SUFFOLK COUNTY FIREMATICS
676 MAPLE STREET
YAPHANK, NEW YORK
SECTION 742, BLOCK 1, P/O LOTS 3.001 AND 3.002
NYSDEC SITE: 152246

REMEDIAL INVESTIGATION WORK PLAN

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016

PREPARED FOR:

Suffolk County
H. Lee Dennison Building
100 Veterans Hwy.
Hauppauge, New York 11788

PREPARED BY:

P.W. Grosser Consulting, Inc.
630 Johnson Avenue, Suite 7
Bohemia, New York 11716
Phone: 631-589-6353
Fax: 631-589-8705

James Rhodes, PG, Sr. Vice President jamesrpwgrosser.com
Andy Lockwood, PG, LEP andyl@pwgrosser.com

PWGC Project Number: SHD1702

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PWGC
Strategic Environmental Engineering Solutions

P.W. GROSSER CONSULTING, INC.
PROJECT No. SHD1702

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Suffolk County Firematics Site
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Yaphank, New York 11980
Site No.: 152246

SUBMITTED:
September 2017

Submitted to:
The New York State Department of Environmental Conservation
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1.0 INTRODUCTION

P.W. Grosser Consulting, Inc. (PWGC) has prepared the following Remedial Investigation Work Plan (RIWP) to outline procedures and a scope of work intended to delineate the on-site nature and extent of soil and groundwater contamination from historical site uses at the property known as Suffolk County Firematics Site (Site) located at 676 Maple Street, Yaphank, New York. A Site Location Map is included as **Figure 1** and a Site Plan is included as **Figure 2**.

1.1 Project Background

The site is registered as New York State Class 2 Inactive Hazardous Waste Disposal Site (IHWDS) as Site No. 152246. This Remedial Investigation Work Plan (RIWP) is a requirement of an Order on Consent and Administrative Settlement (Index No. CO 1-20170321-84) entered into between Suffolk County and the New York State Department of Environmental Conservation (NYSDEC) to address hazardous substances detected at the site. The primary contaminants of concern are a class of chemicals referred to as perfluorinated compounds (PFCs), primarily perfluoro-ooctane sulfonate (PFOS) and perfluoro-octanoic acid (PFOA). This RIWP documents the planned investigative activities to be completed at the Site.

2.0 SITE DESCRIPTION AND HISTORY

This section describes the site history, physical characteristics, and previous environmental investigations performed at the Site.

2.1 Site Description

The subject property consists of sections of two parcels located at 676 Maple Street in the hamlet of Yaphank, New York. The Site is located in the Town of Brookhaven, Suffolk County **(Figure 1)**. The property is identified in the Suffolk County Tax Map as:

- 0200-779.00-01.00-002.000

The Site consists of several buildings used for various firefighting training activities with and without the use of live fire. The Site measures approximately 28 acres in area. The buildings located at the Site were constructed between 1959 and 2005 **(Figure 2)**.

2.2 Site History

The subject Site was vacant until 1957. Sometime between 1957 and 1959 the land was developed to be utilized as a firefighter training facility. In 1959 the first buildings were erected and included a Communications Building (since demolished), a Multistory Training Area (Tower), a recharge basin, roadways, and several open pits (oil pits) used for firefighting training.

Between 1959 and 1980, several additions were made to the property which included a Class “A” Residential Training Area (current Smoke House), a Railroad Tank Car Training Area, the eastern most administrative building and parking area, pump test building, LPG Training Area, and an additional recharge basin. In addition, the correctional facility to the north was constructed (approximately 1960) and the STP facility west of the Site was constructed (approximately 1978).

Between 1980 and 1994 several additional buildings were added and the training areas were better defined by the installation of concrete pads. The concrete pads currently used for HAZMAT Response, LPG Training Area, and Extrication training were installed between 1980 and 1985. The current office and classroom building, the Commercial Class “A” Training Area, the Emergency Response Equipment Storage, and the Tech Rescue Training Area were added to the Site.

In the 1990s the railroad tank car was converted to LPG to reduce use of liquid accelerants. Between 1995 and 2011, a replacement Class "A" Residential Training Area was built. It measured approximately 5,000 square feet and included a front porch, attached 2 car garage, a basement and an attic. The original Class "A" residential burn building was converted for use as a training area for new recruit courses and fire fighter survival courses. During this time the Staff Field Office and Pump Test Facility was constructed, and the Communications Building was demolished.

2.3 Regional Geology/Hydrogeology

The geologic setting of Long Island is well documented and consists of crystalline bedrock composed of schist and gneiss overlain by layers of unconsolidated deposits. Immediately overlying the bedrock is the Raritan Formation, consisting of the Lloyd sand member confined by the Raritan clay member. The Lloyd sand is an aquifer and consists of discontinuous layers of gravel, sand, sandy and silty clay, and solid clay. The Raritan clay consists of gray, red or white solid and silty clay with few lenses of sand and gravel, and abundant lignite and pyrite.

Above the Raritan clay lies the Magothy Formation. The Magothy Aquifer consists of layers of fine to coarse sand of moderate to high permeability, with inter-bedded lenses of silt and clay of low permeability resulting in areas of preferential horizontal flow. Therefore, this aquifer generally becomes more confined with depth. The Magothy Aquifer is overlain by the Upper Glacial Aquifer. The Upper Glacial Aquifer is the water-table aquifer at this location and is comprised of medium to coarse sand and gravel with occasional thin lenses of fine sand and brown clay. This aquifer extends from the water table to the top of the Magothy and, therefore, is hydraulically connected to the Magothy Aquifer.

2.4 Site Geology/Hydrogeology

The measured depth to groundwater beneath the site is approximately 19 feet below existing grade. Regional groundwater flow is estimated to be toward the southeast. Based on groundwater elevation data collected from on-site vertical profile wells on February 2, 2017, groundwater flow is towards the southeast.

The nearest surface water body is Carman's River, located approximately 0.71 miles east of the subject property. There are no public water supply wells within a one-mile radius of the subject property.

2.5 Site Features

The project site elevation is approximately 40 feet above mean sea level, and is generally level. There are 24 buildings/training areas located within the 28-acre site. The buildings are used for a variety of administrative uses, training, infrastructure/equipment and storage. The training areas are used for a variety of training scenarios; some involve live fire training (fire currently generated using a combination of liquefied petroleum gas or combustibles ignited with an accelerant) and others do not. There are two active storm water/recirculation water detention/recharge basins on the southern end of the site. Two areas of the site are wooded and do not appear to have ever been developed.

2.6 Current and Future Site Use

The site is currently developed for use as a firefighting training facility and county offices. There are no plans to change the current site use.

2.7 Previous Investigations

This section summarizes the initial investigative activities performed on and off-site. Sampling results and a figure showing the location of the sampling events are provided in **Appendix A**.

2.7.1 Suffolk County Department of Health Services Investigation

In April 2016, the NYSDEC completed an emergency rulemaking adding PFOA and PFOS to the list of hazardous substances, the rulemaking was finalized in March 2017. As a result, beginning In July 2016, the SCDHS Office of Water Resources initiated a groundwater investigation to investigate potential PFOS and PFOA groundwater contamination from the suspected historical use of AFFF at the Suffolk County Firematics Site. The SCDHS collected groundwater profile samples from seven temporary wells on-site (FM-1 – FM-5, FM-13 and FM-14). PFOS/PFOA detections were reported in all seven temporary wells, with five of the wells exceeding the USEPA life-time Health Advisory Level (HAL) of 70 nanograms per liter (ng/l) for PFOS and PFOA combined. Two samples had PFOS/PFOA detections, below the HAL. On-site detections exceeding the HAL ranged from 87 (FM-3, 30-35 feet) to 1,700 ng/l (FM-13, 20-25 feet) of total PFOS/PFOA. Results of on-site groundwater sampling are included on **Figure 3**.

In addition to the on-site analysis of groundwater samples, as of August 29, 2017, SCDHS has installed and sampled eighteen off-site temporary wells (FM-6 – FM-12 and FM-15 - FM-25) and one permanent well (HB-10). Of those nineteen wells, detections were reported in all, with twelve exceeding the USEPA HAL. The off-site detections exceeding the HAL ranged from 80.4 (FM-24, 80-85 feet) to 2,670 ng/l (FM-18, 30-35 feet) of total PFOS/PFOA.

SCDHS also conducted a private well survey of water quality in the area of Suffolk Avenue / Yaphank Avenue in Yaphank. PFCs have been detected in some of the private wells in that area. Suffolk County has agreed to connect a total of forty-eight properties in the affected area to public water supply at no cost to the property owners. As of September 14, 2017, forty-two properties have been connected to public water.

2.7.2 Records Search Report

A records search of the site was performed and the results are detailed in the Records Search Report included in **Appendix B**. The report delineated five general areas of the site based on historical and current use (**Figure 4**). In addition, several specific areas of potential concern (e.g. Foam Training area) or systems of concern (e.g. USTs, old on-site sanitary systems, etc.) were highlighted.

2.7.2.1 General Site Areas

The five general areas of the Site, based on historical and current uses, include:

- “Undeveloped” - Areas that appear to have been undeveloped since at least 1959, when development first began. This includes two small areas of the Site located in the northeast corner and south central portion of the Site;
- “Office and Classroom Training Use” - Areas primarily used for office, classroom training, and storage. These areas are not currently used for active firefighting training purposes. This includes the eastern portion of the Site;
- “Stormwater Discharge” - The area of the recharge basins located at the southern end of the Site;
- “Active Fire Training” - The area of current and historical active firefighting training. This includes the central portion of the Site; and,
- “Active Fire Training Structures” - The western end of the Site which has been more recently developed for active firefighting training.

2.7.2.2 Specific Areas of Potential Concern

The records search has identified several specific areas and/or systems of concern. These areas of potential concern will be the focus of the remedial Investigation.

- HAZMAT Response Training Area (Foam Training Area) - This area is known to have been used for firefighting foam training. Groundwater directly downgradient of the training area had detected concentrations of PFOS/PFOA greater than the EPA HAL (FM-4).

- Flammable Liquid and Open Pit Burning Area - This area (south of Maple Street, east of Tower Road, north of Pine Street and West of Central Avenue) appears to be the on-site location most heavily utilized for firefighting activity. This area was the first area developed and open pits were used for training purposes. Once open pit burning was stopped, the area was used for flammable liquids training. Groundwater in the central portion of this area had the highest levels of PFOS/PFOA (FM-3) detected on-site.
- Underground Injection Control - Several stormwater, sanitary, or training water recirculation systems are located on-site. Some of the storm water and training water recirculation systems service the Foam Training and Flammable Liquid and Open Burning Pit Areas. Several historical on-site sanitary systems are located on-site, some have been documented to be closed, and no information on the others is available.
- Lined Recirculation Basin/System - This basin was the first recharge basin on-site and operated unlined until 1996. This Basin receives water from the central portion of the site. Groundwater downgradient of the basin had concentrations of PFOS/PFOA (FM-5) above the EPA HAL.
- Unlined Recharge Basin - The unlined recharge basin receives water from the Foam Training Area as well as other locations on the site. This basin may have been impacted by discharges containing PFCs or other compounds used on-site.
- Underground and Aboveground Storage Tanks - There are active and former underground and aboveground storage tanks at the site used for gasoline, diesel, kerosene and fuel oil storage.

3.0 STANDARDS, CRITERIA, AND GUIDANCE (SCGS)

The primary chemicals of potential concern (COPC) to be encountered at the Site are PFCs related to the historical use of firefighting foam. In addition, other COPCs may be present from the historical use and storage of petroleum liquids, use of on-site sanitary and storm water systems, or the presence of upgradient off-site sources of volatile organic compounds (VOCs) in groundwater.

The SCGs to be considered during the RI include:

- NYSDEC, Division of Environmental Restoration, 6 NYCRR Part 375 Environmental Remediation Programs, Subparts 1, 2 and 6, December 2006;
- NYSDEC, Division of Environmental Remediation, DER-10, Technical Guidance for Site Investigation and Remediation, May 2012;
- NYSDEC, Division of Environmental Remediation, CP-51, Soil Cleanup Guidance, October 2010;
- NYSDEC, Class GA Ambient Water Quality Standards (AWQS) as specified in the Technical Operation; Guidance Series (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values, June 1998;
- NYSDOH, Guidance for Evaluating Soil Vapor Intrusion in the State of New York (2006);
- SCDHS, Standard Operating Procedure (SOP) 9-95, Pumpout and Soil Cleanup Criteria, January 2011;
- USEPA, Drinking Water Health Advisory for Perfluoro-octanoic Acid (PFOA), May 2016; and
- USEPA, Drinking Water Health Advisory for Perfluoro-octane Sulfonate (PFOS), May 2016.

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4.0 REMEDIAL INVESTIGATION SCOPE OF WORK

The primary objectives of the work detailed in this plan will be to delineate the extent of on-site soil and groundwater contamination at the site associated with its historical use as a fire training facility. The Scope of Work includes the following tasks:

1. Geophysical investigation – focused on the areas of concern identified in the records search
2. Delineation of on-site soil impacts
3. Characterization of on-site groundwater impacts
4. Collection of site specific hydrogeologic data
5. Characterization of on-site soil vapor impacts
6. Qualitative human health exposure evaluation
7. Fish and Wildlife Resource Impact Analysis (Part 1)
8. QA/QC and Data Validation

4.1 Geophysical Investigation

To determine if subsurface anomalies are present at the site and identify site utilities at proposed drilling locations a geophysical investigation will be performed. The geophysical survey will be targeted to buildings known to historically have on-site sanitary systems, areas of concern identified in the records search, primarily within the area historically used for active firefighting training. The geophysical survey will be completed in the areas identified on **Figure 5**.

4.1.1 Electromagnetic Survey

The electromagnetic (EM) method uses the principle of electromagnetic induction to measure the variability of electrical conductivity of subsurface materials and the presence of buried metal objects. Significant contrasts in the electrical properties between non-indigenous materials and surrounding soil enable accurate delineation of buried waste materials, fill, and air spaces. The large EM response to metal makes this technique particularly well suited to identifying buried metal objects such as underground storage tanks (USTs), metallic wastes, buried drums, pipelines, reinforced building foundations, or other metal components of buried structures.

The EM-31 (or equivalent) is an electromagnetic surveying instrument where the direct readout of the instrument is the bulk electrical conductivity of an equivalent homogeneous earth at that position referred to as "terrain conductivity." Terrain conductivity is commonly used to detect lateral variations in electrical conductivity along a traverse or over a broad region. These variations can be due to disturbed filled-in areas such as buried trenches, or buried metallic objects such as drums, tanks, or utility lines.

A survey of the area will also be performed using a hand-held split-box metal detector (Fisher Model TW-6, or equivalent). The TW-6 is a split-box electromagnetic metal detector that is very sensitive to near surface ferrous metal objects and is very useful in detecting the surface expression of subsurface ferrous objects. This instrument is commonly used to identify buried storage tanks and other metallic objects.

Anomalies detected during the EM surveys will be marked on the ground and further investigated using ground-penetrating radar (GPR).

4.1.2 Ground Penetrating Radar Survey

The GPR survey will be performed in areas of anomalies detected by the EM survey. The GPR method is based upon the transmission of repetitive, radio-frequency electromagnetic (EM) pulses into the subsurface. When the transmitted energy of down-going wave contacts an interface of dissimilar electrical character, part of the energy is returned to the surface in the form of a reflected signal. This reflected signal is detected by a receiving transducer and is displayed on the screen of the GPR unit as well as being recorded on the internal hard-drive.

The received GPR response remains constant as long as the electrical contrast between media is present and constant. Lateral or vertical changes in the electrical properties of the subsurface result in equivalent changes in the GPR responses. The system records a continuous image of the subsurface by plotting two-way travel time of the reflected EM pulse versus distance traveled along the ground surface. Two-way travel time values are then converted to depth using known soil velocity functions. Each radar profile will be examined for characteristic GPR signatures that may indicate the presence of buried targets.

Following the geophysical survey, exploratory test pits or soil borings may be conducted in the vicinity of anomalies in order to determine their origin.

4.2 Characterization of Potential Areas of Concern

The records search report has identified several potential areas of concern as well as general areas of historical site use, both of which will be used to guide soil and groundwater sampling frequency and locations. Sampling will focus on potential areas of concern, in addition, an adequate number (and type) of samples will be collected to perform a sufficient characterization of the entire site. Areas with historical site uses that are unlikely to have contributed to soil or groundwater impacts (office use) will have a lower sampling frequency than those areas that have a use likely (active fire training use) to have resulted in soil or groundwater impacts at the site.

Sampling will be performed in accordance with the Division of Environmental Remediation (DER) Draft DER-10 Technical Guidance for Site Investigation and Remediation, May 2012, and the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

4.3 Soil Sampling

To characterize subsurface conditions, soil borings will be installed throughout the property. Soil boring frequency will be as described below (**Table 1**) and as shown on **Figure 6**.

TABLE 1 – Proposed Soil Sampling Frequency

Site Use	Area (ft^2)	Proposed Sampling Frequency	Number of Borings	Approximate number of samples	Comment
Active Fire Training (Foam Use and Open Pit Fires)	380,000	one soil boring every 20,000 ft^2	20	60	Five soil samples collected from each boring, a minimum of 3 analyzed by laboratory
Active Fire Training Structures	166,000	one soil boring every 30,000 ft^2	6	18	Five soil samples collected from each boring, a minimum of 3 analyzed by laboratory
Office and Classroom Training Use	534,000	one soil boring every 100,000 ft^2	6	18	Five soil samples collected from each boring, a minimum of 3 analyzed by laboratory
Storm/Recirculation water Discharge	55,000	One soil boring every 10,000 ft^2	6	18	Five soil samples collected from each boring, a minimum of 3 analyzed by laboratory
Undeveloped	80,000	None	0	0	Areas have never been developed, impact unlikely

Soil borings will be installed utilizing a Geoprobe® direct-push drill rig outfitted with a macro-core sampler and dedicated acetate liners, or equivalent approved methods. Soils will be collected continuously from ground surface to twenty feet below ground surface (bgs), or the top of the water table, whichever is shallower. Soils will be field screened for the presence of VOCs using a photoionization detector (PID). Soil samples will be classified using the Unified Soil Classification System. Boring logs will be prepared for each boring location.

Soil samples will generally be collected from every five-foot interval from each soil boring. Soil samples will be collected as detailed in **Table 1**. Generally, samples from each boring location will be collected from 0.0 to 0.5 feet (surface), 2 to 4 feet, 5 to 7 feet, 10 to 12 feet, and 15 to 17 feet bgs. These samples will be submitted for laboratory analysis. Initially, the three shallowest soil samples will be analyzed, if PFCs are detected in the deepest sample (e.g. 5 to 7 feet bgs) the next deeper sample will be analyzed. Soil samples will not be collected from below the water table.

Soil samples will be analyzed for PFCs using USEPA Method 537, rev 1.1 (modified). One soil sample from each boring will be analyzed for VOCs by USEPA Method 8260 (Part 375 list), SVOCs by USEPA Method 8270 (Part 375 list), Pesticides/PCBs by USEPA Method 8081/8082 and metals by USEPA Method 6010/7471. The sample selected for analysis will be based on results of PID screening as well as visual and olfactory observations. All soils samples collected for VOCs will be collected using Terracore samplers, or equivalent, to minimize VOC loss during sampling.

Additional soil borings and soil samples, or relocation of proposed soil borings may be performed based on field observations and the results of the geophysical survey.

4.3.1 SPLP Sampling and Analysis

The Synthetic Precipitation Leaching Procedure (SPLP) is a USEPA SW-846 test method that can be used with soil samples to estimate a site-specific adsorption-desorption potential of a contaminant that may impact ground water.

To support development of a site-specific impact to groundwater screening level for PFOS and PFOA in soil, the leachate from select soil samples using the Synthetic Precipitation Leaching Procedure (SPLP) will be analyzed for PFCs. At a minimum, nine soil samples showing elevated levels of PFCs will be subjected to the SPLP procedure.

The samples will be evaluated utilizing the guidance document, *Development of Site-Specific impact to Groundwater Soil Remediation Standards Using the Synthetic Precipitation Leaching Procedure*, Version 3.0, New Jersey Department of Environmental Protection(NJDEP), November 2013, or equivalent NYSDEC approved procedure.

4.4 Temporary Vertical Profile Well Installation

Temporary vertical profile wells will be installed at the site to aid in the delineation of groundwater contamination at the site. A minimum of 17 vertical profile wells will be installed. Locations of proposed temporary vertical profile wells are provided on **Figure 7**. Based on the groundwater sampling performed by the SCDHS (2016) PFCs were not detected on-site below 30-35 feet. Based on this data sampling at each proposed vertical profile location will be conducted at three intervals 18-22 -feet bgs (shallow interval straddling the groundwater table), 28-32 feet bgs and 38-42 feet bgs. Several of the vertical profiles proposed along the eastern property line will have an additional deep sampling interval (48-52 feet bgs). Proposed sampling rationale is provided in **Table 2**.

TABLE 2 – Proposed Vertical Profile Sampling Frequency

Sample Name	Sample Depth BGS	Analytes	Rationale
VP-1	18-22	PFCs, VOCs	Downgradient of STP, Upgradient of the Site
	28-32	PFCs	
	38-42	PFCs	
VP-2	18-22	PFCs, VOCs, perchlorate	Upgradient of Site, Historical perchlorate plume upgradient
	28-32	PFCs, VOCs, perchlorate	
	38-42	PFCs, VOCs, perchlorate	
VP-3	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	Upgradient of Site
	28-32	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	
	38-42	PFCs, VOCs	
VP-4	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs, perchlorate	Recharge Basin, Historical perchlorate plume upgradient
	28-32	PFCs, VOCs, perchlorate	
	38-42	PFCs, VOCs, perchlorate	
VP-5	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	Downgradient of Recharge Basins
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
VP-6	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	GW quality in active fire fighting area, downgradient of OW separator, historical USTs
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
VP-7	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	GW quality in active fire fighting area, downgradient of Tank Car Training Area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
VP-8	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	GW quality in active fire fighting area, downgradient of Flammable Liquids Training Area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
VP-9	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	GW quality in active fire fighting area, downgradient of HAZMAT Training Area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
VP-10	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	GW quality in active fire fighting area, downgradient of HAZMAT Training Area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
VP-11	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	GW quality in active fire fighting area, downgradient of HAZMAT Training Area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
VP-12	18-22	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	GW quality in active fire fighting area, downgradient of HAZMAT Training Area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
VP-13	18-22	PFCs, VOCs	GW quality downgradient of recharge basins
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
	48-52	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	
VP-14	18-22	PFCs, VOCs	GW quality downgradient of active firefighting area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
	48-52	PFCs, VOCs	
VP-15	18-22	PFCs, VOCs	GW quality downgradient of active firefighting area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
	48-52	PFCs, VOCs	
VP-16	18-22	PFCs, VOCs	GW quality downgradient of active firefighting area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
	48-52	PFCs, VOCs, SVOCs, Metals, Pest/PCBs	
VP-17	18-22	PFCs, VOCs	GW quality downgradient of active firefighting area
	28-32	PFCs, VOCs	
	38-42	PFCs, VOCs	
	48-52	PFCs, VOCs	

Temporary vertical profile wells will be installed using a direct-push drill rig (Geoprobe®, or equivalent) fitted with a stainless steel, sealed screen sampler (Geoprobe® Screen Point Sampler, or equivalent). At each vertical profile location, the sampling screen will initially be installed to a terminal depth of the deepest sample to be collected (e.g. 38-42 feet bgs).

At the terminal depth for each vertical profile, the screen point sampler will be opened so that the four-foot screen is exposed, and a groundwater sample will be collected. Following sample collection, the screen will be pulled up to the next interval and a sample will be collected. This process will continue until the groundwater table is reached.

At each groundwater sampling interval, disposable polyethylene tubing with a stainless-steel check valve will be inserted through the probe rods into the water bearing zone. The tubing will then be connected to a peristaltic pump (low flow rate of a maximum of 200 ml/min) to purge the well prior to sampling. After purging each well volume field measurements will be collected using portable field instruments. Turbidity, pH, temperature, and conductivity measurements will be collected. Groundwater samples will be collected after readings stabilize. Stabilization is considered achieved when consecutive readings within five percent of each other are collected between purge volumes. If turbidity cannot be reduced to 50 Nephelometric Turbidity Units (NTUs), but other parameters stabilize, samples will be collected. All sampling data will be recorded in a vertical profile sampling log.

Groundwater samples will be analyzed for PFCs by USEPA Method 537, rev 1.1 (Modified). Select samples will be analyzed for VOCs by USEPA Method 8260 (Part 375 list), SVOCs by USEPA Method 8270 (Part 375 list), Pesticides/PCBs by USEPA Method 8081/8082 and metals by USEPA Method 6010/7471 (both filtered and unfiltered) in accordance with **Table 2**.

4.4.1 Total Oxidizable Precursor (TOP) Sampling and Analysis

Precursors are compounds which have the potential to form perfluoroalkyl acids (PFAAs) after biotransformation. The TOP assay rapidly converts PFAA precursors into PFAAs. These substances are of importance to aid in quantifying the potential present and future concentrations of PFAAs to support remedial actions as well as current and future human health risks.

TOP analysis will be performed on selected groundwater and soil samples. At a minimum, four groundwater samples exhibiting elevated levels of PFCs and two soil samples will be subjected to the analysis.

4.5 Monitoring Well Installation

To characterize groundwater quality beneath the site, provide hydrogeologic data, and to provide locations for continued groundwater monitoring, permanent groundwater monitoring wells will be installed. A minimum of 11 shallow monitoring wells (water table wells) and four intermediate wells (well cluster) will be installed. Proposed monitoring well locations are identified on **Figure 8**. Prior to installation, these proposed locations will be re-evaluated (and moved if necessary) based on the analytical results of samples collected from the temporary vertical profile wells and soil borings. The NYSDEC will be notified prior to making modifications to the proposed monitoring well locations.

A rotary drill rig and/or Geoprobe® (or equivalent) direct push drill rig outfitted for rotary drilling will be used to install the wells with hollow-stem augers using standard drilling methods. The wells will be constructed of two-inch diameter, schedule 40 PVC casing and screen with 0.010-inch slot.

4.5.1 Shallow Well Installation

Shallow wells will be constructed with a 10-foot screen section and riser to grade unless precluded by hydrogeologic conditions. The well annulus will be filled with #2 morie sand, or equivalent, to two feet above the well screen. The shallow wells will have the screen set with seven (7) feet into and three (3) feet above the water table at the time of installation. A two-foot fine sand layer will be installed above the screen followed by a two-foot bentonite seal. Above the bentonite layer, the annulus around the well will be filled with a cement/bentonite grout. A concrete surface pad (2 feet by 2 feet by 6-inch) will be installed. The wells will be finished with lockable test plugs and properly color coded flush mount curb boxes (white circle with black triangle). Monitoring well construction diagrams will be developed for each of the monitoring wells.

4.5.2 Intermediate Well Installation

Intermediate wells (total of 4) will be clustered with shallow wells shown on **Figure 8**. The intermediate wells will be constructed with a five-foot screen section and riser to grade unless precluded by hydrogeologic conditions. The well annulus will be filled with #2 morie sand, or equivalent, to two feet above the well screen. The wells will have the screen set between 35-40 feet bgs, or appropriate depth as determined by the vertical profile well sample results. A two-foot fine sand layer will be installed above the screen followed by a two-foot bentonite seal. Above the bentonite layer, the annulus around the well will be filled with a cement/bentonite grout. A concrete surface pad (2 feet by 2 feet by 6-inch) will be installed. The wells will be finished with lockable test plugs and properly color coded flush mount curb boxes (white circle with black triangle). Monitoring well construction diagrams will be developed for each of the monitoring wells.

4.5.3 Monitoring Well Development and Sampling

No less than 48-hours after installation, newly installed monitoring wells will be developed by over-pumping to restore the hydraulic properties of the aquifer. Well development will continue until the turbidity of the groundwater is less than or equal to 50 NTUs, or when pH, temperature, and conductivity measurements stabilize. Stabilization is considered achieved when three consecutive readings of these field parameters are within five percent of each other over a period of 15 minutes. Monitoring well development water will be containerized for off-site disposal.

4.5.4 Monitoring Well Sampling

Groundwater samples will be collected in compliance with the USEPA Low-flow Groundwater Purging and Sampling Procedure (USEPA, 1998). Groundwater samples will be analyzed for PFCs by USEPA Method 537, rev 1.1 (Modified), VOCs by USEPA Method 8260 (Part 375 list), SVOCs by USEPA Method 8270 (Part 375 list), Pesticides/PCBs by USEPA Method 8081/8082 and metals by USEPA Method 6010/7471 (both filtered and unfiltered).

4.5.5 Lined Recharge Basin and Supply Well Sampling

A groundwater sample will also be collected from the on-site water recirculation system supply well. The sample will be analyzed for PFCs by USEPA Method 537, rev 1.1 (Modified) and VOCs by USEPA Method 8260 (Part 375 list).

A surface water sample will be collected from the Lined Recharge Basin. The sample will be collected using a PVC bailer, or equivalent. The sample will be collected from the center of the basin by lowering the bailer to approximately 6-inches above the bottom of the basin and transferring the sample into laboratory supplied containers. The sample will be analyzed for PFCs by USEPA Method 537, rev 1.1 (Modified), VOCs by USEPA Method 8260 (Part 375 list), SVOCs by USEPA Method 8270 (Part 375 list), Pesticides/PCBs by USEPA Method 8081/8082 and metals by USEPA Method 6010/7471 (both filtered and unfiltered).

4.5.6 Monitoring Well Survey

Monitoring wells (top of casings and top of manways) will be surveyed to a relative datum for the purposes of determining site-specific groundwater flow direction. This information will be utilized on groundwater contour maps generated for the Remedial Investigation Report.

4.6 Underground Injection Control and Storm Water/Training water Catch Basin Sampling

There are several potential former sanitary cesspools located on-site (identified as UIC structures on **Figure 9**). The location of these structures will be confirmed in the field by visual inspection and/or geophysical survey. If structures are identified they will be sampled.

An active Storm Water/Training Water Discharge System is located at the site. This system may have been impacted by historical site use, including by firefighting foam containing PFCs. Eight catch basins will be sampled; locations of the catch basins proposed for sampling are included on **Figure 9**.

Sediment in the structures will be sampled using stainless steel hand augers. Samples will be analyzed for PFCs using USEPA Method 537, rev 1.1 (modified), VOCs by USEPA Method 8260, SVOCs by USEPA Method 8270, Pesticides/PCBs by USEPA Method 8081/8082 and metals by USEPA Method 6010/7471. All samples collected for VOCs will be collected using Terracore samplers, or equivalent, to minimize VOC loss during sampling.

4.7 Soil Vapor Sampling

A limited soil vapor sampling investigation will be performed at the site to assess the potential for VOCs in soil vapor. Soil vapor sample locations are presented on **Figure 10**.

4.7.1 Soil Vapor

Four temporary soil vapor sampling points will be installed approximately two feet above the water table. The soil vapor points will be installed with direct-push technology and will include a six-inch stainless steel screen at the base of the sampling point and polyethylene tubing to grade. The annulus around the vapor implant will be filled with inert material (clean sand or equivalent) and sealed with bentonite grout.

Soil vapor samples will be collected at minimum of 24 hours after installation. A tracer gas (100% helium, ±2%) will be utilized to test if a competent seal exists around the soil vapor point in accordance with NYSDOH soil vapor intrusion guidance. Once the integrity of the seal is confirmed at each location, three volumes of air will be extracted from each point prior to sample collection with a flow rate of less than 0.2 liters/minute. Sample duration will be a minimum of 2 hours. A sample log sheet will be maintained.

Samples will be collected in appropriately sized Summa canisters that have been batch certified clean by the laboratory, and analyzed using USEPA Method TO-15.

4.8 Qualitative Exposure Assessments

A qualitative Human Health Exposure Assessment, and Fish and Wildlife Resources Impact Analysis (FWRIA) will be performed.

4.8.1 Human Health Exposure Assessment

A qualitative human health exposure assessment will be completed for the site, characterizing the exposure setting, identifying exposure pathways, and evaluating contaminant fate and transport. The qualitative human health exposure assessment will follow DER-10, Appendix 3B and Section 3.3 (b) 8.

4.8.2 Fish and Wildlife Resources Impact Analysis

The purpose of the FWRIA is to identify actual or potential impacts to fish and wildlife resources from site contaminants of ecological concern. The FWRIA provides steps that include decision points for determining when the process is complete and further assessment is unnecessary. The FWRIA will be completed following DER-10 Section 3.10.1.

It is anticipated that the FWRIA evaluation will include appropriate maps detailing topography, drainage and cover types, including major vegetative communities, wetlands, NYSDEC Significant Habitats, and areas of special concern. A description of fish and wildlife resources at the site will be documented by site reconnaissance and available literature, and qualitative descriptions of fish and wildlife resources will be provided. A pathway analysis will be performed; if no resources and/or potential pathways are identified then the analysis will be considered complete. However, if potential pathways are present recommendations will be made for a more detailed Ecological Impact Assessment.

5.0 QUALITY ASSURANCE PROJECT PLAN

A quality assurance project plan (QAPP) presents the objectives, functional activities, methods, and quality assurance / quality control (QA/QC) requirements associated with sample collection and laboratory analysis for characterization activities. The QAPP follows requirements detailed in DER-10, Section 2 and the Uniform Federal Policy for Quality Assurance Project Plans (EPA-505-B-04-900A, B&C, March 2005). The QAPP is provided in **Appendix C**.

All analytical data will be analyzed by a NYSDOH ELAP certified laboratory. Data will be generated using NYSDEC Analytical Services Protocol Category B data deliverables. Electronic Data Deliverables (EDD) will be submitted at the completion of the investigation.

5.1 Sample Identification

Each sample will be identified with a set of information relating individual sample characteristics. Required information consists of Sample Designation, Depth, Date, Time, and Matrix. Examples of sample IDs are shown below.

- SB001(0-2) (soil sample, boring 001 from 0 to 2 feet)
- VP001(17-22) (groundwater sample, Vertical Profile 001 from 17 to 22 feet)
- MW004 (groundwater sample, permanent monitoring well 004)
- SV001 (soil vapor point 001)

Sample frequency, locations, depths, and nomenclature may change subject to field decisions and professional judgment.

5.2 Special Sampling Considerations for PFCs

There are several potential sources of PFCs that could contribute to the cross-contamination of environmental samples collected during the RI. Weatherproof clothing, pens, logbooks, cosmetics, personal hygiene products, insect repellents, and sampling equipment could contain PFCs that could lead to false positive sampling results.

To ensure that the analytical results obtained during the RI are representative of the actual site conditions several measures should be taken:

- Collection of appropriate field QA/QC samples (blanks, duplicates, equipment rinseate samples, etc.) as detailed in the QAPP;

- Collection of samples using the sample guidelines contained in **Appendix D**; and
- Analysis by the analytical laboratory using established laboratory QA/QC procedures and methods as detailed in the QAPP.

5.3 Equipment Decontamination

To minimize the potential for cross-contamination, non-dedicated drilling and sampling equipment shall be properly decontaminated prior to and between sampling/drilling locations.

5.3.1 General Procedures

Drilling equipment will be decontaminated in a designated area. Sampling equipment and probes will be decontaminated in an area covered with plastic sheeting near the sampling location. Waste material generated during decontamination activities will be containerized, stored and disposed of in accordance with the procedures detailed in **Section 5.4**. Decontamination of sampling equipment shall be kept to a minimum, and wherever possible, dedicated sampling equipment shall be used. Personnel directly involved in equipment decontamination shall wear appropriate personal protective equipment (PPE).

5.3.2 Drilling Equipment

Drilling equipment shall be decontaminated prior to performance of the first boring/excavation and between all subsequent borings/excavations. This shall include hand tools, casing, augers, drill rods, temporary well material and other related tools and equipment. Water used during drilling and/or steam cleaning operations shall be from a potable source.

5.3.3 Sampling Equipment

Sampling equipment (e.g.., trowels, knives, split-spoons, bowls, hand augers, etc.) will be decontaminated prior to each use as follows:

- Laboratory-grade glassware detergent and tap water scrub to remove visual contamination
- Generous tap water rinse
- Distilled water rinse

5.3.4 Meters and Probes

All meters and probes that are used in the field (other than those used solely for air monitoring purposes, e.g., PID) will be decontaminated between uses as follows:

- Laboratory-grade detergent and tap water solution wash
- Tap water rinse
- Distilled water rinse (triple rinse)

5.4 Management of Investigation Derived Waste

Waste materials generated from field operations may consist of soil cuttings, purge water, and miscellaneous solid materials such as personal protective equipment (PPE) and supplies. Investigative derived waste (IDW) generated during field operations will be disposed of in accordance with applicable regulations.

Soil cuttings generated from soil boring and well installation activities will be stored in 55-gallon drums. Drums will be labeled to indicate the source of the soil and will be stored in a designated area onsite. Soil cores and soil cuttings will be field screened using a PID, while performing drilling operations. Drummed soils will be disposed of at an off-site disposal facility or reused onsite at the point of generation, if appropriate. Following receipt of the analytical results, recommendations for disposition of the drummed soil will be provided to the NYSDEC.

Development and purge water generated during the field activities will be stored in a portable holding tank and/or 55-gallon drums. Drums will be labeled to indicate the source of the fluid and will be stored in a designated area onsite. Drummed groundwater will be sampled to determine if discharge to the surface of the site is appropriate or off-site disposal is required. Following receipt of the groundwater sampling results, recommendations for disposition of the water will be provided to NYSDEC.

5.5 Field Documentation

Documentation will take place on either appropriate forms or in a dedicated site logbook (non-weatherproof). Permanent black or blue ink (no use of Sharpie® permanent markers) will be used to record information in the logbook. Errors in field documentation will be lined through, initialed, dated, and corrected. Forms will be kept by the PWGC Field Team Leader during the field activities. Field activities will be documented in the field logbook. The logbook will contain pages that are consecutively numbered, and will be permanently bound with a cover. Upon completion of daily activities, unused portions of pages will be lined-through and initialed.

The primary purpose of the field logbook is to document the daily field activities and to provide descriptions of each activity. All entries in the field logbook will be recorded and dated by person making the entry.

6.0 REMEDIAL INVESTIGATION REPORT PREPARATION

The Remedial Investigation Report (RIR) will incorporate the methods and findings of the investigation activities performed as outlined in this work plan. The report will identify specific contamination concentrations throughout each media (e.g., soil, groundwater, etc.), delineate the extent of contamination in soil and groundwater on-site, evaluate potential exposure pathways, and provide conclusions and recommendations for additional investigation. Electronic copies of the Investigation Report will be submitted to the NYSDEC along with hard copies. Analytical results of the investigation will be reported with Category B data deliverables and submitted in the electronic data delivery (EDD) format through the Department's environmental information management system (EIMS).

7.0 HEALTH AND SAFETY

Field operations will be performed in accordance with the health and safety requirements provided in the site-specific Health and Safety Plan (HASP). The HASP is included as **Appendix E**. The HASP outlines the requirements for training, medical surveillance, daily tailgate meetings, emergency response, and accident and injury reporting.

The PWGC Field Team Leader will be responsible for implementing the HASP, completing the daily tailgate safety meetings and performing necessary Industrial Hygiene (IH) monitoring as specified in the HASP.

When considering the health and safety of site personnel use of prohibited items (i.e. Tyvek suits) associated with PFC sampling can be used if an equivalent alternate is not available.

8.0 COMMUNITY AIR MONITORING PLAN

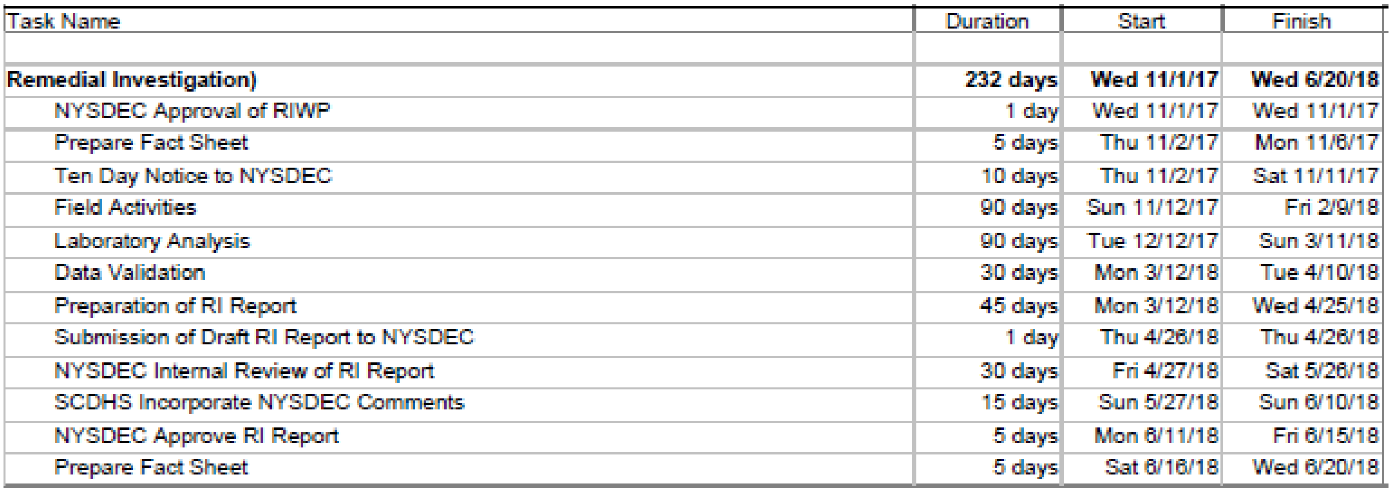
A site-specific Community Air Monitoring Plan (CAMP) has been prepared to provide measures for protection for on-site workers and the downwind community from potential airborne contaminants as a direct result of the Remedial Investigation. The CAMP is included as **Appendix F**.

The Community Air Monitoring Plan will be implemented and executed in accordance with 29 CFR 1910.120(h), the New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan, and the New York State Department of Environmental Conservation (NYSDEC) TAGM #4031.

9.0 PROJECT SCHEDULE

The preliminary schedule for the major project milestones is presented in **Table 3**. The field work is anticipated to be begin in November 2017, following approval of this RIWP by NYSDEC. A draft RI Report should be submitted to the NYSDEC by April 2018.

Table 3 - Preliminary Project Schedule



Task Name	Duration	Start	Finish
Remedial Investigation)	**232 days**	**Wed 11/1/17**	**Wed 6/20/18**
NYSDEC Approval of RIWP	1 day	Wed 11/1/17	Wed 11/1/17
Prepare Fact Sheet	5 days	Thu 11/2/17	Mon 11/6/17
Ten Day Notice to NYSDEC	10 days	Thu 11/2/17	Sat 11/11/17
Field Activities	90 days	Sun 11/12/17	Fri 2/9/18
Laboratory Analysis	90 days	Tue 12/12/17	Sun 3/11/18
Data Validation	30 days	Mon 3/12/18	Tue 4/10/18
Preparation of RI Report	45 days	Mon 3/12/18	Wed 4/25/18
Submission of Draft RI Report to NYSDEC	1 day	Thu 4/26/18	Thu 4/26/18
NYSDEC Internal Review of RI Report	30 days	Fri 4/27/18	Sat 5/26/18
SCDHS Incorporate NYSDEC Comments	15 days	Sun 5/27/18	Sun 6/10/18
NYSDEC Approve RI Report	5 days	Mon 6/11/18	Fri 6/15/18
Prepare Fact Sheet	5 days	Sat 6/16/18	Wed 6/20/18

10.0 REFERENCES

NJDEP, Development of Site-Specific impact to Groundwater Soil Remediation Standards Using the Synthetic Precipitation Leaching Procedure, Version 3.0, November 2013.

NYSDEC, Division of Environmental Restoration, 6 NYCRR Part 375, Environmental Remediation Programs, December 14, 2006.

NYSDEC, Division of Environmental Remediation, DER-10, Technical Guidance for Site Investigation and Remediation, May 2012.

NYSDEC, Division of Environmental Remediation, CP-51, Soil Cleanup Guidance, October 2010.

NYSDEC, Division of Water, Technical and Operational Guidance Series 1:1:1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, June 1998, Addendum April 2000.

NYSDOH, Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006.

USEPA, Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP), Parts 1, 2, and 3 (EPA-505-B-04-900A, B&C, March 2005.

SCDHS, Standard Operating Procedure (SOP) 9-95, Pumpout and Soil Cleanup Criteria, January 2011.

USEPA, Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA), May 2016.

USEPA, Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS), May 2016.

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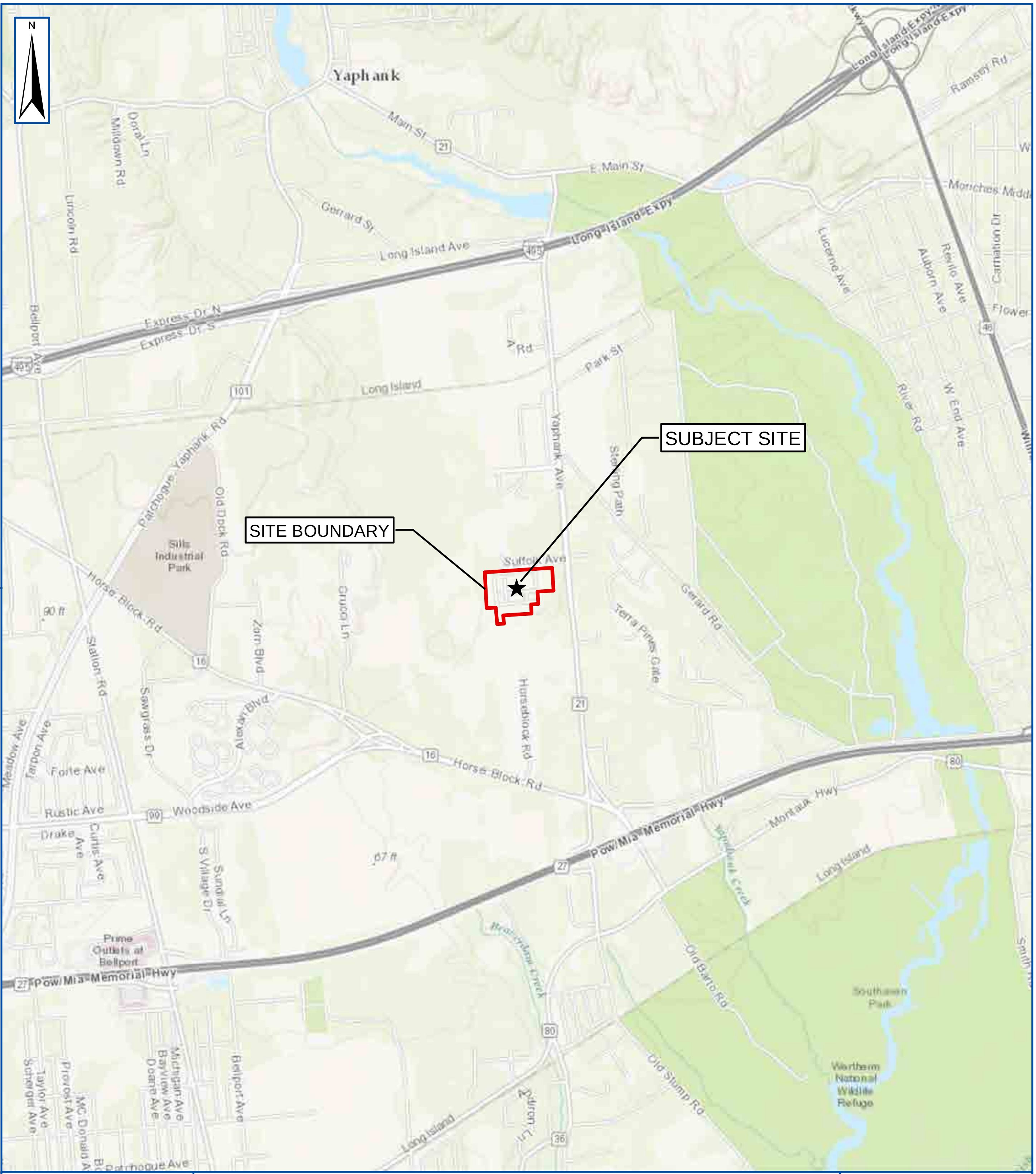
FIGURES



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Strategic Environmental and Engineering Solutions

P.W. GROSSER CONSULTING ENGINEER AND HYDROGEOLOGIST, P.C.

630 Johnson Avenue. • Suite 7
Bohemia • NY • 11716-2618
Phone: (631) 589-6353 • Fax: (631) 589-8705
E-mail: INFO@PWGROSSER.COM

SITE LOCATION

676 MAPLE AVE
YAPHANK, NY

0 ½ 1 1½ 2 Miles

Project:	SHD1702
Date:	9/6/2017
Designed by:	JCG
Drawn by:	JCG
Approved by:	AL
Figure No:	1

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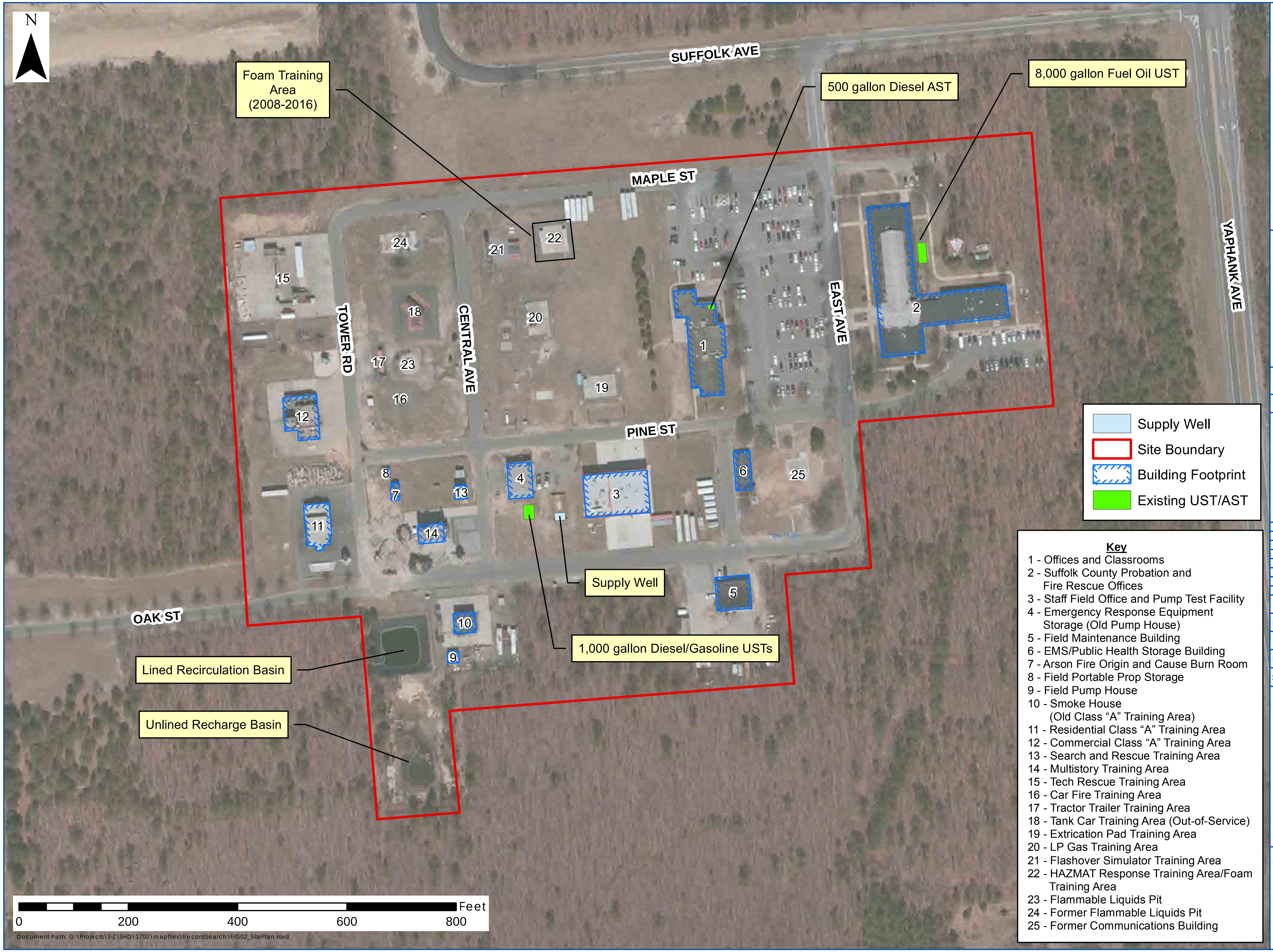

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🟦	Supply Well
🟥	Site Boundary
▨	Building Footprint
🟩	Existing UST/AST

Key

1 - Offices and Classrooms
2 - Suffolk County Probation and Fire Rescue Offices
3 - Staff Field Office and Pump Test Facility
4 - Emergency Response Equipment Storage (Old Pump House)
5 - Field Maintenance Building
6 - EMS/Public Health Storage Building
7 - Arson Fire Origin and Cause Burn Room
8 - Field Portable Prop Storage
9 - Field Pump House
10 - Smoke House (Old Class "A" Training Area)
11 - Residential Class "A" Training Area
12 - Commercial Class "A" Training Area
13 - Search and Rescue Training Area
14 - Multistory Training Area
15 - Tech Rescue Training Area
16 - Car Fire Training Area
17 - Tractor Trailer Training Area
18 - Tank Car Training Area (Out-of-Service)
19 - Extrication Pad Training Area
20 - LP Gas Training Area
21 - Flashover Simulator Training Area
22 - HAZMAT Response Training Area/Foam Training Area
23 - Flammable Liquids Pit
24 - Former Flammable Liquids Pit
25 - Former Communications Building

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P.W. GROSSER CONSULTING ENGINEER AND HYDROGEOLOGIST, P.C.
630 Johnson Avenue. • Suite 7
Bohemia • NY • 11716-2618
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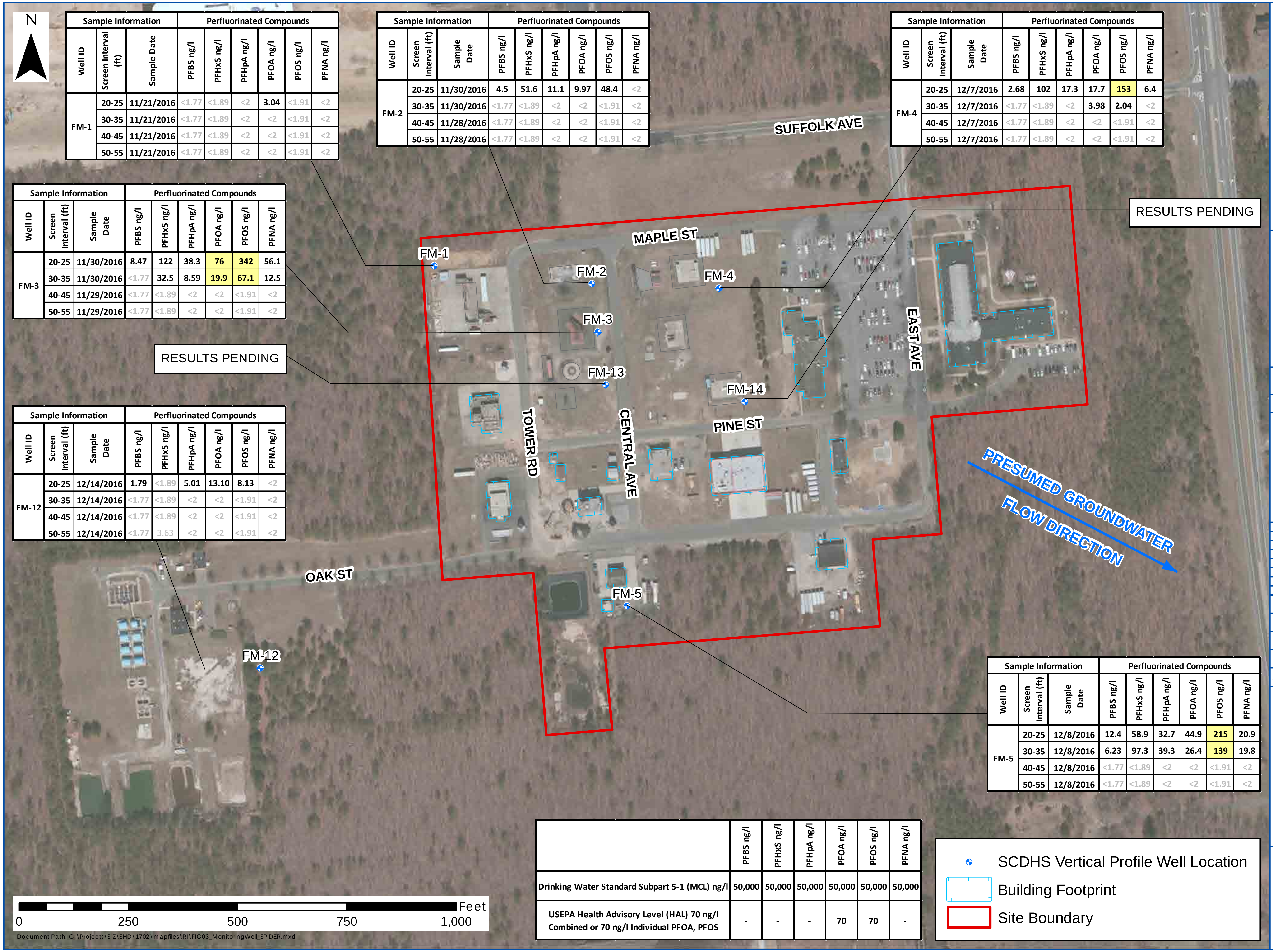
SITE PLAN

SUFFOLK COUNTY
FIREMATICS
676 MAPLE ST
YAPHANK, NY

FIGURE NO:

2



Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-1	20-25	11/21/2016	<1.77	<1.89	<2	3.04	<1.91	<2
	30-35	11/21/2016	<1.77	<1.89	<2	<2	<1.91	<2
	40-45	11/21/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	11/21/2016	<1.77	<1.89	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-2	20-25	11/30/2016	4.5	51.6	11.1	9.97	48.4	<2
	30-35	11/30/2016	<1.77	<1.89	<2	<2	<1.91	<2
	40-45	11/28/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	11/28/2016	<1.77	<1.89	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-4	20-25	12/7/2016	2.68	102	17.3	17.7	153	6.4
	30-35	12/7/2016	<1.77	<1.89	<2	3.98	2.04	<2
	40-45	12/7/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	12/7/2016	<1.77	<1.89	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-3	20-25	11/30/2016	8.47	122	38.3	76	342	56.1
	30-35	11/30/2016	<1.77	32.5	8.59	19.9	67.1	12.5
	40-45	11/29/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	11/29/2016	<1.77	<1.89	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-12	20-25	12/14/2016	1.79	<1.89	5.01	13.10	8.13	<2
	30-35	12/14/2016	<1.77	<1.89	<2	<2	<1.91	<2
	40-45	12/14/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	12/14/2016	<1.77	3.63	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-5	20-25	12/8/2016	12.4	58.9	32.7	44.9	215	20.9
	30-35	12/8/2016	6.23	97.3	39.3	26.4	139	19.8
	40-45	12/8/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	12/8/2016	<1.77	<1.89	<2	<2	<1.91	<2

	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
Drinking Water Standard Subpart 5-1 (MCL) ng/l	50,000	50,000	50,000	50,000	50,000	50,000
USEPA Health Advisory Level (HAL) 70 ng/l Combined or 70 ng/l Individual PFOA, PFOS	-	-	-	70	70	-

⌖	SCDHS Vertical Profile Well Location
▢	Building Footprint
🟥	Site Boundary

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Strategic Environmental and Engineering Solutions
P.W. GROSSER CONSULTING ENGINEER
AND HYDROGEOLOGIST, P.C.
630 Johnson Avenue. • Suite 7
Bohemia • NY • 11716-2618
Phone: (631) 589-6353 • Fax: (631) 589-8705
E-mail: INFO@PWGROSSER.COM

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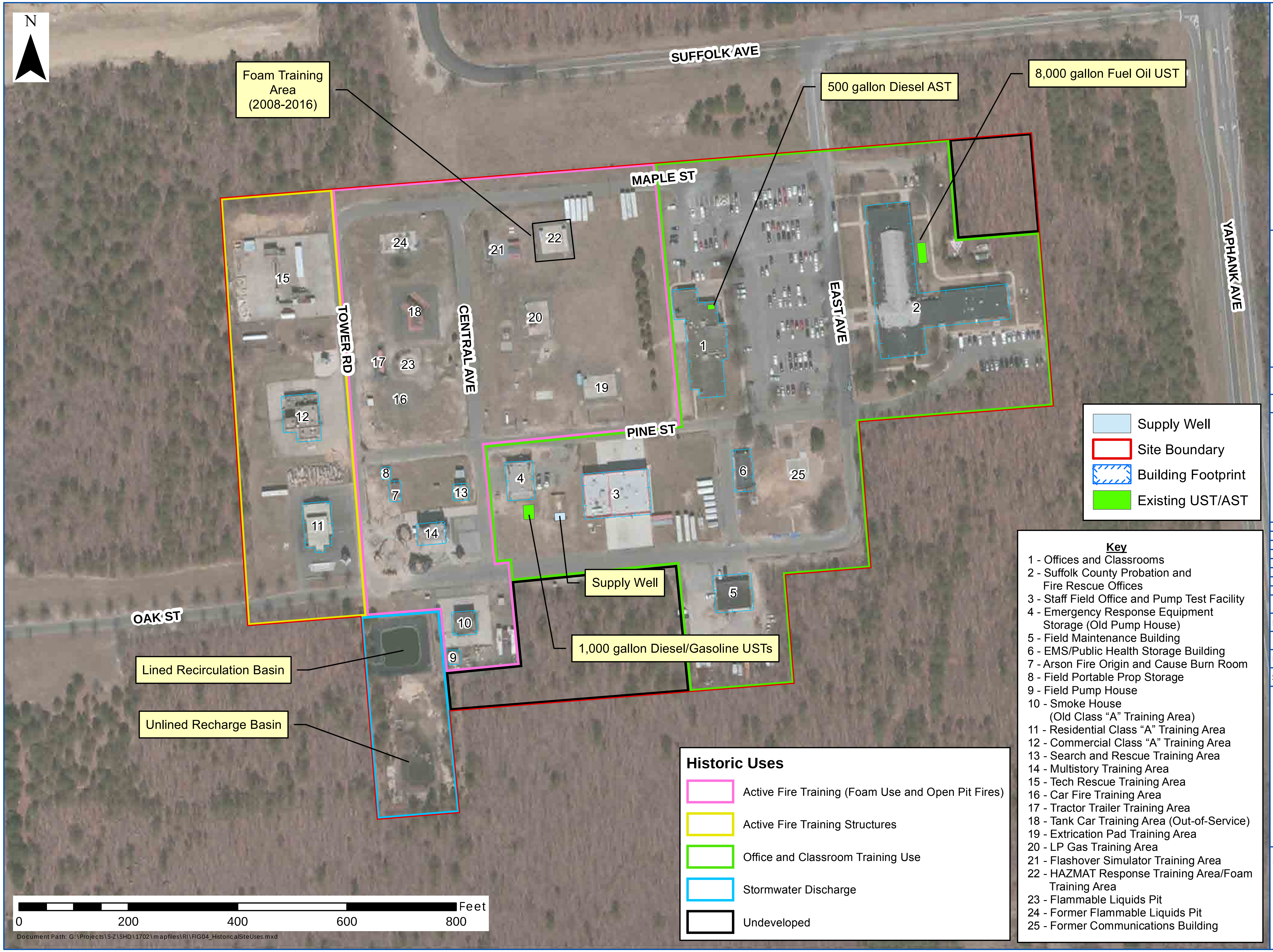
GROUNDWATER SAMPLING RESULTS 2016

SUFFOLK COUNTY
FIREMATICS
676 MAPLE AVE
YAPHANK, NY

FIGURE NO:

3



Key

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18 - Tank Car Training Area (Out-of-Service)
19 - Extrication Pad Training Area
20 - LP Gas Training Area
21 - Flashover Simulator Training Area
22 - HAZMAT Response Training Area/Foam Training Area
23 - Flammable Liquids Pit
24 - Former Flammable Liquids Pit
25 - Former Communications Building

Historic Uses

- Active Fire Training (Foam Use and Open Pit Fires)
- Active Fire Training Structures
- Office and Classroom Training Use
- Stormwater Discharge
- Undeveloped

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Strategic Environmental and Engineering Solutions

P.W. GROSSER CONSULTING ENGINEER AND HYDROGEOLOGIST, P.C.
630 Johnson Avenue. • Suite 7
Bohemia • NY • 11716-2618
Phone: (631) 589-6353 • Fax: (631) 589-8705
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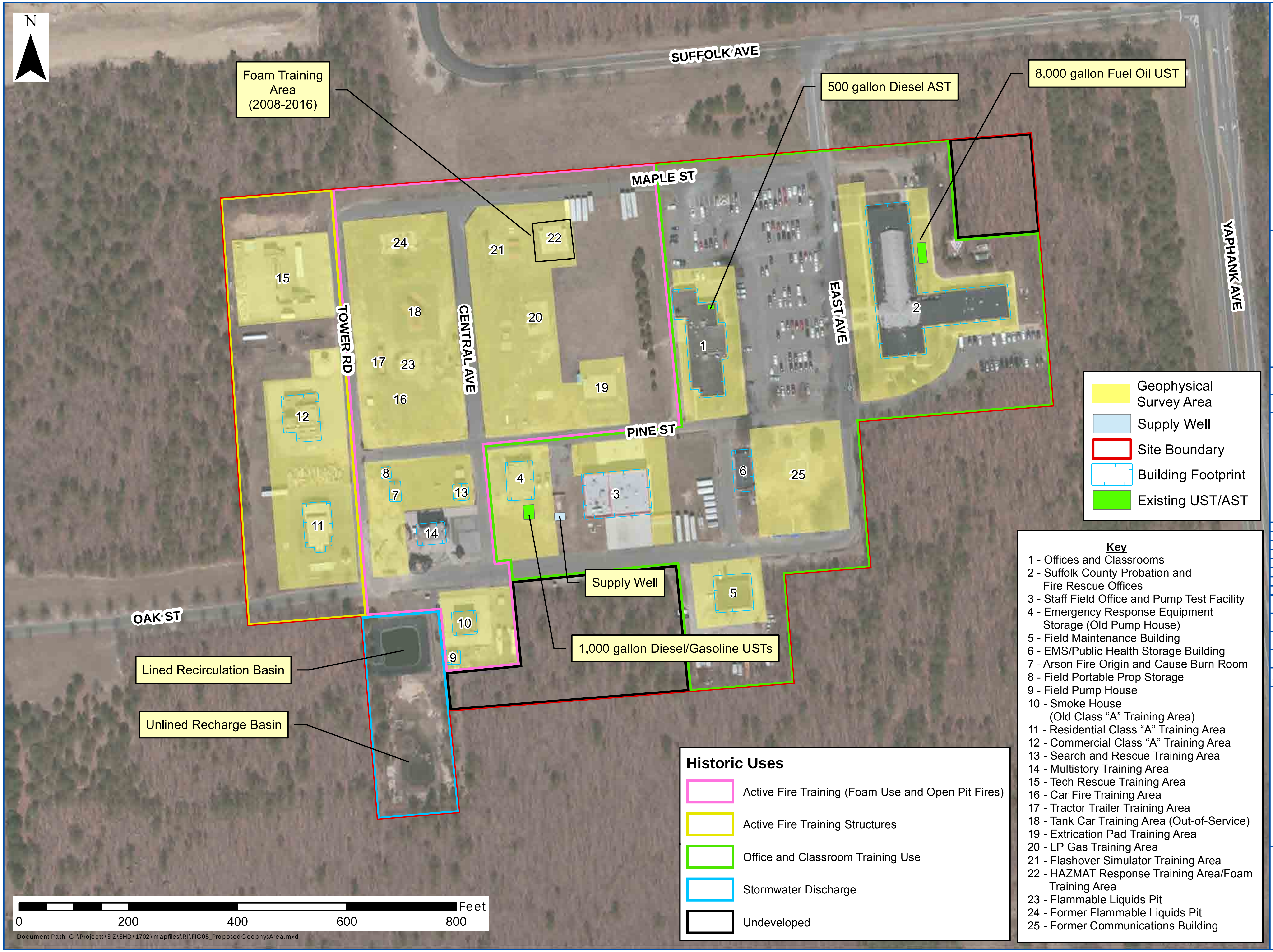
GENERALIZED CURRENT/HISTORICAL SITE USES

SUFFOLK COUNTY
FIREMATICS
676 MAPLE ST
YAPHANK, NY

FIGURE NO:
4



🟨	Geophysical Survey Area
▭	Supply Well
🟥	Site Boundary
▭	Building Footprint
🟩	Existing UST/AST

Key

1 - Offices and Classrooms
2 - Suffolk County Probation and Fire Rescue Offices
3 - Staff Field Office and Pump Test Facility
4 - Emergency Response Equipment Storage (Old Pump House)
5 - Field Maintenance Building
6 - EMS/Public Health Storage Building
7 - Arson Fire Origin and Cause Burn Room
8 - Field Portable Prop Storage
9 - Field Pump House
10 - Smoke House (Old Class "A" Training Area)
11 - Residential Class "A" Training Area
12 - Commercial Class "A" Training Area
13 - Search and Rescue Training Area
14 - Multistory Training Area
15 - Tech Rescue Training Area
16 - Car Fire Training Area
17 - Tractor Trailer Training Area
18 - Tank Car Training Area (Out-of-Service)
19 - Extrication Pad Training Area
20 - LP Gas Training Area
21 - Flashover Simulator Training Area
22 - HAZMAT Response Training Area/Foam Training Area
23 - Flammable Liquids Pit
24 - Former Flammable Liquids Pit
25 - Former Communications Building

Historic Uses

▭	Active Fire Training (Foam Use and Open Pit Fires)
▭	Active Fire Training Structures
▭	Office and Classroom Training Use
▭	Stormwater Discharge
▭	Undeveloped

Document Path: G:\Projects\S-Z\SHD\1702\mapfiles\RI\FIG05_ProposedGeophysArea.mxd

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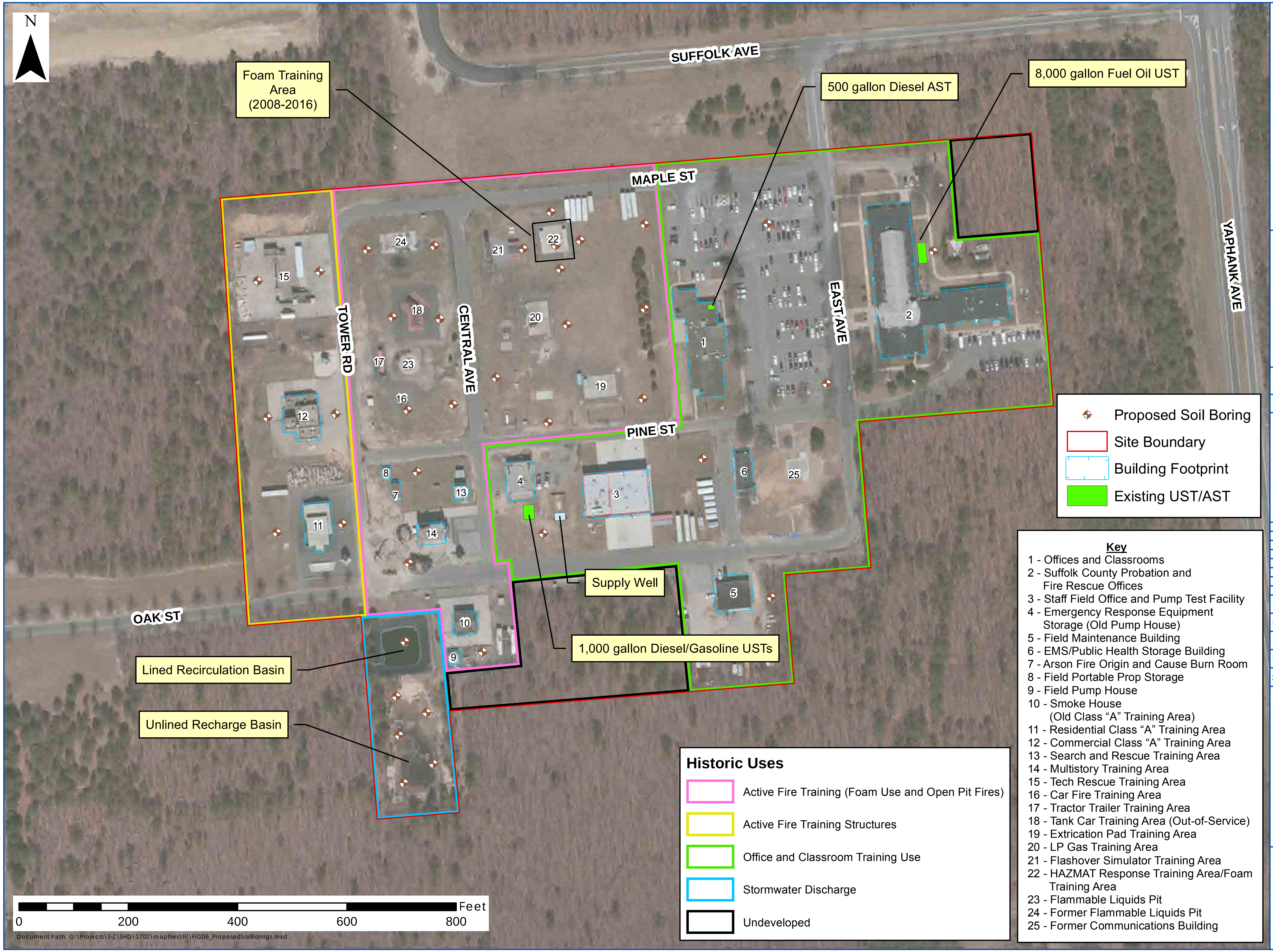
Scale:	AS SHOWN	Approved by:	AL

PROPOSED GEOPHYSICAL SURVEY AREA

SUFFOLK COUNTY
FIREMATICS
676 MAPLE ST
YAPHANK, NY

FIGURE NO:
5



- ⌖ Proposed Soil Boring
- 🟥 Site Boundary
- ☐ Building Footprint
- 🟩 Existing UST/AST

Key

1 - Offices and Classrooms
2 - Suffolk County Probation and Fire Rescue Offices
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23 - Flammable Liquids Pit
24 - Former Flammable Liquids Pit
25 - Former Communications Building

Historic Uses

- ☐ Active Fire Training (Foam Use and Open Pit Fires)
- ☐ Active Fire Training Structures
- ☐ Office and Classroom Training Use
- ☐ Stormwater Discharge
- ☐ Undeveloped

Document Path: G:\Projects\S-Z\SHD\1702\mapfiles\RI\FIG06_ProposedSoilBorings.mxd

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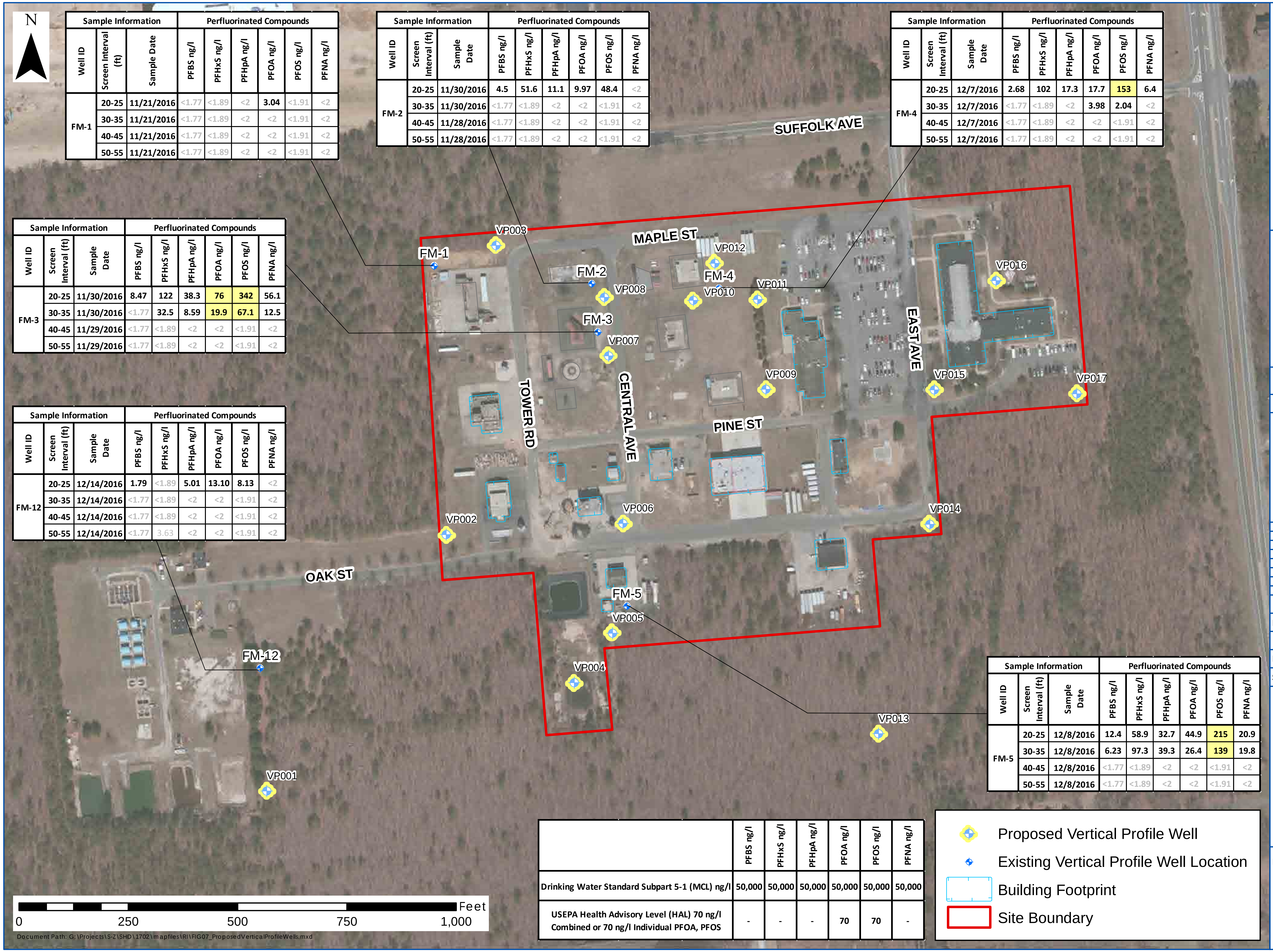
PROPOSED SOIL BORING LOCATIONS

SUFFOLK COUNTY
FIREMATICS
676 MAPLE ST
YAPHANK, NY

FIGURE NO:
6



Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-1	20-25	11/21/2016	<1.77	<1.89	<2	3.04	<1.91	<2
	30-35	11/21/2016	<1.77	<1.89	<2	<2	<1.91	<2
	40-45	11/21/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	11/21/2016	<1.77	<1.89	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
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	30-35	11/30/2016	<1.77	<1.89	<2	<2	<1.91	<2
	40-45	11/28/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	11/28/2016	<1.77	<1.89	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-4	20-25	12/7/2016	2.68	102	17.3	17.7	153	6.4
	30-35	12/7/2016	<1.77	<1.89	<2	3.98	2.04	<2
	40-45	12/7/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	12/7/2016	<1.77	<1.89	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-3	20-25	11/30/2016	8.47	122	38.3	76	342	56.1
	30-35	11/30/2016	<1.77	32.5	8.59	19.9	67.1	12.5
	40-45	11/29/2016	<1.77	<1.89	<2	<2	<1.91	<2
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Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-12	20-25	12/14/2016	1.79	<1.89	5.01	13.10	8.13	<2
	30-35	12/14/2016	<1.77	<1.89	<2	<2	<1.91	<2
	40-45	12/14/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	12/14/2016	<1.77	3.63	<2	<2	<1.91	<2

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
FM-5	20-25	12/8/2016	12.4	58.9	32.7	44.9	215	20.9
	30-35	12/8/2016	6.23	97.3	39.3	26.4	139	19.8
	40-45	12/8/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	12/8/2016	<1.77	<1.89	<2	<2	<1.91	<2

	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
Drinking Water Standard Subpart 5-1 (MCL) ng/l	50,000	50,000	50,000	50,000	50,000	50,000
USEPA Health Advisory Level (HAL) 70 ng/l Combined or 70 ng/l Individual PFOA, PFOS	-	-	-	70	70	-

⌖	Proposed Vertical Profile Well
◆	Existing Vertical Profile Well Location
☐	Building Footprint
🟥	Site Boundary

0 250 500 750 1,000 Feet

Document Path: G:\Projects\S-Z\SHD\1702\mapfiles\RI\FIG07_ProposedVerticalProfileWells.mxd

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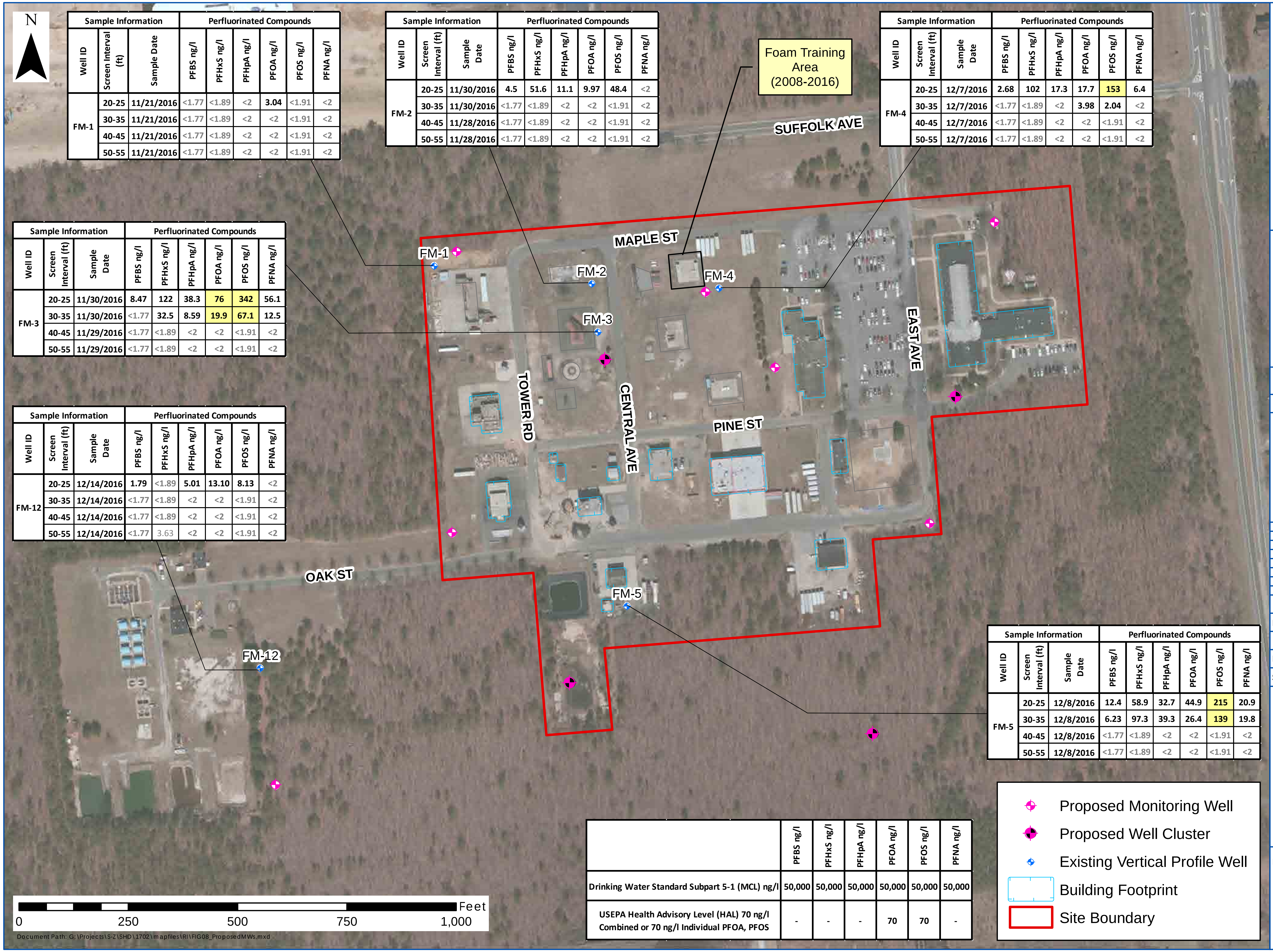
PROPOSED TEMPORARY VERTICAL PROFILE WELL LOCATIONS

SUFFOLK COUNTY FIREMATICS
676 MAPLE ST
YAPHANK, NY

FIGURE NO:
7



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Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
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Well ID	Screen Interval (ft)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
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	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
Drinking Water Standard Subpart 5-1 (MCL) ng/l	50,000	50,000	50,000	50,000	50,000	50,000
USEPA Health Advisory Level (HAL) 70 ng/l Combined or 70 ng/l Individual PFOA, PFOS	-	-	-	70	70	-

⊕	Proposed Monitoring Well
⊕	Proposed Well Cluster
◆	Existing Vertical Profile Well
☐	Building Footprint
🟥	Site Boundary

Document Path: G:\Projects\S-Z\SHD\1702\mapfiles\RI\FIG08_ProposedMWs.mxd

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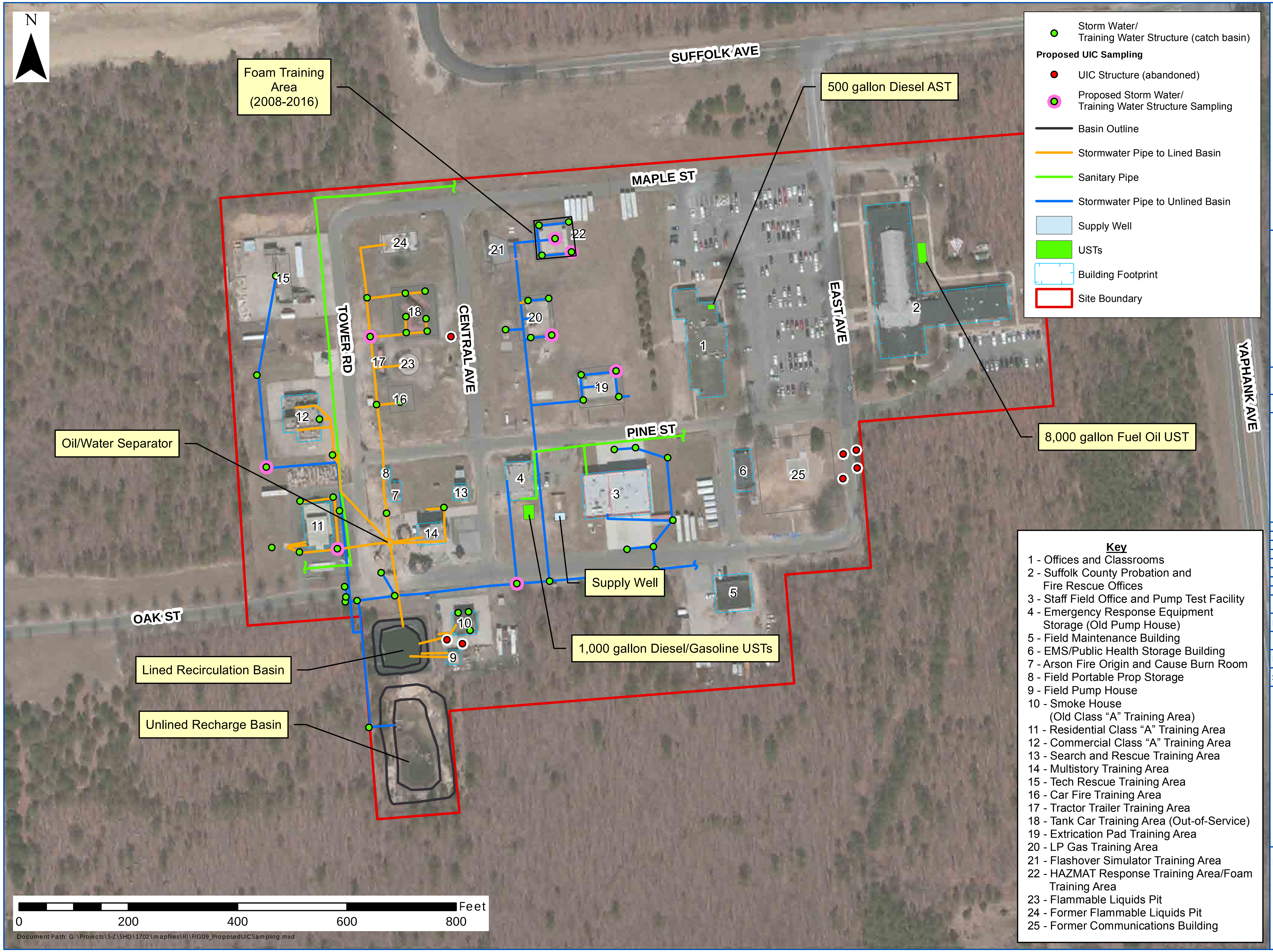
Date:	9/7/2017	Drawn by:	JCG
Scale:	AS SHOWN	Approved by:	AL

PROPOSED MONITORING WELL LOCATIONS

SUFFOLK COUNTY FIREMATICS
676 MAPLE ST
YAPHANK, NY

FIGURE NO:
8



Document Path: G:\Projects\S-Z\SHD\1702\mapfiles\RI\FIG09_ProposedUICSampling.mxd

- ● Storm Water/ Training Water Structure (catch basin)

Proposed UIC Sampling

- ● UIC Structure (abandoned)
- ◉ Proposed Storm Water/ Training Water Structure Sampling
- — Basin Outline
- — Stormwater Pipe to Lined Basin
- — Sanitary Pipe
- — Stormwater Pipe to Unlined Basin
- ▭ Supply Well
- 🟩 USTs
- ▭ Building Footprint
- 🟥 Site Boundary

Key

1 - Offices and Classrooms
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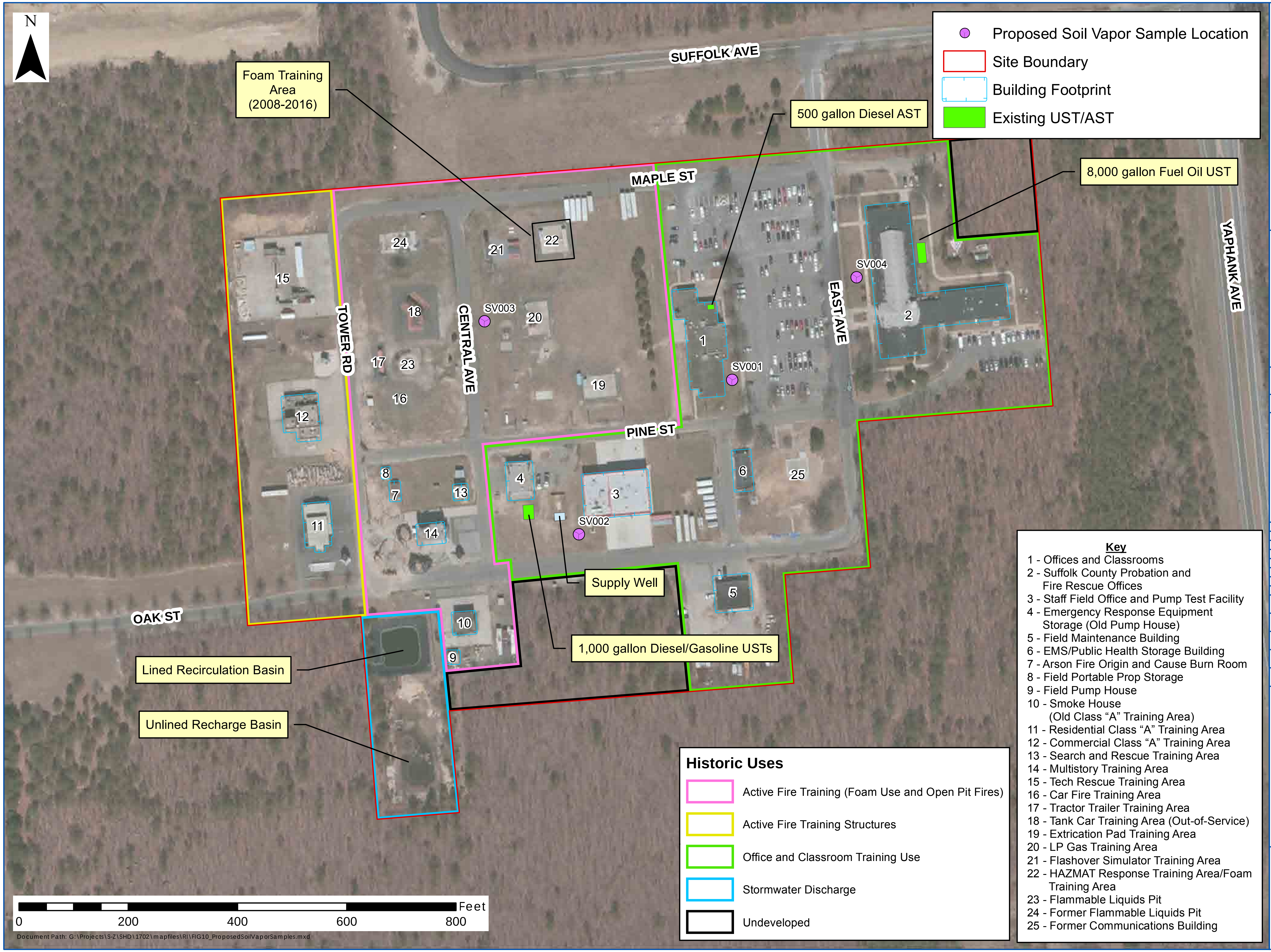
Scale: AS SHOWN		Approved by:	AL

PROPOSED UIC AND CATCH BASIN SAMPLING LOCATIONS

SUFFOLK COUNTY FIREMATICS
676 MAPLE AVE
YAPHANK, NY

FIGURE NO:

9



● Proposed Soil Vapor Sample Location
🟥 Site Boundary
▭ Building Footprint
🟩 Existing UST/AST

Historic Uses

- ▭ Active Fire Training (Foam Use and Open Pit Fires)
- ▭ Active Fire Training Structures
- ▭ Office and Classroom Training Use
- ▭ Stormwater Discharge
- ▭ Undeveloped

Key

1 - Offices and Classrooms
2 - Suffolk County Probation and Fire Rescue Offices
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Document Path: G:\Projects\S-Z\SHD\1702\mapfiles\RI\FIG10_ProposedSoilVaporSamples.mxd

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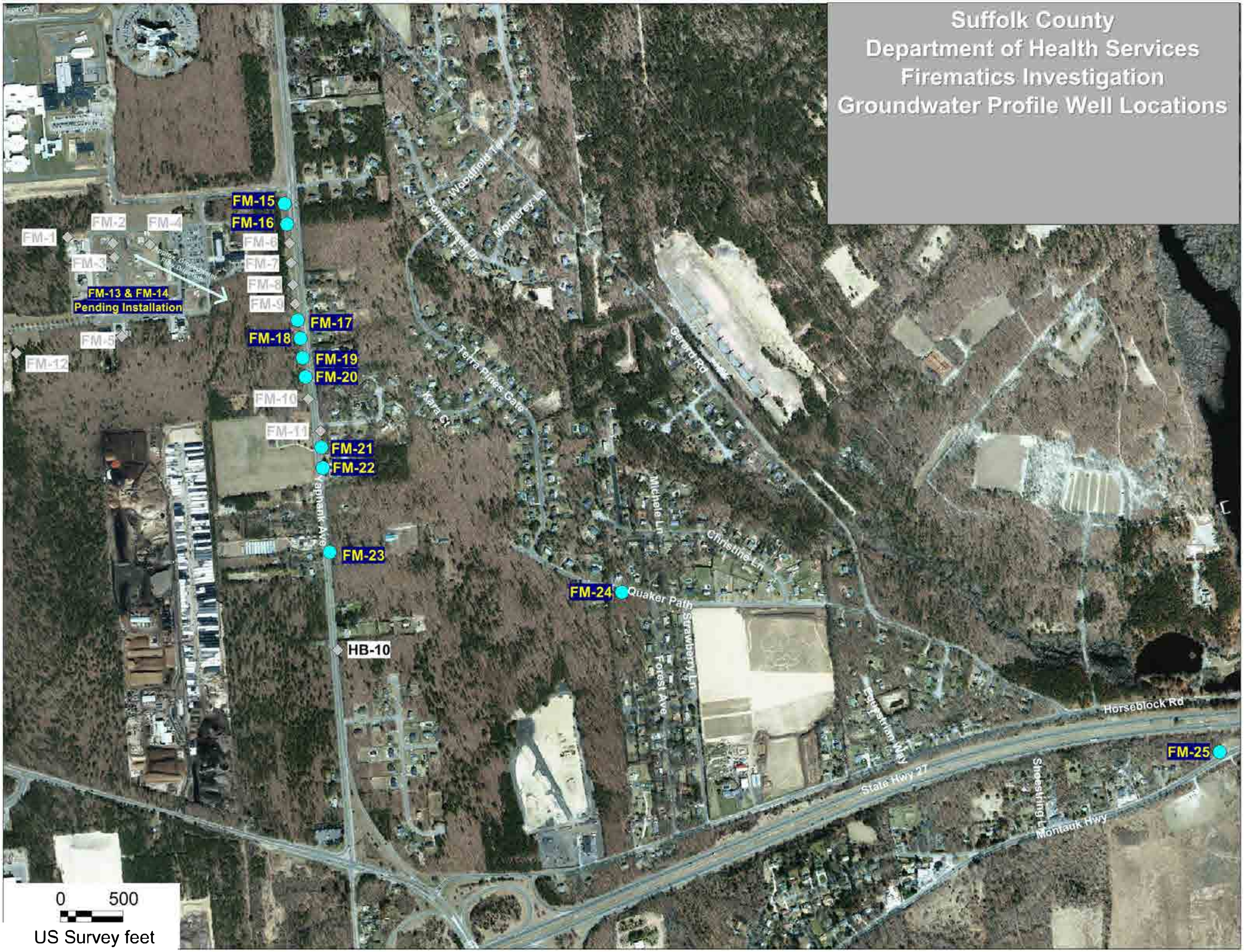
PROPOSED SOIL VAPOR SAMPLING LOCATIONS

SUFFOLK COUNTY FIREMATICS
676 MAPLE ST
YAPHANK, NY

FIGURE NO:
10

APPENDIX A
SCDHS Vertical Profile Sampling Results

Suffolk County
Department of Health Services
Firematics Investigation
Groundwater Profile Well Locations



Suffolk County Department of Health Services
Profile Well Results for Perflourinated Compounds
Data as of December 19, 2016

Sample Information			Perfluorinated Compounds					
Well ID	Screen Interval (ft) (depth below grade)	Sample Date	PFBS ng/l	PFHxS ng/l	PFHpA ng/l	PFOA ng/l	PFOS ng/l	PFNA ng/l
Drinking Water Standard Subpart 5-1 (MCL) ng/l			50,000	50,000	50,000	50,000	50,000	50,000
USEPA Health Advisory Level (HAL) 70 ng/l Combined or 70 ng/l Individual PFOA, PFOS			-	-	-	70	70	-
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	50-55	12/8/2016	<1.77	<1.89	<2	<2	<1.91	<2
FM-6	20-25	10/25/2016	<1.77	6.39	4.20	6.55	8.85	<2
	30-35	10/25/2016	<1.77	6.28	2.41	4.16	3.18	<2
	40-45	10/25/2016	<1.77	3.94	<2	3.28	2.03	<2
	50-55	10/25/2016	<1.77	2.52	<2	2.45	<1.91	<2
FM-7	20-25	10/20/2016	<1.77	3.49	4.74	12.4	6.71	<2
	30-35	10/20/2016	<1.77	8.52	4.18	6	8.07	<2
	40-45	10/20/2016	***BROKEN IN TRANSIT***					
	50-55	10/20/2016	<1.77	3.32	<2	2.18	2.14	<2
FM-8	20-25	11/2/2016	1.84	20.7	27.1	20.8	95.3	13.2
	30-35	11/2/2016	<1.77	25.8	38.8	24.2	69	12.7
	45-50	11/2/2016	***BROKEN IN TRANSIT***					
	55-60	11/2/2016	<1.77	4.88	3.11	3.66	12.30	<2
FM-9	20-25	12/27/2016	2.09	49.5	37.8	37.2	408	118
	30-35	11/1/2016	4.11	104	95.1	82.2	904	279
	40-45	11/1/2016	<1.77	28	27.9	24.5	259	75
	50-55	11/1/2016	<1.77	8.66	7.42	6.29	51	16.3

🟨 Concentration Exceeds HAL

The above is the standard battery of testing for PFOA and PFOS, as per U.S. EPA Method 537,
which includes four additional Perflourinated Chemicals (PFCs).
EPA has not established Health Advisory Levels (HALs) for these chemicals.

Suffolk County Department of Health Services
Profile Well Results for Perflourinated Compounds
Data as of December 19, 2016

Sample Information			Perfluorinated Compounds					
Well ID	**Screen Interval (ft) (depth below grade)**	**Sample Date**	**PFBS ng/l**	**PFHxS ng/l**	**PFHpA ng/l**	**PFOA ng/l**	**PFOS ng/l**	**PFNA ng/l**
Drinking Water Standard Subpart 5-1 (MCL) ng/l			50,000	50,000	50,000	50,000	50,000	50,000
USEPA Health Advisory Level (HAL) 70 ng/l Combined or 70 ng/l Individual PFOA, PFOS			-	-	-	70	70	-
FM-10	20-25	11/16/2016	6.16	66	11.1	10.7	100	30.3
	30-35	11/16/2016	16.8	201	26.4	27.2	475	39.6
	40-45	11/16/2016	17.5	228	30.9	33.7	541	71.2
	50-55	11/16/2016	9.81	141	21.4	23.5	265	35
FM-11	20-25	11/17/2016	2.91	42.7	20.4	10.7	73	9.41
	30-35	11/17/2016	9.61	96.4	34.1	26.3	297	2.07
	40-45	11/17/2016	<1.77	11.5	2.7	2.07	28.2	2.48
	50-55	11/17/2016	<1.77	2.54	<2	<2	<1.91	<2
FM-12	20-25	12/14/2016	1.79	<1.89	5.01	13.10	8.13	<2
	30-35	12/14/2016	<1.77	<1.89	<2	<2	<1.91	<2
	40-45	12/14/2016	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	12/14/2016	<1.77	3.63	<2	<2	<1.91	<2
HB-10	35-40	12/27/2016	2.2	2.33	5.14	9.19	3.78	<2

The above is the standard battery of testing for PFOA and PFOS, as per U.S. EPA Method 537,
which includes four additional Perflourinated Chemicals (PFCs).
EPA has not established Health Advisory Levels (HALs) for these chemicals.

🟨 Concentration Exceeds HAL

Suffolk County Department of Health Services
Profile Well Results for Perfourinated Compounds
Data as of August 29, 2017

Sample Information			Perfluorinated Compounds					
Well ID	**Screen Interval (ft) (depth below grade)**	**Sample Date**	**PFBS ng/l**	**PFHxS ng/l**	**PFHpA ng/l**	**PFOA ng/l**	**PFOS ng/l**	**PFNA ng/l**
Drinking Water Standard Subpart 5-1 (MCL) ng/l			50,000	50,000	50,000	50,000	50,000	50,000
USEPA Health Advisory Level (HAL) 70 ng/l Combined or 70 ng/l Individual PFOA, PFOS			-	-	-	70	70	-
FM-13	20-25	7/11/2017	402	2500	217	240	1460	87
	30-35	7/11/2017	<1.77	2.83	<2	<2	4.95	<2
	40-45	7/11/2017	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	7/11/2017	<1.77	<1.89	<2	<2	<1.91	<2
FM-14	20-25	7/11/2017	153	1580	234	330	1270	143
	30-35	7/10/2017	<1.77	25.70	5.96	10.90	61.00	5.48
	40-45	7/10/2017	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	7/10/2017	<1.77	<1.89	<2	<2	<1.91	<2
FM-15	20-25	4/24/2017	<1.77	4.6	<2	<2	14.4	<2
	30-35	4/24/2017	<1.77	<1.89	<2	<2	3.3	<2
	40-45	4/24/2017	<1.77	<1.89	<2	<2	<1.91	<2
	50-55	4/24/2017	<1.77	2.6	<2	<2	2.4	<2
FM-16	20-25	5/24/2017	<1.77	3.4	<2.00	3.6	4.1	<2.00
	30-35	5/24/2017	<1.77	2.5	<2.00	3.3	<1.91	<2.00
	40-45	5/24/2017	<1.77	2.0	3.2	6.9	<1.91	<2.00
	50-55	5/24/2017	<1.77	2.8	<2.00	2.8	2.3	<2.00
FM-17	20-25	4/26/2017	19.3	502.0	114.3	112.0	1,532.0	125.0
	30-35	4/26/2017	21.7	398.0	137.1	133.0	1,301.0	158.0
	40-45	4/26/2017	13.1	243.0	70.5	69.6	677.0	108.0
	50-55	4/26/2017	3.7	70.5	20.9	19.9	185.0	31.0
FM-18	20-25	5/23/2017	9.7	289.0	48.6	62.6	1,410.0	178.0
	30-35	5/22/2017	24.5	528.0	82.8	130.0	2,540.0	252.0
	40-45	5/22/2017	5.1	160.0	29.4	33.3	692.0	119.0
	50-55	5/22/2017	<1.77	7.1	<2.00	<2.00	19.8	2.6
FM-19	20-25	5/1/2017	18.0	276.0	36.1	42.4	665.0	32.0
	30-35	5/1/2017	20.8	316.0	41.1	51.7	811.0	37.9
	40-45	5/1/2017	23.2	380.0	55.0	68.6	1,030.0	38.6
	50-55	5/1/2017	5.3	83.6	12.7	15.0	273.0	10.2
FM-20	20-25	5/23/2017	7.1	120.0	9.2	14.4	276.0	10.0
	30-35	5/23/2017	23.1	451.0	71.3	74.2	782.0	42.6
	45-50	5/23/2017	8.2	127.0	17.2	19.0	287.0	12.1
	55-60	5/23/2017	<1.77	<1.89	<2	<2	<1.91	<2

🟨 Concentration Exceeds HAL

The above is the standard battery of testing for PFOA and PFOS, as per U.S. EPA Method 537,
which includes four additional Perflourinated Chemicals (PFCs).
EPA has not established Health Advisory Levels (HALs) for these chemicals.

Suffolk County Department of Health Services
Profile Well Results for Perflourinated Compounds
Data as of August 29, 2017

Sample Information			Perfluorinated Compounds					
Well ID	**Screen Interval (ft) (depth below grade)**	**Sample Date**	**PFBS ng/l**	**PFHxS ng/l**	**PFHpA ng/l**	**PFOA ng/l**	**PFOS ng/l**	**PFNA ng/l**
Drinking Water Standard Subpart 5-1 (MCL) ng/l			50,000	50,000	50,000	50,000	50,000	50,000
USEPA Health Advisory Level (HAL) 70 ng/l Combined or 70 ng/l Individual PFOA, PFOS			-	-	-	70	70	-
FM-21	20-25	5/8/2017	3.3	15.3	9.6	8.1	16.5	3.2
	30-35	5/8/2017	7.5	60.7	16.0	21.0	79.8	6.7
	40-45	5/8/2017	10.1	56.5	18.2	18.2	118.0	10.8
	50-55	5/8/2017	5.3	35.8	12.5	13.5	72.3	21.8
FM-22	20-25	5/9/2017	12.7	114.0	62.4	56.7	182.0	103.0
	30-35	5/9/2017	13.2	101.0	56.3	52.8	91.1	21.1
	40-45	5/9/2017	6.2	49.2	32.3	28.4	44.8	10.6
	50-55	5/9/2017	<1.77	3.3	2.7	<2	3.1	<2
FM-23	20-25	5/11/2017	5.4	6.9	4.0	4.9	5.1	<2
	30-35	5/11/2017	3.5	4.5	2.8	<2	2.8	<2
	40-45	5/11/2017	7.1	4.6	3.8	2.7	4.5	<2
	50-55	5/11/2017	3.4	6.7	<2	<2	5.5	<2
FM-24	20-25	6/8/2017	<1.77	<1.89	<2	3.7	2.8	<2
	30-35	6/8/2017	1.8	16.6	6.2	7.4	31.3	2.6
	40-45	6/8/2017	3.8	63.1	21.2	17.5	167.0	12.6
	50-55	6/8/2017	<1.77	23.5	6.7	5.6	48.5	5.7
	60-65	6/5/2017	<1.77	<1.89	<2	<2	2.1	<2
	70-75	6/5/2017	<1.77	5.2	<2	<2	10.9	7.4
	80-85	6/5/2017	2.0	16.1	2.3	2.8	77.6	4.7
	90-95	6/1/2017	<1.77	<1.89	<2	<2	<1.91	<2
	100-105	5/31/2017	<1.77	<1.89	<2	<2	<1.91	<2
	110-115	5/31/2017	<1.77	<1.89	<2	<2	<1.91	<2
FM-25	20-25	6/14/2017	<1.77	<1.89	<2	<2	<1.91	<2
	30-35	6/14/2017	3.8	29.6	5.4	10.8	92.9	12.0
	40-45	6/14/2017	2.4	24.6	4.8	8.7	81.1	12.0
	50-55	6/14/2017	3.6	47.1	9.5	14.8	184.0	21.5
	60-65	6/13/2017	13.7	172	26	24.2	584	21.3
	70-75	6/13/2017	13.9	203	24.9	25	696	25.1
	80-85	6/13/2017	10.9	149	12.8	15.4	444	19.7
	90-95	6/12/2017	4.01	46.6	3.41	4.49	111	6.9
	100-105	6/12/2017	6.8	70.6	4.27	6.07	166	6.07
	110-115	6/1/2017	<1.77	<1.89	<2	<2	2.7	<2

🟨 Concentration Exceeds HAL

The above is the standard battery of testing for PFOA and PFOS, as per U.S. EPA Method 537, which includes four additional Perflourinated Chemicals (PFCs).
EPA has not established Health Advisory Levels (HALs) for these chemicals.

APPENDIX B
Records Search Report

APPENDIX C
Quality Assurance Project Plan

SUFFOLK COUNTY FIREMATICS
676 MAPLE STREET
YAPHANK, NEW YORK
SECTION 742, BLOCK 1, P/O LOTS 3.001 AND 3.002
NYSDEC SITE: 152246

SITE-SPECIFIC UNIFORM FEDERAL POLICY (UFP) QUALITY ASSURANCE PROJECT PLAN (QAPP)

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016

PREPARED FOR:

Suffolk County
H. Lee Dennison Building
Hauppauge, New York 11788

PREPARED BY:

P.W. Grosser Consulting Engineer & Hydrogeologist, PC
630 Johnson Avenue, Suite 7
Bohemia, New York 11716
Phone: 631-589-6353
Fax: 631-589-8705

James Rhodes, PG Sr. Vice President jamesr@pwgrosser.com
Andy Lockwood, PG, LEP andyl@pwgrosser.com

PWGC Project Number: SHD1702

SEPTEMBER 2017

TABLE OF CONTENTS (TOC)

ACRONYM	DEFINITION
%R	Percent Recovery
AES	Atomic Emission Spectrometry
AFFF	Aqueous Film Forming Foam
COC	Chain-of-Custody
DQI	Data Quality Indicator
EDD	Electronic Data Deliverables
ELAP	Environmental Laboratory Approval Program
ERT	Environmental Response Team
FTL	Field Team Leader
HAL	USEPA Health Advisory Limit
ICP	Inductively Coupled Plasma
LDC	Laboratory Data Consultants, Inc.
LOQ	Limit of Quantitation
MDL	Method Detection Limit
MS	Mass Spectrometry
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSHA	Occupational Safety & Health Administration
PCB	Polychlorinated Biphenyl
PFC	Perfluorinated Compounds
PFOA	Perfluoroocanoic acid
PFOS	Perfluorooctanesulfonic acid
PM	Project Manager
PWGC	P.W. Grosser Consulting, Inc.
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RIWP	Remedial Investigation Work Plan
RL	Reporting Limit
RPD	Relative Percent Difference
SCDHS	Suffolk County Department of Health Services
SOP	Standard Operating Procedure
SVOC	Semi-Volatile Organic Compound
TBD	To Be Determined
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

QAPP Worksheet #1 & 2: Title and Approval Page

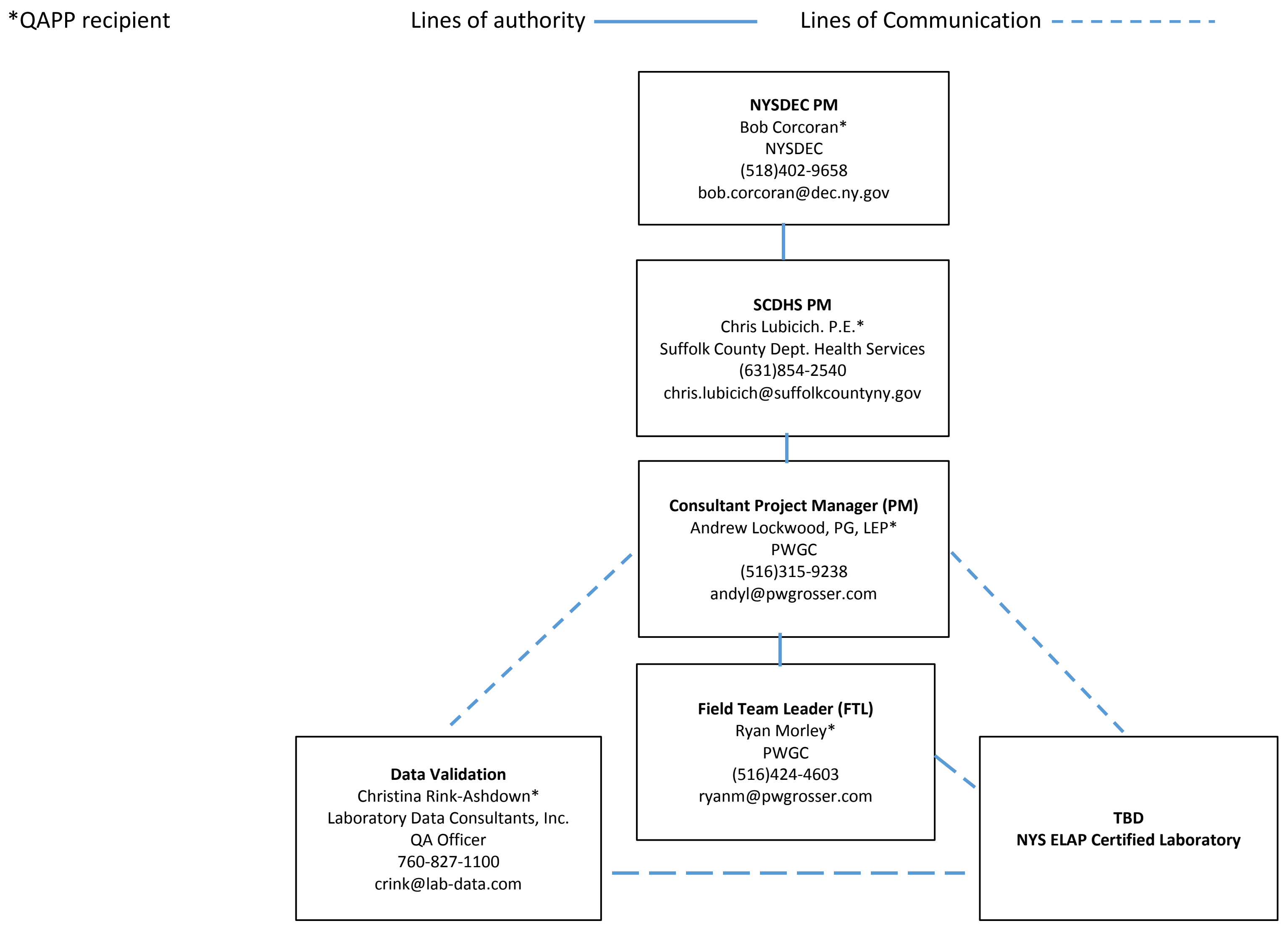
1. Project Identifying Information
   a. Site name/project name: Suffolk County Firematics Site
   b. Site location/number: 676 Maple Ave, Yaphank, NY /DEC Site #: 152246

2. Lead Organization – PWGC

a. Project Manager (PM)	Andrew Lockwood, P.G., L.E.P./PWGC *Printed Name/Title/Organization*
	____________________________ *Signature/Date*
b. QA/QC Manager	James P. Rhodes, P.G./Sr. Vice President/PWGC *Printed Name/Title/Organization*
	____________________________ *Signature/Date*

3. List plans and reports from previous investigations relevant to this project
   - Citizen Participation Plan, August 14, 2017;
   - No remedial investigation has been performed to date.

QAPP Worksheet #3 & 5: Project Organization and QAPP Distribution



NYSDEC PM
Bob Corcoran*
NYSDEC
(518)402-9658
bob.corcoran@dec.ny.gov

SCDHS PM
Chris Lubicich. P.E.*
Suffolk County Dept. Health Services
(631)854-2540
chris.lubicich@suffolkcountyny.gov

Consultant Project Manager (PM)
Andrew Lockwood, PG, LEP*
PWGC
(516)315-9238
andyl@pwgrosser.com

Field Team Leader (FTL)
Ryan Morley*
PWGC
(516)424-4603
ryanm@pwgrosser.com

Data Validation
Christina Rink-Ashdown*
Laboratory Data Consultants, Inc.
QA Officer
760-827-1100
crink@lab-data.com

TBD
NYS ELAP Certified Laboratory

QAPP Worksheet #4, 7 & 8: Personnel Qualifications

ORGANIZATION: Prime Consultant - PWGC

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications
Andrew Lockwood	PM / Maintains direct contact with POC for site activities.	B.A. Geology SUNY Potsdam, over 25 years' experience with field and laboratory QA/QC procedures and preparing QAPPs.	Licensed Professional Geologist (NYS), 40-Hour Occupational Safety & Health Administration (OSHA) Hazardous Waste Site Worker Training; 8-Hour OSHA Refresher Training; 8 Hour OSHA Supervisor Training, and 30-Hour Construction Safety & Health Training.
Ryan Morley	FTL/Maintains direct contact with PM, manages daily field activities, ensures implementation of QAPP.	B.S. Geology, University at Buffalo, Buffalo, NY, over 8-years' experience with field sampling/QA/QC protocol.	40-Hour OSHA Hazardous Waste Site Worker Training; 10-Hour Construction Safety Training

ORGANIZATION: Prime Contractor – Suffolk County Department of Health

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications
Chris Lubicich, PE	PM/Manages construction team		Professional Engineer

ORGANIZATION: Laboratory TBD

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications
NYS ELAP Certified Laboratory	PM/Manages sample transportation, orders, and QA/QC		

ORGANIZATION: Data Validation Consultant - LDC

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications
Christina Rink-Ashdown	QA Officer/Manages the validation of data.	B.S. Biology UC San Diego/Over 8 years’ experience with environmental laboratory and data validation.	

QAPP Worksheet #6: Communication Pathways

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Regulatory agency interface	NYSDEC	Bob Corcoran	(518) 402-9658 bob.corcoran@dec.ny.gov	Maintains lines of communication between NYSDEC and SCDHS, approves site-specific QAPPs in accordance with USEPA guidance documents and policy, and provides guidance or instruction for site-specific QA documents.
Field progress reports	PWGC FTL	Ryan Morley	(516) 967-7752 jcooley@pwgrosser.com	Prepares daily field report and submits to PWGC PM.
Stop work due to safety issues	PWGC FTL	Ryan Morley	(516) 967-7752 jcooley@pwgrosser.com	Communicates with PWGC PM regarding safety issues/reporting on a daily basis, when required.
QAPP changes prior to field work	PWGC PM	Andy Lockwood	(631) 589-6353 andyl@pwgrosser.com	Communicates changes to QAPP to SCDHS and NYSDEC and determines need for field and analytical corrective actions.
QAPP changes during project execution	PWGC FTL	Ryan Morley	(516) 967-7752 jcooley@pwgrosser.com	Communicates QAPP to PWGC PM on a daily basis, when required.
Field corrective actions	PWGC FTL	Ryan Morley	(516) 424-4603 ryanm@pwgrosser.com	Communicates field activities to PWGC PM on a daily basis, when required.

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Sample receipt variances	Lab PM	TBD	TBD	The Lab PM will report any issues with project samples to the PWGC PM.
Laboratory quality control variances	Lab QA Manager	TBD	TBD	The LAb QA manager will report any issues with project samples to the PWGC PM.
Analytical corrective actions	Lab QA Manager	TBD	TBD	The Lab QA manager will report any issues with project samples to the PWGC PM.
Data verification issues, e.g., incomplete records	Lab QA Manager	TBD	TBD	The Lab QA manager will report any issues with project samples to the PWGC PM.
Data validation issues, e.g., non-compliance with procedures	Lab QA Manager	TBD	TBD	The Lab QA manager will report any issues with project samples to the PWGC PM.
Data review corrective actions	LDC PM	Christina Rink-Ashdown	760-827-1100 crink@lab-data.com	The LDC PM will report any issues with the analytical results to the Alpha and PWGC PM.

QAPP Worksheet #9: Project Planning Session Summary

Date of planning session: July 19, 2017
Location: SCDHS, 360 Yaphank Ave, Yaphank, NY
Purpose: This meeting was conducted to define the scope of the Firematics Remedial Investigation Feasibility Study (RIFS) project.

Participants:

Name	Organization	Name	Organization
W. Dawydiak	SCDHS	J. Rhodes	PWGC
J. Vetter	SCFRES	A. Lockwood	PWGC
J. Jordan	SCFRES	J. Cooley	PWGC
C. Capobianco	SCDHS		
C. Lubicich	SCDHS		
A. Rapiejko	SCDHS		
D. Feldman	SCDHS		
R. Paulsen	SCDHS		
A. Juchatz	SCDHS		
M. Jensen	SCDHS		
J. Meyers	SCDHS		

Consensus decisions made: Develop a remedial investigation work plan.

Action	Responsible Party	Due Date
Prepare RIWP	PWGC	9-22-17

QAPP Worksheet #10: Preliminary Conceptual Site Model

BACKGROUND INFORMATION

Site Location and Description

This section provides the site background and history as well as available groundwater analytical data for the site. The site conceptual model (CSM) will be updated throughout the remedial investigation.

The Site is located within the firefighting facility along Maple St. in Yaphank, New York. The Site occupies approximately 28 acres and is comprised of several buildings used for various firefighting training activities with and without the use of live fire. The site is identified as Suffolk County Tax Map Section 742, Block 1, p/o Lots 3.001 and 3.002. The current buildings were constructed between 1959 and 2005. The direction of groundwater flow beneath the site is toward the east-southeast. The depth to groundwater is approximately 20 feet below ground surface.

Site History

The subject Site was vacant until 1957. Sometime between 1957 and 1959 the land was developed to be utilized as a firefighter training facility. In 1959 the first buildings were erected and included a Communications Building (since demolished), a Multistory Training Area (Tower), a recharge basin, roadways, and several open pits (oil pits) used for firefighting training. Between 1959 and 1980, several additions were made to the property which included a Class “A” residential Training Area (current Smoke House), a railroad tank car training area, the eastern most administrative building and parking area, pump test building, LPG training area, and an additional recharge basin. In addition, the correctional facility to the north was constructed (approximately 1960) and the STP facility west of the Site was constructed (approximately 1978). Between 1980 and 1994 several additional buildings were added and the training areas were better defined by the installation of concrete pads. The concrete pads currently used for HAZMAT Response, LP Gas, and Extrication training were installed between 1980 and 1985. The current office and classroom building, the Commercial Class “A” training area, the Emergency Response Equipment Storage, and the Tech Rescue training area were added to the Site. In the 1990s the railroad tank car was converted to LPG to reduce use of liquid accelerants. Between 1995 and 2011, a replacement Class “A” Residential training area was built. It measured approximately 5,000 square feet and included a front porch, attached 2 car garage, a basement and an attic. The original Class “A” residential burn building was converted for use as a training area for new recruit courses and fire fighter survival courses. During this time the Staff Field Office and Pump Test Facility was constructed, and the Communications Building was demolished.

On April 26, 2017, the NYSDEC listed the Suffolk County Firematics site as a Class 2 State Superfund Site. The determination was based upon investigations performed by the Suffolk County Water Authority (SCWA) and Suffolk County Department of Health Services (SCDHS) that detected the perflourinated compounds (PFCs), perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) in groundwater as well as nearby drinking water supplies. Copies of investigation findings were submitted to NYSDEC; a summary of the significant findings of on-site sampling from the SCDHS investigations is included below:

- In July 2016, the SCDHS Office of Water Resources initiated a groundwater investigation to investigate potential PFOS and PFOA groundwater contamination from the suspected historical use of AFFF at the Suffolk County Firematics Site. The SCDHS collected groundwater profile samples from seven temporary wells on-site (FM-1 – FM-5, FM-13 and FM-14). PFOS/PFOA detections were reported in all seven temporary wells, with five of the wells exceeding the USEPA life-time Health Advisory Level (HAL) of 70 nanograms per liter (ng/l) for PFOS and PFOA combined. Two samples had PFOS/PFOA detections, below the HAL. On-site detections exceeding the HAL ranged from 87 (FM-3, 30-35 feet) to 1,700 ng/l (FM-13, 20-25 feet) of total PFOS/PFOA.
- In addition to the on-site analysis of groundwater samples, as of August 29, 2017, SCDHS has installed and sampled eighteen off-site temporary wells (FM-6 – FM-12 and FM-15 - FM-25) and one permanent well (HB-10). Of those nineteen wells, detections were reported in all, with twelve exceeding the USEPA HAL. The off-site detections exceeding the HAL ranged from 80.4 (FM-24, 80-85 feet) to 2,670 ng/l (FM-18, 30-35 feet) of total PFOS/PFOA.
- SCDHS also conducted a private well survey of water quality in the area of Suffolk Avenue / Yaphank Avenue in Yaphank. PFCs have been detected in some of the private wells in that area. Suffolk County has agreed to connect a total of forty-eight properties in the affected area to public water supply at no cost to the property owners. As of September 14, 2017, forty-two properties have been connected to public water.

QUALITATIVE EXPOSURE ASSESSMENT

A qualitative exposure assessment will be included in the Remedial Investigation Report. The assessment will include an evaluation of contaminant sources, potential receptors and contaminant release and transport.

Human Health Exposure Assessment

The potential for contaminant exposure shall be discussed in the Remedial Investigation Report, which will be submitted to the department for review and approval.

Potential Receptor Populations

The subject property is comprised of structures for fire training purposes and municipal office buildings. The site is served by municipal water; however, private water supply wells exist on some residential properties located in close proximity to the site.

Contaminant Release and Transport

PFCs have been identified in the groundwater at the subject property as well as private water wells at neighboring residential locations. The extent of contamination has not yet been identified but may extend as far east as the Carmans River.

Points of Exposure

Potential off-site pathways for PFCs include ingestion through drinking water supply, however, residences where impacted wells were identified have been notified and are supplied with bottled water until a public water supply connection can be made. The only possible on-site exposure pathway is by ingestion, which is unlikely or by dermal contact during site activities (e.g., construction, earthwork, or during fire training exercises using water from the recirculation system).

QAPP Worksheet #11: Project/Data Quality Objectives

State the Problem

Perfluorinated Compounds (PFCs) have been detected in the groundwater at the subject property as well as nearby private water wells. It is believed that the contaminants are a result of historic use of Aqueous Film Forming Foam.

The NYSDEC and SCDHS have entered into an Order on Consent and administrative settlement to address hazardous substances detected at the site.

Identify the Goals of the Investigation

The goal of this remedial investigation program is to identify contaminants and the extent to which they exist laterally and horizontally in the subsurface and groundwater.

Identify Information Inputs

To support the above objectives, the following data will be collected:

- Validated soil, groundwater and soil vapor sample analytical data.
- Geospatial data of sampling locations.
- Field documentation and photographs of site activities.

Boundaries of the investigation

<u>Spatial Boundaries:</u> The Site is located at 676 Maple Street, which is on the south side of Maple Street in Yaphank, New York.

<u>Temporal Boundaries:</u> The data collected will represent existing conditions prior to performing necessary remedial efforts. A tentative sampling schedule is included in Worksheet 14/16.

<u>Practical Constraints on Data Collection:</u> Scheduling and/or sampling location adjustments will be made if physical constraints on planned field events occur due to weather, safety considerations, or problems that may impact the technical quality of the measurements or samples.

Develop the Analytic Approach

Samples will be collected from locations to be designated in the Remedial Investigation Work Plan (RIWP).

Specify Performance or Acceptance Criteria

All data will be reviewed and verified to ensure that they are acceptable for the intended use. All data will be validated in accordance with the procedures specified in Worksheet 36. QC criteria for analytical data are listed in Worksheet 28.

Decision errors will be limited to the extent practicable by following approved USEPA methods and requirements of the Remedial Investigation Work Plan, and NYSDEC DER-10 requirements for site investigation. Any deviation from the QAPP will be documented.

Develop the Detailed Plan for Obtaining Data

Soil, groundwater and soil vapor samples will be collected at the locations, which will be detailed in the RIWP.

Worksheets 19, 20, 24-28 and 30 specify analytical requirements. Data from the laboratories will be delivered in electronic data deliverable (EDD) and Adobe pdf format. The data will be documented in a Remedial Investigation Report (RIR).

QAPP Worksheet #12A: Measurement Performance Criteria

Laboratory: TBD
Matrix: Soil/Water
Analytical Group or Method: Volatile Organics, 8260C
Concentration Level: All

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Overall Precision	Field Duplicates	1 per 20 samples per matrix Relative Percent Difference (RPD) ≤ 30% when metals are detected in both samples ≥ sample-specific Limit of Quantitation (LOQ)
Accuracy	Tuning	Every 12 hours Injection of BFB evaluated against method tune criteria (Table 3 of EPA 8260C)
Accuracy	Initial Calibration (ICAL)	Initially, and when CCV fails Minimum 5-standards; must contain all targets and lowest standard ≤RL. % RSD ≤ 20% for all compounds and minimum RF of method or ‘r’ ≥0.99.
Accuracy	Initial Calibration Verification (ICV)	Daily after calibration Separate-source from calibration standards; Must contain all target analytes at the mid-range of the calibration curve ICV: 80-120% recovery.
Accuracy	Continuing Calibration Verification (CCV)	1 per 10 samples, and at end of each run Concentration level near mid-point of ICAL curve containing all target compounds; minimum RRF criteria met. % D of ≤ 20% for all compounds.

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Accuracy & Sensitivity (Contamination)	Method Blank (MB)	1 per batch - not to exceed 20 field samples MB: < RL
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	1 per batch - not to exceed 20 field samples Must contain all target analytes and be matrix-specific; Evaluate against lab generated recovery limits.
Analytical Accuracy/Bias (laboratory)	Matrix Spike	1 per ≤20 field samples per matrix (when requested) Must be performed on a Site field sample & must contain all target analytes. Evaluate against lab generated recovery limits.
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicates	1 per ≤20 field samples per matrix (when requested) RPD: <30%
Accuracy	Surrogates	Every sample including QC Minimum of 3 surrogates. Evaluate recovery against lab generated limits.
Accuracy	Internal Standards (IS)	Every sample including QC Minimum of 3 internal standards. Areas 50-200% of the most recent midpoint CCV standard. Retention times ±30 seconds from midpoint ICAL standard.
Accuracy (preservation)	Sample preservation	Soil/Sediment: < 6º C per SW-846 Chapter 3 Table 3-2 but allow for < 2º C if freezing samples are intact. Preserve per SW5035A within 48 hours of sampling.
Overall accuracy/bias (contamination)	Equipment Blanks	1 per 20 samples per matrix or 1 per day for non-dedicated sampling equipment No target analyte concentrations ≥ 1/2 LOQ

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Completeness	See Worksheet #34	See Worksheet #34

QAPP Worksheet #12B: Measurement Performance Criteria

Laboratory: TBD
Matrix: Soil/Water
Analytical Group or Method: Semi-volatile Organics, 8270D
Concentration Level: All

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Overall Precision	Field Duplicates	1 per 20 samples per matrix RPD ≤ 30% when metals are detected in both samples ≥ sample-specific LOQ
Accuracy	Tuning	Every 12 hours Injection of DFTPP evaluated against method tune criteria (Table 3 of EPA 8270D)
Accuracy	Initial Calibration (ICAL)	Initially, and when CCV fails Minimum 5-standards; must contain all targets and lowest standard ≤RL. % RSD ≤ 20% for all compounds and minimum RF found in Table 4 of method or ‘r’ ≥0.99.
Accuracy	Initial Calibration Verification (ICV)	Daily after calibration Separate-source from calibration standards; Must contain all target analytes at the mid-range of the calibration curve ICV: 80-120% recovery.

Data Quality Indicator (DQI)	QC sample or measurement performance activity	Measurement Performance Criteria
Accuracy	Continuing Calibration Verification (CCV)	1 per 10 samples, and at end of each run Concentration level near mid-point of ICAL curve containing all target compounds; minimum RRF criteria met. % D of ≤ 20% for CCCs and 30% for all other compounds.
Accuracy & Sensitivity (Contamination)	Method Blank (MB)	1 per batch - not to exceed 20 field samples MB: < RL
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	1 per batch - not to exceed 20 field samples Must contain all target analytes and be matrix-specific; Evaluate against lab generated recovery limits.
Analytical Accuracy/Bias (laboratory)	Matrix Spike	1 per ≤20 field samples per matrix (when requested) Must be performed on a Site field sample & must contain all target analytes. Evaluate against lab generated recovery limits.
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicates	1 per ≤20 field samples per matrix (when requested) RPD:<30%
Accuracy	Surrogates	Every sample including QC Minimum of 3 base neutral and 3 acid surrogates. Evaluate recovery against lab generated limits.
Accuracy	Internal Standards (IS)	Every sample including QC Minimum of 6 internal standards. Areas 50-200% of the most recent midpoint CCV standard. Retention times ±30 seconds from midpoint ICAL standard.

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Accuracy (preservation)	Sample preservation	Soil/Sediment: < 6º C per SW-846 Chapter 3 Table 3-2 but allow for <2º C if freezing samples are intact
Overall accuracy/bias (contamination)	Equipment Blanks	1 per 20 samples per matrix or 1 per day for non-dedicated sampling equipment No target analyte concentrations ≥ 1/2 LOQ
Completeness	See Worksheet #34	See Worksheet #34

QAPP Worksheet #12C: Measurement Performance Criteria

Laboratory: TBD
Matrix: Soil/Water
Analytical Group or Method: Metals, 6010C
Concentration Level: All

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Overall Precision	Field Duplicates	1 per 20 samples per matrix RPD ≤ 30% when metals are detected in both samples ≥ sample-specific LOQ
Accuracy	Initial Calibration (ICAL)	Daily prior to sample analysis Minimum of a calibration blank plus a standard per manufacturing recommended procedures; RL standard may be included in multipoint calibration curve; linear curve fit with correlation coefficient >0.998.
Accuracy	Initial Calibration Verification (ICV)	Daily after calibration Separate-source from calibration standards; Must contain all target analytes at the mid-range of the calibration curve ICV: 90-110% recovery.
Sensitivity	Low Level Initial Calibration Check Verification (LLICV)	At the beginning of the run before any samples and at the end of the run Same source as calibration standards; must contain all target analytes at level of the RL LLCV: 70-130% recovery

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Accuracy	Interference Check Standards (ICSA and ICSAB)	Daily after calibration ICSA & ICSB: 80-120% recovery ICSA: non-spiked analytes < 2x RL
Accuracy	Continuing Calibration Verification (CCV)	1 per 10 samples and at end of each run Same source as initial calibration standards; Must contain all target analytes at the mid-range of the calibration curve CCV: 90 - 110% recovery
Accuracy & Sensitivity (Contamination)	Method Blank (MB)	1 per digestion batch - not to exceed 20 field samples Must be digested with samples using same preparation method and amount of acids; MB: < RL
Analytical Precision (laboratory)	Sample Duplicates	1 per < 20 field samples if an MS/MSD was not performed RPD: <20% RPD aqueous; <35% solids; If results <5xRL: absolute difference between result and RL.
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	1 per digestion batch - not to exceed 20 field samples Must contain all target analytes and be matrix-specific; Aqueous LCS: 80-120% recovery; Soil/Sediment/Solid LCS: vendor control limits (95% confidence limits)
Analytical Accuracy/Bias (laboratory)	Matrix Spike	1 per ≤20 field samples per matrix (when requested) Must be performed on a Site field sample & must contain all target analytes. 75-125% recovery (professional judgment if sample concentration is ≥ 4x spike concentration)

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicates	1 per ≤20 field samples per matrix (when requested) RPD: <20% RPD aqueous; <35% solids; If results <5xRL: absolute difference between result and RL.
Accuracy	Post-Digestion Spike	1 per < 20 field samples if less than acceptable accuracy and precision data are generated. Should be performed if MS/MSD recoveries were unacceptable: 80-120% recovery
Accuracy	Serial Dilution	1 per < 20 field samples if less than acceptable accuracy and precision data are generated Perform 5x dilution on same sample used for MS % Difference < 10% for results >10x RL.
Accuracy (preservation)	Sample preservation	Aq.: Total Metals: HNO3 pH < 2; (Dissolved Metals: filter on site or at the lab then HNO3 pH < 2 but cannot be used for regulatory compliance) Soil/Sediment: collect unpreserved per SW-846 Chapter 3 Table 3-2
Overall accuracy/bias (contamination)	Equipment Blanks	1 per 20 samples per matrix or 1 per day for non-dedicated sampling equipment No target analyte concentrations ≥ 1/2 LOQ
Completeness	See Worksheet #34	See Worksheet #34

QAPP Worksheet #12D: Measurement Performance Criteria

Laboratory: TBD
Matrix: Soil and Water
Analytical Group or Method: PCBs, 8082A
Concentration Level: All

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Overall Precision	Field Duplicates	1 per 20 samples per matrix RPD ≤ 30% when metals are detected in both samples ≥ sample-specific LOQ
Accuracy	Initial Calibration (ICAL)	Initially, and when CCV fails Minimum 5-levels for Aroclors 1016 and 1260 and single-level at midpoint concentration for other Aroclors; 3-5 peaks of each Aroclor evaluated using peak height or peak area; lowest level ≤ RL; %RSD ≤20% or ‘r’ ≥0.99 for Aroclors 1016 and 1260.
Accuracy	Initial Calibration Verification (ICV)	Daily after calibration Separate-source from calibration standards; Must contain all target analytes at the mid-range of the calibration curve ICV: 80-120% recovery.
Accuracy	Continuing Calibration Verification (CCV)	Every 12 hours or every 20 samples, whichever is more frequent, and at the end of the analytical sequence. Concentration level near mid-point of ICAL curve containing Aroclors 1016 and 1260; %D ≤ ±20% and analytes fall within expected retention time windows; Aroclors other than 1016 and 1260 must be verified within 12 hours of being detected in a sample.

Data Quality Indicator (DQI)	**QC sample or measurement performance activity**	**Measurement Performance Criteria**
Accuracy & Sensitivity (Contamination)	Method Blank (MB)	1 per batch - not to exceed 20 field samples MB: < RL
Analytical Accuracy/Bias (laboratory)	Laboratory Control Samples	1 per batch - not to exceed 20 field samples Must contain all target analytes and be matrix-specific; Evaluate against lab generated recovery limits.
Analytical Accuracy/Bias (laboratory)	Matrix Spike	1 per ≤20 field samples per matrix (when requested) Must be performed on a Site field sample & must contain all target analytes. Evaluate against lab generated recovery limits.
Analytical Accuracy/Bias (matrix interference)	Matrix Spike Duplicates	1 per ≤20 field samples per matrix (when requested) RPD: <30%
Accuracy	Surrogates	Every sample, including QC Minimum of 2 surrogates. Evaluate recovery against lab generated limits.
Accuracy (preservation)	Sample preservation	Soil/Sediment: < 6º C per SW-846 Chapter 3 Table 3-2 but allow for < 2º C if freezing samples are intact
Overall accuracy/bias (contamination)	Equipment Blanks	1 per 20 samples per matrix or 1 per day for non-dedicated sampling equipment No target analyte concentrations ≥ 1/2 LOQ
Completeness	See Worksheet #34	See Worksheet #34

QAPP Worksheet #12E: Measurement Performance Criteria

Laboratory: TBD
Matrix: Soil/Water
Analytical Group or Method: Perflourinated Compounds, 537 rev 1.1, modified
Concentration Level: All

Data Quality Indicator (DQI)	**QC sample**	**Measurement Performance Criteria**
Accuracy/Precision	Matrix Spike(MS)/Matrix Spike Duplicate (MSD)	1 per 20 samples See Worksheet #28
Precision	Field Duplicate (FD)	1 per 20 samples Relative percent difference (RPD) <30%
Bias/Contamination	Field Blank	1 per sample shipment (water samples only) No analytes detected more than (>) ½ limit of quantitation (LOQ) of > 1/10 sample concentration, whichever is greater
Accuracy/Representativeness	Cooler Temp Indicator	One per cooler PFCs

QAPP Worksheet #13: Secondary Data Uses and Limitations

Data type	Source	Data uses relative to current project	Factors affecting the reliability of data and limitations on data use
NA			

QAPP Worksheet #14/16: Project Tasks & Schedule

Activity	**Responsible party**	**Planned start date**	**Planned completion date**	**Deliverable(s)**	**Deliverable due date**
Project Initiation	NYSDEC/SCDHS/PWGC	August 31, 2017	October 31, 2016	NA	NA
Develop RIWP/QAPP	PWGC	August 31, 2017	November 1, 2017	RAWP/QAPP	September 22, 2017
Mobilization/demobilization	PWGC/SCDHS	November 1, 2017	February 9, 2018	Field notes	December 15, 2017
Sample collection Tasks	PWGC	November 12, 2017	February 9, 2018	Field notes	March 15, 2018
Analysis	TBD	December 12, 2017	March 11, 2018	Report of Analyses/Data package	3 Days from receipt
Validation	LDC	March 12, 2018	April 10, 2018	Validation Summary report	60 Days from completion of data package
Remedial Investigation Feasibility Study Report	PWGC	March 12, 2018	April 25, 2018	RI Report	90 days from field work completion

QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

Matrix: Soil
Analytical Method: 6010C
Concentration level (if applicable): Low

Analyte	**CAS Number**	**Preliminary Action Goal (ppm)1**		**Achievable Laboratory limits**	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	**Method Detection Limits (MDLs) (mg/kg)**	**Reporting Limits (RLs) (mg/kg)**
Aluminum	7429-09-5	NS	NS	1.08	4
Antimony	7440-36-0	NS	NS	0.152	2
Arsenic	7440-38-2	16 or background	16 or background	0.0832	0.4
Barium	7440-39-3	400	820	0.0696	0.4
Beryllium	7440-41-7	590	47	0.0132	0.2
Cadmium	7440-43-9	9.3	7.5	0.0392	0.4
Calcium	7440-70-2	NS	NS	1.4	4
Chromium	7440-47-3	NS	NS	0.0384	0.4
Cobalt	7440-48-4	NS	NS	0.0664	0.8
Copper	7440-50-8	270	1,720	0.1032	0.4
Iron	7439-89-6	NS	NS	0.3612	2
Lead	7439-92-1	1,000	450	0.1072	2
Magnesium	7439-95-4	NS	NS	0.616	4
Manganese	7439-96-5	10,000	2,000	0.0636	0.4
Mercury (Method 7471B)	7439-97-6	2.8	0.73	0.016896	0.08
Nickel	7440-02-0	310	130	0.0968	1
Potassium	7440-09-7	NS	NS	5.76	100
Selenium	7782-49-2	1,500	4	0.1032	0.8

Analyte	CAS Number	Preliminary Action Goal (ppm)1		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	Restricted Use Soil Cleanup Objectives for the Protection of Groundwater	Method Detection Limits (MDLs) (mg/kg)	Reporting Limits (RLs) (mg/kg)
Silver	7440-22-4	1,500	8.3	0.1132	0.4
Sodium	7440-23-5	NS	NS	1.26	80
Thallium	7440-28-0	NS	NS	0.126	0.8
Vanadium	7440-62-2	NS	NS	0.0812	0.4
Zinc	7440-66-6	10,000	2,480	0.1172	2

Matrix: Water
Analytical Method: 6020a
Concentration level (if applicable): Low

Analyte	CAS Number	Preliminary Action Goal (µg/l)2	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (mg/l)	Reporting Limits (RLs) (mg/l)
Aluminum	7429-09-5	NS	0.01	0.00327
Antimony	7440-36-0	3	0.004	0.000429
Arsenic	7440-38-2	25	0.0005	0.000165
Barium	7440-39-3	1,000	0.0005	0.000173
Beryllium	7440-41-7	3	0.0005	0.000107
Cadmium	7440-43-9	5	0.0002	0.0000599
Calcium	7440-70-2	NS	0.1	0.0394
Chromium	7440-47-3	50	0.001	0.000178
Cobalt	7440-48-4	NS	0.000163	0.0005
Copper	7440-50-8	200	0.000384	0.001

Analyte	**CAS Number**	**Preliminary Action Goal (µg/l)2**	**Achievable Laboratory limits**	
			Method Detection Limits (MDLs) (mg/l)	**Reporting Limits (RLs) (mg/l)**
Iron	7439-89-6	NS	0.0191	0.05
Lead	7439-92-1	25	0.000343	0.001
Magnesium	7439-95-4	35,000	0.0242	0.07
Manganese	7439-96-5	300	0.00044	0.001
Mercury (Method 7470A)	7439-97-6	0.7	0.000066	0.0002
Nickel	7440-02-0	100	0.000556	0.002
Potassium	7440-09-7	NS	0.0309	0.1
Selenium	7782-49-2	10	0.00173	0.005
Silver	7440-22-4	50	0.000163	0.0004
Sodium	7440-23-5	20,000	0.0293	0.1
Thallium	7440-28-0	0.5 (GV)	0.000143	0.0005
Vanadium	7440-62-2	NS	0.00157	0.005
Zinc	7440-66-6	2,000	0.00341	0.01

Matrix: Soil
Analytical Method: 8260C
Concentration level (if applicable): High & Low

Analyte	CAS Number	**Preliminary Action Goal** (ppm)[1]		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Methylene chloride	75-09-2	500	0.05	1.65	10
1,1-Dichloroethane	75-34-3	240	0.27	0.27	1.5
Chloroform	67-66-3	350	0.37	0.37	1.5
Carbon tetrachloride	56-23-5	22	0.76	0.345	1
1,2-Dichloropropane	78-87-5	NS	NS	0.228	3.5
Dibromochloromethane	124-48-1	NS	NS	0.176	1
1,1,2-Trichloroethane	79-00-5	NS	NS	0.313	1.5
Tetrachloroethene	127-18-4	150	1.3	0.302	1
Chlorobenzene	108-90-7	500	1.1	0.348	1
Trichlorofluoromethane	75-69-4	NS	NS	0.417	5
1,2-Dichloroethane	107-06-2	30	0.02 or background	0.246	1
1,1,1-Trichloroethane	71-55-6	500	0.68	0.35	1
Bromodichloromethane	75-27-4	NS	NS	0.308	1
trans-1,3-Dichloropropene	10061-02-6	NS	NS	0.208	1
cis-1,3-Dichloropropene	10061-01-5	NS	NS	0.231	1
1,3-Dichloropropene, Total	542-75-6	NS	NS	0.208	1
1,3-Dichloropropene, Total	542-75-6	NS	NS	0.208	1
1,1-Dichloropropene	563-58-6	NS	NS	0.328	5
Bromoform	75-25-2	NS	NS	0.237	4
1,1,2,2-Tetrachloroethane	79-34-5	NS	NS	0.298	1

Analyte	CAS Number	**Preliminary Action Goal** (ppm)[1]		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Benzene	71-43-2	44	0.06	0.193	1
Toluene	108-88-3	500	0.7	0.195	1.5
Ethylbenzene	100-41-4	390	1	0.17	1
Chloromethane	74-87-3	NS	NS	0.436	5
Bromomethane	74-83-9	NS	NS	0.338	2
Vinyl chloride	75-01-4	13	0.02	0.315	2
Chloroethane	75-00-3	NS	NS	0.316	2
1,1-Dichloroethene	75-35-4	500	0.33	0.372	1
trans-1,2-Dichloroethene	156-60-5	500	0.19	0.241	1.5
Trichloroethene	79-01-6	200	0.47	0.302	1
1,2-Dichlorobenzene	95-50-1	500	1.1	0.182	5
1,3-Dichlorobenzene	541-73-1	280	2.4	0.218	5
1,4-Dichlorobenzene	106-46-7	130	1.8	0.182	5
Methyl tert butyl ether	1634-04-4	500	0.93	0.153	2
p/m-Xylene	179601-23-1	500 (total)	1.6 (total)	0.351	2
o-Xylene	95-47-6	500 (total)	1.6 (total)	0.338	2
Xylene (Total)	1330-20-7	500	1.6	0.338	2
cis-1,2-Dichloroethene	156-59-2	500	0.25	0.342	2
1,2-Dichloroethene (total)	540-59-0	NS	NS	0.241	1
Dibromomethane	74-95-3	NS	NS	0.239	10

Matrix: Water
Analytical Method: 8260C
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (µg/l)^2	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/l)	Reporting Limits (RLs) (µg/l)
Methylene chloride	75-09-2	5	0.7	2.5
1,1-Dichloroethane	75-34-3	5	0.7	2.5
Chloroform	67-66-3	7	0.7	2.5
Carbon tetrachloride	56-23-5	5	0.134	0.5
1,2-Dichloropropane	78-87-5	1	0.137	1
Dibromochloromethane	124-48-1	50	0.149	0.5
1,1,2-Trichloroethane	79-00-5	1	0.5	1.5
Tetrachloroethene	127-18-4	5	0.181	0.5
Chlorobenzene	108-90-7	5	0.7	2.5
Trichlorofluoromethane	75-69-4	5	0.7	2.5
1,2-Dichloroethane	107-06-2	0.6	0.132	0.5
1,1,1-Trichloroethane	71-55-6	5	0.7	2.5
Bromodichloromethane	75-27-4	50	0.192	0.5
trans-1,3-Dichloropropene	10061-02-6	NS	0.164	0.5
cis-1,3-Dichloropropene	10061-01-5	NS	0.144	0.5
1,3-Dichloropropene, Total	542-75-6	NS	0.144	0.5
1,1-Dichloropropene	563-58-6	5	0.7	2.5
Bromoform	75-25-2	50	0.65	2
1,1,2,2-Tetrachloroethane	79-34-5	5	0.167	0.5
Benzene	71-43-2	1	0.159	0.5

Analyte	CAS Number	**Preliminary Action Goal** (µg/l)^2	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/l)	Reporting Limits (RLs) (µg/l)
Toluene	108-88-3	5	0.7	2.5
Ethylbenzene	100-41-4	5	0.7	2.5
Chloromethane	74-87-3	NS	0.7	2.5
Bromomethane	74-83-9	5	0.7	2.5
Vinyl chloride	75-01-4	2	0.0714	1
Chloroethane	75-00-3	5	0.7	2.5
1,1-Dichloroethene	75-35-4	5	0.169	0.5
trans-1,2-Dichloroethene	156-60-5	5	0.7	2.5
Trichloroethene	79-01-6	5	0.175	0.5
1,2-Dichlorobenzene	95-50-1	3	0.7	2.5
1,3-Dichlorobenzene	541-73-1	3	0.7	2.5
1,4-Dichlorobenzene	106-46-7	3	0.7	2.5
Methyl tert butyl ether	1634-04-4	10	0.7	2.5
p/m-Xylene	179601-23-1	NS	0.7	2.5
o-Xylene	95-47-6	5	0.7	2.5
Xylene (Total)	1330-20-7	5	0.7	2.5
cis-1,2-Dichloroethene	156-59-2	5	0.7	2.5
1,2-Dichloroethene (total)	540-59-0	NS	0.7	2.5
Dibromomethane	74-95-3	5	1	5

Matrix: Soil
Analytical Method: 8270D
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (mg/kg)[1]		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Acenaphthene	83-32-9	500	98	17.3012	133.6
1,2,4-Trichlorobenzene	130-82-1	NS	NS	19.1048	167
Hexachlorobenzene	118-74-1	NS	NS	18.704	100.2
Bis(2-chloroethyl)ether	111-44-4	NS	NS	22.6452	150.3
2-Chloronaphthalene	91-58-7	NS	NS	16.5664	167
1,2-Dichlorobenzene	95-50-1	NS	NS	29.9932	167
1,3-Dichlorobenzene	541-73-1	NS	NS	28.724	167
1,4-Dichlorobenzene	106-46-7	NS	NS	29.1582	167
3,3'-Dichlorobenzidine	91-94-1	NS	NS	44.422	167
2,4-Dinitrotoluene	121-14-2	NS	NS	33.4	167
2,6-Dinitrotoluene	606-20-2	NS	NS	28.6572	167
Fluoranthene	206-44-0	500	1000	19.1716	100.2
4-Chlorophenyl phenyl ether	7005-72-3	NS	NS	17.869	167
4-Bromophenyl phenyl ether	101-55-3	NS	NS	25.4842	167
Bis(2-chloroisopropyl)ether	108-60-1	NS	NS	28.5236	200.4
Bis(2-chloroethoxy)methane	111-91-1	NS	NS	16.73340	180.36
Hexachlorobutadiene	87-68-3	NS	NS	24.4488	167
Hexachlorocyclopentadiene	77-47-4	NS	NS	151.302	477.62
Hexachloroethane	67-72-1	NS	NS	27.0206	133.6

Analyte	CAS Number	Preliminary Action Goal (mg/kg)[1]		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Isophorone	78-59-1	NS	NS	21.6766	150.3
Naphthalene	91-20-3	500	12	20.3406	167
Nitrobenzene	98-95-3	NS	NS	24.716	150.3
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	NS	NS	19.0046	133.6
n-Nitrosodi-n-propylamine	621-64-7	NS	NS	25.7848	167
Bis(2-Ethylhexyl)phthalate	117-81-7	NS	NS	57.782	167
Butyl benzyl phthalate	85-68-7	NS	NS	42.084	167
Di-n-butylphthalate	84-74-2	NS	NS	31.6632	167
Di-n-octylphthalate	117-84-0	NS	NS	56.78	167
Diethyl phthalate	84-66-2	NS	NS	15.4642	167
Dimethyl phthalate	131-11-3	NS	NS	35.07	167
Benzo(a)anthracene	56-55-3	5.6	1 or background	18.8042	100.2
Benzo(a)pyrene	50-32-8	1 or background	22	40.748	133.6
Benzo(b)fluoranthene	205-99-2	5.6	1.7	28.1228	100.2
Benzo(k)fluoranthene	207-08-9	56	1.7	26.72	100.2
Chrysene	218-01-9	56	1	17.368	100.2
Acenaphthylene	208-96-8	500	107	25.7848	133.6
Anthracene	120-12-7	500	1000	32.565	100.2
Benzo(ghi)perylene	191-24-2	500	1000	19.6392	133.6
Fluorene	86-73-7	500	386	16.2324	167
Phenanthrene	85-01-8	500	1000	20.3072	100.2
Dibenzo(a,h)anthracene	53-70-3	0.56	1000	19.3052	100.2
Indeno(1,2,3-cd)Pyrene	193-39-5	5.6	8.2	23.2798	133.6

Matrix: Water
Analytical Method: 8270D
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (mg/kg)[2]	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Acenaphthene	83-32-9	20	0.591	2
1,2,4-Trichlorobenzene	130-82-1	NS	0.661	5
Hexachlorobenzene	118-74-1	0.04	0.579	2
Bis(2-chloroethyl)ether	111-44-4	1.0	0.669	2
2-Chloronaphthalene	91-58-7	10	0.64	2
1,2-Dichlorobenzene	95-50-1	3	0.732	2
1,3-Dichlorobenzene	541-73-1	3	0.688	2
1,4-Dichlorobenzene	106-46-7	3	0.708	2
3,3'-Dichlorobenzidine	91-94-1	5	1.39	5
2,4-Dinitrotoluene	121-14-2	5	0.845	5
2,6-Dinitrotoluene	606-20-2	5	1.12	5
Fluoranthene	206-44-0	50	0.568	2
4-Chlorophenyl phenyl ether	7005-72-3	NS	0.625	2
4-Bromophenyl phenyl ether	101-55-3	NS	0.731	2
Bis(2-chloroisopropyl)ether	108-60-1	5	0.696	2
Bis(2-chloroethoxy)methane	111-91-1	5	0.626	5
Hexachlorobutadiene	87-68-3	0.5	0.717	2
Hexachlorocyclopentadiene	77-47-4	5	7.84	20
Hexachloroethane	67-72-1	5	0.682	2
Isophorone	78-59-1	50	0.601	5

Analyte	CAS Number	**Preliminary Action Goal** (mg/kg)[2]	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Naphthalene	91-20-3	10	0.68	2
Nitrobenzene	98-95-3	0.4	0.753	2
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	50	0.644	2
n-Nitrosodi-n-propylamine	621-64-7	NS	0.7	5
Bis(2-Ethylhexyl)phthalate	117-81-7	5	0.91	3
Butyl benzyl phthalate	85-68-7	50	1.26	5
Di-n-butylphthalate	84-74-2	NS	0.689	5
Di-n-octylphthalate	117-84-0	NS	1.14	5
Diethyl phthalate	84-66-2	50	0.628	5
Dimethyl phthalate	131-11-3	50	0.65	5
Benzo(a)anthracene	56-55-3	0.002	0.61	2
Benzo(a)pyrene	50-32-8	ND	0.539	2
Benzo(b)fluoranthene	205-99-2	0.002	0.635	2
Benzo(k)fluoranthene	207-08-9	0.002	0.597	2
Chrysene	218-01-9	0.002	0.543	2
Acenaphthylene	208-96-8	NS	0.658	2
Anthracene	120-12-7	50	0.645	2
Benzo(ghi)perylene	191-24-2	NS	0.611	2
Fluorene	86-73-7	50	0.619	2
Phenanthrene	85-01-8	50	0.613	2
Dibenzo(a,h)anthracene	53-70-3	NS	0.548	2
Indeno(1,2,3-cd)Pyrene	193-39-5	0.002	0.707	2

Matrix: Soil
Analytical Method: 8082A
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (ppm)[1]		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
PCB-1016	12674-11-2	1.0	3.2	3.7989	33.5
PCB-1221	11104-28-2	1.0	3.2	5.0987	33.5
PCB-1232	11141-16-5	1.0	3.2	3.2964	33.5
PCB-1242	53469-21-9	1.0	3.2	4.1004	33.5
PCB-1248	12672-29-6	1.0	3.2	3.7587	33.5
PCB-1254	11097-69-1	1.0	3.2	2.7336	33.5
PCB-1260	11096-82-5	1.0	3.2	3.4974	33.5
PCB-1262	37324-23-5	1.0	3.2	2.7537	33.5
PCB-1268	11100-14-4	1.0	3.2	2.3718	33.5

Matrix: Water
Analytical Method: 8082A
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (µg/l)[2]	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/l)	Reporting Limits (RLs) (µg/l)
PCB-1016	12674-11-2	0.09 (Total PCBs)	0.019588	0.083
PCB-1221	11104-28-2	0.09 (Total PCBs)	0.031872	0.083
PCB-1232	11141-16-5	0.09 (Total PCBs)	0.027058	0.083
PCB-1242	53469-21-9	0.09 (Total PCBs)	0.029548	0.083

Analyte	CAS Number	**Preliminary Action Goal** (µg/l)[2]	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/l)	Reporting Limits (RLs) (µg/l)
PCB-1248	12672-29-6	0.09 (Total PCBs)	0.022576	0.083
PCB-1254	11097-69-1	0.09 (Total PCBs)	0.034611	0.083
PCB-1260	11096-82-5	0.09 (Total PCBs)	0.01992	0.083
PCB-1262	37324-23-5	0.09 (Total PCBs)	0.017098	0.083
PCB-1268	11100-14-4	0.09 (Total PCBs)	0.027058	0.083

Matrix: Soil
Analytical Method: 537(m)
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (ppt)	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (ng/g)	Target MDC (RLs) (ng/g)
Perfluorobutane sulfonate (PFBS)	375-73-5	TBD	0.363	1
Perfluorohexanoic acid (PFHxA)	307-24-4	TBD	0.203	1
Perfluoroheptanoic acid (PFHpA)	375-85-9	TBD	0.205	1
Perfluorohexane sulfonate (PFHxS)	355-46-4	TBD	0.31	1
Perfluoro-n-octanoic acid (PFOA)	335-67-1	TBD	0.236	1
Perfluorooctane sulfonate (PFOS)	1763-23-1	TBD	0.845	1
Perfluorononanoic acid (PFNA)	375-95-1	TBD	0.187	1
Perfluorodecanoic acid (PFDA)	335-76-2	TBD	0.256	1
Perfluoroundecanoic acid (PFUnA)	2058-94-8	TBD	0.354	1
Perfluorododecanoic acid (PFDoA)	307-55-1	TBD	0.276	1
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	TBD	0.122	1
Perfluorotetradecanoic acid (PFTA)	376-06-7	TBD	0.198	1
N-Ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	None	TBD	0.321	1

Analyte	CAS Number	**Preliminary Action Goal** (ppt)	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (ng/g)	Target MDC (RLs) (ng/g)
N-Methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	None	TBD	0.302	1

Matrix: Water
Analytical Method: 537(m)
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (µg/L)	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (ng/l)	Target MDC (RLs) (ng/l)
Perfluorobutane sulfonate (PFBS)	375-73-5	400[3]	0.648	2
Perfluorohexanoic acid (PFHxA)	307-24-4	TBD	0.404	2
Perfluoroheptanoic acid (PFHpA)	375-85-9	TBD	0.236	2
Perfluorohexane sulfonate (PFHxS)	355-46-4	TBD	0.328	2
Perfluoro-n-octanoic acid (PFOA)	335-67-1	70 (Individually or combined w/ PFOS)[4]	0.26	2
Perfluorooctane sulfonate (PFOS)	1763-23-1	70 (Individually or combined w/ PFOA)[4]	0.224	2
Perfluorononanoic acid (PFNA)	375-95-1	TBD	0.256	2
Perfluorodecanoic acid (PFDA)	335-76-2	TBD	0.228	2
Perfluoroundecanoic acid (PFUnA)	2058-94-8	TBD	0.216	2
Perfluorododecanoic acid (PFDoA)	307-55-1	TBD	0.284	2
Perfluorotridecanoic acid (PFTrDA)	72629-94-8	TBD	0.576	2
Perfluorotetradecanoic acid (PFTA)	376-06-7	TBD	0.516	2
N-Ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)	None	TBD	0.596	2
N-Methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)	None	TBD	0.636	2

Matrix: Soil
Analytical Method: 6860
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (ppt)	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Perchlorate	14797-73-0	TBD	0.0414	0.5

Matrix: Water
Analytical Method: 6860
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (ppt)	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Perchlorate	14797-73-0	TBD	0.0107	0.5

Matrix: Soil
Analytical Method: 9010C/9012B
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (ppt)[1]		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	Method Detection Limits (MDLs) (mg/kg)	Reporting Limits (RLs) (mg/kg)
Total Cyanide	57-12-5	27	40	0.212	1

Matrix: Water
Analytical Method: 9010C/9012B
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal** (ppt)[2]	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (mg/kg)	Reporting Limits (RLs) (mg/kg)
Total Cyanide	NA	200	0.0018	0.005

Matrix: Soil
Analytical Method: 7196A
Concentration level (if applicable): Low

Analyte	**CAS Number**	**Preliminary Action Goal (ppt)**		**Achievable Laboratory limits**	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	**Method Detection Limits (MDLs) (mg/kg)**	**Reporting Limits (RLs) (mg/kg)**
Hexavalent Chromium	18540-29-9	400	19	0.16	0.8

Matrix: Water

Analytical Method: 7196A
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal (ppt)**	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (mg/kg)	Reporting Limits (RLs) (mg/kg)
Hexavalent Chromium	18540-29-9	50	0.003	0.10

Matrix: Soil
Analytical Method: 8151A
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal (ppt)[1]**		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
2,4-D	94-75-7	NS	NS	10.4895	166.5
2,4,5-T	93-76-5	NS	NS	5.1615	166.5
2,4,5-TP (SIlvex)	93-72-1	500	3.8	4.4289	166.5

Matrix: Water
Analytical Method: 8151A
Concentration level (if applicable): Low

Analyte	CAS Number	**Preliminary Action Goal (ppt)[2]**	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
2,4-D	94-75-7	50	0.498	10
2,4,5-T	93-76-5	35	0.531	2
2,4,5-TP (SIlvex)	93-72-1	0.26	0.539	2

Matrix: Soil
Analytical Method: 8081
Concentration level (if applicable): Low

Analyte	**CAS Number**	**Preliminary Action Goal (ppt)[1]**		**Achievable Laboratory limits**	
		Restricted Use Soil Cleanup Objectives for Commercial Use	**Restricted Use Soil Cleanup Objectives for the Protection of Groundwater**	**Method Detection Limits (MDLs) (µg/kg)**	**Reporting Limits (RLs) (µg/kg)**
Delta-BHC	319-86-8	500	0.25	1.5651	7.992
Lindane	58-89-9	9.2	0.1	1.48851	3.33
Alpha-BHC	319-84-6	3.4	0.02	0.94572	3.33
Beta-BHC	319-85-7	3	0.09	3.0303	7.992
Heptachlor	76-44-8	15	0.38	1.79154	3.996
Aldrin	309-00-2	0.68	0.18	2.81385	7.992
Heptachlor epoxide	1024-57-3	NS	NS	4.4955	14.985
Endrin	72-20-8	89	0.06	1.3653	3.33
Endrin aldehyde	7421-93-4	NS	NS	3.4965	9.99
Endrin ketone	53494-70-5	NS	NS	2.05794	7.992

Analyte	CAS Number	Preliminary Action Goal (ppt)[1]		Achievable Laboratory limits	
		Restricted Use Soil Cleanup Objectives for Commercial Use	Restricted Use Soil Cleanup Objectives for the Protection of Groundwater	Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Dieldrin	60-57-1	1.4	0.1	2.4975	4.995
4,4'-DDE	72-55-9	62	17	1.84815	7.992
4,4'-DDD	72-54-8	92	14	2.85048	7.992
4,4'-DDT	50-29-3	47	136	6.4269	14.985
Endosulfan I	959-98-8	200	102	1.88811	7.992
Endosulfan II	33213-65-9	200	102	2.67066	7.992
Endosulfan sulfate	1031-07-8	200	1000	1.58508	3.33
Methoxychlor	72-43-5	NS	NS	4.662	14.985
Toxaphene	8001-35-2	NS	NS	41.958	149.85
cis-Chlordane	5103-71-9	24	2.9	2.78388	9.99
trans-Chlordane	5103-74-2	NS	NS	2.63736	9.99
Chlordane	57-74-9	NS	NS	26.4735	64.935

Matrix: Water
Analytical Method: 8081
Concentration level (if applicable): Low

Analyte	CAS Number	Preliminary Action Goal (ppt)[2]	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/kg)	Reporting Limits (RLs) (µg/kg)
Delta-BHC	319-86-8	0.04	0.00467	0.02
Lindane	58-89-9	0.05	0.00434	0.02
Alpha-BHC	319-84-6	0.01	0.00439	0.02
Beta-BHC	319-85-7	0.04	0.0056	0.02

Analyte	**CAS Number**	**Preliminary Action Goal (ppt)[2]**	**Achievable Laboratory limits**	
			Method Detection Limits (MDLs) (µg/kg)	**Reporting Limits (RLs) (µg/kg)**
Heptachlor	76-44-8	0.04	0.0031	0.02
Aldrin	309-00-2	ND	0.00216	0.02
Heptachlor epoxide	1024-57-3	0.03	0.00415	0.02
Endrin	72-20-8	ND	0.00429	0.04
Endrin aldehyde	7421-93-4	5	0.0081	0.04
Endrin ketone	53494-70-5	5	0.00477	0.04
Dieldrin	60-57-1	0.001 (sum of Aldrin & Dieldrin)	0.00429	0.04
4,4'-DDE	72-55-9	0.2	0.00381	0.04
4,4'-DDD	72-54-8	0.3	0.00464	0.04
4,4'-DDT	50-29-3	0.2	0.00432	0.04
Endosulfan I	959-98-8	NS	0.00345	0.02
Endosulfan II	33213-65-9	NS	0.00519	0.04
Endosulfan sulfate	1031-07-8	NS	0.00481	0.04
Methoxychlor	72-43-5	35	0.00684	0.2
Toxaphene	8001-35-2	0.06	0.0627	0.2
cis-Chlordane	5103-71-9	NS	0.00666	0.02
trans-Chlordane	5103-74-2	NS	0.00627	0.02
Chlordane	57-74-9	0.05	0.0463	0.2

Matrix: Soil Vapor
Analytical Method: TO-15
Concentration level (if applicable): Low

Analyte	**CAS Number**	**Preliminary Action Goal (µg/m³)⁵**	**Achievable Laboratory limits**	
			Method Detection Limits (MDLs) (µg/m³)	**Reporting Limits (RLs) (µg/m³)**
1,1,1-Trichloroethane	71-55-6	NS	-	1.09
1,1,2,2-Tetrachloroethane	79-34-5	NS	-	1.37
1,1,2-Trichloroethane	79-00-5	NS	-	1.09
1,1-Dichloroethane	75-34-3	NS	-	0.809
1,1-Dichloroethene	75-35-4	NS	-	0.793
1,2,4-Trichlorobenzene	120-82-1	NS	-	1.48
1,2,4-Trimethylbenzene	95-63-6	NS	-	0.983
1,2-Dibromoethane	106-93-4	NS	-	1.54
1,2-Dichlorobenzene	95-50-1	NS	-	1.2
1,2-Dichloroethane	107-06-2	NS	-	0.809
1,2-Dichloropropane	78-87-5	NS	-	0.924
1,3,5-Trimethylbenzene	108-67-8	NS	-	0.983
1,3-Butadiene	106-99-0	NS	-	0.442
1,3-Dichlorobenzene	541-73-1	NS	-	1.2
1,4-Dichlorobenzene	106-46-7	NS	-	1.2
1,4-Dioxane	123-91-1	NS	-	0.721
2,2,4-Trimethylpentane	540-84-1	NS	-	0.934
2-Butanone	78-93-3	NS	-	1.47
2-Hexanone	591-78-6	NS	-	0.82

Analyte	CAS Number	Preliminary Action Goal (µg/m^3)[5]	Achievable Laboratory limits	
			Method Detection Limits (MDLs) (µg/m^3)	Reporting Limits (RLs) (µg/m^3)
3-Chloropropene	107-05-1	NS	-	0.626
4-Ethyltoluene	622-96-8	NS	-	0.983
4-Methyl-2-pentanone	108-10-1	NS	-	2.05
Acetone	67-64-1	NS	-	2.38
Benzene	71-43-2	NS	-	0.639
Benzyl chloride	100-44-7	NS	-	1.04
Bromodichloromethane	75-27-4	NS	-	1.34
Bromoform	75-25-2	NS	-	2.07
Bromomethane	74-83-9	NS	-	0.777
Carbon disulfide	75-15-0	NS	-	0.623
Carbon tetrachloride	56-23-5	NS	-	1.26
Chlorobenzene	108-90-7	NS	-	0.921
Chloroethane	75-00-3	NS	-	0.528
Chloroform	67-66-3	NS	-	0.977
Chloromethane	74-87-3	NS	-	0.413
cis-1,2-Dichloroethene	156-59-2	NS	-	0.793
cis-1,3-Dichloropropene	10061-01-5	NS	-	0.908
Cyclohexane	110-82-7	NS	-	0.688
Dibromochloromethane	124-48-1	NS	-	1.7
Dichlorodifluoromethane	75-71-8	NS	-	0.989
Ethanol	64-17-5	NS	-	9.42
Ethyl Acetate	141-78-6	NS	-	1.8
Ethylbenzene	100-41-4	NS	-	0.869

Analyte	**CAS Number**	**Preliminary Action Goal (µg/m^3)[5]**	**Achievable Laboratory limits**	
			Method Detection Limits (MDLs) (µg/m^3)	**Reporting Limits (RLs) (µg/m^3)**
Freon-113	76-13-1	NS	-	1.53
Freon-114	76-14-2	NS	-	1.4
Heptane	142-82-5	NS	-	0.82
Hexachlorobutadiene	87-68-3	NS	-	2.13
Isopropanol	67-63-0	NS	-	1.23
Methyl tert butyl ether	1634-04-4	NS	-	0.721
Methylene chloride	75-09-2	60	-	1.74
n-Hexane	110-54-3	NS	-	0.705
o-Xylene	95-47-6	NS	-	0.869
p/m-Xylene	179601-23-1	NS	-	1.74
Styrene	100-42-5	NS	-	0.852
Tertiary butyl Alcohol	75-65-0	NS	-	1.52
Tetrachloroethene	127-18-4	100	-	1.36
Tetrahydrofuran	109-99-9	NS	-	1.47
Toluene	108-88-3	NS	-	0.754
trans-1,2-Dichloroethene	156-60-5	NS	-	0.793
trans-1,3-Dichloropropene	10061-02-6	NS	-	0.908
Trichloroethene	79-01-6	5	-	1.07
Trichlorofluoromethane	75-69-4	NS	-	1.12
Vinyl bromide	593-60-2	NS	-	0.874
Vinyl chloride	75-01-4	NS	-	0.511

1 - Above Preliminary Action Goals for acquired from 6NYCRR 375-6.8 Table 375-6.8(b) Restricted Use Soil Cleanup Objectives;

2 - Above Preliminary Action Goals for acquired from TOGS Table 1 NYS Ambient Water Quality Standards and Guidance Values. Value represents standard unless otherwise indicated.

3 – Preliminary Action Goals acquired from USEPA Regional Screening Level for Tapwater (May 2016)

4 – Preliminary Action Goals acquired from Office of Water Lifetime Health Advisory

5 – Preliminary Action Goal Values obtained from New York State Department of Health Air Guideline Values (Table 3.1 - Guidance for Evaluating Soil Vapor Intrusion in the State of New York)

NS – Not Specified

GV – Guidance Value

QAPP Worksheet #17: Sampling Design and Rationale

As part of the scope of work, PWGC is tasked with the collection of soil, groundwater and soil vapor samples. Samples will be collected to define the horizontal and vertical extent of on-site soil and groundwater contamination. The samples collected will be submitted to an Environmental Laboratory Approval Program (ELAP) laboratory.

Sampling locations shall be selected based on existing sampling data and historical activities information. Specific sampling frequency and locations will be documented in the Remedial Investigation Work Plan. Based upon the results of the first round of sampling, follow-up sampling may be warranted. The initial round of sampling activities shall be confined to the boundaries of the Site and areas immediately adjacent. The SCDHS is currently collecting off-site groundwater analytical data. The data collected off-site by the SCDHS will be used with the data collected on-site to prepare a remedial investigation report.

QAPP Worksheet #18: Sampling Locations and Methods

Sample ID	Matrix[1]	Depth (feet bgs)	Type	Analyte/ Analytical Group	Sampling SOP	Comments
TBD (See RIWP)						

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

Laboratory: TBD
Address:
Contact:
Email:
Phone:

List any required accreditations/certifications: NYSDEC ELAP

Back-up Laboratory: TBD

Sample Delivery Method: Courier

Analyte/ Analyte Group	**Matrix**	**Method/ SOP**	**Accreditation Expiration Date**	**Container(s) (number, size & type per sample)**	**Preservation**	**Preparation Holding Time**	**Analytical Holding Time**	**Data Package Turnaround**
PFCs	Soil	EPA 537, rev 1.1 (modified)						
PFCs	Water	EPA 537		3 x 250 ml HDPE, unlined cap	Trizma Cool < 6 °C	14 days	28 days	
Metals	Soil	EPA 6010C		1 x 2 oz, glass	Metals ex	6 months	6 months	
Metals	Water	EPA 6020A		1 x 500 ml plastic	HNO_3	6 months	6 months	
VOCs	Soil	EPA 8260C		3 x 40 ml VOA, glass vial	1 x Methanol 2 x DI H_2O Cool ≤ 6 °C	48 hours	14 Days	
VOCs	Water	EPA 8260C		3 x 40 ml VOA, glass vial	HCl Cool ≤ 6 °C	48 hours	14 Days	

Analyte/ Analyte Group	Matrix	Method/ SOP	Accreditation Expiration Date	Container(s) (number, size & type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time	Data Package Turnaround
SVOCs	Soil	EPA 8270D		1 x 8 oz, glass	Cool ≤ 6 °C	14 days	40 days	
SVOCs	Water	EPA 8270D		2 x 1000 ml, amber glass	Cool ≤ 6 °C	7 days	40 days	
PCBs	Soil	EPA 8082A		1 x 8 oz, glass	Cool ≤ 6 °C	14 days	40 Days	
PCBs	Water	EPA 8082A		1 x 1000 ml, amber glass	Cool ≤ 6 °C	7 days	40 Days	
Cyanide	Soil	EPA 9010C/9012B		1 x 250 ml, plastic	Cool ≤ 6 °C	14 days	4 days	
Cyanide	Water	EPA 9010C/9012B		1 x 250 ml, plastic	NaOH	14 days	14 days	
Herbicides	Soil	EPA 8151A		1 x 8 oz, glass	Cool ≤ 6 °C	14 days	14 days	
Herbicides	Water	EPA 8151A		1 x 1000 ml, amber glass	Cool ≤ 6 °C	7 days	7 days	
Pesticides	Soil	EPA 8081B		1 x 8 oz, glass	Cool ≤ 6 °C	14 days	14 days	
Pesticides	Water	EPA 8081B		1 x 500 ml, amber glass	Cool ≤ 6 °C	7 days	7 days	
Perchlorate	Soil	EPA 6860		1 x 8 oz, glass	Cool ≤ 6 °C	28 days	28 days	
Perchlorate	Water	EPA 6860		1 x Plastic-A/ Bacteria-A/Stersyringe& Filter	Cool ≤ 6 °C	28 days	28 days	
Hexavalent Chromium	Soil	EPA 7196A		1 x 4 oz, glass	Cool ≤ 6 °C	30 days	30 days	
Hexavalent Chromium	Water	EPA 7196A		1 x 500 ml, Plastic	Cool ≤ 6 °C	24 hrs	24 hrs	

QAPP Worksheet #20: Field QC Summary

Matrix	Analyte/Analytical Group	Field Samples	Field Duplicates	Matrix Spikes	Matrix Spike Duplicates	Field Blanks	Equipment Blanks	Trip Blanks	Other	Total # analyses
Soil/Water	PFCs	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
Soil/Water	Metals	↓	↓	↓	↓	↓	↓	↓	↓	↓
Soil/Water	VOCs									
Soil/Water	SVOCs									
Soil/Water	PCBs									
Soil/Water	Cyanide									
Soil/Water	Herbicides									
Soil/Water	Pesticides									
Soil/Water	Perchlorate									
Soil/Water	Hexavalent Chromium									

*Note: Field QC samples will be collected at the frequency specified in the RIWP.

QAPP Worksheet #21: Field SOPs

SOP # or reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
NA	Remedial Investigation Work Plan	PWGC	NA	Y	
NA	NYSDEC, Division of Environmental Remediation, DER-10, Technical Guidance for Site Investigation and Remediation, 2012	NYSDEC	NA	N	

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment	Activity	SOP Reference	Title or position of responsible person	Frequency	Acceptance Criteria	Corrective Action
Photo-ionization Detector	Screening	Manufacturer Reference	PWGC FTL	Check daily before each use	Pass/fail	Return to rental company for replacement
Dust Meter	Monitoring	Manufacturer Reference	PWGC FTL	Check daily before each use	Pass/Fail	Return to rental company for replacement
Water Quality Meter	Monitoring	Manufacturer Reference	PWGC FTL	Check daily before each use	Pass/Fail	Replacement or Repair
Water Level Meter	Monitoring	Manufacturer Reference	PWGC FTL	Check daily before each use	Pass/Fail	Replacement or Repair

QAPP Worksheet #23: Analytical SOP's

Laboratory: TBD

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
ED-MT-004 (Rev 9)	Trace Metals Analysis by Inductively Coupled Plasma Emission Spectroscopy by using SW846 Method 6010B and 6010C	Definitive	Soil and Aqueous/Metals	ICP-AES	N
ED-MTP-005 (Rev 11)	Hot Block Digestion of Sediments, Sludges, and Soils using SW846 Method 3050B	Definitive	Soil/Metals	Prep	N
ED-MTP-003 (Rev 10)	Digestion of Water and Wastewater Samples for Analysis by ICP using Method 3010A	Definitive	Soil/Aqueous	Prep	N
ED-MSV-014 (Rev 5)	SW846 Method 8260C Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry	Definitive	Soil and Aqueous/Volatile Organics	Purge and Trap GC-MS	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
ED-MSV-002 (Rev 9)	SW846 Method 5035A, Closed System Purge and Trap and Extraction for Volatile Organics in Soil	Definitive	Soil/Volatile Organics	Prep	N
ED-MSV-001 (Rev 9)	Purge and Trap for Aqueous Samples Method 5030, SW846	Definitive	Aqueous/Volatile Organics	Prep	N
ED-MSS-009 (Rev 3)	SW8270D, Semivolatile Organic Compounds by Gas Chromatography/ Mass Spectrometry (GC/MS)	Definitive	Soil and Aqueous/Semivolatile Organics	GC/MS	N
ED-ORP-044 (Rev 11)	SW846 Method 3546: Microwave Extraction of Solids	Definitive	Soil/Semivolatile Organics	Prep	N
ED-ORP-002 (Rev 10)	SW846 Method 3510C-Extraction of Semi-Volatile Organic Compounds in Water by Separatory Funnel	Definitive	Aqueous/Semivolatile Organics	Prep	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
ED-GCS-017 (Rev 4)	SW846 Method 8082A, Analysis of PCBs by Gas Chromatography	Definitive	Soil and Aqueous/PCBs	GC-ECD	N
	Determination of Selected Perfluorinated Alkyl Acids (PFAA) in Drinking Water by Solid Phase Extraction (SPE) and Analysis by Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS); Rev. 1.4; November 4, 2016	Definitive	Water/PFCs	LC/MS/MS	N
	Waste Disposal; Rev. 4.5; September 18, 2015	N/A (Disposal)	Water/PFCs	N/A (Disposal)	N
	Sample Receipt and Procedures; Rev/ 12.1; June 24, 2016	N/A (Receiving)	Water/PFCs	N/A (Receiving)	N
ED-GCS-016 (Rev 3)	SW846 Method 8081B, Analysis of Organochlorine Pesticides by Gas Chromatography	Definitive	Soil and Aqueous/Pesticides	GC-ECD	N
ED-GCS-005 (Rev 9)	SW846 Method 8151A Analysis of Organochlorine Herbicides	Definitive	Soil and Aqueous/Herbicides	GC-ECD	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
ED-ORP-023 (Rev 9)	SW846 Method 8151A Extraction of Organochlorine Herbicides in Soil	Definitive	Soil and Aqueous/Herbicides	Prep	N
ED-ORP-015 (Rev 13)	SW846 Method 8151 Extraction of Organochlorine Herbicides in Water	Definitive	Soil and Aqueous/Herbicides	Prep	N
ED-WET-012 (Rev 8)	SW846 7196A, The Analysis of Waters for Hexavalent Chromium	Definitive	Aqueous/Hex Chrom	UV-VIS Spectrophotometer	N
ED-WET-010 (Rev 12)	SW846 3060A, The Alkaline Digestion of Soil Samples for the Analysis of Hexavalent Chromium	Definitive	Soil/Hex Chrom	Prep	N

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
ED-WET-011 (Rev 10)	SW846 7196A, The Analysis of Digestates for Hexavalent Chromium	Definitive	Soil/Hex Chrom	UV-VIS Spectrophotometer	N
ED-WET-002 (Rev 11)	CYANIDE, Analysis of Total and Amenable Cyanide in Water, Waste Water, and Soil - Automated (EPA SW846 9012B; 335.4 and Standard Method 4500 CN^-C, G)	Definitive	Soil/Cyanide	UV-VIS Spectrophotometer	N

QAPP Worksheet #24: Analytical Instrument Calibration

Laboratory: TBD

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action (CA)	Title/position responsible for Corrective Action	SOP Reference
Metals	**1)** Initial calibration (ICAL) **2)** Initial Calibration Verification (ICV) (second source) **3)** Continuing Calibration Verification (CCV)	2.0-250000 ppb (varies by analyte)	**1)** Daily **2)** After ICAL before sample analysis **3)** At the beginning and end of analysis and after every 10 samples	**1)**Correlation≥0.998 **2)** Within +/- 10% of the true value **3)** Within +/- 10% of the true value	All: Table 2 of SOP.	Analyst/Department Manager	ED-MT-004
GC/MS (Semivolatiles)	**1)** MS Tuning Check (BFB) **2)** Initial calibration (ICAL) **3)** Initial Calibration Verification (ICV) (second source) Continuing Calibration Verification (CCV)	ICAL range = 5-120 ppm	**1)** 12 hours **2)** Initially and as needed. **3)** After ICAL 12 hours (after tuning check)	**1)** Criteria outlined in Sec. 9.2.1 of SOP. **2)** Criteria outlined in Sec. 9.2.4.2 of SOP. **3)** Criteria outlined in Sect. 9.2.4.3 of SOP. Criteria outlined in Sec. 9.2.4.2 of SOP.	**1)** Outlined in Sec. 9.2.1 of SOP. **2)** Outlined in Sec. 9.2.4.2 of SOP. **3)** Outlined in Sect. 9.2.4.3 of SOP. Outlined in Sec. 9.2.4.2 of SOP.	Analyst/Department Manager	ED-MSS-009
GC/MS (Volatiles)	**1)** MS Tuning Check (BFB) **2)** Initial calibration (ICAL) **3)** Initial Calibration Verification (ICV) (second source) **4)** Continuing Calibration Verification (CCV)	ICAL range 0.5-500 ppb	**1)** 12 hours **2)** Initially and as needed. **3)** After ICAL 12 hours (after tuning check)	**1)** Criteria outlined in Sec. 9.2.1 of SOP. **2)** Criteria outlined in Sec. 9.2.4.2 of SOP. **3)** Criteria outlined in Sect. 9.2.4.3 of SOP. Criteria outlined in Sec. 9.2.4.2 of SOP.	**1)** Outlined in Sec. 9.2.1 of SOP. **2)** Outlined in Sec. 9.2.4.2 of SOP. **3)** Outlined in Sect. 9.2.4.3 of SOP. Outlined in Sec. 9.2.4.2 of SOP.	Analyst/Department Manager	ED-MSV-014
LC/MS/MS	**1)** Tune Check **2)** Minimum five-point initial calibration for target analytes, lowest concentration standard at or below the RL **3)** Peak Asymmetry Verification		**1)** Prior to ICAL and after any mass calibration or maintenance is performed **2)** Initial Calibration prior to sample analysis **3)** With initial calibration	**1)** Tune Standard must contain analytes of interest or appropriate substitute. Mass assignments of tuning standard within 0.5 amu of true value.	**1)** Retune instrument. If the tuning will not meet acceptance criteria, an instrument mass calibration must be performed and the tuning redone. **2)** Evaluate standards, chromatography, and mass spectrometer response. If	Analyst/Department Manager	WS-DW-0004

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action (CA)	Title/position responsible for Corrective Action	SOP Reference
	4) Second-source calibration verification **5)** Daily calibration verification		**4)** Once per initial calibration, following initial calibration **5)** Before sample analysis, after every 10 samples, and at the end of the sequence.	**2)** Each Calibration point for each analyte (natives and surrogates) must calculate to be within 40-130 percent, except the lowest calibration point, which must calculate to within 50 to 150 percent for natives. **3)** Calculated factor in the range of 0.8 to 1.5 **4)** All reported analytes and labeled compounds within +/- 30 percent of true value **5)** If CCV </= LOQ, analytes must be within =/- 50 percent of true value, surrogates within +/- 30 percent of true value. For CCVs>LOQ, all analytes (including surrogates) must be within +/- 50 percent of true value and 70 to 140 percent of the most recent prior CCV.	problem found with above, correct as appropriate, then repeat initial calibration. **3)** Change instrument conditions to correct, then repeat initial calibration. **4)** Evaluate data. If problem (e.g., concentrated standard, plugged transfer line) found, correct then repeat second source verification. If it still fails, then repeat initial calibration. **5)** Evaluate failure and impact on samples. If samples non-detect for analytes that have a high bias, report non-detect results with case narrative comment. For closing CCVs, if compounds are not identified as critical compounds of concern report results with qualifiers. For closing CCVs if the compound is identified as a critical compound of concern, then recalibrate, and reanalyze all affected samples since the last acceptable CCV; or Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, take CA(s) and recalibrate; then reanalyze all affected samples since the last acceptable CCV.		
GC (PCBs)	1) Initial calibration (ICAL) 2) Initial Calibration Verification (ICV) (second source) 3) Continuing Calibration Verification (CCV)	50-2500 ppb	Initial: After instrument set up and when calibration verification fails; minimum 5 points or 6 points (non-linear) Continuing: Daily prior to samples and after every 20 samples, or every 12 hours, whichever is more frequent	Initial: %RSD < 20 or r > 0.995 Continuing: %D < 15	Perform necessary equipment maintenance and check calibration standards	Lab Analyst	ED-GCS-017

Instrument	Calibration Procedure	Calibration Range	Frequency	Acceptance Criteria	Corrective Action (CA)	Title/position responsible for Corrective Action	SOP Reference
GC (Pesticides)	1) Initial calibration (ICAL) 2) Initial Calibration Verification (ICV) (second source) 3) Continuing Calibration Verification (CCV)	50-2500 ppb	Initial: After instrument set up and when calibration verification fails; minimum 5 points or 6 points (non-linear) Continuing: Daily prior to samples and after every 20 samples, or every 12 hours, whichever is more frequent	Initial: %RSD < 20 or r > 0.995 Continuing: %D < 15	Perform necessary equipment maintenance and check calibration standards	Lab Analyst	ED-GCS-016
GC (Herbicides)	1) Initial Calibration (ICAL) 2) Initial Calibration Verification (ICV) 3) Continuing Calibration Verification (CCV)	0.25-2.5 ppm	1) Initially and as needed. 2) After ICAL; 3) 12 hours	**1) <20% RSD or Correlation** ≥0.990 2) Must be within +/- 15% D of expected concentration 3) Must be within +/- 15% D of expected concentration	**1)** Recalibrate **2)** Reanalyze. If still outside limits recalibrate **3)** Fix the problem & reanalyze the previous samples	Analyst/Department Manager	ED-GCS-005
UV-Visible Spectrophotometer – Total Cyanide	1) Initial Calibration (ICAL) 2) Initial Calibration Verification (ICV) 3) Continuing Calibration Verification (CCV)	0.01-0.4 ppm	Daily	Correlelation coefficient ≥0.995	Reject data, reanalyze under acceptable calibration	Analyst/Department Manager	ED-WET-002
UV-Visible Spectrophotometer – Hexavalent Chromium	1) Initial Calibration (ICAL) 2) Initial Calibration Verification (ICV) 3) Continuing Calibration Verification (CCV)	10-200 ppb (water) 0.05-1.25 ppm (solid)	Daily	Correlation coefficient ≥0.995	Reject data, reanalyze under acceptable calibration	Analyst/Department Manager	ED-WET-010 and ED-WET-011

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Laboratory: TBD

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	Reference
Gas Chromatograph/ Mass Spectrometer (GC.MS) (VOA and SVOA)	-Dust around instrument and instrument surface. -Check all fans and clean filter -Remove syringe, clean, reinstall or replace (SVs) -Remove all glassware and acid wash(VOC)	NA	NA	Monthly	Per SOP	Per SOP	Analyst	ED-MSS-009 ED-MSV-014
	-Replace roughing pump oil -Replace aux pump oil (VOC)			Every 6 months				
	-Replace forline trap absorbent. -Lubricate turbo pump			Yearly				

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Title/position responsible for corrective action	Reference
	-Methanol rinse Tekmar (VOC) -Renew chemical filter -Clean injection port -Clean source -Change Column Change trap	NA	NA	As needed				
Inductively Coupled Plasma (ICP) (Metals)	Perform leak test, change pump tubing, change torch and window, clean filters	Monitor instrument performance via CCV and CCB	Monitor instrument performance via CCV and CCB	Daily, after every 10 samples	Per Laboratory SOP	Replace pump tubing, replace torch and window, clean all filters	Laboratory analyst	ED-MT-004
Gas Chromatograph	Compare standard response to previous day or since last initial calibration Check carrier gas flow rate in column Check temp. of detector, inlet, column oven	Monitor instrument performance via CCV and CCB,	As required	Daily	Per Laboratory SOP	Replace Septa, Clean and replace Injection Port Liner, Replace or clip Guard and or analytical Columns Clean Detector	Laboratory Analyst	ED-GCS-016
LC/MS/MS	Replace columns as needed, check eluent reservoirs	Sensitivity Check	Instrument performance and sensitivity	Daily or as needed	CCV pass criteria	Recalibrate	Lab Chemist	WS-DW-0004

QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal

Sampling Organization: PWGC

Laboratory: TBD

Method of sample delivery (shipper/carrier): Laboratory Courier

Number of days from reporting until sample disposal: 90

Activity	Organization and title or position of person responsible for the activity	Protocol
Sample labeling	PWGC/FTL	See Below
Chain-of-custody form completion	PWGC/FTL	See Below
Packaging	PWGC/FTL	See Below
Shipping coordination	PWGC/PM	See Below
Sample receipt, inspection, & log-in	Laboratory Sample Receipt Tech	See Below
Sample custody and storage	Laboratory Lab Team Leader	See Below
Sample disposal	Laboratory Lab Waste Manager	See Below

Sample Collection: PWGC staff will collect all samples. Samples will be labeled with a specific sample ID that depicts a specific location. A coding system will be used to identify each sample collected during the duration of the project. This coding system will provide a tracking record to allow retrieval of information about a particular sample and ensure that each sample is uniquely identified. Each sample will be identified by a unique code which will indicate the sample date, type, sample number, and sample depth where applicable. The total number and types of samples collected will be detailed in the RIWP.

Sample Packaging: Qualified PWGC personnel will perform the sample packaging. Samples will be packed in dedicated coolers and ice added in double sealed Ziploc bags when necessary for preservation. This task will be assigned to experienced field personnel.

Coordination of Shipment: PWGC FTL, and Lab coordinator.

Type of Shipment/Carrier: Laboratory Couriers will drop off empty sample jars and pick up the completed at a designated location and frequency to be determined.

SAMPLE RECEIPT AND ANALYSIS

Sample Receipt (Personnel/Organization): Laboratory Sample Custodian - TBD. The Laboratory assignment sheet will indicate the laboratory sample custodian, and if a subcontract laboratory is required. The laboratory project officer will notify the field team of the laboratory sample custodian.

Sample Custody and Storage (Personnel/Organization): TBD

Sample Preparation (Personnel/Organization): TBD

Sample Determinative Analysis (Personnel/Organization): TBD

SAMPLE ARCHIVING

Field Sample Storage (No. of days from sample collection): All samples will be shipped to a laboratory or a subcontract laboratory within the required holding times.

Sample Extract/ Digestate Storage (No. of days from extraction/digestion): Refer to Worksheet #19 for holding time requirements

SAMPLE DISPOSAL

Laboratory responsible for analysis will dispose of samples in accordance with the applicable regulations.

Number of Days from Analysis: 90 days

QAPP Worksheet #28A: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil /Water
Analytical Group: VOA
Analytical Method: SW-846 8260C

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Method Blank	1/batch	<RL, Common contaminants (acetone, methylene chloride, MEK) must be <5x RL	Reanalyze. Report non-conformances in narrative. 'B' flag as needed.	Analyst	Accuracy
LCS	1/batch	Recoveries within lab generated limits.	Reanalyze if necessary, qualify data and narrate.	Analyst	Accuracy
Matrix Spike	1/20 samples	Recoveries within lab generated limits.	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Accuracy
Matrix Spike Duplicate	1/20 samples	⩽ 30% RPD	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Precision

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	Laboratory	Precision
Field Blanks	1 per Day	<2X RL	If <RL and ≤ AL, qualify as non-detect at the RL If >RL and ≤ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	Laboratory	Precision

QAPP Worksheet #28B: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: SVOCs
Analytical Method: SW-846 8270D

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
ICV/CCV	Once/Calibration, every ten samples afterwards	80-120%	Rerun once, recalibrate on continued failure	Analyst	Accuracy
Method Blank	1/batch	<RL, Common contaminants (phthalates) must be <5x RL	Reanalyze. Report non-conformances in narrative. 'B' flag as needed.	Analyst	Accuracy
LCS	1/batch	Recoveries within lab generated limits.	Reanalyze if necessary, qualify data and narrate.	Analyst	Accuracy
Matrix Spike	1/20 samples	Recoveries within lab generated limits.	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Accuracy

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Matrix Spike Duplicate	1/20 samples	⩽ 30% RPD	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Precision
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	QA Officer	Precision
Field Blanks	1 per Day	<2X RL	If <RL and ⩽ AL, qualify as non-detect at the RL If >RL and ⩽ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	QA Officer	Precision

QAPP Worksheet #28C: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: Metals
Analytical Method: SW-846 6010C

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
ICV/CCV	Once per calibration; every ten samples afterwards	90-110%; 90-110% on continuing	Rerun once; recalibrate on continued failure	Analyst	Accuracy
ICB/CCB	Once per calibration; every ten samples afterwards	< RL; > 2x RL if below zero	Rerun once; recalibrate on continued failure	Analyst	Accuracy
CRI	Once per calibration	70-130%	Rerun once; recalibrate on continued failure	Analyst	RL Accuracy
Method Blank	1/batch	< RL, > 2x RL if below zero	Rerun once, re-digest batch on continued failure	Analyst	Accuracy

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
LCS	1/batch	80-120% for aqueous; Vendor limits for soils	Rerun once, re-digest batch on continued failure	Analyst	Accuracy
Matrix Spike	1/20 samples	75-125%	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Accuracy
Post Spike	1/20 samples	80-120%	Review data for errors and narrate non-conformance	Analyst	Accuracy
Sample Duplicate	1/20 samples	≤ 20% RPD	Review data for errors and narrate non-conformance	Analyst	Precision
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	QA Officer	Precision
Equipment Blank	1 per Day	<2X RL	If <RL and ⩽ AL, qualify as non-detect at the RL If >RL and ⩽ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	QA Officer	Precision

QAPP Worksheet #28D: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: PCBs
Analytical Method: SW-846 8082A

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
ICV/CCV	Once/Calibration, every ten samples afterwards	80-120%	Rerun once, recalibrate on continued failure	Analyst	Accuracy
Method Blank	1/batch	<RL	Reanalyze. Report non-conformances in narrative. 'B' flag as needed.	Analyst	Accuracy
LCS	1/batch	Recoveries within lab generated limits.	Reanalyze if necessary, qualify data and narrate.	Analyst	Accuracy
Matrix Spike	1/20 samples	Recoveries within lab generated limits.	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Accuracy

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Matrix Spike Duplicate	1/20 samples	⩽ 30% RPD	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Precision
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	QA Officer	Precision
Field Blanks	1 per Day	<2X RL	If <RL and ⩽ AL, qualify as non-detect at the RL If >RL and ⩽ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	QA Officer	Precision

QAPP Worksheet #28E: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: PFC
Analytical Method: USEPA Method 537

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Internal Standards	Every samples, spiked sample and method blank	%R within 70–130%	Evaluate the data, and re-prepare/reanalyze if laboratory error is indicated. If matrix affect demonstrated for a representative sample set, discuss with PC.	Analyst	Same as method/SOP QC Acceptance Limits
Method Blank	One per prep batch of 20 or fewer samples of similar matrix; or one per day, whichever comes first	No analytes detected > 1/2 LOQ or >1/10 sample concentration or >1/10 regulatory limit, whichever is greater. For common laboratory contaminants, no analytes detected >LOQ	Verify instrument clean (evaluate calibration blank and samples prior to method blank), then reanalyze. Evaluate to determine if systematic issue within laboratory, correct, then re-prepare and reanalyze the method blank and all samples processed with the contaminated blank in accordance with DoD QSM requirements.	Analyst	Same as method/SOP QC Acceptance Limits
LCS	One per prep batch of 20 or fewer samples of similar matrix; or one per day, whichever comes first	Recoveries within lab generated limits.	Reanalyze if necessary, qualify data and narrate.	Analyst	Same as method/SOP QC Acceptance Limits

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Matrix Spike/Matrix Spike Duplicate	One per prep batch of 20 or fewer samples of similar matrix; or one per day, whichever comes first	Method Limits of 70 to 130 percent for spikes > LOQ, and 50 to 150 percent for spikes at or below the LOQ.	Evaluate the data, and re-prepare /reanalyze the native sample and MS/MSD pair if laboratory error is indicated.	Analyst	Same as method/SOP QC Acceptance Limits
Surrogates	Every samples, spiked sample, and method blank	%R within 70 to 130 percent.	Evaluate the data, and re-prepare/reanalyze if laboratory error is indicated. If matrix affect demonstrated for a representative sample set, discuss with PC.	Analyst	Same as method/SOP QC Acceptance Limits

QAPP Worksheet #28F: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: Perchlorate
Analytical Method: EPA6860

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Matrix Spike Duplicate	1/20 samples	⩽ 30% RPD	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Precision
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	QA Officer	Precision
Field Blanks	1 per Day	<2X RL	If <RL and ⩽ AL, qualify as non-detect at the RL If >RL and ⩽ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	QA Officer	Precision

QAPP Worksheet #28G: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: Pesticides
Analytical Method: EPA8081B

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Matrix Spike Duplicate	1/20 samples	⩽ 30% RPD	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Precision
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	QA Officer	Precision
Field Blanks	1 per Day	<2X RL	If <RL and ⩽ AL, qualify as non-detect at the RL If >RL and ⩽ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	QA Officer	Precision

QAPP Worksheet #28H: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: Herbicides
Analytical Method: EPA 8151A

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Matrix Spike Duplicate	1/20 samples	⩽ 30% RPD	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Precision
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	QA Officer	Precision
Field Blanks	1 per Day	<2X RL	If <RL and ⩽ AL, qualify as non-detect at the RL If >RL and ⩽ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	QA Officer	Precision

QAPP Worksheet #28I: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: Cyanide
Analytical Method: EPA 9010C/9012B

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Matrix Spike Duplicate	1/20 samples	≤ 30% RPD	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Precision
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	QA Officer	Precision
Field Blanks	1 per Day	<2X RL	If <RL and ≤ AL, qualify as non-detect at the RL If >RL and ≤ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	QA Officer	Precision

QAPP Worksheet #28J: Analytical Quality Control and Corrective Action

Laboratory: TBD
Matrix: Soil/Water
Analytical Group: Hexavalent Chromium
Analytical Method: EPA 7196A

QC Sample	Number/Frequency	Method/SOP Acceptance Criteria	Corrective Action	Title/position of person responsible for corrective action	Project-Specific MPC
Matrix Spike Duplicate	1/20 samples	⩽ 30% RPD	Check LCS; If recoveries are acceptable in LCS, qualify data and narrate non-conformance	Analyst	Precision
Blind Duplicate	1/20 Samples	2XQL	If > 5XQL and RPD > 100; estimate results in the field duplicate pair If < 5X QL; the sample and duplicate results must be within 2 X QL	QA Officer	Precision
Field Blanks	1 per Day	<2X RL	If <RL and ⩽ AL, qualify as non-detect at the RL If >RL and ⩽ AL, qualify as not detected at the reported concentration If > RL and > AL, reject sample result	QA Officer	Precision

QAPP Worksheet #29: Project Documents and Records

Sample Collection Field Records			
Record	Generation	Verification	Storage location/archival
Field logbook or data collection sheets	PWGC FTL	PWGC PM	Project File
Chain-of-Custody Forms	PWGC FTL	PWGC PM	Project File
Photo-documentation	PWGC FTL	PWGC PM	Project File

Project Assessments			
Record	Generation	Verification	Storage location/archival
Data validation report	Data Validator	PWGC PM	Project File
Data usability assessment report	Data Validator	PWGC PM	Project File

QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action

Assessments:

Assessment Type	Frequency	Internal or External	Organization Performance Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
Laboratory Technical Systems/Performance Audits	TBD	External	PWGC/SCDHS/NYSDEC	TBD	TBD	TBD	PWGC/SCDHS/NYSDEC
Performance Evaluation Samples	TBD	External	PWGC/SCDHS/NYSDEC	TBD	TBD	TBD	PWGC/NYSDEC/NYSDEC
Sample Collection and Documentation	Once	Internal	PWGC	TBD	TBD	TBD	PWGC
Health and Safety	Once If warranted	Internal	PWGC	TBD	TBD	TBD	PWGC
Field Audit	Once	Internal	PWGC	TBD	TBD	TBD	PWGC
Data Review	Once	Internal	PWGC	TBD	TBD	TBD	PWGC

Assessment Response and Corrective Action:

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Timeframe for Response
Laboratory Technical Systems/Performance Audits	Written Report	Laboratory Manager & PWGC	30 days	Letter	TBD	14 days
Performance Evaluation Samples	Electronic Report	Laboratory Manager & PWGC	30 days	Letter or Written Report	TBD	14 days
Project Readiness Review	Checklist or logbook entry	PWGC FTL	Immediately to within 24 hours of review	Checklist or logbook entry	PWGC FTL	Immediately to within 24 hours of review
Field Observations/Deviations from work plan	Logbook	PWGC FTL	Immediately to within 24 hours of deviation	Logbook	PWGC FTL	Immediately to within 24 hours of deviation
On-Site Field Inspection	Written Report	PWGC FTL	7 calendar days after completion of the audit	Letter/Internal Memorandum	PWGC FTL	To be identified in the cover letter of the report
Health and Safety	Audit Checklist	PWGC PM	Notify by phone immediately	Memorandum and checklist	PWGC Health & Safety Manager	10-30 days from notice
Field Audit	Field Audit Report	PWGC PM	Provide summary of findings to field team on day of audit	Corrective Action Plan	PWGC QA Manager	10-30 days from notice
Data Review	Memorandum	Data Validator	Notify by phone – 24 hours	Memorandum	PWGC PM	TBD

QAPP Worksheet #34: Data Verification and Validation Inputs

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Field SOPs	X	
3	Laboratory SOPs	X	
Field Records			
4	Field logbooks	X	X
5	Equipment calibration records	X	X
6	Chain-of-Custody Forms	X	X
7	Sampling diagrams/surveys	X	X
8	Drilling logs	X	X
9	Relevant Correspondence	X	X
10	Field audit reports	X	X
11	Field corrective action reports	X	X
Analytical Data Package			
12	Cover sheet (laboratory identifying information)	X	X
13	Case narrative	X	X
14	Internal laboratory chain-of-custody	X	X
15	Sample receipt records	X	X
16	Sample chronology (i.e. dates and times of receipt, preparation, & analysis)	X	X
17	Communication records	X	X
18	Project-specific PT sample results	X	X
19	LOD/LOQ establishment and verification	X	X
20	Standards Traceability	X	X
21	Instrument calibration records	X	X
22	Definition of laboratory qualifiers	X	X
23	Results reporting forms	X	X
24	QC sample results	X	X
25	Corrective action reports	X	X
26	Raw data	X	X
27	Electronic data deliverable	X	X

QAPP Worksheet #35: Data Verification Procedures

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field logbook	QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Daily – PWGC PM At conclusion of field activities - Project QA Manager
COC forms	QAPP	Verify the completeness of chain-of-custody records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Daily – PWGC Lab At conclusion of field activities - Project Manager

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Laboratory Deliverable	QAPP	Verify that the laboratory deliverable contains all records specified in the QAPP. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with the COCs to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Before release – Laboratory QA Manager Upon receipt - Project Chemist
Audit Reports, Corrective Action Reports	QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	Project QA Manager

QAPP Worksheet #36: Data Validation Procedures

Data Validator: LDC

Analytical Group/Method:	Volatile Organics – SW-846 8260	Semivolatile Organics – SW-846 8270	Metals – SW-846 6010	PCBs – SW-846 8082
Data deliverable requirements:	Category B (pdf)	Category B (pdf)	Category B (pdf)	Category B (pdf)
Analytical specifications:	WS 28-1	WS-28-2	WS 28-3	WS 28-3
Measurement performance criteria:	WS 12	WS 12	WS 12	WS 12
Percent of data packages to be validated:	100%	100%	100%	100%
Percent of raw data reviewed:	100%	100%	100%	100%
Percent of results to be recalculated:	10%	10%	10%	10%
Validation procedure:	EPA Region 2 – Category B	EPA Region 2 – Category B	EPA Region 2 – Category B	EPA Region 2 – Category B
Validation code (*see attached table):	S4VM	S4VM	S4VM	S4VM
Electronic validation program/version:	Not applicable	Not applicable	Not applicable	Not applicable

Validation Code and Label Identifier Table (To be attached to the QAPP)

Validation Code*	Validation Label	Description/Reference
S1VE	Stage 1 Validation Electronic	EPA 540-R-08-005
S1VM	Stage 1 Validation Manual	EPA 540-R-08-005
S1VEM	Stage 1 Validation Electronic and Manual	EPA 540-R-08-005
S2aVE	Stage 2a Validation Electronic	EPA 540-R-08-005
S2aVM	Stage 2a Validation Manual	EPA 540-R-08-005
S2aVEM	Stage 2a Validation Electronic and Manual	EPA 540-R-08-005
S2bVE	Stage 2b Validation Electronic	EPA 540-R-08-005
S2bVM	Stage 2b Validation Manual	EPA 540-R-08-005
S2bVEM	Stage 2b Validation Electronic and Manual	EPA 540-R-08-005
S3VE	Stage 3 Validation Electronic	EPA 540-R-08-005
S3VM	Stage 3 Validation Manual	EPA 540-R-08-005
S3VEM	Stage 3 Validation Electronic and Manual	EPA 540-R-08-005
S4VE	Stage 4 Validation Electronic	EPA 540-R-08-005
S4VM	Stage 4 Validation Manual	EPA 540-R-08-005
S4VEM	Stage 4 Validation Electronic and Manual	EPA 540-R-08-005
NV	Not Validated	EPA 540-R-08-005

The following data qualifiers will be applied during data validation by a third party. Potential impacts on project-specific data quality objectives will be discussed in the data validation report.

U - The analyte was analyzed for, but due to blank contamination was flagged as nondetect (U). The result is usable as a nondetect.

J - Data are flagged (J) when a QC analysis fails outside the primary acceptance limits. The qualified “J” data are not excluded from further review or consideration. However, only one flag (J) is applied to a sample result, even though several associated QC analyses may fail. The ‘J’ data may be biased high or low or the direction of the bias may be indeterminable.

UJ - The analyte was not detected above the reported sample quantitation limit. Data are flagged (UJ) when a QC analysis fails outside the primary acceptance limits. The qualified "UJ" data are not excluded from further review or consideration. However, only one flag is applied to a sample result, even though several associated QC analyses may fail. The 'UJ' data may be biased low.

JN - The analysis indicates the presence of a compound that has been "tentatively identified" (N) and the associated numerical value represents its approximate (J) concentration.

R - Data rejected (R) on the basis of an unacceptable QC analysis should be excluded from further review or consideration. Data are rejected when associated QC analysis results exceed the expanded control limits of the QC criteria. The rejected data are known to contain significant errors based on documented information. The data user must not use the rejected data to make environmental decisions. The presence or absence of the analyte cannot be verified.

Category B Data Package Deliverables

All Analytical Fractions
Case Narrative – A detailed case narrative per analytical fraction and will include explanation of any non-compliance and/or exceptions and corrective action.
Sample ID Cross Reference Sheet (Lab ID's and Client ID's)
Completed Chain of Custody and any sample receipt information
Sample preparation (extraction/digestion) logs

Form *	**GC/MS Organic Fractions**
1	Sample results + raw
2	Surrogate Recovery Summary (w/ applicable control limits)
3	MS/MSD Accuracy & Precision Summary ** + raw
3	LCS Accuracy Summary + raw
4	Method Blank Summary + raw
5	Instrument Tuning Summary (including tuning summary for applicable initial calibrations)
6	Initial Calibration Summary (including concentration levels of standards) + raw
7	Continuing Calibration Summary + raw
8	Internal Standard Summary (including applicable initial calibrations)

Form *	**Metals Inorganic Fractions *****
1	Sample Results + raw
2A	Initial and Continuing Calibration Summary + raw

3 Initial and Continuing Calibration Blanks and Method Blanks Summary + raw
4 Interference Check Standard Summary + raw
5A Pre-digestion Matrix Spike Recoveries Summary + raw
5B Post-digestion Spike Recoveries Summary + raw
6 Native Duplicate or MS/MSD Precision Summary ** + raw
7 Laboratory Control Sample Recovery Summary + raw
8 Serial Dilutions and Method of Standard Addition (if necessary) + raw
9 Instrument or Method Detection Limit Summary
10 ICP Interelement Correction Factors
11 Linear Range Summary
12 Preparation Log Summary + raw
13 Analytical Run Sequence + raw

Form * **General Chemistry Fractions ***:** (Includes potentiometric, gravimetric, colorimetric, and titrimetric analytical techniques. Examples, TPH (418.1), TOC, etc.)
1B Sample Results + raw
2 Initial and Continuing Calibration Verifications and Blanks (if necessary) + raw
3 Method Blanks Summary + raw
5 Pre-digestion Matrix Spike/Matrix Spike Duplicate Recoveries and Precision Summary + raw
6 Duplicate Precision Summary ** + raw
7A Laboratory Control Sample Recovery Summary + raw
9 Reporting Limit / Method Detection Limit Summary
12 Preparation Log Summary (if necessary) + raw
13 Analytical Run Sequence + raw

* CLP Form or summary form with equivalent information
** with RPD calculated according to method specifications (CLP using % recovery, SW-846 using concentration)
*** All raw data is reported after the summary forms and not in each individual section

QAPP Worksheet #37: Data Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: The Data Usability Assessment will be performed by a team of personnel at LDC. LDC will be responsible for information in the Usability Assessment and will also be responsible for assigning task work to the individual task members who will be supporting the Data Usability Assessment. Note that the Data Usability Assessment will be conducted on validated data. After the Data Usability Assessment, has been performed, data deemed appropriate for use will then be used in the S*I Report*. The results of the Data Usability Assessment will be presented in the project-specific report. The following items will be assessed and conclusions drawn based on their results.

Precision – Results of laboratory duplicates will be assessed during data validation and data will be qualified according to the data validation procedures cited on Worksheet #36. Field duplicates will be assessed by matrix using the RPD for each pair of results reported above CRQL for organic and inorganic analyses respectively. RPD acceptance criteria, presented in Worksheet #12, will be used to access field sampling precision. Absolute difference will be used for low results as described in worksheets 12 and 28. A discussion summarizing the results of laboratory and field precision and any limitations on the use of the data will be described.

Field duplicates – The data validator will review the extent of exceedance of the field duplicate criteria. For groundwater, the sample results will be flagged according to the data validation protocol. For soils, the exceedances will be compared with the field lithological logs and grain size results, if available. Based on this review, the project manager will determine whether the exceedance is due to inherent soil heterogeneity or the result of sample handling in the field or laboratory. This information will be included in the data assessment report. As an added measure, the field team leader will be asked to inspect the soil coning and quartering procedures and re-train staff if needed. The data assessor will review the data validation report. If the field duplicate comparison is not included, it will be performed by the assessor.

Accuracy/Bias Contamination –Laboratory blank results will be assessed as part of data validation. During the data validation process the validator will qualify the data following the procedures listed on Worksheet #36. A discussion summarizing the results of laboratory accuracy and bias based on contamination will be presented and limitations on the use of the data will be described.

Overall Accuracy/Bias – The results of instrument calibration and matrix spike recoveries will be reviewed and data will be qualified according to the data validation procedures cited on Worksheet #36. A discussion summarizing the results of laboratory accuracy and any limitations on the use of the data will be described.

Sensitivity – Data results will be compared to criteria provided on Worksheet #15. A discussion summarizing any conclusions about sensitivity of the analyses will be presented and any limitations on the use of the data will be described.

Representativeness – A review of adherence to the sampling plan, field procedures and of project QA audits will be performed in order to assess the representativeness of the sampling program. Data validation narratives will also be reviewed and any conclusions about the representativeness of the data set will be discussed.

Comparability – Study results will be used in conjunction with existing data to make qualitative and quantitative assessments of the data to be used to produce the Site reports.

Reconciliation – The DQIs presented in Worksheet #12 will be examined to determine if the MPC were met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of major impacts observed from data validation, data quality indicators and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. Based on the quality determined, the usability of the data for each analysis will be determined. Ba sed on the combined usability of the data from all analyses for an objective, it will be determined if the DQIs were met and whether project goals were achieved. As part of the reconciliation of each objective, conclusions will be drawn and any limitations on the usability of any of the data will be described.

Completeness - The Environmental Quality Information Systems (EQuIS) database will be queried to summarize the number of samples in each analytical fraction that are estimated and rejected. This data will be used along with the planned samples indicated in the QAPP to calculate the completeness of the obtained data set.

Data validation reports will be reviewed to determine the quality of the data and potential impacts on data usability. Field duplicates will be evaluated against the MPCs outlined in worksheet #12. Non-compliant data will be discussed in the usability report. The following equations will be used:

1. To calculate field duplicate precision: RPD = 100 x 2 |X1 - X2 | / (X1 + X2) where X1 and X2 are the reported concentrations for each duplicate or replicate

2. To calculate completeness: % Completeness = V/n x 100

where V= number of measurements judged valid; n = total number of measurements made and % Completeness = C/x x 100

where C= number of samples collected; x = total number of measurements planned

2. *Describe the evaluative procedures used to assess overall measurement error associated with the project:* PWGC will determine if quality control data is within specifications (MPC) through the data assessment and data validation process.

3. Identify the personnel responsible for performing the usability assessment: LDC, Christina Rink-Ashdown

4. Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: A usability report will describe the rationale for the data used and present any data limitations. The report will include a discussion of the accuracy, precision, representativeness, completeness and comparability of the data set and deviations from planned procedures and analysis and the impact on the project objectives. Tables will be prepared, including: a summary of planned samples, collected samples and parameters analyzed; detections in field and trip blanks; comparison of field duplicates; and a comparison of planned and actual detection limits.

5. Discuss the impacts of any qualified data, any deviations from original plan or sampling procedures, whether the project objectives were met, etc.

The following procedures will be followed for using data in preparing the RI Report.

- Defining the nature and extent of contamination – [PWGC will evaluate individual sample results for the RI Report. The sample results will be compared to the site-specific screening criteria defined as project action limits on worksheet #15. In addition, as part of the RI Report, figures will be generated in order to further refine the understanding of the nature and extent of contamination and to help identify data gaps. Figures may include geological profiles and cross-sections, water table maps, contaminant iso-concentration maps, and longitudinal and cross-sectional profiles of groundwater contamination.
- Identifying data gaps - Data gaps will be identified while writing the RI Report. As soon as data gaps are identified, PWGC will discuss them with USEPA/NYSDEC. To identify data gaps, PWGC will evaluate the analytical results by media and determine if results indicate levels or locations of contamination that need to be further delineated.
    - Using qualified data - PWGC utilizes all data not rejected during validation to determine the nature and extent of contamination.
- Deciding if high results are legitimate or outliers - PWGC will assume that all data not rejected during validation will be considered in defining the nature and extent of contamination at the site. PWGC will work with NYSDEC if there is a concern about the statistical validity of the sample results. In particular, high "outlier" results that do not have surrounding comparable results as confirmation will be discussed with NYSDEC.

APPENDIX D
Sampling Considerations when Analyzing for PFCs

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

APPENDIX E
Health and Safety Plan

SUFFOLK COUNTY FIREMATICS
676 MAPLE STREET
YAPHANK, NEW YORK
SECTION 742, BLOCK 1, P/O LOTS 3.001 AND 3.002
NYSDEC SITE: 152246

HEALTH AND SAFETY PLAN

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016

PREPARED FOR:

Suffolk County
H. Lee Dennison Building
Hauppauge, New York 11788

PREPARED BY:

P.W. Grosser Consulting, Inc.
630 Johnson Avenue, Suite 7
Bohemia, New York 11716
Phone: 631-589-6353
Fax: 631-589-8705

James Rhodes, PG, Sr. Vice President jamesr@pwgrosser.com
Andy Lockwood, PG, LEP, Vice President andyl@pwgrosser.com

PWGC Project Number: SHD1702

SEPTEMBER 2017

PWGC
Strategic Environmental Engineering Solutions

P.W. GROSSER CONSULTING, INC.
PROJECT No. SHD1702

HEALTH AND SAFETY PLAN

Suffolk County Firematics Site
676 Pine Street
Yaphank, New York 11980
Site No.: 152246

SUBMITTED:

SEPTEMBER 2017

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York 12233

PREPARED FOR:

Suffolk County
H. Lee Dennison Building
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Bohemia, New York 11716

HEALTH AND SAFETY PLAN
SUFFOLK COUNTY FIREMATICS SITE
676 MAPLE STREET
YAPHANK, NEW YORK 11980
SITE NO.: 152246

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STATEMENT OF COMMITMENT

This Health and Safety Plan (HASP) has been prepared to ensure that workers are not exposed to chemical, biological and physical hazards during the planned Remedial Investigation (RI) to be performed at the site known as Suffolk County Firematics Site, located at 676 Maple Street, Yaphank, New York. P.W. Grosser Consulting Inc.'s (PWGC's) policy is to minimize the possibility of work-related exposure through awareness and qualified supervision, health and safety training, medical monitoring, use of appropriate personal protective equipment, and the following activity specific safety protocols contained in this HASP. PWGC has established a guidance program to implement this policy in a manner that protects personnel to the maximum reasonable extent.

This HASP, which applies to persons present at the site actually or potentially exposed to safety or health hazards, describes emergency response procedures for actual and potential physical, biological and chemical hazards. This HASP is also intended to inform and guide personnel entering the work area or exclusion zone. Persons are to acknowledge that they understand the potential hazards and the contents of this Health and Safety policy.

1.0 INTRODUCTION AND SITE ENTRY REQUIREMENTS

This document describes the health and safety guidelines developed by P.W. Grosser Consulting, Inc. (PWGC) at the request of Suffolk County for the proposed site remedial investigation to be performed at the Site known as Suffolk County Firematics Site, located at 676 Maple Street, Yaphank, New York to protect on-site personnel, visitors, and the public from exposure to hazardous materials or wastes. In accordance with the Occupational Safety and Health Administration (OSHA) 29 CFR Part 1910.120 Hazardous Waste Operations and Emergency Response Final rule, this HASP, including the attachments, addresses safety and health hazards relating to this phase of site operations and is based on the best information available. The HASP may be revised by PWGC at the request of Suffolk County upon receipt of new information regarding site conditions. Changes will be documented by written amendments.

1.1 Site Safety Plan Acceptance, Acknowledgement and Amendments

The Project Manager and the Site Safety Officer (SSO) are responsible for informing personnel entering the work area of the contents of this plan and ensuring that each person signs the safety plan acknowledging the on-site hazards and procedures required to minimize exposure to adverse effects of these hazards. A copy of the Acknowledgement Form is included in **Appendix A**.

Site conditions may warrant an amendment to the HASP. Amendments to the HASP are acknowledged by completing forms included in **Appendix B**.

1.2 Daily Safety Meetings

Each day before work begins; the Site Safety Officer will hold safety (tailgate or tool box) meetings to ensure that on-site personnel understand the site conditions and operating procedures and to address safety questions and concerns. Meeting minutes and attendance will be recorded. Project staff will discuss and remedy health and safety issues at these meetings.

1.3 Key Personnel – Roles and Responsibilities

The following key personnel are planned for this project:

- Project Manager (PM)
- Site Safety Officer (SSO)

The PM is responsible for overall project administration and, with guidance from the site safety officer, for supervising the implementation of this HASP. The SSO will conduct daily (tailgate or tool box) safety meetings at the project site and oversee daily safety issues. Each subcontractor and supplier (defined as an OSHA employer) is also responsible for the health and safety of its employees. If there is any dispute about health and safety or project activities, on-site personnel will attempt to resolve the issue. If the issue cannot be resolved at the site, then the PM will be consulted.

The SSO is responsible for the following:

1. Educating personnel about information in this HASP and other safety requirements to be observed during site operations, including, but not limited to, designation of work zones and levels of protection and emergency procedures dealing with fire and first aid.
2. Coordinating site safety decisions with the PM.
3. Monitoring the condition and status of known on-site hazards specified in this HASP.
4. Maintaining the work zone entry/exit log and site entry/exit log.
5. Maintaining records of safety problems, corrective measures and documentation of chemical exposures or physical injuries (the SSO will document these conditions in a bound notebook and maintain a copy of the notebook on-site).

The person who observes safety concerns and potential hazards that have not been addressed in the daily safety meetings should immediately report their observations/concerns to the SSO or appropriate key personnel.

2.0 SITE BACKGROUND AND SCOPE OF WORK

The Site (Suffolk County Firematics) is identified as Suffolk County Section 742, Block 1, p/o Lots 3.001 and 3.002 and is located at 676 Maple Street, Yaphank, New York. Currently, the Site consists of 25 buildings/training areas located within 28-acres. The training areas are used for variety of training scenarios, some involve live fire training (fire generated using liquefied petroleum gas) and others do not. The current buildings were constructed between 1959 and 2005.

Perfluorinated Compounds (PFCs) have been identified above the United States Environmental Protection Agency (USEPA) Health Advisory Level (HAL) of 70 ng/l combined or 70 ng/l for individual compounds Perfuorooctanic Acid (PFOA) and Perflurooctanesulfonic Acid (PFOS) in groundwater monitoring wells at the site.

3.0 POTENTIAL HAZARDS OF THE SITE

This section presents an assessment of the chemical, biological, and physical hazards that may be encountered. Additional information can be found in **Appendix C** – Chemical Safety Data Sheets.

3.1 Chemical Hazards

Review of historical information from the site indicates that the PFCs were detected above the USEPA HAL of 70 ng/l in groundwater monitoring wells at the site. These compounds may present an occupational exposure hazard during site operations.

The chemicals identified above may have fetal effects and effects on breastfed children (low birth weight, accelerated puberty, skeletal variations), liver effects, immune effects, thyroid effects and cholesterol changes. These chemicals may also be linked to testicular and kidney cancers. Acute exposure symptoms may include cough, sore throat, redness and pain on skin, redness, blurred vision, abdominal pain, nausea and vomiting. Specific information on the chemicals identified at the Site can be found in Table 5-1 as well as on the Safety Data Sheets found in **Appendix C**.

Table 3-1

Chemical Hazards

COMPOUND	CAS#	TLV	ROUTES OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
PFOA	355-67-1	Not yet established	Inhalation Ingestion Skin/Eye	Short Term: Cough, sore throat, redness and pain on skin, redness, blurred vision, abdominal pain, nausea and vomiting. Long Term: Can affect a subject's liver, cardiovascular system, development, reproductive system, immune system and thyroid.	Respiratory tract, eyes and skin	White Powder
PFOS	1763-23-1	Not yet established	Inhalation Ingestion Skin/Eye	Short Term: Cough, sore throat, redness and pain on skin, redness, blurred vision, abdominal pain, nausea and vomiting. Long Term: Can affect a subject's liver, cardiovascular system, development, reproductive system, immune system and thyroid.	Respiratory tract, eyes and skin	White Powder

Abbreviations

TLV=Threshold Limit Values

3.1.1 *Additional Chemical Hazards*

There is the potential to come in contact with petroleum related VOCs and semi-VOCs given the past and existing storage of petroleum products and the nature of the activities at the site. Additionally, metals are commonly found in subsurface soils. For these reasons, specific information regarding the compounds most anticipated to be encountered can be found in the Safety Data Sheets in **Appendix C**. Additional compounds will be added should sampling activities planned at the site document their presence.

3.2 Biological Hazards

Work will be performed at a fire training facility containing several building, outdoor spaces, and various props used during fire training exercises. During the course of the project, there is potential for workers to come into contact with biological hazards such as animals, insects and plants.

3.2.1 *Animals*

The Site is located in a predominantly undeveloped area. It is possible that dogs, cats, rats and mice may be present. Workers shall use discretion and avoid all contact with animals.

3.2.2 *Insects*

Insects, such as mosquitoes, ticks, bees and wasps may be present during certain times of the year. Workers will be encouraged to wear appropriate repellents and PPE, if deemed necessary, when working in areas where insects are expected to be present. However, given the nature of the compounds of concern, certain sampling equipment, field clothing and PPE should be avoided, if possible. A summary of Prohibited and Acceptable Materials is included in **Appendix D**

During the months of April through October, particular caution must be exercised to minimize exposure to deer ticks and the potential for contracting Lyme disease or other tick-borne illnesses. Specific precautionary work practices that are recommended include the following:

- Cover your body as much as possible. Wear long pants and long sleeved shirts. Light color clothing makes spotting of ticks easier.
- Try to eliminate possible paths by which the Deer Tick may reach unprotected skin. For example, tuck bottoms of pants into socks or boots and sleeves into gloves. (Duct tape may be utilized to help seal cuffs and ankles).
- Conduct periodic and frequent, (e.g., hourly), surveys of your clothing for the presence of ticks.
- Certain types of insect repellents may be used and are listed below.

- Jason Natural Quit Bugging Me
- Repel Lemon Eucalyptus Insect Repellant
- Herbal Armor
- California Baby Natural Bug Spray
- BabyGanics

3.2.3 *Plants*

Poison ivy, sumac and oak may be present on site. The PM/SSO should identify the susceptible individuals. Worker shall avoid all contact with these plants.

3.3 Physical Hazards

During the project, there is potential for workers to come into contact with physical hazards such as heat stress, cold stress, noise, fire and explosions.

3.3.1 *Temperature Extremes*

Heat Stress

Heat stress is a significant potential hazard, which is greatly exacerbated with the use of PPE in hot environments. The potential hazards of working in hot environments include dehydration, cramps, heat rash, heat exhaustion, and heat stroke.

Cold Stress

At certain times of the year, workers may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia as well as slippery surfaces, brittle equipment, and poor judgment.

PWGC’s Heat/Cold Stress Protocols are specified in **Appendix E**

3.3.2 *Steam, Heat and Splashing*

Exposure to steam/heat/splashing hazards can occur during steam cleaning activities. Splashing can also occur during well development and sampling activities. Exposure to steam/heat/splashing can result in scalding/burns, eye injury, and puncture wounds. Workers shall prevent or avoid steam/heat/splashing hazards if possible.

3.3.3 *Noise*

Noise is a potential hazard associated with the operation of heavy equipment, drill rigs, pumps and engines. Workers will wear hearing protection while in the work zone when these types of machinery are operating.

3.3.4 *Fire and Explosion*

When conducting excavation or drilling activities, the opportunity of encountering fire and explosion hazards may exist from encountering underground utilities, from the use of diesel engine equipment, propane, liquefied petroleum gas and other potential ignition sources. During dry periods there is an increased chance of forest and brush fires starting at the job site. If these conditions occur no smoking will be permitted at the site and all operations involving potential ignition sources will be monitored continuously (fire watch).

3.3.5 *Manual Lifting/Material Handling*

Manual lifting of heavy objects may be required. Failure to follow proper lifting technique can result in back injuries and strains. Back injuries are a serious concern as they are the most common work place injury, often resulting in lost or restricted work time, and long treatment and recovery periods.

3.3.6 *Slips, Trips and Falls*

Working in and around the site will pose slip, trip and fall hazards due to slippery surfaces that may be oil covered, or from rough terrain, surfaces that are steep inclines, surfaced debris, or surfaces which are wet from rain or ice. Falls may result in twisted ankles, broken bones, head trauma or back injuries.

3.3.7 *Heavy Equipment Operation*

Drilling equipment will be utilized for the installation of soil borings and groundwater monitoring wells and an excavator/backhoe may be used to excavate where required. Working with or near heavy equipment poses many potential hazards, including electrocution, fire/explosion, being struck by or against, or pinched/caught/crushed by, and can result in serious physical harm.

3.3.8 *Electrocution*

Encountering underground utilities may pose electrical hazards to workers. Additionally, overhead electrical lines can be a concern during drilling operations. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

4.0 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) shall be selected in accordance with OSHA 29 CFR 1910.120(c), (g), and 1910.132. Protective equipment shall be NIOSH approved and respiratory protection shall conform to OSHA 29 CFR Part 1910.133 and 1910.134 specifications; head protection shall conform to 1910.135; eye and face protection shall conform to 1910.133; and foot protection shall conform to 1910.136. The main difference among the levels of protection from D through B is the addition of the type of respiratory protection. **It is anticipated that work will be performed in Level D PPE.**

4.1 Level D

Level D PPE shall be donned when the atmosphere contains no known hazards and work functions preclude splashes, immersion, or the potential for inhalation of, or contact with, hazardous concentrations of harmful chemicals. Given the nature of the compounds of concern, certain sampling equipment, field clothing and PPE should be avoided, if possible. A summary of prohibited and Acceptable Materials is included in **Appendix D.** Level D PPE consists of:

- standard work uniform, or coveralls, as needed;
- steel toe work that do not contain waterproofing (e.g. Gore-Tex). boots;
- hard hat;
- gloves, as needed;
- safety glasses;
- hearing protection;
- equipment replacements are available as needed.

4.2 Level C

Level C PPE shall be donned when the concentrations of measured total organic vapors in the breathing zone exceed background concentrations (using a portable PID, or equivalent), by ten ppm or greater for a period of twenty minutes or longer in the twenty foot zone surrounding the immediate work area. The specifications on the APR filters used must be appropriate for contaminants identified or expected to be encountered. Level C PPE shall be donned when the identified contaminants have adequate warning properties and criteria for using APR have been met. Given the nature of the compounds of concern, certain sampling equipment, field clothing and PPE should be avoided, if possible. A summary of prohibited and Acceptable Materials is included in **Appendix E.** Level C PPE consists of:

- chemical resistant or coated tyvek coveralls;
- steel-toe work boots that do not contain Gore-Tex;
- chemical resistant over boots or disposable boot covers;
- disposable inner gloves (surgical gloves);
- disposable outer gloves;
- full face APR fitted with organic vapor/dust and mist filters or filters appropriate for the identified or expected contaminants;
- hard hat;
- splash shield, as needed; and,
- ankles/wrists taped with duct tape.

The SSO will verify if Level C is appropriate by checking organic vapor concentrations using compound and/or class-specific detector tubes.

4.3 Level B

Level B PPE shall be donned when the contaminants have not been identified and/or the concentrations of unknown measured total organic vapors in the breathing zone exceed 5 ppm (using a portable PID, or equivalent) for a period of twenty minutes or longer in the twenty foot zone surrounding the immediate work area. Level B PPE shall be donned if the IDLH of a known contaminant is exceeded. If a contaminant is identified or is expected to be encountered for which NIOSH and/or OSHA recommend the use of a positive pressure self-contained breathing apparatus (SCBA) when that contaminant is present, Level B PPE shall be donned even though the total organic vapors in the breathing zone may not exceed 5 ppm. Level B shall be donned for confined space entry, and when the atmosphere is oxygen deficient (oxygen less than 19.5%) or potentially oxygen deficient. If Level B PPE is required for a task, at least three people shall be donned in Level B at any one time during that task. PPE shall only be donned at the direction of the site safety officer. Given the nature of the compounds of concern, certain sampling equipment, field clothing and PPE should be avoided, if possible. A summary of prohibited and Acceptable Materials is included in **Appendix D.** Level B PPE consists of:

- supplied air SCBA or airline system with five-minute egress system;
- chemical resistant coveralls;
- steel-toe work boots that do not contain Gore-Tex;
- chemical resistant over boots or disposable boot covers;
- disposable inner gloves;
- disposable outer gloves;
- hard hat; and,
- ankles/wrists taped.

The exact PPE ensemble is decided on a site-by-site basis by the PWGC Health and Safety Officer with the intent to provide the most protective and efficient worker PPE.

5.0 AIR MONITORING

Air monitoring will be performed for protection for on-site workers and the downwind community (i.e., off-site receptors including residences, businesses, and on-site workers not directly involved in the remedial investigation work) from potential airborne contaminant releases resulting from remedial activities at the site. Air monitoring will be used to help to confirm that the remedial investigation work will not spread contamination off-site through the air. The primary concerns for this site are dust particulates and VOCs. Site monitoring with a photo-ionization detector (PID) and particulate dust/aerosol meter will be performed during any invasive activities.

Real-time monitoring for dust and VOCs will be conducted both within the work area, and along the site perimeter, during intrusive activities such as excavation and drilling activities.

Detailed information on the types, frequency and location of real-time monitoring and community air monitoring requirements are provided in the Community Air Monitoring Plan prepared for this project.

6.0 TRAINING AND MEDICAL SURVEILANCE

Site workers that have the potential of coming in contact with site contaminants will have the following training and medical surveillance.

6.1 HAZWOPER Training

40-hr Hazwoper training and annual eight-hour Hazwoper refresher training, if appropriate, will be required of site field personnel directly involved with site activities whom may come in contact with site contaminants. The training will cover a review of 1910.120 requirements and related company programs and procedures.

6.2 Medical Surveillance

Site field personnel directly involved with site activities whom may come in contact with site contaminants are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120(f).

7.0 CONTINGENCY PLAN/EMERGENCY RESPONSE PLAN

Site personnel must be prepared in the event of an emergency. Emergencies can take many forms: illnesses, injuries, chemical exposure, fires, explosions, spills, leaks, releases of harmful contaminants, or sudden changes in the weather.

Emergency telephone numbers and a map to the hospital (**Figure 1**) will be posted on-site. Site personnel should be familiar with the emergency procedures, and the locations of site safety, first aid, and communication equipment. These will be outlined in the site specific HASP.

7.1 Emergency Equipment On-site

Private telephones:	Site personnel.
Two-way radios:	Site personnel where necessary.
Emergency Alarms:	On-site vehicle horns.
First aid kits:	On-site, in vehicles or field office.
Fire extinguisher:	On-site, in field office or on equipment.

7.2 Emergency Telephone Number

General Emergencies	911
New York City Police	911
Brookhaven Memorial Hospital	1-631-654-7100
NYSDEC Spills Division	1-800-457-7362
NYSDEC Hazardous Waste Division	1-718-482-4994
Suffolk County Department of Health	1-631-854-0000
Brookhaven Fire Department	911
National Response Center	1-800-424-8802
Poison Control	1-212-340-4494
Project Manager	1-631-589-6353
Site Safety Officer	1-631-589-6353
Alternate Site Safety Officer	1-631-589-6353

7.3 Personnel Responsibilities during an Emergency

The PM is primarily responsible for responding to and correcting any emergency situations. However, in the absence of the PM, the SSO shall act as the PM's on-site designee and perform the following tasks:

- Take appropriate measures to protect personnel;
- Ensure that appropriate federal, state, and local agencies are informed and emergency response plans are coordinated.
    - In the event of fire or explosion, the local fire department should be summoned immediately. If toxic materials are released to the air, the local authorities should be informed in order to assess the need for evacuation;
- Ensure appropriate decontamination, treatment, or testing for exposed or injured personnel;
- Determine the cause of incidents and make recommendations to prevent recurrence; and,
- Ensure that all required reports have been prepared.

7.4 Medical Emergencies

A person who becomes ill or injured, first aid will be administered while waiting for an ambulance or paramedics. A Field Accident Report (**Appendix F**) must be filled out for any injury.

A person transporting an injured/exposed person to a clinic or hospital for treatment will take the directions to the hospital and information on the chemical(s) to which they may have been exposed.

7.5 Fire or Explosion

In the event of a fire or explosion, the local fire department will be summoned immediately. The SSO or his designated alternate will advise the fire commander of the location, nature and identification of the hazardous materials on-site. If it is safe to do so, site personnel may:

- Use firefighting equipment available on site; or,
- Remove or isolate flammable or other hazardous materials that may contribute to the fire.

7.6 Evacuation Routes

Evacuation routes established by work area locations for each site will be reviewed prior to commencing site operations. As the work areas change, the evacuation routes will be altered accordingly, and the new route will be reviewed.

Under extreme emergency conditions, evacuation is to be immediate without regard for equipment. The evacuation signal will be a continuous blast of a vehicle horn, if possible, and/or by verbal/radio communication.

When evacuating the site, personnel will follow these instructions:

- Keep upwind of smoke, vapors, or spill location.
- Exit through the decontamination corridor if possible.
- If evacuation through the decontamination corridor is not possible, personnel should remove contaminated clothing once they are in a safe location and leave it near the exclusion zone or in a safe place.
- The SSO will conduct a head count to ensure that all personnel have been evacuated safely. The head count will be correlated to the site and/or exclusion zone entry/exit log.
- If emergency site evacuation is necessary, all personnel are to escape the emergency situation and decontaminate to the maximum extent practical.

FIGURE 1

SUBJECT SITE

BROOKHAVEN MEMORIAL HOSPITAL
101 Hospital Rd, Patchogue, NY

PWGC
Strategic Environmental and Engineering Solutions

P.W. GROSSER CONSULTING ENGINEER AND HYDROGEOLOGIST, P.C.

630 Johnson Avenue • Suite 7
Bohemia • NY • 11716-2618
Phone: (631) 589-6353 • Fax: (631) 589-8705
E-mail: INFO@PWGROSSER.COM

HOSPITAL ROUTE MAP

676 MAPLE AVE
YAPHANK, NY

0 ½ 1 1½ 2 Miles

Project:	SHD1702
Date:	9/6/2017
Designed by:	JCG
Drawn by:	JCG
Approved by:	AL
Figure No:	1

Document Path: G:\Projects\S-Z\SHD\1702\mapfiles\HospitalRouteMap.mxd

Appendix A

Site Safety Plan Acceptance and Acknowledgment Form

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the HASP. It is maintained on site by the FTL/SHSO as a project record. Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read, or have been informed of, the Health and Safety Plan and understand the information presented. I will comply with the provisions contained therein.

Name (Print and Sign)	*Date*

Appendix B

Site Safety Amendment Form

SITE SAFETY PLAN AMENDMENT FORM

SITE SAFETY PLAN AMENDMENT # ______________: ____

SITE NAME: ____

REASON FOR AMENDMENT: ____

____

____

ALTERNATIVE PROCEDURES: ____

____

____

REQUIRED CHANGES IN PPE: ____

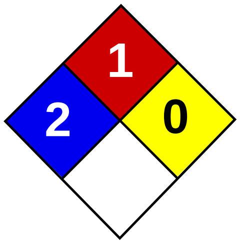
____

____

______________________________	______________________________
PROJECT MANAGER	DATE
______________________________	______________________________
SITE SAFETY OFFICER	DATE

Appendix C

Chemical Safety Data Sheets



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Acenaphthene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acenaphthene

Catalog Codes: SLA2332

CAS#: 83-32-9

RTECS: AB1000000

TSCA: TSCA 8(b) inventory: Acenaphthene

CI#: Not applicable.

Synonym: Ethylenenaphthalene

Chemical Name: 1,8-Dehydroacenaphthalene

Chemical Formula: $C_{10}H_6(CH_2)_2$

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acenaphthene	83-32-9	100

Toxicological Data on Ingredients: Acenaphthene LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Flammable in presence of oxidizing materials.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Combustible.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Solid needles.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 154.21 g/mole

Color: White.

pH (1% soln/water): Not applicable.

Boiling Point: 277.5°C (531.5°F)

Melting Point: 93.6 (200.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.02 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol.

Solubility:
Partially soluble in methanol. Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Acenaphthene Massachusetts RTK: Acenaphthene New Jersey: Acenaphthene TSCA 8(b) inventory: Acenaphthene CERCLA: Hazardous substances.: Acenaphthene

Other Regulations: Not available.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC): R36/38- Irritating to eyes and skin.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

Other Special Considerations: Not available.

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ARSENIC

0013

October 1999

CAS No: 7440-38-2
RTECS No: CG0525000
UN No: 1558
EC No: 033-001-00-X

Grey arsenic
As
Atomic mass: 74.9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight when exposed to hot surfaces or flames in the form of fine powder or dust.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	

EXPOSURE		**PREVENT DISPERSION OF DUST! AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	**IN ALL CASES CONSULT A DOCTOR!**
Inhalation	Cough. Sore throat. Shortness of breath. Weakness. See Ingestion.	Closed system and ventilation.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness.	Face shield or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Diarrhoea. Nausea. Vomiting. Burning sensation in the throat and chest. Shock or collapse. Unconsciousness.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment.	T Symbol N Symbol R: 23/25-50/53 S: (1/2-)20/21-28-45-60-61 UN Hazard Class: 6.1 UN Pack Group: II	Do not transport with food and feedstuffs. Marine pollutant.

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-61GT5-II	Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed.

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IMPORTANT DATA

Physical State; Appearance
ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS.

Chemical dangers
Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens, causing fire and explosion hazard. Reacts with acids to produce toxic arsine gas (see: ICSC 0222).

Occupational exposure limits
TLV: 0.01 mg/m^3 as TWA; A1 (confirmed human carcinogen); BEI issued; (ACGIH 2004).
MAK: Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly, when dispersed.

Effects of short-term exposure
The substance is irritating to the eyes, the skin and the respiratory tract. The substance may cause effects on the gastrointestinal tract, cardiovascular system, central nervous system and kidneys, resulting in severe gastroenteritis, loss of fluid, and electrolytes, cardiac disorders, shock, convulsions and kidney impairment. Exposure above the OEL may result in death. The effects may be delayed. Medical observation is indicated.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the mucous membranes, skin, peripheral nervous system, liver and bone marrow, resulting in pigmentation disorders, hyperkeratosis, perforation of nasal septum, neuropathy, liver impairment, anaemia. This substance is carcinogenic to humans. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Sublimation point: 613/C
Density: 5.7 g/cm^3
Solubility in water: none

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms. It is strongly advised that this substance does not enter the environment.

NOTES

The substance is combustible but no flash point is available in literature.
Depending on the degree of exposure, periodic medical examination is suggested.
Do NOT take working clothes home.
Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC 0377), Arsenic trichloride (ICSC 0221), Arsenic trioxide (ICSC 0378), Arsine (ICSC 0222).
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.
Card has been partly updated in October 2005 in section Effects of long-term or repeated exposure.

ADDITIONAL INFORMATION

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BARIUM

1052
October 1999

CAS No: 7440-39-3
RTECS No: CQ8370000
UN No: 1400

Ba
Atomic mass: 137.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Flammable. Many reactions may cause fire or explosion.	NO open flames, NO sparks, and NO smoking. NO contact with water.	Special powder, dry sand, NO hydrous agents, NO water.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		**PREVENT DISPERSION OF DUST! STRICT HYGIENE!**	
Inhalation	Cough. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Redness.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
Eyes	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Chemical protection suit including self-contained breathing apparatus. Do NOT wash away into sewer.	UN Hazard Class: 4.3 UN Pack Group: II

EMERGENCY RESPONSE	STORAGE
Transport Emergency Card: TEC (R)-43G12	Separated from halogenated solvents, strong oxidants, acids. Dry. Keep under inert gas, oil or oxygen-free liquid.

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IMPORTANT DATA

Physical State; Appearance
YELLOWISH TO WHITE LUSTROUS SOLID IN VARIOUS FORMS.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
The substance may spontaneously ignite on contact with air (if in powder form). The substance is a strong reducing agent and reacts violently with oxidants and acids. Reacts violently with halogenated solvents. Reacts with water, forming flammable/explosive gas (hydrogen - see ICSC 0001), causing fire and explosion hazard.

Occupational exposure limits
TLV: 0.5 mg/m^3 (as TWA) (ACGIH 1999).

Routes of exposure
The substance can be absorbed into the body by ingestion.

Effects of short-term exposure
The substance irritates the eyes, the skin and the respiratory tract.

PHYSICAL PROPERTIES

Boiling point: 1640°C
Melting point: 725°C

Density: 3.6 g/cm^3
Solubility in water: reaction

ENVIRONMENTAL DATA

NOTES

Reacts violently with fire extinguishing agents such as water, bicarbonate, powder, foam, and carbon dioxide.
Rinse contaminated clothes (fire hazard) with plenty of water.

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BENZENE	**ICSC: 0015**

Date of Peer Review: May 2003

Cyclohexatriene
Benzol

CAS #	71-43-2	C_6H_6
RTECS #	CY1400000	Molecular mass: 78.1
UN #	1114	
EC #	601-020-00-8	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive. Risk of fire and explosion: see Chemical Dangers.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling. Use non-sparking handtools. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation	Dizziness. Drowsiness. Headache. Nausea. Shortness of breath. Convulsions. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	MAY BE ABSORBED! Dry skin. Redness. Pain. (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
Eyes	Redness. Pain.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to

			a doctor.
Ingestion	Abdominal pain. Sore throat. Vomiting. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: complete protective clothing including self-contained breathing apparatus.	Do not transport with food and feedstuffs. **EU Classification** Symbol: F, T R: 45-46-11-36/38-48/23/24/25-65 S: 53-45 Note: [E] **UN Classification** UN Hazard Class: 3 UN Pack Group: II

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S1114 / 30GF1-II NFPA Code: H2; F3; R0	Fireproof. Separated from food and feedstuffs oxidants and halogens.

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BENZENE ICSC: 0015

IMPORTANT DATA	
PHYSICAL STATE; APPEARANCE: COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR. **PHYSICAL DANGERS:** The vapour is heavier than air and may travel along the ground; distant ignition possible. As a result of flow, agitation, etc., electrostatic charges can be generated. **CHEMICAL DANGERS:** Reacts violently with oxidants, nitric acid, sulfuric acid and halogens causing fire and explosion hazard. Attacks plastic and rubber. **OCCUPATIONAL EXPOSURE LIMITS:**	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation, through the skin and by ingestion. **INHALATION RISK:** A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance is irritating to the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous

TLV: 0.5 ppm as TWA; 2.5 ppm as STEL; (skin); A1; BEI issued; (ACGIH 2004).
MAK: H; Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004).

system, resulting in lowering of consciousness. Exposure far above the occupational exposure limit value may result in unconsciousness and death.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. The substance may have effects on the bone marrow and immune system, resulting in a decrease of blood cells. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 80°C
Melting point: 6°C
Relative density (water = 1): 0.88
Solubility in water, g/100 ml at 25°C: 0.18
Vapour pressure, kPa at 20°C: 10
Relative vapour density (air = 1): 2.7

Relative density of the vapour/air-mixture at 20°C (air = 1): 1.2
Flash point: -11°C c.c.
Auto-ignition temperature: 498°C
Explosive limits, vol% in air: 1.2-8.0
Octanol/water partition coefficient as log Pow: 2.13

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms.

NOTES

Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient.
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

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BENZO(a)PYRENE

0104
October 2005

CAS No: 50-32-8 RTECS No: DJ3675000 EC No: 601-032-00-3	Benz(a)pyrene 3,4-Benzopyrene Benzo(d,e,f)chrysene $C_{20}H_{12}$ Molecular mass: 252.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, foam, powder, carbon dioxide.
EXPLOSION			
EXPOSURE	**See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.**	**AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Personal protection: complete protective clothing including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	T Symbol N Symbol R: 45-46-60-61-43-50/53 S: 53-45-60-61

EMERGENCY RESPONSE	SAFE STORAGE
	Separated from strong oxidants.

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IMPORTANT DATA

Physical State; Appearance
PALE-YELLOW CRYSTALS

Chemical dangers
Reacts with strong oxidants causing fire and explosion hazard.

Occupational exposure limits
TLV: Exposure by all routes should be carefully controlled to levels as low as possible A2 (suspected human carcinogen); (ACGIH 2005).
MAK: Carcinogen category: 2; Germ cell mutagen group: 2; (DFG 2005).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

Effects of long-term or repeated exposure
This substance is carcinogenic to humans. May cause heritable genetic damage to human germ cells. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 496/C
Melting point: 178.1/C
Density: 1.4 g/cm^3

Solubility in water: none (<0.1 g/100 ml)
Vapour pressure : negligible
Octanol/water partition coefficient as log Pow: 6.04

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms. Bioaccumulation of this chemical may occur in fish, in plants and in molluscs. The substance may cause long-term effects in the aquatic environment.

NOTES

Do NOT take working clothes home.
Benzo(a)pyrene is present as a component of polycyclic aromatic hydrocarbons (PAHs) in the environment, usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco.

ADDITIONAL INFORMATION

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BENZO(b)FLUORANTHENE

0720

March 1999

CAS No: 205-99-2 RTECS No: CU1400000 EC No: 601-034-00-4	Benz(e)acephenanthrylene 2,3-Benzofluoroanthene Benzo(e)fluoranthene 3,4-Benzofluoranthene $C_{20}H_{12}$ Molecular mass: 252.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE			In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	T Symbol N Symbol R: 45-50/53 S: 53-45-60-61

EMERGENCY RESPONSE	SAFE STORAGE
	Provision to contain effluent from fire extinguishing. Well closed.

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IMPORTANT DATA

Physical State; Appearance
COLOURLESS CRYSTALS

Chemical dangers
Upon heating, toxic fumes are formed.

Occupational exposure limits
TLV: A2 (suspected human carcinogen); (ACGIH 2004).
MAK: Carcinogen category: 2; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol and through the skin.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

Effects of long-term or repeated exposure
This substance is possibly carcinogenic to humans. May cause genetic damage in humans.

PHYSICAL PROPERTIES

Boiling point: 481/C
Melting point: 168/C
Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.12

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to air quality and water quality.

NOTES

Benzo(b)fluoranthene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco. ACGIH recommends environment containing benzo(b)fluoranthene should be evaluated in terms of the TLV-TWA for coal tar pitch volatile, as benzene soluble 0.2 mg/m^3.
Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.
Card has been partly updated in October 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

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BENZO(ghi)PERYLENE

0739
October 1999

CAS No: 191-24-2
RTECS No: DI6200500

1,12-Benzoperylene
1,12-Benzperylene
$C_{22}H_{12}$
Molecular mass: 276.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible under specific conditions.	NO open flames.	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			

EXPOSURE		**PREVENT DISPERSION OF DUST!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety spectacles, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into covered containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	

EMERGENCY RESPONSE	STORAGE
	Well closed.

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IMPORTANT DATA

Physical State; Appearance
PALE YELLOW-GREEN CRYSTALS.

Chemical dangers
Upon heating, toxic fumes are formed.

Occupational exposure limits
TLV not established.

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol and through the skin.

Inhalation risk
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

PHYSICAL PROPERTIES

Boiling point: 550°C
Melting point: 278°C
Density: 1.3 g/cm^3

Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.58

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to air and water.

NOTES

Benzo(ghi)perylene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco.
Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken.

ADDITIONAL INFORMATION

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BENZO(k)FLUORANTHENE

0721
March 1999

CAS No: 207-08-9 RTECS No: DF6350000 EC No: 601-036-00-5	Dibenzo(b,jk)fluorene 8,9-Benzofluoranthene 11,12-Benzofluoranthene $C_{20}H_{12}$ Molecular mass: 252.3

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE			In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety spectacles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	T Symbol N Symbol R: 45-50/53 S: 53-45-60-61

EMERGENCY RESPONSE	SAFE STORAGE
	Provision to contain effluent from fire extinguishing. Well closed.

IMPORTANT DATA

Physical State; Appearance
YELLOW CRYSTALS

Chemical dangers
Upon heating, toxic fumes are formed.

Occupational exposure limits
TLV not established.
MAK: Carcinogen category: 2; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol and through the skin.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

Effects of long-term or repeated exposure
This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 480/C
Melting point: 217/C
Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.84

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to air quality and water quality. Bioaccumulation of this chemical may occur in crustacea and in fish.

NOTES

Benzo(k)fluoranthene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco. ACGIH recommends environment containing benzo(k)fluoranthene should be evaluated in terms of the TLV-TWA for coal tar pitch volatile, as benzene soluble 0.2 mg/m^3.
Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.
Card has been partly updated in October 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

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CADMIUM

0020
April 2005

CAS No: 7440-43-9 RTECS No: EU9800000 UN No: 2570 EC No: 048-002-00-0	Cd Atomic mass: 112.4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Flammable in powder form and spontaneously combustible in pyrophoric form. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking. NO contact with heat or acid(s).	Dry sand. Special powder. NO other agents.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		**PREVENT DISPERSION OF DUST! AVOID ALL CONTACT!**	**IN ALL CASES CONSULT A DOCTOR!**
Inhalation	Cough. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Diarrhoea. Headache. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Evacuate danger area! Personal protection: chemical protection suit including self-contained breathing apparatus. Remove all ignition sources. Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place.	T+ Symbol N Symbol R: 45-26-48/23/25-62-63-68-50/53 S: 53-45-60-61 Note: E UN Hazard Class: 6.1	Airtight. Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs.

EMERGENCY RESPONSE	SAFE STORAGE
	Fireproof. Dry. Keep under inert gas. Separated from igntion sources, oxidants acids, food and feedstuffs.

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IMPORTANT DATA

Physical State; Appearance
SOFT BLUE-WHITE METAL LUMPS OR GREY POWDER. MALLEABLE. TURNS BRITTLE ON EXPOSURE TO 80/C AND TARNISHES ON EXPOSURE TO MOIST AIR.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
Reacts with acids forming flammable/explosive gas (hydrogen - see ICSC0001). Dust reacts with oxidants, hydrogen azide, zinc, selenium or tellurium, causing fire and explosion hazard.

Occupational exposure limits
TLV: (Total dust) 0.01 mg/m^3; (Respirable fraction) 0.002 mg/m^3; as TWA; A2 (suspected human carcinogen); BEI issued; (ACGIH 2005).
MAK: skin absorption (H); Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

Inhalation risk
A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered.

Effects of short-term exposure
The fume is irritating to the respiratory tract. Inhalation of fume may cause lung oedema (see Notes). Inhalation of fumes may cause metal fume fever. The effects may be delayed. Medical observation is indicated.

Effects of long-term or repeated exposure
Lungs may be affected by repeated or prolonged exposure to dust particles. The substance may have effects on the kidneys, resulting in kidney impairment. This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 765/C
Melting point: 321/C
Density: 8.6 g/cm^3
Solubility in water: none
Auto-ignition temperature: (cadmium metal dust) 250/C

ENVIRONMENTAL DATA

NOTES

Reacts violently with fire extinguishing agents such as water, foam, carbon dioxide and halons.
Depending on the degree of exposure, periodic medical examination is indicated.
The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential.
Do NOT take working clothes home.
Cadmium also exists in a pyrophoric form (EC No. 048-011-00-X), which bears the additional EU labelling symbol F, R phrase 17, and S phrases 7/8 and 43. UN numbers and packing group will vary according to the physical form of the substance.

ADDITIONAL INFORMATION

LEGAL NOTICE

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CHROMIUM

0029
October 2004

CAS No: 7440-47-3 RTECS No: GB4200000	Chrome (powder) Cr Atomic mass: 52.0

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible under specific conditions.	No open flames if in powder form.	In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION		Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		**PREVENT DISPERSION OF DUST!**	
Inhalation	Cough.	Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
Eyes	Redness.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Rinse mouth.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Personal protection: P2 filter respirator for harmful particles.	

EMERGENCY RESPONSE	SAFE STORAGE

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SEE IMPORTANT INFORMATION ON THE BACK.

0029	CHROMIUM

IMPORTANT DATA

Physical State; Appearance
GREY POWDER

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
Chromium is a catalytic substance and may cause reaction in contact with many organic and inorganic substances, causing fire and explosion hazard.

Occupational exposure limits
TLV: (as Cr metal, Cr(III) compounds) 0.5 mg/m^3 as TWA; A4; (ACGIH 2004).
MAK not established.

Inhalation risk
A harmful concentration of airborne particles can be reached quickly when dispersed.

Effects of short-term exposure
May cause mechanical irritation to the eyes and the respiratory tract.

PHYSICAL PROPERTIES

Boiling point: 2642/C
Melting point: 1900/C
Density: 7.15 g/cm^3
Solubility in water: none

ENVIRONMENTAL DATA

NOTES

The surface of the chromium particles is oxidized to chromium(III)oxide in air.
See ICSC 1531 Chromium(III) oxide.

ADDITIONAL INFORMATION

LEGAL NOTICE

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Safety (MSDS) data for chrysene

General

Synonyms: 1,2-benzophenanthrene, benzo(a)phenanthrene, 1,2-benzphenanthrene, coal tar pitch, benz(a)phenanthrene, 1,2,5,6-dibenzonaphthalene
Molecular formula: $C_{18}H_{12}$
CAS No: 218-01-9
EC No: 205-923-4

Physical data

Appearance: crystalline powder
Melting point: 253 C
Boiling point: 448 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 1.27
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: insoluble

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Toxic. Confirmed animal carcinogen, possible human carcinogen. Harmful if swallowed, inhaled or absorbed through the skin.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)
IPR-MUS LD50 >320 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R20 R21 R22 R45 R46.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 2811. Packing group I. Hazard class 6.1. CDG UK Transport category 1. EMS No 6.1-04.

Personal protection

Safety glasses, good ventilation, gloves. Handle as a carcinogen. A COSHH assessment is required.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S3 S7 S9 S36 S37 S39 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on April 1, 2005. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

DIBENZO(a,h)ANTHRACENE

0431
October 1995

CAS No: 53-70-3 RTECS No: HN2625000 EC No: 601-041-00-2	1,2:5,6-Dibenzanthracene $C_{22}H_{14}$ Molecular mass: 278.4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		**AVOID ALL CONTACT!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin	Redness. Swelling. Itching.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Personal protection: P3 filter respirator for toxic particles.	T Symbol N Symbol R: 45-50/53 S: 53-45-60-61

EMERGENCY RESPONSE	SAFE STORAGE
	Well closed.

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IMPORTANT DATA

Physical State; Appearance
COLOURLESS CRYSTALLINE POWDER.

Occupational exposure limits
TLV not established.

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

Effects of long-term or repeated exposure
The substance may have effects on the skin, resulting in photosensitization. This substance is probably carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: 524/C
Melting point: 267/C
Relative density (water = 1): 1.28
Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.5

ENVIRONMENTAL DATA

Bioaccumulation of this chemical may occur in seafood.

NOTES

This is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form.
Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.
Do NOT take working clothes home.
DBA is a commonly used name.
This substance is one of many polycyclic aromatic hydrocarbons (PAH).
Card has been partly updated in October 2005. See section EU classification.

ADDITIONAL INFORMATION

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ETHYLBENZENE

0268
March 1995

CAS No: 100-41-4 RTECS No: DA0700000 UN No: 1175 EC No: 601-023-00-4	Ethylbenzol Phenylethane EB C_8H_{10} / C_6H_5-C_2H_5 Molecular mass: 106.2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**PREVENT GENERATION OF MISTS!**	
Inhalation	Cough. Dizziness. Drowsiness. Headache.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness. Pain. Blurred vision.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	(Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Ventilation. Collect leaking liquid in covered containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Personal protection: A filter respirator for organic gases and vapours.	**EU classification** F Symbol Xn Symbol R: 11-20 S: (2-)16-24/25-29 **UN classification** UN Hazard Class: 3 UN Pack Group: II

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S1175 or 30GF1-I+II NFPA Code: H2; F3; R0	Fireproof. Separated from strong oxidants.

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IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH AROMATIC ODOUR.

Physical dangers
The vapour mixes well with air, explosive mixtures are easily formed.

Chemical dangers
Reacts with strong oxidants. Attacks plastic and rubber.

Occupational exposure limits
TLV: 100 ppm as TWA, 125 ppm as STEL; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued (ACGIH 2005).
MAK: skin absorption (H); Carcinogen category: 3A; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.

Inhalation risk
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20/C.

Effects of short-term exposure
The substance is irritating to the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Exposure far above the OEL could cause lowering of consciousness.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis.

PHYSICAL PROPERTIES

Boiling point: 136/C
Melting point: -95/C
Relative density (water = 1): 0.9
Solubility in water, g/100 ml at 20/C: 0.015
Vapour pressure, kPa at 20/C: 0.9
Relative vapour density (air = 1): 3.7
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.02
Flash point: 18/C c.c.
Auto-ignition temperature: 432/C
Explosive limits, vol% in air: 1.0-6.7
Octanol/water partition coefficient as log Pow: 3.2

ENVIRONMENTAL DATA

The substance is harmful to aquatic organisms.

NOTES

The odour warning when the exposure limit value is exceeded is insufficient.
Card has been partly updated in October 2005. See sections Occupational Exposure Limits, Emergency Response.

ADDITIONAL INFORMATION

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Safety (MSDS) data for fluoranthene

General

Synonyms: 1,2-(1,8-naphthylene)benzene, idryl, benzo[jk]fluorene, 1,2-(1,8-naphthalenediyl)benzene, 1,2-benzacenaphthene
Use:
Molecular formula: $C_{16}H_{10}$
CAS No: 206-44-0
EINECS No: 205-912-4

Physical data

Appearance: solid
Melting point: 105 - 110 C
Boiling point: 375 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point: 198 C
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Incompatible with strong oxidizing agents.

Toxicology

Harmful if swallowed. Limited evidence that this may act as a carcinogen. Skin, eye and respiratory irritant.

Toxicity data

(The meaning of any toxicological abbreviations which appear in this section is given here.)

ORL-RAT LD50 2000 mg kg^{-1}

IVN-MUS LD50 100 mg kg^{-1}

SKN-RBT LD50 3180 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R22 R36 R37 R38 R40.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)

Personal protection

Safety glasses, good ventilation. Rubber gloves.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)

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This information was last updated on November 21, 2003. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

LEAD

0052
October 2002

CAS No: 7439-92-1
RTECS No: OF7525000

Lead metal
Plumbum
(powder)
Pb
Atomic mass: 207.2

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE	**See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.**	**PREVENT DISPERSION OF DUST! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes		Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. Personal protection: P3 filter respirator for toxic particles.	

EMERGENCY RESPONSE	SAFE STORAGE
	Separated from food and feedstuffs and incompatible materials. See Chemical Dangers.

IMPORTANT DATA

Physical State; Appearance
BLUISH-WHITE OR SILVERY-GREY SOLID IN VARIOUS FORMS. TURNS TARNISHED ON EXPOSURE TO AIR.

Physical dangers
Dust explosion possible if in powder or granular form, mixed with air.

Chemical dangers
On heating, toxic fumes are formed. Reacts with oxidants. Reacts with hot concentrated nitric acid, boiling concentrated hydrochloric acid and sulfuric acid. Attacked by pure water and by weak organic acids in the presence of oxygen.

Occupational exposure limits
TLV: 0.05 mg/m^3 as TWA; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2004).
MAK: Carcinogen category: 3B; Germ cell mutagen group: 3A; (DFG 2004).
EU OEL: as TWA 0.15 mg/m^3; (EU 2002).

Routes of exposure
The substance can be absorbed into the body by inhalation and by ingestion.

Inhalation risk
A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered.

Effects of long-term or repeated exposure
The substance may have effects on the blood, bone marrow, central nervous system, peripheral nervous system and kidneys, resulting in anaemia, encephalopathy (e.g., convulsions), peripheral nerve disease, abdominal cramps and kidney impairment. Causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 1740/C
Melting point: 327.5/C
Density: 11.34 g/cm^3
Solubility in water: none

ENVIRONMENTAL DATA

Bioaccumulation of this chemical may occur in plants and in mammals. It is strongly advised that this substance does not enter the environment.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested.
Do NOT take working clothes home.
Card has been partly updated in April 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

LEGAL NOTICE

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MERCURY

0056
April 2004

CAS No: 7439-97-6
RTECS No: OV4550000
UN No: 2809
EC No: 080-001-00-0

Quicksilver
Liquid silver
Hg
Atomic mass: 200.6

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION	Risk of fire and explosion.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!**	**IN ALL CASES CONSULT A DOCTOR!**
Inhalation	Abdominal pain. Cough. Diarrhoea. Shortness of breath. Vomiting. Fever or elevated body temperature.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
Skin	MAY BE ABSORBED! Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
Eyes		Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work. Wash hands before eating.	Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Evacuate danger area in case of a large spill! Consult an expert! Ventilation. Collect leaking and spilled liquid in sealable non-metallic containers as far as possible. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Chemical protection suit including self-contained breathing apparatus.	T Symbol N Symbol R: 23-33-50/53 S: (1/2-)7-45-60-61 UN Hazard Class: 8 UN Pack Group: III	Special material. Do not transport with food and feedstuffs.

EMERGENCY RESPONSE	STORAGE
Transport Emergency Card: TEC (R)-80GC9-II+III	Provision to contain effluent from fire extinguishing. Separated from food and feedstuffs. Well closed.

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IMPORTANT DATA

Physical State; Appearance
ODOURLESS, HEAVY AND MOBILE SILVERY LIQUID METAL.

Chemical dangers
Upon heating, toxic fumes are formed. Reacts violently with ammonia and halogens causing fire and explosion hazard. Attacks aluminium and many other metals forming amalgams.

Occupational exposure limits
TLV: 0.025 mg/m^3 as TWA; (skin); A4; BEI issued; (ACGIH 2004).
MAK: 0.1 mg/m^3; Sh; Peak limitation category: II(8); Carcinogen category: 3B; (DFG 2003).

Routes of exposure
The substance can be absorbed into the body by inhalation of its vapour and through the skin, also as a vapour!

Inhalation risk
A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20/C.

Effects of short-term exposure
The substance is irritating to the skin. Inhalation of the vapours may cause pneumonitis. The substance may cause effects on the central nervous system and kidneys. The effects may be delayed. Medical observation is indicated.

Effects of long-term or repeated exposure
The substance may have effects on the central nervous system and kidneys, resulting in irritability, emotional instability, tremor, mental and memory disturbances, speech disorders. May cause inflammation and discoloration of the gums. Danger of cumulative effects. Animal tests show that this substance possibly causes toxic effects upon human reproduction.

PHYSICAL PROPERTIES

Boiling point: 357/C
Melting point: -39/C
Relative density (water = 1): 13.5
Solubility in water: none
Vapour pressure, Pa at 20/C: 0.26
Relative vapour density (air = 1): 6.93
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.009

ENVIRONMENTAL DATA

The substance is very toxic to aquatic organisms. In the food chain important to humans, bioaccumulation takes place, specifically in fish.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated.
No odour warning if toxic concentrations are present.
Do NOT take working clothes home.

ADDITIONAL INFORMATION

LEGAL NOTICE

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PERFLUOROOCTANOIC ACID

ICSC: 1613

Pentadecafluorooctanoic acid Pentadecafluoro-n-octanoic acid Perfluorocaprylic acid $C_8HF_{15}O_2$ Molecular mass: 414.1 ICSC # 1613 	CAS # 335-67-1 RTECS # RH0781000 UN # 3261 October 20, 2005 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION	Cough. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Redness. Pain.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness. Pain. Blurred vision.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: P2 filter respirator for harmful particles. Do NOT let this chemical enter the environment. Sweep spilled substance into covered, non-metallic containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Separated from strong oxidants, strong bases, strong acids, strong reducing agents , food and feedstuffs .	Do not transport with food and feedstuffs. UN Hazard Class: 8 UN Packing Group: III

ICSC: 1613	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 1613

PERFLUOROOCTANOIC ACID

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
WHITE POWDER , WITH PUNGENT ODOUR.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
The substance decomposes on heating above 300°C or on burning producing toxic gases including hydrogen fluoride . The solution in water is a weak acid. Reacts with bases , oxidants and reducing agents . Attacks many metals forming flammable/explosive gas (hydrogen - see ICSC 0001).

OCCUPATIONAL EXPOSURE LIMITS:
TLV not established.
MAK: 0.005 mg/m^3; skin absorption (H);
Peak limitation category: II(8); Carcinogen category: 4; Pregnancy risk group: C;
(DFG 2005).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

INHALATION RISK:
A harmful concentration of airborne particles can be reached quickly when dispersed.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes , the skin and the respiratory tract .

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Tumours have been detected in experimental animals but may not be relevant to humans.

PHYSICAL PROPERTIES

Boiling point: 189°C
Melting point: 52-54°C
Density: 1.79 g/cm^3
Solubility in water: none
Octanol/water partition coefficient as log Pow: 6.3

ENVIRONMENTAL DATA

The substance may cause long-term effects in the aquatic environment.

NOTES

Common name: PFOA.

Transport Emergency Card: TEC (R)-80GC4-II+III

ADDITIONAL INFORMATION

ICSC: 1613 **PERFLUOROOCTANOIC ACID**

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Page last reviewed: July 22, 2015
Page last updated: July 1, 2014
Content source: National Institute for Occupational Safety and Health (https://www.cdc.gov/NIOSH/)

Safety (MSDS) data for phenanthrene

General

Synonyms: coal tar pitch volatiles, ravatite, phenantrin
Use:
Molecular formula: $C_{14}H_{10}$
CAS No: 85-01-8
EC No: 201-581-5

Physical data

Appearance: white crystals
Melting point: 99 - 101 C
Boiling point: 336 C
Vapour density:
Vapour pressure:
Density ($g\ cm^{-3}$): 1.063
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Harmful if swallowed. May be harmful if inhaled or absorbed through the skin. Skin, eye and respiratory irritant. Causes photosensitivity.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

ORL-MUS LD50 700 mg kg^{-1}

IPR-MUS LD50 700 mg kg^{-1}

IVN-MUS LD50 56 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R20 R21 R22 R36 R37 R38 R40.

Transport information

Non-hazardous for air, sea and road freight.

Personal protection

Safety glasses, adequate ventilation.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S26 S27 S36 S37 S39 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on January 2, 2004. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

PYRENE

1474
November 2003

CAS No: 129-00-0
RTECS No: UR2450000

Benzo (d,e,f) phenanthrene
beta-Pyrene
$C_{16}H_{10}$
Molecular mass: 202.26

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Water spray, carbon dioxide, dry powder, alcohol-resistant foam, or polymer foam.
EXPLOSION			
EXPOSURE			
Inhalation		Avoid inhalation of dust.	Fresh air, rest.
Skin	Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
Eyes	Redness.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	Do NOT induce vomiting. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder. Do NOT let this chemical enter the environment. (Extra personal protection: P2 filter respirator for harmful particles.)	Do not transport with food and feedstuffs.

EMERGENCY RESPONSE	STORAGE
	Separated from strong oxidants. Keep in a well-ventilated room.

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IMPORTANT DATA

Physical State; Appearance
PALE YELLOW OR COLOURLESS SOLID IN VARIOUS FORMS

Chemical dangers
The substance decomposes on heating producing irritating fumes.

Occupational exposure limits
TLV not established.
MAK not established.

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

Effects of short-term exposure
Exposure to sun may provoke an irritating effect of pyrene on skin and lead to chronic skin discoloration.

PHYSICAL PROPERTIES

Boiling point: 404°C
Melting point: 151°C
Density: 1.27 g/cm^3

Solubility in water: 0.135 mg/l at 25°C
Vapour pressure, Pa at °C: 0.08
Octanol/water partition coefficient as log Pow: 4.88

ENVIRONMENTAL DATA

Bioaccumulation of this chemical may occur in crustacea, in fish, in milk, in algae and in molluscs. It is strongly advised that this substance does not enter the environment.

NOTES

Pyrene is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, pyrene may be encountered as a laboratory chemical in its pure form.
Health effects of exposure to the substance have not been investigated adequately.
See ICSC 1415 Coal-tar pitch.

ADDITIONAL INFORMATION

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SELENIUM

0072
April 1993

CAS No: 7782-49-2 RTECS No: VS7700000 EC No: 034-001-00-2	(powder) Se Atomic mass: 79.0

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with oxidants.	Powder, AFFF, foam, carbon dioxide. NO water.
EXPLOSION	Risk of fire and explosion on contact with oxidants.		
EXPOSURE		**PREVENT DISPERSION OF DUST! STRICT HYGIENE!**	
Inhalation	Irritation of nose. Cough. Dizziness. Headache. Laboured breathing. Nausea. Sore throat. Vomiting. Weakness. Symptoms may be delayed (see Notes).	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Redness. Skin burns. Pain. Discolouration.	Protective gloves. Protective clothing.	Rinse skin with plenty of water or shower. Refer for medical attention. Remove and isolate contaminated clothes.
Eyes	Redness. Pain. Blurred vision.	Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Metallic taste. Diarrhoea. Chills. Fever. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING	
Do NOT wash away into sewer. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Personal protection: P3 filter respirator for toxic particles.	T Symbol R: 23/25-33-53 S: (1/2-)20/21-28-45-61	Airtight. Do not transport with food and feedstuffs.

EMERGENCY RESPONSE	SAFE STORAGE
	Fireproof. Separated from strong oxidants, strong acids, food and feedstuffs. Dry.

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IMPORTANT DATA

Physical State; Appearance
ODOURLESS SOLID IN VARIOUS FORMS. DARK RED-BROWN TO BLUISH-BLACK AMORPHOUS SOLID OR RED TRANSPARENT CRYSTALS OR METALLIC GREY TO BLACK CRYSTALS.

Chemical dangers
Upon heating, toxic fumes are formed. Reacts violently with oxidants strong acids. Reacts with water at 50/C forming flammable/explosive gas (hydrogen - see ICSC0001) and selenious acids. Reacts with incandescence on gentle heating with phosphorous and metals such as nickel, zinc, sodium, potassium, platinum.

Occupational exposure limits
TLV: 0.2 mg/m^3 as TWA; (ACGIH 2004).
MAK: (Inhalable fraction) 0.05 mg/m^3; Peak limitation category: II(4); Carcinogen category: 3B; Pregnancy risk group: C; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
Evaporation at 20/C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

Effects of short-term exposure
The substance is irritating to the eyes and the respiratory tract. Inhalation of dust may cause lung oedema (see Notes). Inhalation of fume may cause symptoms of asphyxiation, chills and fever and bronchitis. The effects may be delayed.

Effects of long-term or repeated exposure
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the respiratory tract, gastrointestinal tract, and skin, resulting in nausea, vomiting, cough, yellowish skin discolouration, loss of nails, garlic breath and bad teeth.

PHYSICAL PROPERTIES

Boiling point: 685/C
Melting point: 170-217/C
Relative density (water = 1): 4.8
Solubility in water: none
Vapour pressure, Pa at 20/C: 0.1

ENVIRONMENTAL DATA

NOTES

Do NOT take working clothes home.
Card has been partly updated in April 2005. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

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SILVER

0810
October 1997

CAS No: 7440-22-4	Argentium
RTECS No: VW3500000	C.I. 77820
UN No:	Ag
EC No:	Atomic mass: 107.9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Not combustible, except as powder.		
EXPLOSION			
EXPOSURE		**PREVENT DISPERSION OF DUST!**	
Inhalation		Local exhaust or breathing protection.	Fresh air, rest.
Skin		Protective gloves.	Rinse skin with plenty of water or shower.
Eyes		Safety spectacles, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion		Do not eat, drink, or smoke during work.	

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Symbol R: S:

EMERGENCY RESPONSE	STORAGE
	Separated from ammonia, strong hydrogen peroxide solutions, strong acids.

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IMPORTANT DATA

Physical State; Appearance
WHITE METAL, TURNS DARK ON EXPOSURE TO OZONE, HYDROGEN SULFIDE OR SULFUR.

Chemical Dangers
Shock-sensitive compounds are formed with acetylene. Reacts with acids causing fire hazard. Contact with strong hydrogen peroxide solution will cause violent decomposition to oxygen gas. Contact with ammonia may cause formation of compounds that are explosive when dry.

Occupational Exposure Limits
TLV (metal): 0.1 mg/m^3 (ACGIH 1997).
MAK: 0.1 mg/m^3; (1996)

Routes of Exposure
The substance can be absorbed into the body by inhalation and by ingestion.

Inhalation Risk
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

Effects of Short-term Exposure
Inhalation of high amounts of metallic silver vapours may cause lung damage with pulmonary edema.

Effects of Long-term or Repeated Exposure
The substance may cause a grey-blue discoloration of the eyes, nose, throat and skin (argyria/argyrosis).

PHYSICAL PROPERTIES

Boiling point: 2212°C
Melting point: 962°C

Relative density (water = 1): 10.5
Solubility in water: none

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to aquatic organisms.

NOTES

ADDITIONAL INFORMATION

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TOLUENE

0078
October 2002

CAS No: 108-88-3 RTECS No: XS5250000 UN No: 1294 EC No: 601-021-00-3	Methylbenzene Toluol Phenylmethane $C_6H_5CH_3$ / C_7H_8 Molecular mass: 92.1

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/SYMPTOMS	PREVENTION	FIRST AID/FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding). Do NOT use compressed air for filling, discharging, or handling. Use non-sparking handtools.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		**STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!**	
Inhalation	Cough. Sore throat. Dizziness. Drowsiness. Headache. Nausea. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
Eyes	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area in large spill! Consult an expert in large spill! Remove all ignition sources. Ventilation. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Personal protection: self-contained breathing apparatus in large spill.	F Symbol Xn Symbol R: 11-38-48/20-63-65-67 S: (2-)36/37-46-62 UN Hazard Class: 3 UN Pack Group: II

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S1294 NFPA Code: H 2; F 3; R 0	Fireproof. Separated from strong oxidants.

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IMPORTANT DATA

Physical State; Appearance
COLOURLESS LIQUID, WITH CHARACTERISTIC ODOUR.

Physical dangers
The vapour mixes well with air, explosive mixtures are formed easily. As a result of flow, agitation, etc., electrostatic charges can be generated.

Chemical dangers
Reacts violently with strong oxidants causing fire and explosion hazard.

Occupational exposure limits
TLV: 50 ppm as TWA; (skin); A4; BEI issued; (ACGIH 2004).
MAK: 50 ppm, 190 mg/m^3; H; Peak limitation category: II(4); Pregnancy risk group: C; (DFG 2004).

Routes of exposure
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

Inhalation risk
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20/C.

Effects of short-term exposure
The substance is irritating to the eyes and the respiratory tract. The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. Exposure at high levels may result in cardiac dysrhythmia and unconsciousness.

Effects of long-term or repeated exposure
The liquid defats the skin. The substance may have effects on the central nervous system. Exposure to the substance may enhance hearing damage caused by exposure to noise. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 111/C
Melting point: -95/C
Relative density (water = 1): 0.87
Solubility in water: none
Vapour pressure, kPa at 25/C: 3.8
Relative vapour density (air = 1): 3.1
Relative density of the vapour/air-mixture at 20/C (air = 1): 1.01
Flash point: 4/C c.c.
Auto-ignition temperature: 480/C
Explosive limits, vol% in air: 1.1-7.1
Octanol/water partition coefficient as log Pow: 2.69

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested.
Use of alcoholic beverages enhances the harmful effect.
Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

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Appendix D

Summary of Prohibited and Acceptable Materials

SAMPLING CONSIDERATIONS WHEN ANALYZING FOR PFCS

Summary of Prohibited and Acceptable Materials

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

Appendix E

Heat and Cold Stress Protocols

HEAT STRESS

Heat Stress (Hyperthermia)

Heat stress is the body's inability to regulate the core temperature. A worker's susceptibility to heat stress can vary according to his/her physical fitness, degree of acclimation to heat, humidity, age and diet.

1. Prior to site activity, the field team leader may make arrangements for heat stress monitoring (i.e., monitoring heart rate, body temperature, and body water loss) during actual site work if conditions warrant. In addition, the FTL is to ensure that each team member has been acclimatized to the prevailing environmental conditions, that personnel are aware of the signs and symptoms of heat sickness, that they have been adequately trained in first aid procedures, and that there are enough personnel on-site to rotate work assignments and schedule work during hours of reduced temperatures. Personnel should not consume alcoholic or caffeinated beverages but rather drink moderate levels of an electrolyte solution and eat well prior to commencing site work.

2. Although there is no specific test given during a baseline physical that would identify a person's intolerance to heat, some indicators are tobacco or medication use, dietary habits, body weight, and chronic conditions such as high blood pressure or diabetes.

3. *Heat cramps*, caused by profuse perspiration with inadequate fluid intake and salt replacement, most often afflict people in good physical condition who work in high temperature and humidity. Heat cramps usually come on suddenly during vigorous activity. Untreated, heat cramps may progress rapidly to heat exhaustion or heat stroke. First aid treatment: remove victim to a cool place and replace lost fluids with water.

4. Thirst is not an adequate indicator of heat exposure. Drinking fluid by itself does not indicate sufficient water replacement during heat exposure. A general rule, the amount of water administered should replace the amount of water lost, and it should be administered at regular intervals throughout the day. For every half pound of water lost, 8 ounces of water should be ingested. Water should be replaced by drinking 2 – 4 ounce servings during every rest period. A recommended alternative to water is an electrolyte drink split 50/50 with water.

5. *Heat exhaustion* results from salt and water loss along with peripheral pooling of blood. Like heat cramps, heat exhaustion tends to occur in persons in good physical health who are working in high temperatures and humidity. Heat exhaustion may come on suddenly as dizziness and collapse. Untreated, heat exhaustion may progress to heat stroke.

6. *Treatment for heat exhaustion*: Move the victim to a cool environment (e.g. air-conditioned room/car), lay victim down and fan him/her. If the air-conditioning is not available, remove the victim to a shaded area, remove shirt, and fan. If symptoms do not subside within an hour, notify 911 to transport to hospital.

7. *Heat stroke* results from the body's inability to dissipate excess heat. A true medical emergency that requires immediate care, it usually occurs when one ignores the signs of heat exhaustion and continues strenuous activities. Working when the relative humidity exceeds 60% is a particular problem. Workers in the early phase of heat stress may not be coherent of they will be confused, delirious or comatose. Changes in behavior, irritability and combativeness are useful early signs of heat stroke.

8. *Treatment of heat stroke*: Move the victim to a cool, air-conditioned environment. Place victim in a semi-reclined position with head elevated and strip to underclothing. Cool victim as rapidly as possible, applying ice packs to the arms and legs and massaging the neck and torso. Spray victim with tepid water and constantly fan to promote evaporation. Notify 911 to transport to hospital as soon as possible.

TABLE 1

SYMPTOMS OF HEAT STRESS

Heat cramps are caused by heavy sweating with inadequate fluid intake. Symptoms include;

- Muscle cramps
- Cramps in the hands, legs, feet and abdomen

Heat exhaustion occurs when body organs attempt to keep the body cool. Symptoms include;

- Pale, cool moist skin
- Core temperature elevated 1-2°
- Thirst
- Anxiety
- Rapid heart rate
- Heavy sweating
- Dizziness
- Nausea

Heat stroke is the most serious form of heat stress. Immediate action must be taken to cool the body before serious injury and death occur. Symptoms are;

- Red, hot, dry skin
- Lack of perspiration
- Seizures
- Dizziness and confusion
- Strong, rapid pulse
- Core temperature of 104° or above
- Coma

TABLE 2

HEAT STRESS INDICATORS

Heat stress indicator	When to measure	If Exceeds...	Action
Heart rate (pulse)	Beginning of rest period	110 beats per minute	Shorten next work period by 33%
Oral temperature	Beginning of rest period	99°F (after thermometer is under tongue for 3 minutes) 100.6°F	Shorten next work period by 33% Prohibit work in impermeable clothing
Body weight	1. Before workday begins (a.m.) 2. After workday ends (p.m.)		Increase fluid intake

COLD STRESS

Cold stress (Hypothermia)

In hypothermia the core body temperature drops below 95°F. Hypothermia can be attributed to a decrease in heat production, increased heat loss or both.

Prevention

Institute the following steps to prevent overexposure of workers to cold:

1. Maintain body core temperature at 98.6°F or above by encouraging workers to drink warm liquids during breaks (preferably not coffee) and wear several layers of clothing that can keep the body warm even when the clothing is wet.
2. Avoid frostbite by adequately covering hands, feet and other extremities. Clothing such as insulated gloves or mittens, earmuffs and hat liners should be worn. To prevent contact frostbite (from touching metal and cold surfaces below 20°F), workers should wear gloves. Tool handles should be covered with insulating material.
3. Adjust work schedules to provide adequate rest periods. When feasible, rotate personnel and perform work during the warmer hours of the day.
4. Provide heated shelter. Workers should remove their outer layer(s) of clothing while in the shelter to allow sweat to evaporate.
5. In the event that wind barriers are constructed around an intrusive operation (such as drilling), the enclosure must be properly vented to prevent the buildup of toxic or explosive gases or vapors. Care must be taken to keep a heat source away from flammable substances.
6. Using a wind chill chart such as the one in Table 3, obtain the equivalent chill temperature (ECT) based on actual wind speed and temperature. Refer to the ECT when setting up work warm-up schedules, planning appropriate clothing, etc. Workers should use warming shelters at regular intervals at or below an ECT of 20°F. For exposed skin, continuous exposure should not be permitted at or below an ECT of -25°F.

Frostbite

Personnel should be aware of symptoms of frostbite/hypothermia. If the following symptoms are noticed in any worker, he/she should immediately go to a warm shelter.

Condition	Skin Surface	Tissue Under Skin	Skin Color
Frostnip	Soft	Soft	Initially red, then white
Frostbite	Hard	Soft	White and waxy
Freezing	Hard	Hard	Blotchy, white to yellow-gray to gray

1. *Frostnip* is the incipient stage of frostbite, brought about by direct contact with a cold object or exposure of a body part to cool/cold air. Wind chill or cold water also can be major factors. This condition is not serious. Tissue damage is minor and the response to care is good. The tip of the nose, tips of ears, upper cheeks and fingers (all areas generally exposed) are most susceptible to frostnip.

2. *Treatment of frostnip*: Care for frostnip by warming affected areas. Usually the worker can apply warmth from his/her bare hands, blow warm air on the site, or, if the fingers are involved, hold them in the armpits. During recovery, the worker may complain of tingling or burning sensation, which is normal. If the condition does not respond to this simple care, begin treatment for frostbite.

3. *Frostbite*: The skin and subcutaneous layers become involved. If frostnip goes untreated, it becomes superficial frostbite. This condition is serious. Tissue damage may be serious. The worker must be transported to a medical facility for evaluation. The tip of the nose, tips of ears, upper cheeks and fingers (all areas generally exposed) are most susceptible to frostbite. The affected area will feel frozen, but only on the surface. The tissue below the surface must still be soft and have normal response to touch. *DO NOT* squeeze or poke the tissue. The condition of the deeper tissues can be determined by gently palpating the affected area. The skin will turn mottled or blotchy. It may also be white and then turn grayish-yellow.

4. *Treatment of frostbite*: When practical, transport victim as soon as possible. Get the worker inside and keep him/her warm. Do not allow any smoking or alcohol consumption. Thaw frozen parts by immersion, re-warming in a 100°F to 106°F water bath. Water temperature will drop rapidly, requiring additional warm water throughout the process. Cover the thawed part with a dry sterile dressing. Do not puncture or drain any blisters.

   NOTE: Never listen to myths and folk tales about the care of frostbite. *Never* rub a frostbitten or frozen area. *Never* rub snow on a frostbitten or frozen area. Rubbing the area may cause serious damage to already injured tissues. Do not attempt to thaw a frozen area if there is any chance it will be re-frozen.

5. *General cooling/Hypothermia*: General cooling of the body is known as systemic hypothermia. This condition is not a common problem unless workers are exposed to cold for prolonged periods of time without any shelter.

Body Temperature	°C	Symptoms
99-96	37-35.5	Intense, uncontrollable shivering
95-91	35.5-32.7	Violent shivering persists. If victim is conscious, he has difficulty speaking.
90-86	32-30	Shivering decreases and is replaced by strong muscular rigidity. Muscle coordination is affected. Erratic or jerkey movements are produced. Thinking is less clear. General comprehension is dulled. There may be total amnesia. The worker is generally still able to maintain the appearance of psychological contact with his surroundings.
85-81	29.4-27.2	Victim becomes irrational, loses contact with his environment, and drifts into a stuporous state. Muscular rigidity continues. Pulse and respirations are slow and the worker may develop cardiac arrhythmias.
80-78	26.6-18.5	Victim becomes unconscious. He does not respond to the spoken word. Most reflexes cease to function. Heartbeat becomes erratic
Below 78	25.5	Cardiac and respiratory centers of the brain fail. Ventricular fibrillation occurs; probably edema and hemorrhage in the lungs; death.

6. *Treatment of hypothermia*: Keep worker dry. Remove any wet clothing and replace with dry clothes, or wrap person in dry blankets. Keep person at rest. Do not allow him/her to move around. Transport the victim to a medical facility as soon as possible.

TABLE 3(1)

COOLING POWER OF WIND ON EXPOSED FLESH EXPRESSED AS AN EQUIVALENT TEMPERATURE (UNDER CALM CONDITIONS)

Estimated wind Speed (in mph)	Actual Temperature Reading (°F)P											
	50	40	30	20	10	0	10	20	30	40	50	60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	15	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-146
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER in < hr with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute			GREAT DANGER may freeze within 30 seconds.				Flesh
	Trench foot and imersion foot may occur at any point on this chart											

Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

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(1) Reproduced from American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1985-1986, p.01.

Appendix F

Field Accident Report

FIELD ACCIDENT REPORT

This report is to be filled out by the designated Site Safety Officer after EVERY accident.

PROJECT NAME: ________________________________PROJECT. NO.: ________________

Date of Accident: _____________________Time: _______Report By:_____________________

Type of Accident (Check One):

( ) Vehicular ( ) Personal ( ) Property

Name of Injured: _________________________________DOB or Age____________________

How Long Employed: ____

Names of Witnesses: ____

Description of Accident: ____

____

____

Action Taken: ____

____

____

Did the Injured Lose Any Time?_________________How Much (Days/Hrs.)?_______________

Was Safety Equipment in Use at the Time of the Accident (Hard Hat, Safety Glasses, Gloves, Safety Shoes, etc.)?____

____

____

(If not, it is the EMPLOYEE'S sole responsibility to process his/her claims through his/her Health and Welfare Fund.)

INDICATE STREET NAMES, DESCRIPTION OF VEHICLES, AND NORTH ARROW

____

____

____

APPENDIX F
Community Air Monitoring Plan

SUFFOLK COUNTY FIREMATICS
676 MAPLE STREET
YAPHANK, NEW YORK
SECTION 742, BLOCK 1, P/O LOTS 3.001 AND 3.002
NYSDEC SITE: 152246

COMMUNITY AIR MONITORING PLAN

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7016

PREPARED FOR:

Suffolk County
H. Lee Dennison Building
Hauppauge, New York 11788

PREPARED BY:

P.W. Grosser Consulting Engineer & Hydrogeologist, PC
630 Johnson Avenue, Suite 7
Bohemia, New York 11716
Phone: 631-589-6353
Fax: 631-589-8705

James Rhodes, PG Sr. Vice President jamesr@pwgrosser.com
Andy Lockwood, PG, LEP, Vice President andyl@pwgrosser.com

PWGC Project Number: SHD1702

SEPTEMBER 2017

COMMUNITY AIR MONITORING PLAN
SUFFOLK COUNTY FIREMATICS
676 MAPLE STREET
YAPHANK, NEW YORK

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TABLES

APPENDICES

1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) provides measures for protection for on-site workers, and the downwind community (i.e., off-site receptors including residences, businesses, and on-site workers not directly involved in the remedial investigation) from potential airborne contaminant releases resulting from the Remedial Investigation (RI) at 676 Maple Street Yaphank, New York.

The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that the remedial work did not spread contamination off-site through the air.

The primary chemicals of potential concern (COPC) to be encountered at the Site are PFCs related to the historical use of firefighting foam. In addition, other COPC may be present from the historical use and storage of petroleum liquids, use of on-site sanitary and storm water systems, or the presence of up gradient off-site sources of volatile organic compounds (VOCs) in groundwater. On-site soil contamination could also be spread by dust particulates generated during site activities.

1.1 Regulatory Requirements

This CAMP was established in accordance with the following requirements:

- 29 CFR 1910.120(h): This regulation specifies that air shall be monitored to identify and quantify levels of airborne hazardous substances and health hazards, and to determine the appropriate level of protection for workers.
- New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan (**Appendix 1A**): This guidance specifies that a community air-monitoring program shall be implemented to protect the surrounding community and to confirm that the work does not spread contamination off-site through the air.
- New York State Department of Environmental Conservation's (NYSDEC's) Fugitive Dust and Particulate Monitoring from DER-10 Technical Guidance for Site Investigation and Remediation (**Appendix 1B**) - Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites: This guidance provides a basis for developing and implementing a fugitive dust suppression and particulate monitoring program as an element of a hazardous waste site's health and safety program.

2.0 AIR MONITORING

The following sections contain information describing the types, frequency and location of real-time monitoring.

2.1 Real-Time Monitoring

This section addresses the real-time monitoring that will be conducted within the work area, and along the site's downwind perimeter, during all ground intrusive activities, such as drilling and test pit excavation.

2.1.1 *Work Area*

The following instruments will be used for work area monitoring:

- Photoionization Detector (PID)
- Dust Monitor

Table 1-1 presents a breakdown of each main activity and provides the instrumentation, frequency and location of the real-time monitoring for the site. Table 1-2 lists the Real-Time Air Monitoring Action Levels to be used in all work areas.

2.1.2 *Community Air Monitoring Requirements*

To establish ambient air background concentrations, air will be monitored at several locations around the site perimeter before investigation activities begin. These points will be monitored periodically in series during the site work.

Fugitive respirable dust will be monitored using a MiniRam Model PDM-3 aerosol monitor or equivalent, which is capable of measuring particulate matter less than 10 micrometers in size (PM-10). Air will be monitored for VOCs with a portable Photovac MicroTip PID or equivalent. All air monitoring data is documented in a site log book by the designated site safety officer. PWGC's site safety officer or delegate must ensure that air monitoring instruments are calibrated and maintained in accordance with manufacturer's specifications. All instruments will be zeroed daily and checked for accuracy. A daily log will be kept. If additional monitoring is required, the protocols will be developed and appended to this plan.

Table 1-1

Frequency and Location of Air Monitoring

ACTIVITY	AIR MONITORING INSTRUMENT	FREQUENCY AND LOCATION
Drilling, Sampling	PID	Continuous in Work Zone (WZ) during intrusive activities or if odors become apparent, screening in the BZ every 30 minutes during non-intrusive activities Every 60 minutes at the perimeter during intrusive activities
Drilling, Sampling	Particulate (Dust, Mist or Aerosol) Meter	Continuous in Work Zone (WX) during intrusive activities or if odors become apparent, screening in the BZ every 30 minutes during non-intrusive activities Every 60 minutes at the perimeter during intrusive activities

Table 1-2

Real-Time Air Monitoring Action Levels

AIR MONITORING INSTRUMENT	MONITORING LOCATION	ACTION LEVEL	SITE ACTION	REASON FOR SITE ACTION
PID	Breathing Zone	0-25 ppm, non-transient	None	Exposure below established exposure limits
PID	Breathing Zone	25-100 ppm, non-transient	Don APR	Based on potential exposure to VOCs
PID	Breathing Zone	>100 ppm, non-transient	Don ASR or SCBA, Institute vapor/odor suppression measures, Notify SSO.	Increased exposure to site contaminants, potential for vapor release to public areas.
PID	Work Area Perimeter (20-foot radius)	< 5 ppm	None	Exposure below established exposure limits.
PID	Work Area Perimeter (20-foot radius)	> 5 ppm	Stop work and implement vapor release response plan until readings return to acceptable levels, Notify SSO.	Increased exposure to site contaminants, potential for vapor release to public areas
Particulate (Dust, Mist or Aerosol) Meter	Work Area Perimeter (20-foot radius)	>100 but < 150 μg/m^3	Institute dust suppression measures, Notify SSO. Work may continue if particulate concentrations remain below 150 μg/m3	Increased exposure to site contaminants, potential for vapor release to public areas
Particulate (Dust, Mist or Aerosol) Meter	Work Area Perimeter (20-foot radius)	>150 μg/m^3	Don ASR or SCBA, Institute dust suppression measures. Stop work and implement dust suppression techniques until readings return to acceptable levels, Notify SSO.	Increased exposure to site contaminants, potential for vapor release to public areas

3.0 VAPOR EMISSION RESPONSE PLAN

This section is excerpted from the NYSDOH guidance for Community Air Monitoring Plan - Ground Intrusive Activities.

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. Vapor suppression measures can also be taken at this time. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- The organic vapor level 200 feet downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down. When work shutdown occurs, downwind air monitoring as directed by the Site Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission Response Plan Section (Section 4.0).

4.0 MAJOR VAPOR EMISSION RESPONSE PLAN

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted. The area 200 feet downwind will be monitored if WZ organic vapor levels are recorded at the levels and durations explained below.

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

If efforts to abate the emission source (see Section 5.0) are unsuccessful and if organic vapor levels are approaching 5 ppm above background for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect.

However, the Major Vapor Emission Response Plan shall be immediately placed in effect if organic vapor levels are greater than 10 ppm above background for more than 30 minutes in the 20 Foot Zone.

Upon activation, the following activities will be undertaken:

1. All emergency Response Contacts as listed in the Health & Safety Plan will go into effect.

2. The local police authorities will immediately be contacted by the Health & Safety Officer and advised of the situation.
3. Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Site Safety Officer.

5.0 VAPOR SUPPRESSION TECHNIQUES

Vapor suppression techniques must be employed when action levels warrant the use of these techniques.

The techniques to be implemented for control of VOCs from stockpiled soil or from the open excavation will include one or more of the following:

- Cover with plastic
- Cover with "clean soil"
- Application of hydro-mulch material or encapsulating foam
- Limit working hours to favorable wind and temperature conditions

6.0 DUST SUPPRESSION TECHNIQUES

Reasonable dust-suppression techniques must be employed during all work that may generate dust, such as drilling, excavation, and placement of clean fill. The following techniques were shown to be effective for controlling the generation and migration of dust during remedial activities:

- Wetting equipment and excavation faces;
- Spraying water on buckets during excavation and dumping;
- Hauling materials in properly covered containers; and,
- Restricting vehicle speeds to 10 mph.

It is imperative that utilizing water for suppressing dust does not create surface runoff.

7.0 DATA QUALITY ASSURANCE

7.1 Calibration

Instrument calibration shall be documented in the designated field logbook. All instruments shall be calibrated in accordance with manufacturer's instructions and specifications before each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

7.2 Operations

All instruments shall be operated in accordance with the manufacturer's specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on-site by the SSO for reference.

7.3 Data Review

The Project Manager will interpret all monitoring data based on Table 1-2 and his/her professional judgment. The Project Manager shall review the data with the SSO to evaluate the potential for worker and community exposure, upgrades/downgrades in level of protection, comparison to direct reading instrumentation and changes in the integrated monitoring strategy.

Monitoring and sampling data, along with all sample documentation will be periodically reviewed by the SSP.

8.0 RECORDS AND REPORTING

All readings must be recorded and available for review by personnel from NYSDEC and NYSDOH. Should any of the action levels be exceeded for the duration of 30 minutes in the WZ , the NYSDEC Division of Air Resources and NYSDOH must be notified immediately (within one business day).

The notification shall include a description of the control measures implemented to prevent further exceedances.

APPENDIX 1A
NYSDOH GENERIC CAMP

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

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

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

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

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

> **Continuous monitoring** will be required for all <u>ground intrusive</u> activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.
>
> **Periodic monitoring** for VOCs will be required during <u>non-intrusive</u> activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

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

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

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

<u>December 2009</u>

APPENDIX 1B

FUGITIVE DUST AND PARTICULATE MONITORING FROM DER-10 TECHNICAL GUIDANCE FOR SITE INVESTIGATIONS AND REMEDATION

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50° C (14 to 122° F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.