17.50
90	6	MW-3 (XDDMW-3)	17.50
79	31	FMW-24	8.50
45	24	MW-18	14.95
44	8	FMW-11	8.50
43	14	MW-7D(XDDMW-7R) (BR)	45.60
42	20	FMW-25	12.80
35	25	DPWMW-3	14.00
28	11	FMW-26	15.80
23	3	FMW-2R	11.80
18	9	MW-15S	23.10
8	5	FMW-39	6.30

(ng/l) - nanograms per liter (equivalent to parts per trillion)
(ft btoc) Feet Below Top of Casing
100 Indicates PFOA + PFOS exceeds EPA Health Advisory Level of 70 ng/l

* Indicates well was re-sampled. See Table 6

Prepared by WSP USA

TABLE 5
WESTCHESTER COUNTY AIRPORT - GROUNDWATER SAMPLING RESULTS SUMMARY
Volatile Organics and PFAS

Sample ID	NYSDEC TOGS Standards and Guidance Values	BRMW-1		BRMW-2		DPW-2		DPWMW-3		FMW-1R		FMW-2R		FMW-3		FMW-6		FMW-7		FMW-8		FMW-11		FMW-12		FMW-13R		FMW-14	
Compound		08/28/18	03/26/19	08/28/18	03/27/19	08/29/18	03/26/19	08/31/18	04/01/19	08/28/18	03/26/19	08/30/18	03/27/19	08/30/18	03/27/19	08/28/18	03/26/19	08/28/18	03/26/19	08/30/18	03/28/19	08/30/18	03/28/19	08/29/18	03/27/19	08/28/18	03/27/19	08/28/18	03/28/19
Volatile Organics, 8260	**ug/L**	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-Trichloroethane	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
1,1-Dichloroethane	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
1,1-Dichloroethylene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
1,2,4-Trimethylbenzene	**5**	ND	NT	ND	ND	ND	**0.39**	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**0.86**	ND	**0.39**	ND	**0.46**	ND	NT	ND	**0.27**
1,2-Dibromo-3-chloropropane	**0.04**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
1,2-Dichlorobenzene	**3**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
1,2-Dichloroethane	**0.6**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
1,3,5-Trimethylbenzene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**0.20**	ND	ND	ND	ND	ND	NT	ND	ND
1,4-Dichlorobenzene	**3**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.35**
2-Butanone	**50***	ND	NT	**0.8**	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	**0.27 J**	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
4-Methyl-2-pentanone	**~**	ND	NT	ND	ND	ND	ND	**1.5**	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Acetone	**50***	ND	NT	**3.8**	**2.4**	ND	ND	ND	**2.7**	ND	NT	ND	NT	ND	NT	**3.20**	ND	**2.70**	ND	**1.20 J**	ND	**1.90 J**	ND	**4.40**	ND	ND	NT	ND	**1.6**
Benzene	**1**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	**0.3 J**	**0.86**
Bromodichloromethane	**50***	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Carbon disulfide	**60***	ND	NT	ND	ND	**0.2 J**	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Chlorobenzene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	**9**	**23**
Chloroethane	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Chloroform	**7**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
cis-1,2-Dichloroethylene	**5**	ND	NT	ND	ND	ND	**0.37**	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**0.98**	ND	ND	ND	**0.22**	ND	NT	ND	**0.27**
Cyclohexane	**~**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Ethyl Benzene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**0.28**	ND	ND	ND	ND	ND	NT	ND	ND
Isopropylbenzene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Methyl acetate	**~**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Methyl tert-butyl ether (MTBE)	**10***	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Methylene chloride	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
n-Propylbenzene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
o-Xylene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**0.41**	ND	ND	ND	ND	ND	NT	ND	ND
p-&-m-Xylenes	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**1**	ND	ND	ND	ND	ND	NT	ND	ND
sec-Butylbenzene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
tert-Butyl alcohol (TBA)	**~**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
tert-Butylbenzene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Tetrachloroethylene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	**0.25**	ND	ND	ND	NT	ND	ND
Toluene	**5**	ND	NT	ND	ND	ND	ND	**220**	**0.65**	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**0.47**	ND	**0.22**	ND	ND	ND	NT	ND	ND
trans-1,2-Dichloroethylene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Trichloroethylene	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**0.22**	ND	ND	ND	**0.26**	ND	NT	ND	ND
Vinyl Chloride	**2**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
Xylenes, Total	**5**	ND	NT	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND	ND	**1.40**	ND	ND	ND	ND	ND	NT	ND	ND
PFAS EPA 537	**ng/L**	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	**~**	ND	ND	ND	ND	ND	ND	**5**	ND	ND	ND	ND	ND	**4.8**	ND	**2,500**	**2,530**	**350**	**452**	**14**	ND	ND	ND	**16**	**24.6**	**7.3**	ND	ND	ND
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	**~**	ND	**10.4**	**5.1**	**45**	ND	**6.8**	**2.2**	ND	ND	ND	ND	ND	ND	**45.8**	**3,000**	**1,640**	**1,400**	**1,000**	**63**	**126**	ND	**6.9**	**46**	ND	**420**	**202**	**9.5**	**11.7**
N-EtFOSAA	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-MeFOSAA	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoro-1-decanesulfonic acid (PFDS)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**77**	ND	**16**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoro-1-heptanesulfonic acid (PFHpS)	**~**	**2.1**	ND	**2.2**	**2.2**	ND	ND	ND	ND	ND	**5.8**	ND	ND	ND	ND	**260**	**274**	**310**	**205**	**30**	**41**	ND	ND	**7.7**	ND	**29**	ND	**2.1**	**3.2**
Perfluoro-1-octanesulfonamide (FOSA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**17**	ND	ND	ND	ND	ND	ND	ND	**5.4**	**62.2**	ND	ND	ND	**2.4**
Perfluorobutanesulfonic acid (PFBS)	**~**	**7.8**	**8.2**	**19**	**23.7**	**5.1**	**2**	ND	ND	**3.1**	**5.9**	**2.6**	ND	ND	**4.1**	**480**	ND	**360**	ND	**70**	**94**	**4.6**	**5.3**	**28**	**33.9**	**81**	**49**	**9.4**	**9.03**
Perfluorodecanoic acid (PFDA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	**20**	**56.4**	ND	ND	ND	**2.1**	**370**	**553**	**110**	ND	ND	ND	ND	ND	ND	ND	**2.6**	ND	ND	ND
Perfluorododecanoic acid (PFDoA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**57**	ND	**12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroheptanoic acid (PFHpA)	**~**	**9**	**11**	**16**	**20.7**	**25**	**21.8**	ND	ND	**6.9**	**11.6**	**4.2**	ND	**3.5**	**8.1**	**3,800**	**1,520**	**1,100**	**428**	**99**	**148**	**3.6**	**3.5**	**43**	**56.9**	**370**	**354**	**13**	**15.1**
Perfluorohexanesulfonic acid (PFHxS)	**~**	**44**	**41.6**	**78**	**92.3**	**31**	**10.4**	ND	**3.3**	**60**	**107**	**3.3**	ND	**30**	**21.7**	**9,900**	**4,030**	**7,100**	**2,660**	**850**	**910**	**9.7**	**5.2**	**350**	**346**	**940**	**870**	**110**	**124**
Perfluorohexanoic acid (PFHxA)	**~**	**18**	**20.8**	**34**	**47.9**	**53**	**30.6**	ND	**2.3**	**11**	**16.9**	**3.7**	**3.3**	**8.2**	**12.6**	**4,700**	**1,550**	**1,800**	**645**	**190**	**316**	**7**	**5.7**	**99**	**121**	**810**	**583**	**28**	**29.9**
Perfluoro-n-butanoic acid (PFBA)	**~**	**6.6**	**12**	**17**	**27.8**	**11**	**15**	**13**	ND	**2.3**	**8.3**	ND	**11.1**	**5.7**	**16.4**	**980**	**681**	**220**	**250**	**25**	**128**	**5.8**	**6.2**	**19**	**33.4**	**330**	**316**	**4.4**	**14.3**
Perfluorononanoic acid (PFNA)	**~**	**10**	**15.8**	**4.8**	**4.9**	**45**	**21.2**	ND	ND	**130**	**389**	ND	ND	**9.6**	**9.96**	**1,100**	**1,310**	**970**	**1,610**	**93**	**199**	ND	ND	**6.8**	ND	**120**	**70**	**17**	**29.5**
Perfluorooctanesulfonic acid (PFOS)	**70***	**30**	**49.7**	**39**	**70.5**	**19**	**26.8**	**14**	**25.4**	**270**	**694**	**4.8**	ND	**40**	**58.5**	**11,000**	**15,300**	**14,000**	**18,500**	**1,200**	**2,590**	**3.8**	ND	**530**	**687**	**990**	**638**	**61**	**126**
Perfluorooctanoic acid (PFOA)	**70***	**11**	**12.7**	**25**	**27.9**	**19**	**14.4**	**2.8**	ND	**29**	**65.7**	**12**	**3.5**	**7.3**	**10**	**2,700**	**1,690**	**940**	**547**	**190**	**297**	**10**	**7.5**	**64**	**96.5**	**200**	**179**	**62**	**94.7**
Perfluoropentanoic acid (PFPeA)	**~**	**24**	**32.6**	**44**	**52.6**	**67**	**48.2**	ND	ND	**6.9**	**11.1**	**4.3**	**5.1**	**16**	**30.4**	**7,800**	**1,950**	**2,600**	**937**	**280**	**374**	**5.7**	**4**	**55**	**71.5**	**2,100**	**1,080**	**30**	**29.9**
Perfluorotetradecanoic acid (PFTA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**8.6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorotridecanoic acid (PFTrDA)	**~**	ND	ND	ND	ND	ND	ND	ND	**4.0**	**9.7**	**6.5**	ND	ND	ND	ND	**440**	**1,100**	**85**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroundecanoic acid (PFUnA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	**89**	**70.8**	ND	ND	**2.6**	**3.1**	**8,200**	**10,100**	**610**	**1,190**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**2.2**

ug/L micrograms per liter (parts per billion)
ND - analyte not detected at or above the method detection limit. See lab reports for associated detection limits.
NT - Not Tested
* - indicates a guidence value as opposed to a standard
~ - indicates that no regulatory limit has been established for this analyte
ng/L - nanograms per liter (parts per trillion)
70* - This is an EPA guidence value that applies to the combined total of Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS)

TABLE 5
WESTCHESTER COUNTY AIRPORT - GROUNDWATER SAMPLING RESULTS SUMMARY
Volatile Organics and PFAS

Sample ID	NYSDEC TOGS Standards and Guidance Values	FMW-15		FMW-16		FMW-17		FMW-23		FMW-24		FMW-25		FMW-26		FMW-27		FMW-31		FMW-35		FMW-36		FMW-37		FMW-39	
Compound		08/30/18	03/28/19	08/30/18	03/28/19	08/31/18	3/27/19 5/23/19	08/28/18	3/27/19 5/23/19	08/30/18	03/27/19	08/30/18	03/25/19	08/30/18	03/27/19	08/29/18	03/28/19	08/29/18	3/27/19 5/23/19	08/30/18	03/28/19	08/29/18	03/27/19	08/29/18	03/28/19	08/29/18	04/01/19
Volatile Organics, 8260	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-Trichloroethane	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	5	ND	NT	ND	ND	ND	ND	ND	**0.5**	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	5	ND	NT	ND	**0.22**	ND	**0.29**	ND	ND	ND	ND	ND	ND	ND	NT	ND	**0.47**	**7**	**11**	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	0.04	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	**0.38 J**	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	3	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.6	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	**1.9**	**3.5**	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	3	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	50*	ND	NT	ND	ND	**0.95**	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	~	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	**2.6**	ND	ND	ND	ND	ND	**0.27 J**	ND	ND	ND	ND	ND
Acetone	50*	ND	NT	ND	ND	**6.8**	**2.4**	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	**2.8**	ND	**1.2 J**	ND	**2.7**	ND	**4.3**	ND	**5**	**3.8**
Benzene	1	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	**0.2 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	50*	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	**0.8**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	60*	ND	NT	ND	ND	ND	**0.29**	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	**1.3**	ND	**0.25 J**	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	7	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethylene	5	ND	NT	ND	ND	ND	ND	**84**	**280**	ND	ND	ND	ND	ND	NT	ND	ND	**2.3**	**1.4**	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	~	ND	NT	ND	ND	ND	ND	ND	**0.21**	ND	ND	ND	ND	ND	NT	ND	**0.3**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	**0.36 J**	**0.6**	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	**0.7**	**1.5**	ND	ND	ND	ND	ND	ND	ND	ND
Methyl acetate	~	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	**0.33 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tert-butyl ether (MTBE)	10*	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	**0.35**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	**0.8**	**1.8**	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	**0.38**	ND	ND	ND	ND	ND	ND	ND	ND
p-&-m-Xylenes	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	**0.86**	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	**0.26**	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butyl alcohol (TBA)	~	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	**0.5**	**0.39**	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.2 J**	ND
trans-1,2-Dichloroethylene	5	ND	NT	ND	ND	ND	ND	**0.28 J**	**2.9**	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	5	ND	NT	ND	ND	ND	ND	**0.51**	**1.4**	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	NT	ND	ND	ND	ND	**12**	**77**	ND	ND	ND	ND	ND	NT	ND	ND	**1.2**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes, Total	5	ND	NT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	**1.2**	ND	ND	ND	ND	ND	ND	ND	ND
PFAS EPA 537	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	~	ND	ND	ND	ND	**290**	ND	**29**	ND	ND	ND	ND	ND	ND	ND	**46**	**27.9**	**30**	ND	**4.4**	ND	**27**	**3.8**	**37**	**29.3**	ND	ND
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	~	ND	ND	**4.9**	ND	**500**	**69.2**	**140**	ND	ND	**17.3**	ND	ND	ND	**6.0**	**52**	**90.5**	**580**	**466**	**2.1**	ND	**32**	**113**	**180**	**124**	**4.7**	ND
N-EtFOSAA	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-MeFOSAA	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoro-1-decanesulfonic acid (PFDS)	~	ND	ND	ND	ND	**7.9**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoro-1-heptanesulfonic acid (PFHpS)	~	ND	ND	**8.1**	ND	**54**	ND	**11**	ND	ND	ND	ND	ND	ND	ND	**22**	ND	**240**	**177**	ND	**2.1**	ND	ND	**42**	**44**	ND	ND
Perfluoro-1-octanesulfonamide (FOSA)	~	ND	ND	ND	ND	**2.6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorobutanesulfonic acid (PFBS)	~	**22**	**12.1**	**24**	**20.2**	**37**	**53.7**	**37**	**59.1**	ND	**2.6**	**2.7**	**2.6**	ND	ND	**40**	**26.5**	**170**	**108**	**6.8**	**5.3**	**15**	**4.9**	**64**	**58**	ND	ND
Perfluorodecanoic acid (PFDA)	~	**2.4**	ND	ND	ND	**6.8**	**49.6**	**2.8**	**37.1**	ND	ND	ND	ND	ND	ND	**4.6**	ND	ND	**156**	ND	ND	ND	ND	**6**	ND	ND	ND
Perfluorododecanoic acid (PFDoA)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroheptanoic acid (PFHpA)	~	**14**	**3.8**	**27**	**36.5**	**82**	ND	**80**	ND	**7.5**	**6.1**	**2.1**	**3.5**	ND	ND	**68**	**92.1**	**160**	ND	**5.8**	**4.9**	**8.2**	**3.7**	**110**	**102**	**3.3**	ND
Perfluorohexanesulfonic acid (PFHxS)	~	**84**	**17.7**	**320**	**153**	**620**	**81.8**	**240**	**76**	**9.1**	**5.6**	**6.9**	**7.1**	**3.4**	**2.9**	**350**	**321**	**2,200**	**146**	**54**	**61.3**	**24**	**5**	**750**	**748**	**3.4**	ND
Perfluorohexanoic acid (PFHxA)	~	**32**	**8.0**	**49**	**67.5**	**140**	**354**	**180**	**315**	**7.5**	**4.8**	**4**	**3.0**	**2.3**	**2.4**	**130**	**134**	**440**	**2330**	**16**	**6.8**	**15**	**7.5**	**260**	**205**	**5.2**	ND
Perfluoro-n-butanoic acid (PFBA)	~	ND	**3.5**	**14**	**46**	**20**	**146**	**62**	**161**	**2.1**	**7.4**	ND	**3.2**	ND	**3.9**	**26**	**58.5**	**89**	**388**	**14**	**11.6**	**440**	**7.8**	**36**	**82.9**	**3.1**	ND
Perfluorononanoic acid (PFNA)	~	**41**	**10.9**	**14**	**11.2**	**25**	**28.6**	**140**	**144**	**2.8**	ND	ND	ND	ND	ND	**21**	**27**	**110**	**144**	ND	**2.6**	**2**	ND	**29**	**40.2**	ND	ND
Perfluorooctanesulfonic acid (PFOS)	70*	**29**	**9.4**	**350**	**291**	**5,400**	**3350**	**370**	**630**	**15**	**8.8**	**6.6**	**6.4**	**10**	**5.5**	**1,300**	**1,420**	**4,800**	**5980**	**54**	**122**	**28**	**6.2**	**1800**	**2410**	**7.1**	**3**
Perfluorooctanoic acid (PFOA)	70*	**20**	**4.7**	**40**	**46.3**	**62**	**91.8**	**71**	**97.1**	**26**	**22.2**	**11**	**13.5**	**6.6**	**5.3**	**80**	**76.1**	**270**	**251**	**11**	**19.5**	**6**	**3.4**	**110**	**90.6**	**5.8**	**2.4**
Perfluoropentanoic acid (PFPeA)	~	**33**	**11.4**	**48**	**97.7**	**150**	**187**	**360**	**296**	**6.6**	**4**	**2.5**	**2.8**	**2.3**	**2.5**	**140**	**190**	**430**	**398**	**10**	**6.4**	**28**	**8.4**	**250**	**228**	**5.6**	**2.3**
Perfluorotetradecanoic acid (PFTA)	~	ND	ND	ND	ND	ND	ND	ND	**28**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorotridecanoic acid (PFTrDA)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroundecanoic acid (PFUnA)	~	**28**	**21.8**	ND	ND	**9.2**	ND	**12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ug/L micrograms per liter (parts per billion)
ND - analyte not detected at or above the method detection limit. See lab reports for associated detection limits.
NT - Not Tested
* - indicates a guidence value as opposed to a standard
~ - indicates that no regulatory limit has been established for this analyte
ng/L - nanograms per liter (parts per trillion)
70* - This is an EPA guidence value that applies to the combined total of Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS)

TABLE 5
WESTCHESTER COUNTY AIRPORT - GROUNDWATER SAMPLING RESULTS SUMMARY
Volatile Organics and PFAS

Sample ID	NYSDEC TOGS Standards and Guidance Values	FMW-40		MW-3 (XDDMW-3)		MW-4 (PMMW-1)		MW-7S		MW-7D (XDDW-7R)		MW-10D		MW-10S		MW-15S		MW-16		MW-17S		MW-18		MW-42		MW-43	
Compound		08/30/18	03/27/19	09/11/18	03/29/19	09/11/18	03/29/19	09/11/18	03/29/19	09/11/18	03/29/19	09/11/18	03/29/19	09/11/18	03/29/19	08/31/18	03/29/19	08/31/18	03/29/19	08/31/18	03/29/19	08/31/18	03/29/19	08/28/18	03/26/19	08/29/18	03/26/19
Volatile Organics, 8260	**ug/L**	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-Trichloroethane	**5**	ND	ND	ND	ND	ND	ND	**8**	**7.4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
1,1-Dichloroethane	**5**	ND	ND	ND	ND	ND	**0.22**	**72**	**100**	**49**	**35**	**11**	**15**	**17**	**19**	**0.76**	ND	ND	NT	**0.22 J**	NT	ND	NT	ND	ND	ND	ND
1,1-Dichloroethylene	**5**	ND	ND	ND	ND	ND	ND	**15**	**32**	**12**	**6.6**	**1**	**0.52**	**5.80**	**6.1**	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
1,2,4-Trimethylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	**0.04**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
1,2-Dichlorobenzene	**3**	ND	ND	ND	ND	**0.47 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
1,2-Dichloroethane	**0.6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
1,3,5-Trimethylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
1,4-Dichlorobenzene	**3**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
2-Butanone	**50***	ND	ND	ND	ND	**1.4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**3.1**	**1.5**	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
4-Methyl-2-pentanone	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.35 J**	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Acetone	**50***	**15**	**2.3**	**4.8**	**1.8**	**8.8**	ND	ND	ND	ND	ND	**1.3 J**	ND	ND	ND	**8.5**	**6.2**	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Benzene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Bromodichloromethane	**50***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Carbon disulfide	**60***	**0.29 J**	ND	ND	ND	ND	ND	ND	ND	**0.39 J**	ND	**0.26 J**	ND	ND	ND	**0.6**	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Chlorobenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Chloroethane	**5**	ND	ND	**0.23 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Chloroform	**7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
cis-1,2-Dichloroethylene	**5**	ND	ND	ND	**0.55**	ND	ND	**36**	**45**	**17**	**12**	**7.1**	**3.2**	**14**	**16**	**1.3**	ND	ND	NT	**0.37 J**	NT	ND	NT	ND	ND	ND	ND
Cyclohexane	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Ethyl Benzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Isopropylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Methyl acetate	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Methyl tert-butyl ether (MTBE)	**10***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	**0.21 J**	**0.25**	ND	**8.3**
Methylene chloride	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
n-Propylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
o-Xylene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
p-&-m-Xylenes	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
sec-Butylbenzene	**5**	ND	ND	ND	ND	**0.2 J**	**0.2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
tert-Butyl alcohol (TBA)	**~**	ND	ND	ND	ND	**14**	**12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
tert-Butylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Tetrachloroethylene	**5**	ND	ND	ND	ND	ND	ND	**19**	**30**	**5.6**	**1.5**	**0.9**	**0.4**	**5.8**	**4.9**	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Toluene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
trans-1,2-Dichloroethylene	**5**	ND	ND	ND	ND	**0.29 J**	ND	**0.390 J**	**0.64**	**0.25 J**	ND	ND	**0.4**	**0.35 J**	**0.42**	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Trichloroethylene	**5**	ND	ND	ND	ND	ND	ND	**18**	**26**	**21**	**14**	**1.4**	**1.1**	**4**	**4.2**	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Vinyl Chloride	**2**	ND	ND	ND	**0.32**	**0.41 J**	**0.61**	**7.1**	**9**	**1.2**	**0.68**	**0.41 J**	**2.5**	**1.6**	**3.2**	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
Xylenes, Total	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	NT	ND	NT	ND	ND	ND	ND
PFAS EPA 537	**ng/L**	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	**~**	**4.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	**~**	**26**	ND	**8.4**	ND	**9.3**	ND	**9.3**	**7.8**	**3.6**	ND	**13**	**5.5**	**5.4**	ND	**4.9**	ND	ND	ND	ND	ND	ND	ND	ND	ND	**14.0**	**6.6**
N-EtFOSAA	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-MeFOSAA	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoro-1-decanesulfonic acid (PFDS)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoro-1-heptanesulfonic acid (PFHpS)	**~**	**12**	**17.6**	ND	ND	ND	ND	**2.1**	**2**	ND	ND	**2.9**	ND	**3.2**	**2.4**	ND	ND	ND	ND	**3.6**	**3.5**	ND	ND	**4.7**	**6.5**	**4.3**	**4.1**
Perfluoro-1-octanesulfonamide (FOSA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorobutanesulfonic acid (PFBS)	**~**	**15**	**18.2**	**11**	**6.3**	**18**	**5.5**	**14**	**9.9**	**4.1**	ND	**9.6**	**7.8**	**12**	**8.4**	**6.1**	ND	ND	**3.8**	**7.7**	**5.4**	**2.7**	ND	**15**	**21.8**	**14**	**12.9**
Perfluorodecanoic acid (PFDA)	**~**	**3.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**2.5**	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorododecanoic acid (PFDoA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroheptanoic acid (PFHpA)	**~**	**47**	**58.1**	**7.3**	**9.2**	**6.5**	**7.6**	**17**	**20**	**3.6**	**2.3**	**14.0**	**13.9**	**19**	**18.7**	**6.5**	**2**	**2.4**	**8.2**	**10**	**12.1**	**2.6**	**2.8**	**12**	**14.2**	**36**	**33.2**
Perfluorohexanesulfonic acid (PFHxS)	**~**	**280**	**354**	**9.2**	**5.3**	**15**	**4.8**	**44**	**48.7**	**20**	**10.3**	**64.0**	**54.6**	**66**	**60.5**	**12**	ND	**2.1**	**5.3**	**58**	**53.1**	**5.2**	**5**	**91**	**106**	**120**	**95.1**
Perfluorohexanoic acid (PFHxA)	**~**	**78**	**77.9**	**21**	**23.6**	**12**	**25.9**	**33**	**34.3**	**7**	**4.5**	**28.0**	**26.7**	**32**	**31.7**	**9.8**	**2.2**	**11**	**9.3**	**20**	**17.5**	**7.7**	**2.8**	**22**	**26.1**	**74**	**66.3**
Perfluoro-n-butanoic acid (PFBA)	**~**	**25**	**47.8**	**12**	**10**	**11**	**18.9**	**8**	**25.2**	ND	**2.3**	**5.6**	**14.3**	**4.6**	**19.3**	**8.7**	**2.8**	ND	**13.4**	**2.2**	**12.7**	**2.6**	**4.1**	**2.3**	**10.7**	**7.3**	**31.7**
Perfluorononanoic acid (PFNA)	**~**	**110**	**142**	ND	ND	ND	ND	**18**	**24.5**	**3.7**	**3.1**	**8.3**	**10.2**	**12**	**13.4**	**4.7**	ND	**4.4**	**7.1**	**17**	**27.9**	**3.3**	**3.1**	**130**	**196**	**33**	**53.7**
Perfluorooctanesulfonic acid (PFOS)	**70***	**580**	**1220**	ND	ND	ND	ND	**80**	**115**	**14**	**11.1**	**42.0**	**63.5**	**77**	**96.1**	**24**	**6**	**82**	**123**	**96**	**159**	**16**	**18.3**	**91**	**170**	**120**	**167**
Perfluorooctanoic acid (PFOA)	**70***	**59**	**75.1**	**5.4**	**6.3**	ND	**2.2**	**28**	**29.8**	**4.6**	**3**	**18**	**18**	**24**	**23.6**	**12**	**2.5**	**4.9**	**11.8**	**18**	**23.4**	**5.1**	**5.5**	**26**	**32.6**	**50.0**	**43.1**
Perfluoropentanoic acid (PFPeA)	**~**	**88**	**101**	**19**	**29.4**	**36**	**37.7**	**41**	**45**	**9.3**	**6**	**37**	**32.5**	**52**	**39**	**9.4**	**2.3**	**3.1**	**11.2**	**17**	**21**	**3.7**	**3.3**	**20**	**26**	**96**	**82.6**
Perfluorotetradecanoic acid (PFTA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorotridecanoic acid (PFTrDA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroundecanoic acid (PFUnA)	**~**	**10**	**12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**2.6**	ND	ND	**2.3**	ND	ND

ug/L micrograms per liter (parts per billion)
ND - analyte not detected at or above the method detection limit. See lab reports for associated detection limits.
NT - Not Tested
* - indicates a guidence value as opposed to a standard
~ - indicates that no regulatory limit has been established for this analyte
ng/L - nanograms per liter (parts per trillion)

70* - This is an EPA guidence value that applies to the combined total of Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS)

TABLE 5
WESTCHESTER COUNTY AIRPORT - GROUNDWATER SAMPLING RESULTS SUMMARY
Volatile Organics and PFAS

Sample ID	NYSDEC TOGS Standards and Guidance Values	MW-44		MW-45		MW-46		MW-47		MW-48		MW-49		PAR-02		PAR-03		UW-1		WW-1		XDDMW-10		XDDMW-11		XDDMW-13	
Compound		08/29/18	03/25/19	08/28/18	03/26/19	08/29/18	03/25/19	08/29/18	03/25/19	08/29/18	03/26/19	08/29/18	03/25/19	08/2018	03/27/19	08/29/18	03/26/19	08/29/18	4/01/19 5/23/19	08/28/18	03/28/19	08/30/18	04/01/19	08/30/18	04/01/19	08/31/18	04/01/19
Volatile Organics, 8260	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-Trichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	4	6.2	1.20	0.76	ND	NT
1,1-Dichloroethylene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
1,2,4-Trimethylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.22	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
1,2-Dibromo-3-chloropropane	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
1,2-Dichlorobenzene	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
1,2-Dichloroethane	0.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
1,3,5-Trimethylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
1,4-Dichlorobenzene	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
2-Butanone	50*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
4-Methyl-2-pentanone	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Acetone	50*	ND	ND	ND	ND	ND	ND	2.1	ND	ND	1.6	ND	ND	NS	NT	ND	NT	1.4 J	ND	ND	NT	ND	ND	1.8 J	2.1	ND	NT
Benzene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Bromodichloromethane	50*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Carbon disulfide	60*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	0.41 J	0.51	ND	ND	ND	NT
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Chloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
cis-1,2-Dichloroethylene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	3	6.6	1	0.62	ND	NT
Cyclohexane	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Ethyl Benzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Isopropylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Methyl acetate	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Methyl tert-butyl ether (MTBE)	10*	7.9	ND	ND	ND	ND	ND	ND	ND	1.7	0.95	0.32 J	0.39	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	1.5	1.8	ND	NT
Methylene chloride	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
n-Propylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
o-Xylene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
p-&-m-Xylenes	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
sec-Butylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
tert-Butyl alcohol (TBA)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
tert-Butylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Tetrachloroethylene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Toluene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
trans-1,2-Dichloroethylene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Trichloroethylene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
Xylenes, Total	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NT	ND	NT	ND	ND	ND	NT	ND	ND	ND	ND	ND	NT
PFAS EPA 537	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	36	ND	ND	ND	ND	ND	24	ND	ND	ND
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.9	7.3	NS	26.8	ND	6.7	41	ND	35	48.6	22	6.8	ND	ND	26	ND
N-EtFOSAA	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
N-MeFOSAA	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	17	ND	ND	ND
Perfluoro-1-decanesulfonic acid (PFDS)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	2.6	ND	ND	ND	ND	ND	52	ND	ND	ND
Perfluoro-1-heptanesulfonic acid (PFHpS)	~	6.3	4.3	4.6	ND	4.1	4.8	2.1	2	ND	ND	ND	ND	NS	ND	ND	ND	24	ND	17	31.8	2.6	ND	14	ND	5.2	ND
Perfluoro-1-octanesulfonamide (FOSA)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	16	ND	ND	ND
Perfluorobutanesulfonic acid (PFBS)	~	21	20.7	20	5.5	ND	10.7	5.8	12.2	16	16.2	5.4	5.1	NS	15.8	12.0	15.1	9.3	ND	75	65.1	11	4.5	13	23.7	11	ND
Perfluorodecanoic acid (PFDA)	~	ND	ND	ND	ND	ND	ND	2.3	ND	ND	ND	ND	ND	NS	ND	ND	ND	2.2	ND	2.4	ND	ND	ND	23	ND	3.3	ND
Perfluorododecanoic acid (PFDoA)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroheptanoic acid (PFHpA)	~	19	15.6	16	4.1	8.7	23.8	12	18.7	24	21.4	14	13	NS	14.5	15	19.4	120	ND	41	38.2	5.4	4.6	150	35.8	31	24.1
Perfluorohexanesulfonic acid (PFHxS)	~	150	111	120	22.6	23	48	55	90.2	60	47.1	26	26.2	NS	65.6	69	75.6	200	59.2	370	465	41	25.1	130	167	81	53.1
Perfluorohexanoic acid (PFHxA)	~	38	26.7	34	7	15	59.3	15	24.6	70	66.4	39	29.8	NS	27.9	33	43	89	143	100	87.7	14	10.8	130	72.4	52	35.3
Perfluoro-n-butanoic acid (PFBA)	~	5.2	17.1	4.8	4.1	4.8	26.3	6.6	20	ND	29.9	2.8	17.2	NS	16.1	7.6	18.9	6.7	42.1	10	30.8	6.6	5	24	36.3	3.9	23.9
Perfluorononanoic acid (PFNA)	~	31	24.6	20	7.4	2.8	6.1	17	24.5	12	13.1	21	28.7	NS	24.5	3.7	4.9	25	ND	480	856	4.4	3.1	40	ND	19	14.0
Perfluorooctanesulfonic acid (PFOS)	70*	130	135	110	62	16	19.4	70	87.8	17	25.4	28	35.5	NS	59.5	31	49.9	1,900	1440	180	698	43	25.3	310	79.8	160	137.0
Perfluorooctanoic acid (PFOA)	70*	58.0	57.1	120	46.3	17	17.5	22	27.6	21	20.5	13	12	NS	15.9	23	24.1	110	59.8	140	156	6.6	4.4	170	37.8	30	21.1
Perfluoropentanoic acid (PFPeA)	~	43.0	35.4	37	7	14	73	18	27.8	95	93.6	61	52.5	NS	39.2	38	56.3	76	40.1	89	82	17	13.6	170	91.1	67	45.9
Perfluorotetradecanoic acid (PFTA)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorotridecanoic acid (PFTrDA)	~	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroundecanoic acid (PFUnA)	~	6.7	2.6	9.2	ND	ND	ND	13	5.6	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	2.8	ND	ND	ND	ND	ND	4.2	ND

ug/L micrograms per liter (parts per billion)
ND - analyte not detected at or above the method detection limit. See lab reports for associated detection limits.
NT - Not Tested
* - indicates a guidence value as opposed to a standard
~ - indicates that no regulatory limit has been established for this analyte
ng/L - nanograms per liter (parts per trillion)
70* - This is an EPA guidence value that applies to the combined total of Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS)

TABLE 6
WESTCHESTER COUNTY AIRPORT
PFAS Re-Sampling Summary

Sampling Location	Total PFAS (ng/l)			PFOA + PFOS (ng/l)		
	2018	2019 - March	2019 - May	2018	2019 - March	2019 - May
FMW-17	7,407	1,704	4,412	5,462	1,110	3,442
FMW-23	1,735	12,279	1,843	441	4,312	727
FMW-31	9,519	71,827	10,544	5,070	45,390	6,231
UW-1	2,642	7,163	1,784	2,010	6,606	1,500

(ng/l) - nanograms per liter (equivalent to parts per trillion)

TABLE 7
WESTCHESTER COUNTY AIRPORT - GROUNDWATER SAMPLING RESULTS SUMMARY
Former Air National Guard Site V00499

Sample ID	NYSDEC TOGS	DPW MW-3		FMW-12		FMW-31		FMW-35		FMW-36		FMW-37		FMW-40	
Sampling Date	Standards and	August 2018	April 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019
Compound	Guidance Values	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Volatile Organics, 8260	**ug/L**	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-Trichloroethane	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	**5**	ND	ND	ND	**0.46**	**7**	**11**	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	**0.04**	ND	ND	ND	ND	ND	ND	**0.380 J**	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	**3**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	**0.6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	**5**	ND	ND	ND	ND	**1.90**	**3.5**	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	**50***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	**~**	**1.50**	ND	ND	ND	ND	ND	ND	ND	**0.27 J**	ND	ND	ND	ND	ND
Acetone	**50***	ND	**2.7**	**4.40**	ND	**2.80**	ND	**1.20 J**	ND	**2.70**	ND	**4.30**	ND	**15**	**2.3**
Benzene	**1**	ND	ND	ND	ND	**0.2 J**	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	**50***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	**60***	ND	ND	ND	ND	**1.30**	ND	**0.250 J**	ND	ND	ND	ND	ND	**0.290 J**	ND
Chlorobenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	**7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethylene	**5**	ND	ND	ND	**0.22**	**2.30**	**1.4**	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	**5**	ND	ND	ND	ND	**0.36 J**	**0.6**	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	**5**	ND	ND	ND	ND	**0.70**	**1.5**	ND	ND	ND	ND	ND	ND	ND	ND
Methyl acetate	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tert-butyl ether (MTBE)	**10***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene chloride	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	**5**	ND	ND	ND	ND	**0.820**	**1.8**	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	**5**	ND	ND	ND	ND	ND	**0.26**	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butyl alcohol (TBA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	**5**	ND	ND	ND	ND	**0.50**	**0.39**	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	**5**	ND	ND	ND	**0.25**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**5**	**220**	**0.65**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethylene	**5**	ND	ND	ND	**0.26**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
o-Xylene	**5**	ND	ND	ND	ND	ND	**0.38**	ND	ND	ND	ND	ND	ND	ND	ND
p-&-m-Xylenes	**5**	ND	ND	ND	ND	ND	**0.86**	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes, Total	**5**	ND	ND	ND	ND	ND	**1.2**	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	**2**	ND	ND	ND	ND	**1.20**	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFAS EPA 537	**ng/L**	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
8:2 Fluorotelomersulfonate (8:2 FTS)	**~**	**5**	ND	**16**	**24.6**	**30**	ND	**4.4**	ND	**27**	**3.78**	**37**	**29.3**	**4.1**	ND
6:2 Fluorotelomersulfonate (6:2 FTS)	**~**	**2.2**	ND	**46**	ND	**580**	**466**	**2.1**	ND	**32**	**113**	**180**	**124**	**26**	ND
NEtFOSAA	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NMeFOSAA	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorodecanesulfonic acid (PFDS)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroheptanesulfonic acid (PFHpS)	**~**	ND	ND	**7.7**	ND	**240**	**177**	ND	2.1	ND	ND	**42**	**44**	**12**	**17.6**
Perfluorooctanesulfonamide (FOSA)	**~**	ND	ND	**5.4**	**62.2**	ND	ND	ND	2.0	ND	ND	ND	ND	ND	ND
Perfluorobutanoic acid (PFBA)	**~**	**13**	ND	**19**	**33.4**	**89**	**108**	**14**	**11.6**	**440**	**7.81**	**36**	**82.9**	**25**	**47.8**
Perfluorobutanesulfonic acid (PFBS)	**~**	ND	ND	**28**	**33.9**	**170**	**156**	**6.8**	**5.3**	**15**	**4.85**	**64**	**58**	**15**	**18.2**
Perfluorodecanoic acid (PFDA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**6**	ND	**3.1**	ND
Perfluorododecanoic acid (PFDoA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroheptanoic acid (PFHpA)	**~**	ND	ND	**43**	**56.9**	**160**	**146**	**5.8**	**4.9**	**8.2**	**3.72**	**110**	**102**	**47**	**58.1**
Perfluorohexanesulfonic acid (PFHxS)	**~**	ND	**3**	**350**	**346**	**2,200**	**2330**	**54**	**61.3**	**24**	**4.98**	**750**	**748**	**280**	**354**
Perfluorohexanoic acid (PFHxA)	**~**	ND	**2**	**99**	**121**	**440**	**388**	**16**	**6.8**	**15**	**7.45**	**260**	**205**	**78**	**77.9**
Perfluorononanoic acid (PFNA)	**~**	ND	ND	**6.8**	ND	**110**	**144**	ND	2.6	**2.4**	ND	**29**	**40.2**	**110**	**142**
Perfluorooctanesulfonic acid (PFOS)	**70***	**14**	**25.4**	**530**	**687**	**4,800**	**5980**	**54**	**122**	**28**	**6.18**	**1,800**	**2,410**	**580**	**1,220**
Perfluorooctanoic acid (PFOA)	**70***	**2.8**	ND	**64**	**96.5**	**270**	**251**	**11**	**19.5**	**5.8**	**3.42**	**110**	**90.6**	**59**	**75.1**
Perfluoropentanoic acid (PFPeA)	**~**	ND	ND	**55**	**71.5**	**430**	**398**	**10**	**6.4**	**28**	**8.37**	**250**	**228**	**88**	**101**
Perfluorotetradecanoic acid (PFTA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorotridecanoic acid (PFTrDA)	**~**	ND	4.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroundecanoic acid (PFUnA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**10**	**12**

ug/L micrograms per liter (parts per billion)
ND - analyte not detected at or above the method detection limit. See lab reports for associated detection limits.
J - analyte detected at or above the method detection limit but below the Reporting Limit - data is estimated
* - indicates a guidence value as opposed to a standard
~ - indicates that no regulatory limit has been established for this analyte
(ng/l) - nanograms per liter (equivalent to parts per trillion)
70* - This is an EPA guidence value that applies to the combined total of Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS)

TABLE 8
WESTCHESTER COUNTY AIRPORT - GROUNDWATER SAMPLING RESULTS SUMMARY
Former Hangar B Site V00611

Sample ID	NYSDEC TOGS	MW-42		MW-43		MW-44		MW-45		MW-46		MW-47		MW-48		MW-49	
Sampling Date	Standards and	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019	August 2018	March 2019
Compound	Guidance Values	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
Volatile Organics, 8260	**ug/L**	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1,1-Trichloroethane	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.22**	ND	ND
1,2-Dibromo-3-chloropropane	**0.04**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	**3**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	**0.6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	**50***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-pentanone	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	**50***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**2.10**	ND	ND	**1.6**	ND	ND
Benzene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	**50***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon disulfide	**60***	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	**7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethylene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl Benzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl acetate	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tert-butyl ether (MTBE)	**10***	**0.21 J**	**0.25**	ND	**8.3**	**7.90**	ND	ND	ND	ND	ND	ND	ND	**1.70**	**0.95**	**0.32 J**	**0.39**
Methylene chloride	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butyl alcohol (TBA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-Butylbenzene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethylene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	**5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFAS EPA 537	**ng/L**	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
8:2 Fluorotelomersulfonate (8:2 FTS)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
6:2 Fluorotelomersulfonate (6:2 FTS)	**~**	ND	ND	**14**	**6.57**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**7.9**	**7.3**
NEtFOSAA	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
NMeFOSAA	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorodecanesulfonic acid (PFDS)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroheptanesulfonic acid (PFHpS)	**~**	**4.7**	**6.46**	**4.3**	**4.07**	**6.3**	**4.32**	**4.6**	**ND**	**4.1**	**4.76**	**2.1**	**2.04**	ND	ND	ND	ND
Perfluorooctanesulfonamide (FOSA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorobutanoic acid (PFBA)	**~**	**2.3**	**10.7**	**7.3**	**31.7**	**5.2**	**17.1**	**4.8**	**4.12**	**4.8**	**26.3**	**6.6**	**20**	ND	29.900	**2.8**	**17.2**
Perfluorobutanesulfonic acid (PFBS)	**~**	**15**	**21.8**	**14**	**12.9**	**21**	**20.7**	**20**	**5.54**	ND	**10.7**	**5.8**	**12.2**	**16**	**16.2**	**5.4**	**5.1**
Perfluorodecanoic acid (PFDA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**2.3**	**ND**	ND	ND	ND	ND
Perfluorododecanoic acid (PFDoA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroheptanoic acid (PFHpA)	**~**	**12**	**14.2**	**36**	**33.2**	**19**	**15.6**	**16**	**4.14**	**8.7**	**23.8**	**12**	**18.7**	**24**	**21.4**	**14**	**13**
Perfluorohexanesulfonic acid (PFHxS)	**~**	**91**	**106**	**120**	**95.1**	**150**	**111**	**120**	**22.6**	**23**	**48**	**55**	**90.2**	**60**	**47.1**	**26**	**26.2**
Perfluorohexanoic acid (PFHxA)	**~**	**22**	**26.1**	**74**	**66.3**	**38**	**26.7**	**34**	**6.98**	**15**	**59.3**	**15**	**24.6**	**70**	**66.4**	**39**	**29.8**
Perfluorononanoic acid (PFNA)	**~**	**130**	**196**	**33**	**53.7**	**31**	**24.6**	**20**	**7.39**	**2.8**	**6.14**	**17**	**24.5**	**12**	**13.1**	**21**	**28.7**
Perfluorooctanesulfonic acid (PFOS)	**70***	**91**	**170**	**120**	**167**	**130**	**135**	**110**	**62**	**16**	**19.4**	**70**	**87.8**	**17**	**25.4**	**28**	**35.5**
Perfluorooctanoic acid (PFOA)	**70***	**26**	**32.6**	**50**	**43.1**	**58**	**57.1**	**120**	**46.3**	**17**	**17.5**	**22**	**27.6**	**21**	**20.5**	**13**	**12**
Perfluoropentanoic acid (PFPeA)	**~**	**20**	**26**	**96**	**82.6**	**43**	**35.4**	**37**	**ND**	**14**	**73**	**18**	**27.8**	**95**	**93.6**	**61**	**52.5**
Perfluorotetradecanoic acid (PFTA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluorotridecanoic acid (PFTrDA)	**~**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Perfluoroundecanoic acid (PFUnA)	**~**	ND	2.290	ND	ND	**6.7**	**2.55**	**9.2**	**ND**	ND	ND	**13**	**5.58**	ND	ND	ND	ND

ug/L micrograms per liter (parts per billion)
ND - analyte not detected at or above the method detection limit. See lab reports for associated detection limits.
J - analyte detected at or above the method detection limit but below the Reporting Limit - data is estimated
* - indicates a guidence value as opposed to a standard
~ - indicates that no regulatory limit has been established for this analyte
ng/L - nanograms per liter (parts per trillion)
70* - This is an EPA guidence value that applies to the combined total of Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS)

TABLE 9
WESTCHESTER COUNTY AIRPORT
Duplicate Sample Summary

Sample ID	FMW-25	FD-1	FMW-26	FD-3	FMW-2R	FD-4
Compound	(sample)	(duplicate)	(sample)	(duplicate)	(sample)	(duplicate)
PFAS EPA 537	ng/L	ng/l	ng/L	ng/l	ng/L	ng/l
1H,1H,2H,2H-Perfluorodecanesulfonic acid (8:2 FTS)	ND	ND	ND	ND	ND	ND
1H,1H,2H,2H-Perfluorooctanesulfonic acid (6:2 FTS)	ND	ND	**5.96**	**27.8**	ND	**37.9**
N-EtFOSAA	ND	ND	ND	ND	ND	ND
N-MeFOSAA	ND	ND	ND	ND	ND	ND
Perfluoro-1-decanesulfonic acid (PFDS)	ND	ND	ND	ND	ND	ND
Perfluoro-1-heptanesulfonic acid (PFHpS)	ND	ND	ND	ND	ND	ND
Perfluoro-1-octanesulfonamide (FOSA)	ND	ND	ND	ND	ND	ND
Perfluorobutanesulfonic acid (PFBS)	**2.64**	**2.32**	ND	ND	ND	**2.15**
Perfluorodecanoic acid (PFDA)	ND	ND	ND	ND	ND	ND
Perfluorododecanoic acid (PFDoA)	ND	ND	ND	ND	ND	ND
Perfluoroheptanoic acid (PFHpA)	**3.46**	**3.02**	ND	**2.33**	ND	**2.33**
Perfluorohexanesulfonic acid (PFHxS)	**7.11**	**6.07**	**2.91**	**3.32**	ND	ND
Perfluorohexanoic acid (PFHxA)	**3.03**	**2.9**	**2.41**	**2.7**	**3.33**	**3.83**
Perfluoro-n-butanoic acid (PFBA)	**3.18**	**2.83**	**3.85**	**4.37**	**11.1**	**12.4**
Perfluorononanoic acid (PFNA)	ND	ND	ND	ND	ND	ND
Perfluorooctanesulfonic acid (PFOS)	**6.44**	**6.02**	**5.46**	**7.14**	ND	ND
Perfluorooctanoic acid (PFOA)	**13.5**	**13.2**	**5.28**	**6.69**	**3.45**	**3.96**
Perfluoropentanoic acid (PFPeA)	**2.81**	**2.3**	**2.47**	**2.97**	**5.10**	**6.01**
Perfluorotetradecanoic acid (PFTA)	ND	ND	ND	ND	ND	ND
Perfluorotridecanoic acid (PFTrDA)	ND	ND	ND	ND	ND	ND
Perfluoroundecanoic acid (PFUnA)	ND	ND	ND	ND	ND	ND

ND = Not Detected down to the minimum detection limit which is 2.00 ng/l for PFAS.

ng/l = nanograms per liter or parts per trillion.

ug/l = micrograms per liter or parts per billion.

Sample ID	FMW-25	FD-1	MW--44	FD-2
Compound	(sample)	(duplicate)	(sample)	(duplicate)
Volatile Organics, 8260	ug/l	ug/l	ug/l	ug/l
1,1,1-Trichloroethane	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND
1,2,4-Trimethylbenzene	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,3,5-Trimethylbenzene	ND	ND	ND	ND
1,4-Dichlorobenzene	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND
4-Methyl-2-pentanone	ND	ND	ND	ND
Acetone	ND	ND	ND	ND
Benzene	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND
Carbon disulfide	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
cis-1,2-Dichloroethylene	ND	ND	ND	ND
Cyclohexane	ND	ND	ND	ND
Ethyl Benzene	ND	ND	ND	ND
Isopropylbenzene	ND	ND	ND	ND
Methyl acetate	ND	ND	ND	ND
Methyl tert-butyl ether (MTBE)	ND	ND	ND	ND
Methylene chloride	ND	ND	ND	ND
n-Propylbenzene	ND	ND	ND	ND
o-Xylene	ND	ND	ND	ND
p-&-m-Xylenes	ND	ND	ND	ND
sec-Butylbenzene	ND	ND	ND	ND
tert-Butyl alcohol (TBA)	ND	ND	ND	ND
tert-Butylbenzene	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
trans-1,2-Dichloroethylene	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND
Xylenes, Total	ND	ND	ND	ND
1,4-Dioxane	---	---	ND	ND
Glycols	ND	ND	---	---

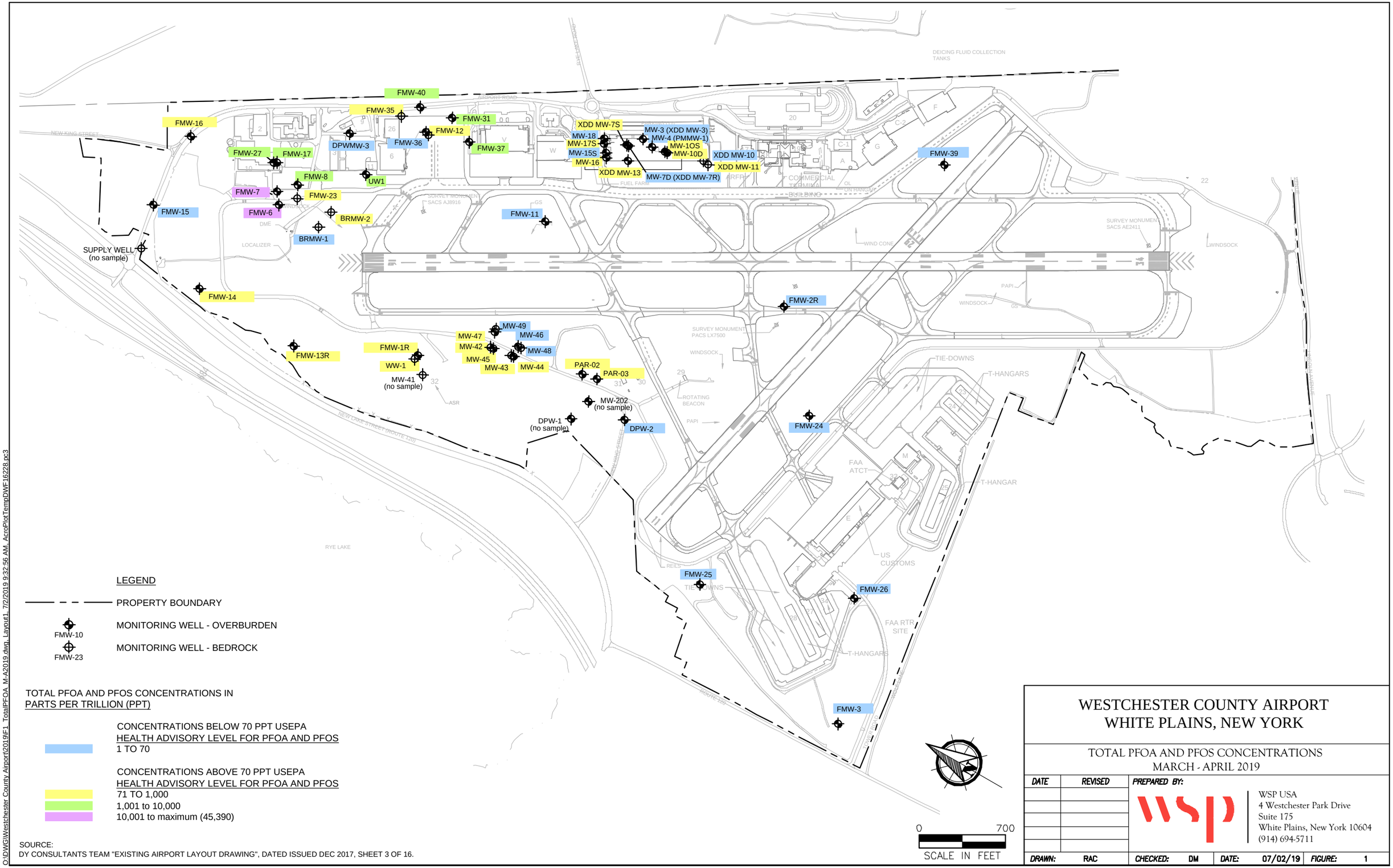
TABLE 10
WESTCHESTER COUNTY AIRPORT
Groundwater Level Measurements
MARCH - APRIL 2019

Well (BR) = Bedrock Well	Date	Top of Casing Elevation (ft msl)	Depth to Groundwater (ft btoc)	Groundwater Elevation (ft msl)	Well Depth (ft btoc)
BRMW-1 (BR)	03/26/19	429.62	2.23	427.39	44.00
BRMW-2 (BR)	03/27/19	431.33	2.55	428.78	45.75
DPW-2	03/26/19	NA	2.19	--	11.30
DPWMW-3	04/01/19	435.02	7.02	428.00	14.00
FMW-1R	03/26/19	440.90	7.71	433.19	15.25
FMW-2R	03/27/19	398.60	2.83	395.77	11.80
FMW-3	03/27/19	428.42	3.61	424.81	15.10
FMW-6	03/26/19	424.75	2.49	422.26	10.70
FMW-7	03/26/19	423.72	1.22	422.50	10.00
FMW-8	03/28/19	423.40	0.01	423.39	11.00
FMW-11	03/28/19	424.36	0.85	423.51	8.50
FMW-12	03/27/19	435.45	12.98	422.47	18.78
FMW-13R	03/27/19	427.87	5.99	421.88	17.55
FMW-14	03/28/19	404.69	4.33	400.36	15.45
FMW-15	03/28/19	415.29	9.25	406.04	14.90
FMW-16	03/28/19	416.20	4.67	411.53	15.80
FMW-17	03/27/19	422.37	1.12	421.25	9.48
FMW-23 (BR)	03/26/19	423.72	0.85	422.87	42.30
FMW-24	03/27/19	394.21	1.30	392.91	8.50
FMW-25	03/25/19	375.35	4.81	370.54	12.80
FMW-26	03/27/19	404.79	7.73	397.06	15.80
FMW-27	03/28/19	421.89	1.78	420.11	11.64
FMW-31	03/28/19	428.37	8.80	419.57	19.65
FMW-35 (BR)	03/28/19	440.53	17.55	422.98	57.50
FMW-36 (BR)	03/27/19	435.42	6.65	428.77	51.50
FMW-37	03/28/19	425.71	5.67	420.04	13.40
FMW-39	04/01/19	388.77	4.66	384.11	6.30
FMW-40	03/27/19	428.93	7.25	421.68	12.70
MW-3 (XDDMW-3)	03/29/19	409.54	10.49	399.05	17.50
MW-4 (PMMW-1)	03/29/19	408.93	10.12	398.81	17.50
MW-7S	03/28/19	NA	8.19	--	24.65
MW-7D (XDDMW-7R) (BR)	03/29/19	409.46	8.82	400.64	45.60
MW-10D (BR)	03/29/19	NA	10.55	--	50.60
MW-10S	03/29/19	NA	10.28	--	32.00
MW-15S	03/29/19	NA	3.35	--	23.10
MW-16	03/29/19	NA	3.28	--	11.10
MW-17S	03/29/19	NA	3.77	--	31.70
MW-18	03/29/19	NA	3.59	--	14.95
MW-41 (BR)	08/28/18	441.62	DRY	---	
MW-42 (BR)	03/25/19	423.08	6.75	416.33	58.85
MW-43 (BR)	03/25/19	417.08	4.30	412.78	67.30
MW-44	03/25/19	417.66	5.72	411.94	18.10
MW-45	03/25/19	421.84	4.37	417.47	15.00
MW-46	03/25/19	426.17	13.63	412.54	17.70
MW-47	03/25/19	428.90	12.46	416.44	17.70
MW-48 (BR)	03/25/19	425.51	14.95	410.56	72.45
MW-49 (BR)	03/25/19	428.26	11.85	416.41	62.60
PAR-02	03/27/19	NA	1.76	---	8.05
PAR-03	03/26/19	NA	2.77	---	10.75
UW-1	04/01/19	NA	5.38	---	13.29
WW-1 (BR)	03/28/19	443.76	16.57	427.19	62.10
XDDMW-10 (BR)	04/01/19	409.69	19.36	390.33	59.00
XDDMW-11 (BR)	04/01/19	409.19	18.48	390.71	41.30
XDDMW-13	04/01/19	411.59	7.00	404.59	38.60

(ft msl) - feet above mean sea level
(ft btoc) - feet below top of casing
NA - Not Available

Prepared by WSP USA

FIGURES



LEGEND

PROPERTY BOUNDARY

FMW-10 — MONITORING WELL - OVERBURDEN

FMW-23 — MONITORING WELL - BEDROCK

TOTAL PFOA AND PFOS CONCENTRATIONS IN PARTS PER TRILLION (PPT)

CONCENTRATIONS BELOW 70 PPT USEPA HEALTH ADVISORY LEVEL FOR PFOA AND PFOS
1 TO 70

CONCENTRATIONS ABOVE 70 PPT USEPA HEALTH ADVISORY LEVEL FOR PFOA AND PFOS
71 TO 1,000
1,001 to 10,000
10,001 to maximum (45,390)

SOURCE:
DY CONSULTANTS TEAM "EXISTING AIRPORT LAYOUT DRAWING", DATED ISSUED DEC 2017, SHEET 3 OF 16.

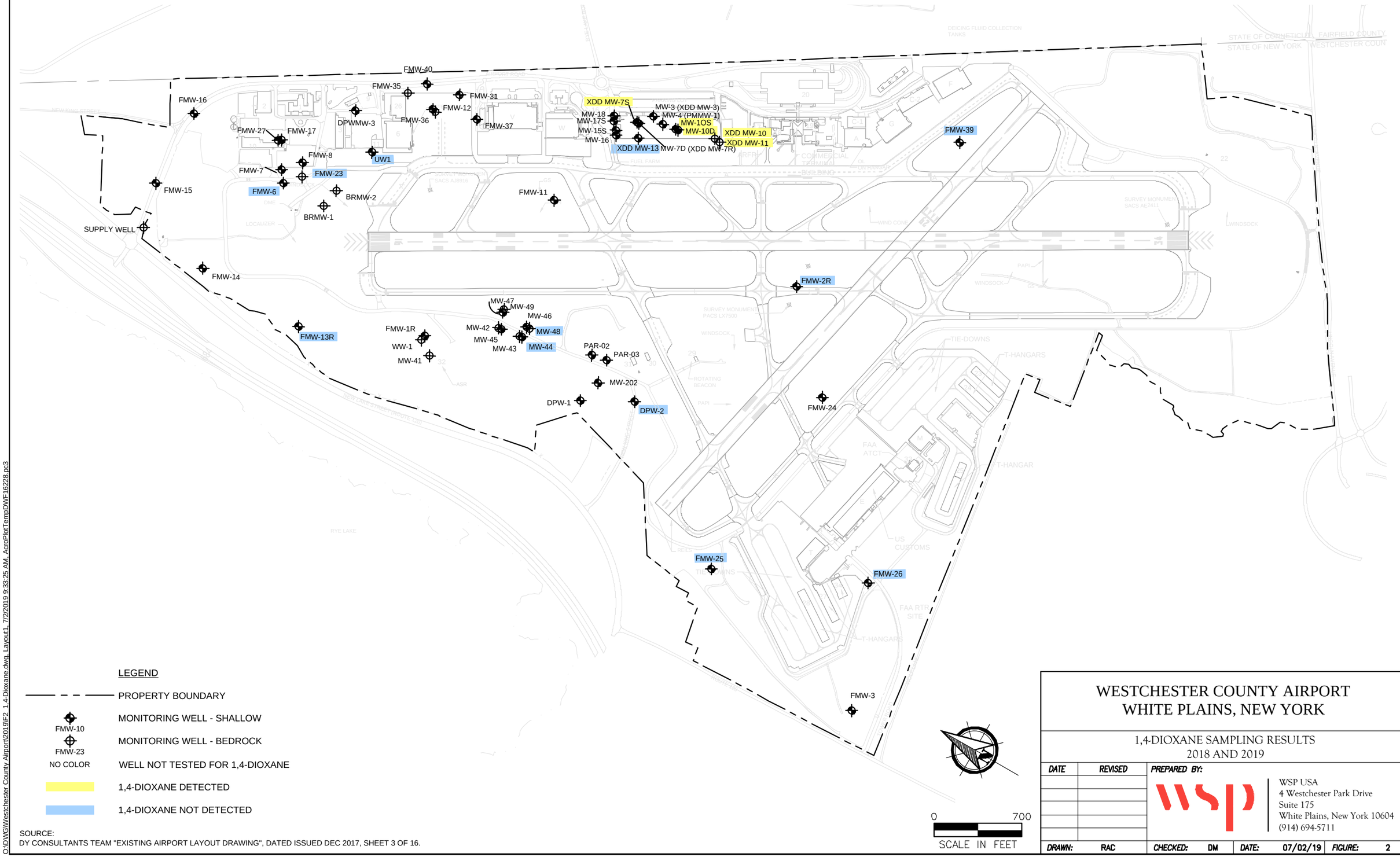
WESTCHESTER COUNTY AIRPORT
WHITE PLAINS, NEW YORK

TOTAL PFOA AND PFOS CONCENTRATIONS
MARCH - APRIL 2019

DATE	REVISED

PREPARED BY:
WSP USA
4 Westchester Park Drive
Suite 175
White Plains, New York 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	07/02/19	FIGURE:	1



LEGEND

- PROPERTY BOUNDARY
- FMW-10 — MONITORING WELL - SHALLOW
- FMW-23 — MONITORING WELL - BEDROCK
- NO COLOR — WELL NOT TESTED FOR 1,4-DIOXANE
- 1,4-DIOXANE DETECTED
- 1,4-DIOXANE NOT DETECTED

SOURCE:
DY CONSULTANTS TEAM "EXISTING AIRPORT LAYOUT DRAWING", DATED ISSUED DEC 2017, SHEET 3 OF 16.

0 700
SCALE IN FEET

WESTCHESTER COUNTY AIRPORT
WHITE PLAINS, NEW YORK

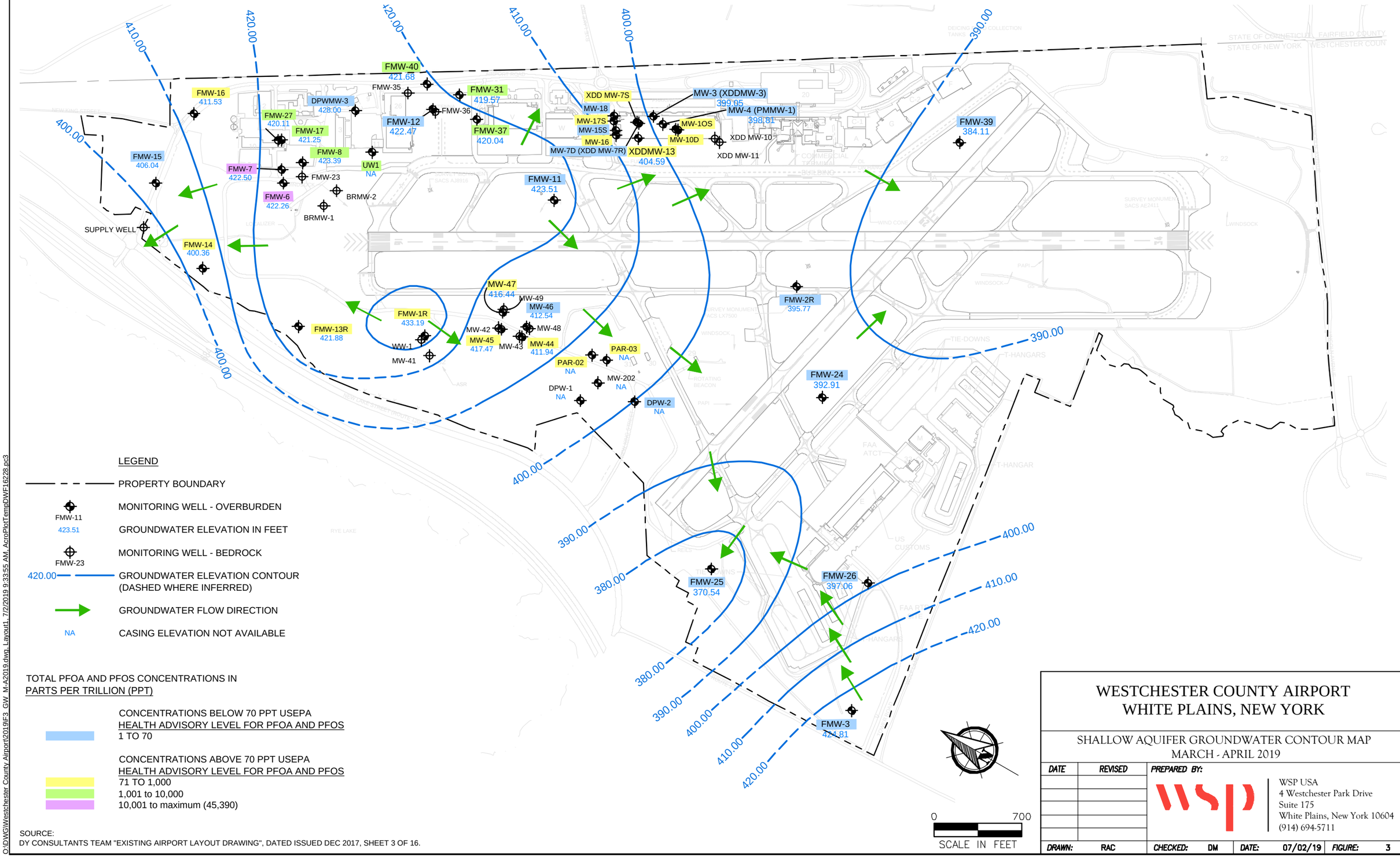
1,4-DIOXANE SAMPLING RESULTS
2018 AND 2019

DATE	REVISED

PREPARED BY:

WSP USA
4 Westchester Park Drive
Suite 175
White Plains, New York 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	07/02/19	FIGURE:	2



LEGEND

- PROPERTY BOUNDARY
- FMW-11 — MONITORING WELL - OVERBURDEN
- 423.51 — GROUNDWATER ELEVATION IN FEET
- FMW-23 — MONITORING WELL - BEDROCK
- 420.00 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION
- NA — CASING ELEVATION NOT AVAILABLE

TOTAL PFOA AND PFOS CONCENTRATIONS IN PARTS PER TRILLION (PPT)

- CONCENTRATIONS BELOW 70 PPT USEPA HEALTH ADVISORY LEVEL FOR PFOA AND PFOS: 1 TO 70
- CONCENTRATIONS ABOVE 70 PPT USEPA HEALTH ADVISORY LEVEL FOR PFOA AND PFOS:
  - 71 TO 1,000
  - 1,001 to 10,000
  - 10,001 to maximum (45,390)

SOURCE:
DY CONSULTANTS TEAM "EXISTING AIRPORT LAYOUT DRAWING", DATED ISSUED DEC 2017, SHEET 3 OF 16.

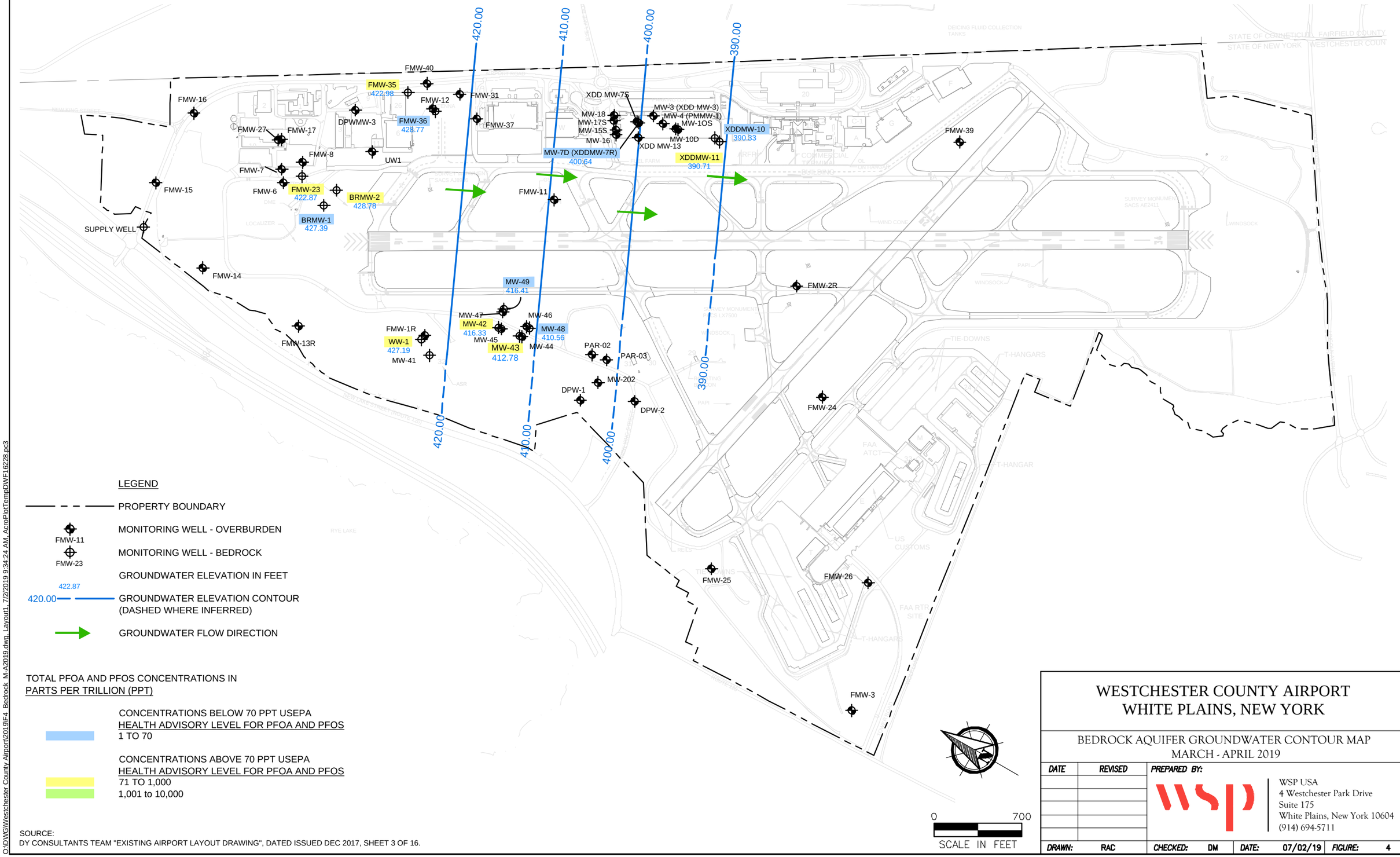
WESTCHESTER COUNTY AIRPORT
WHITE PLAINS, NEW YORK

SHALLOW AQUIFER GROUNDWATER CONTOUR MAP
MARCH - APRIL 2019

DATE	REVISED

PREPARED BY:
WSP USA
4 Westchester Park Drive
Suite 175
White Plains, New York 10604
(914) 694-5711

DRAWN:	CHECKED:	DATE:	FIGURE:
RAC	DM	07/02/19	3



LEGEND

- PROPERTY BOUNDARY
- FMW-11 — MONITORING WELL - OVERBURDEN
- FMW-23 — MONITORING WELL - BEDROCK
- GROUNDWATER ELEVATION IN FEET
- 422.87 / 420.00 — GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION

TOTAL PFOA AND PFOS CONCENTRATIONS IN PARTS PER TRILLION (PPT)

- CONCENTRATIONS BELOW 70 PPT USEPA HEALTH ADVISORY LEVEL FOR PFOA AND PFOS
  1 TO 70
- CONCENTRATIONS ABOVE 70 PPT USEPA HEALTH ADVISORY LEVEL FOR PFOA AND PFOS
  71 TO 1,000
  1,001 to 10,000

SOURCE:
DY CONSULTANTS TEAM "EXISTING AIRPORT LAYOUT DRAWING", DATED ISSUED DEC 2017, SHEET 3 OF 16.

WESTCHESTER COUNTY AIRPORT
WHITE PLAINS, NEW YORK

BEDROCK AQUIFER GROUNDWATER CONTOUR MAP
MARCH - APRIL 2019

DATE	REVISED

PREPARED BY:

WSP USA
4 Westchester Park Drive
Suite 175
White Plains, New York 10604
(914) 694-5711

DRAWN:	RAC	CHECKED:	DM	DATE:	07/02/19	FIGURE:	4

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APPENDIX B

HASP TRACKING SHEET

Project Number: WESTC028

List all tasks at the site for which a HASP is required. Add tasks as needed for project:

Task Code	Task Description	Date added to HASP	Date(s) Task Revised in HASP	Reason(s) for Revision
A	Groundwater and surface water sample collection	6/3/19	06/25/2020	Added COVID-19 response information
B	Monitoring well installation/HPT/EC/MIP	6/3/19	06/25/2020	Added COVID-19 response information
C	GPR/Video Survey	9/9/19	06/25/2020	Added COVID-19 response information
D	Storm Sewer Modification	9/9/19	06/25/2020	Added COVID-19 response information
E	PlumeStop/Application at OF-4	9/19/19	06/25/2020	Added COVID-19 response information

Add more tasks as needed

Complete prior to each field effort:

Dates of Field Effort	Task Code(s) Included in Effort	Task Descriptions	Contractor on site for work? (Y,N)	Hazard Level	Completed by:	Field Team Leader/Field Health and Safety Officer

Dates of Field Effort	Task Code(s) Included in Effort	Task Descriptions	Contractor on site for work? (Y,N)	Hazard Level	Completed by:	Field Team Leader/Field Health and Safety Officer

Add more as needed

Site Health and Safety Plan[1]

Section 1: General Information

Site Name:	Westchester County Airport	**Project Manager:**	David H. F. Luer
Project Name:	Westchester County Airport	**Site Emer Contact:**	David H. F. Luer
Project Number:	WESTC028	**Site Emer Contact #:**	973-229-8348
Project Location:	240 Airport Road, White Plains, NY 10604	**HASP Revision #:**	01
Client Name:	Westchester County	**HASP Approval Date:**	07/01/2020
Site Contact:	Peter Scherrer	**HASP Effective Date:**	07/01/2020
Contact #:	914-995-4856		

Section 2: Emergency Contact Information

Local Service Contact Numbers

Ambulance:	911	**Poison Control:**	800-462-6642
Fire:	911	**Fire (non-emergency):**	914 422-6360
Police:	911	**Police (non-emergency):**	914 422-6111

Spill Response Information

DOT HazMat Info:	202-366-4488	CHEMTREC	800-424-9300
National Response Center Hotline:	800-424-8802	CMA Chemical Referral Center:	800-262-8200
State Spill Response Hotline Name	NYDEC Emergency Hotline	Emergency Response Contractor Name:	NA
State Spill Response Hotline number:	800-457-7362	Emergency Response Contractor Number:	NA

First Environment Contact Information

Project Manager:	David H. F. Luer	FE Office Number:	973-334-0003
Cell Phone:	973-229-8348	Alternate FE Contact:	Phil Cicolello
Home Phone:	NA	Cell Phone:	908-346-3520
FE Medical Consultant:	Jeffrey Liva, M.D.	FE Human Resources Dir:	Scott Kymer
FE Medical Consultant #:	201-444-3060	Cell Phone:	973-632-6741

Hospital Information (Do NOT attempt to transport anyone for anything other than a minor injury in which the individual is ambulatory. Call 911 for an ambulance instead.)

Name:	White Plains Hospital		
Address:	41 E. Post Road, White Plains, NY 10601		
Non-Emerg. Phone:	914-681-1155	Hours of Operation:	24/7
Verified by:	PC	Date:	6/3/2019

[1] Note: This Health and Safety Plan & COVID-19 1.1 Plan has been written for the use of First Environment, Inc., its employees, and the tasks to be performed by First Environment employees. The plan is written for specific trained personnel who are under medical surveillance. The plan is applicable for the specific work stated and is representative of conditions believed to exist at the time of its preparation. First Environment, Inc. claims no responsibility for its use by others.

Section 3: Map to Hospital

This page reserved for a map and directions to the hospital.

18 min (8.7 miles)

via I-684 S

Fastest route, the usual traffic

Westchester County Airport

240 Airport Rd, White Plains, NY 10604

- Take Airport Rd and New King St to NY-120 S in North Castle

  5 min (1.7 mi)

- Take I-684 S, Westchester Ave and Maple Ave to Davis Ave in White Plains

  13 min (6.9 mi)

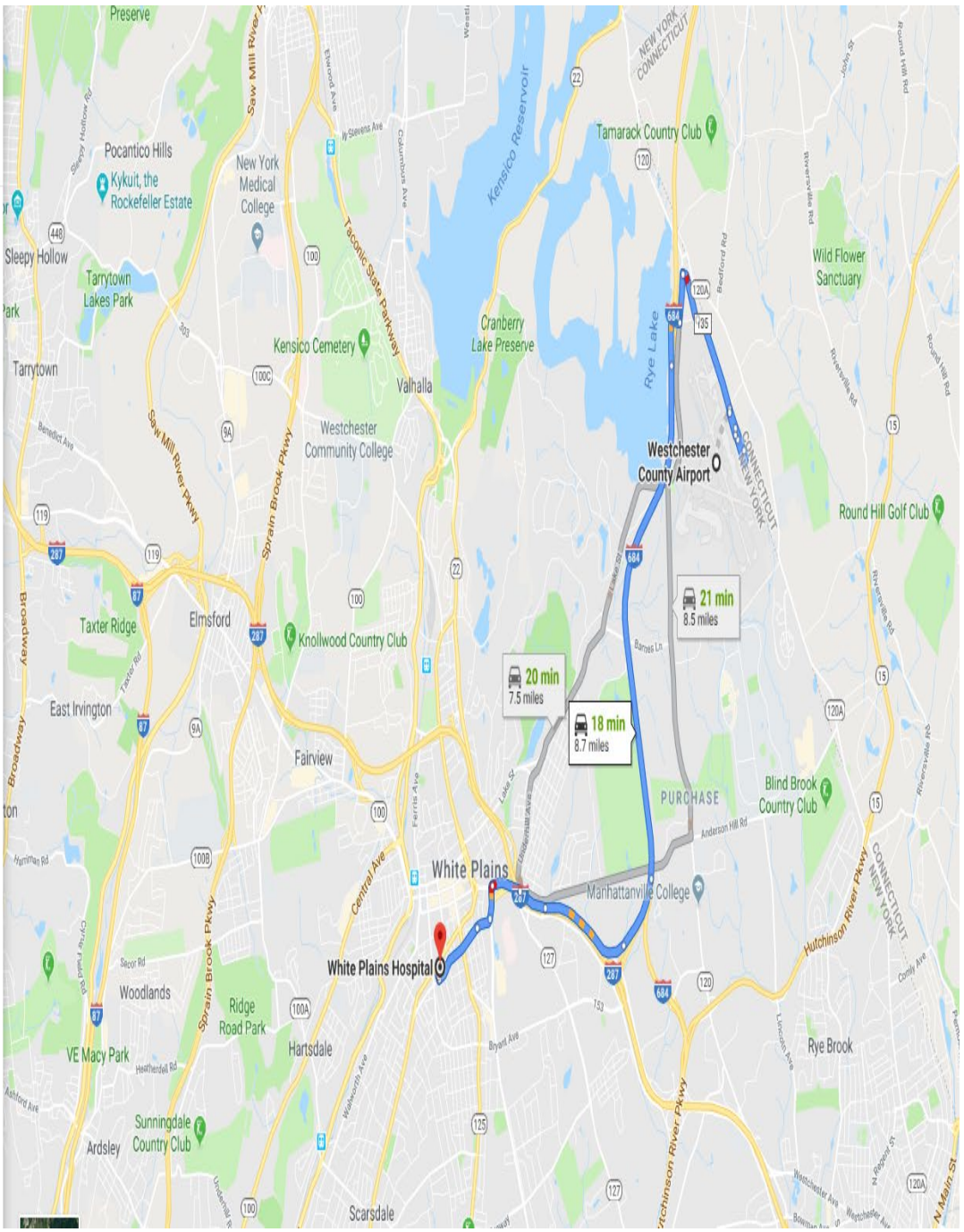
- Drive to your destination

  46 s (413 ft)

White Plains Hospital

41 E Post Rd, White Plains, NY 10601

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.



In the event of an injury, incident or release, notify the PM, Senior Management, and HR as soon as safe to do so

Section 4: Site Description

Field Effort Objectives (check those applicable)

Initial Assessment	**X**
Delineate contamination	**X**
Remediate contamination	**X**
Other (list below)	**X**
On-going investigation soil, sediment, groundwater & surface water sample collection	

Site Characteristics (check all that apply)

First Entry	**X**	Hazardous (CERCLA/State Superfund)	
Previously Characterized	**X**	Hazardous (RCRA)	
Active	**X**	HAZWOPER	**X**
Inactive		Sanitary or C and D Landfill	
UST/LUST		Secure	
Manufacturing		Other (list below)	
Construction	X		

Project History

First Environment, Inc. was retained by Westchester County Airport to investigate environmental contamination associated with historic operations at the site. Specifically, the investigation includes evaluation of emerging contaminants PFOS and PFAS at the site and in the immediate vicinity of adjacent off-site properties.

Site Security and Control Measures

None by First Environment.

Section 5: Known General Site Hazards

Potential Chemical Hazards found at Site

Identify suspected compounds and levels if known. If levels are unknown, indicate unknown with **U**. If compounds are not present or not suspected to be present indicate with **NA**. If a class of compounds (in bold) is not present at the site, indicate NA for the class, it is then not necessary to fill in NA for compounds within the class.

Compounds	Known Concentration Ranges			Symptoms of Acute Exposure
	Soil (mg/kg)	W/GW (μg/L)	Indoor Air (ug/m^3)	
Nonchlorinated VOCs				
Benzene				Irritation: Eyes, Skin, Respiratory System
2-Butanone (MEK)				
Ethylbenzene				
Hexone (MIBK)				
Methyl-t-butyl Ether (MTBE)				
Toluene		**220**		
Xylene				
Other(specify)				
Chlorinated VOCs				
Carbon tetrachloride				
Chlorobenzene				
1,2-Dichloroethane				
1,1 Dichloroethylene (1,1-DCE)		**15**		Irritation: Eyes, Skin, Throat; Dizziness; Headache; Nausea, Breathing Difficulty
Tetrachloroethylene (PCE)		**19**		Irritation; Eyes, Skin, Nose; Throat, Respiratory System; Nausea; Flush Face and Neck; Dizziness; Lack of Coordination; Headache; Drowsiness
1,1,1-Trichloroethane (TCA)		**8**		Irritation; Eyes, Skin; Headache; Weakness; Exhaustion
Trichloroethylene (TCE)		**21**		Irritation: Eyes, Skin; Headache
Vinyl Chloride		**12**		Weakness; Abdominal Pain
Other (specify)				
1,4-dioxane		**32**		
Semi-Volatile Organics				
Naphthalene				
PAHs				
Other (specify)				

Compounds	Known Concentration Ranges			Symptoms of Acute Exposure
	Soil (mg/kg)	W/GW (μg/L)	Indoor Air (ug/m^3)	
Petroleum Products				
Gasoline				
Fuel Oil #2				
Fuel Oil #6				
Petroleum Distillates				
Other (specify)				
Metals				
Arsenic				
Cadmium				
Chromium				
Lead				
Mercury				
Other(specify)				
PCBs				
Coal/MGP Tar				
Pesticides				
Asbestos				
Fiberglass				
Other (specify)				
PFOA + PFOS		ND-53		

Potential Physical Hazards Found at Site

Check all that apply. Indicate NA if they do not apply.

Unknown/Partially Characterized	**X**	Stored Energy/Energized Equipment	
Utility Lines	**X**	Confined Space*	
Electrical (other than utilities)	**X**	Oxygen Deficiency	
Fire		Slippery Surfaces/Tripping Hazards	**X**
Explosion*		Fall Potential	
Toxic Gases		Flying or Falling Material	
Ionizing Radiation*		Pinch Points	
Uneven Terrain		Poor Visibility/Inadequate Light	
Traffic	**X**	Water Hazards (specify)	**X (streams and creeks)**
Heavy Machinery/Moving Equipment	**X**	Air or steam emissions	

* If this risk is identified, Senior Management must approve the HASP.

Crushing Hazard		Biological Waste (specify)	
Venomous Snakes	X	Wild Animals	
Poisonous Plants		Other (specify)	
Venomous Spiders			
Mosquitoes, Ticks or other Biting Insects	**X**	Aircraft taxing on and off runways; other airport equipment	**X**

Restroom Facilities Location: N/A

Section 6: Work (Task) Description

If multiple tasks with different hazard profiles and risk controls are planned or as tasks are added , copy Sections 6, 7, and 8 and fill out for each task to identify task related hazards and appropriate controls.

Task Code: _A_ (see cover page)

Tasks to be performed by First Environment

Describe Tasks: Site Inspection/Collect Soil, sediment, groundwater & surface water sample collection

Work Plan attached to HASP or provide separately? Separately

Describe roles and responsibilities personnel will perform: Collect soil, sediment, groundwater & surface water samples

Tasks to be performed by First Environment contractors[2]

	Groundwater & surface water sample analysis	Subcontract Type (place x beneath type of agreement	
		MSA	Individual
Task:			**X**
	York Labs	Effective Dates:	Effective Dates: 6/3/2019
Contractor:			

	Cascade Drilling	Subcontract Type (place x beneath type of agreement	
		MSA	Individual
Task:			x
		Effective Dates;	Effective Dates:6/3/2019
Contractor:			

Confirm all subcontracts covering tasks to be performed by subcontractors are in place, cover the work to be performed, and are for the time period of the work. Attach to back of HASP.

Section 7: FE Work Hazard Assessment

Task Code: __A__

All chemicals to be brought on site for work	Approximate Amount	Form (liquid, solid, gas)
Alconox	4 oz.	Solid
Gasoline		
Dilute Hydrochloric Acid	<40 mL	Liquid
Methanol		

[2] Site characteristics to the best of First Environment's knowledge are included in this HASP. Per the subcontractor agreement, each subcontractor must assess hazards associated with their site work and have a site- specific health and safety plan covering their work on site.

Dilute Nitric Acid		
Dilute Sulfuric Acid		
Other (specify names)		

Is there a potential for a chemical release beyond an incidental release?
If yes, explain:

Heavy equipment brought on site for work	Check all Applicable
Drill rig	
Geoprobe	X
Excavator	
Backhoe	
Front End Loader	
Injection system	
Dump truck	
Generator	
Other (specify)	

If equipment at the facility is to be relied on, list the equipment and location:

Equipment	Location

Hazards that apply to work to be performed	Check all applicable	Describe work activities to which it applies
Unknown/Partially Characterized	X	Sample collection
Cold Exposure	X	Sample collection
Heat Stress	X	Sample collection
Explosion*		
Fire		
Toxic Gases		
Oxygen Deficiency*		
Confined Space*		
Ionizing Radiation*		
Chemical Dermal Exposure		
Chemical Inhalation		
Chemical Ingestion		
Dust/air emissions		
Air or steam emissions		
Biological Waste (specify)		
Extreme weather, heat	X	Sample collection; mapping
Stored Energy/Energized Equipment		
Heavy Machinery/Moving Equipment	X	Sample collection; mapping

* If this hazard is present, Senior Management must approve the HASP.

Hazards that apply to work to be performed	Check all applicable	Describe work activities to which it applies
Pump Winch		
Slippery Surfaces	**X**	Sample collection; mapping
Fall Potential		
Pinch Points		
Flying or Falling Material/Equipment		
Heavy Lifting		
Crushing		
Repetitive Motion		
Venomous Snakes	X	Sample collection; mapping
Poisonous Plants		
Mosquitoes, Ticks or other Biting Insects	**X**	Sample collection; mapping
Venomous Spiders		
Wild Animals		
On or Near Water	**X**	Surface water sample collection
Other (specify)		
Aircraft taxing on and off runways; other airport equipment	**X**	Sample collection; mapping

Overall Hazard Evaluation for Task

High		**Medium**		**Low**	X	**Unknown**[3]	
Justification:	Sample collection						

Section 8 Risk Control:

(Must address all hazards identified under Sections 5 and 7, both those existing at the site and those associated with the work to be performed)

Task Code: A

Public Utilities

Utility Markout

Utility	Req.	Company Name	Telephone #
One Call		New York 811	811
Gas:		Con ED	800-752-6633
Electric:		Con Ed	800-752-6633
Water:		White Plains	914-422-1207
Sewer:		Mamaroneck	914-381-7825
Telephone:		Verizon	800-922-0204
Cable:		Verizon	800-922-0204

Markout Ticket Confirmation #	Date
NA	NA

Were non-public utility locations on site marked out or otherwise identified on facility? (Y/N) N

If no, identify activity modifications to address unidentified utilities, on-site utility lines, and other buried anomalies:

[3] If unknown, treat as high hazard until sufficient information has been developed

Buddy System required? (Y/N) N
If yes, describe circumstances:
If no, describe communication contingencies:

If stored energy/energized equipment is present: N
Is LO–TO required? (Y/N)
Specify equipment to be locked out/tagged out:
Follow the LO-TO procedure. List any differences or additions below:

Add photos of equipment subject to LO-TO to back of plan.

If LO-TO is not required, describe actions to ensure stored energy/energized equipment is managed during equipment set up, operation, and demobilization:

Exclusion Zones:
Will exclusion zones be used at the site? (Y/N) N
If yes, indicate zones on the site map.

PPE

Specify primary protective equipment to be worn during this task		Specify applicable activities
Level C		
Level D		
Level D Modified	**X**	No Tyvek; follow protocol in QAPP for sampling; sampling
If PPE beyond Level D is required, consult the Project Manager or Senior Management		

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**
Respiratory			
Respirator (full)			
Respirator (half)		X	
Cartridge type:			
P100			
Combo			
Other			
Dust Mask			
Other (specify)			
Head and Eye			
Safety Glasses	**X**		
Face Shield			
Goggles			
Hard Hat			
Other (specify)			
Hearing			
Ear plugs/muffs			
Dual			
Feet			
Overboots			
Safety-toed Workboots	**X**		
Other (specify)			
Hands			
Nitrile Gloves	**X**		

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**
Overgloves			
Other (specify)			
Body			
Tyvek Coverall			
Polycoated Tyvek			
Cold Weather Gear (Carhart)			
Rain Gear		**X**	No pfas
Safety Vest	**X**		
U.S. Coast Guard-approved life jacket or buoyant work vest			
Other (specify)			
Other (specify)			
COVID-19 related precautions	**X**		See Attachment A

Other Equipment and Supplies:

Lighting	
Potable Water	
Insect Repellent	
Fire Extinguisher (2.5 lb)	**X**
Fire Extinguisher (5 lb)	
Fire Extinguisher (10 lb)	
Eyewash Kit	
Spill Kit	**X**
First Aid Kit	**X**
Ring Buoys	
Lifesaving Skiff	
Portable Toilet	
Other (specify):	

Operational Control Procedures and Work Instructions: (Attach procedures to back of HASP)

Decontamination Procedures:
Follow the Field Decontamination Procedure. List any differences or additions below.

Discharge Control Measures (Y/N) N
If yes describe Discharge Control Measures:

Waste Disposal Practices:
Specify Waste Management Practices:

Waste Type	Sample	Containerize	Dispose of off Site	Return to Site	Dispose in FE Solid Waste
Drill Cuttings					
Purge Water	**X**	X			
Soil	**X**	**X**		**X**	
PPE and other field related waste					**X**
Other (Specify)					

Additional waste handling instructions:

Other instructions:

General Safe Work Practices:
To ensure the safety of First Environment personnel and the public at a site where fieldwork is being conducted, the Safe Work Practices listed below will be followed.

- Good housekeeping practices are to be maintained.
- A "buddy system" in which another worker is close enough to render immediate aid will be in effect when specified in the HASP.
- In the event of treacherous weather-related working conditions field tasks will be suspended until conditions improve or appropriate protection from the elements is provided.
- Smoking, eating, chewing gum or tobacco, or drinking are forbidden except in clean or designated area.
- Ignition of flammable liquids within or through improvised heating devices is forbidden.
- Contact with samples, excavated materials, or other contaminated materials must be minimized.
- Use of contact lenses is not advisable.
- If drilling equipment is involved, know where the 'kill switch' is.
- All electrical equipment used in outside locations, wet area or near water must be plugged into ground fault circuit interrupter protected outlets.
- Illumination - Work in the early morning or at dusk may require site lighting.

List any differences or additions below:

Emergency Preparedness: (Attach procedures to back of HASP)

Field Emergency Response:
Follow the Field Emergency Response Procedure. List any differences or additions below

Spill Response:
Follow the Field Spill Response Procedure. List any differences or additions below.

Is a stand-by external emergency response contractor required? (Y/N) If yes, explain: N

: Contractor:	Date Contacted:	Contacted by:

Section 7: Work (Task) Description

If multiple tasks with different hazard profiles and risk controls are planned or as tasks are added , copy Sections 6, 7, and 8 and fill out for each task to identify task related hazards and appropriate controls.

Task Code: _B_ (see cover page)

Tasks to be performed by First Environment

Describe Tasks: Monitoring well installation and development

Work Plan attached to HASP or provide separately? Separately

Describe roles and responsibilities personnel will perform: Site inspection and Groundwater Sample Collection

Tasks to be performed by First Environment contractors[4]

Task:	Monitoring well installation and development	Subcontract Type (place x beneath type of agreement	
		MSA	Individual
			X
Contractor:	Summit Drilling	Effective Dates:	Effective Dates: 6/30/19

Task:	Geophysical/Video Storm Sewer/Modification	Subcontract Type (place x beneath type of agreement	
		MSA	Individual
			X
Contractor:	GPR One Call	Effective Dates;	Effective Dates:

Task:		Subcontract Type (place x beneath type of agreement	
		MSA	Individual
Contractor:		Effective Dates;	Effective Dates:

Confirm all subcontracts covering tasks to be performed by subcontractors are in place, cover the work to be performed, and are for the time period of the work. Attach to back of HASP.

Section 8: FE Work Hazard Assessment

Task Code: __B__

All chemicals to be brought on site for work	Approximate Amount	Form (liquid, solid, gas)
Alconox	4 oz.	Solid
Gasoline		
Dilute Hydrochloric Acid		
Methanol		
Dilute Nitric Acid		
Dilute Sulfuric Acid		
Other (specify names)		

Is there a potential for a chemical release beyond an incidental release? N

If yes, explain:

Heavy equipment brought on site for work	Check all Applicable
Drill rig	**X**
Geoprobe	
Excavator	
Backhoe	
Front End Loader	

[4] Site characteristics to the best of First Environment's knowledge are included in this HASP. Per the subcontractor agreement, each subcontractor must assess hazards associated with their site work and have a site- specific health and safety plan covering their work on site.

Injection system	
Dump truck	
Generator	
Other (specify)	
Air compressor	**X**

If equipment at the facility is to be relied on, list the equipment and location:

Equipment	**Location**

Hazards that apply to work to be performed	**Check all applicable**	**Describe work activities to which it applies**
Unknown/Partially Characterized	**X**	Monitoring well installation
Cold Exposure		
Heat Stress	**X**	Monitoring well installation
Explosion*		
Fire		
Toxic Gases		
Oxygen Deficiency*		
Confined Space*		
Ionizing Radiation*		
Chemical Dermal Exposure		
Chemical Inhalation		
Chemical Ingestion		
Dust/air emissions		
Air or steam emissions		
Biological Waste (specify)		
Extreme weather, heat	**X**	Monitoring well installation
Stored Energy/Energized Equipment		
Heavy Machinery/Moving Equipment	**X**	Monitoring well installation
Pump Winch		
Slippery Surfaces	**X**	Monitoring well installation
Fall Potential		
Pinch Points		
Flying or Falling Material/Equipment		
Heavy Lifting		
Crushing		
Repetitive Motion		
Venomous Snakes		
Poisonous Plants		
Mosquitoes, Ticks or other Biting Insects	**X**	Monitoring well installation
Venomous Spiders		
Wild Animals		
On or Near Water		
Other (specify)		
Aircraft taxing on and off runways;	**X**	Monitoring well installation

* If this hazard is present, Senior Management must approve the HASP.

Hazards that apply to work to be performed	Check all applicable	Describe work activities to which it applies
other airport equipment		

Overall Hazard Evaluation for Task

High		**Medium**		**Low**	X	**Unknown**[5]	
Justification:	Monitoring well installation/hpt/EC						

Section 9 Risk Control:

(Must address all hazards identified under Sections 5 and 7, both those existing at the site and those associated with the work to be performed)

Task Code: _B_

Public Utilities

Utility Markout

Utility	Req.	Company Name	Telephone #
One Call		New York 811	811
Gas:		Con ED	800-752-6633
Electric:		Con Ed	800-752-6633
Water:		White Plains	914-422-1207
Sewer:		Mamaroneck	914-381-7825
Telephone:		Verizon	800-922-0204
Cable:		Verizon	800-922-0204

Markout Ticket Confirmation #	Date
NA	NA

Were non-public utility locations on site marked out or otherwise identified on facility? (Y/N) N

If no, identify activity modifications to address unidentified utilities, on-site utility lines, and other buried anomalies: Replacement monitoring well to be installed adjacent to existing monitoring well.

Buddy System required? (Y/N) N
If yes, describe circumstances:
If no, describe communication contingencies:

If stored energy/energized equipment is present: N
Is LO–TO required? (Y/N)
Specify equipment to be locked out/tagged out:
Follow the LO-TO procedure. List any differences or additions below:

Add photos of equipment subject to LO-TO to back of plan.

If LO-TO is not required, describe actions to ensure stored energy/energized equipment is managed during equipment set up, operation, and demobilization:

Exclusion Zones:
Will exclusion zones be used at the site? (Y/N) N
If yes, indicate zones on the site map.

[5] If unknown, treat as high hazard until sufficient information has been developed

PPE

Specify primary protective equipment to be worn during this task		Specify applicable activities
Level C		
Level D		
Level D Modified	**X**	Monitoring well installation
If PPE beyond Level D is required, consult the Project Manager or Senior Management		

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**
Respiratory			
Respirator (full)			
Respirator (half)		**X**	
Cartridge type:			
P100			
Combo			
Other			
Dust Mask			
Other (specify)			
Head and Eye			
Safety Glasses	**X**		
Face Shield			
Goggles			
Hard Hat	**X**		
Other (specify)			
Hearing			
Ear plugs/muffs	**X**		
Dual			
Feet			
Overboots			
Safety-toed Workboots	**X**		
Other (specify)			
Hands			
Nitrile Gloves	**X**		
Overgloves			
Other (specify)			
Body			
Tyvek Coverall			
Polycoated Tyvek			
Cold Weather Gear (Carhart)			
Rain Gear		**X**	
Safety Vest	**X**		
U.S. Coast Guard-approved life jacket or buoyant work vest			
Other (specify)			
Other (specify)			
COVID-19 related precautions	X		See Attachment A

Other Equipment and Supplies:

Lighting	
Potable Water	
Insect Repellent	
Fire Extinguisher (2.5 lb)	**X**
Fire Extinguisher (5 lb)	
Fire Extinguisher (10 lb)	
Eyewash Kit	
Spill Kit	**X**
First Aid Kit	**X**
Ring Buoys	
Lifesaving Skiff	
Portable Toilet	
Other (specify):	

Operational Control Procedures and Work Instructions: (Attach procedures to back of HASP)

Decontamination Procedures:
Follow the Field Decontamination Procedure. List any differences or additions below.

Discharge Control Measures (Y/N) N
If yes describe Discharge Control Measures:

Waste Disposal Practices:
Specify Waste Management Practices:

Waste Type	Sample	Containerize	Dispose of off Site	Return to Site	Dispose in FE Solid Waste
Drill Cuttings					
Purge Water	**X**	X			
Soil	**X**	X		**X**	
PPE and other field related waste					**X**
Other (Specify)					

Additional waste handling instructions:

Other instructions:

General Safe Work Practices:
To ensure the safety of First Environment personnel and the public at a site where fieldwork is being conducted, the Safe Work Practices listed below will be followed.

- Good housekeeping practices are to be maintained.
- A "buddy system" in which another worker is close enough to render immediate aid will be in effect when specified in the HASP.
- In the event of treacherous weather-related working conditions field tasks will be suspended until conditions improve or appropriate protection from the elements is provided.
- Smoking, eating, chewing gum or tobacco, or drinking are forbidden except in clean or designated area.
- Ignition of flammable liquids within or through improvised heating devices is forbidden.
- Contact with samples, excavated materials, or other contaminated materials must be minimized.
- Use of contact lenses is not advisable.
- If drilling equipment is involved, know where the 'kill switch' is.

- All electrical equipment used in outside locations, wet area or near water must be plugged into ground fault circuit interrupter protected outlets.
- Illumination - Work in the early morning or at dusk may require site lighting.

List any differences or additions below:

Emergency Preparedness: (Attach procedures to back of HASP)

Field Emergency Response:
Follow the Field Emergency Response Procedure. List any differences or additions below

Spill Response:
Follow the Field Spill Response Procedure. List any differences or additions below.

Is a stand-by external emergency response contractor required? (Y/N) If yes, explain: N

: Contractor:	Date Contacted:	Contacted by:

This page reserved for a site map showing work locations, staging areas, exclusion zones as appropriate, emergency response equipment locations as appropriate, and the evacuation route and muster point.

Section 6: Work (Task) Description

If multiple tasks with different hazard profiles and risk controls are planned or as tasks are added , copy Sections 6, 7, and 8 and fill out for each task to identify task related hazards and appropriate controls.

Task Code: _C_ (see cover page)

Tasks to be performed by First Environment

Describe Tasks: Inpect Storm Sewers via downhole video camera.

Work Plan attached to HASP or provide separately? Separately

Describe roles and responsibilities personnel will perform: Oversight of subcontractor

Tasks to be performed by First Environment contractors[6]

	GPR/Video	Subcontract Type (place x beneath type of agreement	
		MSA	Individual
Task:			x
	GPR One Call	Effective Dates;	Effective Dates: 9/09/19
Contractor:			

Confirm all subcontracts covering tasks to be performed by subcontractors are in place, cover the work to be performed, and are for the time period of the work. Attach to back of HASP.

Section 7: FE Work Hazard Assessment

Task Code: __C__

[6] Site characteristics to the best of First Environment's knowledge are included in this HASP. Per the subcontractor agreement, each subcontractor must assess hazards associated with their site work and have a site- specific health and safety plan covering their work on site.

All chemicals to be brought on site for work	Approximate Amount	Form (liquid, solid, gas)
Alconox	4 oz.	Solid
Gasoline		
Dilute Hydrochloric Acid	<40 mL	Liquid
Methanol		
Dilute Nitric Acid		
Dilute Sulfuric Acid		
Other (specify names)		

Is there a potential for a chemical release beyond an incidental release?
If yes, explain:

Heavy equipment brought on site for work	Check all Applicable
Drill rig	
Geoprobe	
Excavator	
Backhoe	
Front End Loader	
Injection system	
Dump truck	
Generator	
Other (specify)	

If equipment at the facility is to be relied on, list the equipment and location:

Equipment	Location
Forklift	Air side – Will coordinate with Emily

Hazards that apply to work to be performed	Check all applicable	Describe work activities to which it applies
Unknown/Partially Characterized	**X**	Video inspection
Cold Exposure	**X**	Video inspection
Heat Stress	**X**	Video inspection
Explosion*		
Fire		
Toxic Gases		
Oxygen Deficiency*		
Confined Space*		
Ionizing Radiation*		
Chemical Dermal Exposure		
Chemical Inhalation		
Chemical Ingestion		
Dust/air emissions		
Air or steam emissions		

* If this hazard is present, Senior Management must approve the HASP.

Hazards that apply to work to be performed	Check all applicable	Describe work activities to which it applies
Biological Waste (specify)		
Extreme weather, heat	**X**	Video inspection
Stored Energy/Energized Equipment		
Heavy Machinery/Moving Equipment	**X**	Video inspection
Pump Winch		
Slippery Surfaces	**X**	Video inspection
Fall Potential	**X**	Video inspection
Pinch Points		
Flying or Falling Material/Equipment	X	Video inspection
Heavy Lifting		
Crushing		
Repetitive Motion		
Venomous Snakes	X	Video inspection
Poisonous Plants		
Mosquitoes, Ticks or other Biting Insects	**X**	Video inspection
Venomous Spiders		
Wild Animals		
On or Near Water	**X**	Video inspection
Other (specify)		
Aircraft taxing on and off runways; other airport equipment	**X**	Video inspection

Overall Hazard Evaluation for Task

High		**Medium**		**Low**	X	**Unknown**[7]	
Justification:	Video inspection						

Section 8 Risk Control:

(Must address all hazards identified under Sections 5 and 7, both those existing at the site and those associated with the work to be performed)

Task Code: _C_

Public Utilities

Non-intrusive work for this task- No utility call out needed.

Utility	Req.	Company Name	Telephone #
One Call		New York 811	811
Gas:		Con ED	800-752-6633
Electric:		Con Ed	800-752-6633
Water:		White Plains	914-422-1207
Sewer:		Mamaroneck	914-381-7825
Telephone:		Verizon	800-922-0204
Cable:		Verizon	800-922-0204

Markout Ticket Confirmation #	Date
NA	NA

[7] If unknown, treat as high hazard until sufficient information has been developed

Were non-public utility locations on site marked out or otherwise identified on facility? (Y/N) N

If no, identify activity modifications to address unidentified utilities, on-site utility lines, and other buried anomalies:

Buddy System required? (Y/N) N
If yes, describe circumstances:
If no, describe communication contingencies:

If stored energy/energized equipment is present: N
Is LO–TO required? (Y/N)
Specify equipment to be locked out/tagged out:
Follow the LO-TO procedure. List any differences or additions below:

Add photos of equipment subject to LO-TO to back of plan.

If LO-TO is not required, describe actions to ensure stored energy/energized equipment is managed during equipment set up, operation, and demobilization:

Exclusion Zones:
Will exclusion zones be used at the site? (Y/N) N
If yes, indicate zones on the site map.

PPE

Specify primary protective equipment to be worn during this task		Specify applicable activities
Level C		
Level D		
Level D Modified	**X**	No Tyvek; follow protocol in QAPP for sampling; sampling
If PPE beyond Level D is required, consult the Project Manager or Senior Management		

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**
Respiratory			
Respirator (full)			
Respirator (half)		X	
Cartridge type:			
P100			
Combo			
Other			
Dust Mask			
Other (specify)			
Head and Eye			
Safety Glasses	**X**		
Face Shield			
Goggles			
Hard Hat			
Other (specify)			
Hearing			
Ear plugs/muffs			
Dual			
Feet			
Overboots			
Safety-toed Workboots	**X**		

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**
Other (specify)			
Hands			
Nitrile Gloves	X		
Overgloves			
Other (specify)			
Body			
Tyvek Coverall			
Polycoated Tyvek			
Cold Weather Gear (Carhart)			
Rain Gear		X	Bad weather
Safety Vest	X		
U.S. Coast Guard-approved life jacket or buoyant work vest			
Other (specify)			
Other (specify)			
COVID-19 related precautions	X		See Attachment A

Other Equipment and Supplies:

Lighting	
Potable Water	
Insect Repellent	
Fire Extinguisher (2.5 lb)	X
Fire Extinguisher (5 lb)	
Fire Extinguisher (10 lb)	
Eyewash Kit	
Spill Kit	X
First Aid Kit	X
Ring Buoys	
Lifesaving Skiff	
Portable Toilet	
Other (specify):	

Operational Control Procedures and Work Instructions: (Attach procedures to back of HASP)

Decontamination Procedures:
Follow the Field Decontamination Procedure. List any differences or additions below.

Discharge Control Measures (Y/N) N
If yes describe Discharge Control Measures:

Waste Disposal Practices:
Specify Waste Management Practices:

Waste Type	Sample	Containerize	Dispose of off Site	Return to Site	Dispose in FE Solid Waste
Drill Cuttings					
Purge Water					
Soil					

Waste Type	Sample	Containerize	Dispose of off Site	Return to Site	Dispose in FE Solid Waste
PPE and other field related waste					**X**
Other (Specify)					

Additional waste handling instructions:

Other instructions:

General Safe Work Practices:
To ensure the safety of First Environment personnel and the public at a site where fieldwork is being conducted, the Safe Work Practices listed below will be followed.

- Good housekeeping practices are to be maintained.
- A "buddy system" in which another worker is close enough to render immediate aid will be in effect when specified in the HASP.
- In the event of treacherous weather-related working conditions field tasks will be suspended until conditions improve or appropriate protection from the elements is provided.
- Smoking, eating, chewing gum or tobacco, or drinking are forbidden except in clean or designated area.
- Ignition of flammable liquids within or through improvised heating devices is forbidden.
- Contact with samples, excavated materials, or other contaminated materials must be minimized.
- Use of contact lenses is not advisable.
- If drilling equipment is involved, know where the 'kill switch' is.
- All electrical equipment used in outside locations, wet area or near water must be plugged into ground fault circuit interrupter protected outlets.
- Illumination - Work in the early morning or at dusk may require site lighting.

List any differences or additions below:

Emergency Preparedness: (Attach procedures to back of HASP)

Field Emergency Response:
Follow the Field Emergency Response Procedure. List any differences or additions below

Spill Response:
Follow the Field Spill Response Procedure. List any differences or additions below.

Is a stand-by external emergency response contractor required? (Y/N) If yes, explain: N

: Contractor:	Date Contacted:	Contacted by:

Section 6: Work (Task) Description

If multiple tasks with different hazard profiles and risk controls are planned or as tasks are added , copy Sections 6, 7, and 8 and fill out for each task to identify task related hazards and appropriate controls.

Task Code: _D_ (see cover page)

Tasks to be performed by First Environment

Describe Tasks: Modify Storm Sewer

Work Plan attached to HASP or provide separately? Separately

Describe roles and responsibilities personnel will perform: Oversite of operations, direction of excavation and modifications

Tasks to be performed by First Environment contractors[8]

Task:	Excavation and modification of storm sewers	Subcontract Type (place x beneath type of agreement	
		MSA	Individual
			x
Contractor:	Spiniello	Effective Dates;	Effective Dates:6/3/2019

Confirm all subcontracts covering tasks to be performed by subcontractors are in place, cover the work to be performed, and are for the time period of the work. Attach to back of HASP.

Section 7: FE Work Hazard Assessment

Task Code: __D__

All chemicals to be brought on site for work	Approximate Amount	Form (liquid, solid, gas)
Alconox	4 oz.	Solid
Gasoline		
Dilute Hydrochloric Acid	<40 mL	Liquid
Methanol		
Dilute Nitric Acid		
Dilute Sulfuric Acid		
Other (specify names)		

Is there a potential for a chemical release beyond an incidental release?
If yes, explain:

Heavy equipment brought on site for work	Check all Applicable
Drill rig	
Geoprobe	
Excavator	
Backhoe	**X**
Front End Loader	
Injection system	
Dump truck	**X**
Generator	
Other (specify)	

[8] Site characteristics to the best of First Environment's knowledge are included in this HASP. Per the subcontractor agreement, each subcontractor must assess hazards associated with their site work and have a site- specific health and safety plan covering their work on site.

If equipment at the facility is to be relied on, list the equipment and location:

Equipment	Location

Hazards that apply to work to be performed	Check all applicable	Describe work activities to which it applies
Unknown/Partially Characterized	**X**	Sewer Modification
Cold Exposure	**X**	Sewer Modification
Heat Stress	**X**	Sewer Modification
Explosion*		
Fire		
Toxic Gases		
Oxygen Deficiency*		
Confined Space*		
Ionizing Radiation*		
Chemical Dermal Exposure		
Chemical Inhalation		
Chemical Ingestion		
Dust/air emissions	X	Sewer Modification
Air or steam emissions		
Biological Waste (specify)		
Extreme weather, heat	**X**	Sewer Modification
Stored Energy/Energized Equipment		
Heavy Machinery/Moving Equipment	**X**	Sewer Modification
Pump Winch		
Slippery Surfaces	**X**	Sewer Modification
Fall Potential		
Pinch Points		
Flying or Falling Material/Equipment	X	Sewer Modification
Heavy Lifting		
Crushing	X	Sewer Modification
Repetitive Motion		
Venomous Snakes	X	Sewer Modification
Poisonous Plants		
Mosquitoes, Ticks or other Biting Insects	**X**	Sewer Modification
Venomous Spiders		
Wild Animals		
On or Near Water	**X**	Sewer Modification
Other (specify)		
Aircraft taxing on and off runways; other airport equipment	**X**	Sewer Modification

Overall Hazard Evaluation for Task

High		**Medium**		**Low**	X	**Unknown**[9]	
Justification:	Sample collection						

* If this hazard is present, Senior Management must approve the HASP.

[9] If unknown, treat as high hazard until sufficient information has been developed

Section 8 Risk Control:

(Must address all hazards identified under Sections 5 and 7, both those existing at the site and those associated with the work to be performed)

Task Code: D

Public Utilities

Utility Markout

Utility	Req.	Company Name	Telephone #
One Call		New York 811	811
Gas:		Con ED	800-752-6633
Electric:		Con Ed	800-752-6633
Water:		White Plains	914-422-1207
Sewer:		Mamaroneck	914-381-7825
Telephone:		Verizon	800-922-0204
Cable:		Verizon	800-922-0204

Markout Ticket Confirmation #	Date
NA	NA

Were non-public utility locations on site marked out or otherwise identified on facility? (Y/N) N

If no, identify activity modifications to address unidentified utilities, on-site utility lines, and other buried anomalies:
In areas needing modification, GPR as well as referencing site as builts will mitigate risk of buried utilities during excavation activities.

Buddy System required? (Y/N) N
If yes, describe circumstances:
If no, describe communication contingencies:

If stored energy/energized equipment is present: N
Is LO–TO required? (Y/N)
Specify equipment to be locked out/tagged out:
Follow the LO-TO procedure. List any differences or additions below:

Add photos of equipment subject to LO-TO to back of plan.

If LO-TO is not required, describe actions to ensure stored energy/energized equipment is managed during equipment set up, operation, and demobilization:

Exclusion Zones:
Will exclusion zones be used at the site? (Y/N) N
If yes, indicate zones on the site map.

PPE

Specify primary protective equipment to be worn during this task		Specify applicable activities
Level C		
Level D		
Level D Modified	X	No Tyvek; follow protocol in QAPP for sampling; sampling
If PPE beyond Level D is required, consult the Project Manager or Senior Management		

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**
Respiratory			
Respirator (full)			
Respirator (half)		X	
Cartridge type:			
P100			
Combo			
Other			
Dust Mask			
Other (specify)			
Head and Eye			
Safety Glasses	**X**		
Face Shield			
Goggles			
Hard Hat	**X**		
Other (specify)			
Hearing			
Ear plugs/muffs	**X**		
Dual			
Feet			
Overboots			
Safety-toed Workboots	**X**		
Other (specify)			
Hands			
Nitrile Gloves	**X**		
Overgloves			
Other (specify)			
Body			
Tyvek Coverall			
Polycoated Tyvek			
Cold Weather Gear (Carhart)			
Rain Gear		**X**	No PFAS containing clothing to be used
Safety Vest	**X**		
U.S. Coast Guard-approved life jacket or buoyant work vest			
Other (specify)			
Other (specify)			
COVID-19 related precautions	**X**		See Attachment A

Other Equipment and Supplies:

Lighting	
Potable Water	
Insect Repellent	
Fire Extinguisher (2.5 lb)	**X**
Fire Extinguisher (5 lb)	
Fire Extinguisher (10 lb)	
Eyewash Kit	

Spill Kit	**X**
First Aid Kit	**X**
Ring Buoys	
Lifesaving Skiff	
Portable Toilet	
Other (specify):	

Operational Control Procedures and Work Instructions: (Attach procedures to back of HASP)

Decontamination Procedures:
Follow the Field Decontamination Procedure. List any differences or additions below.

Discharge Control Measures (Y/N) N
If yes describe Discharge Control Measures:

Waste Disposal Practices:
Specify Waste Management Practices:

Waste Type	Sample	Containerize	Dispose of off Site	Return to Site	Dispose in FE Solid Waste
Drill Cuttings					
Purge Water					
Soil		**x**		**X**	
PPE and other field related waste					**X**
Other (Specify)					

Additional waste handling instructions:

Other instructions:

General Safe Work Practices:
To ensure the safety of First Environment personnel and the public at a site where fieldwork is being conducted, the Safe Work Practices listed below will be followed.

- Good housekeeping practices are to be maintained.
- A "buddy system" in which another worker is close enough to render immediate aid will be in effect when specified in the HASP.
- In the event of treacherous weather-related working conditions field tasks will be suspended until conditions improve or appropriate protection from the elements is provided.
- Smoking, eating, chewing gum or tobacco, or drinking are forbidden except in clean or designated area.
- Ignition of flammable liquids within or through improvised heating devices is forbidden.
- Contact with samples, excavated materials, or other contaminated materials must be minimized.
- Use of contact lenses is not advisable.
- If drilling equipment is involved, know where the 'kill switch' is.
- All electrical equipment used in outside locations, wet area or near water must be plugged into ground fault circuit interrupter protected outlets.
- Illumination - Work in the early morning or at dusk may require site lighting.

List any differences or additions below:

Emergency Preparedness: (Attach procedures to back of HASP)

Field Emergency Response:
Follow the Field Emergency Response Procedure. List any differences or additions below

Spill Response:
Follow the Field Spill Response Procedure. List any differences or additions below.

Is a stand-by external emergency response contractor required? (Y/N) If yes, explain: N

: Contractor:	Date Contacted:	Contacted by:

Section 6: Work (Task) Description

If multiple tasks with different hazard profiles and risk controls are planned or as tasks are added , copy Sections 6, 7, and 8 and fill out for each task to identify task related hazards and appropriate controls.

Task Code: _E_ (see cover page)

Tasks to be performed by First Environment

Describe Tasks: Site Inspection/Collect Soil, sediment, groundwater & surface water sample collection

Work Plan attached to HASP or provide separately? Separately

Describe roles and responsibilities personnel will perform: Collect soil, sediment, groundwater & surface water samples

Tasks to be performed by First Environment contractors[10]

Task:	PlumeStop/Application at OF-4	Subcontract Type (place x beneath type of agreement	
		MSA	Individual
			X
Contractor:	Spinello	Effective Dates:	Effective Dates: 6/3/2019

Task:	Subsurface injections of PlumeStop	Subcontract Type (place x beneath type of agreement	
		MSA	Individual
			x
Contractor:		Effective Dates;	Effective Dates:6/3/2019

Confirm all subcontracts covering tasks to be performed by subcontractors are in place, cover the work to be performed, and are for the time period of the work. Attach to back of HASP.

Section 7: FE Work Hazard Assessment

Task Code: __E__

All chemicals to be brought on site for work	Approximate Amount	Form (liquid, solid, gas)
Alconox	4 oz.	Solid
Gasoline		
Dilute Hydrochloric Acid	<40 mL	Liquid
Methanol		

[10] Site characteristics to the best of First Environment's knowledge are included in this HASP. Per the subcontractor agreement, each subcontractor must assess hazards associated with their site work and have a site- specific health and safety plan covering their work on site.

Dilute Nitric Acid		
Dilute Sulfuric Acid		
Other (specify names)		

Is there a potential for a chemical release beyond an incidental release?
If yes, explain:

Heavy equipment brought on site for work	Check all Applicable
Drill rig	
Geoprobe	
Excavator	
Backhoe	
Front End Loader	
Injection system	**X**
Dump truck	
Generator	X
Other (specify)	

If equipment at the facility is to be relied on, list the equipment and location:

Equipment	Location

Hazards that apply to work to be performed	Check all applicable	Describe work activities to which it applies
Unknown/Partially Characterized	**X**	PlumeStop/Application
Cold Exposure	**X**	PlumeStop/Application
Heat Stress	**X**	PlumeStop/Application
Explosion*		
Fire		
Toxic Gases		
Oxygen Deficiency*		
Confined Space*		
Ionizing Radiation*		
Chemical Dermal Exposure		
Chemical Inhalation		
Chemical Ingestion		
Dust/air emissions		
Air or steam emissions		
Biological Waste (specify)		
Extreme weather, heat	**X**	PlumeStop/Application
Stored Energy/Energized Equipment		
Heavy Machinery/Moving Equipment	**X**	PlumeStop/Application
Pump Winch		

* If this hazard is present, Senior Management must approve the HASP.

Hazards that apply to work to be performed	Check all applicable	Describe work activities to which it applies
Slippery Surfaces	**X**	PlumeStop/Application
Fall Potential		
Pinch Points		
Flying or Falling Material/Equipment	X	PlumeStop/Application
Heavy Lifting		
Crushing		
Repetitive Motion		
Venomous Snakes	X	PlumeStop/Application
Poisonous Plants	X	PlumeStop/Application
Mosquitoes, Ticks or other Biting Insects	**X**	PlumeStop/Application
Venomous Spiders		
Wild Animals		
On or Near Water	**X**	PlumeStop/Application
Other (specify)		
Aircraft taxing on and off runways; other airport equipment	**X**	PlumeStop/Application

Overall Hazard Evaluation for Task

High		**Medium**		**Low**	X	**Unknown**[11]	
Justification:	PlumeStop/Application						

Section 8 Risk Control:

(Must address all hazards identified under Sections 5 and 7, both those existing at the site and those associated with the work to be performed)

Task Code: E

Public Utilities

Utility Markout

Utility	Req.	Company Name	Telephone #
One Call		New York 811	811
Gas:		Con ED	800-752-6633
Electric:		Con Ed	800-752-6633
Water:		White Plains	914-422-1207
Sewer:		Mamaroneck	914-381-7825
Telephone:		Verizon	800-922-0204
Cable:		Verizon	800-922-0204

Markout Ticket Confirmation #	Date
NA	NA

Were non-public utility locations on site marked out or otherwise identified on facility? (Y/N) N

If no, identify activity modifications to address unidentified utilities, on-site utility lines, and other buried anomalies:

Buddy System required? (Y/N) N
If yes, describe circumstances:
If no, describe communication contingencies:

[11] If unknown, treat as high hazard until sufficient information has been developed

If stored energy/energized equipment is present: N
Is LO–TO required? (Y/N)
Specify equipment to be locked out/tagged out:
Follow the LO-TO procedure. List any differences or additions below:

Add photos of equipment subject to LO-TO to back of plan.

If LO-TO is not required, describe actions to ensure stored energy/energized equipment is managed during equipment set up, operation, and demobilization:

Exclusion Zones:
Will exclusion zones be used at the site? (Y/N) N
If yes, indicate zones on the site map.

PPE

Specify primary protective equipment to be worn during this task		Specify applicable activities
Level C		
Level D		
Level D Modified	**X**	No Tyvek; follow protocol in QAPP for sampling; sampling
If PPE beyond Level D is required, consult the Project Manager or Senior Management		

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**
Respiratory			
Respirator (full)			
Respirator (half)		X	
Cartridge type:			
P100			
Combo			
Other			
Dust Mask			
Other (specify)			
Head and Eye			
Safety Glasses	**X**		
Face Shield			
Goggles			
Hard Hat			
Other (specify)			
Hearing			
Ear plugs/muffs			
Dual			
Feet			
Overboots			
Safety-toed Workboots	**X**		
Other (specify)			
Hands			
Nitrile Gloves	**X**		
Overgloves			
Other (specify)			
Body			

PPE Equipment	Primary	Contingency**	Trigger for Contingency Requirements**
Tyvek Coverall			
Polycoated Tyvek			
Cold Weather Gear (Carhart)			
Rain Gear		**X**	No PFAS
Safety Vest	**X**		
U.S. Coast Guard-approved life jacket or buoyant work vest			
Other (specify)			
Other (specify)			
COVID-19 related precautions	**X**		See Attachment A

Other Equipment and Supplies:

Lighting	
Potable Water	
Insect Repellent	
Fire Extinguisher (2.5 lb)	**X**
Fire Extinguisher (5 lb)	
Fire Extinguisher (10 lb)	
Eyewash Kit	
Spill Kit	**X**
First Aid Kit	**X**
Ring Buoys	
Lifesaving Skiff	
Portable Toilet	
Other (specify):	

Operational Control Procedures and Work Instructions: (Attach procedures to back of HASP)

Decontamination Procedures:
Follow the Field Decontamination Procedure. List any differences or additions below.

Discharge Control Measures (Y/N) N
If yes describe Discharge Control Measures:

Waste Disposal Practices:
Specify Waste Management Practices:

Waste Type	Sample	Containerize	Dispose of off Site	Return to Site	Dispose in FE Solid Waste
Drill Cuttings					
Purge Water		X		**X**	
Soil		**X**		**X**	
PPE and other field related waste					**X**
Other (Specify)					

Additional waste handling instructions:

Other instructions:

General Safe Work Practices:
To ensure the safety of First Environment personnel and the public at a site where fieldwork is being conducted, the Safe Work Practices listed below will be followed.

- Good housekeeping practices are to be maintained.
- A "buddy system" in which another worker is close enough to render immediate aid will be in effect when specified in the HASP.
- In the event of treacherous weather-related working conditions field tasks will be suspended until conditions improve or appropriate protection from the elements is provided.
- Smoking, eating, chewing gum or tobacco, or drinking are forbidden except in clean or designated area.
- Ignition of flammable liquids within or through improvised heating devices is forbidden.
- Contact with samples, excavated materials, or other contaminated materials must be minimized.
- Use of contact lenses is not advisable.
- If drilling equipment is involved, know where the 'kill switch' is.
- All electrical equipment used in outside locations, wet area or near water must be plugged into ground fault circuit interrupter protected outlets.
- Illumination - Work in the early morning or at dusk may require site lighting.

List any differences or additions below:

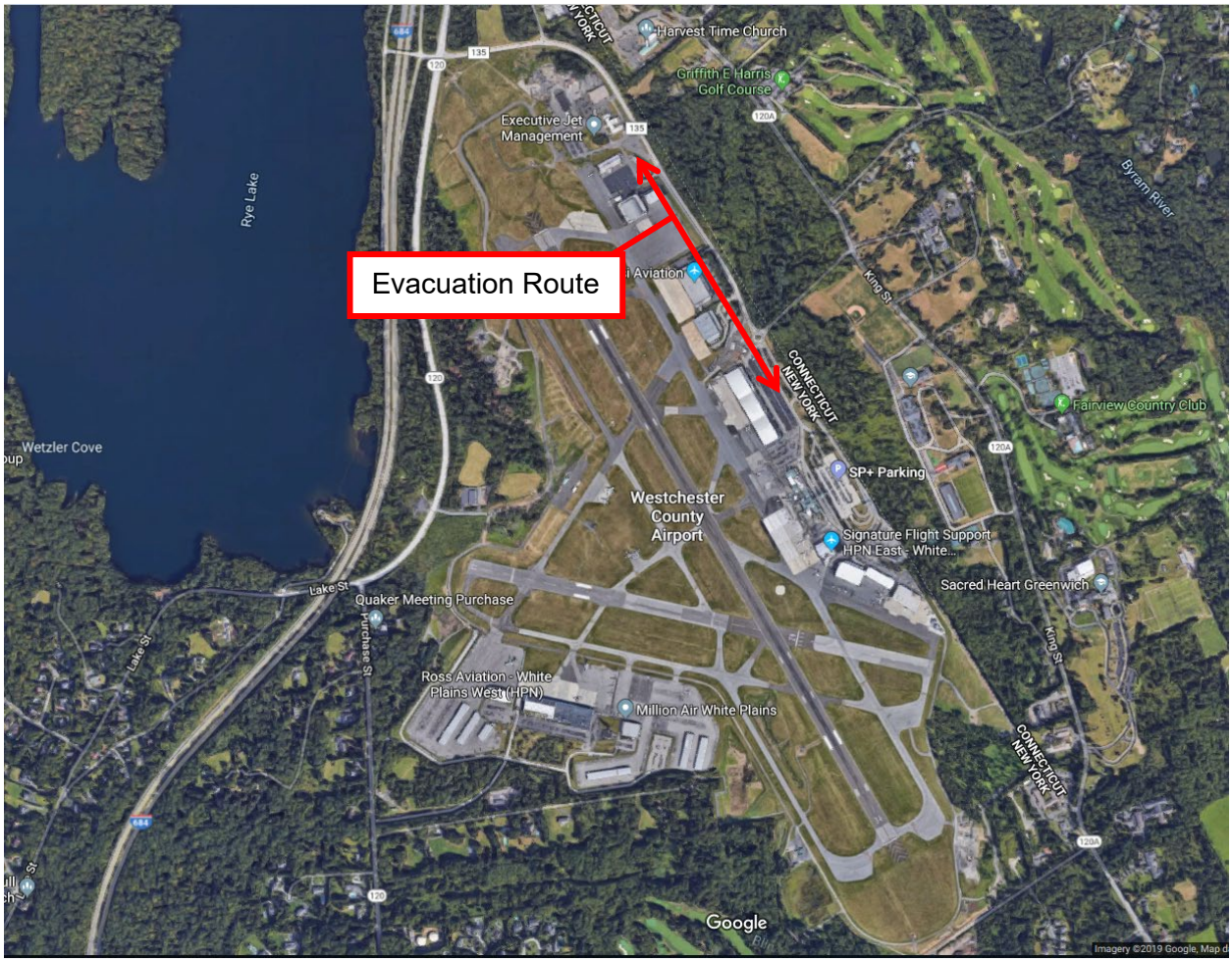
Emergency Preparedness: (Attach procedures to back of HASP)

Field Emergency Response:
Follow the Field Emergency Response Procedure. List any differences or additions below

Spill Response:
Follow the Field Spill Response Procedure. List any differences or additions below.

Is a stand-by external emergency response contractor required? (Y/N) If yes, explain: N

: Contractor:	Date Contacted:	Contacted by:



In the event of an injury, incident or release, notify the PM, senior management, and HR as soon as safe to do so.

H&S Monitoring and Measurement:

H&S field monitoring required? Y/N Y

If so, follow the Health and Safety Monitoring Table below.

Type of Meter/Monitoring	Monitors	Check if to be Used	Surveillance Methodology (select one)		Monitoring Locations	Guidance Action Levels*	Site Action Levels**
			Determined by FTL Based on Site Conditions	Specified Frequency			
Photoionization Detector (PID) 9.8eV 10.2eV 10.6 eV 11.7eV Dust Monitoring	Total Volatile Organics levels Fugitive dust					5 ppm above background - evacuate and notify 100 mg/m^3, above background, halt activity, suppress dust. 9.8eV 10.2eV 10.6 eV 11.7eV Dust Monitoring	Photoionization Detector (PID)
Flame Ionization Detector (FID)	Total Volatile Organics levels					5 ppm above background - evacuate and notify	
Multi-gas meters Oxygen Combustible Gas CO H2S Other Gas (Specify)	 Oxygen levels LEL Toxic gas levels Toxic gas levels					 < 21% - notify < 19.5% - evacuate 10-20% - notify >20% - evacuate >9 ppm – notify >10 ppm – notify	
Other equipment (specify)							

* For notify action levels, move off worksite and contact PM to take corrective action or upgrade PPE. For evacuation, move off worksite and contact PM for further instructions.
**If site levels are different from guidance levels specify reason:

Heat and cold monitoring required: (Y/N) Y

If required, follow precautions in attached heat and cold guides.

Corrective/Preventive Action

In the event that corrective action becomes necessary and is taken in the field or a necessary preventive action is identified, the Field Team must ensure the notification of the PM so that appropriate modifications can be made to the HASP and fieldwork activities. In the event that a corrective or preventive action has application beyond the

immediate project and work being performed or in the event of an incident or accident, a PCAN must be filed by the PM or Field Team Leader.

Audits

As part of First Environment's Management System, the HASP and its implementation are subject to internal audit and audit by our third party auditor. Findings are addressed through the PCAN Process.

Section 10: Plan Approval

The HASP must be reapproved for each new task and when a task in the HASP is revised. Minor revisions in the field may be made by the FTL. The FTL make changes, initials the changes, and documents the specifics on the last page of this HASP. Changes are cleared with the Project Manager who ensures others are consulted as necessary.

In signing this plan, the signatories are confirming to the best of their knowledge the accuracy, adequacy, and suitability of the plan to address the H&S risks associated with the planned work.

HASP Initial Tasks

Complete each time a new task is added to the HASP

TASK __A__

Plan Prepared by:	Philip Cicolello	Date:	6/3/2019
Plan Reviewed/Approved by:	Thomas C. Bambrick	Date:	6/30/2020
Project Manager:	David H. F. Luer	Date:	09/27/2019

TASK __B__

Plan Prepared by:	Philip Cicolello	Date:	6/3/2019
Plan Reviewed/Approved by:	Thomas C. Bambrick	Date:	6/30/2020
Project Manager:	David H. F. Luer	Date:	09/27/2019

TASK __C__

Plan Prepared by:	David Luer	Date:	9/9/19
Plan Reviewed/Approved by:	Scott R. Green	Date:	7/1/2020
Project Manager:	David H. F. Luer	Date:	09/27/19

TASK _D___

Plan Prepared by:	David Luer	Date:	9/9/19
Plan Reviewed/Approved by:	Scott R. Green	Date:	7/20/2020
Project Manager:	David H. F. Luer	Date:	09/27/19

Add additional tasks as required.

HASP Task Revisions

Complete if the HASP is revised for a particular Task or Tasks.

TASK _E_

Plan Revised by:	David H. F. Luer	Date:	9/9/19
Revision Reviewed/Approved by:	Scott R. Green	Date:	7/1/2020
Project Manager:	David H. F. Luer	Date:	09/27/19

TASK _ALL___

Plan Revised by:	David H. F. Luer	Date:	6/25/2020
Revision Reviewed/Approved by:	Scott R. Green	Date:	7/1/2020
Project Manager:	David H. F. Luer	Date:	6/25/2020

TASK _____

Plan Revised by:		Date:	
Revision Reviewed/Approved by:		Date:	
Project Manager:		Date:	

TASK _____

Plan Revised by:		Date:	
Revision Reviewed/Approved by:		Date:	
Project Manager:		Date:	

Add additional tasks as required

Section 11: FE Field Personnel Acknowledgement

First Environment employees assigned to work on site have attended 40-hour HAZWOPER training and annual refreshers, as applicable, per 29 CFR 1910.120, and have been certified medically fit by a qualified occupational physician to work on hazardous sites and to wear a respirator. Medical and training records are maintained by Human Resources.

By signing below, First Environment employees acknowledge that they:

- Have participated in the morning meeting and been briefed on work to be performed and site H&S.
- Have read and understand this Site HASP.
- Have raised and had adequately answered any questions about the HASP and site H&S (all employees are authorized to raise health and safety concerns through the leadership chain and HR if required before beginning or continuing work).
- Meet the training and medical fitness requirements.
- Understand the process of continual improvement and will use the PCAN process.
- Agree to notify the field team leader of any unsafe conditions in the field as soon as they are observed or encountered.

	Name	Responsibilities	Site Task/#	Signature	Date
1		FTL / FT / FHSO			
2		FTL / FT / FHSO			
3		FTL / FT / FHSO			
4		FTL / FT / FHSO			
5		FTL / FT / FHSO			
6		FTL / FT / FHSO			
7		FTL / FT / FHSO			
8		FTL / FT / FHSO			
9		FTL / FT / FHSO			
10		FTL / FT / FHSO			
11		FTL / FT / FHSO			

	Name	Responsibilities	Site Task/#	Signature	Date
12		FTL / FT / FHSO			
13		FTL / FT / FHSO			
14		FTL / FT / FHSO			
15		FTL / FT / FHSO			
16		FTL / FT / FHSO			
17		FTL / FT / FHSO			
18		FTL / FT / FHSO			
19		FTL / FT / FHSO			
20		FTL / FT / FHSO			
21		FTL / FT / FHSO			
22		FTL / FT / FHSO			
23		FTL / FT / FHSO			
24		FTL / FT / FHSO			
25		FTL / FT / FHSO			
26		FTL / FT / FHSO			
27		FTL / FT / FHSO			
28		FTL / FT / FHSO			
29		FTL / FT / FHSO			
30		FTL / FT / FHSO			

	Name	Responsibilities	Site Task/#	Signature	Date
31		FTL / FT / FHSO			
32		FTL / FT / FHSO			
33		FTL / FT / FHSO			
34		FTL / FT / FHSO			
35		FTL / FT / FHSO			
36		FTL / FT / FHSO			
37		FTL / FT / FHSO			
38		FTL / FT / FHSO			
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41		FTL / FT / FHSO			
42		FTL / FT / FHSO			
43		FTL / FT / FHSO			
44		FTL / FT / FHSO			
45		FTL / FT / FHSO			
46		FTL / FT / FHSO			
47		FTL / FT / FHSO			
48		FTL / FT / FHSO			

Complete for each day contractor is on site.

Contractor	Responsibilities	Date	Contractor Provided FE Safety Guide[12]	Subcontract on site and correct for tasks to be performed (Y/N)	Contractor HASP on Site (Y/N)[13]	Contractor Participated in Morning Meeting (Y/N)	Describe Corrective Action taken in case of deficiencies. Contractor work cannot proceed until deficiencies are addressed.	Signature FE Field Team Leader

[12] Subcontractor has received our Guide for Subcontractors and Vendors and has signed the Read and Acknowledge Form
[13] Subcontractor is using HASP onsite and has reviewed it with employees

Contractor	Responsibilities	Date	Contractor Provided FE Safety Guide[12]	Subcontract on site and correct for tasks to be performed (Y/N)	Contractor HASP on Site (Y/N)[13]	Contractor Participated in Morning Meeting (Y/N)	Describe Corrective Action taken in case of deficiencies. Contractor work cannot proceed until deficiencies are addressed.	Signature FE Field Team Leader

Contractor	Responsibilities	Date	Contractor Provided FE Safety Guide[12]	Subcontract on site and correct for tasks to be performed (Y/N)	Contractor HASP on Site (Y/N)[13]	Contractor Participated in Morning Meeting (Y/N)	Describe Corrective Action taken in case of deficiencies. Contractor work cannot proceed until deficiencies are addressed.	Signature FE Field Team Leader

If review of the plan at the site indicates changes to the HASP are necessary, provide the specifics below (Make changes in the HASP and initial the changes). Notify Project Manager after occurrence for minor changes. Clear major changes with Project Manager prior to performing work.

Date: _____ FTL: _____

Section 12 Attach current versions of Safety Data Sheets and procedures relevant to site work

Material Safety Data Sheet

1,4-Dioxane

MSDS# 26970

Section 1 - Chemical Product and Company Identification

MSDS Name:	1,4-Dioxane
Catalog Numbers:	AC117110000, AC117110010, AC117110025, AC117110050, AC117110250, AC167800000 AC167800000, AC167800010, AC167800025, AC167805000, AC268340000, AC268340010 AC268340010, AC268340025, AC270490000, AC270490010, AC270490025, AC270492500 AC270492500, AC326890000, AC326890010, AC326891000, AC326892500, AC364340000 AC364340000, AC364340010, AC364341000, AC408820000, AC408820010, AC61033019, AC61033019 AC61033019, AC61033050, AC61033050, AC61033115, AC61033115, AC61033200, AC61033200 AC61033200, 40882-5000, 61033-1000, 61512-0010, 61512-1000, BP2611-100, D111-4, D111-4LC, D111-500, D116-200, D116-4, D117-1, D117RS-19, D117RS-200, D117RS-50, D56S-4, NC9734646
Synonyms:	Diox; Diethylene dioxide; OptiDry.

Company Identification:	Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410
For information in the US, call:	201-796-7100
Emergency Number US:	201-796-7100
CHEMTREC Phone Number, US:	800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#:	123-91-1
Chemical Name:	1,4-Dioxane
%:	97+
EINECS#:	204-661-8

Hazard Symbols: XN F

Risk Phrases: 11 19 36/37 40 66

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Danger! May form explosive peroxides. Flammable liquid and vapor. Causes eye, skin, and respiratory tract irritation. Repeated exposure may cause skin dryness or cracking. Possible cancer hazard. May cause cancer based on animal data. Target Organs: Kidneys, central nervous system, liver, respiratory system, eyes, skin.

Potential Health Effects

Eye:	Causes eye irritation.
Skin:	May cause skin irritation. Causes skin irritation. May be harmful if absorbed through the skin. Repeated or prolonged exposure may cause drying and cracking of the skin.
Ingestion:	May cause irritation of the digestive tract. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. May be harmful if swallowed.
	Inhalation of high concentrations may cause central nervous system effects characterized by nausea, headache,

Inhalation: dizziness, unconsciousness and coma. Causes respiratory tract irritation. May cause liver and kidney damage. May be harmful if inhaled.

Chronic: Possible cancer hazard based on tests with laboratory animals. May cause liver and kidney damage. Adverse reproductive effects have been reported in animals. Laboratory experiments have resulted in mutagenic effects. Chronic exposure may cause blood effects. Exposure to high concentrations may cause central nervous system depression. Animal studies have reported the development of tumors.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion: Do not induce vomiting. Get medical aid.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. Will burn if involved in a fire. Flammable liquid and vapor. May form explosive peroxides.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or alcohol-resistant foam.

Autoignition Temperature: 180 deg C (356.00 deg F)

Flash Point: 12 deg C (53.60 deg F)

Explosion Limits: Lower: 2 vol %

Explosion Limits: Upper: 22 vol %

NFPA Rating: health: 2; flammability: 3; instability: 3;

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Remove all sources of ignition. Use a spark-proof tool. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

Handling: Use spark-proof tools and explosion proof equipment. Do not get in eyes, on skin, or on clothing. Take precautionary measures against static discharges. Keep away from heat, sparks and flame. Do not ingest or inhale. Use only in a chemical fume hood. If peroxide formation is suspected, do not open or move container. Do not distill to dryness. Test for peroxide formation before distillation.

Storage: Keep away from sources of ignition. Store in a tightly closed container. Store in a dry area. Flammables-area. Regularly check inhibitor levels to maintain peroxide levels below 1%. After opening, purge container with nitrogen before reclosing. Periodically test for peroxide formation on long-term storage. Addition of water or appropriate reducing materials will lessen peroxide formation. Store under nitrogen. Containers should be dated when opened and tested periodically for the presence of peroxides. Should crystals form in a peroxidizable liquid, peroxidation may have occurred and the product should be considered extremely dangerous. In this instance, the container should only be opened remotely by professionals. May form explosive peroxides on prolonged storage.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs

1,4-Dioxane	20 ppm; Skin - potential significant contribution to overall exposure by the cutaneous r oute	500 ppm IDLH	100 ppm TWA; 360 mg/m3 TWA

OSHA Vacated PELs: 1,4-Dioxane: 25 ppm TWA; 90 mg/m3 TWA

Engineering Controls:

Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Color: clear, colorless - APHA: 15 max

Odor: ethereal odor

pH: 6 - 8 (500 g/L aq.sol.)

Vapor Pressure: 41 mbar @ 20 deg C

Vapor Density: Not available

Evaporation Rate: Not available

Viscosity: 1.54 cPa @ 20 deg C

Boiling Point: 101 deg C @ 760 mmHg (213.80°F)

Freezing/Melting Point: 12 deg C (53.60°F)

Decomposition Temperature: Not available

Solubility in water: Soluble

Specific Gravity/Density: 1.030

Molecular Formula: C4H8O2

Molecular Weight: 88.11

Section 10 - Stability and Reactivity

Chemical Stability: May form explosive peroxides. Moisture sensitive.

Conditions to Avoid: Incompatible materials, light, ignition sources, excess heat, exposure to moist air or water, electrical sparks.

Incompatibilities with Other Materials: Strong oxidizing agents, reducing agents, halogens, silver perchlorate, oxygen.

Hazardous Decomposition Products: Carbon monoxide, carbon monoxide, carbon dioxide.

Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#: CAS# 123-91-1: JG8225000

RTECS:

CAS# 123-91-1: Draize test, rabbit, eye: 100 mg Severe;
Draize test, rabbit, eye: 100 mg/24H Moderate;
Inhalation, mouse: LC50 = 37 gm/m3/2H;
Inhalation, rat: LC50 = 46 gm/m3/2H;

LD50/LC50:
Oral, mouse: LD50 = 5300 mg/kg;
Oral, rabbit: LD50 = 2 gm/kg;
Oral, rat: LD50 = 4200 mg/kg;
Skin, rabbit: LD50 = 7600 uL/kg;
.

Carcinogenicity: 1,4-Dioxane - ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
California: carcinogen, initial date 1/1/88 NTP: Suspect carcinogen IARC: Group 2B carcinogen

Other: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: LC50 = >10,000mg/L; 96 Hr.; Static conditions, 23 degrees C
Water flea Daphnia: EC50 =163 mg/L; 48 Hr.; Static Condition, 20-21 degrees C

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT
Shipping Name: DIOXANE
Hazard Class: 3
UN Number: UN1165
Packing Group: II
Canada TDG
Shipping Name: DIOXANE
Hazard Class: 3
UN Number: UN1165
Packing Group: II

USA RQ: CAS# 123-91-1: 100 lb final RQ; 45.4 kg final RQ

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN F

Risk Phrases:

R 11 Highly flammable.

R 19 May form explosive peroxides.

R 36/37 Irritating to eyes and respiratory system.

R 40 Limited evidence of a carcinogenic effect.

R 66 Repeated exposure may cause skin dryness or cracking.

Safety Phrases:

S 9 Keep container in a well-ventilated place.

S 16 Keep away from sources of ignition - No smoking.

S 36/37 Wear suitable protective clothing and gloves.

S 46 If swallowed, seek medical advice immediately and show this container or label.

WGK (Water Danger/Protection)

CAS# 123-91-1: 2

Canada

CAS# 123-91-1 is listed on Canada's DSL List

Canadian WHMIS Classifications: B2, D2A, D2B, F

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 123-91-1 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

CAS# 123-91-1 is listed on the TSCA Inventory.

Section 16 - Other Information

MSDS Creation Date: 6/16/1999

Revision #10 Date 7/20/2009

SAFETY DATA SHEET

Creation Date 04-Feb-2010 **Revision Date** 18-Jan-2018 **Revision Number** 6

1. Identification

Product Name **1,2-Dichloroethane**

Cat No. : **E175-4; E175-20; E175-500; E175RS-19; E175RS-50; E190-4**

CAS-No 107-06-2
Synonyms Ethylene dichloride; Ethylene chloride (Certified ACS/Spectranalyzed)

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 3
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system, Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Harmful if swallowed
Causes skin irritation
Causes serious eye irritation

Toxic if inhaled
May cause respiratory irritation
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Wear eye/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician
Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Ethylene dichloride	107-06-2	>95

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms and effects Breathing difficulties. May cause cardiac arrhythmia. May cause central nervous system depression: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.

Unsuitable Extinguishing Media Water may be ineffective

Flash Point 13 °C / 55.4 °F

Method - No information available

Autoignition Temperature 440 °C / 824 °F

Explosion Limits

Upper 15.9 vol %
Lower 6.2 vol %
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Keep product and empty container away from heat and sources of ignition. Thermal decomposition can lead to release of irritating gases and vapors.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2) Hydrogen chloride gas Phosgene
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
3	3	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Remove all sources of ignition. Take precautionary measures against static discharges.

Environmental Precautions Should not be released into the environment. See Section 12 for additional ecological information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not ingest. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Take precautionary measures against static discharges.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Ethylene dichloride	TWA: 10 ppm	(Vacated) TWA: 1 ppm (Vacated) TWA: 4 mg/m³ Ceiling: 100 ppm (Vacated) STEL: 2 ppm (Vacated) STEL: 8 mg/m³ TWA: 50 ppm	IDLH: 50 ppm TWA: 1 ppm TWA: 4 mg/m³ STEL: 2 ppm STEL: 8 mg/m³	TWA: 10 ppm TWA: 40 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. Tightly fitting safety goggles. Face-shield.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	sweet
Odor Threshold	400 ppm
pH	No information available
Melting Point/Range	-35 °C / -31 °F
Boiling Point/Range	81 - 85 °C / 177.8 - 185 °F
Flash Point	13 °C / 55.4 °F
Evaporation Rate	6.5 (Butyl Acetate = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.9 vol %
Lower	6.2 vol %
Vapor Pressure	65 mmHg @ 29 °C
Vapor Density	3.4
Specific Gravity	1.250
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	440 °C / 824 °F
Decomposition Temperature	No information available
Viscosity	0.8 mPa s at 20 °C
Molecular Formula	C2 H4 Cl2
Molecular Weight	98.96

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Strong oxidizing agents, Bases, Alkali metals

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrogen chloride gas, Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ethylene dichloride	625 mg/kg (Rat) 413 mg/kg (Mouse)	2800 mg/kg (Rabbit)	28.79 mg/L (Rat) 1h 7.8 mg/l (Rat) 4h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Ethylene dichloride	107-06-2	Group 2B	Reasonably Anticipated	Not listed	X	Not listed

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed May cause central nervous system depression: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Ethylene dichloride	EC50: = 166 mg/L, 96h static (Desmodesmus subspicatus) EC50: > 433 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 110 - 123 mg/L, 96h flow-through (Pimephales promelas) LC50: 230 - 710 mg/L, 96h flow-through (Lepomis macrochirus) LC50: = 225 mg/L, 96h static (Oncorhynchus mykiss)	Not listed	EC50: 140 - 190 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Ethylene dichloride	1.45

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Ethylene dichloride - 107-06-2	U077	-

14. Transport information

DOT

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

TDG

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

IATA

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

IMDG/IMO

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Ethylene dichloride	X	X	-	203-458-1	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Component	TSCA 12(b)
Ethylene dichloride	Section 4

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Ethylene dichloride	107-06-2	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Ethylene dichloride	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Ethylene dichloride	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Ethylene dichloride	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Ethylene dichloride	107-06-2	Carcinogen	10 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Ethylene dichloride	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Serious risk, Grade 3

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 04-Feb-2010
Revision Date 18-Jan-2018
Print Date 18-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

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

End of SDS

SAFETY DATA SHEET

Creation Date 16-Sep-2014 **Revision Date** 23-Jan-2018 **Revision Number** 3

1. Identification

Product Name **trans-1,2-Dichloroethylene, stabilized**

Cat No. : **AC406840000; AC406840250; AC406842500**

CAS-No 156-60-5
Synonyms trans-Acetylene dichloride

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 4

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Harmful if swallowed or if inhaled

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Wear protective gloves/protective clothing/eye protection/face protection
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Ingestion
Rinse mouth
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Explosion risk in case of fire
Fight fire with normal precautions from a reasonable distance
Evacuate area
Storage
Store in a well-ventilated place. Keep cool
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
trans-1,2-Dichloroethylene	156-60-5	>95

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention.

Inhalation Remove from exposure, lie down. Remove to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Get medical attention. If not breathing, give artificial respiration.

Ingestion Do NOT induce vomiting. Get medical attention.

Most important symptoms and effects	Difficulty in breathing. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray. Carbon dioxide (CO_2). Dry chemical. Chemical foam. Water mist may be used to cool closed containers. Water mist may be used to cool closed containers.

Unsuitable Extinguishing Media No information available

Flash Point 6 °C / 42.8 °F

Method - No information available

Autoignition Temperature 440 °C / 824 °F

Explosion Limits

Upper	12.80%
Lower	9.70%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Flammable. Vapors may travel to source of ignition and flash back. Containers may explode when heated. Vapors may form explosive mixtures with air. Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2). Phosgene. Hydrogen chloride gas.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	3	0	N/A

6. Accidental release measures

Personal Precautions Remove all sources of ignition. Take precautionary measures against static discharges. Use personal protective equipment as required. Ensure adequate ventilation.

Environmental Precautions Do not flush into surface water or sanitary sewer system. See Section 12 for additional Ecological Information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Ensure adequate ventilation. Avoid contact with skin and eyes. Handle product only in closed system or provide appropriate exhaust ventilation. Use spark-proof tools and explosion-proof equipment. Use only non-sparking tools. Keep away from open flames, hot surfaces and sources of ignition. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Take precautionary measures against static discharges.

Storage Keep in a dry, cool and well-ventilated place. Refer product specification and/or product

label for specific storage temperature requirement. Keep container tightly closed. Keep away from heat, sparks and flame. Flammables area. Keep container tightly closed in a dry and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
trans-1,2-Dichloroethylene	TWA: 200 ppm			TWA: 200 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

Engineering Measures Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	aromatic
Odor Threshold	No information available
pH	6.5-7.2
Melting Point/Range	-50 °C / -58 °F
Boiling Point/Range	48 °C / 118.4 °F @ 760 mmHg
Flash Point	6 °C / 42.8 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	12.80%
Lower	9.70%
Vapor Pressure	331 mmHg @ 25 °C
Vapor Density	3.34 (Air = 1.0)
Specific Gravity	1.260
Solubility	Immiscible with water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	440 °C / 824 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C2 H2 Cl2
Molecular Weight	96.94

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Keep away from open flames, hot surfaces and sources of ignition. Exposure to air. Exposure to light. Incompatible products. Exposure to moist air or water.

Incompatible Materials Bases, Strong acids, Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Phosgene, Hydrogen chloride gas

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
trans-1,2-Dichloroethylene	LD50 = 1235 mg/kg (Rat)	>5 g/kg (Rabbit)	LC50 = 24100 ppm (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
trans-1,2-Dichloroethylene	156-60-5	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
trans-1,2-Dichloroethylene	Not listed	LC50: = 135 mg/L, 96h static (Lepomis macrochirus)	Not listed	Not listed

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
trans-1,2-Dichloroethylene	1.48

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
trans-1,2-Dichloroethylene - 156-60-5	U079	-

14. Transport information

DOT

UN-No UN1150
Proper Shipping Name 1,2-DICHLOROETHYLENE
Hazard Class 3
Packing Group II

TDG

UN-No UN1150
Proper Shipping Name 1,2-DICHLOROETHYLENE
Hazard Class 3
Packing Group II

IATA

UN-No UN1150
Proper Shipping Name 1,2-DICHLOROETHYLENE
Hazard Class 3
Packing Group II

IMDG/IMO

UN-No UN1150
Proper Shipping Name 1,2-DICHLOROETHYLENE
Hazard Class 3
Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
trans-1,2-Dichloroethylene	156-60-5	X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
trans-1,2-Dichloroethylene	156-60-5	X	-	205-860-2	X	X	X	X	KE-10123

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
trans-1,2-Dichloroethylene	-	-	-	X

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
trans-1,2-Dichloroethylene	1000 lb 1 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
trans-1,2-Dichloroethylene	X	-	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 16-Sep-2014
Revision Date 23-Jan-2018
Print Date 23-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally

Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

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

End of SDS

Benzene

Version 1.9 Revision Date 2016-01-08

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Product information

Product Name : Benzene
Material : 1098293, 1059192, 1059060, 1037212, 1037213, 1037103, 1029170, 1037104, 1015526, 1016960

Company : Chevron Phillips Chemical Company LP
10001 Six Pines Drive
The Woodlands, TX 77380

Emergency telephone:

Health:
866.442.9628 (North America)
1.832.813.4984 (International)
Transport:
CHEMTREC 1.800.424.9300 (within USA and Canada) or 703.527.3887 (outside USA and Canada)
Asia: +800 CHEMCALL (+800 2436 2255) China:+86-21-22157316
EUROPE: BIG +32.14.584545 (phone) or +32.14583516 (telefax)
South America SOS-Cotec Inside Brazil: 0800.111.767 Outside Brazil: +55.19.3467.1600

Responsible Department : Product Safety and Toxicology Group
E-mail address : SDS@CPChem.com
Website : www.CPChem.com

SECTION 2: Hazards identification

Classification of the substance or mixture
This product has been classified in accordance with the hazard communication standard 29 CFR 1910.1200; the SDS and labels contain all the information as required by the standard.

Emergency Overview

Danger

Physical state: Liquid **Color**: Clear, Colorless **Odor**: sweet, distinct

OSHA Hazards : Flammable Liquid, Aspiration hazard, Carcinogen, Moderate skin irritant, Moderate eye irritant, Mutagen, Target Organ Effects

Classification

: Flammable liquids , Category 2
Skin irritation , Category 2
Eye irritation , Category 2A
Germ cell mutagenicity , Category 1B
Carcinogenicity , Category 1A
Specific target organ systemic toxicity - repeated exposure , Category 1 , Blood
Aspiration hazard , Category 1

Labeling

Symbol(s) :

Signal Word : Danger

Hazard Statements : H225: Highly flammable liquid and vapor.
H304: May be fatal if swallowed and enters airways.
H315: Causes skin irritation.
H319: Causes serious eye irritation.
H340: May cause genetic defects.
H350: May cause cancer.
H372: Causes damage to organs (Blood) through prolonged or repeated exposure.

Precautionary Statements : **Prevention:**
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.
P243 Take precautionary measures against static discharge.
P260 Do not breathe dust/fume/gas/mist/vapor/spray.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P280 Wear protective gloves/ eye protection/ face protection.
P281 Use personal protective equipment as required.
Response:
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.
P331 Do NOT induce vomiting.
P332 + P313 If skin irritation occurs: Get medical advice/ attention.
P337 + P313 If eye irritation persists: Get medical advice/

attention.
P362 Take off contaminated clothing and wash before reuse.
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
Storage:
P403 + P235 Store in a well-ventilated place. Keep cool.
P405 Store locked up.
Disposal:
P501 Dispose of contents/ container to an approved waste disposal plant.

Carcinogenicity:

IARC	Group 1: Carcinogenic to humans	
	Benzene	71-43-2
NTP	Known to be human carcinogen	
	Benzene	71-43-2
ACGIH	Confirmed human carcinogen	
	Benzene	71-43-2

SECTION 3: Composition/information on ingredients

Synonyms : Aromatic Benzene
Benzol
Cyclohexatriene
Phene
Phenyl Hydride

Molecular formula : C6H6

Component	CAS-No.	Weight %
Benzene	71-43-2	100

SECTION 4: First aid measures

General advice : Move out of dangerous area. Show this material safety data sheet to the doctor in attendance. Material may produce a serious, potentially fatal pneumonia if swallowed or vomited.

If inhaled : If unconscious place in recovery position and seek medical advice. If symptoms persist, call a physician.

In case of skin contact : If skin irritation persists, call a physician. If on skin, rinse well with water. If on clothes, remove clothes.

In case of eye contact : Immediately flush eye(s) with plenty of water. Remove contact lenses. Protect unharmed eye. Keep eye wide open while rinsing. If eye irritation persists, consult a specialist.

If swallowed : Keep respiratory tract clear. Never give anything by mouth to an unconscious person. If symptoms persist, call a physician.

Take victim immediately to hospital.

SECTION 5: Firefighting measures

Flash point	:	-11 °C (12 °F) Method: Tag closed cup
Autoignition temperature	:	498 °C (928 °F)
Suitable extinguishing media	:	Alcohol-resistant foam. Carbon dioxide (CO2). Dry chemical.
Unsuitable extinguishing media	:	High volume water jet.
Specific hazards during fire fighting	:	Do not allow run-off from fire fighting to enter drains or water courses.
Special protective equipment for fire-fighters	:	Wear self-contained breathing apparatus for firefighting if necessary.
Further information	:	Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. For safety reasons in case of fire, cans should be stored separately in closed containments. Use a water spray to cool fully closed containers.
Fire and explosion protection	:	Do not spray on an open flame or any other incandescent material. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Use only explosion-proof equipment. Keep away from open flames, hot surfaces and sources of ignition.
Hazardous decomposition products	:	No data available.

SECTION 6: Accidental release measures

Personal precautions	:	Use personal protective equipment. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.
Environmental precautions	:	Prevent product from entering drains. Prevent further leakage or spillage if safe to do so. If the product contaminates rivers and lakes or drains inform respective authorities.
Methods for cleaning up	:	Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13).

SECTION 7: Handling and storage

Handling

Advice on safe handling : Avoid formation of aerosol. Do not breathe vapors/dust. Avoid exposure - obtain special instructions before use. Avoid contact with skin and eyes. For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Provide sufficient air exchange and/or exhaust in work rooms. Container may be opened only under exhaust ventilation hood. Open drum carefully as content may be under pressure. Dispose of rinse water in accordance with local and national regulations.
Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary, but may not by themselves be sufficient. Review all operations, which have the potential to generating and accumulation of electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106 "Flammable and Combustible Liquids"; National Fire Protection Association (NFPA 77), "Recommended Practice on Static Electricity"; and/or the American Petroleum Institute (API) Recommended Practice 2003, "Protection Against Ignitions Arising Out of Static, Lightning, and stray Currents". Avoid formation of aerosol. Do not breathe vapors/dust. Avoid exposure - obtain special instructions before use. Avoid contact with skin and eyes. For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. Take precautionary measures against static discharges. Provide sufficient air exchange and/or exhaust in work rooms. Container may be opened only under exhaust ventilation hood. Open drum carefully as content may be under pressure. Dispose of rinse water in accordance with local and national regulations.

Advice on protection against fire and explosion : Do not spray on an open flame or any other incandescent material. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Use only explosion-proof equipment. Keep away from open flames, hot surfaces and sources of ignition.

Storage

Requirements for storage areas and containers : No smoking. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Observe label precautions. Electrical installations / working materials must comply with the technological safety standards.

SECTION 8: Exposure controls/personal protection

Ingredients with workplace control parameters

US

Ingredients	Basis	Value	Control parameters	Note
Benzene	ACGIH	TWA	0.5 ppm,	BEI, A1, Skin,
	ACGIH	STEL	2.5 ppm,	BEI, A1, Skin,
	OSHA Z-1-A	TWA	1 ppm,	
	OSHA Z-1-A	CEIL	5 ppm,	
	OSHA Z-2	Peak	50 ppm,	(a),
	OSHA 29 CFR 1910.1028(c)	TWA	1 ppm,	
	OSHA 29 CFR 1910.1028(c)	STEL	5 ppm,	
	OSHA CARC	PEL	1 ppm,	
	OSHA CARC	STEL	5 ppm,	

(a) This standard applies to the industry segments exempt from the 1 ppm 8-hour TWA and 5 ppm STEL of the benzene standard at 1910.1028.
A1 Confirmed human carcinogen
BEI Substances for which there is a Biological Exposure Index or Indices (see BEI® section)
Skin Danger of cutaneous absorption

Immediately Dangerous to Life or Health Concentrations (IDLH)

Substance name	CAS-No.	Control parameters	Update
Benzene	71-43-2	Immediately Dangerous to Life or Health Concentration Value 500 ppm	1995-03-01

Engineering measures

Adequate ventilation to control airborned concentrations below the exposure guidelines/limits. Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

Personal protective equipment

Respiratory protection : Wear a supplied-air NIOSH approved respirator unless ventilation or other engineering controls are adequate to maintain minimal oxygen content of 19.5% by volume under normal atmospheric pressure. Wear a NIOSH approved respirator that provides protection when working with this material if exposure to harmful levels of airborne material may occur, such as:. Air-Purifying Respirator for Organic Vapors. Use a positive pressure, air-supplying respirator if there is potential for uncontrolled release, exposure levels are not known, or other circumstances where air-purifying respirators may not provide adequate protection.

Hand protection : The suitability for a specific workplace should be discussed with the producers of the protective gloves. Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. Also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion, and the contact time. Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Eye protection : Eye wash bottle with pure water. Tightly fitting safety goggles.

Skin and body protection : Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. Wear as appropriate:. Flame retardant

antistatic protective clothing. Workers should wear antistatic footwear.

Hygiene measures : When using do not eat or drink. When using do not smoke. Wash hands before breaks and at the end of workday.

SECTION 9: Physical and chemical properties

Information on basic physical and chemical properties

Appearance

Physical state	:	Liquid
Color	:	Clear, Colorless
Odor	:	sweet, distinct

Safety data

Flash point	:	-11 °C (12 °F) Method: Tag closed cup
Lower explosion limit	:	1.2 %(V)
Upper explosion limit	:	7.8 %(V)
Oxidizing properties	:	no
Autoignition temperature	:	498 °C (928 °F)
Molecular formula	:	C6H6
Molecular weight	:	78.12 g/mol
pH	:	Not applicable
Pour point	:	No data available
Boiling point/boiling range	:	80 °C (176 °F)
Vapor pressure	:	75.00 MMHG at 20 °C (68 °F)
Relative density	:	0.88 at 25 °C (77 °F)
Water solubility	:	1.88 g/l at 23.5 °C (74.3 °F)
Partition coefficient: n-octanol/water	:	log Pow: 2.13
Relative vapor density	:	2.77 (Air = 1.0)
Evaporation rate	:	2.8
Percent volatile	:	> 99 %

Other information

Conductivity	:	< 50 pSm at 20 °C

SECTION 10: Stability and reactivity

Reactivity	:	No decomposition if stored and applied as directed.
Chemical stability	:	This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. No decomposition if stored and applied as directed.

Possibility of hazardous reactions

Conditions to avoid	:	Heat, flames and sparks.
Materials to avoid	:	May react with oxygen and strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Hazardous decomposition products	:	No data available
Other data	:	No decomposition if stored and applied as directed.

SECTION 11: Toxicological information

Acute oral toxicity

Benzene	:	LD50: > 2,000 mg/kg Species: Rat Sex: female

Acute inhalation toxicity

Benzene	:	LC50: 44.5 mg/l Exposure time: 4 h Species: Rat Sex: Not Specified Test atmosphere: vapor

Acute dermal toxicity

Benzene	:	LD50: > 8,260 mg/kg Species: Rabbit

Benzene
Skin irritation : May cause skin irritation in susceptible persons.

Benzene
Eye irritation : May cause irreversible eye damage.

Sensitization

Benzene : Did not cause sensitization on laboratory animals.

Repeated dose toxicity

Benzene : Species: Rat, female
Sex: female
Application Route: oral gavage
Dose: 0, 25, 50, 100 mg/kg
Exposure time: 103 wk
Number of exposures: 5 d/wk
NOEL: < 25 mg/kg
Lowest observable effect level: 25 mg/kg

Species: Rat, male
Sex: male
Application Route: oral gavage
Dose: 0, 50, 100, 200 mg/kg
Exposure time: 103 wk
Number of exposures: 5 d/wk
NOEL: < 50 mg/kg
Lowest observable effect level: 50 mg/kg

Species: Mouse
Application Route: oral gavage
Dose: 0, 25, 50,100 mg/kg
Exposure time: 103 wk
NOEL: < 25 mg/kg

Carcinogenicity

Benzene : Species: Rat
Sex: female
Dose: 0, 25, 50, 250 mg/kg
Exposure time: 103 wks
Number of exposures: daily, 5 days/week
Test substance: yes
Remarks: zymbal gland carcinomas, squamous cell papillomas

Species: Rat
Sex: male
Dose: 0, 50, 100, 200 mg/kg
Exposure time: 103 wks
Number of exposures: daily, 5 days/week
Test substance: yes
Remarks: zymbal gland carcinomas, squamous cell papillomas

Species: Mouse
Sex: male and female
Dose: 25, 50, 100 mg/kg
Exposure time: 103 wks
Number of exposures: daily, 5 days/week
Test substance: yes
Remarks: Clear evidence of multiple organ carcinogenicity.

Benzene
Aspiration toxicity : May be fatal if swallowed and enters airways.

Substances known to cause human aspiration toxicity hazards or to be regarded as if they cause human aspiration toxicity hazard.

CMR effects

Benzene : Carcinogenicity: Human carcinogen.
Mutagenicity: In vivo tests showed mutagenic effects
Teratogenicity: Did not show teratogenic effects in animal experiments.
Reproductive toxicity: Animal testing did not show any effects on fertility.

Benzene
Further information : Chronic Health Hazard.
Solvents may degrease the skin.

SECTION 12: Ecological information

Toxicity to fish

Benzene : LC50: 5.3 mg/l
Exposure time: 96 h
Species: Oncorhynchus mykiss (rainbow trout)
flow-through test Test substance: yes
Method: OECD Test Guideline 203

Toxicity to daphnia and other aquatic invertebrates

Benzene : EC50: 10 mg/l
Exposure time: 48 h
Species: Daphnia magna (Water flea)
static test Test substance: yes
Method: OECD Test Guideline 202

Toxicity to algae

Benzene : ErC50: 100 mg/l
Exposure time: 72 h
Species: Pseudokirchneriella subcapitata (green algae)
Test substance: yes
Method: OECD Test Guideline 201

Elimination information (persistence and degradability)

Biodegradability : This material is expected to be readily biodegradable.

Ecotoxicology Assessment

Acute aquatic toxicity
Benzene : Toxic to aquatic life.

Chronic aquatic toxicity
Benzene : Harmful to aquatic life with long lasting effects.

Results of PBT assessment

Benzene	:	This substance is not considered to be persistent, bioaccumulating and toxic (PBT)., This substance is not considered to be very persistent and very bioaccumulating (vPvB).
Additional ecological information	:	Toxic to aquatic life. An environmental hazard cannot be excluded in the event of unprofessional handling or disposal., Toxic to aquatic life.

SECTION 13: Disposal considerations

The information in this SDS pertains only to the product as shipped.

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

Product	:	The product should not be allowed to enter drains, water courses or the soil. Do not contaminate ponds, waterways or ditches with chemical or used container. Send to a licensed waste management company.
Contaminated packaging	:	Empty remaining contents. Dispose of as unused product. Do not re-use empty containers. Do not burn, or use a cutting torch on, the empty drum.

SECTION 14: Transport information

The shipping descriptions shown here are for bulk shipments only, and may not apply to shipments in non-bulk packages (see regulatory definition).

Consult the appropriate domestic or international mode-specific and quantity-specific Dangerous Goods Regulations for additional shipping description requirements (e.g., technical name or names, etc.) Therefore, the information shown here, may not always agree with the bill of lading shipping description for the material. Flashpoints for the material may vary slightly between the SDS and the bill of lading.

US DOT (UNITED STATES DEPARTMENT OF TRANSPORTATION)
UN1114, BENZENE, 3, II, RQ (BENZENE)

IMO / IMDG (INTERNATIONAL MARITIME DANGEROUS GOODS)
UN1114, BENZENE, 3, II, (-11 °C)

IATA (INTERNATIONAL AIR TRANSPORT ASSOCIATION)
UN1114, BENZENE, 3, II

ADR (AGREEMENT ON DANGEROUS GOODS BY ROAD (EUROPE))

UN1114, BENZENE, 3, II, (D/E)

RID (REGULATIONS CONCERNING THE INTERNATIONAL TRANSPORT OF DANGEROUS GOODS (EUROPE))
UN1114, BENZENE, 3, II

ADN (EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY INLAND WATERWAYS)
UN1114, BENZENE, 3, II

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Other information	**:**	**Benzene and mixtures having 10% Benzene or more, S.T. 3, Cat.Y**

SECTION 15: Regulatory information

National legislation

CERCLA Reportable Quantity	:	10 lbs Benzene
SARA 302 Reportable Quantity	:	This material does not contain any components with a SARA 302 RQ.
SARA 302 Threshold Planning Quantity	:	No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
SARA 304 Reportable Quantity	:	This material does not contain any components with a section 304 EHS RQ.
SARA 313 Ingredients	:	The following components are subject to reporting levels established by SARA Title III, Section 313:
	:	Benzene - 71-43-2

Clean Air Act

Ozone-Depletion Potential	:	This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).

The following chemical(s) are listed as HAP under the U.S. Clean Air Act, Section 12 (40 CFR 61):

: Benzene - 71-43-2

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).

The following chemical(s) are listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489):

: Benzene - 71-43-2

US State Regulations

Pennsylvania Right To Know

: Benzene - 71-43-2

New Jersey Right To Know

: Benzene - 71-43-2

California Prop. 65 Ingredients : WARNING! This product contains a chemical known in the State of California to cause cancer.

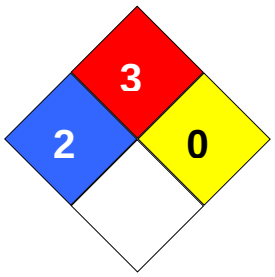
WARNING: This product contains a chemical known in the State of California to cause birth defects or other reproductive harm.

Notification status

Europe REACH	:	On the inventory, or in compliance with the inventory
United States of America TSCA	:	On the inventory, or in compliance with the inventory
Canada DSL	:	On the inventory, or in compliance with the inventory
Australia AICS	:	On the inventory, or in compliance with the inventory
New Zealand NZIoC	:	On the inventory, or in compliance with the inventory
Japan ENCS	:	On the inventory, or in compliance with the inventory
Korea KECI	:	On the inventory, or in compliance with the inventory
Philippines PICCS	:	On the inventory, or in compliance with the inventory
China IECSC	:	On the inventory, or in compliance with the inventory

SECTION 16: Other information

NFPA Classification : Health Hazard: 2
Fire Hazard: 3
Reactivity Hazard: 0



Further information

Legacy SDS Number : CPC00091

Significant changes since the last version are highlighted in the margin. This version replaces all previous versions.

The information in this SDS pertains only to the product as shipped.

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

Key or legend to abbreviations and acronyms used in the safety data sheet			
ACGIH	American Conference of Government Industrial Hygienists	LD50	Lethal Dose 50%
AICS	Australia, Inventory of Chemical Substances	LOAEL	Lowest Observed Adverse Effect Level
DSL	Canada, Domestic Substances List	NFPA	National Fire Protection Agency
NDSL	Canada, Non-Domestic Substances List	NIOSH	National Institute for Occupational Safety & Health
CNS	Central Nervous System	NTP	National Toxicology Program
CAS	Chemical Abstract Service	NZIoC	New Zealand Inventory of Chemicals
EC50	Effective Concentration	NOAEL	No Observable Adverse Effect Level
EC50	Effective Concentration 50%	NOEC	No Observed Effect Concentration
EGEST	EOSCA Generic Exposure Scenario Tool	OSHA	Occupational Safety & Health Administration
EOSCA	European Oilfield Specialty Chemicals Association	PEL	Permissible Exposure Limit
EINECS	European Inventory of Existing Chemical Substances	PICCS	Philippines Inventory of Commercial Chemical Substances
MAK	Germany Maximum Concentration Values	PRNT	Presumed Not Toxic
GHS	Globally Harmonized System	RCRA	Resource Conservation Recovery Act
>=	Greater Than or Equal To	STEL	Short-term Exposure Limit
IC50	Inhibition Concentration 50%	SARA	Superfund Amendments and Reauthorization Act.
IARC	International Agency for Research on Cancer	TLV	Threshold Limit Value
IECSC	Inventory of Existing Chemical Substances in China	TWA	Time Weighted Average
ENCS	Japan, Inventory of Existing and New Chemical Substances	TSCA	Toxic Substance Control Act
KECI	Korea, Existing Chemical Inventory	UVCB	Unknown or Variable Composition, Complex Reaction Products, and Biological Materials
<=	Less Than or Equal To	WHMIS	Workplace Hazardous Materials Information System
LC50	Lethal Concentration 50%		

Safety Data Sheet
acc. to OSHA HCS

Printing date 12/13/2016 *Reviewed on 12/13/2016*

1 Identification

· **Product identifier**

· **Product Name: Perfluoro-n-octane Sulfonate (PFOS)**

· **Part Number:** LCS-4951
· **Application of the substance / the mixture** Certified Reference Material

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
SPEX CertiPrep, LLC.
203 Norcross Ave, Metuchen,
NJ 08840 USA

· **Information department:** product safety department
· **Emergency telephone number:**
Emergency Phone Number (24 hours)
CHEMTREC (800-424-9300)
Outside US: 703-527-3887

2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS02 Flame

Flam. Liq. 2 H225 Highly flammable liquid and vapor.

GHS06 Skull and crossbones

Acute Tox. 3 H331 Toxic if inhaled.

GHS08 Health hazard

Carc. 2 H351 Suspected of causing cancer.
Repr. 1 H360-H362 May damage fertility or the unborn child. May cause harm to breast-fed children.
STOT SE 1 H370 Causes damage to organs.

· **Label elements**
· **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**

GHS02 GHS06 GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
methanol
perfluorooctane sulfonic acid
· **Hazard statements**
H225 Highly flammable liquid and vapor.
H331 Toxic if inhaled.
H351 Suspected of causing cancer.
H360-H362 May damage fertility or the unborn child. May cause harm to breast-fed children.
H370 Causes damage to organs.
· **Precautionary statements**
Avoid contact during pregnancy/while nursing.
Keep away from heat/sparks/open flames/hot surfaces. No smoking.
Use explosion-proof electrical/ventilating/lighting/equipment.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.

(Contd. on page 2)

Safety Data Sheet
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Product Name: Perfluoro-n-octane Sulfonate (PFOS)

(Contd. of page 1)

· **Classification system:**
· **NFPA ratings (scale 0 - 4)**

Health = 3
Fire = 3
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = *3
Fire = 3
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Mixtures**
· **Description:** Mixture of the substances listed below with nonhazardous additions.

· **Dangerous components:**		
67-56-1	methanol	99.9%
1763-23-1	perfluorooctane sulfonic acid	0.1%

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Remove breathing apparatus only after contaminated clothing have been completely removed.
In case of irregular breathing or respiratory arrest provide artificial respiration.
· **After inhalation:**
Supply fresh air or oxygen; call for doctor.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Do not induce vomiting; immediately call for medical help.
· **Information for Doctor:**
· **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed** No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:** CO2, sand, extinguishing powder. Do not use water.
· **For safety reasons unsuitable extinguishing agents:** Water with full jet
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures** Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:**
Do not allow product to reach sewage system or any water course.
Inform respective authorities in case of seepage into water course or sewage system.
Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
Do not flush with water or aqueous cleansing agents

(Contd. on page 3)

Safety Data Sheet
acc. to OSHA HCS

Product Name: Perfluoro-n-octane Sulfonate (PFOS)

(Contd. of page 2)

· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
Prevent formation of aerosols.
· **Information about protection against explosions and fires:**
Keep ignition sources away - Do not smoke.
Protect against electrostatic charges.
Keep respiratory protective device available.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** Store in a cool location.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:**
Keep receptacle tightly sealed.
Store in cool, dry conditions in well sealed receptacles.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:**
The following constituent is the only constituent of the product which has a PEL, TLV or other recommended exposure limit.
At this time, the remaining constituent has no known exposure limits.

67-56-1 methanol	
PEL	Long-term value: 260 mg/m³, 200 ppm
REL	Short-term value: 325 mg/m³, 250 ppm Long-term value: 260 mg/m³, 200 ppm Skin
TLV	Short-term value: 328 mg/m³, 250 ppm Long-term value: 262 mg/m³, 200 ppm Skin; BEI

· **Ingredients with biological limit values:**	
67-56-1 methanol	
BEI	15 mg/L Medium: urine Time: end of shift Parameter: Methanol (background, nonspecific)

· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**

Protective gloves

(Contd. on page 4)

Safety Data Sheet
acc. to OSHA HCS

Product Name: Perfluoro-n-octane Sulfonate (PFOS)

(Contd. of page 3)

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Liquid
Color:	According to product specification
· **Odor:**	Characteristic
· **Odour Threshold:**	Not applicable.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	64 °C (147 °F)
· **Flash point:**	11 °C (52 °F)
· **Flammability (solid, gaseous):**	Not applicable.
· **Ignition temperature:**	455 °C (851 °F)
· **Decomposition temperature:**	Not applicable.
· **Auto igniting:**	Product is not selfigniting.
· **Danger of explosion:**	Product is not explosive. However, formation of explosive air/vapor mixtures are possible.
· **Explosion limits:**	
Lower:	5.5 Vol %
Upper:	44.0 Vol %
· **Vapor pressure at 20 °C (68 °F):**	128 hPa (96 mm Hg)
· **Density at 20 °C (68 °F)**	0.79 g/cm³ (6.593 lbs/gal)
· **Relative density**	Not applicable.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not miscible or difficult to mix.
· **Partition coefficient (n-octanol/water):**	Not applicable.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Solvent content:**	
Organic solvents:	99.9 %
VOC content:	99.9 %
Solids content:	0.1 %
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.

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Safety Data Sheet
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Product Name: Perfluoro-n-octane Sulfonate (PFOS)

(Contd. of page 4)

· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**		
67-56-1 methanol		
Oral	LD50	5628 mg/kg (rat)
Dermal	LD50	15800 mg/kg (rabbit)

· **Primary irritant effect:**
· **on the skin:** No irritant effect.
· **on the eye:** No irritating effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:
Toxic

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**
None of the ingredients is listed.

· **NTP (National Toxicology Program)**
None of the ingredients is listed.

· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:** Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, ADR, IMDG, IATA**	UN1230
· **UN proper shipping name**	
· **DOT**	Methanol

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Product Name: Perfluoro-n-octane Sulfonate (PFOS)

(Contd. of page 5)

· **ADR**	1230 Methanol
· **IMDG, IATA**	METHANOL
· **Transport hazard class(es)**	
· **DOT**	
	
· **Class**	3 Flammable liquids
· **Label**	3, 6.1
· **ADR**	
	
· **Class**	3 Flammable liquids
· **Label**	3+6.1
· **IMDG**	
	
· **Class**	3 Flammable liquids
· **Label**	3/6.1
· **IATA**	
	
· **Class**	3 Flammable liquids
· **Label**	3 (6.1)
· **Packing group**	
· **DOT, ADR, IMDG, IATA**	II
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Warning: Flammable liquids
· **Danger code (Kemler):**	336
· **EMS Number:**	F-E,S-D
· **Stowage Category**	B
· **Stowage Code**	SW2 Clear of living quarters.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **ADR**	
· **Excepted quantities (EQ)**	Code: E2 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 500 ml
· **IMDG**	
· **Limited quantities (LQ)**	1L
· **Excepted quantities (EQ)**	Code: E2 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 500 ml
· **UN "Model Regulation":**	UN 1230 METHANOL, 3 (6.1), II

US

(Contd. on page 7)

Safety Data Sheet
acc. to OSHA HCS

Product Name: Perfluoro-n-octane Sulfonate (PFOS)

(Contd. of page 6)

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **Sara**

· **Section 355 (extremely hazardous substances):**
None of the ingredients is listed.

· **Section 313 (Specific toxic chemical listings):**

67-56-1	methanol

· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65**

· **Chemicals known to cause cancer:**
None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients is listed.

· **Chemicals known to cause developmental toxicity:**

67-56-1	methanol

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients is listed.

· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients is listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients is listed.

· **Protective Action Criteria for Chemicals**

· **PAC-1:**

67-56-1	methanol	530 ppm

· **PAC-2:**

67-56-1	methanol	2,100 ppm

· **PAC-3:**

67-56-1	methanol	7200* ppm

· **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**

GHS02 GHS06 GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
methanol
perfluorooctane sulfonic acid
· **Hazard statements**
H225 Highly flammable liquid and vapor.
H331 Toxic if inhaled.
H351 Suspected of causing cancer.
H360-H362 May damage fertility or the unborn child. May cause harm to breast-fed children.
H370 Causes damage to organs.
· **Precautionary statements**
Avoid contact during pregnancy/while nursing.
Keep away from heat/sparks/open flames/hot surfaces. No smoking.
Use explosion-proof electrical/ventilating/lighting/equipment.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.

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Safety Data Sheet
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Product Name: Perfluoro-n-octane Sulfonate (PFOS)

(Contd. of page 7)

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing SDS:** product safety department
· **Contact:**
SPEX CertiPrep, LLC.
1-732-549-7144
· **Date of preparation / last revision** 12/13/2016 / -
· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
BEI: Biological Exposure Limit
Flam. Liq. 2: Flammable liquids – Category 2
Acute Tox. 3: Acute toxicity – Category 3
Carc. 2: Carcinogenicity – Category 2
Repr. 1: Reproductive toxicity – Category 1
STOT SE 1: Specific target organ toxicity (single exposure) – Category 1

SAFETY DATA SHEET

Creation Date 10-Dec-2009 **Revision Date** 23-Jan-2018 **Revision Number** 5

1. Identification

Product Name **Tetrachloroethylene**

Cat No. : **AC445690000; ACR445690010; AC445690025; AC445691000**

CAS-No 127-18-4
Synonyms Perchloroethylene

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements

Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects
WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Tetrachloroethylene	127-18-4	>95

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists,

call a physician.

Inhalation Remove to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.

Ingestion Clean mouth with water and drink afterwards plenty of water.

Most important symptoms and effects None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray, carbon dioxide (CO2), dry chemical, alcohol-resistant foam.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature No information available
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated.

Hazardous Combustion Products
Chlorine. Phosgene. Hydrogen chloride gas.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Ensure adequate ventilation.
Environmental Precautions Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Ensure adequate ventilation. Avoid ingestion and inhalation.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from sunlight.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Tetrachloroethylene	TWA: 25 ppm STEL: 100 ppm	(Vacated) TWA: 25 ppm (Vacated) TWA: 170 mg/m³ Ceiling: 200 ppm TWA: 100 ppm	IDLH: 150 ppm	TWA: 25 ppm STEL: 100 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: NIOSH - National Institute for Occupational Safety and Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic, sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-22 °C / -7.6 °F
Boiling Point/Range	120 - 122 °C / 248 - 251.6 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	6.0 (Ether = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	18 mbar @ 20 °C
Vapor Density	No information available
Density	1.619
Specific Gravity	1.625
Solubility	0.15 g/L water (20°C)
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 150°C
Viscosity	0.89 mPa s at 20 °C
Molecular Formula	C2 Cl4
Molecular Weight	165.83

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Exposure to moist air or water.

Incompatible Materials Strong acids, Strong oxidizing agents, Strong bases, Metals, Zinc, Amines, Aluminium

Hazardous Decomposition Products Chlorine, Phosgene, Hydrogen chloride gas

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Tetrachloroethylene	LD50 = 2629 mg/kg (Rat)	LD50 > 10000 mg/kg (Rat)	LC50 = 27.8 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Tetrachloroethylene	127-18-4	Group 2A	Reasonably Anticipated	A3	X	A3

IARC (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

IARC (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Tetrachloroethylene	Group II Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Tetrachloroethylene	EC50: > 500 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 4.73 - 5.27 mg/L, 96h flow-through (Oncorhynchus mykiss) LC50: 11.0 - 15.0 mg/L, 96h static (Lepomis macrochirus) LC50: 8.6 - 13.5 mg/L, 96h static (Pimephales promelas) LC50: 12.4 - 14.4 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 100 mg/L 24 h EC50 = 112 mg/L 24 h EC50 = 120.0 mg/L 30 min	EC50: 6.1 - 9.0 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

Component	log Pow
Tetrachloroethylene	2.88

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Tetrachloroethylene - 127-18-4	U210	-

14. Transport information

DOT

UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1897

Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IATA

UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IMDG/IMO

UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Tetrachloroethylene	127-18-4	X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Tetrachloroethylene	127-18-4	X	-	204-825-9	X	X	X	X	KE-33294

U.S. Federal Regulations

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Tetrachloroethylene	127-18-4	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Tetrachloroethylene	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Tetrachloroethylene	X		-

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Tetrachloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following Proposition 65 chemicals.

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Tetrachloroethylene	127-18-4	Carcinogen	14 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Tetrachloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Regulatory Affairs
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Email: EMSDS.RA@thermofisher.com

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Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

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

End of SDS

Toluene

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 03/21/2014 Revision date: 02/27/2018 Supersedes: 03/21/2014 Version: 1.1

SECTION 1: Identification

1.1. Identification

Product form	:	Substance
Substance name	:	Toluene
CAS-No.	:	108-88-3
Product code	:	LC26170
Formula	:	C7H8
Synonyms	:	benzyl hydride / methylbenzene / phenylmethane / tolunol / toluol oil / toluole

1.2. Recommended use and restrictions on use

Use of the substance/mixture	:	Solvent

1.3. Supplier

LabChem Inc
Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court
Zelienople, PA 16063 - USA
T 412-826-5230 - F 724-473-0647
info@labchem.com - www.labchem.com

1.4. Emergency telephone number

Emergency number	:	CHEMTREC: 1-800-424-9300 or 011-703-527-3887

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

GHS-US classification

Flammable liquids, Category 2	H225	Highly flammable liquid and vapour.
Skin corrosion/irritation, Category 2	H315	Causes skin irritation.
Reproductive toxicity, Category 2	H361	Suspected of damaging fertility or the unborn child.
Specific target organ toxicity — Single exposure, Category 3, Narcosis	H336	May cause drowsiness or dizziness.
Specific target organ toxicity — Repeated exposure, Category 2	H373	May cause damage to organs (central nervous system, liver, heart) through prolonged or repeated exposure.
Aspiration hazard, Category 1	H304	May be fatal if swallowed and enters airways.
Hazardous to the aquatic environment — Acute Hazard, Category 3	H402	Harmful to aquatic life

Full text of H statements : see section 16

2.2. GHS Label elements, including precautionary statements

GHS-US labelling

Hazard pictograms (GHS-US) :

GHS02 GHS07 GHS08

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) :
H225 - Highly flammable liquid and vapour.
H304 - May be fatal if swallowed and enters airways.
H315 - Causes skin irritation.
H336 - May cause drowsiness or dizziness.
H361 - Suspected of damaging fertility or the unborn child.
H373 - May cause damage to organs (central nervous system, liver, heart) through prolonged or repeated exposure.
H402 - Harmful to aquatic life

Precautionary statements (GHS-US) : P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P210 - Keep away from heat, sparks, open flames, hot surfaces. No smoking.
P233 - Keep container tightly closed.
P240 - Ground/bond container and receiving equipment.
P241 - Use explosion-proof electrical, ventilating, lighting equipment.
P242 - Use only non-sparking tools.
P243 - Take precautionary measures against static discharge.
P260 - Do not breathe mist, vapours, spray.
P264 - Wash exposed skin thoroughly after handling.
P271 - Use only outdoors or in a well-ventilated area.
P273 - Avoid release to the environment.
P280 - Wear protective gloves, protective clothing, eye protection, face protection.
P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER/doctor
P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P308+P313 - IF exposed or concerned: Get medical advice/attention.
P312 - Call a POISON CENTER/doctor if you feel unwell.
P314 - Get medical advice and attention if you feel unwell.
P331 - Do NOT induce vomiting
P332+P313 - If skin irritation occurs: Get medical advice/attention.
P363 - Wash contaminated clothing before reuse.
P370+P378 - In case of fire: Use carbon dioxide (CO_2), powder, alcohol-resistant foam to extinguish.
P403+P235 - Store in a well-ventilated place. Keep cool.
P405 - Store locked up.
P501 - Dispose of contents/container to comply with local, state and federal regulations

2.3. Other hazards which do not result in classification

Other hazards not contributing to the classification : None under normal conditions.

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/information on ingredients

3.1. Substances

Substance type : Mono-constituent

Name	Product identifier	%	GHS-US classification
Toluene (Main constituent)	(CAS-No.) 108-88-3	100	Flam. Liq. 2, H225 Skin Irrit. 2, H315 Repr. 2, H361 STOT SE 3, H336 STOT RE 2, H373 Asp. Tox. 1, H304 Aquatic Acute 3, H402

Full text of hazard classes and H-statements : see section 16

3.2. Mixtures

Not applicable

SECTION 4: First-aid measures

4.1. Description of first aid measures

First-aid measures general : Check the vital functions. Unconscious: maintain adequate airway and respiration. Respiratory arrest: artificial respiration or oxygen. Cardiac arrest: perform resuscitation. Victim conscious with laboured breathing: half-seated. Victim in shock: on his back with legs slightly raised. Vomiting: prevent asphyxia/aspiration pneumonia. Prevent cooling by covering the victim (no warming up). Keep watching the victim. Give psychological aid. Keep the victim calm, avoid physical strain. Depending on the victim's condition: doctor/hospital. Never give alcohol to drink.

First-aid measures after inhalation : Remove the victim into fresh air. Respiratory problems: consult a doctor/medical service.

First-aid measures after skin contact : Wash immediately with lots of water. Soap may be used. Do not apply (chemical) neutralizing agents. Remove clothing before washing. Take victim to a doctor if irritation persists. Take victim to a doctor/medical service if irritation persists.

First-aid measures after eye contact : Rinse immediately with plenty of water. Remove contact lenses, if present and easy to do. Continue rinsing. Do not apply neutralizing agents. Take victim to an ophthalmologist if irritation persists. Take victim to a doctor/medical service if irritation persists.

First-aid measures after ingestion : Rinse mouth with water. Immediately after ingestion: give lots of water to drink. Do not give milk/oil to drink. Do not induce vomiting. Give activated charcoal. Call Poison Information Centre (www.big.be/antigif.htm). Consult a doctor/medical service if you feel unwell. Ingestion of large quantities: immediately to hospital.

4.2. Most important symptoms and effects (acute and delayed)

Symptoms/effects after inhalation : EXPOSURE TO HIGH CONCENTRATIONS: Headache. Nausea. Feeling of weakness. Dizziness. Central nervous system depression. Narcosis. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness.

Symptoms/effects after skin contact : Tingling/irritation of the skin. Red skin.

Symptoms/effects after eye contact : Irritation of the eye tissue.

Symptoms/effects after ingestion : Risk of aspiration pneumonia. Nausea. Abdominal pain. Irritation of the gastric/intestinal mucosa. Symptoms similar to those listed under inhalation.

Chronic symptoms : ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Dry skin. Skin rash/inflammation. Impairment of the nervous system. Tremor. Impaired memory. Impaired concentration. Brain affection. Disturbances of heart rate. Change in the haemogramme/blood composition.

4.3. Immediate medical attention and special treatment, if necessary

Obtain medical assistance.

SECTION 5: Fire-fighting measures

5.1. Suitable (and unsuitable) extinguishing media

Suitable extinguishing media : Quick-acting ABC powder extinguisher. Quick-acting BC powder extinguisher. Quick-acting class B foam extinguisher. Quick-acting CO2 extinguisher. Class B foam (not alcohol-resistant).

Unsuitable extinguishing media : Water (quick-acting extinguisher, reel); risk of puddle expansion. Water; risk of puddle expansion.

5.2. Specific hazards arising from the chemical

Fire hazard : DIRECT FIRE HAZARD: Highly flammable liquid and vapour. Gas/vapour flammable with air within explosion limits. INDIRECT FIRE HAZARD: May build up electrostatic charges: risk of ignition. May be ignited by sparks. Gas/vapour spreads at floor level: ignition hazard. Reactions involving a fire hazard: see "Reactivity Hazard".

Explosion hazard : DIRECT EXPLOSION HAZARD: Gas/vapour explosive with air within explosion limits. INDIRECT EXPLOSION HAZARD: may be ignited by sparks. Reactions with explosion hazards: see "Reactivity Hazard".

Reactivity : Reacts violently with (some) halogens. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Violent to explosive reaction with (some) acids.

5.3. Special protective equipment and precautions for fire-fighters

Firefighting instructions : Cool tanks/drums with water spray/remove them into safety. Do not move the load if exposed to heat.

Protection during firefighting : Heat/fire exposure: compressed air/oxygen apparatus.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment : Gloves. Protective goggles. Head/neck protection. Protective clothing. Large spills/in enclosed spaces: compressed air apparatus. Large spills/in enclosed spaces: gas-tight suit.

Emergency procedures : Keep upwind. Mark the danger area. Consider evacuation. Seal off low-lying areas. Close doors and windows of adjacent premises. Stop engines and no smoking. No naked flames or sparks. Spark- and explosionproof appliances and lighting equipment. Keep containers closed. Wash contaminated clothes.

6.1.2. For emergency responders

Protective equipment : Do not breathe gas, fumes, vapour or spray. Equip cleanup crew with proper protection.

Emergency procedures : Stop leak if safe to do so. Ventilate area. If a major spill occurs, all personnel should be immediately evacuated and the area ventilated.

6.2. Environmental precautions

Prevent soil and water pollution.

6.3. Methods and material for containment and cleaning up

For containment : Contain released product, pump into suitable containers. Plug the leak, cut off the supply. Dam up the liquid spill. Try to reduce evaporation. Measure the concentration of the explosive gas-air mixture. Dilute/disperse combustible gas/vapour with water curtain. Provide equipment/receptacles with earthing. Do not use compressed air for pumping over spills.

Methods for cleaning up : Liquid spill: cover with foam. Take up liquid spill into inert absorbent material, e.g.: sand, earth, vermiculite. Scoop absorbed substance into closing containers. Carefully collect the spill/leftovers. Damaged/cooled tanks must be emptied. Do not use compressed air for pumping over spills. Take collected spill to manufacturer/competent authority. Wash clothing and equipment after handling.

6.4. Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Use spark-/explosionproof appliances and lighting system. Take precautions against electrostatic charges. Keep away from naked flames/heat. Keep away from ignition sources/sparks. Measure the concentration in the air regularly. Work under local exhaust/ventilation. Comply with the legal requirements. Remove contaminated clothing immediately. Clean contaminated clothing. Handle uncleaned empty containers as full ones. Thoroughly clean/dry the installation before use. Do not discharge the waste into the drain. Do not use compressed air for pumping over.

Hygiene measures : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Do not eat, drink or smoke when using this product.

7.2. Conditions for safe storage, including any incompatibilities

Incompatible products : Strong oxidizers.

Incompatible materials : Direct sunlight. Heat sources. Sources of ignition.

Heat and ignition sources : KEEP SUBSTANCE AWAY FROM: heat sources. ignition sources.

Prohibitions on mixed storage : KEEP SUBSTANCE AWAY FROM: oxidizing agents. (strong) acids. halogens.

Storage area : Store at ambient temperature. Ventilation at floor level. Fireproof storeroom. Provide for a tub to collect spills. Provide the tank with earthing. Under a shelter/in the open. Store only in a limited quantity. May be stored under nitrogen. Meet the legal requirements. Keep out of direct sunlight.

Special rules on packaging : SPECIAL REQUIREMENTS: closing. clean. correctly labelled. meet the legal requirements. Secure fragile packagings in solid containers.

Packaging materials : SUITABLE MATERIAL: metal. stainless steel. carbon steel. aluminium. nickel. polypropylene. glass. tin. MATERIAL TO AVOID: polyethylene.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Toluene (108-88-3)		
ACGIH	ACGIH TWA (ppm)	20 ppm
OSHA	OSHA PEL (TWA) (ppm)	200 ppm
OSHA	OSHA PEL (STEL) (ppm)	500 ppm 10-min peak per 8 hour shift
OSHA	OSHA PEL (Ceiling) (ppm)	300 ppm
IDLH	US IDLH (ppm)	500 ppm
NIOSH	NIOSH REL (TWA) (mg/m³)	375 mg/m³
NIOSH	NIOSH REL (TWA) (ppm)	100 ppm
NIOSH	NIOSH REL (STEL) (mg/m³)	560 mg/m³
NIOSH	NIOSH REL (STEL) (ppm)	150 ppm

8.2. Appropriate engineering controls

Appropriate engineering controls : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Ensure adequate ventilation.

8.3. Individual protection measures/Personal protective equipment

Materials for protective clothing:

GIVE GOOD RESISTANCE: tetrafluoroethylene. viton. PVA. GIVE LESS RESISTANCE: butyl rubber. natural rubber. neoprene. nitrile rubber. polyethylene. neoprene/natural rubber. nitrile rubber/PVC. GIVE POOR RESISTANCE: chloroprene rubber

Hand protection:

Gloves

Eye protection:

Safety glasses

Skin and body protection:

Head/neck protection. Protective clothing

Respiratory protection:

Full face mask with filter type A at conc. in air > exposure limit

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Appearance	:	Liquid.
Colour	:	Colourless
Odour	:	Aromatic odour
Odour threshold	:	0.2 - 69 ppm 0.8 - 276 mg/m³
pH	:	No data available
Melting point	:	-95 °C (1013 hPa)
Freezing point	:	No data available
Boiling point	:	110.6 °C (1013 hPa)
Critical temperature	:	321 °C
Critical pressure	:	41077 hPa
Flash point	:	4.4 °C (Closed cup, 1013 hPa)
Relative evaporation rate (butylacetate=1)	:	2.24
Flammability (solid, gas)	:	No data available
Vapour pressure	:	30.89 hPa (21.1 °C)
Vapour pressure at 50 °C	:	109 hPa
Relative vapour density at 20 °C	:	3.1
Relative density	:	0.87 (20 °C)
Relative density of saturated gas/air mixture	:	1.6
Density	:	870 kg/m³
Molecular mass	:	92.14 g/mol
Solubility	:	Insoluble in water. Soluble in ethanol. Soluble in ether. Soluble in acetone. Soluble in chloroform. Soluble in carbondisulfide. Soluble in acetic acid. Soluble in ethylacetate. Soluble in petroleum spirit. Water: 0.057 - 0.059 g/100ml (25 °C) Ethanol: complete Ether: complete Acetone: > 10 g/100ml
Log Pow	:	2.73 (Experimental value, 20 °C)
Auto-ignition temperature	:	480 °C (1013 hPa)
Decomposition temperature	:	No data available
Viscosity, kinematic	:	0.69 mm²/s (20 °C)
Viscosity, dynamic	:	0.6 mPa.s (20 °C)

Explosive limits	:	1.3 - 7 vol % 46 - 270 g/m³ Lower explosive limit (LEL): 1.3 vol % Upper explosive limit (UEL): 7 vol %
Explosive properties	:	No data available
Oxidising properties	:	No data available

9.2. Other information

Minimum ignition energy	:	0.3 mJ
Specific conductivity	:	< 1 pS/m
Saturation concentration	:	110 g/m³
VOC content	:	100 %
Other properties	:	Gas/vapour heavier than air at 20°C. Clear. Volatile. Substance has neutral reaction. May generate electrostatic charges.

SECTION 10: Stability and reactivity

10.1. Reactivity

Reacts violently with (some) halogens. Reacts violently with (strong) oxidizers: (increased) risk of fire/explosion. Violent to explosive reaction with (some) acids.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Heat. Direct sunlight. Sparks. Open flame.

10.5. Incompatible materials

Strong oxidizers.

10.6. Hazardous decomposition products

Carbon dioxide. Carbon monoxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Likely routes of exposure	:	Inhalation; Skin and eyes contact
Acute toxicity	:	Not classified

Toluene (108-88-3)	
LD50 oral rat	5580 mg/kg bodyweight (Equivalent or similar to EU Method B.1: Acute Toxicity (Oral), Rat, Male, Experimental value)
LD50 dermal rabbit	> 5000 mg/kg bodyweight (Other, 24 h, Rabbit, Male, Experimental value)
LC50 inhalation rat (mg/l)	25.7 mg/l air (Equivalent or similar to OECD 403, 4 h, Rat, Male, Experimental value)
ATE US (oral)	5580 mg/kg bodyweight

Skin corrosion/irritation	:	Causes skin irritation.
Serious eye damage/irritation	:	Not classified
Respiratory or skin sensitisation	:	Not classified
Germ cell mutagenicity	:	Not classified
Carcinogenicity	:	Not classified
Reproductive toxicity	:	Suspected of damaging fertility or the unborn child.
Specific target organ toxicity (single exposure)	:	May cause drowsiness or dizziness.
Specific target organ toxicity (repeated exposure)	:	May cause damage to organs (central nervous system, liver, heart) through prolonged or repeated exposure.
Aspiration hazard	:	May be fatal if swallowed and enters airways.

Potential adverse human health effects and symptoms	:	May be fatal if swallowed and enters airways. Practically non-toxic if swallowed (LD50 oral, rat > 2000 mg/kg). Causes skin irritation. Non-toxic in contact with skin (LD50 skin> 5000 mg/kg). May cause drowsiness or dizziness. Non-toxic by inhalation (LC50 inh, rat > 20 mg/l/4h). Moderately irritant for eyes. Caution! Substance is absorbed through the skin.
Symptoms/effects after inhalation	:	EXPOSURE TO HIGH CONCENTRATIONS: Headache. Nausea. Feeling of weakness. Dizziness. Central nervous system depression. Narcosis. Mental confusion. Drunkenness. Coordination disorders. Disturbed motor response. Disturbances of consciousness.
Symptoms/effects after skin contact	:	Tingling/irritation of the skin. Red skin.
Symptoms/effects after eye contact	:	Irritation of the eye tissue.
Symptoms/effects after ingestion	:	Risk of aspiration pneumonia. Nausea. Abdominal pain. Irritation of the gastric/intestinal mucosa. Symptoms similar to those listed under inhalation.
Chronic symptoms	:	ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: Dry skin. Skin rash/inflammation. Impairment of the nervous system. Tremor. Impaired memory. Impaired concentration. Brain affection. Disturbances of heart rate. Change in the haemogramme/blood composition.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general	:	Not classified as dangerous for the environment according to the criteria of Regulation (EC) No 1272/2008.
Ecology - air	:	Not included in the list of fluorinated greenhouse gases (Regulation (EU) No 517/2014). Not classified as dangerous for the ozone layer (Regulation (EC) No 1005/2009).
Ecology - water	:	Toxic to crustacea. Toxic to fishes. Groundwater pollutant. Fouling to shoreline. Inhibits photosynthesis of algae. Harmful to bacteria. Taste alteration in fishes/aquatic organisms.

Toluene (108-88-3)	
LC50 fish 1	5.5 mg/l (96 h, Oncorhynchus kisutch, Flow-through system, Fresh water, Experimental value)

12.2. Persistence and degradability

Toluene (108-88-3)	
Persistence and degradability	Biodegradable in the soil. Readily biodegradable in water.
Biochemical oxygen demand (BOD)	2.15 g O_2/g substance
Chemical oxygen demand (COD)	2.52 g O_2/g substance
ThOD	3.13 g O_2/g substance
BOD (% of ThOD)	0.69

12.3. Bioaccumulative potential

Toluene (108-88-3)	
BCF fish 1	90 (72 h, Leuciscus idus, Static system, Fresh water, Experimental value)
Log Pow	2.73 (Experimental value, 20 °C)
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).

12.4. Mobility in soil

Toluene (108-88-3)	
Surface tension	27.73 N/m (25 °C)
Ecology - soil	Low potential for adsorption in soil.

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Disposal methods

Regional legislation (waste)	:	LWCA (the Netherlands): KGA category 03.

Waste disposal recommendations	:	Do not discharge into drains or the environment. Remove waste in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Recycle by distillation. Do not landfill. Incinerate under surveillance with energy recovery. May be discharged to company wastewater treatment plant.
Additional information	:	Hazardous waste according to Directive 2008/98/EC, as amended by Regulation (EU) No 1357/2014 and Regulation (EU) No 2017/997.

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

Transport document description	:	UN1294 Toluene, 3, II
UN-No.(DOT)	:	UN1294
Proper Shipping Name (DOT)	:	Toluene
Transport hazard class(es) (DOT)	:	3 - Class 3 - Flammable and combustible liquid 49 CFR 173.120
Packing group (DOT)	:	II - Medium Danger
Hazard labels (DOT)	:	3 - Flammable liquid

DOT Packaging Non Bulk (49 CFR 173.xxx)	:	202
DOT Packaging Bulk (49 CFR 173.xxx)	:	242
DOT Special Provisions (49 CFR 172.102)	:	IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized. T4 - 2.65 178.274(d)(2) Normal..... 178.275(d)(3) TP1 - The maximum degree of filling must not exceed the degree of filling determined by the following: Degree of filling = 97 / (1 + a (tr - tf)) Where: tr is the maximum mean bulk temperature during transport, and tf is the temperature in degrees celsius of the liquid during filling.
DOT Packaging Exceptions (49 CFR 173.xxx)	:	150
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	:	5 L
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	:	60 L
DOT Vessel Stowage Location	:	B - (i) The material may be stowed ‘‘on deck’’ or ‘‘under deck’’ on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) ‘‘On deck only’’ on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.
Other information	:	No supplementary information available.

SECTION 15: Regulatory information

15.1. US Federal regulations

Toluene (108-88-3)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory Subject to reporting requirements of United States SARA Section 313	
RQ (Reportable quantity, section 304 of EPA's List of Lists)	1000 lb
SARA Section 311/312 Hazard Classes	Health hazard - Skin corrosion or Irritation Health hazard - Reproductive toxicity Physical hazard - Flammable (gases, aerosols, liquids, or solids) Health hazard - Specific target organ toxicity (single or repeated exposure) Health hazard - Aspiration hazard

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

Chemical(s) subject to the reporting requirements of Section 313 or Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and 40 CFR Part 372.

Toluene	CAS-No. 108-88-3	100%

15.2. International regulations

CANADA

Toluene (108-88-3)
Listed on the Canadian DSL (Domestic Substances List)

EU-Regulations

No additional information available

National regulations

Toluene (108-88-3)
Listed on the Canadian IDL (Ingredient Disclosure List)

15.3. US State regulations

Toluene (108-88-3)	
U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No
No significant risk level (NSRL)	7000 µg/day

This product can expose you to Toluene, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

SECTION 16: Other information

Revision date : 02/27/2018

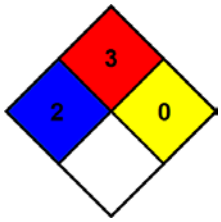
Full text of H-statements: see section 16:

H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H361	Suspected of damaging fertility or the unborn child.
H373	May cause damage to organs through prolonged or repeated exposure.
H402	Harmful to aquatic life

NFPA health hazard : 2 - Materials that, under emergency conditions, can cause temporary incapacitation or residual injury.

NFPA fire hazard : 3 - Liquids and solids (including finely divided suspended solids) that can be ignited under almost all ambient temperature conditions.

NFPA reactivity : 0 - Material that in themselves are normally stable, even under fire conditions.



Hazard Rating		
Health	:	3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given
Flammability	:	1 Slight Hazard - Materials that must be preheated before ignition will occur. Includes liquids, solids and semi solids having a flash point above 200 F. (Class IIIB)
Physical	:	2 Moderate Hazard - Materials that are unstable and may undergo violent chemical changes at normal temperature and pressure with low risk for explosion. Materials may react violently with water or form peroxides upon exposure to air.
Personal protection	:	H H - Splash goggles, Gloves, Synthetic apron, Vapor respirator

SDS US LabChem

Information in this SDS is from available published sources and is believed to be accurate. No warranty, express or implied, is made and LabChem Inc assumes no liability resulting from the use of this SDS. The user must determine suitability of this information for his application.

SAFETY DATA SHEET

Creation Date 03-Feb-2010 **Revision Date** 14-Jul-2016 **Revision Number** 2

1. Identification

Product Name **Trichloroethylene**

Cat No. : **T340-4; T341-4; T341-20; T341-500; T403-4**

Synonyms Trichloroethene (Stabilized/Technical/Electronic/Certified ACS)

Recommended Use Laboratory chemicals.
Uses advised against

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Germ Cell Mutagenicity	Category 2
Carcinogenicity	Category 1A
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, spleen, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
Suspected of causing genetic defects
May cause cancer
May cause damage to organs through prolonged or repeated exposure

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
WARNING! This product contains a chemical known in the State of California to cause cancer, birth defects or other reproductive harm.

3. Composition / information on ingredients

Component	CAS-No	Weight %
Trichloroethylene	79-01-6	100

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a

	pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms/effects	None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	410 °C / 770 °F
Explosion Limits	
Upper	10.5 vol %
Lower	8 vol %
Oxidizing Properties	Not oxidising
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Hydrogen chloride gas Chlorine Phosgene Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas.
Environmental Precautions	Should not be released into the environment. Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Do not ingest.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from light. Do not store in aluminum containers.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Trichloroethylene	TWA: 10 ppm STEL: 25 ppm	(Vacated) TWA: 50 ppm (Vacated) TWA: 270 mg/m³ Ceiling: 200 ppm (Vacated) STEL: 200 ppm (Vacated) STEL: 1080 mg/m³ TWA: 100 ppm	IDLH: 1000 ppm	TWA: 100 ppm TWA: 535 mg/m³ STEL: 200 ppm STEL: 1080 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Long sleeved clothing.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-85 °C / -121 °F
Boiling Point/Range	87 °C / 188.6 °F
Flash Point	No information available
Evaporation Rate	0.69 (Carbon Tetrachloride = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	10.5 vol %
Lower	8 vol %
Vapor Pressure	77.3 mbar @ 20 °C
Vapor Density	4.5 (Air = 1.0)
Specific Gravity	1.460
Solubility	Slightly soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	410 °C / 770 °F
Decomposition Temperature	> 120°C
Viscosity	0.55 mPa.s (25°C)

Molecular Formula C2 H Cl3
Molecular Weight 131.39

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Light sensitive.

Conditions to Avoid Incompatible products. Excess heat. Exposure to light. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong bases, Amines, Alkali metals, Metals,

Hazardous Decomposition Products Hydrogen chloride gas, Chlorine, Phosgene, Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Trichloroethylene	LD50 = 4290 mg/kg (Rat) LD50 = 4920 mg/kg (Rat)	LD50 > 20 g/kg (Rabbit) LD50 = 29000 mg/kg (Rabbit)	LC50 = 26 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Trichloroethylene	79-01-6	Group 1	Reasonably Anticipated	A2	X	Not listed

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in humans.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart spleen Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. The product contains following substances which are hazardous for the environment. Contains a substance which is:. Harmful to aquatic organisms. Toxic to aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Trichloroethylene	EC50: = 175 mg/L, 96h (Pseudokirchneriella subcapitata) EC50: = 450 mg/L, 96h (Desmodesmus subspicatus)	LC50: 39 - 54 mg/L, 96h static (Lepomis macrochirus) LC50: 31.4 - 71.8 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 0.81 mg/L 24 h EC50 = 115 mg/L 10 min EC50 = 190 mg/L 15 min EC50 = 235 mg/L 24 h EC50 = 410 mg/L 24 h EC50 = 975 mg/L 5 min	EC50: = 2.2 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Trichloroethylene	2.4

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Trichloroethylene - 79-01-6	U228	-

14. Transport information

DOT

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IATA

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE

Hazard Class 6.1
Packing Group III

IMDG/IMO

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Trichloroethylene	X	X	-	201-167-4	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

Component	TSCA 12(b)
Trichloroethylene	Section 5

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Trichloroethylene	79-01-6	100	0.1

SARA 311/312 Hazard Categories

Acute Health Hazard Yes
Chronic Health Hazard Yes
Fire Hazard No
Sudden Release of Pressure Hazard No
Reactive Hazard No

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Trichloroethylene	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Trichloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Trichloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Trichloroethylene	79-01-6	Carcinogen Developmental Male Reproductive	14 µg/day 50 µg/day	Developmental Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Trichloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 03-Feb-2010
Revision Date 14-Jul-2016
Print Date 14-Jul-2016
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

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

End of SDS

SAFETY DATA SHEET

M9192 - ANSI - EN

Oxy Vinyls, LP
A subsidiary of Occidental Petroleum Corporation

VINYL CHLORIDE (MONOMER)

SDS No.: M9192 **SDS Revision Date:** 06-Apr-2015

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Company Identification:	Oxy Vinyls, LP 5005 LBJ Freeway Suite 2200 Dallas, Texas 75244-6119
24 Hour Emergency Telephone Number:	1-800-733-3665 or 1-972-404-3228 (USA); CHEMTREC (within USA and Canada): 1-800-424-9300; CHEMTREC (outside USA and Canada): +1 703-527-3887; CHEMTREC Contract No: CCN16186
To Request an SDS:	MSDS@oxy.com or 1-972-404-3245
Customer Service:	1-800-752-5151 or 1-972-404-3700
Product Identifier:	**VINYL CHLORIDE (MONOMER)**
Synonyms:	VCM, Monochloroethylene, Chloroethene, Ethylene, chloro-, Vinyl chloride monomer
Product Use:	PVC Manufacturing
Uses Advised Against:	Aerosol propellant.

2. HAZARDS IDENTIFICATION

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

VINYL CHLORIDE (MONOMER)

SDS No.: M9192 **SDS Revision Date:** 06-Apr-2015

****

EMERGENCY OVERVIEW:

Color: Colorless
Physical state Compressed, liquefied gas
Odor: Sweet

Signal Word: **DANGER**

MAJOR HEALTH HAZARDS: CONTAINS VINYL CHLORIDE, A KNOWN HUMAN CANCER AGENT. MAY CAUSE CANCER. CONTACT WITH LIQUID MAY CAUSE FROSTBITE TO EXPOSED TISSUE. MAY PRODUCE SYMPTOMS OF CENTRAL NERVOUS SYSTEM DEPRESSION INCLUDING HEADACHE, DIZZINESS, NAUSEA, LOSS OF BALANCE AND DROWSINESS. CAUSES SKIN IRRITATION. CAUSES EYE IRRITATION. MAY CAUSE RESPIRATORY IRRITATION. CAUSES DAMAGE TO LIVER, BLOOD, NERVOUS SYSTEM, LYMPHATIC SYSTEM, AND MUSCULOSKELETAL SYSTEM THROUGH PROLONGED OR REPEATED EXPOSURE. CAUSES DAMAGE TO LUNGS THROUGH PROLONGED OR REPEATED EXPOSURE BY INHALATION. SUSPECTED OF CAUSING GENETIC DEFECTS. SUSPECTED REPRODUCTIVE HAZARD.

PHYSICAL HAZARDS: Extremely flammable gas under pressure.

PRECAUTIONARY STATEMENTS: Keep away from heat, sparks and flame. Wash thoroughly after handling. Avoid contact with eyes, skin and clothing. Do not breathe vapors or spray mist. Do not eat, drink or smoke in areas where this material is used. Use only outdoors or in a well-ventilated area. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Store in well-ventilated place. Keep container tightly closed.

****

GHS CLASSIFICATION:

GHS: PHYSICAL HAZARDS:	Flammable Gas - Cat. 1 Extremely Flammable Gas Under Pressure - Liquefied
GHS: CONTACT HAZARD - SKIN:	Category 2 - Causes skin irritation.
GHS: CONTACT HAZARD - EYE:	Category 2B - Causes eye irritation
GHS: TARGET ORGAN TOXICITY (SINGLE EXPOSURE):	Category 3 - May cause respiratory tract irritation Category 3 - May cause drowsiness or dizziness
GHS: TARGET ORGAN TOXICITY (REPEATED EXPOSURE):	Category 1 - Causes damage to liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system through prolonged or repeated exposure
GHS: CARCINOGENICITY:	Category 1A - May cause cancer.
GHS: GERM CELL MUTAGENICITY:	Category 2 - Suspected of causing genetic defects
GHS: REPRODUCTION TOXIN:	Category 2 - Suspected of damaging fertility or the unborn child
GHS - OSHA Hazard(s)	Simple Asphyxiant: May displace oxygen and cause rapid suffocation

Unknown Acute Dermal Toxicity:
100% of this product consists of ingredient(s) of unknown acute dermal toxicity.

Unknown Acute Inhalation Toxicity:
100% of this product consists of ingredient(s) of unknown acute inhalation toxicity.

GHS SYMBOL:
Flame, Gas cylinder, Exclamation mark, Health hazards

GHS SIGNAL WORD: **DANGER**

GHS HAZARD STATEMENTS:

GHS - Physical Hazard Statement(s)
Extremely flammable gas
Contains gas under pressure; may explode if heated
May displace oxygen and cause rapid suffocation

GHS - Health Hazard Statement(s)
Causes eye irritation
Causes skin irritation
May cause drowsiness or dizziness
May cause respiratory irritation
Causes damage to organs through prolonged or repeated exposure: (liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system)
May cause cancer
Suspected of causing genetic defects
Suspected of damaging fertility or the unborn child

GHS - OSHA Hazard(s)
Simple Asphyxiant: May displace oxygen and cause rapid suffocation

GHS - Precautionary Statement(s) - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Keep away from heat/sparks/open flames/hot surfaces. — No smoking
Do not breathe dust/fume/gas/mist/vapors/spray
Use personal protective equipment as required
Wear protective gloves/protective clothing/eye protection/face protection
Wash thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area

GHS - Precautionary Statement(s) - Response
Leaking gas fire: Do not extinguish, unless leak can be stopped safely
Eliminate all ignition sources if safe to do so
IF INHALED: Remove person to fresh air and keep comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
IF ON SKIN: Wash with plenty of water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash it before reuse
Specific treatment (see First Aid information on product label and/or Section 4 of the SDS)
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Specific treatment (see Section 4 of the safety data sheet and/or the First Aid information on the product label)
Get medical advice/attention if you feel unwell
IF exposed or concerned: call a POISON CENTER or doctor/physician

GHS - Precautionary Statement(s) - Storage
Store in a well-ventilated place. Keep container tightly closed
Protect from sunlight
Store locked up

GHS - Precautionary Statement(s) - Disposal
Dispose of contents and container in accordance with applicable local, regional, national, and/or international regulations.

Hazards Not Otherwise Classified (HNOC)
Direct contact with liquid may cause frostbite to exposed tissue (eyes, skin, etc.)
Polymerization can occur

See Section 11: TOXICOLOGICAL INFORMATION

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: VCM, Monochloroethylene, Chloroethene, Ethylene, chloro-, Vinyl chloride monomer

Component	Percent [%]	CAS Number
Vinyl chloride	99 - 100	75-01-4

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer basic life support (Cardio-Pulmonary Resuscitation and/or Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: If frostbite or freezing occur, immediately flush with plenty of lukewarm water (100-105 °F, 38-41 °C). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Not a likely route of exposure in occupational environment.

Most Important Symptoms/Effects (Acute and Delayed) :.

Acute Symptoms/Effects: Listed below. Prolonged, high concentration exposures may cause unconsciousness or death.
Inhalation (Breathing): Respiratory Tract Irritation: rhinitis, scratchy throat, cough, sore throat, runny nose, wheezing, difficulty breathing (dyspnea). Inhalation of this material may cause central nervous system depression (narcotic effects).
Skin: Skin Irritation. If spilled on skin, rapid evaporation can cause local frostbite with redness, blistering, and scaling.
Eye: Eye Irritation. Rapid evaporation can cause local frostbite with corneal and conjunctival irritation or burns. High concentrations of vapor can cause eye irritation.
Ingestion (Swallowing): Ingestion is not a likely route of exposure.
Other Health Effects: Narcotic Effects (Central Nervous System Depression): Ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual or hearing disturbances, nausea, memory loss.

Delayed Symptoms/Effects:
- Carcinogen: Long term significant occupational overexposure to VCM has been associated with a specific cancer (angiosarcoma of the liver) and is associated with hepatocellular cancer
- Suspected mutagen and suspected of causing reproductive damage
- Repeated exposure can damage the skin (scleroderma), bones (acro-osteolysis) and blood vessels in the hand (Raynaud's Syndrome)
- Scleroderma is characterized by a hardening and tightening of patches of skin
- Raynaud's syndrome is characterized by an exaggerated response to cold temperatures or emotional distress, which can cause numbness, pain or color changes in the fingers or toes

Interaction with Other Chemicals Which Enhance Toxicity: Alcohol may enhance toxic effects.

Medical Conditions Aggravated by Exposure: Alcoholic Liver Disease. Infectious Hepatitis. Cirrhosis.

Protection of First-Aiders: Protect yourself by avoiding contact with this material. Direct contact with liquid may cause frostbite to exposed tissue (eyes, skin, etc.). Use personal protective equipment. Refer to Section 8 for specific personal protective equipment recommendations. At minimum, treating personnel should utilize PPE sufficient for prevention of bloodborne pathogen transmission.

Notes to Physician: There is no specific antidote. Treat symptoms with supportive care. Cardiac stimulants such as epinephrine should be avoided in persons overexposed to chlorinated hydrocarbons.

5. FIRE-FIGHTING MEASURES

Fire Hazard: Severe fire hazard. Vapor/air mixtures are explosive. Vapors or gases may ignite at distant sources and flash back. Containers may rupture or explode if exposed to heat.

Extinguishing Media: Stop flow of gas before extinguishing fire. Use carbon dioxide, regular dry chemical, foam or water. Use water spray to keep containers cool.

Fire Fighting: Move container from fire area if it can be done without risk. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this can't be done, then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode.

Hazardous Combustion Products:	Oxides of carbon, Hydrogen chloride, Phosgene
Sensitivity to Mechanical Impact:	Not sensitive.
Sensitivity to Static Discharge:	Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].
Lower Flammability Level (air):	3.6%
Upper Flammability Level (air):	33.0%
Flash point:	-108 °F (-78 °C)
Auto-ignition Temperature:	882 °F (472 °C)

GHS: PHYSICAL HAZARDS:
- Flammable Gas - Cat. 1 Extremely Flammable
- Gas Under Pressure - Liquefied

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:
Isolate hazard area and deny entry. Keep unnecessary and unprotected persons away. Eliminate all sources of heat and ignition. Ventilate closed spaces before entering. Wear appropriate personal protective equipment recommended in Section 8, Exposure Controls / Personal Protection, of the SDS. Refer to Section 7, Handling and Storage, for additional precautionary measures.

Methods and Materials for Containment and Cleaning Up:
Remove sources of ignition. Ventilate closed spaces before entering. Stop leak if possible without personal risk. Vapors or gases may ignite at distant ignition sources and flash back. See Section 13, Disposal considerations, for additional information.

Environmental Precautions:
Keep out of water supplies and sewers. Releases should be reported, if required, to appropriate agencies.

7. HANDLING AND STORAGE

Precautions for Safe Handling:
Avoid breathing vapor or mist. Avoid contact with skin, eyes and clothing. Keep away from heat, sparks and flame. Ground any equipment used in handling. Use non-sparking tools and equipment. All energized electrical equipment must be designed in accordance with the electrical classification of the area.

Safe Storage Conditions:
Store and handle in accordance with all current regulations and standards. Keep container tightly closed and properly labeled. Store in a cool, dry area. Store in a well-ventilated area. Do not enter confined spaces unless adequately ventilated. Avoid heat, flames, sparks and other sources of ignition. May be subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Keep separated from incompatible substances (see below or Section 10 of the Safety Data Sheet).

Incompatibilities/ Materials to Avoid:
oxidizing agents, oxides of nitrogen, metals, aluminum, aluminum alloys, copper, metal alkyl complexes and alkali metals such as sodium, potassium and their alloys

GHS: PHYSICAL HAZARDS:
- Flammable Gas - Cat. 1 Extremely Flammable
- Gas Under Pressure - Liquefied

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Regulatory Exposure Limit(s): As listed below.

Component	OSHA Final PEL TWA	OSHA Final PEL STEL	OSHA Final PELCeiling
Vinyl chloride 75-01-4	1 ppm	5 ppm	-----

OEL: Occupational Exposure Limit; OSHA: United States Occupational Safety and Health Administration; PEL: Permissible Exposure Limit; TWA: Time Weighted Average; STEL: Short Term Exposure Limit

NON-REGULATORY EXPOSURE LIMIT(S): As listed below.

Component	CAS Number	ACGIH TWA	ACGIH STEL	ACGIH Ceiling	OSHA TWA (Vacated)	OSHA STEL (Vacated)	OSHA Ceiling (Vacated)

Vinyl chloride	75-01-4	1 ppm	-----	-----	-----	-----	-----

- The Non-Regulatory United States Occupational Safety and Health Administration (OSHA) limits, if shown, are the Vacated 1989 PEL's (vacated by 58 FR 35338, June 30, 1993).

- The American Conference of Governmental Industrial Hygienists (ACGIH) is a voluntary organization of professional industrial hygiene personnel in government or educational institutions in the United States. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices.

ENGINEERING CONTROLS: Use closed systems when possible. Provide local exhaust ventilation where vapor may be generated. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Wear safety glasses with side-shields. If eye contact is likely, wear chemical resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection: Wear appropriate chemical resistant clothing.

Hand Protection: Wear appropriate chemical resistant gloves. Consult a glove supplier for assistance in selecting an appropriate chemical resistant glove.

Protective Material Types: Butyl rubber, Nitrile, Silver Shield®, Viton®

Respiratory Protection: Refer to 29 CFR 1910.1017 for selection of respirators for vinyl chloride. A respiratory protection program that meets applicable regulatory requirements must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	Compressed, liquefied gas
Color:	Colorless
Odor:	Sweet
Odor Threshold [ppm]:	Not reliable to prevent excessive exposure.
Molecular Weight:	62.5
Molecular Formula:	C2ClH3
Decomposition Temperature:	Not applicable
Boiling Point/Range:	7 °F (-14 °C)
Freezing Point/Range:	No data available.
Melting Point/Range:	Not applicable
Vapor Pressure:	2660 mmHg @ 25 °C
Vapor Density (air=1):	2.15
Relative Density/Specific Gravity (water=1):	0.91 @ 25/25 °C
Water Solubility:	2.7 g/L

pH:	Not applicable
VOC Content (%):	100%
Volatility:	100%
Evaporation Rate (ether=1):	>15
Partition Coefficient (n-octanol/water):	Log Kow = 1.36
Flash point:	-108 °F (-78 °C)
Flammability (solid, gas):	No data available
Lower Flammability Level (air):	3.6%
Upper Flammability Level (air):	33.0%
Auto-ignition Temperature:	882 °F (472 °C)
Viscosity:	Not applicable

10. STABILITY AND REACTIVITY

Reactivity: Not reactive under normal temperatures and pressures.

Chemical Stability: Stable at normal temperatures and pressures.

Possibility of Hazardous Reactions:
Avoid air and sunlight. Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

Conditions to Avoid:
(e.g., static discharge, shock, or vibration) -. Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].

Incompatibilities/ Materials to Avoid:
oxidizing agents. oxides of nitrogen. metals. aluminum. aluminum alloys. copper. metal alkyl complexes and alkali metals such as sodium, potassium and their alloys.

Hazardous Decomposition Products: oxides of carbon, chlorine, hydrogen chloride, phosgene

Hazardous Polymerization: Polymerization can occur. Avoid elevated temperatures, oxidizing agents, oxides of nitrogen, oxygen, peroxides, other polymerization catalysts/initiators, air and sunlight.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA:

PRODUCT TOXICITY DATA: VINYL CHLORIDE (MONOMER)

VINYL CHLORIDE (MONOMER)

LD50 Oral:	LD50 Dermal:	LC50 Inhalation:
> 4,000 mg/kg oral-rat LD50	-----	-----

COMPONENT TOXICITY DATA:

Note: The component toxicity data is populated by the LOLI database and may differ from the product toxicity data given.

Component	LD50 Oral:	LD50 Dermal:	LC50 Inhalation:
Vinyl chloride 75-01-4	-----	-----	18 pph (15 minr-Rat)

****

POTENTIAL HEALTH EFFECTS:

Eye contact: Causes eye irritation. Rapid evaporation of the material may cause frostbite.

Skin contact: Causes skin irritation. Rapid evaporation of the material may cause frostbite.

Inhalation: May cause respiratory tract irritation. Several minutes of exposure to high, but attainable concentrations (over 1000 ppm) may cause difficulty breathing, central nervous system depression and symptoms such as: ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual and or hearing disturbances, nausea, memory loss. Prolonged, high concentration exposures may cause unconsciousness or death. Cardiac: Acute intoxication may cause irregular heartbeats.

Ingestion: Not a likely route of exposure in occupational settings.

Chronic Effects: Chronic exposure to vinyl chloride monomer (VCM) may cause damage to the nervous system, respiratory system, musculoskeletal system, and lymphatic system. Occupational overexposure has produced a specific cancer (angiosarcoma of the liver) and is associated with hepatocellular cancer. Repeated prolonged exposure may damage: skin (scleroderma), bones (acro-osteolysis), blood vessels in the hands (Raynaud's Syndrome). Suspected of causing genetic defects. Suspected of damaging fertility or the unborn child. Reproductive effects and testes damage occurred in rats exposed to vinyl chloride. These endpoints, however, were generally noted at concentrations greater than those necessary to cause liver damage.

SIGNS AND SYMPTOMS OF EXPOSURE:

Listed below.

Inhalation (Breathing): Respiratory Tract Irritation: rhinitis, scratchy throat, cough, sore throat, runny nose, wheezing, difficulty breathing (dyspnea). Inhalation of this material may cause central nervous system depression (narcotic effects).
Skin: Skin Irritation. If spilled on skin, rapid evaporation can cause local frostbite with redness, blistering, and scaling.
Eye: Eye Irritation. Rapid evaporation can cause local frostbite with corneal and conjunctival irritation or burns. High concentrations of vapor can cause eye irritation.
Ingestion (Swallowing): Ingestion is not a likely route of exposure.

Other Health Effects: Narcotic Effects (Central Nervous System Depression): Ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual or hearing disturbances, nausea, memory loss.

Interaction with Other Chemicals Which Enhance Toxicity: Alcohol may enhance toxic effects.

****

GHS HEALTH HAZARDS:

Skin Absorbent / Dermal Route? No.

GHS: CONTACT HAZARD - SKIN: Category 2 - Causes skin irritation

GHS: CONTACT HAZARD - EYE: Category 2B - Causes eye irritation

GHS: CARCINOGENICITY:
Category 1A - May cause cancer.

Component	NTP:	IARC (GROUP 1):	IARC (GROUP 2):	OSHA:
Vinyl chloride	Listed	Group 1	Not listed	Listed

SPECIFIC TARGET ORGAN TOXICITY (Single Exposure):
Category 3 - Respiratory Tract Irritation
Category 3 - Narcotic Effects

SPECIFIC TARGET ORGAN TOXICITY (Repeated or Prolonged Exposure):
Category 1 - Liver, Blood, Nervous System, Lymphatic System, Musculoskeletal System, Respiratory System

MUTAGENIC DATA:
Category 2 - Suspected of causing genetic defects. Mutagenic in bacteria studies. Genetic studies in animals were negative in some cases and positive in others.

REPRODUCTIVE TOXICITY:
Category 2 - Suspected of damaging fertility or the unborn child. Reproductive effects and testes damage occurred in rats exposed to vinyl chloride. These endpoints, however, were generally noted at concentrations greater than those necessary to cause liver damage.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

Aquatic Toxicity:
This material is believed to be practically non-toxic to fish on an acute basis (LC50>100 mg/L).

FATE AND TRANSPORT:

BIODEGRADATION: Vinyl chloride may degrade under anaerobic conditions.

PERSISTENCE: Tropospheric half-life is estimated to be 23 hours. If released to air, this material will remain in the gas phase. If released to soil, volatilization will occur, but material that does not volatilize may be highly mobile. If released to water, evaporation will occur.

BIOCONCENTRATION: Bioconcentration potential is low (BCF <100 or log Kow <3).

13. DISPOSAL CONSIDERATIONS

Waste from material:
Reuse or reprocess, if possible. May be subject to disposal regulations. Dispose in accordance with all applicable regulations.

Container Management:
Refer to manufacturer/supplier for information on recovery/recycling. Dispose of container in accordance with applicable local, regional, national, and/or international regulations. Container rinsate must be disposed of in compliance with applicable regulations.

14. TRANSPORT INFORMATION

LAND TRANSPORT

U.S. DOT 49 CFR 172.101:

UN NUMBER:	UN1086
PROPER SHIPPING NAME:	Vinyl chloride, stabilized
HAZARD CLASS/ DIVISION:	2.1
LABELING REQUIREMENTS:	2.1
RQ (lbs):	RQ 1 Lbs. (Vinyl chloride)

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

UN NUMBER:	UN1086
SHIPPING NAME:	Vinyl chloride, stabilized
CLASS OR DIVISION:	2.1
LABELING REQUIREMENTS:	2.1

MARITIME TRANSPORT (IMO / IMDG) Regulated

UN NUMBER:	UN1086
PROPER SHIPPING NAME:	Vinyl chloride, stabilized

HAZARD CLASS / DIVISION: 2.1
LABELING REQUIREMENTS: 2.1

15. REGULATORY INFORMATION

U.S. REGULATIONS

OSHA REGULATORY STATUS:
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
If a release is reportable under CERCLA section 103, notify the state emergency response commission and local emergency planning committee. In addition, notify the National Response Center at (800) 424-8802 or (202) 426-2675.

Component	CERCLA Reportable Quantities:
Vinyl chloride	1 lb (final RQ)

SARA EHS Chemical (40 CFR 355.30)
Not regulated

EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.10):
Fire Hazard, Reactive Hazard, Sudden Release of Pressure, Acute Health Hazard, Chronic Health Hazard

EPCRA SECTION 313 (40 CFR 372.65):
The following chemicals are listed in 40 CFR 372.65 and may be subject to Community Right-to Know Reporting requirements.

Component	Status:
Vinyl chloride	0.1 %

OSHA SPECIFICALLY REGULATED SUBSTANCES:
OSHA 29 CFR 1910.1017 (Vinyl chloride); The U.S. Department of Labor, Occupational Safety and Health Administration specifically regulates manufacturing, handling and processing of vinyl chloride. Such regulations have been published at 29 CFR 1910.1017.

OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119):
The PSM standard may apply to processes which involve a flammable liquid or gas in a quantity of 10,000 pounds (4535.9 kg) or more.

NATIONAL INVENTORY STATUS

U.S. INVENTORY STATUS: Toxic Substance Control Act (TSCA): All components are listed or exempt.

TSCA 12(b): This product is not subject to export notification.

Canadian Chemical Inventory: All components of this product are listed on either the DSL or the NDSL.

STATE REGULATIONS

Component	California Proposition 65 Cancer WARNING:	California Proposition 65 CRT List - Male reproductive toxin:	California Proposition 65 CRT List - Female reproductive toxin:	Massachusetts Right to Know Hazardous Substance List	New Jersey Right to Know Hazardous Substance List	New Jersey Special Health Hazards Substance List
Vinyl chloride 75-01-4	Listed	Not Listed	Not Listed	Listed	2001	carcinogen; flammable - fourth degree; mutagen

Component	New Jersey - Environmental Hazardous Substance List	Pennsylvania Right to Know Hazardous Substance List	Pennsylvania Right to Know Special Hazardous Substances	Pennsylvania Right to Know Environmental Hazard List	Rhode Island Right to Know Hazardous Substance List
Vinyl chloride 75-01-4	Listed	Listed	Present	Present	Not Listed

CANADIAN REGULATIONS

• This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations

WHMIS - Classifications of Substances:

• A - Compressed Gas
• B1 - Flammable Gas
• D2A - Poisonous and Infectious Material; Materials causing other toxic effects - Very toxic material
• D2B - Poisonous and Infectious Material; Materials causing other toxic effects - Toxic material
• F - Dangerously reactive material

16. OTHER INFORMATION

Prepared by: OxyChem Corporate HESS - Product Stewardship

Rev. Date: 06-Apr-2015

HMIS: (SCALE 0-4) (Rated using National Paint & Coatings Association HMIS: Rating Instructions, 2nd Edition)

Health Rating: 2* **Flammability Rating:** 4 **Reactivity Rating:** 1

NFPA 704 - Hazard Identification Ratings (SCALE 0-4)

Health Rating: 2 **Flammability:** 4 **Reactivity Rating:** 2

VINYL CHLORIDE (MONOMER)

Reason for Revision:
• Revised Major Health Hazards: SEE SECTION 2
• Revised GHS Information: SEE SECTION 2
• Updated First Aid Measures: SEE SECTION 4
• PPE recommendations have been modified: SEE SECTION 8
• Toxicological Information has been revised: SEE SECTION 11
• Updated Disposal Considerations. SEE SECTION 13
• Updated Transportation Information: SEE SECTION 14

IMPORTANT:
The information presented herein, while not guaranteed, was prepared by technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESSED OR IMPLIED, IS MADE REGARDING PERFORMANCE, SAFETY, SUITABILITY, STABILITY OR OTHERWISE. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, storage, disposal and other factors that may involve other or additional legal, environmental, safety or performance considerations, and OxyChem assumes no liability whatsoever for the use of or reliance upon this information. While our technical personnel will be happy to respond to questions, safe handling and use of the product remains the responsibility of the customer. No suggestions for use are intended as, and nothing herein shall be construed as, a recommendation to infringe any existing patents or to violate any Federal, State, local or foreign laws

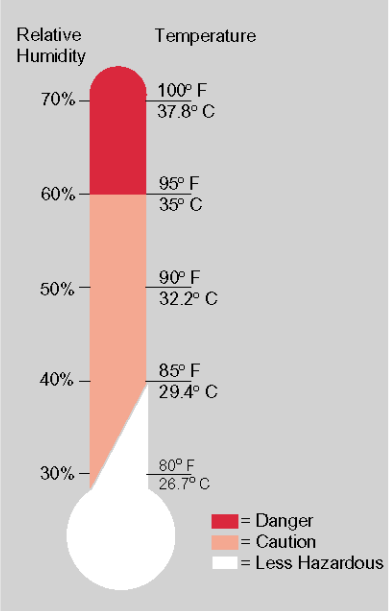
OSHA Standard 29 CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Safety Data Sheet available to your employees

End of Safety Data Sheet

THE HEAT EQUATION

HIGH TEMPERATURE + HIGH HUMIDITY + PHYSICAL WORK = HEAT ILLNESS

When the body is unable to cool itself through sweating, **serious** heat illnesses may occur. The most severe heat-induced illnesses are **heat exhaustion** and **heat stroke**. If actions are not taken to treat heat exhaustion, the illness could progress to heat stroke and possible **death**.



U.S. Department of Labor
Occupational Safety and Health Administration
OSHA 3154
1998

HEAT EXHAUSTION

What Happens to the Body:

HEADACHES, DIZZINESS/LIGHT HEADEDNESS, WEAKNESS, MOOD CHANGES (irritable, or confused/can't think straight), FEELING SICK TO YOUR STOMACH, VOMITING/THROWING UP, DECREASED and DARK COLORED URINE, FAINTING/PASSING OUT, and PALE CLAMMY SKIN.

What Should Be Done:

- Move the person to a cool shaded area to rest. Don't leave the person alone. If the person is dizzy or light headed, lay them on their back and raise their legs about 6-8 inches. If the person is sick to their stomach lay them on their side.
- Loosen and remove any heavy clothing.
- Have the person drink some cool water (a small cup every 15 minutes) if they are not feeling sick to their stomach.
- Try to cool the person by fanning them. Cool the skin with a cool spray mist of water or wet cloth.
- If the person does not feel better in a few minutes call for emergency help (Ambulance or Call 911).

(If heat exhaustion is not treated, the illness may advance to heat stroke.)

HEAT STROKE—A MEDICAL EMERGENCY

What Happens to the Body:

DRY PALE SKIN (no sweating), HOT RED SKIN (looks like a sunburn), MOOD CHANGES (irritable, confused/not making any sense), SEIZURES/FITS, and COLLAPSE/PASSED OUT (will not respond).

What Should Be Done:

- Call for emergency help (Ambulance or Call 911).
- Move the person to a cool shaded area. Don't leave the person alone. Lay them on their back and if the person is having seizures/fits remove any objects close to them so they won't strike against them. If the person is sick to their stomach lay them on their side.
- Remove any heavy and outer clothing.
- Have the person drink some cool water (a small cup every 15 minutes) if they are alert enough to drink anything and not feeling sick to their stomach.
- Try to cool the person by fanning them. Cool the skin with a cool spray mist of water, wet cloth, or wet sheet.
- If ice is available, place ice packs under the arm pits and groin area.

How to Protect Workers

- Learn the signs and symptoms of heat-induced illnesses and what to do to help the worker.
- Train the workforce about heat-induced illnesses.
- Perform the heaviest work in the coolest part of the day.
- Slowly build up tolerance to the heat and the work activity (usually takes up to 2 weeks).
- Use the buddy system (work in pairs).
- Drink plenty of cool water (one small cup every 15-20 minutes)
- Wear light, loose-fitting, breathable (like cotton) clothing.
- Take frequent short breaks in cool shaded areas (allow your body to cool down).
- Avoid eating large meals before working in hot environments.
- Avoid caffeine and alcoholic beverages (these beverages make the body lose water and increase the risk for heat illnesses).

Workers Are at Increased Risk When

- They take certain medication (check with your doctor, nurse, or pharmacy and ask if any medicines you are taking affect you when working in hot environments).
- They have had a heat-induced illness in the past.
- They wear personal protective equipment (like respirators or suits).

1.1 SUBMITTALS

A. First Environment has prepared the below COVID-19 Management Plan as Attachment 1 of First Environment's Health and Safety Plan

B. First Environment shall develop a one-page summary of site-specific practices for COVID-19 management and clearly display on site. Operating hours, delivery times, and extra considerations for works involving a high volume of personnel or potential for interaction with community members could also be included in the summary.

FIRST ENVIRONMENT

Environmental Management System Procedures
Title: First Environment Risk Reduction Policy for Coronavirus

Since we are in a period of uncertainty regarding the potential impact of the Coronavirus, First Environment is implementing the following requirements.

1. Any employee who is sick (fever, coughing, difficulty breathing) is asked to stay home and seek medical attention. Keep HR informed of the situation.
2. Employees should frequently wash hands for a minimum of 20 seconds (Happy Birthday twice) and use hand sanitizer located throughout the office.
3. Employees are asked to take their computers home **every** night rather than leaving them in the office. This will ensure the capacity to work remotely in the event that governmental actions, such as school closures, or risk reduction actions, such as a high local infection rate, mandate that employees to work remotely.
4. Employees are asked to save **all** files they have worked on to the network at the end of the day.
5. First Environment will be looking closely at travel locations and may make changes to planned business travel.
6. Employees traveling for personal reasons are asked to inform HR of plans and decisions on a possible 14-day quarantine period will be made on a case-by-case basis.
7. We are requiring the cleaning crew to used anti-bacterial and anti-viral cleaning products.
8. Wipes have been purchased for the office and are provided for wiping down surfaces prior to contact.
9. Should offices be closed due to government directives or a management decision, you will be notified by email.

Other Relevant FE Policy:

The includes additional requirements for essential work and applies to work performed at client's sites. First Environment has adopted this policy for work in other states whether or not required by state or local government as it represents best practice. Should state or local regulations contradict any of the requirements in the policy, those requirements supersede the policy. Other requirements in the policy remain valid.

Other guidance:

For latest information, guidance and updates on best practices, consult the

- Center for Disease Control (CDC)
- World Health Organization (WHO)
- National Institute of Health (NIH)

First Environment Covid-19 Policy

a. Non-essential visitors shall be prohibited from entering the worksite;

b. Worksite meetings, inductions, and workgroups shall be limited to groups of fewer than ten individuals;

c. Individuals are required to maintain 6 feet or more distance between them wherever possible;

d. Work start and stop times shall be staggered where practicable to limit the number of individuals entering and leaving the worksite concurrently;

e. Lunch breaks and work times shall be staggered where practicable to enable operations to safely continue while utilizing the least number of individuals possible at the site;

f. The number of individuals who can access common areas, such as restrooms and breakrooms, concurrently shall be restricted;

g. Workers and visitors are required to wear cloth face coverings, in accordance with CDC recommendations, while on the premises, except where doing so would inhibit the individual's health or the individual is under two years of age, and workers are require to wear gloves while on the premises. Businesses must provide, at their expense, such face coverings and gloves for their employees. If a visitor refuses to wear a cloth face covering for non-medical reasons and if such covering cannot be provided to the individual by the business at the point of entry, then the business must decline entry to the individual. Nothing in the stated policy should prevent workers or visitors from wearing a surgical-grade mask or other more protective face covering if the individual is already in possession of such equipment, or if the businesses is otherwise required to provide such worker with more protective equipment due to the nature of the work involved. Where an individual declines to wear a face covering on the premises due to a medical condition that inhibits such usage, neither the business nor its staff shall require the individual to produce medical documentation verifying the stated condition;

h. Infection control practices, such as regular hand washing, coughing and sneezing etiquette, and proper tissue usage and disposal are required;

i. Sharing of tools, equipment, and machinery must be limited to the extent practicable;

j. Sanitization materials, such as hand sanitizer and sanitizing wipes, shall be provide to workers and visitors; and

k. High-touch areas like restrooms, breakrooms, equipment, and machinery shall be frequently sanitized.

C. The Daily Health Checklist shall be filled out every day work is performed on site.

DAILY HEALTH CHECKLIST

Is social distancing being practiced?	Yes ☐	No ☐
Is the tail gate safety meeting held outdoors?	Yes ☐	No ☐
Are remote/call-in job meetings being held in lieu of meeting in person where possible?	Yes ☐	No ☐
Were personal protective gloves, masks, and eye protection being used?	Yes ☐	No ☐
Are sanitizing wipes, wash stations or spray available?	Yes ☐	No ☐
Have any workers/visitors been excluded based on close contact with individuals diagnosed with COVID-19, have recently traveled to restricted areas or countries, or are symptomatic (fever, chills, cough/shortness of breath)?	Yes ☐	No ☐
Comments:		

1.2 COVID-19 MANAGEMENT PLAN

A. At a minimum, the COVID-19 Management Plan shall include:

1. Identification of potential exposure pathways and exposure risks associated with work tasks, e.g. activity hazard analysis (AHA).

2. Identification of local health department contact information and COVID-19 testing sites and procedures.

   Westchester County Department of Health
   145 Huguenot St.,
   New Rochelle, N.Y. 10801
   (914) 813-5000

   Nearest COVID-19 Testing Site
   White Plains Hospital
   99 Business Park Road
   Armonk, NY, 10504
   APPOINTMENT NEEDED

3. Detailed written description of the onsite personnel protection measures that will be utilized and a detailed explanation of how they will be implemented, monitored, and communicated.

   Workers shall wear face coverings/masks when needed which follow all appropriate CDC/Department of Health guidelines. Proximity to other people will be minimized at all times by staying at least 6 feet away except when absolutely required to perform work or ensure worker safety. All work being performed and all currently scheduled future work will be performed outside, away from the community and airport employees. See below for further details in Section 3.2 and following.

4. Detailed written description of measures that will be taken to prevent transmission to or from the surrounding community and how they will be implemented and communicated.

   The surrounding community will be protected by having workers at all times in a controlled, secure environment preventing any contact with the surrounding community. Workers will arrive in their vehicles and access the secure area using the communications devices at the gate to gain entrance. Gloves will be worn while using communication devices. Workers will remain in their vehicles to prevent contact until inside secure area.

   Should work need to be performed outside the secure area, workers will set up a perimeter around the work area to prevent community members from approaching.

   See below for further details in Section 3.2 and following.

5. Procedures to be followed in the event a site worker is diagnosed with or is

suspected of having COVID-19, including identification of all personnel potentially exposed and isolation requirements.

Should a site worker be diagnosed with or is suspected of having COVID-19, all that workers contacts will be traced and notified that they may have been exposed. The worker and all contacted people will be sent home for the quarantine period specified below. Exposed workers will undergo testing to determine if they have contracted COVID-19. For further details, see Section 3.3 G below.

6. Daily cleaning schedules and disinfection procedures per the most recent CDC guidelines.

   All site workers shall clean and disinfect all equipment, tools and supplies as specified by the most recent CDC guidelines.

7. Cleaning and disinfection procedures in the event there is/are suspected COVID-19 case(s) among site personnel.

   Should a site worker become infected, all tools, equipment and supplies used by that worker shall be cleaned and disinfected using standard cleaning and disinfection techniques, per CDC guidelines.

8. Site access controls and entry/exit procedures.

   Site access is governed by Westchester Airport Security.

   To enter or exit the site, workers will use the communications devices at the gate by Building 10 to notify security to open the gate remotely. Gloves will be worn while using communications devices.

9. Plan view of points of egress and delivery locations.

B. The COVID-19 Management Plan must be updated following any issued change(s) in federal, state, or local health agency guidance.

This plan shall be updated as changes in guidance warrant.

1.3 PRECONSTRUCTION CONFERENCE

A. Pre-Construction Conference shall include a review of methods and procedures related to COVID-19 risk management including, but not limited to the following:

1. Review of COVID-19 Management Plan
2. Review infection control procedures
3. Review staff monitoring and reporting requirements.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 RISK IDENTIFICATION

A. COVID-19 is a new disease; scientists and health agencies are continuously learning about how it spreads. First Environment shall adjust site policies based on the most up to date government issued guidance regarding transmission.

B. First Environment shall confirm staff that have worked in locations where quarantine orders are in place, have met the minimum quarantine guidance and do not have symptoms prior to mobilizing to site.

C. First Environment shall monitor staff daily, including checking, and documenting, temperature with no contact infrared thermometer, to confirm onsite staff do not exhibit COVID-19 symptoms. First Environment shall provide daily reports of those tests upon NYSDEC's request.

3.2 RISK MINIMIZATION

A. Engineering Controls
1. Increasing ventilation rates of interior workspaces.
2. Access controls, including fences and locking gates.
3. Maintain 6 feet distances, using distance markers where appropriate in the field.

B. Administrative Controls
1. Continuous and effective communication of administrative controls/requirements to all site personnel and visitors, through the posting of site signage, preparation and distribution of site plans, presented during site meetings, and verbal warnings if necessary.
2. Require that all employees exhibiting any COVID-19 symptom do not enter the site and provide sick leave policies to support this requirement.
3. To minimize face-to-face interaction, the Site's Health & Safety Officer's (or other designated employee) phone number shall be prominently posted and disseminated to project staff to be called for the purpose of site sign in and sign out by all visitors to the site upon arrival and exit. The designated employee will receive entry and exit calls each day and will fill out the site entry/exit log for each site visitor to reduce traffic in site trailer and/or the number of individuals contacting the site access tracking log.
4. Staffing: only those employees necessary to complete critical path task(s) shall be present on-site at any given time. Work shall be scheduled to minimize the density of personnel in any given area at any given time.

5. Working Remotely; employees shall be encouraged to complete work remotely if possible.
6. Face-to-face meetings shall be replaced with video or phone conferences when practicable.
7. Social distancing shall be exercised for face-to-face meetings e.g. daily Health and Safety tailgate meeting. In addition, First Environment shall plan to have multiple meetings (if necessary) to keep the number of participants to a threshold that allows for the practice of social distancing protocol. The Health and Safety officer will keep a record of all present for each meeting on the Health and Safety log.
8. Quarantine staff that have been in contact with a anyone that tested positive and notify NYSDEC immediately.

C. Safe Work Practices
1. First Environment shall employ social distancing protocol for all onsite activities when able.
2. First Environment provide PPE and adequate hand washing stations and hand sanitizer (containing a minimum of 60% alcohol) to allow site personnel and visitors to practice good personal hygiene.
3. First Environment shall provide tissues, paper towels, no-touch trash cans, and disinfectants to maintain site cleanliness.
4. Sharing of tools and heavy equipment shall be limited to the extent practicable; handles of shared tools and equipment shall be sanitized regularly.

D. Personal Protective Equipment
1. Employees shall be provided disposable personal protective equipment (PPE), including gloves, goggles, face shields, face masks, and respiratory protection, as appropriate based on work environment and current recommendations by OSHA and CDC.
2. All PPE must be selected based on hazard to the worker, properly fitted and periodically refitted, consistently and properly worn when required, regularly inspected, maintained, and replaced, as necessary, and properly removed, cleaned, and stored or disposed of, to avoid contamination of self, others, or the environment.
3. PPE worn to prevent transmission of COVID-19 is not to be confused with PPE for protection against site contaminants.
4. PPE must be worn, removed, and disposed of correctly in order to remain effective.
    a. Face masks should fit snugly but comfortable against the side of the face and over the nose and be secured with ties or ear loops; cloth masks must include multiple layers of fabric, allow for breathing without restriction, and be able to be laundered and machine dried without damage.
    b. Face masks should be worn consistently and removed without touching eyes, nose, and mouth. An individual should wash their hands after handling a used face mask.
    c. Cloth face coverings should be sterilized by machine washing between use; disposable face masks shall be disposed of properly after using.
    d. Gloves are only effective if changed and disposed of frequently, to avoid cross-contamination.

3.3 NOTIFICATION OF POTENTIAL OR CONFIRMED INFECTION

A. First Environment shall notify the Department immediately upon identification of a suspected or confirmed infection of COVID-19. This notification shall comply with HIPAA regulations.

B. First Environment shall remove an individual suspected to have COVID-19 from the site immediately (to the individuals' hotel or local place of residence if transport home is not immediately feasible), as well as those who have worked in close contact with that individual for extended periods of time (an hour at a time or more) over the previous week. The individual with suspected infection shall contact their health care provider and/or follow local health department testing procedures and protocol.

C. While in the process of removing an employee exhibiting symptoms, steps should be taken to isolate the individual, place a surgical mask on the individual and inform the local health department and the NYSDEC.

D. In the event the individual with suspected infection cannot get home right away, they shall isolate in their hotel room (notifying hotel management of their symptoms), contact their health care provider, and/or follow local health department testing procedures and protocol.

E. In the absence of local health department information, the individual may call the New York State Hotline at 1-888-364-3065.

F. First Environment shall maintain communication with potentially infected individual(s) and notify the Engineer upon receipt of COVID-19 test results.

G. Positively infected individuals may return to work at the site after 72 hours of being symptom-free and 7 days of isolation after the first symptoms appeared, or in accordance with the current federal, state, and local guidelines

H. OSHA recordkeeping requirements at 29 CFR Part 1904 mandate covered employers record certain work-related injuries and illnesses on their OSHA 300 log. COVID-19 can be a recordable illness if a worker is infected as a result of performing their work-related duties. However, employers are only responsible for recording cases of COVID-19 if all the following are met:

1. The case is a confirmed case of COVID-19 (see CDC information on persons under investigation and presumptive positive and laboratory-confirmed cases of COVID-19).

2. The case is work-related, as defined by 29 CFR 1904.5; and

3. The case involves one or more of the general recording criteria set forth in 29 CFR 1904.7 (e.g. medical treatment beyond first-aid, days away from work).

END OF SECTION

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NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

Entry/Exit Log with COVID-19 Acknowledgement

Project Name: _____

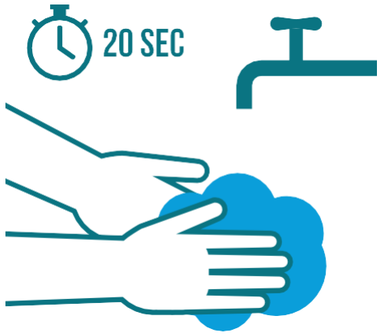
Project #: _____

New York State Department of Environmental Conservation's (DEC) objective is to provide a safe and healthy workplace. In response to COVID-19, DEC is prohibiting access to our work areas by those who pose an elevated risk of spreading COVID-19. By completing this site Entry/Exit log, you acknowledge your understanding of this policy and confirm that your health and travel history is NOT in one of the prohibited access groups listed below, and to the best of your knowledge, you do not pose an elevated risk of transmitting COVID-19 to others. Please leave the site immediately and follow recommendations from public health agencies and your healthcare provider if you fall into one of the prohibited access groups listed below:

- You are experiencing flu-like symptoms including but not limited to fever, chills, cough, sore throat, diarrhea, vomiting, runny/stuffy nose, muscle or body aches, headaches, fatigue.
- You have traveled to CDC-restricted destinations in the last 2 weeks including China, South Korea, Iran, United Kingdom & Ireland, all European Union countries, Switzerland and regions within the U.S. for which public health agencies have prohibited travel.
- You had direct contact with a person diagnosed with COVID-19 or suspected of having COVID-19 during the last 2 weeks.

Name	Initials	Affiliation	Date	Time In	Time Out

PREVENT INFECTION



Wash your hands and use hand sanitizer

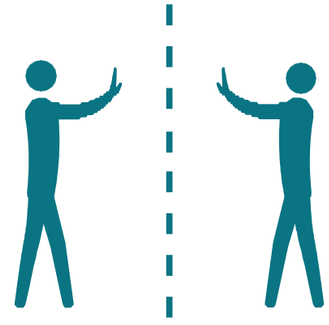
Wash your hands frequently and thoroughly, for a minimum of 20 seconds.

Use hand sanitizer, containing at least 60% alcohol when you are unable to wash you hands with soap and water.

Cover your cough or sneeze

Cover your mouth and nose when coughing or sneezing. Turn your head away from others, if possible, when sneezing.

Use a paper tissue or your sleeve and not your hand. Dispose of used tissues immediately.



Limit physical contact

Avoid handshakes, kisses and hugs.

Maintain at least 6 feet from all others persons when possible.

Keep clean

Regularly sanitize frequently touched and shared surfaces at home as well as at work.

Be considerate

Stay home whenever possible especially if you are experiencing symptoms.

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

SITE ACCESS RESTRICTIONS

SITE ACCESS IS PROHIBITED FOR THE FOLLOWING PERSONS DUE TO COVID-19 RISK

- **You are experiencing flu-like symptoms including but not limited to:**

  Fever or feeling feverish/chills, cough, sore throat, diarrhea, vomiting, runny or stuffy nose, muscle or body aches, headaches, fatigue (tiredness)

- **You have traveled to CDC-restricted destinations during the last 2 weeks:**

  China, South Korea, Iran, United Kingdom & Ireland, all European Union countries, Switzerland and regions within the U.S. for which public health agencies have prohibited travel

- **You had direct contact with a person diagnosed with COVID-19 or suspected of having COVID-19 during the last 2 weeks**

  Immediately notify NYSDEC site management.

NEW YORK STATE OF OPPORTUNITY | Department of Environmental Conservation

APPENDIX C

Quality Assurance Project Plan
Westchester County Airport
Airport Road
White Plains, New York

NYSDEC Site No. 360174

July 2020

Prepared for: Westchester County
240 Airport Road
White Plains, New York 10601

Prepared by: First Environment, Inc.
91 Fulton Street
Boonton, New Jersey 07005

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Introduction

This Quality Assurance Project Plan (QAPP) has been developed as part of the Groundwater Work Plan that has been prepared on behalf of the Westchester County Airport (the Airport), located at Airport Road, White Plains, New York.

Purpose

The purpose of this QAPP is to indicate the prime responsibilities of the Airport and its contractors and subcontractors during implementation of the Groundwater Work Plan. This QAPP also describes the policy, organization, and specific Quality Assurance (QA) and Quality Control (QC) elements necessary to achieve data quality objectives and fulfill NYSDEC requirements. The QAPP also provides detailed descriptions of the field procedures that will be used during Site Characterization.

In general, there are 10 elements to be addressed in a QAPP to ensure safe, efficient, and effective practices are implemented at contaminated sites. These elements include:

1. The project's scope and complexity and how the project relates to the overall site characterization strategy.
2. The data quality objectives specific to the site and sampling event.
3. Project organization, including the name and telephone number of each of the individuals responsible for overall project coordination, sampling activities, and laboratory analyses.
4. An "Analytical Methods/Quality Assurance Summary Table" (combination of Table 2 and Table 3).
5. A detailed description of the site-specific sampling methods, sample storage in the field, and sampling holding times requirements.
6. A detailed description of all calibration and preventative maintenance procedures for all field instrumentation.
7. A detailed description of the criteria and procedures to obtain duplicate and split samples.
8. A detailed description of the chain-of-custody procedures to be utilized in the field and the laboratory.
9. A detailed description of sample storage procedures to be utilized by the laboratory.
10. Laboratory data deliverable formats to be used.

Scope and Goals Relation to IRM

The scope of the project involves addressing:

- Sampling and laboratory analysis of soil and groundwater media at the Airport to identify per- and polyfluoroalkyl substances (PFAS) including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS and Total Organic Carbon content in soil. In addition, if elevated PID readings are identified in soil, a sample will be collected for analysis for Target Compound List/Target Analyte List (TCL/TAL) +30.

Data Quality Objectives

In order to ensure that data generated during Site Characterization and IRM sampling is of the highest quality, the analytical results of such sampling will be compared to appropriate data quality indicators. These indicators include precision, accuracy, representativeness, completeness, and comparability. Each of these indicators is described below:

1. Precision is the agreement or reproducibility among individual measurements on the same property, usually made under the same conditions.
2. Accuracy is the degree of agreement of a measurement with the true or accepted value.
3. Representativeness is the degree to which a measurement accurately and precisely represents a characteristic of a population, parameter, variations at a sampling point, a process condition, or an environmental condition.
4. Completeness is a measure of the amount of valid data obtained from a measurements' system compared with the amount that was expected to be obtained under correct and normal conditions.
5. Comparability is an expression of the confidence with which one data set can be compared with another data set with regard to the same parameter.

The data quality objectives (DQO) vary according to the specific objectives of each task that is being undertaken. For example, accuracy, precision, and representativeness of data are functions of sample origin, analytical procedures, and specific sample matrices. Quality control practices for the evaluation of these data quality indicators include the use of accepted analytical procedures, adherence to holding times, and the analysis of QC samples (blanks, duplicates, spikes, calibration standards, and reference standards).

Completeness is a function of the number of valid data results generated compared to the number of data results planned. Completeness can be less than 100 percent due to poor sample recovery, sample damage, or disqualification of results due to results being outside of laboratory control limits. Completeness is documented by including sufficient information in field logs and laboratory reports to allow the data user to assess the quality of the results. The

overall completeness goal for each task is difficult to determine prior to data acquisition. However, all reasonable attempts will be made for this project to attain a completeness of 85 percent or better. The completeness goal for the analytical laboratory will be 90 percent or greater.

Comparability is a function of the analytical and field methodologies used. Ensuring comparable data will be accomplished by using standard and accepted methodologies; using methods traceable to the National Institute of Standards and Technologies (NIST), NYSDEC sources or USEPA sources; using appropriate levels of quality control; reporting results in consistent standard units of measure; and participating in studies designed to evaluate laboratory performance.

Table 1 identifies the different levels of quality assurance that are being assigned to each task that will be implemented during the Site Characterization.

Table 1: Levels of Quality Assurance

DQO Level	Description	Associated Activity
I	Level I is the lowest quality data but provides the fastest and least expensive results. Field screening or analysis provides Level I data. The generated data can indicate the presence or absence of certain constituents and is generally qualitative rather than quantitative.	• Health and Safety Monitoring (PID, FID)
II	Level II data are generated by field laboratory analysis using more sophisticated portable laboratory instruments or a mobile laboratory on site. This provides fast results and better-quality data than in Level I.	• Field Analyses (pH, specific conductance, temperature, dissolved oxygen)
III	Level III data may be obtained by a commercial laboratory with or without CLP procedures. The analysis does not usually use the validation or documentation procedures required of CLP (Level IV) analysis. The analyzed parameters are relevant to site characterization, risk assessment, and design and implementation of the remedial action.	• Ongoing Groundwater sampling • Waste Classification Sampling

DQO Level	Description	Associated Activity
IV	Level IV data are typically used for risk assessment, engineering design, and cost-recovery documentation. All analyses are performed in a CLP analytical laboratory and follow CLP procedures. Level IV is characterized by rigorous QC protocols, documentation, and detection limits.	• Post-excavation soil sampling • Soil sampling for soil reuse • Final Groundwater sampling
V	Level V data are those obtained by non-standard analytical procedures. Method development or modification may be required for specific constituents or detection limits.	• Not Applicable
VI	Other methodologies not described above.	• Physical soil description • Geotechnical tests • Water level measurements • Aquifer tests

Project Organization and Responsibilities

First Environment and a qualified team of subcontractors will perform the work activities for this Groundwater Work Plan under the direction of representatives from the Airport. The lead regulatory agency for this project is the NYSDEC with the New York State Department of Health (NYSDOH) providing additional regulatory oversight. First Environment is the primary contractor.

All respective roles for the Airport, First Environment, and other appropriate project personnel are described below. The project organization chart for the Site Characterization work is shown in Figure 1.

NYSDEC Project Manager

The NYSDEC Project Manager assigned to this project is Mr. Matthew Hubicki. Mr. Hubicki can be contacted at:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7014
Phone: (518) 402-9605
Fax: (518) 402-9679
E-mail: matthew.hubicki@dec.ny.gov

The Westchester County Airport

The Airport has the overall responsibility for achieving all project objectives. First Environment will be responsible for initiating project activities; monitoring and adjusting efforts and resources as needed to assure that established schedules, work programs, and costs are maintained; and interfacing with NYSDEC on administrative matters.

WSP will also be responsible for retaining a NYSDOH-certified Environmental Laboratory Approval Program (ELAP) and Contract Laboratory Program (CLP) laboratory. All samples will be submitted to the chosen laboratory under the chain-of-custody procedures discussed below. In addition, the Airport will be responsible for retaining an appropriately licensed and certified waste transporter and disposal subcontractor for disposal of all Site Characterization-derived wastes. All wastes generated at the Site will be disposed of in accordance with NYSDEC requirements.

The Airport's primary project contact, business address, and telephone number are:

Peter F. Scherrer, Airport Manager
240 Airport Road, Suite 202
White Plains, New York 10604
Phone: (914) 995-4887
E-mail: pfs5@westchestergov.com

First Environment, Inc.

First Environment, Inc. will be the prime contractor implementing the Site Characterization. The project responsibilities of First Environment personnel shall be as follows:

B. Tod Delaney, Ph.D., P.E., BCEE is the President of First Environment and will act as the Senior Scientist and Senior Project Manager. Dr. Delaney will provide senior management oversight and provide technical advice and review of all site characterization-related issues. Dr. Delaney has the responsibility of ensuring and overseeing the preparation of all deliverables, staffing, scheduling, coordinating subcontractors, and overseeing all technical project activities.

Mr. Scott R. Green, P.G. is a Market Area Director at First Environment and will act as the Project Coordinator. Mr. Green will be responsible for oversight of project operations, review of all deliverables, coordinating subcontractors, and oversight of the implementation of all work being performed in the field.

Mr. David H. F. Luer, P.G., C.P.G. is a Senior Geologist at First Environment and will act as the Project Manager. Mr. Luer will be responsible for the day-to-day project operations, preparation of all deliverables, coordinating subcontractors, and the implementation and oversight of all work being performed in the field. Mr. Luer will be responsible for oversight of all Health and Safety issues during the field activities.

First Environment employees can be contacted at:

First Environment, Inc.
91 Fulton Street
Boonton, New Jersey 07005
Phone: (973) 334-0003
Fax: (973) 334-0928

Subcontractors

First Environment is in the process of obtaining subcontractors to perform the various duties associated with the Site Characterization. To date, the following Subcontractors have been contracted to perform Site Characterization services:

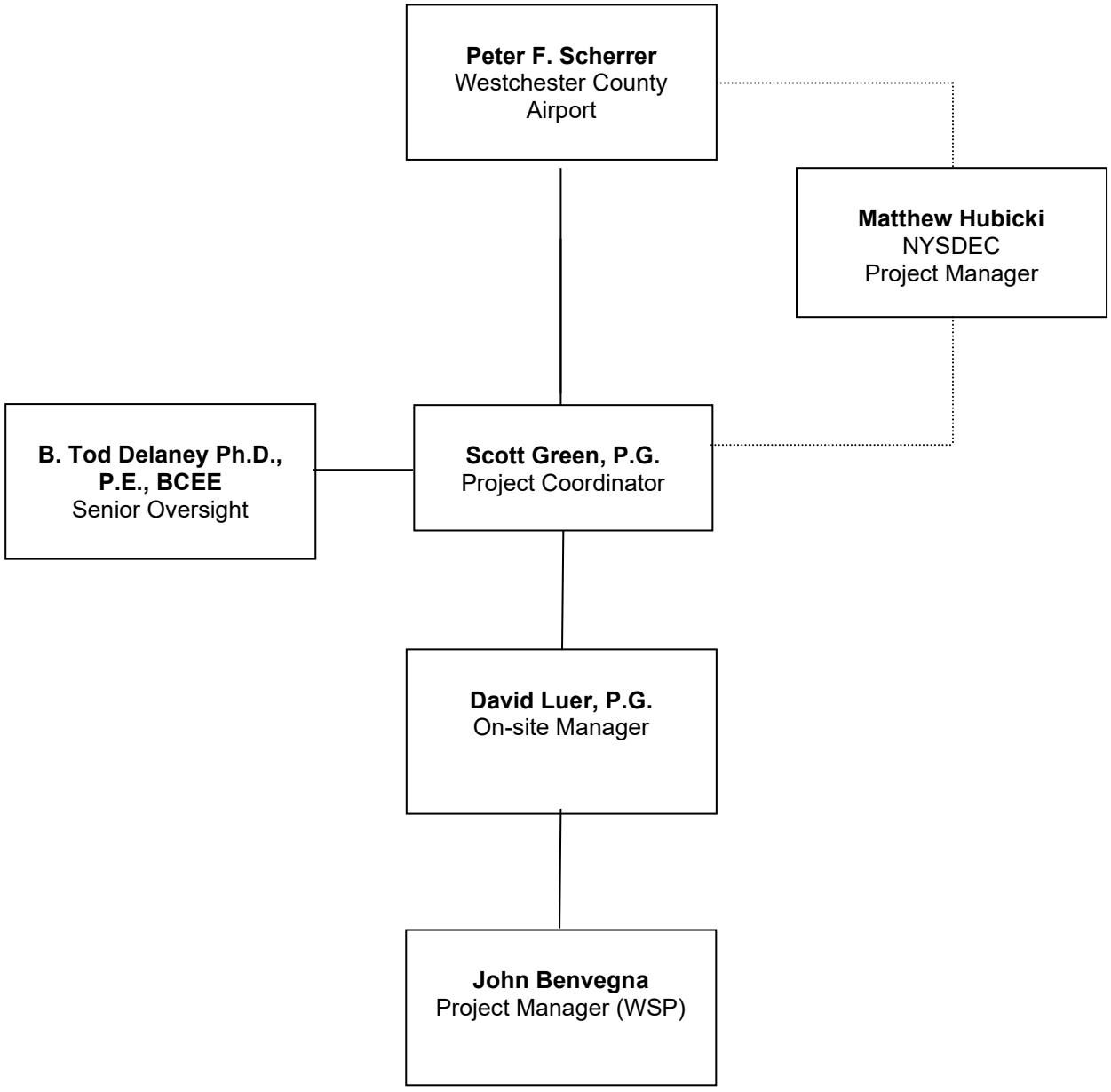
Soil, Groundwater, Sediment and Surface Water Sampling
WSP USA
4 Westchester Park Drive, Ste. 175
White Plains, NY 10604
914-694-5711

Analytical Laboratory
York Analytical Laboratories
120 Research Drive
Stratford, CT 06615

Licensed Well Driller
Cascade Drilling
629 Wright Debow Road
Jackson Township, NJ 08527

Land Surveyor
Stires Associates, PA
43 West High Street
Somerville, NJ 08876

Figure 1: Organization Chart



Analytical Procedures

Method references for the analyses to be performed during the Site Characterization are summarized in Table 2.

Table 2: Method References, Holding Times and Preservation Requirements

Parameters	Matrix	Method Reference	Holding Time	Preservation	Sample Volume	DQO Level
PFAS	Aqueous	USEPA Modified Method 537	14 days	4° C,	250 ml HDPE or polypropylene bottle	III/IV
PFAS	Soil	USEPA Modified Method 537	28 days	4° C	8 oz. HDPE or polypropylene bottle	III/IV
1,4-Dioxane	Aqueous	USEPA Method 8270 SIM	7 days	4° C	1 L Amber glass jar	III/IV
1,4-Dioxane	Soil	USEPA Method 8270 SIM	14 days	4° C	4 oz. Glass container	III/IV
VOC	Aqueous	USEPA 8260	14 days	4° C, HCl	40 ml glass vial	III/IV
VOC	Soil	USEPA 8260	14 days	4° C, Methanol*	5 g glass jar	III/IV
VOC	Air	USEPA TO-15	14 days	N/A	2 to 6 L***	IV
SVOCs	Aqueous	USEPA 8270B	7 days	4° C	2 L glass jar	III/IV
SVOCs	Soil	USEPA 8270	14 days	4° C	4 oz glass jar	III/IV
Pesticides	Aqueous	USEPA Method 8081B	7 days	4° C	1 L Amber glass jar	III/IV
Pesticides	Soil	USEPA Method 8081B	14 days	4° C	4 oz glass jar	III/IV
PCBs	Aqueous	USEPA Method 8082A	None	N/A	1 L Amber glass jar	III/IV
PCBs	Soil	USEPA Method 8082A	None	N/A	4 oz glass jar	III/IV
Metals	Aqueous	3010	6 months	4° C, HNO3	250 ml PE jar	III/IV
Metals	Soil	6010/7471A	180 days, 28 days**	N/A	2 oz glass jar	III/IV
Dissolved Oxygen	Aqueous	Electrode	Immediate	N/A	N/A	II
Temperature	Aqueous	Thermometer	Immediate	N/A	N/A	II
Turbidity	Aqueous	Electrode	Immediate	N/A	N/A	II
Specific Conductivity	Aqueous	Electrode	Immediate	N/A	N/A	II
Organic Vapor	Air	PID or FID	Immediate	N/A	N/A	I
PH	Aqueous	Electrode	Immediate	N/A	N/A	I

* If sample is not collected using an EnCore™ sampling device

** For Mercury samples only
***Sample to be collected via Summa canister

Field Procedures

The accuracy of the data is dependent upon well-conceived and carefully implemented sampling and analysis procedures. This section presents the procedures with which samples will be collected or measurements made during the execution of this project.

Changes in Procedure

Field conditions may require changes to the QAPP. Significant changes to the sampling procedures specified in the QAPP that become necessary as a result of unanticipated field conditions will be identified to and discussed with the First Environment Project Manager and WSP Project Manager prior to the implementation of any revised procedure. The Project Managers will in turn discuss the needed changes in procedure with the NYSDEC Project Manager. Changes in sampling procedures cannot be implemented unless approval is received from the NYSDEC Project Manager. Minor changes may be made with the concurrence of the First Environment Senior Project Manager but must be documented in the field logbook and/or interoffice memoranda. Any and all changes in sampling procedures will also be documented in the associated report submittal.

Acquisition of Samples

Figures 4 to 5 identify soil and groundwater sample locations at the Burn Pit and downgradient of the Burn Pit.

All samples will be adequately marked for identification from the time of collection and packaging through handling and storage. Marking for sample identification shall be on a sample label attached to each sample container. Sample identification will include, at a minimum, the following:

- sample identification number;
- analysis required;
- sample date and time; and
- initials of the individual performing the sampling.

A description of the sample will be included in the field logbook.

Alphanumeric codes will be used to identify sample locations. The coding for sample identification numbers should be consistent, identify a single sample location and, unless otherwise directed, use the following naming convention:

FMW-XX	Monitoring Well
TW-XX	Temporary well point
RW-XX	Recovery Well
SB-XX	Soil/Geoprobe Boring
TP-XX	Test Pit
S-XX	Surface soil sample location
Sed-XX	Sediment
OF-XX	Outfall
D-	Drain/Storm Sewer
SWS-XX	Surface water sampling location
WCS-XX	Soils Waste Classification
WCW-XX	Water Waste Classification

Where XX is a numerical value.

The laboratory will provide appropriately cleaned and prepared sample containers. Reagents, preservation procedures, and analytical holding times will be in accordance with the published analytical methods.

The specific requirements for sample container preparation, sample preservation, holding times, and any special handling requirements are listed in Table 2. Sample containers will be kept closed until the time each set of sample containers is to be filled. After filling, the sample containers will be securely closed, residue wiped from the sides of the containers, sample identification marked on the container label, and the container immediately placed in a cooler that contains ice. Samples will be kept chilled and delivered to or picked up by the laboratory. Samples of dissimilar matrices will be shipped in separate coolers whenever possible. All reasonable effort will be used to limit the time the sample containers are on the Site to no more than two calendar days.

Calibration Procedures

Laboratory calibration procedures and frequency of calibration will be completed in accordance with the NYSDOH ELAP criteria. These criteria represent accepted techniques to ensure

accurate sampling, monitoring, testing, and documentation as per QA/QC standards. Field instruments such as pH meters, dissolved oxygen meters, and specific conductivity meters will be standardized in accordance with the manufacturer's recommendations against National Institute of Standards and Technology (NIST) traceable standards, where appropriate. During sampling, calibration will be performed at the beginning of each day of use. Appropriate calibration records will be maintained in field logbooks.

Samples that do not contain concentrations of target analytes that exceed instrument calibration range, absent of matrix interference, will be analyzed so as to achieve the lowest practical quantitation limits. Samples that do contain concentrations of target analytes that exceed the instrument calibration range will be diluted in accordance with approved methodologies and good laboratory practice.

Field Sampling Procedures

Field screening will be used to obtain immediate site data that can be used to ensure the health and safety of site workers and/or assist in the selection of soil and groundwater sampling locations and depths. Subsurface characterization involves the collection of samples for analysis by the laboratory. The results generated from these sample analyses will be used to characterize and monitor site conditions. The components of the IRM soil sampling activities include:

- soil sampling, and
- groundwater sampling.

Field sampling procedures when sampling for PFAS will be completed in accordance with the attached sampling protocol and checklist for sampling monitor wells for PFC's Attachment 1 and 2. Items like water proof field notebooks, blue ice packs, Teflon containing materials, gore tex fabrics, Tyvek are only few of the items that will be avoided due to the potential presence of PFAS in those items that could interfere with the laboratory results.

Water level monitoring will be completed using a Heron dipper model-T water level indicator which has a steel sensing probe. All wells will be sampled with dedicated, disposable HDPE bailers. Shallow wells (less than 20 feet deep) will also be purged using dedicated disposable HDPE bailers. Wells greater than 20 feet deep will be purged with a PFAS free submersible pump and dedicated HDPE tubing. All purge water will be discharged to the

ground upon the completion of sampling per previous NYSDEC correspondence of October 10, 2017 unless a sheen, odors, or oil are observed. In such cases, purge water will be containerized and characterized for proper disposal.

During sampling for PFAS, one field blank will be collected in the field using water provided by the laboratory. One field duplicate and one matrix spike/matrix spike duplicate will also be collected. All samples will be collected in laboratory supplied containers and placed in coolers on wet ice for overnight shipping to the laboratory or until laboratory pick up. Appropriate chain-of-custody procedures will be followed.

Laboratory Analysis

The samples will be picked up by York Analytical Laboratories, which is a New York State Certified ELAP laboratory. The samples will be analyzed for PFAS by EPA method 537 (modified) with Category B deliverables. For VOCs and SVOCs, samples will be analyzed by EPA method 8260 and 8270 with Category B deliverables. The data will be provided in an electronic data deliverable (EDD) format for the NYSDEC EQUIS Environmental Data Management System.

The field sampling activities for PFAS will follow the PFCs Sampling Checklist identified as Attachments 1 and 2.

Groundwater Level Measurements

Groundwater levels will be measured during Site Characterization. Synoptic (instantaneous) groundwater level measurements will be collected from all accessible wells and piezometers concurrently with all on-site groundwater sampling events. Groundwater level measurements will be made using an electronic water level meter or equivalent. The water level meter will be field decontaminated prior to use and between measurements at each well location. Measurements to the depth-of-water will be made to the nearest 0.01-foot relative to the northernmost point at the top of the casing elevation. This measurement will be converted to a groundwater elevation based upon the surveyed casing elevation.

Groundwater Sampling

Groundwater sampling of any one monitoring well will be performed no sooner than two weeks following the development of that monitoring well unless otherwise approved by the NYSDEC.

Groundwater sampling at permanent wells for any one sampling event will consist of determining the casing volume, purging, and sample collection. These procedures are described below. If necessary, a peristaltic pump may be used to develop the temporary well to reduce turbidity before collecting a groundwater sample for laboratory analysis. Once turbidity is reduced, a groundwater sample will be collected for laboratory analysis and submitted to the certified laboratory.

In addition, a groundwater profile device will be used to sample groundwater using a direct-push drill rig. The stainless steel sampler, WaterlooAPS 175, utilizes a direct-push rod with the unique APS tip design. Once the sampler is located at the desired depth, groundwater will be withdrawn through the sampler and brought to the surface for laboratory analysis.

Determination of Casing Volume

Casing volume will be determined by measuring the water level in each monitoring well and utilizing well construction information to calculate the volume of standing water in the well. An electronic water level indicator will be used to measure the depth from the top of the innermost casing to the water table to the nearest 0.01 feet. The water level indicator will be decontaminated using phosphate-free detergent and distilled or deionized water prior to its use in any one monitoring well. The depth to the bottom of the monitoring well will be determined during the first sampling event to confirm well construction details. The measurement will be taken with a field-decontaminated electronic water level indicator and recorded to the nearest 0.01 feet.

Purging

One of two groundwater purge techniques may be applied at this Site. The first method is low-flow purge method. This method minimizes data quality interference by suspended solids by purging groundwater at such a low rate so as not to cause sediment in the well to become suspended. To ensure that pore water and not casing water is sampled upon completion of purging, groundwater is purged until several indicator parameters become stable. This technique is described in detail by Puls and Barcelona (“Low-flow (minimal drawdown) groundwater sampling procedures.” EPA/540/S-95/504; April 1996).

If a low-flow purging technique is used, then groundwater will be extracted at a rate that is equal to or less than one liter per minute. Water level will be checked periodically during purging to monitor drawdown and to guide flow rate adjustment. The flow rate will be adjusted to achieve a minimal drawdown that does not exceed 0.1 meters (four inches).

If necessary, in-line water quality will be monitored during purging using a flow-through cell. The water quality indicator parameters that will be monitored will include pH, conductivity, dissolved oxygen (DO), and turbidity. Measurements will be taken every three to five minutes until water quality has stabilized. Stabilization is achieved when three successive readings are within ± 0.1 for pH, ± 3 percent for conductivity, and ± 10 percent for turbidity and DO.

If the low-flow purge technique is not used, then three to five casing volumes of water will be purged from the monitoring wells. The wells will be purged using PFAS free positive displacement pumps such as a submersible pump. A bottom-filled HDPE bailer may also be used to purge a well. If a submersible pump is used, then the pump and power cord will be decontaminated prior to each use using the methods described later in this document. New HDPE polyethylene tubing will be attached to the submersible pump to discharge water from the monitoring well. The tubing will be discarded after use at a monitoring well.

If a well or piezometer diameter is such that a positive displacement pump is not used, a peristaltic pump with dedicated thin HDPE plastic tubing will be used to purge the required volume.

The field parameters pH, specific conductance, temperature, and DO will be measured and recorded prior to purging the monitoring well. During purging, all reasonable effort must be made to keep the purging rate low and to avoid pumping the well to dryness. Monitoring well purging rates will not exceed five gpm. In some cases the evacuation of three casing volumes may not be practical due to slow recovery. If a monitoring well is pumped to near dryness at a rate less than 0.5 gpm, then the monitoring well will be allowed to recover to a volume sufficient for sampling. Sampling will occur within two hours of purging, as long as the well has sufficiently recovered. It may be necessary to allow all such monitoring wells to recover sufficiently for sampling. Details of the monitoring well's recovery rate will be noted on the field form.

The following monitoring well purge data will be recorded on the field form for each monitoring well sampled whenever the "3 to 5 volume" purge method is used:

Before Purging:

- date, time, and whether conditions;
- monitoring well identification number;
- pH, DO, temperature, and specific conductivity;
- total monitoring well depth and depth-to-water from the top of the innermost casing; and
- water volume within the monitoring well.

After Purging

- start and end time of purging;
- purge method;
- purge rate (if pumped);
- total volume purged.

After Sampling

- start and end time of sampling;
- pH, DO, temperature, and specific conductivity;
- sampling method;
- pertinent observations regarding sample characteristics (e.g., turbidity, color, odor).

Sampling

If the low-flow purge method is used, then sampling will involve disconnecting the intake hose from the flow-through cell and then using that hose to discharge the sample directly into containers provided by the laboratory.

If the “3 to 5 volume” purge method is used, monitoring well sampling will be performed within two hours of purging unless, as stated earlier, a monitoring well recovers at too slow a rate. Sampling will be performed with a dedicated clean HDPE bailer with a single check valve at the bottom.

To obtain a sample, the bailer will be slowly lowered into the well using the leader and rope until it is submerged and slowly brought back to the surface after filling. The contents of the bailer will then be slowly poured into the sampling containers provided by the laboratory.

The preferred order of sample collection is as follows:

- PFAS;
- TCL/TAL; and
- field measurements (temperature, DO, pH, and specific conductance).

Soil Sampling

Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (e.g., soil, sediments, and groundwater) are required by DER to hold ELAP certification for PFAS in drinking water by EPA Method 537 or ISO 25101. Labs must also adhere to the requirements and criteria set forth in the Laboratory Guidance for Analysis of PFAS in Non-Potable Water and Solids.

EPA Method 537 is the preferred method to use for environmental samples due to its ability to achieve very low detection limits. Reporting limits for PFAS in groundwater and soil are to be 2 ng/L (ppt) and 1 ug/kg (ppb), respectively. First Environment and WSP understand that contract labs or work plans submitted by responsible parties indicate that they are not able to achieve these reporting limits for the entire list of 21 PFAS, site-specific decisions will need to be made by the DEC project manager in consultation with the DEC remedial program chemist. Note: Reporting limits for PFOA and PFOS in groundwater should not exceed 2 ng/L. However, in cases where sample dilution is necessary due to high contaminant concentrations these detections limits will not be achievable.

Samples will be collected using a properly decontaminated stainless steel or HDPE hand scoop/trowel and transferred to the appropriate container. All sample containers will consist of laboratory-cleaned bottles (non-glass for PFAS) that, once filled with sample, are to be properly labeled and then placed into coolers and chilled to 4˚C using wet ice and not blue pack ice.

The soil texture at each soil sampling location shall be logged in accordance with the Unified Soil Classification System (USCS).

Decontamination Procedures

Field sampling procedures for decontamination will be completed in accordance with the attached sampling protocol and checklist for sampling monitoring wells for PFCs (Attachments 1 and 2).

The field sampling equipment will be field-decontaminated utilizing the following procedure:

1. non-phosphate detergent and tap water scrub to remove residual particles;
2. generous potable water rinse;
3. distilled/deionized water rinse.

Decontamination of submersible pumps used for monitoring well purging and sampling will use the following procedures:

1. non-phosphate detergent and tap water wash to remove residual particles from the pump casing, hose, and cables;[1]
2. distilled/deionized water rinse;
3. flush a minimum of one gallon of potable water through the pump.

All tubing used for each well and discarded after use. The submersible pump, associated tubing, and other sampling equipment will be placed on clean polyethylene sheeting prior to use in order to avoid contact with the ground surface.

Waste Handling Procedures

Based on previous investigation across the Airport, presumably because of the lack of soil and groundwater contamination, the NYSDEC has previously agreed to spreading investigation derived waste (IDW) next to the borehole. Assuming soils do contain visible wastes, free product, NAPL, sheens, or are otherwise not grossly contaminated, First Environment will follow the previously approved approach. However, if such occasions, as described above, are encountered, soil cuttings and development water will be containerized for subsequent characterization following Table 5.4(e)10 in DER-10. Once obtained from the laboratory, waste characterization results will be provided to the NYSDEC project manager along with a completed request for importation form for approval of on-site reuse.

[1] Steam cleaning of pump casing, hose and cables may be conducted instead of applying the detergent and tap water rinse.

Field Quality Control Procedures

Field Duplicates

Field Duplicate samples are collected to evaluate the laboratory's performance by comparing two separate samples that were collected from the same location. The frequency of duplicate sample collection will be five percent or one for every 20 samples, or part thereof, per matrix. If less than 20 samples are collected for a particular matrix, then one duplicate will be collected.

The collection of a duplicate groundwater sample will be obtained by alternately filling sample containers from the same sampling device for each parameter. The sample locations that require VOC analysis should have all the VOC sample containers filled from a single sampling device, whenever possible.

Field Blanks

Field Blanks will be collected as a mechanism of control on sample equipment handling, preparation, storage, and shipment. Field Blanks will be collected for all sampling events involving the collection of groundwater. Field Blanks will be collected for sampling events involving the collection of non-aqueous samples only if the samples are to be analyzed for PFAS and VOCs.

Field Blanks will be collected at a frequency of one per day during aqueous sampling events. They will be analyzed for any and all parameters analyzed during a particular sampling event on that day of sampling.

Field Blanks for non-aqueous samples will only be collected when environmental samples are to be analyzed for PFAS and VOCs, and then only for those PFAS and VOCs targeted for analysis in the corresponding environmental samples. In such cases, Field Blanks will be collected at a frequency of five percent of the total number of non-aqueous samples collected over the duration of the sampling event. However, the number of Field Blanks collected will not exceed one per day even if the number of samples collected on a given day exceeds 20.

Field Blank water will be analyte free water provided by the analytical laboratory. The Field Blank water will be transported to the field in bottles that are of the same type as that which is used to contain the Field Blank sample. All Field Blank and sample containers will be

transported to and from the field and handled in a manner that is identical, in every practical aspect, to the manner in which environmental samples and sample containers are handled.

Trip Blanks

A Trip Blank will accompany each environmental sample container (cooler) carrying aqueous samples that are to be analyzed for VOCs. The Trip Blanks will be analyzed for any and all VOC parameters that are targeted for analysis in any sample shipment. Trip Blanks are not required for non-aqueous sampling events.

Trip Blanks will be prepared by the analytical laboratory using analyte-free water. The Trip Blanks will be marked by the laboratory with the date and time of preparation. This date and time will represent the sampling date and time for the Trip Blank that is to be entered into the field logbooks and chain-of-custody forms.

Trip Blanks will accompany the coolers and environmental samples during transport to and from the field. Every practical step should be taken to expose the Trip Blanks to the same conditions as the environmental samples and coolers.

Table 3: Quality Assurance Sample Frequency

QA Sample Type	Aqueous	Soil
Duplicate	5%	5%
Field Blank	Daily	5% (VOCs only)[2]
Trip Blank	1 per Cooler (VOCs only)	Not Required

Chain-of-Custody Procedures, and Sample Storage

Chain-of-custody procedures have been established to ensure sample traceability from the time of collection through the completion of analyses. The National Enforcement Investigation/ Remediations Center (NEIC) of USEPA considers a sample to be in custody under the following conditions:

- it is in your possession; or
- it is in your view after being in your possession; or

[2] This frequency is for a multi-day sampling event. If the sampling event is only one day in duration, then one field blank is required no matter how many samples are collected on that day. For multi-day sampling events where more than 20 samples are collected in a single day, one field blank per day is permitted.

- it was in your possession and you secured it with a lock; or
- it is in a designated secure area.

All environmental samples will be handled under strict chain-of-custody procedures beginning in the field. The First Environment Field Team Leader will be the Field Sample Custodian and will be responsible for ensuring that the procedures outlined in the applicable work plan and this QAPP will be followed. Sample custody for field activities will include the use of chain-of-custody forms, sample labels, and field logbooks. Dedicated field logbooks will be used throughout the project to document field activities.

Once samples are transported to the laboratory, custodial responsibility is transferred to the Laboratory Sample Manager to ensure that the appropriate procedures and methods are followed.

Data Reduction, Evaluation, and Reporting

The laboratory will submit analytical reports to First Environment. Precision, accuracy, representativeness, comparability, and completeness of the laboratory data will be evaluated based upon adherence to sample holding times and the analysis of QA/QC samples (i.e., duplicates, spikes, and blanks). Data validation of non-CLP reduced deliverables (Category A) will be based upon method-specific QC criteria similar to the criteria of Section 8 of the USEPA 600 series methods provided in 40 CFR Part 136. The overall responsibility for reporting laboratory data lies with the laboratory director. Professional judgment will be used to determine data usability with respect to the Data Quality Objectives. Data validation of CLP deliverables (Category B) will be performed by a third-party verifier and be reported in a Data Usability Summary Report (DUSR) as specified in the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation dated May 2010.

In accordance with Section 502 of the Public Health Law, data upon which decisions impacting human health are based will be analyzed by an ELAP certified lab and documented by Category B deliverables. The following types of samples fall under this category:

- initial groundwater sampling (including both on-site and off-site sampling);
- soil to remain at the site (waste classification for reuse);
- post-excavation sampling; and
- air sampling, including outdoor air, indoor air, sub-slab vapor, and soil vapor samples.

Assessment of accuracy, precision, and completeness of both field and laboratory measurements is based upon obtaining acceptable results from QA/QC samples. Where appropriate, these may include blanks, duplicate samples, laboratory control spikes, or matrix spike/matrix spike duplicate samples. At least one physical set of Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected and analyzed per 20 samples for each matrix. Duplicates and MS/MSDs will be collected at least once during each major analytical event.

Method blanks, field blanks, and trip blanks are expected not to contain any targeted analytes with concentrations greater than the reported detection limit, with the possible exception of common laboratory contaminants (e.g., methylene chloride and acetone).

Field and laboratory duplicate results will be assessed based upon the relative percent difference (RPD) between values, using the following equation:

$$RPD = \frac{(D1-D2)}{(D1+D2)/2} \times 100$$

where, D1 = Primary sample result; and
D2 = Duplicate sample result.

Laboratory Control Samples will be assessed based upon the percent recovery of spiked analytes. The percent recovery will be calculated using the following equation:

$$\text{Percent Recovery} = \frac{X}{TV} \times 100$$

where, X = observed value of measurement; and,
TV = “true” value of spiked analyte.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) data will be assessed based upon the percent recovery of spiked analytes using the following equation:

$$\text{Percent Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

where, SSA = Spiked sample result for analyte x;
SR = Sample result for analyte x;
SA = Spike of analyte x added.

Laboratory completeness will be assessed based upon the amount of valid data obtained from a particular measurement system. It may be quantitatively expressed using the following equation:

$$\text{Laboratory Completeness} = \frac{N1}{N2} \times 100$$

where, N1 = Number of valid measurements obtained; and,
N2 = Number of measurements validated.

Project Data completeness will be assessed based upon the amount of valid data obtained from field sampling and laboratory analyses. It may be quantitatively expressed using the following equation:

$$\text{Project Completeness} = \frac{N1}{N2} \times 100$$

where, N1 = Number of valid measurements obtained; and,
N2 = Number of measurements anticipated in the Groundwater Work Plan.

The laboratory will assess all QC data with regard to precision and accuracy. Individuals making field measurements will determine whether or not field QC criteria were met. A First Environment data validator will examine laboratory analytical data and field data to determine the usability of this data as well as the data's consistency with Analytical Data Quality Objectives.

Analytical Laboratory and Methods

Analytical Laboratory

York Analytical Laboratories
1275 Bloomfield Avenue
Fairfield, NJ 07004
Phone: 973-227-0422

Analytical Methods

Please refer to Table 2 for the analytical protocols, sample preservation, and holding times for the analyte to be investigated. Detection limits (Method Detection Limits or reporting Limits) for each analysis will be provided with the sample analytical results (see Attachment 3). The data will be provided in an electronic data deliverable (EDD) format for the NYSDEC EQUIS Environmental Data Management System.

Corrective Actions

The need for corrective action will be based upon predetermined limits for acceptability for all aspects of sample collection and analysis. Predetermined limits for acceptability may include, but are not limited to, historical data and precision, accuracy, representativeness, consistency, and completeness criteria.

Laboratory Corrective Actions are described in the laboratory's Quality Assurance Manual. Laboratory personnel will assess laboratory QC samples and, if applicable, re-analyze samples that do not meet Quality Assurance requirements prior to expirations of holding times. Other corrective actions may include collection and analysis of additional samples from the site. Problems that cannot be resolved by the laboratory's managers or QA officers will be brought to the attention of the First Environment Project Manager and WSP Project Manager. The Project Managers, following consulting with NYSDEC, will determine the corrective action to be taken, if any.

The detection of system and performance problems during field activities and the implementation of any resulting corrective actions will be documented in the field logbook and placed in the project file. System and performance problems may include, but not be limited to, field equipment failure, limited or no site access, and unanticipated field conditions. The First Environment Project Manager will be notified of all system and performance problems immediately after field personnel discover them. The Project Manager may consult with the NYSDEC and the Airport, if necessary, to determine the corrective action to be taken, if any.

ATTACHMENT 1

PFCs Sampling Checklist

Date: _____

Weather (*temp./precipitation*): _____ Site Name: _____

Field Clothing and PPE:

- ☐ No clothing or boots containing Gore-Tex™
- ☐ All safety boots made from polyurethane and PVC
- ☐ No materials containing Tyvek®
- ☐ Field crew has not used fabric softener on clothing
- ☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products this morning
- ☐ Field crew has not applied unauthorized sunscreen or insect repellant

Field Equipment:

- ☐ No Teflon® or LDPE containing materials on-site
- ☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No waterproof field books on-site
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☐ No adhesives (Post-It Notes) on-site
- ☐ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☐ All sample containers made of HDPE or polypropylene
- ☐ Caps are unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☐ Wet weather gear made of polyurethane and PVC only

Equipment Decontamination:

- ☐ "PFC-free" water on-site for decontamination of sample equipment. No other water sources to be used.
- ☐ Alconox and Liquinox to be used as decontamination materials

Food Considerations:

- ☐ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Lead shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the site or removal of worker offsite until in compliance.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

_____

_____

_____

Field Lead Name: _____

Field Lead Signature: _____ Time: _____

PFC Sampling – Prohibited and Acceptable Items

Prohibited	Acceptable
Field Equipment	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Low density polyethylene (LDPE) materials	Acetate Liners
	Silicon Tubing
Waterproof field books	Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
	Sharpies®, pens
Post-It Notes®	
Chemical (blue) ice packs	Regular ice
Field Clothing and PPE	
New cotton clothing or synthetic water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing made of natural fibers (preferable cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™	Boots made with polyurethane and PVC
Tyvek®	Cotton clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	**Sunscreens** - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural" **Insect Repellents** - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics **Sunscreen and insect repellant -** Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90®	Alconox® and/or Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply
Food Considerations	
All food and drink, with exceptions noted on right	Bottled water and hydration fluids (i.e, Gatorade® and Powerade®) to be brought and consumed only in the staging areas

ATTACHMENT 2

Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The procedure used must be consistent with the NYSDEC March 1991 Sampling Guidelines and Protocols http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Equipment blanks should be generated at least daily. Additional materials may be acceptable if pre-approved by NYSDEC. Requests to use alternate equipment should include clean equipment blanks. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse will be performed for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and “plumbers thread seal tape” contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

ATTACHMENT 3

York Analytical Laboratories, Inc.

9/26/2019

Analytical Method Information

Mercury by EPA 7000/200 Series Methods

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Mercury by 7473 in Soil (EPA 7473)					Units: **mg/kg**			
Preservation: Cool 4°C						**Hold Time to Analysis**	days	
Container: 06_8 oz. WM Clear Glass Cool to 4° C		**Amount Required:**	10 g.			**Hold Time to Extr.**	28 days	
Mercury	0.0300	0.0300 mg/kg		35	75 - 125		67.6 - 131	
Metals, Target Analyte in Soil (EPA 6010D)					Units: **mg/kg**			
Preservation: Cool 4°C						**Hold Time to Analysis**	days	
Container: 06_4 oz. WM Clear Glass Cool to 4° C		**Amount Required:**	50			**Hold Time to Extr.**	180 days	
Aluminum	5.00	5.00 mg/kg		35	75 - 125	35	80 - 120	
Antimony	2.50	2.50 mg/kg		35	75 - 125	35	80 - 120	
Arsenic	1.50	1.50 mg/kg		35	75 - 125	35	80 - 120	
Barium	2.50	2.50 mg/kg		35	75 - 125	35	80 - 120	
Beryllium	0.0500	0.0500 mg/kg		35	75 - 125	35	80 - 120	
Cadmium	0.300	0.300 mg/kg		35	75 - 125	35	80 - 120	
Calcium	0.500	5.00 mg/kg		35	75 - 125	35	80 - 120	
Chromium	0.500	0.500 mg/kg		35	75 - 125	35	80 - 120	
Cobalt	0.400	0.400 mg/kg		35	75 - 125	35	80 - 120	
Copper	2.00	2.00 mg/kg		35	75 - 125	35	80 - 120	
Iron	25.0	25.0 mg/kg		35	75 - 125	35	80 - 120	
Lead	0.500	0.500 mg/kg		35	75 - 125	35	80 - 120	
Magnesium	5.00	5.00 mg/kg		35	75 - 125	35	80 - 120	
Manganese	0.500	0.500 mg/kg		35	75 - 125	35	80 - 120	
Nickel	1.00	1.00 mg/kg		35	75 - 125	35	80 - 120	
Potassium	5.00	5.00 mg/kg		35	75 - 125	35	80 - 120	
Selenium	2.50	2.50 mg/kg		35	75 - 125	35	80 - 120	
Silver	0.500	0.500 mg/kg		35	75 - 125	35	80 - 120	
Sodium	50.0	50.0 mg/kg		35	75 - 125	35	80 - 120	
Thallium	2.50	2.50 mg/kg		35	75 - 125	35	80 - 120	
Vanadium	1.00	1.00 mg/kg		35	75 - 125	35	80 - 120	
Zinc	2.50	2.50 mg/kg		35	75 - 125	35	80 - 120	
Metals, Target Analyte List in Soil (varies)					Units: **NA**			
Preservation: [Group Analysis]						**Hold Time to Analysis**	0 days	
Container:		**Amount Required:**				**Hold Time to Extr.**	5 days	

York Analytical Laboratories, Inc.

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Analytical Method Information

Mercury by EPA 7000/200 Series Methods

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Mercury by 7473 in Water (EPA 7473)					Units: **mg/L**			
Preservation: Add HNO3 to pH<2, Cool 4°C						**Hold Time to Analysis**	days	
Container: 10_250mL Plastic pH <2 w/ HNO3		**Amount Required:**	100 mL			**Hold Time to Extr.**	28 days	
Mercury	0.000200	0.000200 mg/L		20	75 - 125		80 - 120	
Metals, Target Analyte, ICP in Water (EPA 6010D)					Units: **mg/L**			
Preservation: Add HNO3 to pH<2, Cool 4°C						**Hold Time to Analysis**	days	
Container: 10_250mL Plastic pH <2 w/ HNO3		**Amount Required:**	250			**Hold Time to Extr.**	180 days	
Aluminum	0.0500	0.0500 mg/L		20	75 - 125	20	80 - 120	
Barium	0.0250	0.0250 mg/L		20	75 - 125	20	80 - 120	
Calcium	0.0500	0.0500 mg/L		20	75 - 125	20	80 - 120	
Chromium	0.00500	0.00500 mg/L		20	75 - 125	20	80 - 120	
Cobalt	0.00400	0.00400 mg/L		20	75 - 125	25	80 - 120	
Copper	0.0200	0.0200 mg/L		20	75 - 125	20	80 - 120	
Iron	0.250	0.250 mg/L		20	75 - 125	20	80 - 120	
Lead	0.00500	0.00500 mg/L		20	75 - 125	20	80 - 120	
Magnesium	0.0500	0.0500 mg/L		20	75 - 125	20	80 - 120	
Manganese	0.00500	0.00500 mg/L		20	75 - 125	20	80 - 120	
Nickel	0.0100	0.0100 mg/L		20	75 - 125	20	80 - 120	
Potassium	0.0500	0.0500 mg/L		20	75 - 125	20	80 - 120	
Silver	0.00500	0.00500 mg/L		20	75 - 125	20	80 - 120	
Sodium	0.500	0.500 mg/L		20	75 - 125	20	80 - 120	
Vanadium	0.0100	0.0100 mg/L		20	75 - 125	20	80 - 120	
Zinc	0.0250	0.0250 mg/L		20	75 - 125	20	80 - 120	
Metals, Target Analyte, ICPMS in Water (EPA 6020B)					Units: **ug/L**			
Preservation: Add HNO3 to pH<2, Cool 4°C						**Hold Time to Analysis**	days	
Container: 10_250mL Plastic pH <2 w/ HNO3		**Amount Required:**	200			**Hold Time to Extr.**	180 days	
Antimony	1.00	1.00 ug/L		20	75 - 125	20	80 - 120	
Arsenic	1.00	1.00 ug/L		20	75 - 125	20	80 - 120	
Beryllium	0.300	0.300 ug/L		20	75 - 125	20	80 - 120	
Cadmium	0.500	0.500 ug/L		20	75 - 125	20	80 - 120	
Selenium	1.00	1.00 ug/L		20	75 - 125	20	80 - 120	
Thallium	1.00	1.00 ug/L		20	75 - 125	20	80 - 120	

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Analytical Method Information

PFAS Target compounds by LC/MS-MS

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
PFAS, NYSDEC Target List in Water (EPA 537m)					Units: **ng/L**			
Preservation: Cool 4°C						**Hold Time to Analysis**	28 days	
Container: 10_250mL Plastic Cool to 4° C			**Amount Required:**	250 mL		**Hold Time to Extr.**	14 days	
1H,1H,2H,2H-Perfluorodecanesulfonic aci	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
1H,1H,2H,2H-Perfluorooctanesulfonic aci	5.00	5.00 ng/L		30	25 - 150	35	50 - 130	30
N-EtFOSAA	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
N-MeFOSAA	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluoro-1-decanesulfonic acid (PFDS)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluoro-1-heptanesulfonic acid (PFHpS)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluoro-1-octanesulfonamide (FOSA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorobutanesulfonic acid (PFBS)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorodecanoic acid (PFDA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorododecanoic acid (PFDoA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluoroheptanoic acid (PFHpA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorohexanesulfonic acid (PFHxS)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorohexanoic acid (PFHxA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluoro-n-butanoic acid (PFBA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorononanoic acid (PFNA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorooctanesulfonic acid (PFOS)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorooctanoic acid (PFOA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluoropentanoic acid (PFPeA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorotetradecanoic acid (PFTA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluorotridecanoic acid (PFTrDA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
Perfluoroundecanoic acid (PFUnA)	2.00	2.00 ng/L		30	25 - 150	35	50 - 130	30
PFAS, NYSDEC Target List in Soil (EPA 537m)					Units: **ug/kg**			
Preservation: Cool 4°C						**Hold Time to Analysis**	28 days	
Container: 10_250mL Plastic Cool to 4° C			**Amount Required:**	250 mL		**Hold Time to Extr.**	14 days	
1H,1H,2H,2H-Perfluorodecanesulfonic aci	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
1H,1H,2H,2H-Perfluorooctanesulfonic aci	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
N-EtFOSAA	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
N-MeFOSAA	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluoro-1-decanesulfonic acid (PFDS)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluoro-1-heptanesulfonic acid (PFHpS)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluoro-1-octanesulfonamide (FOSA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorobutanesulfonic acid (PFBS)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorodecanoic acid (PFDA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorododecanoic acid (PFDoA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluoroheptanoic acid (PFHpA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorohexanesulfonic acid (PFHxS)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorohexanoic acid (PFHxA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluoro-n-butanoic acid (PFBA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorononanoic acid (PFNA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorooctanesulfonic acid (PFOS)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorooctanoic acid (PFOA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluoropentanoic acid (PFPeA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorotetradecanoic acid (PFTA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluorotridecanoic acid (PFTrDA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30
Perfluoroundecanoic acid (PFUnA)	0.750	0.750 ug/kg		30	25 - 150	35	50 - 130	30

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Analytical Method Information

Semivolatile Organic Compounds by GC/MS/SIM

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Semi-Volatiles, 1,4-Dioxane by 8270-SIM in Water (EPA 8270D SIM)					Units: **ug/L**			
Preservation: Cool 4°C						**Hold Time to Analysis** 28 days		
Container: 07_1000mL Amber Glass Cool to 4° C		**Amount Required:** 1000 mL				**Hold Time to Extr.** 7 days		
1,4-Dioxane	0.200	0.200 ug/L		30	70 - 130	30	70 - 130	30
Semi-Volatiles, 1,4-Dioxane by 8270-SIM in Soil (EPA 8270D SIM)					Units: **ug/kg**			
Preservation: Cool 4°C						**Hold Time to Analysis** 28 days		
Container: 06_4 oz. WM Clear Glass Cool to 4° C		**Amount Required:** 250 mL				**Hold Time to Extr.** 14 days		
1,4-Dioxane		10.0 ug/kg						

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Analytical Method Information

Semivolatile Organic Compounds by GC/MS

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Semi-Volatiles, 8270 - Comprehensive in Water (EPA 8270D)					Units: **ug/L**			
Preservation: Cool 4°C						**Hold Time to Analysis** 40 days		
Container: 07_1000mL Amber Glass Cool to 4° C		**Amount Required:** 1000 mL				**Hold Time to Extr.** 7 days		
1,1-Biphenyl	2.50	5.00 ug/L			40 - 140	20	21 - 102	20
1,2,4,5-Tetrachlorobenzene	2.50	5.00 ug/L			40 - 140	20	28 - 105	20
1,2,4-Trichlorobenzene	2.50	5.00 ug/L			31 - 92	20	35 - 91	20
1,2-Dichlorobenzene	2.50	5.00 ug/L			31 - 91	20	42 - 85	20
1,2-Diphenylhydrazine (as Azobenzene)	2.50	5.00 ug/L			40 - 140	20	16 - 137	20
1,3-Dichlorobenzene	2.50	5.00 ug/L			24 - 93	20	45 - 80	20
1,4-Dichlorobenzene	2.50	5.00 ug/L			26 - 95	20	42 - 82	20
2,3,4,6-Tetrachlorophenol	2.50	5.00 ug/L			30 - 130	20	30 - 130	20
2,4,5-Trichlorophenol	2.50	5.00 ug/L			44 - 96	20	36 - 112	20
2,4,6-Trichlorophenol	2.50	5.00 ug/L			39 - 107	20	41 - 107	20
2,4-Dichlorophenol	2.50	5.00 ug/L			38 - 99	20	43 - 92	20
2,4-Dimethylphenol	2.50	5.00 ug/L			10 - 116	20	25 - 92	20
2,4-Dinitrophenol	2.50	5.00 ug/L			10 - 168	20	10 - 149	20
2,4-Dinitrotoluene	2.50	5.00 ug/L			26 - 120	20	41 - 114	20
2,6-Dinitrotoluene	2.50	5.00 ug/L			28 - 118	20	49 - 106	20
2-Chloronaphthalene	2.50	5.00 ug/L			33 - 99	20	40 - 96	20
2-Chlorophenol	2.50	5.00 ug/L			25 - 106	20	35 - 84	20
2-Methylnaphthalene	2.50	5.00 ug/L			29 - 102	20	33 - 101	20
2-Methylphenol	2.50	5.00 ug/L			10 - 118	20	10 - 90	20
2-Nitroaniline	2.50	5.00 ug/L			48 - 99	20	31 - 122	20
2-Nitrophenol	2.50	5.00 ug/L			36 - 103	20	37 - 97	20
3- & 4-Methylphenols	2.50	5.00 ug/L			10 - 102	20	10 - 101	20
3,3-Dichlorobenzidine	2.50	5.00 ug/L			10 - 140	20	25 - 155	20
3-Nitroaniline	2.50	5.00 ug/L			10 - 169	20	29 - 128	20
4,6-Dinitro-2-methylphenol	2.50	5.00 ug/L			10 - 142	20	10 - 135	20
4-Bromophenyl phenyl ether	2.50	5.00 ug/L			35 - 109	20	38 - 116	20
4-Chloro-3-methylphenol	2.50	5.00 ug/L			20 - 117	20	28 - 101	20
4-Chloroaniline	2.50	5.00 ug/L			24 - 116	20	10 - 154	20
4-Chlorophenyl phenyl ether	2.50	5.00 ug/L			31 - 112	20	34 - 112	20
4-Nitroaniline	2.50	5.00 ug/L			24 - 143	20	15 - 143	20
4-Nitrophenol	2.50	5.00 ug/L			10 - 119	20	10 - 112	20
Acenaphthene	0.0500	0.0500 ug/L			17 - 132	20	24 - 114	20
Acenaphthylene	0.0500	0.0500 ug/L			13 - 124	20	26 - 112	20
Acetophenone	2.50	5.00 ug/L			40 - 140	20	47 - 92	20
Aniline	2.50	5.00 ug/L			10 - 133	20	10 - 107	20
Anthracene	0.0500	0.0500 ug/L			40 - 105	20	35 - 114	20
Atrazine	0.500	0.500 ug/L			40 - 140	20	43 - 101	20
Benzaldehyde	2.50	5.00 ug/L			40 - 140	20	17 - 117	20
Benzidine	10.0	20.0 ug/L				20		20
Benzo(a)anthracene	0.0500	0.0500 ug/L			23 - 141	20	38 - 127	20
Benzo(a)pyrene	0.0500	0.0500 ug/L			46 - 118	20	30 - 146	20
Benzo(b)fluoranthene	0.0500	0.0500 ug/L			22 - 133	20	36 - 145	20
Benzo(g,h,i)perylene	0.0500	0.0500 ug/L			10 - 126	20	10 - 163	20
Benzo(k)fluoranthene	0.0500	0.0500 ug/L			18 - 152	20	16 - 149	20
Benzoic acid	25.0	50.0 ug/L			10 - 162	20	30 - 130	20
Benzyl alcohol	2.50	5.00 ug/L			10 - 114	20	18 - 75	20

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Analytical Method Information

Semivolatile Organic Compounds by GC/MS

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Benzyl butyl phthalate	2.50	5.00 ug/L			31 - 121	20	28 - 129	20
Bis(2-chloroethoxy)methane	2.50	5.00 ug/L			23 - 110	20	27 - 112	20
Bis(2-chloroethyl)ether	2.50	5.00 ug/L			10 - 132	20	24 - 114	20
Bis(2-chloroisopropyl)ether	2.50	5.00 ug/L			12 - 132	20	21 - 124	20
Bis(2-ethylhexyl)phthalate	0.500	0.500 ug/L			14 - 131	20	10 - 171	20
Caprolactam	2.50	5.00 ug/L			40 - 140	20	10 - 29	20
Carbazole	2.50	5.00 ug/L			10 - 169	20	49 - 116	20
Chrysene	0.0500	0.0500 ug/L			30 - 127	20	33 - 120	20
Dibenzo(a,h)anthracene	0.0500	0.0500 ug/L			10 - 131	20	10 - 149	20
Dibenzofuran	2.50	5.00 ug/L			37 - 103	20	42 - 105	20
Diethyl phthalate	2.50	5.00 ug/L			41 - 106	20	38 - 112	20
Dimethyl phthalate	2.50	5.00 ug/L			38 - 105	20	49 - 106	20
Di-n-butyl phthalate	2.50	5.00 ug/L			24 - 121	20	36 - 110	20
Di-n-octyl phthalate	2.50	5.00 ug/L			25 - 141	20	12 - 149	20
Fluoranthene	0.0500	0.0500 ug/L			29 - 123	20	33 - 126	20
Fluorene	0.0500	0.0500 ug/L			20 - 133	20	28 - 117	20
Hexachlorobenzene	0.0200	0.0200 ug/L			24 - 120	20	27 - 120	20
Hexachlorobutadiene	0.500	0.500 ug/L			26 - 98	20	25 - 106	20
Hexachlorocyclopentadiene	2.50	5.00 ug/L			10 - 103	20	10 - 99	20
Hexachloroethane	0.500	0.500 ug/L			11 - 102	20	33 - 84	20
Indeno(1,2,3-cd)pyrene	0.0500	0.0500 ug/L			10 - 130	20	10 - 150	20
Isophorone	2.50	5.00 ug/L			19 - 113	20	29 - 115	20
Naphthalene	0.0500	0.0500 ug/L			26 - 104	20	30 - 99	20
Nitrobenzene	0.250	0.250 ug/L			25 - 107	20	32 - 113	20
N-Nitrosodimethylamine	0.500	0.500 ug/L			10 - 110	20	10 - 63	20
N-nitroso-di-n-propylamine	2.50	5.00 ug/L			16 - 127	20	36 - 118	20
N-Nitrosodiphenylamine	2.50	5.00 ug/L			46 - 116	20	27 - 145	20
Pentachlorophenol	0.250	0.250 ug/L			10 - 181	20	19 - 127	20
Phenanthrene	0.0500	0.0500 ug/L			29 - 121	20	31 - 112	20
Phenol	2.50	5.00 ug/L			10 - 107	20	10 - 37	20
Pyrene	0.0500	0.0500 ug/L			34 - 129	20	42 - 125	20

Semi-Volatiles, 8270 - Comprehensive in Soil (EPA 8270D)

Units: **ug/kg**

Preservation: Cool 4°C

Hold Time to Analysis 40 days

Container: 06_4 oz. WM Clear Glass Cool to 4° C

Amount Required: 100 g

Hold Time to Extr. 14 days

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
1,1-Biphenyl	20.9	41.7 ug/kg			24 - 112	30	22 - 103	30
1,2,4,5-Tetrachlorobenzene	41.7	83.3 ug/kg			18 - 152	30	10 - 144	30
1,2,4-Trichlorobenzene	20.9	41.7 ug/kg			15 - 139	30	23 - 130	30
1,2-Dichlorobenzene	20.9	41.7 ug/kg			29 - 106	30	26 - 113	30
1,2-Diphenylhydrazine (as Azobenzene)	20.9	41.7 ug/kg			10 - 135	30	10 - 140	30
1,3-Dichlorobenzene	20.9	41.7 ug/kg			34 - 100	30	32 - 113	30
1,4-Dichlorobenzene	20.9	41.7 ug/kg			26 - 107	30	28 - 111	30
2,3,4,6-Tetrachlorophenol	41.7	83.3 ug/kg			30 - 130	30	30 - 130	30
2,4,5-Trichlorophenol	20.9	41.7 ug/kg			10 - 148	30	14 - 138	30
2,4,6-Trichlorophenol	20.9	41.7 ug/kg			12 - 138	30	27 - 122	30
2,4-Dichlorophenol	20.9	41.7 ug/kg			16 - 144	30	23 - 133	30
2,4-Dimethylphenol	20.9	41.7 ug/kg			11 - 133	30	15 - 131	30
2,4-Dinitrophenol	41.7	83.3 ug/kg			10 - 132	30	10 - 149	30
2,4-Dinitrotoluene	20.9	41.7 ug/kg			42 - 113	30	30 - 123	30
2,6-Dinitrotoluene	20.9	41.7 ug/kg			36 - 124	30	30 - 125	30
2-Chloronaphthalene	20.9	41.7 ug/kg			31 - 116	30	22 - 115	30
2-Chlorophenol	20.9	41.7 ug/kg			28 - 114	30	25 - 121	30
2-Methylnaphthalene	20.9	41.7 ug/kg			10 - 143	30	16 - 127	30
2-Methylphenol	20.9	41.7 ug/kg			10 - 160	30	10 - 146	30
2-Nitroaniline	41.7	83.3 ug/kg			33 - 122	30	24 - 126	30
2-Nitrophenol	20.9	41.7 ug/kg			12 - 127	30	17 - 129	30
3- & 4-Methylphenols	20.9	41.7 ug/kg			16 - 115	30	20 - 109	30
3,3-Dichlorobenzidine	20.9	41.7 ug/kg			10 - 134	30	10 - 147	30
3-Nitroaniline	41.7	83.3 ug/kg			24 - 128	30	23 - 123	30
4,6-Dinitro-2-methylphenol	41.7	83.3 ug/kg			10 - 149	30	10 - 149	30
4-Bromophenyl phenyl ether	20.9	41.7 ug/kg			32 - 148	30	30 - 138	30
4-Chloro-3-methylphenol	20.9	41.7 ug/kg			14 - 138	30	16 - 138	30
4-Chloroaniline	20.9	41.7 ug/kg			10 - 124	30	10 - 117	30
4-Chlorophenyl phenyl ether	20.9	41.7 ug/kg			10 - 153	30	18 - 132	30
4-Nitroaniline	41.7	83.3 ug/kg			10 - 151	30	14 - 125	30
4-Nitrophenol	41.7	83.3 ug/kg			10 - 141	30	10 - 136	30
Acenaphthene	20.9	41.7 ug/kg			13 - 133	30	17 - 124	30
Acenaphthylene	20.9	41.7 ug/kg			25 - 125	30	16 - 124	30
Acetophenone	20.9	41.7 ug/kg			25 - 105	30	28 - 105	30
Aniline	83.5	167 ug/kg			10 - 112	30	10 - 111	30
Anthracene	20.9	41.7 ug/kg			27 - 128	30	24 - 124	30
Atrazine	20.9	41.7 ug/kg			10 - 139	30	22 - 120	30
Benzaldehyde	20.9	41.7 ug/kg			24 - 96	30	21 - 100	30
Benzidine	83.5	167 ug/kg				30		30
Benzo(a)anthracene	20.9	41.7 ug/kg			20 - 147	30	25 - 134	30
Benzo(a)pyrene	20.9	41.7 ug/kg			18 - 153	30	29 - 144	30
Benzo(b)fluoranthene	20.9	41.7 ug/kg			10 - 163	30	20 - 151	30
Benzo(g,h,i)perylene	20.9	41.7 ug/kg			10 - 157	30	10 - 153	30
Benzo(k)fluoranthene	20.9	41.7 ug/kg			10 - 157	30	10 - 148	30
Benzoic acid	20.9	41.7 ug/kg			10 - 130	30	10 - 116	30
Benzyl alcohol	20.9	41.7 ug/kg			20 - 122	30	17 - 128	30

York Analytical Laboratories, Inc.

Analytical Method Information

Semivolatile Organic Compounds by GC/MS

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Benzyl butyl phthalate	20.9	41.7 ug/kg			10 - 129	30	10 - 132	30
Bis(2-chloroethoxy)methane	20.9	41.7 ug/kg			12 - 128	30	10 - 129	30
Bis(2-chloroethyl)ether	20.9	41.7 ug/kg			18 - 113	30	14 - 125	30
Bis(2-chloroisopropyl)ether	20.9	41.7 ug/kg			10 - 130	30	14 - 122	30
Bis(2-ethylhexyl)phthalate	20.9	41.7 ug/kg			10 - 138	30	10 - 141	30
Caprolactam	41.7	83.3 ug/kg			10 - 100	30	10 - 123	30
Carbazole	20.9	41.7 ug/kg			24 - 139	30	31 - 120	30
Chrysene	20.9	41.7 ug/kg			18 - 133	30	24 - 116	30
Dibenzo(a,h)anthracene	20.9	41.7 ug/kg			10 - 146	30	17 - 147	30
Dibenzofuran	20.9	41.7 ug/kg			26 - 134	30	23 - 123	30
Diethyl phthalate	20.9	41.7 ug/kg			30 - 119	30	23 - 122	30
Dimethyl phthalate	20.9	41.7 ug/kg			34 - 120	30	28 - 127	30
Di-n-butyl phthalate	20.9	41.7 ug/kg			20 - 128	30	19 - 123	30
Di-n-octyl phthalate	20.9	41.7 ug/kg			10 - 133	30	10 - 132	30
Fluoranthene	20.9	41.7 ug/kg			10 - 155	30	36 - 125	30
Fluorene	20.9	41.7 ug/kg			12 - 150	30	16 - 130	30
Hexachlorobenzene	20.9	41.7 ug/kg			16 - 142	30	10 - 129	30
Hexachlorobutadiene	20.9	41.7 ug/kg			11 - 150	30	22 - 153	30
Hexachlorocyclopentadiene	20.9	41.7 ug/kg			10 - 115	30	10 - 134	30
Hexachloroethane	20.9	41.7 ug/kg			14 - 106	30	20 - 112	30
Indeno(1,2,3-cd)pyrene	20.9	41.7 ug/kg			10 - 155	30	10 - 155	30
Isophorone	20.9	41.7 ug/kg			14 - 127	30	14 - 131	30
Naphthalene	20.9	41.7 ug/kg			15 - 132	30	20 - 121	30
Nitrobenzene	20.9	41.7 ug/kg			18 - 125	30	20 - 121	30
N-Nitrosodimethylamine	20.9	41.7 ug/kg			10 - 123	30	10 - 124	30
N-nitroso-di-n-propylamine	20.9	41.7 ug/kg			23 - 115	30	21 - 119	30
N-Nitrosodiphenylamine	20.9	41.7 ug/kg			16 - 166	30	10 - 163	30
Pentachlorophenol	20.9	41.7 ug/kg			10 - 160	30	10 - 143	30
Phenanthrene	20.9	41.7 ug/kg			10 - 151	30	24 - 123	30
Phenol	20.9	41.7 ug/kg			11 - 124	30	15 - 123	30
Pyrene	20.9	41.7 ug/kg			13 - 148	30	24 - 132	30

York Analytical Laboratories, Inc.

9/26/2019

Analytical Method Information

Volatile Organic Compounds by GC/MS

Volatile Organics, 8260 - Comprehensive in Water (EPA 8260C) Units: **ug/L**

Preservation: Add HCl to pH<2; Store cool at 4°C **Hold Time to Analysis** days

Container: 00_40mL Clear Vial (pre-pres.) HCl; Cool to 4° C **Amount Required:** 80 mL **Hold Time to Extr.** 14 days

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
1,1,1,2-Tetrachloroethane	0.20	0.50 ug/L			45 - 161	30	82 - 126	30
1,1,1-Trichloroethane	0.20	0.50 ug/L			70 - 146	30	78 - 136	30
1,1,2,2-Tetrachloroethane	0.20	0.50 ug/L			74 - 121	30	76 - 129	30
1,1,2-Trichloro-1,2,2-trifluoroethane (Freo	0.20	0.50 ug/L			21 - 217	30	54 - 165	30
1,1,2-Trichloroethane	0.20	0.50 ug/L			59 - 146	30	82 - 123	30
1,1-Dichloroethane	0.20	0.50 ug/L			54 - 146	30	82 - 129	30
1,1-Dichloroethylene	0.20	0.50 ug/L			44 - 165	30	68 - 138	30
1,2,3-Trichlorobenzene	0.20	0.50 ug/L			40 - 161	30	76 - 136	30
1,2,3-Trichloropropane	0.20	0.50 ug/L			74 - 127	30	77 - 128	30
1,2,4-Trichlorobenzene	0.20	0.50 ug/L			41 - 161	30	76 - 137	30
1,2,4-Trimethylbenzene	0.20	0.50 ug/L			72 - 129	30	82 - 132	30
1,2-Dibromo-3-chloropropane	0.20	0.50 ug/L			31 - 151	30	45 - 147	30
1,2-Dibromoethane	0.20	0.50 ug/L			75 - 125	30	83 - 124	30
1,2-Dichlorobenzene	0.20	0.50 ug/L			63 - 122	30	79 - 123	30
1,2-Dichloroethane	0.20	0.50 ug/L			68 - 131	30	73 - 132	30
1,2-Dichloropropane	0.20	0.50 ug/L			77 - 121	30	78 - 126	30
1,3,5-Trimethylbenzene	0.20	0.50 ug/L			69 - 126	30	80 - 131	30
1,3-Dichlorobenzene	0.20	0.50 ug/L			74 - 119	30	86 - 122	30
1,4-Dichlorobenzene	0.20	0.50 ug/L			70 - 124	30	85 - 124	30
1,4-Dioxane	40	40 ug/L			10 - 310	30	10 - 349	30
2-Butanone	0.20	0.50 ug/L			10 - 193	30	49 - 152	30
2-Hexanone	0.20	0.50 ug/L			53 - 133	30	51 - 146	30
4-Methyl-2-pentanone	0.20	0.50 ug/L			38 - 150	30	57 - 145	30
Acetone	1.0	2.0 ug/L			13 - 149	30	14 - 150	30
Acrolein	0.20	0.50 ug/L			10 - 195	30	10 - 153	30
Acrylonitrile	0.20	0.50 ug/L			37 - 165	30	51 - 150	30
Benzene	0.20	0.50 ug/L			38 - 155	30	85 - 126	30
Bromochloromethane	0.20	0.50 ug/L			75 - 121	30	77 - 128	30
Bromodichloromethane	0.20	0.50 ug/L			70 - 129	30	79 - 128	30
Bromoform	0.20	0.50 ug/L			66 - 136	30	78 - 133	30
Bromomethane	0.20	0.50 ug/L			30 - 158	30	43 - 168	30
Carbon disulfide	0.20	0.50 ug/L			10 - 138	30	68 - 146	30
Carbon tetrachloride	0.20	0.50 ug/L			71 - 146	30	77 - 141	30
Chlorobenzene	0.20	0.50 ug/L			81 - 117	30	88 - 120	30
Chloroethane	0.20	0.50 ug/L			51 - 145	30	65 - 136	30
Chloroform	0.20	0.50 ug/L			80 - 124	30	82 - 128	30
Chloromethane	0.20	0.50 ug/L			16 - 163	30	43 - 155	30
cis-1,2-Dichloroethylene	0.20	0.50 ug/L			76 - 125	30	83 - 129	30
cis-1,3-Dichloropropylene	0.20	0.50 ug/L			58 - 131	30	80 - 131	30
Cyclohexane	0.20	0.50 ug/L			70 - 130	30	63 - 149	30
Dibromochloromethane	0.20	0.50 ug/L			71 - 129	30	80 - 130	30
Dibromomethane	0.20	0.50 ug/L			76 - 120	30	72 - 134	30
Dichlorodifluoromethane	0.20	0.50 ug/L			30 - 147	30	44 - 144	30
Ethyl Benzene	0.20	0.50 ug/L			72 - 128	30	80 - 131	30
Hexachlorobutadiene	0.20	0.50 ug/L			34 - 166	30	67 - 146	30
Isopropylbenzene	0.20	0.50 ug/L			66 - 139	30	76 - 140	30

York Analytical Laboratories, Inc.

Analytical Method Information

Volatile Organic Compounds by GC/MS

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Methyl acetate	0.20	0.50 ug/L			10 - 200	30	51 - 139	30
Methyl tert-butyl ether (MTBE)	0.20	0.50 ug/L			75 - 128	30	76 - 135	30
Methylcyclohexane	0.20	0.50 ug/L			70 - 130	30	72 - 143	30
Methylene chloride	1.0	2.0 ug/L			57 - 128	30	55 - 137	30
n-Butylbenzene	0.20	0.50 ug/L			61 - 138	30	79 - 132	30
n-Propylbenzene	0.20	0.50 ug/L			66 - 134	30	78 - 133	30
o-Xylene	0.20	0.50 ug/L			69 - 126	30	78 - 130	30
p- & m- Xylenes	0.50	1.0 ug/L			67 - 130	30	77 - 133	30
p-Isopropyltoluene	0.20	0.50 ug/L			64 - 137	30	81 - 136	30
sec-Butylbenzene	0.20	0.50 ug/L			53 - 155	30	79 - 137	30
Styrene	0.20	0.50 ug/L			69 - 125	30	67 - 132	30
tert-Butyl alcohol (TBA)	0.50	1.0 ug/L			10 - 130	30	25 - 162	30
tert-Butylbenzene	0.20	0.50 ug/L			65 - 139	30	77 - 138	30
Tetrachloroethylene	0.20	0.50 ug/L			64 - 139	30	82 - 131	30
Toluene	0.20	0.50 ug/L			76 - 123	30	80 - 127	30
trans-1,2-Dichloroethylene	0.20	0.50 ug/L			79 - 131	30	80 - 132	30
trans-1,3-Dichloropropylene	0.20	0.50 ug/L			55 - 130	30	78 - 131	30
trans-1,4-dichloro-2-butene	0.20	0.50 ug/L			25 - 155	30	63 - 141	30
Trichloroethylene	0.20	0.50 ug/L			53 - 145	30	82 - 128	30
Trichlorofluoromethane	0.20	0.50 ug/L			61 - 142	30	67 - 139	30
Vinyl Chloride	0.20	0.50 ug/L			31 - 165	30	58 - 145	30
Xylenes, Total	0.60	1.5 ug/L						

York Analytical Laboratories, Inc.

Analytical Method Information

Volatile Organic Compounds by GC/MS

Volatile Organics, 8260 - Comprehensive in Soil (EPA 8260C) Units: **ug/kg**

Preservation: Cool 4°C **Hold Time to Analysis** days

Container: 03_5035 Vial Set **Amount Required:** 20 g. **Hold Time to Extr.** 14 days

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
1,1,1,2-Tetrachloroethane	2.5	5.0 ug/kg			15 - 161	33	75 - 129	30
1,1,1-Trichloroethane	2.5	5.0 ug/kg			42 - 145	30	71 - 137	30
1,1,2,2-Tetrachloroethane	2.5	5.0 ug/kg			16 - 167	56	79 - 129	30
1,1,2-Trichloro-1,2,2-trifluoroethane (Freo	2.5	5.0 ug/kg			11 - 160	31	58 - 146	30
1,1,2-Trichloroethane	2.5	5.0 ug/kg			44 - 145	40	83 - 123	30
1,1-Dichloroethane	2.5	5.0 ug/kg			46 - 142	36	75 - 130	30
1,1-Dichloroethylene	2.5	5.0 ug/kg			30 - 153	31	64 - 137	30
1,2,3-Trichlorobenzene	2.5	5.0 ug/kg			10 - 157	47	81 - 140	30
1,2,3-Trichloropropane	2.5	5.0 ug/kg			38 - 155	48	81 - 126	30
1,2,4-Trichlorobenzene	2.5	5.0 ug/kg			10 - 151	52	80 - 141	30
1,2,4-Trimethylbenzene	2.5	5.0 ug/kg			10 - 170	242	84 - 125	30
1,2-Dibromo-3-chloropropane	2.5	5.0 ug/kg			36 - 138	54	74 - 142	30
1,2-Dibromoethane	2.5	5.0 ug/kg			40 - 142	39	86 - 123	30
1,2-Dichlorobenzene	2.5	5.0 ug/kg			10 - 147	52	85 - 122	30
1,2-Dichloroethane	2.5	5.0 ug/kg			48 - 133	32	71 - 133	30
1,2-Dichloropropane	2.5	5.0 ug/kg			47 - 141	37	81 - 122	30
1,3,5-Trimethylbenzene	2.5	5.0 ug/kg			10 - 150	62	82 - 126	30
1,3-Dichlorobenzene	2.5	5.0 ug/kg			10 - 144	51	84 - 124	30
1,4-Dichlorobenzene	2.5	5.0 ug/kg			10 - 160	52	84 - 124	30
1,4-Dioxane	50	100 ug/kg			10 - 191	196	10 - 228	30
2-Butanone	2.5	5.0 ug/kg			10 - 189	67	58 - 147	30
2-Hexanone	2.5	5.0 ug/kg			10 - 181	60	70 - 139	30
4-Methyl-2-pentanone	2.5	5.0 ug/kg			10 - 166	47	72 - 132	30
Acetone	5.0	10 ug/kg			10 - 196	150	36 - 155	30
Acrolein	5.0	10 ug/kg			10 - 192	128	10 - 238	30
Acrylonitrile	2.5	5.0 ug/kg			13 - 161	48	66 - 141	30
Benzene	2.5	5.0 ug/kg			43 - 139	64	77 - 127	30
Bromochloromethane	2.5	5.0 ug/kg			38 - 145	30	74 - 129	30
Bromodichloromethane	2.5	5.0 ug/kg			38 - 147	37	81 - 124	30
Bromoform	2.5	5.0 ug/kg			29 - 156	51	80 - 136	30
Bromomethane	2.5	5.0 ug/kg			10 - 166	42	32 - 177	30
Carbon disulfide	2.5	5.0 ug/kg			10 - 131	36	10 - 136	30
Carbon tetrachloride	2.5	5.0 ug/kg			35 - 145	31	66 - 143	30
Chlorobenzene	2.5	5.0 ug/kg			21 - 154	32	86 - 120	30
Chloroethane	2.5	5.0 ug/kg			15 - 160	40	51 - 142	30
Chloroform	2.5	5.0 ug/kg			47 - 142	29	76 - 131	30
Chloromethane	2.5	5.0 ug/kg			10 - 159	31	49 - 132	30
cis-1,2-Dichloroethylene	2.5	5.0 ug/kg			42 - 144	30	74 - 132	30
cis-1,3-Dichloropropylene	2.5	5.0 ug/kg			18 - 159	39	81 - 129	30
Cyclohexane	2.5	5.0 ug/kg			70 - 130	30	70 - 130	30
Dibromochloromethane	2.5	5.0 ug/kg			10 - 179	41	10 - 200	30
Dibromomethane	2.5	5.0 ug/kg			47 - 143	41	83 - 124	30
Dichlorodifluoromethane	2.5	5.0 ug/kg			10 - 145	34	28 - 158	30
Ethyl Benzene	2.5	5.0 ug/kg			11 - 158	42	84 - 125	30
Hexachlorobutadiene	2.5	5.0 ug/kg			10 - 158	45	83 - 133	30
Isopropylbenzene	2.5	5.0 ug/kg			10 - 162	57	81 - 127	30

York Analytical Laboratories, Inc.

9/26/2019

Analytical Method Information

Volatile Organic Compounds by GC/MS

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
Methyl acetate	2.5	5.0 ug/kg			10 - 149	64	41 - 143	30
Methyl tert-butyl ether (MTBE)	2.5	5.0 ug/kg			42 - 152	47	74 - 131	30
Methylcyclohexane	2.5	5.0 ug/kg			70 - 130	30	70 - 130	30
Methylene chloride	5.0	10 ug/kg			28 - 151	49	57 - 141	30
n-Butylbenzene	2.5	5.0 ug/kg			10 - 162	96	80 - 130	30
n-Propylbenzene	2.5	5.0 ug/kg			10 - 155	56	74 - 136	30
o-Xylene	2.5	5.0 ug/kg			10 - 158	51	83 - 123	30
p- & m- Xylenes	5.0	10 ug/kg			10 - 156	47	82 - 128	30
p-Isopropyltoluene	2.5	5.0 ug/kg			10 - 147	60	85 - 125	30
sec-Butylbenzene	2.5	5.0 ug/kg			10 - 157	56	83 - 125	30
Styrene	2.5	5.0 ug/kg			13 - 171	39	86 - 126	30
tert-Butyl alcohol (TBA)	2.5	5.0 ug/kg			34 - 179	35	70 - 130	30
tert-Butylbenzene	2.5	5.0 ug/kg			10 - 160	79	80 - 127	30
Tetrachloroethylene	2.5	5.0 ug/kg			30 - 167	33	80 - 129	30
Toluene	2.5	5.0 ug/kg			21 - 160	50	85 - 121	30
trans-1,2-Dichloroethylene	2.5	5.0 ug/kg			29 - 153	30	72 - 132	30
trans-1,3-Dichloropropylene	2.5	5.0 ug/kg			18 - 155	30	78 - 132	30
trans-1,4-dichloro-2-butene	2.5	5.0 ug/kg			17 - 154	30	75 - 135	30
Trichloroethylene	2.5	5.0 ug/kg			24 - 169	30	84 - 123	30
Trichlorofluoromethane	2.5	5.0 ug/kg			35 - 142	30	62 - 140	30
Vinyl Chloride	2.5	5.0 ug/kg			12 - 160	35	52 - 130	30
Xylenes, Total	7.5	15 ug/kg						

APPENDIX D

Community Air Monitoring Plan (CAMP)
Westchester County Airport
240 Airport Road
White Plains, New York 10604

NYSDEC No. 360174

July 2020

Prepared for: Westchester County Airport
240 Airport Road
White Plains, New York 10604

Prepared by: First Environment, Inc.
91 Fulton Street
Boonton, New Jersey 07005

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TABLES

TABLE 1 - Tasks Requiring CAMP 2

Introduction

In addition to the precautions outlined in the Health and Safety Plan, the following measures will be taken to evaluate and control, as necessary, potential fugitive particulates and volatile organic compounds (VOC) generated during both ground intrusive and non-intrusive activities. Accordingly, the following Community Air Monitoring Plan (CAMP) was developed using the New York State Department of Health Generic Community Air Monitoring Plan in combination with site-specific information and proposed activities.

Depending on the type of activity, the levels of airborne particulates and/or VOCs will be monitored and recorded in real-time at both the upwind and downwind perimeters of the immediate work area. The purpose of the CAMP is to protect the downwind community from potential release of contaminants to the air generated during the activities. The action levels developed by the NYSDOH will be followed as part of the CAMP.

If the recorded levels approach pre-established action levels, or if airborne particulates are visually observed migrating off site or towards sensitive receptors, suppression measures will be implemented immediately. Suppression measures may include misting the particulate source with water, use of particulate suppression materials, wetting the work area prior to initiating the activities, or stopping work activities until recorded levels fall below the action level.

Scope-of-Work

This CAMP addresses the activities that will occur at the Westchester County Airport including the following:

1. Lining of selected portions of the storm sewer system.
2. Installation of soil borings and/or monitoring wells.
3. Collection of soil and groundwater samples.

Continuous monitoring will be required for those activities considered ground intrusive. Intrusive activities at the Site include installation of soil borings and monitoring wells.

Periodic monitoring for volatile organic compounds (VOCs) will be required during non-intrusive activities. Non-intrusive activities at the Site will include the lining of selected portions of the storm sewer system and the collection of groundwater samples from existing on-site monitoring wells. "Periodic" monitoring may consist of recording a reading upon arrival at a sample location while opening a well cap or overturning soil, monitoring during well bailing/purging, and taking a reading prior to leaving a sample location.

Table 1 presents a summary of the various tasks during the course of Site Characterization and IRM activities and the associated monitoring requirements.

TABLE 1 - Tasks Requiring CAMP

TASK NO.	TASK DESCRIPTION	ACTIVITY TYPE	MONITORING FREQUENCY
1	Lining Selected Portions of the Storm Sewer	Non-Ground Intrusive	N/A for Particulates; Periodic for VOCs
2	Subsurface Investigation Installation	Ground Intrusive	Continuous for Particulates and VOCs
3	Groundwater Sampling	Non-Ground Intrusive	N/A for Particulates; Periodic for VOCs

Air Monitoring Procedures

Intrusive Activities

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the Site at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 microns in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level (Thermo MIE pDR-1000 or equivalent). The equipment will include an audible alarm or other means of alerting the operator to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities.

- If the downwind PM-10 level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period, or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 levels are greater than 150 mcg/m3 above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

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

VOC Monitoring, Response Levels, and Actions

The VOC monitoring for intrusive activities will be conducted on a continuous basis and will follow the same response levels and actions for VOCs as outlined below. The measurements will be collected from the immediate work area using a MiniRAE 2000 photoionization detector or equivalent.

VOCs will be continuously monitored at the downwind perimeter of the work area, or exclusion zone, during storm sewer lining and soil boring and well installation activities using a MiniRAE 2000 photoionization detector or equivalent. Upwind measurements will also be collected prior

to the start of work each day and periodically throughout the day at locations away from the work areas to establish background conditions. A minimum of three background measurements will be collected daily. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily against a standard VOC calibrations gas appropriate for the contaminants of concern and for concentrations which will be comparable to the levels specified below. The monitoring, response levels, and actions for VOCs are as follows:

- If the ambient air concentration of total organic vapors in the work area exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.
- If total organic vapor levels in the work area persist at levels in excess of 5 ppm over 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 Site or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down.

Non-intrusive Activities

Based on the tasks requiring a CAMP presented in Table 1 above, the two non-intrusive activities to be performed are lining selected portions of the storm sewer system and groundwater sampling, which will not require particulate monitoring. Periodic monitoring for VOCs will be conducted during groundwater sampling activities.

VOC Monitoring, Response Levels, and Actions

The VOC monitoring for non-intrusive activities will be conducted on a periodic basis and will follow the same response levels and equipment for VOCs as outlined above. The measurements will be collected from the exclusion zone using a MiniRAE 2000 photoionization detector or equivalent.

Periodic VOC monitoring will consist of taking readings prior to the initiation of work at each well location, during bailing and purging activities, and prior to leaving each monitoring well location. Upwind concentrations will also be measured at the start of each workday and periodically thereafter to establish background conditions. The equipment will be calibrated at least daily

against a standard VOC calibrations gas appropriate for the contaminants of concern and for concentrations which will be comparable to the levels specified below. The monitoring, response levels, and actions for VOCs are as follows:

- If the ambient air concentration of total organic vapors in the work area exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.
- If total organic vapor levels in the work area persist at levels in excess of 5 ppm over 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 Site or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down.

Weather Monitoring

In order to identify the specific upgradient and downgradient sampling locations, meteorological data will be gauged in the field and collected from nearby weather station used by Airport.

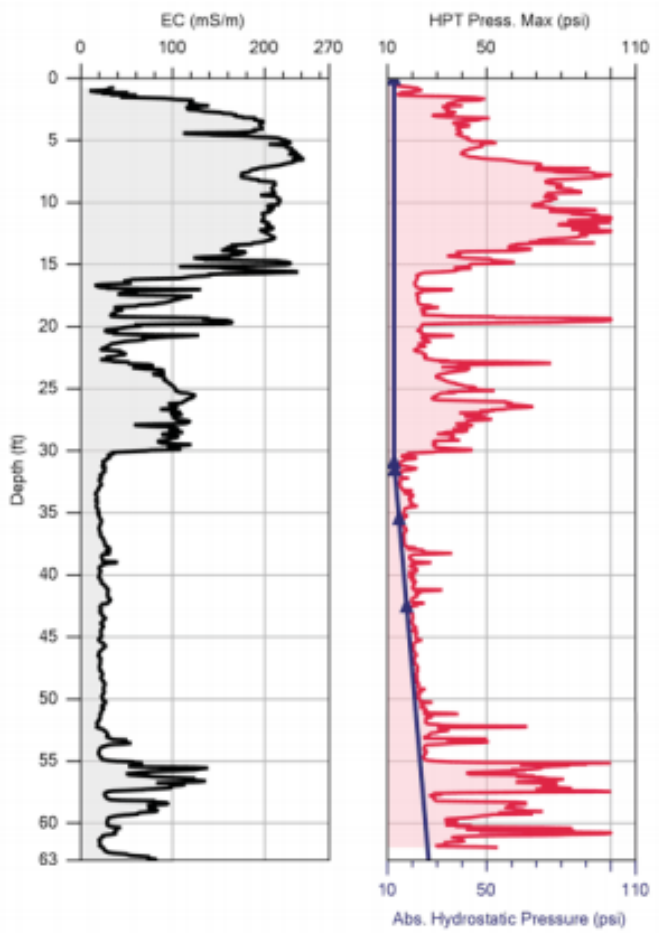
APPENDIX E

HYDRAULIC PROFILING TOOL

The Hydraulic Profiling Tool (HPT) is an injection logging tool that generates essential stratigraphic data that are integral to the creation of sound conceptual site models. The tool measures the subsurface resistance to injected water as the probe is advanced into the subsurface. This injection pressure log is an excellent indicator of formation permeability. In addition to measuring injection pressure, the HPT can be used to measure hydrostatic pressure (equivalent to equipotential surface) and can also be used to estimate hydraulic conductivity. Because it is a direct sensing tool, the data are made available immediately and the investigators can use this information to strategically collect groundwater and soil samples at important transition zones within the formation

BENEFITS OF THE HPT

- Produces a detailed hydrostratigraphic log
- Can be used to estimate hydraulic conductivity in the saturated zone
- Logs both HPT injection pressure and electrical conductivity
- Measures hydrostatic pressure and depth to water table
- Logging is easy to learn and operate
- Interpretation of logs is straight forward and intuitive



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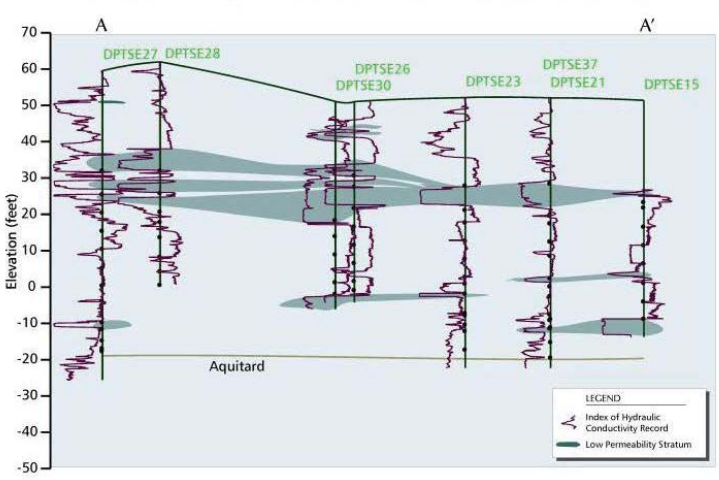
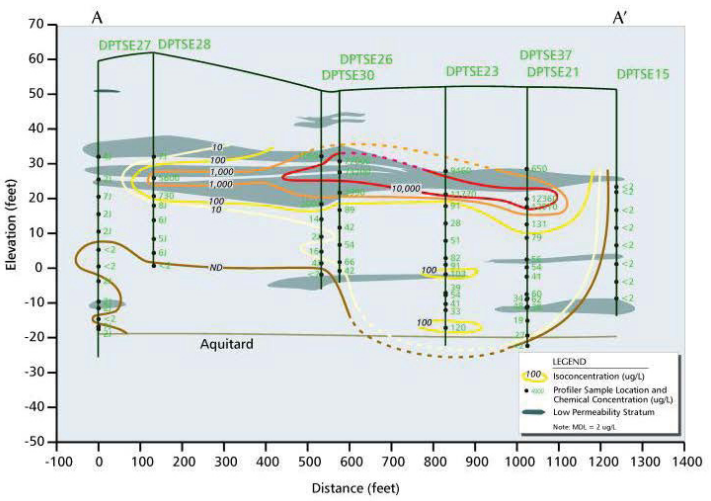
WATERLOO^{APS}™

VERTICAL AQUIFER PROFILING WITH WATERLOO ADVANCED PROFILING SYSTEM

The Waterloo Advanced Profiling System (Waterloo^{APS}) is the next generation of the Waterloo Profiler first introduced to investigation and remediation professionals in 1994.

Developed and tested extensively at the University of Waterloo, in Ontario Canada, the Waterloo Profiler transferred High-Resolution Site Characterization (HRSC) capabilities from the groundwater research community to the wider site investigation industry. Built around the original Waterloo Profiler, the Waterloo^{APS} is a complete subsurface data collection platform, combining the same high-quality, discrete sampling capability with continuous, real-time hydrostratigraphic logging. This system has been utilized worldwide for the past 14 years in a broad array of environments. Using hybrid drive methods, the Waterloo^{APS} has achieved depths exceeding 600 feet below ground surface. The profiler uses a hydraulic conductivity profiling system (KPRO), a tool that provides a real-time continuous Index of Hydraulic Conductivity (IK) to determine the stratigraphy and ideal depths for sample collection.





Real-time hydrostratigraphic profiling in a single push with discrete depth sampling, without withdrawing the tool between samples, allows for very efficient high-resolution groundwater contamination investigations. In this figure the I_k allowed the investigator to identify and sample sand lenses within a clay unit that serve as major contaminant transport pathways.

REAL-TIME HYDROSTRATIGRAPHIC LOGGING AND SAMPLING IN A SINGLE PUSH

The KRPO system incorporated into the Waterloo^{APS} is the original injection logging hydraulic profiling tool. As the tool is advanced, clean water is injected into the formation while depth, pressure and flow rate are monitored. From these data, a real-time continuous log of the Index of Hydraulic Conductivity is calculated. It is not necessary to drive the tool more than once to log both the hydrostratigraphy and to collect a sample – both are accomplished in a single push.

SAVING TIME AND MONEY

The integrated KRPO hydrostratigraphic profiling system saves time and money in three important ways:

1. KPRO helps us select ideal depths at which to collect samples, based on ongoing changes in stratigraphy, as opposed to random or predetermined "blind" intervals. The I_k and sample collection are accomplished in a single push, obtaining data quickly and cost effectively.
2. It provides a better understanding of the site's hydrostratigraphy for creation of more accurate conceptual site models, and flow and transport models.
3. It identifies impermeable zones so time is not spent in attempt to collect samples in suboptimal locations. Low permeability zones can, and should, be sampled by high-resolution soil sampling techniques.

MULTIPLE MODELS FOR VARIOUS HYDOGEOLOGIC CONDITIONS

1. Waterloo^{APS} 2254 – a 2.25-inch Outside Diameter (OD) version of the most robust model, ideally paired with Geoprobe 8040 rigs for maximal depth penetration. The tip has wider area for higher sampling rates and reduced clogging. The 225 can be used with either a peristaltic pump or with the downhole nitrogen drive positive displacement pump.
2. Waterloo^{APS} 175 – the 1.75-inch OD version is the same diameter as the original Waterloo Profiler but utilizes a more durable direct push rod with the unique APS tip design.

One of the above three profiling tip models is right for most conditions.

The KPRO system provides an integrated, high quality, high-resolution data collection system.

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