SUFFOLK COUNTY FIREMATICS SITE
NORTH OF MAPLE STREET, YAPHANK, NEW YORK 11980
PORTION OF 0200-742.00-01.00-003.011
NYSDEC SITE: 152246

SOIL/MATERIALS MANAGEMENT PLAN

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233-7016

PREPARED FOR:

Suffolk County Department of Health Services
Office of Pollution Control
15 Horseblock Place
Farmingville, New York 11738

PREPARED BY:

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PWGC Project Number: SHD2302

FEBRUARY 2025

SOIL/MATERIALS MANAGEMENT PLAN
SUFFOLK COUNTY FIREMATICS SITE
NORTH OF MAPLE STREET, YAPHANK, NEW YORK 11980

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ACRONYMS

Acronym	Definition
AOC	Area of Concern
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
NYCDCP	New York City Department of City Planning
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PID	Photo Ionization Detector
QEP	Qualified Environmental Professional
RCA	Recycled Concrete Aggregate
SCDHS	Suffolk County Department of Health Services
SMMP	Soil/Materials Management Plan
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
UUSCO	Unrestricted Use Soil Cleanup Objective
VOCs	Volatile Organic Compounds

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CERTIFICATION

I, Edmond Kirby, PE, am a Professional Engineer licensed in the State of New York. I have primary direct responsibility for implementation of the Soils/Materials Management Plan (SMMP) for the Suffolk County Firematics Site (NYSDEC Site **152246).**

I, Zeb Youngman, PG am a Qualified Environmental Professional (QEP) as defined in §43-140. I have primary direct responsibility for implementation of the Soils/Materials Management Plan (SMMP) Suffolk County Firematics Site (NYSDEC Site **152246).**

I certify that the SMMP has a plan for handling, transport and disposal of soil, fill, fluids and other materials removed from the property in accordance with applicable City, State and Federal laws and regulations. Importation of soil, fill and other material from off-Site will be in accordance with applicable City, State and Federal laws and requirements. This SMMP has provisions to control nuisances during invasive work, including dust suppression.

Edmond Kirby, PE
Name

105360
NYS PE License Number

Signature

STATE OF NEW YORK
EDMOND J. KIRBY
105360
LICENSED PROFESSIONAL ENGINEER

2/21/2025
Date

Zeb Youngman, PG

2/21/2025
Date

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1.0 SITE BACKGROUND

This SMMP has been developed for the development project located at an undeveloped plot of land located north of 676 Maple Street, Yaphank, New York (hereinafter referred to as the "Site"). Site redevelopment will include the construction of two apartment prop structures, along with associated driveways and parking areas, to be used for fire training purposes. This SMMP is based on the findings of a May 2023 Soil Delineation Investigation Report prepared for the site by PWGC.

1.1. Site Location, Current Usage and Current Zoning

The Site is located in Yaphank, New York and is identified as a portion of 0200-742.00-01.00-003.011 on the Suffolk County Tax Map. **Figure 1** is a Site location map. The Site is approximately 2.41 acres and is bounded by Suffolk Avenue to the north, the Suffolk County Firematics Site to the south, East Avenue to the east, and an undeveloped, wooded area to the west. The Site is currently vacant.

1.2. Proposed Plan

The proposed use of the Site will be for fire training purposes. The work being proposed is to install new utilities (water supply, storm drainage, communications, electric) for the prop structures and cut/fill onsite soils to grade the site for road paving and the prop buildings' foundations. Layout of the proposed site development is presented in **Appendix A**.

1.3. Description of Surrounding Property

The adjacent property to the south is the Suffolk County Firematics site, which is included in the State Superfund Program (Site Code: 152246). The Firematics site is separated from the Site by a chain-link fence. The site is owned by Suffolk County and has been used as a firefighting training facility since 1959. The Firematics site measures approximately 28 acres in size. PWGC prepared a Remedial Investigation Report in January 2021 and a Soil Delineation Investigation in May 2023. Per- and poly-fluoroalkyl substances (PFAS) were identified in soil and groundwater across the site. The adjacent property to the east and west are undeveloped, wooded plots of land. Yaphank Avenue and single-family residential properties are present farther to the east and Sill Industrial Park is present farther to the

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west. The Suffolk County Sheriff's office is present to the north. **Figure 2** shows the surrounding land usage.

A portion of the proposed site development is anticipated to occur within the northern boundary of the Firematics site, currently separated from the Site by a chain-link fence. Any soil disturbed within the Firematics site will be handled separately from soil generated within the Site (discussed further in Section 2).

1.4. Environmental Investigation Reports

PWGC performed a Soil Delineation Investigation (SDI) for the Suffolk County Firematics Site in May of 2023. The SDI included the adjacent property to the north of the Firematics site, the undeveloped target site.

Eleven soil borings were installed to four feet below the ground surface (bgs) using a hand auger to horizontally delineate PFAS in the undeveloped area adjacent to the north of the Firematics site. The specific PFAS of interest are Perfluorooctane sulfonate (PFOS) and Perfluorooctanoate (PFOA). Soil samples were collected from zero to six-inches, six-inches to two-feet, and two-feet to four-feet intervals. Samples collected from the two-feet to four-feet interval were initially placed on hold, pending the results of the shallower sample intervals. A total of 28 soil samples were collected.

PFOS was detected above Protection of Groundwater (POG) Soil Guidance Values (SGVs) in four out of 28 samples. The four samples were concentrated in the southeastern corner of the undeveloped area, adjacent to the Firematics site. One of the four exceeding samples was collected from the two-feet to four-feet interval.

PFOA was detected above POGSGVs in ten out of 28 samples. Each of the exceedances were from either the zero to 6-inch or 6-inch to 2-feet intervals. PFOA was not detected above POGSGVs in the two-feet to four-feet interval.

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2.0 SOIL/MATERIALS MANAGEMENT PLAN

2.1. Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be conducted during invasive work related to construction activities under the supervision of a Qualified Environmental Professional and will be reported to SCDHS and NYSDEC at the end of construction activities.

2.2. Excavation Activities

Excavation will occur both on and off site. All excavation will be performed in a manner that minimizes to the extent practicable,

- The amount/degree of soil disturbance.
- Ensures soil excavation from on site remains on site and soil excavated from off site (Firematics) remains off-site,
- Soils excavated on site will be stockpiled on site, if necessary, and soil excavated off-site (Firematics) will be stockpiled off site (Firematics), if necessary.

2.3. Stockpile Methods

If stockpiles are generated, excavated soil will be stockpiled directly on poly sheeting and removed as soon as practicable. Excavated soils will be stockpiled on, at minimum, a single layer of 8-mil poly sheeting, will be kept covered at all times with appropriately anchored plastic tarps, and will be routinely inspected. Damaged tarps will be promptly replaced. Soil excavated from within the Firematics site will be stockpiled separately from soil excavated within the Site's boundaries and will be appropriately labeled.

All stockpile activities will be compliant with applicable laws and regulations.

2.4. Characterization of Excess Excavated Materials

Soil/fill or other excavated media on-Site will be reused onsite for similar purposes. Soil/fill or other excavated media at the Firematics site will be sampled and evaluated for reuse onsite or transport off-Site for disposal in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Soils proposed for reuse on-Site will be managed as defined in this plan.

2.5. Materials Excavation, Load-Out, and Departure

The PE/QEP overseeing the implementation of the SMMP will:

- oversee work and the excavation and load-out of excavated material;
    - ensure that soil excavated within the Firematics site is stockpiled separately from the Site soils, sampled, and evaluated for reuse or disposal off-site.
- ensure that there is a party responsible for the safe execution of soil disturbance and other work performed under this work plan;
- ensure that the presence of utilities and easements on the Site has been investigated and that any identified risks from work proposed under this plan are properly addressed by appropriate parties;
- ensure that all loaded outbound trucks are inspected and cleaned, if necessary, before leaving the Site;
- ensure that all egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during Site remediation.

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

Open and uncontrolled mechanical processing of soil on-Site will not be performed without prior SCDHS/NYSDEC approval.

2.6. Off-Site Materials Transport

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 New York Codes, Rules and Regulations NYCRR Part 364. If loads contain wet material capable of causing leakage from trucks, truck liners will be used. Queuing of trucks will be performed on-Site, when possible in order to minimize off Site disturbance. Off-Site queuing will be minimized.

Outbound truck transport routes are in **Figure 3**. This routing takes into account the following factors: (a) limiting transport through residential areas and past sensitive sites; (b) use of mapped truck routes; (c) minimizing off-Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport. To the extent possible, all trucks loaded with Site materials will travel from the Site using these truck routes. Trucks will not stop or idle in the neighborhood after leaving the project Site.

2.7. Materials Disposal Off-Site

The following documentation will be established and reported by the PE/QEP for each disposal destination used in this project to document that the disposal of material exported from the Site and adjacent regulated Firematics site conforms with applicable laws and regulations: (1) a letter from the PE/QEP or Applicant to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at an environmental remediation Site in New York under a governmental remediation program. The letter will provide the project identity and the name and phone number of the PE/QEP or Applicant. The letter will include as an attachment a summary of all chemical data for the material being transported; and (2) a letter from each disposal facility stating it is in receipt of the correspondence (1, above) and is approved to accept the material. These documents will be reported to SCDHS/NYSDEC at the end of construction activities.

The report will include an itemized account of the destination of all material removed from the Site during construction activities. Documentation associated with disposal of excess soils will include records and approvals for receipt of the material.

Excess soil/fill removed from the Site will be managed as regulated material and will be disposed of in accordance with applicable laws and regulations.

Waste characterization will be performed for off-Site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported to SCDHS/NYSDEC as soon as the analytical results are obtained. A manifest

system for off-Site transportation of exported materials will be employed. Manifest information will be reported to SCDHS/NYSDEC at the end of construction activities. Excess soils generated as part of this project will be stored, transported, and disposed of in compliance with applicable laws and regulations.

2.8. Materials Reuse On-Site

Site soils (north of the existing chain-link fence separating the Firematics site) that are excavated for the installation of utilities may be placed back into the excavation following installation. Soil excavated for the installation of utilities and prop structure construction may be utilized on-site for backfilling and grading purposes. All excess soils will be disposed of off-site, as described above, and no soils from other sources will be added to this portion of the property.

Soil excavated within the Firematics site (south of the existing chain-link fence) shall be stockpiled separately from Site soils, sampled, and compared to POGSGVs. If the soil does not meet POGSGVs, it will be further characterized for offsite disposal.

2.9. Import of Material from Off-Site Sources

It is not anticipated that import of backfill soils will be brought on-site from off-site sources. It is possible that RCA or gravel may be needed during construction as sub-base for the proposed utilities, paved areas, and prop structure foundations. If this should be the case, the following potential sources may be used:

- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of NYSDEC.

All materials received for import to the Site will be approved by a PE/QEP and will be in compliance with applicable City, State and Federal laws and requirements. The source of the fill, evidence that an inspection was performed on the source, chemical sampling results, frequency of testing, and a Site map indicating the locations where backfill or soil cover was placed will be reported to SCDHS and NYSDEC at the end of construction activities.

Source Screening and Testing

Recycled concrete aggregate (RCA) will be imported from facilities permitted or registered by NYSDEC. Facilities will be reported to SCDHS/NYSDEC at the end of construction activities. A PE/QEP is responsible to ensure that the facility is compliant with 6NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require additional testing, unless required by NYSDEC under its terms for operation of the facility. RCA imported to the Site must be derived from recognizable and uncontaminated concrete. RCA material is not acceptable for and will not be used as cover material.

Inspection of imported fill material will include visual, olfactory and PID screening for evidence of contamination. Materials imported to the Site will be subject to inspection, as follows:

- Trucks with imported fill material will be in compliance with applicable laws and regulations and will enter the Site at designated locations;
- The PE/QEP is responsible to ensure that every truck load of imported material is inspected for evidence of contamination; and
- Fill material will be free of solid waste including pavement materials, debris, stumps, roots, and other organic matter, as well as ashes, oil, perishables or foreign matter.

2.10. Fluids Management

Fluids management is not anticipated for this project; however, if fluids are encountered, the following procedures will be followed. All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable laws and regulations.

Discharge of water generated during construction to surface waters (i.e. a stream or river) is prohibited without a SPDES permit issued by NYSDEC.

2.11. Stormwater Pollution Prevention

Applicable laws and regulations pertaining to storm-water pollution prevention will be addressed during construction. Erosion and sediment control measures (silt fences and barriers, and hay bale checks) will be installed around the entire perimeter of the

construction area and inspected once a week and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective in preventing significant impacts to receptors. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by SCDHS/NYSDEC. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence anchor will be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

2.12. Contingency Plan

This contingency plan is developed for the construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to SCDHS and NYSDEC. Petroleum spills will be reported to the NYSDEC Spill Hotline. These findings will be included in the daily report. If previously unidentified contaminant sources are found during on-Site excavation or development-related excavation, sampling will be performed on contaminated source material and surrounding soils and reported to SCDHS/NYSDEC. Chemical analytical testing will be performed for Full List volatiles and semi-volatiles, pesticides/PCBs, and TAL metals, as appropriate.

2.13. Odor, Dust, and Nuisance Control

Odor Control

All necessary means will be employed to prevent on- and off-Site odor nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) use of foams to cover exposed odorous soils. If odors develop and cannot otherwise be controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-Site disposal; and (e) use of chemical odorants in spray or misting systems.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. SCDHS and

NYSDEC will be notified of all odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the PE/QEP's certifying the summary letter which will be provided to SCDHS/NYSDEC at the end of construction activities.

Dust Control

Dust management during invasive on-Site work will include, at a minimum:

- Use of a dedicated water spray methodology for roads, excavation areas and stockpiles.
- Use of properly anchored tarps to cover stockpiles.
- Exercise extra care during dry and high-wind periods.
- Use of gravel or recycled concrete aggregate on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will not resume until all nuisance dust emissions have been abated. SCDHS and NYSDEC will be notified of all dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the PE/QEP's.

Other Nuisances

Noise control will be exercised during construction activities. In addition, rodent control will be provided, during Site clearing and grubbing, and during construction activities, as necessary, to prevent nuisances.

2.14. Import of Clean Cover

It is not anticipated that any soils will be imported to the site for use as clean cover.

2.15. Reporting and Record Keeping

Daily Reports

Daily reports providing a general summary of activities for each day of active trenching/excavation work will be emailed to the SCDHS and NYSDEC Project Managers by the end of the following business day. Those reports will include:

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- Project number and statement of the activities and an update of progress made and locations of excavation and other work performed;
- Quantities of material imported and exported from the Site;
- Status of on-Site soil/fill stockpiles;
- A summary of all citizen complaints, with relevant details (basis of complaint; actions taken; etc.);
- A summary of CAMP results noting all exceedances
- Photograph of notable Site conditions and activities.

The frequency of the reporting period may be revised in consultation with SCDHS and NYSDEC project managers based on planned project tasks. Daily email reports are not intended to be the primary mode of communication for notification to SCDHS/NYSDEC of emergencies (accidents, spills), requests for changes to the proposed actions or other sensitive or time critical information. However, such information will be included in the daily reports. Emergency conditions and changes to the approved actions will be communicated directly to the SCDHS and NYSDEC project managers by personal communication.

Record Keeping and Photo Documentation

Job-site record keeping for all work will be performed. These records will be maintained on-Site during the project and will be available for inspection by SCDHS/NYSDEC staff. Representative photographs will be taken of the Site prior to site activities. Photographs will be submitted at the completion of the project in digital format (i.e. jpeg files).

Complaint Management

All complaints from citizens will be promptly reported to SCDHS and NYSDEC. Complaints will be addressed and outcomes will also be reported to SCHDS/NYSDEC in daily reports. Notices to SCDHS/NYSDEC will include the nature of the complaint, the party providing the complaint, and the actions taken to resolve any problems.

Deviations From the Approved Actions

All changes to the proposed actions will be reported to, and approved by, the SCDHS and NYSDEC Project Managers and will be documented in daily reports. The process to be

followed if there are any deviations from the approved actions will include a request for approval for the change from SCDHS/NYSDEC noting the following:

- Reasons for deviating from the approved actions;
- Effect of the deviations on overall approved actions; and
- Determination with basis that the approved action with the deviation(s) is protective of public health and the environment.

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3.0 CONSTRUCTION HEALTH AND SAFETY PLAN (CHASP)

A copy of the Construction Health and Safety Plan (CHASP) is included as **Appendix C.**

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FIGURES

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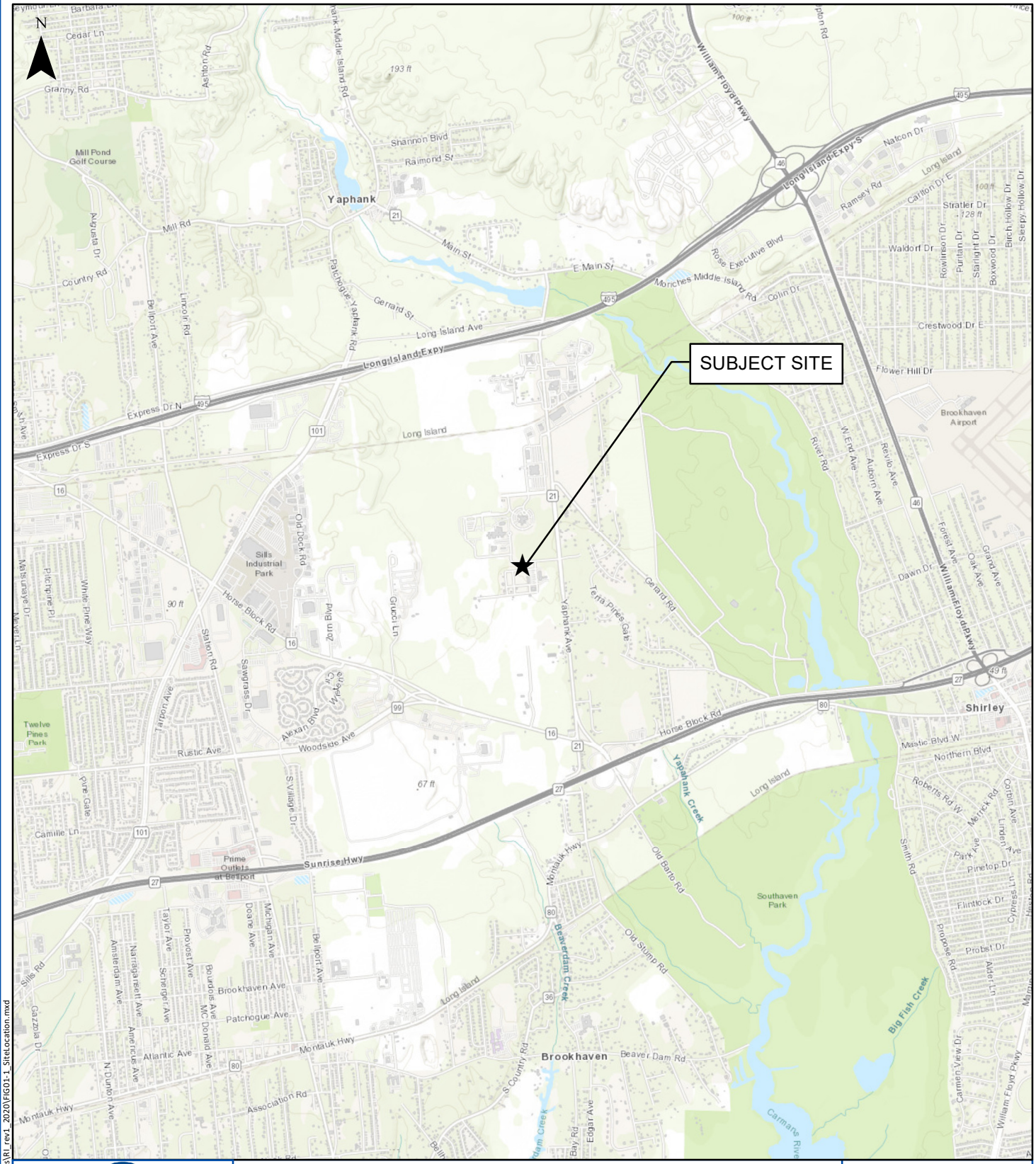

SITE LOCATION

676 MAPLE ST
YAPHANK, NY

0 ½ 1 1½ 2 Miles

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Project:	SHD2205
Date:	3/28/2023
Designed by:	MP
Drawn by:	PH
Approved by:	ZY
Figure No:	1

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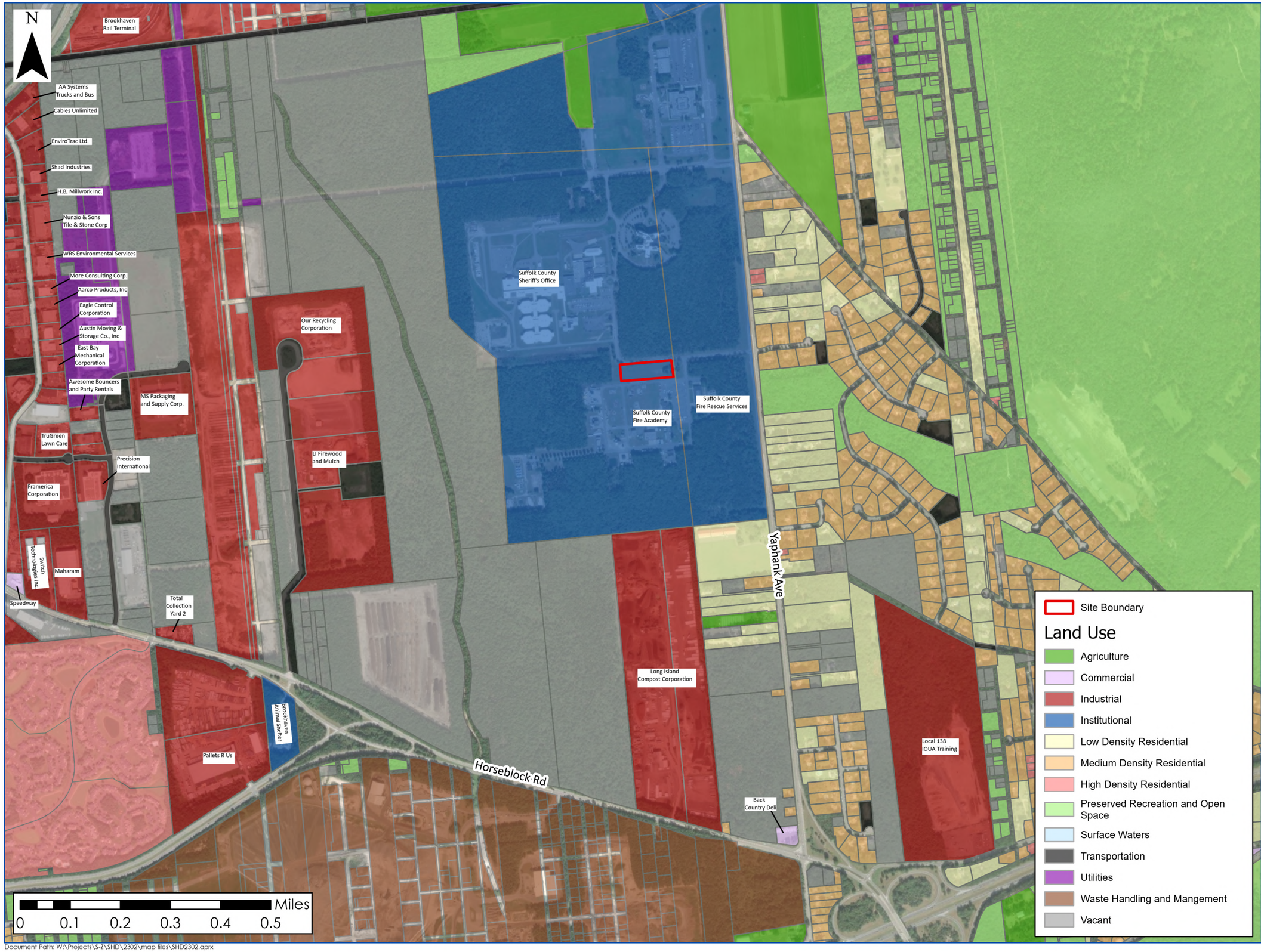

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DRAWING INFORMATION:

Project:	SHD2302	Designed by:	MP
Date:	4/2/2024	Drawn by:	AM
Scale:	AS SHOWN	Approved by:	MP

Surrounding Land Usage

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

2

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Project:	SHD2302	Designed by:	MP
Date:	4/2/2024	Drawn by:	AM
Scale:	AS SHOWN	Approved by:	MP

Truck Route Map

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

3

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APPENDIX A

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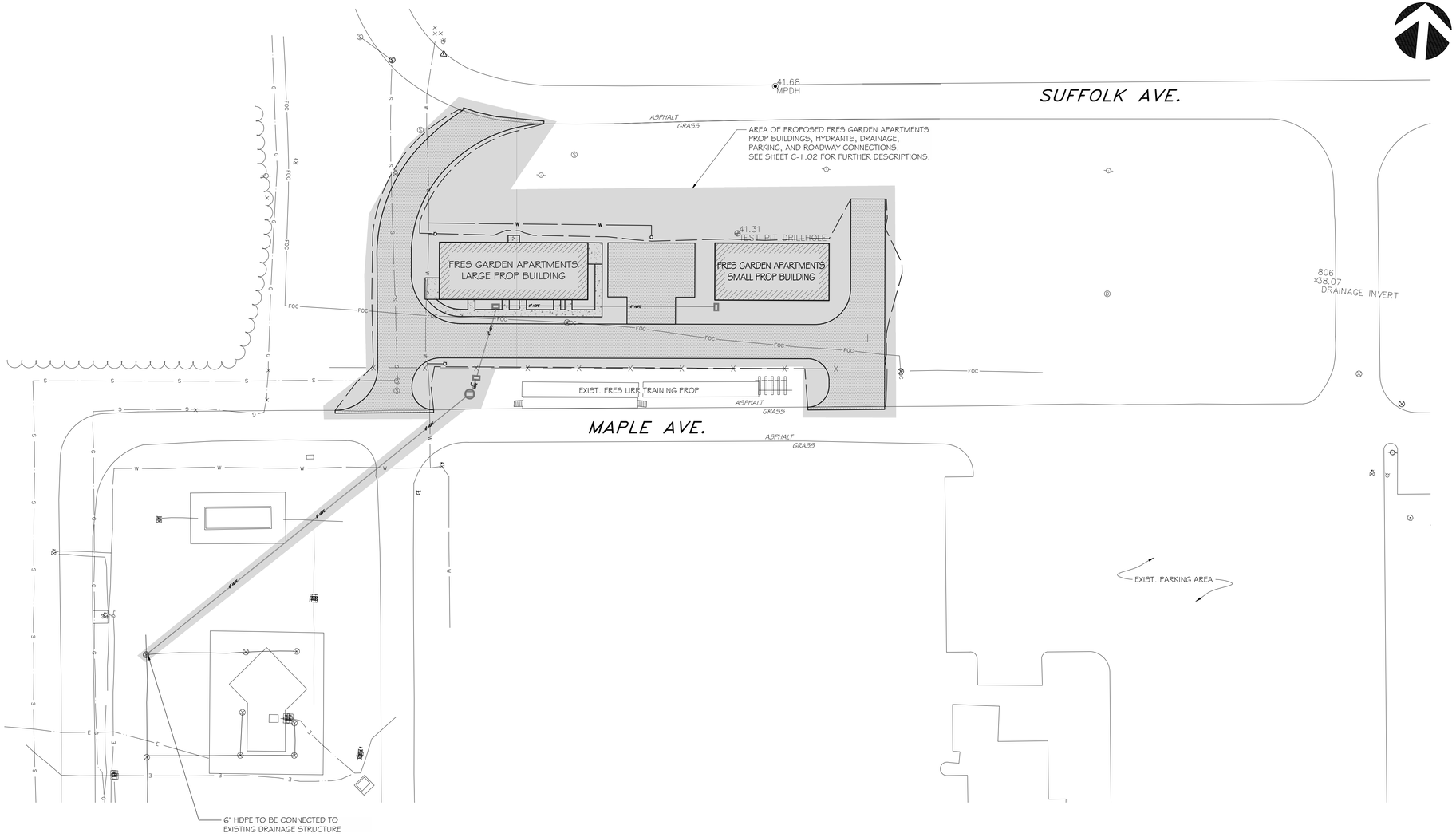


1 OVERALL SITE PLAN
SCALE: 1" = 20'

LEGEND

- EXISTING SITE FACILITIES
- OVERALL PROJECT AREA
- EXISTING CHAIN LINK FENCE
- EXISTING TREE LINE
- EXISTING CABLE
- EXISTING ELECTRIC
- EXISTING TELEPHONE
- EXISTING WATER
- PROPOSED BLDG LOCATION
- PROPOSED STORM STRUCTURE
- PROPOSED STORM PIPE

COUNTY OF SUFFOLK
DEPARTMENT OF PUBLIC WORKS
YAPHANK NEW YORK

MICHAEL J. MONAGHAN, P.E.
CHIEF ENGINEER

JOSEPH T. BROWN, P.E.
COMMISSIONER

REVISION

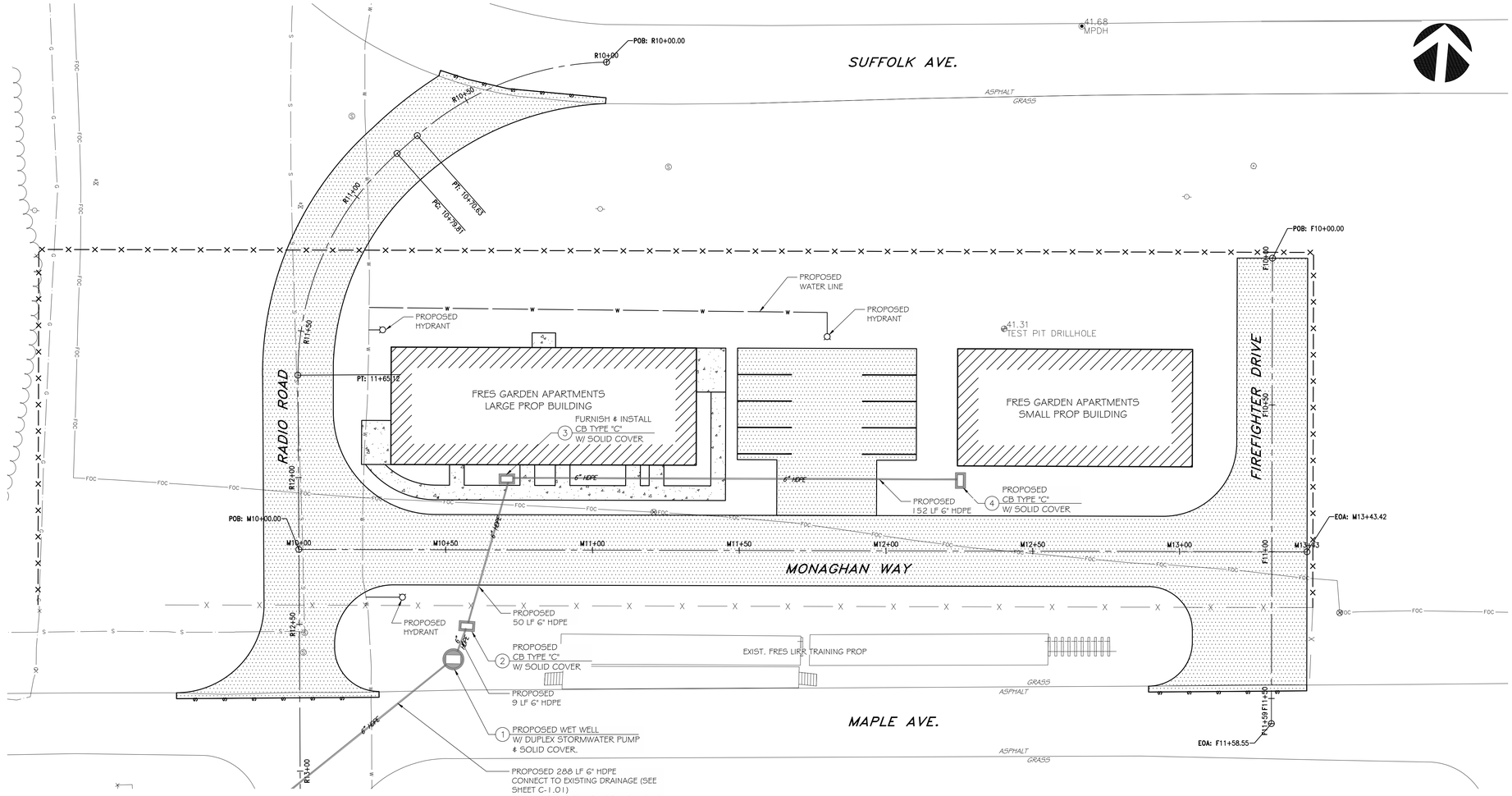
PROJECT TITLE: FRES GARDEN APARTMENTS TRAINING BUILDINGS

TITLE SHEET: OVERALL SITE PLAN

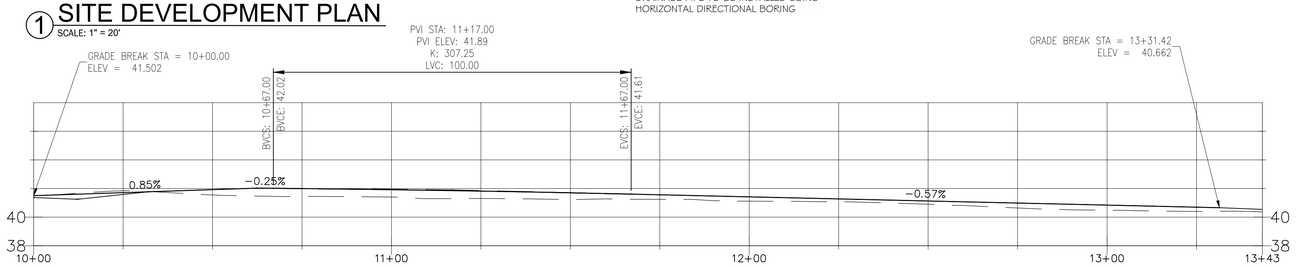
DRAWN BY: KAW | CHCK'D BY: RM | SCALE: AS NOTED | DATE: 12.01.2022 | LAD No. 51

DWG No: C-1.01

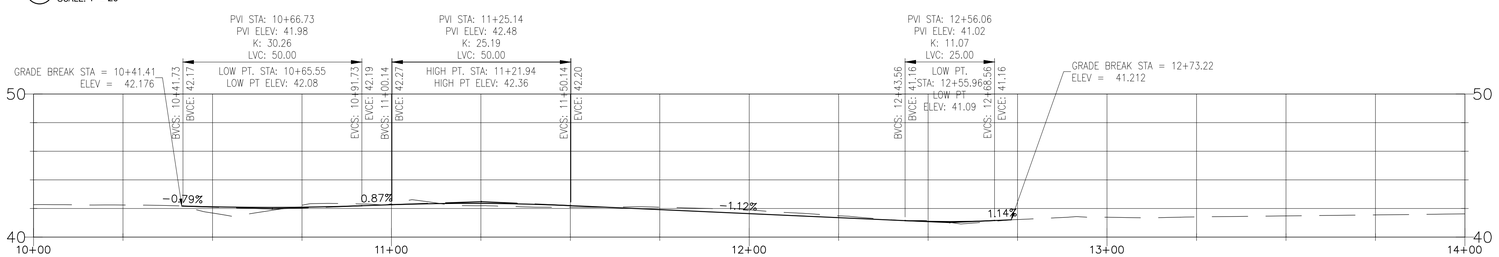
CP No: 3405 | BLDG. No: C0000



1 SITE DEVELOPMENT PLAN
SCALE: 1" = 20'



2 MONAGHAN WAY PROFILE
SCALE: 1" = 20'



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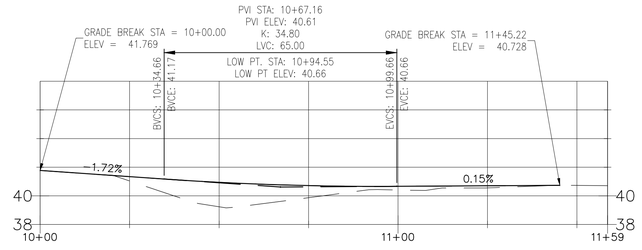


4 FIREFIGHTER DRIVE PROFILE
SCALE: 1" = 20'

FRES NORTH EXPASION EARTHWORK				
	Area	Cut	Fill	Net
PAVED AREAS	21716.61	631.42	11.23	620.19 CUT
REST OF SITE	15,182.95	9.63	297.88	288.25 FILL
TOTAL				**331.94 CUT**

5 TABLE OF EARTHWORK
SCALE: NONE

LEGEND

- PROPOSED BLDG
- PROPOSED CONCRETE SIDEWALK
- PROPOSED ASPHALT
- PROPOSED STORM STRUCTURES
- 6" HDPE — PROPOSED STORM PIPE
- EXISTING SITE FACILITIES
- x — EXISTING CHAIN LINK FENCE
- EXISTING TREE LINE
- FOC — EXISTING CABLE
- E — EXISTING ELECTRIC
- T — EXISTING TELEPHONE
- W — EXISTING WATER

SUFFOLK COUNTY NEW YORK

COUNTY OF SUFFOLK
DEPARTMENT OF PUBLIC WORKS
YAPHANK NEW YORK

MICHAEL J. MONAGHAN, P.E.
CHIEF ENGINEER

JOSEPH T. BROWN, P.E.
COMMISSIONER

REVISION

PROJECT TITLE: FRES GARDEN APARTMENTS TRAINING BUILDINGS

TITLE SHEET: SITE DEVELOPMENT PLAN & PROFILES

DRAWN BY: KAW

CHK'D BY: RM

SCALE: AS NOTED

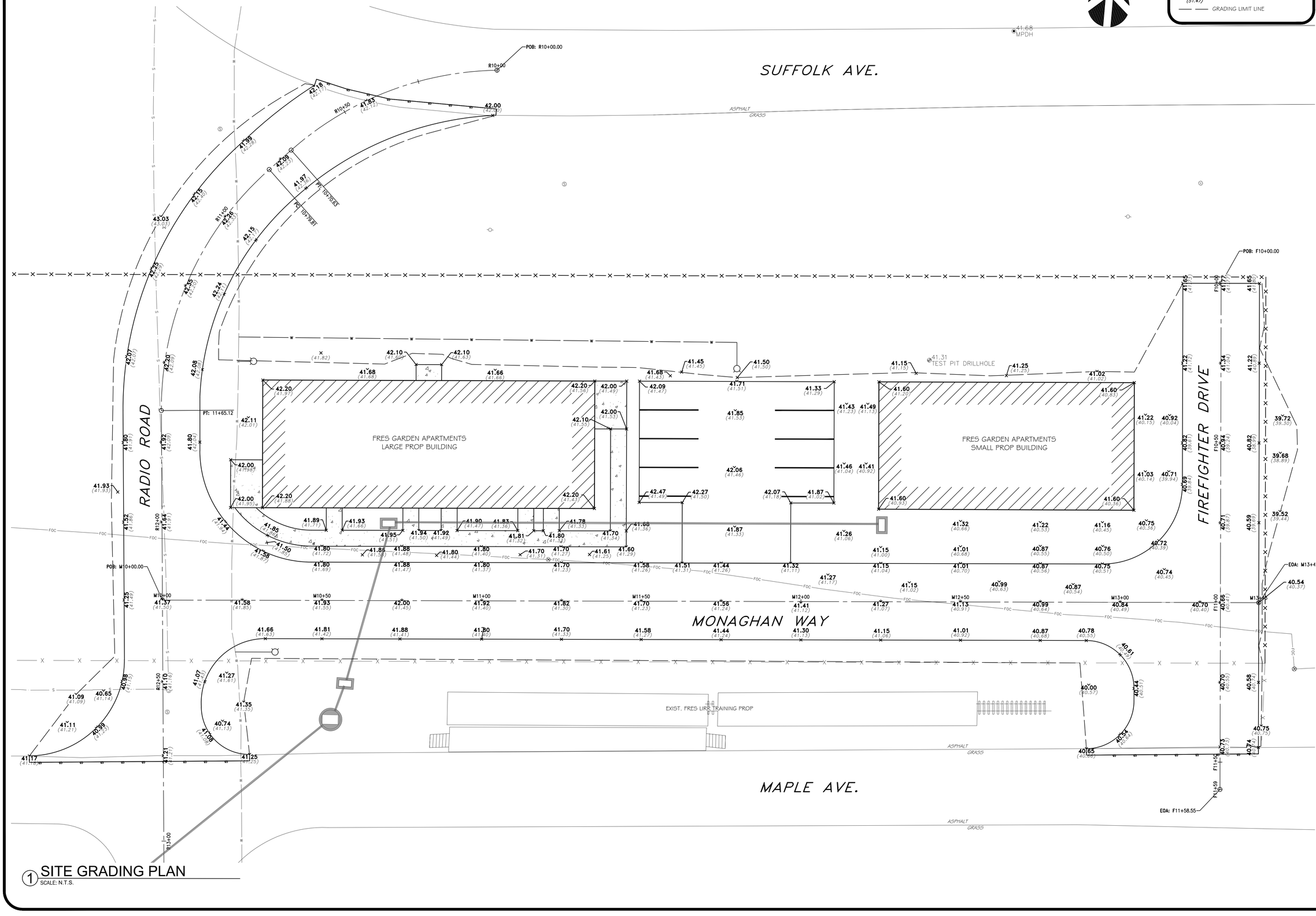
DATE: 12.01.2022

LAD No. 51

DWG No: C-1.02

CP No: 3405

BLDG. No: C0000



1 SITE GRADING PLAN
SCALE: N.T.S.

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DEPARTMENT OF PUBLIC WORKS
YAPHANK NEW YORK

MICHAEL J. MONAGHAN, P.E.
CHIEF ENGINEER

JOSEPH T. BROWN, P.E.
COMMISSIONER

REVISION

PROJECT TITLE: FRES GARDEN APARTMENTS TRAINING BUILDINGS

TITLE SHEET: SITE GRADING PLAN

DRAWN BY: KAW | CHCK'D BY: RM | SCALE: AS NOTED | DATE: 12.01.2022 | LAD NO. 51

DWG NO: C-1.03

CP NO: 3405 | BLDG. NO: C0000

APPENDIX B

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SUFFOLK COUNTY FIREMATICS SITE
676 MAPLE STREET, YAPHANK, NEW YORK 11980
SCTM ID: 0200-799.00-01.00-002.000
NYSDEC SITE: 152246

SOIL DELINEATION INVESTIGATION REPORT

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233-7016

PREPARED FOR:

Suffolk County Department of Health Services
Office of Pollution Control
15 Horseblock Place
Farmingville, New York 11738

PREPARED BY:

P.W. Grosser Consulting, Inc.
630 Johnson Ave., Suite 7
Bohemia, NY 11716
Phone: 631-589-6353

PWGC Project Number: SHD2205

OCTOBER 2023

PWGC
CLIENT DRIVEN SOLUTIONS

SOIL DELINEATION INVESTIGATION REPORT
676 MAPLE STREET, YAPHANK, NEW YORK 11980

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Acronym/Abbreviation	Definition
6:2FTS	1H,1H,2H,2H-Perfluorooctanesulfonic Acid
µg/m^3	Microgram per cubic meter
µg/kg	Microgram per kilogram
AFFF	Aqueous film forming foam
AMSL	Above mean sea level
AOC	Area of concern
Bgs	Below ground surface
COC	Chemical of concern
CUSCOs	Commercial Use Soil Cleanup Objectives
DER	Division of Environmental Remediation
DER-10	DER Technical Guidance for Site Investigation and Remediation
ELAP	Environmental Laboratory Approval Program
FOSA	Perfluorooctanesulfonamide
HAZMAT	Hazardous Materials
LPG	Liquified Propane Gas
MCL	Maximum contaminant level
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
ng/L	Nanograms per liter
NYCRR	6 New York Codes, Rules, and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCB	Polychlorinated biphenyls
PID	Photoionization detector
PFOA	Perfluorooctanoate
PFOS	Perfluorooctanesulfonic Acid
PFAS	Per- and polyfluoroalkyl substances
PFBA	Perfluorobutanoate
PFBS	Perfluorobutane sulfonate
PFDA	Perfluorodecanoic Acid
PFDoA	Perfluorododecanoic Acid
PFDS	Perfluorodecanesulfonic Acid
PFHpA	Perfluoroheptanoic Acid
PFHpS	Perfluoroheptanesulfonic Acid

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Acronym/Abbreviation	Definition
PFHxA	Perfluorohexanoate
PFHxS	Perfluorohexane sulfonate
PFNA	Perfluorononanoic Acid
PFPeA	Perfluoropentanoate
POGSCO	Protection of Groundwater Soil Cleanup Objective
ppm	Parts per million
PWGC	P.W. Grosser Consulting, Inc.
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QEP	Qualified Environmental Professional
RI	Remedial Investigation
SCDHS	Suffolk County Department of Health Services
SCDHS OWR	Suffolk County Department of Health Services Office of Water Resources
SDIWP	Soil Delineation Investigation Work Plan
SDIR	Soil Delineation Investigation Report
SGV	Soil guidance value
SVOC	Semi-volatile organic compound
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound

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CERTIFICATION

I, Zeb Youngman, PG, certify that I am currently a Qualified Environmental Professional (QEP) as defined in 6 New York Codes, Rules, and Regulations (NYCRR) Part 375 and that this Soil Investigation Delineation Report (SDIR) was prepared in accordance with applicable statutes and regulations and in substantial conformance with the New York State Department of Environmental Conservation's (NYSDEC's) Division of Environmental Remediation's (DER's) Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that the information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

October 11, 2023

Signature Date

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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1.0 INTRODUCTION

P.W. Grosser Consulting, Inc. (PWGC) has prepared the following Soil Delineation Investigation Report (SDIR) on behalf of the Suffolk County Department of Health Services (SCDHS) to summarize the investigative activities performed at the Suffolk County Firematics Site (hereinafter referred to as the "Site") located at 676 Maple Street in Yaphank, New York. The purpose of the investigations was to further delineate the nature and extent of on-site soil contamination from per- and polyfluoroalkyl substances (PFAS) associated with historical site operations to support preparation of a Feasibility Study. A Site Location Map is included as **Figure 1** and a Site Plan is included as **Figure 2**.

1.1 Project Background

In 1959, the Fire Training Center at Yaphank was commissioned. Its facilities consisted of a training tower, smokehouse and oil pits, and formed the basis for the development of today's training complex. Between 1959 and 1981, the Class A residential burn building, the Railroad Tank Car, Pump Test building, Liquified Propane Gas (LPG) Training facility, maze facility and the classroom/administration building were constructed on the Site. Since then, various improvements of the facility have been undertaken, including a new Class A burn building and a railcar training prop. The old Class A building is being used for training new recruits and firefighter survival courses.

After nearby drinking water wells were found to contain perfluorooctane sulfonate (PFOS) and perfluorooctonoate (PFOA), the NYSDEC and SCDHS worked quickly to identify the source of contamination and determined the Firematics facility was a likely source. Impacted homes in the area were provided bottled water and Suffolk County has connected over 47 properties to the municipal water supply or provided point of entry treatment systems on impacted homes.

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2.0 SITE DESCRIPTION

This section describes the Site usage, physical characteristics, and previous environmental investigations performed at the Site associated with the Areas of Concern (AOC), including a Hazardous Materials (HAZMAT) Response Training area (Foam Training Area), Flammable Liquid and Open Pit Burning Area, and an unlined groundwater recharge basin.

2.1 Site Description

The Site is located at 676 Maple Street in the hamlet of Yaphank, New York in the Town of Brookhaven, Suffolk County (**Figure 1**). The Site is identified on the Suffolk County Tax Map as: 0200-779.00-01.00-00100-002.000.

The Site consists of several buildings used for firefighting training activities, with and without the use of live fire, or for administrative support (offices, classrooms, etc.). The Site measures approximately 28 acres in size. The buildings located at the Site were constructed between 1959 and 2005 (**Figure 2**).

2.2 Site Geology/Hydrogeology

The Upper Glacial Aquifer at this location has a thickness of approximately 125 feet and extends from the water table surface to the top of the Magothy Aquifer (~125 feet below grade surface (bgs), Jensen and Soren, 1974). The Upper Glacial Aquifer is comprised of highly permeable medium to coarse sand and gravel, with occasional thin lenses of fine sand and brown clay. The average porosity of the aquifer is assumed to be 30 percent (McClymonds and Franke, 1972). Based on the soil sampling conducted on-Site, the shallow soils consist of fine to coarse sand with trace silt and gravel. The Unified Soil Classification System (USCS) classifications observed at the Site were poorly graded gravelly sands with silty sands and included a layer of organic silty clays with low plasticity (less than 1-foot thick) encountered between 5 to 10 feet bgs. The silty clay layer is not continuous across the Site.

The measured depth to groundwater beneath the Site is approximately 16 feet bgs. Based on groundwater elevation data collected from the on-site monitoring well system on July 5, 2018, groundwater flow direction beneath the Site is towards the southeast. Calculated groundwater flow velocity at the Site is approximately 149 feet per year.

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The nearest surface water body is the Carmans River, located approximately 1.5 miles east of the Site. There are no public water supply wells within a one-mile radius of the Site. The USCS classifications observed along the Carmans River were well graded sands with some gravel and some silt.

2.3 Site Features

The project Site elevation is approximately 40 feet above mean sea level (AMSL) and is generally level. Elevation drops by approximately 15 feet within the unlined recharge basin to the southwest. There are 24 buildings/training areas located within the 28-acre Site (**Figure 2**). 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 of which involve live fire training (fire currently generated using a combination of liquefied petroleum gas or combustibles ignited with an accelerant). 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.

2.4 Previous Environmental Reports

This section summarizes the initial investigative activities performed on and off-site.

2.4.1 Suffolk County Department of Health Services Investigation (2016)

In April 2016, the NYSDEC completed an emergency rulemaking and concurrently proposed a formal rulemaking adding PFOA and PFOS to the list of hazardous substances. The rulemaking was finalized in March 2017 however, the New York State (NYS) Maximum Contaminant Level (MCL) of 10 nanograms per liter (ng/L) was not promulgated until 2020. As a result, beginning in October 2016, the SCDHS Office of Water Resources (OWR) initiated a groundwater investigation to investigate potential PFOS and PFOA groundwater contamination from the suspected historical use of aqueous film forming foam (AFFF) at the Site. The SCDHS OWR collected groundwater samples from seven temporary vertical profile wells on the Site (FM-1 – FM-5, FM-13 and FM-14) and a sample was collected from the on-Site water recirculation system supply well. PFAS were detected above the laboratory method detection limit (MDL) in samples from the seven temporary vertical profile wells. Concentrations of PFOS and/or PFOA exceeded the NYSDEC MCLs of 10 ng/L, in five of the temporary vertical profile wells. In addition to the on-site analysis

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of groundwater samples, the SCDHS installed and sampled 27 offsite vertical profile wells (FM-6 - FM-12, FM-15 - FM-34) between October 2016 and December 2017. PFAS were detected above the laboratory MDL in at least one sample interval from each of the 27 temporary vertical profile wells. Concentrations of PFOS and/or PFOA exceeded their NYS MCLs in 21 of the 27 vertical profile wells.

Other PFAS compounds detected above the laboratory MDL included 6:2 fluorotelomer sulfonate (6:2FTS), perfluorooctane sulfonamide (FOSA), perfluorobutanoic acid (PFBA), Perfluorobutane sulfonate (PFBS), Perfluorodecanoate (PFDA), Perfluorododecanoate (PFDoA), Perfluorododecane sulfonate (PFDS), Perfluoroheptanoate (PFHpA), Perfluoroheptane sulfonate (PFHpS), Perfluorohexanoate (PFHxA), Perfluorohexane sulfonate (PFHxS), Perfluorononanoate (PFNA), and Perfluoropentanoate (PFPeA). The presence of these PFAS compounds is likely attributed to the on-Site use as a firefighting training facility including the use of AFFF.

2.4.2 Remedial Investigation Report (2021)

A Remedial Investigation Report, dated January 25, 2021, prepared by PWGC, was submitted to the NYSDEC. The investigation was conducted in accordance with the Remedial Investigation Work Plan (RIWP), prepared by PWGC in November 2017, and a Supplemental Remedial Investigation Work Plan, prepared by PWGC in September 2019. The findings of the remedial investigation pertinent to this work plan are summarized below.

- Volatile organic compounds (VOCs), metals, pesticides and polychlorinated biphenyls (PCBs) were not detected in on-site soil above NYSDEC Commercial Use Soil Cleanup Objectives (CUSCOs). One semi-volatile organic compound (SVOC) was detected above its NYSDEC CUSCO in one soil sample. Acetone was detected above its proposed NYSDEC Protection of Groundwater Soil Cleanup Objectives (POGSCOs) at several locations and lead was detected above its proposed NYSDEC POGSCOs at one location. Based upon the analytical results, PWGC concluded that VOCs, SVOCs, metals, pesticides and PCBs are not present in the on-site soil at levels that would require further investigation or remedial action.
- PFAS were found above detection limits in soil samples collected from across the Active Fire Training Area. The highest concentrations were found in the Active Firefighting Training Area.

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PFOA and PFOS were detected at concentrations above POGSCOs at three delineated locations, including the HAZMAT Response Training Area/Foam Training Area, the Tank Car Flammable Liquids Pit Training Areas, and Unlined Recharge Basin Area.

- PFAS were detected at concentrations above laboratory MDLs in groundwater samples collected both on-Site and offsite. Concentrations of individual PFOA and individual PFOS exceeded their NYS MCL of 10 ng/L in shallow groundwater over much of the central and eastern portions of the Site. Concentrations of individual PFOA and individual PFOS exceeding their NYS MCLs extended deeper into the aquifer farther downgradient (east-southeast) from the source areas. The PFAS plume extends east-southeast to the Carmans River.

The previous characterization efforts summarized above confirmed that soil and groundwater has been impacted by PFAS in areas where firefighting foam training has occurred. The potential source areas are further discussed in **Section 3.1** and are provided on **Figure 2**.

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3.0 AREAS OF CONCERN (AOC) SUMMARY

As discussed in **Section 2.4**, previous characterization efforts confirmed that soil and groundwater at the Site are impacted by PFAS compounds (PFOA and PFOS) that were in firefighting foams previously used at the facility. The AOC pertaining to this Delineation Investigation Work Plan are summarized below. **Figure 2** shows the locations of the AOC.

3.1 Sources of PFAS Contamination

Based on the results of previous soil sampling conducted at the Site and review of historical operational data, the potential sources of PFAS contamination include:

- HAZMAT Response Training Area (Foam Training Area) - This area is known to have been used for firefighting foam training. Surface soils (zero-to-two feet bgs) contained concentrations of PFOS/PFOA in contravention of proposed NYSDEC Part 375 POGSCOs (maximum concentration of PFOS at 1,870 ug/kg and PFOA at 17 ug/kg). Deeper soil samples (two-to-10 feet bgs) contained concentrations of PFOS (max concentration of 100 ug/kg) and PFOA (max concentration of 5.9 ug/kg) in contravention of their respective proposed NYSDEC Part 375 POGSCOs. Groundwater directly downgradient of the training area had detected concentrations of PFOS/PFOA greater than their NYS MCLs.

- 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. Surface soils (zero-to-two feet bgs) contained concentrations of PFOS/PFOA in contravention of proposed NYSDEC Part 375 POGSCOs (maximum concentration of 260 ug/kg of PFOS and 24 ug/kg of PFOA). Deeper soil samples (two-to-10 feet bgs) contained concentrations of PFOS (max concentration of 810 ug/kg) and PFOA (max concentration of 1.7 ug/kg) in contravention of their respective proposed NYSDEC Part 375 POGSCOs. Groundwater in the central portion of this area had the highest levels of PFOS/PFOA detected on-site.

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- Unlined Recharge Basin - The unlined recharge basin receives water from the Foam Training Area as well as other locations on the site. This basin has been impacted by discharges containing PFAS or other compounds used on-site. Surface soils (zero-to-two feet bgs) contained concentrations of PFOS/PFOA in contravention of their proposed NYSDEC Part 375 POGSCOs (maximum concentration of 9.5 ug/kg of PFOS and 27.0 ug/kg of PFOA).

The results of the RI soil sampling are shown on **Figure 3**.

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4.0 SOIL DELINEATION INVESTIGATION

The primary objectives of the work detailed in this report were to further delineate the extent of PFAS in soils. The Scope of Work included the following tasks:

- Collection of soil samples in the areas of soil impact identified in the RI,
- Analysis of the samples for PFAS by EPA method 537.1 (modified)
- Preparation of a report detailing the results of the investigation,
- Quality Assurance/Quality Control (QA/QC) and Data Validation

4.1 Soil Delineation Investigation

4.1.1 Sampling Protocol

Shallow soil/sediment samples were collected with a hand auger. After reaching the desired depth, the auger was slowly removed from the boring. The samples were collected and placed in laboratory supplied bottleware, placed in a cooler, and delivered to the laboratory for analysis. Samples were collected from the ground surface to up to four feet bgs.

Soil/sediment samples not accessible with hand tools were installed by means of a Geoprobe® direct-push drill rig outfitted with a dual-tube sampler and dedicated acetate liners. Each Geoprobe® location was hand cleared to five feet bgs with a hand auger. Soils were collected continuously from ground surface to a maximum depth of eighteen feet bgs. Sample orientation was maintained when the liners were removed from the sample tube. The samples were collected and placed in laboratory supplied bottleware, placed in a cooler, and delivered to the laboratory for analysis. Samples were collected in two-foot intervals.

Sampling intervals were composited by placing the soil/sediment into a stainless-steel bowl and mixing until homogeneous before placing in laboratory supplied bottleware.

All soil samples were field screened for the presence of VOCs using a photoionization detector (PID). Soil/Sediment sampling logs were prepared for each boring location and are included in **Appendix A**.

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There are several potential sources of PFAS that could contribute to the cross-contamination of environmental samples collected during the Soil Delineation Investigation. Weatherproof clothing, pens, logbooks, cosmetics, personal hygiene products, insect repellents, and sampling equipment could contain PFAS that could lead to false positive sampling results. To ensure that the analytical results obtained during the RI were representative of the actual site conditions, several measures were taken:

- During decontamination, non-dedicated equipment to be used for PFAS sampling was rinsed with PFAS free water supplied by the laboratory. Equipment will be allowed to fully air dry before use.
- New nitrile gloves were worn between each sample interval.
- Only clean cotton or synthetic clothes were worn – preferably washed more than six times, and without the use of fabric softeners. No waterproof or insecticide treated clothing, boots or rain jackets made or treated with Teflon products were used at the collection site. This includes all Gore-Tex® and Tyvek® products.
- No moisturizers or hand creams were applied to hands or face on the day of sampling. No sunblock or insect repellants. No packaged food or aluminum foil were brought to the work site.
- Field notes were taken using ink pens on non-waterproof plain paper attached to a metal clipboard. No Sharpies or markers were used. Field notes were transcribed to Chain-of-Custody forms and official field books when back in the office after the collection process.
- Labels were printed before going into the field and applied to the sample containers.
- Laboratory supplied PFAS-free water was used for trip, field, and equipment blanks.
- Each sample container was placed in a separate polypropylene zip-lock bag.
- For the shipping coolers, regular crushed ice packaged in polypropylene zip-lock plastic bags was used for sample preservation.
- Laboratory supplied shipping coolers were used to ship sample containers for this project. Coolers were taped shut before shipping samples to the laboratory.

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4.1.2 Sample Analysis

Samples during this investigation were collected in pre-cleaned, pre-preserved, laboratory-supplied glassware and stored on ice in a cooler for transport to the laboratory. Samples were submitted to York Analytical Laboratories, Inc. (York) of Stratford, Connecticut, a NYSDOH ELAP certified laboratory (ELAP ID: 10854 and 12058).

The samples from each boring were analyzed for PFAS by USEPA Method 537, rev 1.1 (modified). Samples were compared to the NYSDEC soil guidance values (SGVs) for Protection of Groundwater Use, Unrestricted Use, Residential Use, and Commercial Use. A summary of the SGVs are included in the table below:

Soil Guidance Values for Anticipated Site Use	PFOA (microgram/kilogram (µg/kg))	PFOS (µg/kg)
Protection of Groundwater (proposed)	0.8	1.0
Unrestricted Use	0.66	0.88
Residential Use	6.6	8.8
Commercial Use	500	440

4.1.3 Phase I Soil Delineation

Between September 20 and September 26, 2022, a series of shallow borings (zero-to-two feet) and deep borings (two-feet to 14-feet) were installed at the site. These sampling locations were selected based on the data collected during the RI (see **Figure 3**).

The shallow borings were located primarily at the edges of the areas identified during the RI to aid in horizontal delineation of the limits of the source areas above the proposed NYSDEC POGSCOs and where previous sampling has already confirmed vertical delineation of the source area. The shallow boring

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locations samples were collected from two intervals (zero-to-six-inches and six-inches to two-feet). Both samples from each shallow boring were analyzed for PFAS.

The deep borings were located centrally in the areas identified during the RI as exceeding the proposed NYSDEC POGSCOs. Samples were collected from these borings continuously from two-feet bgs, in two-foot intervals, to 12-feet bgs. In addition, soil samples were collected at 12 to 14-feet bgs in six of the deep borings (SB051, SB055, SB056, SB059, SB063, and SB064) in order to delineate hot spot areas associated with RI borings (SB003 and SB012). Samples collected from the eight-feet to ten-feet and ten-feet to twelve-feet in multiple deep borings were initially placed on hold, pending analytical results of the shallower samples.

Table 1 details the samples which were analyzed from each soil boring location during Phase I.

Soil sampling was performed in accordance with DER-10 and the NYSDEC-approved SDIWP.

4.1.4 Phase I Analytical Results

PFAS in soil samples were evaluated against the existing and proposed NYSDEC amendments to 6 NYCRR Part 375. Analytical data from the investigation are summarized in **Table 2** and **Figure 4** and laboratory reports are included in **Appendix B**.

The zero to six-inches interval was analyzed from 26 sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- Three samples did not exceed SGVs for PFOA or PFOS.
- One sample exceeded the SGVs for Unrestricted Use.
- Ninteen samples exceeded the proposed SGVs for Protection of Groundwater.
- Three samples exceeded the SGVs for Residential Use.

The six-inches to two-feet interval was analyzed from 26 sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- Three samples did not exceed SGVs for PFOA or PFOS.
- Two samples exceeded the SGVs for Unrestricted Use.
- Twenty samples exceeded the proposed SGVs for Protection of Groundwater.

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- One sample exceeded the SGVs for Residential Use.

The two-feet to four-feet interval was analyzed from 23 sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- Two samples did not exceed SGVs for PFOA or PFOS.
- Five samples exceeded the proposed SGVs for Protection of Groundwater.
- Fourteen samples exceeded the SGVs for Residential Use.
- Two samples exceeded the SGVs for Commercial Use.

The four-feet to six-feet interval was analyzed from 23 sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- Two samples did not exceed SGVs for PFOA or PFOS.
- One sample exceeded the SGVs for Unrestricted Use.
- Six samples exceeded the proposed SGVs for Protection of Groundwater.
- Thirteen samples exceeded the SGVs for Residential Use.
- One sample exceeded the SGVs for Commercial Use.

The six-feet to eight-feet interval was analyzed from 23 sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- Nine samples did not exceed SGVs for PFOA or PFOS.
- One sample exceeded the SGVs for Unrestricted Use.
- Three samples exceeded the proposed SGVs for Protection of Groundwater.
- Eight samples exceeded the SGVs for Residential Use.
- Two samples exceeded the SGVs for Commercial Use.

The eight-feet to ten-feet interval was analyzed from six sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- Four samples exceeded the SGVs for Residential Use.
- Two samples exceeded the SGVs for Commercial Use.

The ten-feet to twelve-feet interval was analyzed from six sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- One sample exceeded the proposed SGVs for Protection of Groundwater.
- Three samples exceeded the SGVs for Residential Use.

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- Two samples exceeded the SGVs for Commercial Use.

The twelve-feet to fourteen-feet interval was analyzed from six sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- One sample exceeded the SGVs for Unrestricted Use.
- Four samples exceeded the SGVs for Residential Use.
- One sample exceeded the SGVs for Commercial Use.

4.1.5 Phase II Soil Delineation

Following review of sampling during Phase I, held samples (8-10 ft and 10-12 feet bgs) from soil borings with results exceeding NYSDEC POGSCOs at their terminal analyzed depth of eight feet (SB050, SB065, SB066, SB070, SB071, SB073, and SB079) were analyzed to aid in completing vertical delineation of soil at the site.

4.1.6 Phase II Analytical Results

The eight-feet to ten-feet interval was analyzed from the seven sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- Five samples exceeded the proposed SGVs for Protection of Groundwater.
- Two samples exceeded the SGVs for Residential Use.

The ten-feet to twelve-feet interval was analyzed from the seven sample locations. PFOA and/or PFOS were detected above the SGVs discussed in **4.1.2** as follows:

- Four samples exceeded the proposed SGVs for Protection of Groundwater.
- Three samples exceeded the SGVs for Residential Use.

4.1.7 Phase III Soil Delineation

Between November 23 and December 9, 2022, PWGC remobilized to the site to collect additional soil samples, following review of samples analyzed during Phase I and Phase II.

Eleven soil borings were installed to four feet bgs using a hand auger to horizontally delineate PFAS in the undeveloped area adjacent to the north of the site. Soil samples were collected from zero to six-inches,

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six-inches to two-feet, and two-feet to four-feet intervals. Samples collected from the two-feet to four-feet interval were initially placed on hold, pending the results of the shallower sample intervals.

Ten shallow soil borings installed and sampled during Phase I (SB047, SB048, SB049, SB052, SB053, SB060, SB081, SB082, SB088, and SB090) exceeded the proposed SGV for Protection of Groundwater for PFOA and/or PFOS. Samples were collected at the two-feet to four-feet, four-feet to six-feet, six-feet to eight-feet, and eight-feet to ten-feet intervals to increase vertical delineation of PFAS impact in these areas. Samples collected from the six-feet to eight-feet and eight-feet to ten-feet intervals were initially placed on hold, pending the results of the shallower sample intervals.

A total of twenty-seven shallow soil borings were installed to a depth of four feet bgs to increase horizontal delineation of PFAS across the site. Borings were located at the northern and western extents of the site, and around Phase I borings (SB079, SB081, SB082, SB088, and SB090) in the southern portion of the site. Soil samples were collected from zero to six-inches, six-inches to two-feet, and two-feet to four-feet intervals. Samples collected from the two-feet to four-feet interval were initially placed on hold, pending the results of the shallower sample intervals.

Eleven soil borings were installed to a depth of eighteen feet to horizontally and vertically delineate PFAS around Phase I soil borings (SB051, SB056, SB059, and SB064) which exceeded the SGVs for Residential Use for PFOA and/or PFOS. Samples were collected at the 2-feet to four-feet, four-feet to six-feet, six-feet to eight-feet, eight-feet to ten-feet, ten-feet to twelve-feet, twelve-feet to fourteen-feet, fourteen-feet to sixteen-feet, and sixteen-feet to eighteen-feet intervals. Samples collected from the twelve-feet to fourteen-feet, fourteen-feet to sixteen-feet, and sixteen-feet to eighteen-feet intervals were initially placed on hold, pending the results of the shallower sample intervals.

4.1.8 Phase III Analytical Results

PFAS in Phase III soil samples were evaluated against the existing and proposed NYSDEC amendments to 6 NYCRR Part 375. Analytical data from the investigation are summarized in **Table 2, Figures 4** and **5,** and laboratory reports are included in **Appendix B**.

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4.1.8.1 Northern Area Delineation

In order to provide further horizontal delineation along the undeveloped area adjacent to the northern portion of the Site, eleven soil borings (SB095-SB105) were installed between the zero to six-inch, six-inch to two-foot, and two-foot to four-foot depth intervals. Each sample collected from the two-foot to four-foot depth intervals was initially placed on hold, pending the results of the shallower sample intervals.

Zero to Six-Inch Depth Interval

- Nine soil samples (SB096-SB097, SB099-SB105) collected between the zero to six-inch depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, with concentrations ranging from 1.07 to 5.38 ug/kg (ppb). Two soil samples (SB095 and SB098) analyzed for PFOS were below SGVs for Unrestricted Use or were non-detect.
- One soil sample (SB103) collected between the zero to six-inch depth interval detected PFOA concentrations above the SGVs for Unrestricted Use (0.699 ug/kg (ppb), and one soil sample (SB104) detected PFOA concentrations above the proposed SGVs for Protection of Groundwater (0.994 ug/kg (ppb). Nine soil samples (SB095-SB102 and SB105) analyzed for PFOA were below SGVs for Unrestricted Use or were non-detect.

Six-Inch to Two-Foot Depth Interval

- Seven soil samples (SB096-SB097, SB100-SB101, SB103-SB105) collected between the six-inch to two-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, with overall concentrations ranging from 1.52 to 7.54 ug/kg (ppb). Four soil samples (SB095, SB098-SB099, and SB102) analyzed for PFOS were below SGVs for Unrestricted Use or were non-detect.
- Each of the eleven soil samples analyzed for PFOA between the six-inch to two-foot depth interval were below SGVs for Unrestricted Use or were non-detect.

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Two-Foot to Four-Foot Depth Interval

- Six held soil samples (SB095- SB099 and SB104) were analyzed from the two-foot to four-foot depth intervals based on the results of the shallower sample intervals. One soil sample (SB096) collected between the two-foot to four-foot depth interval detected PFOS concentrations above the SGVs for Unrestricted Use, two soil samples (SB099 and SB104) detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, with overall concentrations ranging from 0.93 to 6.38 ug/kg (ppb). Three soil samples (SB095, SB097 and SB098) analyzed for PFOS were below SGVs for Unrestricted Use or were non-detect.

- Six held soil samples (SB095-SB099 and SB104) were analyzed from the two-foot to four-foot depth intervals based on the results of the shallower sample intervals. Each of the six soil samples collected between the two-foot to four-foot depth interval and analyzed for PFOA were below SGVs for Unrestricted Use or were non-detect.

4.1.8.2 Vertical Delineation

In order to provide further vertical delineation around ten shallow samples collected during Phase I (zero to six-inch/six-inch to two-foot depth intervals), ten additional samples (SB047-SB049, SB052-SB053, SB060, SB081-SB082, SB088 and SB090) were collected between the two-foot to four-foot and four-foot to six-foot depth intervals. Samples collected from the six-foot to eight-foot and eight-foot to ten-foot intervals were initially placed on hold, pending the results of the shallower sample intervals.

Two-Foot to Four-Foot Depth Interval

- Seven soil samples (SB049, SB052, SB053, SB060, SB081, SB082 and SB088) collected between the two-foot to four-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, one soil sample (SB047) detected PFOS concentrations above the SGVs for Residential Use, and one soil sample (SB048) detected PFOS concentrations above the SGVs for Commercial Use, with overall concentrations ranging from 1.07 to 20,400 ug/kg (ppb). One soil sample (SB090) analyzed for PFOS was below SGVs for Unrestricted Use.

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- Six soil samples (SB048, SB049, SB052, SB060, SB082, SB088) detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, with overall concentrations ranging from 0.917 to 3.13 ug/kg (ppb). Four soil samples (SB047, SB053, SB081, SB090) analyzed for PFOA were below SGVs for Unrestricted Use.

Four-Foot to Six-Foot Depth Interval

- One soil sample (SB053) collected between the four-foot to six-foot depth interval detected PFOS concentrations above the SGVs for Unrestricted Use, four soil samples (SB049, SB081, SB088 and SB090) detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, one soil sample (SB047) detected PFOS concentrations above the SGVs for Residential Use, and one soil sample (SB048) detected PFOS concentrations above the SGVs for Commercial Use, with overall concentrations ranging from 0.897 to 2,040 ug/kg (ppb). Three soil samples (SB052, SB060, and SB082) analyzed for PFOS were below SGVs for Unrestricted Use.

- Two soil samples (SB048 and SB088) collected between the four-foot to six-foot depth interval detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, with overall concentrations ranging from 1.17 to 1.22 ug/kg (ppb). Eight soil samples (SB047, SB049, SB052-SB053, SB060, SB081, SB082, and SB090) analyzed for PFOA were below SGVs for Unrestricted Use.

Six-Foot to Eight-Foot Depth Interval

- Five soil samples (SB047-SB049, SB081, SB088) initially placed on hold were analyzed from the six-foot to eight-foot depth intervals based on the results of the shallower sample intervals. Upon further analysis, one soil sample (SB049) collected between the six-foot to eight-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, one soil sample (SB047) detected PFOS concentrations above the SGVs for Residential Use, and one soil sample (SB048) detected PFOS concentrations above the proposed SGVs for Commercial Use, with overall concentrations ranging from 6.05 to 789 ug/kg (ppb). Two soil samples (SB081 and SB088) analyzed for PFOS were below SGVs for Unrestricted Use.

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- Five soil samples (SB047-SB049, SB081, SB088) initially placed on hold were analyzed from the six-foot to eight-foot depth intervals based on the results of the shallower sample intervals. Upon further analysis, one soil sample (SB048) collected between the six-foot to eight-foot depth interval detected PFOA concentrations above the SGVs for Unrestricted Use, with a concentration of 0.716 ug/kg (ppb). Four soil samples (SB047, SB049, SB081 and SB088) analyzed for PFOA were below SGVs for Unrestricted Use.

Eight-Foot to Ten-Foot Depth Interval

- Five soil samples (SB047-SB049, SB081, SB088) initially placed on hold were analyzed from the eight-foot to ten-foot depth intervals based on the results of the shallower sample intervals. Upon further analysis, one soil sample (SB049) collected between the eight-foot to ten-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, and two soil samples (SB047 and SB048) detected PFOS concentrations above the SGVs for Residential Use, with overall concentrations ranging from 4.84 to 340 ug/kg (ppb). Two soil samples (SB081 and SB088) analyzed for PFOS were below SGVs for Unrestricted Use.

- Five soil samples (SB047-SB049, SB081, SB088) initially placed on hold were analyzed from the eight-foot to ten-foot depth intervals based on the results of the shallower sample intervals. Upon further analysis, one soil sample (SB048) collected between the eight-foot to ten-foot depth interval detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, with a concentration of 3.97 ug/kg (ppb). Four soil samples (SB047, SB049, SB081 and SB088) analyzed for PFOA were below SGVs for Unrestricted Use.

4.1.8.3 Horizontal Delineation

In order to provide further horizontal delineation around the northern and western extents of the site, and five southern samples collected during Phase I (SB079, SB081, SB082, SB088, and SB090), twenty-eight additional samples (SB106-SB133) were collected between the zero to six-inch and the six-inch to two-foot depth intervals. Samples collected from the two-foot to four-foot depth interval were initially placed on hold, pending the results of the shallower sample intervals.

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Zero to Six-Inch Depth Interval

- One soil sample (SB107) collected between the zero to six-inch depth interval detected PFOS concentrations above the SGVs for Unrestricted Use, twenty-one soil samples (SB106, SB108, SB110-SB115, SB117-SB126, SB128-SB129, SB131 and SB133) detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, and two soil samples (SB109 and SB130) detected PFOS concentrations above the SGVs for Residential Use, with overall concentrations ranging from 0.925 to 14.2 ug/kg (ppb). Four soil samples (SB116, SB125, SB127, and SB132) analyzed for PFOS were below SGVs for Unrestricted Use.
- Six soil samples (SB109-SB113, and SB124) collected between the zero to six-inch depth interval detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, with overall concentrations ranging from 0.819 to 2.49 ug/kg (ppb). Twenty-two soil samples (SB106-SB108, SB114-SB123, and SB125-SB133) analyzed for PFOA were below SGVs for Unrestricted Use.

Six-Inch to Two-Foot Depth Interval

- Seventeen soil samples (SB106, SB110, SB112-SB113, SB115, SB116, SB118-SB120, SB122-SB124, SB126, SB130-SB131, and SB133) collected between the six-inch to two-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater and five soil samples (SB107, SB111, SB114, SB129, SB132) detected PFOS concentrations above the SGVs for Residential Use, with overall concentrations ranging from 1.12 to 22.7 ug/kg (ppb). Six soil samples (SB108-SB109, SB121, SB125, and SB127-SB128) analyzed for PFOS were below SGVs for Unrestricted Use.
- One soil sample (SB109) collected between the six-inch to two-foot depth interval detected PFOA concentrations above the SGVs for Unrestricted Use, and one soil sample (SB112) detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, with overall concentrations ranging from 0.687 to 2.49 ug/kg (ppb). Twenty-six soil samples (SB106-SB108, SB110-SB111, and SB113-SB133) analyzed for PFOA were below SGVs for Unrestricted Use.

Two-Foot to Four-Foot Depth Interval

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- Eleven soil samples (SB107, SB111-SB114, SB116, SB119, SB126, SB129, SB132, and SB133) initially placed on hold were analyzed from the two-foot to four-foot depth intervals based on the results of the shallower sample intervals. Upon further analysis, one soil sample (SB112) collected between the two-foot to four-foot depth interval detected PFOS concentrations above the SGVs for Unrestricted Use, five soil samples (SB107, SB113, SB119, SB126, and SB133) detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, and four soil samples (SB111, SB114, SB129, and SB132) detected PFOS concentrations above the SGVs for Residential Use, with overall concentrations ranging from 0.88 to 48.7 ug/kg (ppb). One soil sample (SB116) analyzed for PFOS was below SGVs for Unrestricted Use.
- Eleven soil samples (SB107, SB111-SB114, SB116, SB119, SB126, SB129, SB132, and SB133) initially placed on hold were analyzed from the two-foot to four-foot depth intervals based on the results of the shallower sample intervals. Upon further analysis, two soil samples (SB129 and SB132) collected between the two-foot to four-foot depth interval detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, with overall concentrations ranging from 2.78 to 4.17 ug/kg (ppb). Nine soil samples (SB107, SB111-SB114, SB116, SB119, SB126, and SB133) analyzed for PFOA were below SGVs for Unrestricted Use.

4.1.8.4 Hot Spot Step Out Delineation

In order to provide further horizontal and vertical delineation around the Phase I soil borings (SB051, SB056, SB059, and SB064) which exceeded the SGVs for Residential Use for PFOA and/or PFOS, eleven soil samples (SB134-SB144) were collected from the two-foot to four-foot, four-foot to six-foot, six-foot to eight-foot, eight-foot to ten-foot, and ten-foot to twelve-foot depth intervals. Soil samples collected from the twelve-foot to fourteen-foot, fourteen-foot to sixteen-foot, and sixteen-foot to eighteen-foot depth interval were initially placed on hold, pending the results of the shallower sample intervals.

Two-Foot to Four-Foot Depth Interval

- Eight soil samples (SB135-SB136, SB138-SB140, and SB142-SB144) collected between the two-foot to four-foot depth interval detected PFOS concentrations above the SGVs for Residential Use,

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and three soil samples (SB134, SB137, and SB141) detected PFOS concentrations above the SGVs for Commercial Use, with overall concentrations ranging from 17.2 to 7,360 ug/kg (ppb).

- Five soil samples (SB137-SB139, SB140, SB144) detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, and six soil samples (SB134-SB136, and SB141-SB143) detected PFOA concentrations above the SGVs for Residential Use, with overall concentrations ranging from 0.963 to 37.6 ug/kg (ppb).

Four-Foot to Six-Foot Depth Interval

- One soil sample (SB144) collected between the four-foot to six-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, eight soil samples (SB135, and SB137-SB143) detected PFOS concentrations above SGVs for Residential Use, and two soil samples (SB134 and SB136) detected PFOS concentrations above the SGVs for Commercial Use, with overall concentrations ranging from 8.45 to 10,700 ug/kg (ppb).
- Seven soil samples (SB137, SB138-SB141, and SB143-SB144) detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, and four soil samples (SB134-SB136, and SB142) detected PFOA concentrations above the SGVs for Residential Use, with overall concentrations ranging from 0.944 to 80.9 ug/kg (ppb).

Six-Foot to Eight-Foot Depth Interval

- Four soil samples (SB139, SB140, SB142, and SB144) collected between the six-foot to eight-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, five soil samples (SB135-SB138, and SB141) detected PFOS concentrations above the SGVs for Residential Use, and one soil sample (SB134) detected PFOS concentrations above the SGVs for Commercial Use, with overall concentrations ranging from 1.27 to 443 ug/kg (ppb). One soil sample (SB143) analyzed for PFOS was below SGVs for Unrestricted Use.
- Four soil samples (SB135, SB139, and SB141-SB142) collected between the six-foot to eight-foot depth interval detected PFOA concentrations above the proposed SGVs for Protection of

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Groundwater, and three soil samples (SB134, and SBSB136-SB137) detected PFOA concentrations above the SGVs for Residential Use, with overall concentrations ranging from 1.80 to 17.6 ug/kg (ppb). Four soil samples (SB138, SB140, and SB143-SB144) analyzed for PFOA were below SGVs for Unrestricted Use.

Eight-Foot to Ten-Foot Depth Interval

- Three soil samples (SB139, SB140 and SB144) collected between the eight-feet to ten-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, five soil samples (SB134-SB135, SB137, and SB141-SB142) detected PFOS concentrations above the SGVs for Residential Use, and two soil samples (SB136 and SB138) detected PFOS concentrations above the SGVs for Commercial Use, with overall concentrations ranging from 2.91 to 552 ug/kg (ppb). One soil sample (SB143) analyzed for PFOS was below SGVs for Unrestricted Use.

- Five soil samples (SB136, SB139, SB141-SB142, and SB144) collected between the eight-foot to ten-foot depth interval detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, and two soil samples (SB134 and SB137) detected PFOA concentrations above the SGVs for Residential Use, with overall concentrations ranging from 1.78 to 19.5 ug/kg (ppb). Four soil samples (SB135, SB138, SB140, and SB143) analyzed for PFOA were below SGVs for Unrestricted Use.

Ten-Foot to Twelve-Foot Depth Interval

- Two soil samples (SB137, SB139, SB140 and SB144) collected between the ten-foot to twelve-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, five soil samples (SB134-SB136 and SB141-SB142) detected PFOS concentrations above the SGVs for Residential Use, and one soil sample (SB138) detected PFOS concentrations above the SGVs for Commercial Use, with overall concentrations ranging from 1.34 to 467 ug/kg (ppb). One soil sample (SB143) analyzed for PFOS was below SGVs for Unrestricted Use.

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- One soil sample (SB138) collected between the ten-foot to twelve-foot depth interval detected PFOA concentrations above the SGVs for Unrestricted Use, seven soil samples (SB135, SB137, and SB139-SB143) detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, and two soil samples (SB134 and SB136) detected PFOA concentrations above the SGVs for Residential Use, with overall concentrations ranging from 0.773 to 19.5 ug/kg (ppb). One soil sample (SB144) analyzed for PFOA was below SGVs for Unrestricted Use.

Twelve-Foot to Fourteen-Foot Depth Interval

- Ten soil samples (SB134-SB143) initially placed on hold were analyzed from the twelve-foot to fourteen-foot depth intervals based on the results of the shallower sample intervals. Four soil samples (SB137, SB139-SB140, and SB143) collected between the twelve-foot to fourteen-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, four soil samples (SB135, SB138, and SB141-SB142) detected PFOS concentrations above the SGVs for Residential Use, and two soil samples (SB134 and SB136) detected PFOS concentrations above the SGVs for Commercial Use, with overall concentrations ranging from 3.93 to 469 ug/kg (ppb).
- Ten soil samples (SB134-SB143) initially placed on hold were analyzed from the twelve-foot to fourteen-foot depth intervals based on the results of the shallower sample intervals. One soil sample (SB138) collected between the twelve-foot to fourteen-foot depth interval detected PFOA concentrations above the SGVs for Unrestricted Use, seven soil samples (SB135-SB137, SB139, and SB141-SB143) detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, and one soil sample (SB134) detected PFOA concentrations above the SGVs for Residential Use, with overall concentrations ranging from 0.762 to 23.8 ug/kg (ppb). One soil sample (SB140) analyzed for PFOA was below SGVs for Unrestricted Use.

Fourteen-Foot to Sixteen-Foot Depth Interval

- Ten soil samples (SB134-SB143) initially placed on hold were analyzed from the fourteen-foot to sixteen-foot depth intervals based on the results of the shallower sample intervals. Two soil

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samples (SB139-SB140) collected between fourteen-foot to sixteen-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, and eight soil samples (SB134-SB138 and SB141-SB143) detected PFOS concentrations above the SGVs for Residential Use, with overall concentrations ranging from 1.90 to 386 ug/kg (ppb).

- Ten soil samples (SB134-SB143) initially placed on hold were analyzed from the fourteen-foot to sixteen-foot depth intervals based on the results of the shallower sample intervals. Six soil samples (SB134-SB135, SB138-SB139, and SB141-SB142) collected between the fourteen-foot to sixteen-foot depth interval detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, and three soil samples (SB136-SB137, and SB143) detected PFOA concentrations above the SGVs for Residential Use, with overall concentrations ranging from 1.57 to 15.3 ug/kg (ppb). One soil sample (SB140) analyzed for PFOA was below SGVs for Unrestricted Use.

Sixteen-Foot to Eighteen-Foot Depth Interval

- Four soil samples (SB134, SB137, SB139, and SB142) initially placed on hold were analyzed from the sixteen-foot to eighteen-foot depth intervals based on the results of the shallower sample intervals. One soil sample (SB134) collected between sixteen-foot to eighteen-foot depth interval detected PFOS concentrations above the proposed SGVs for Protection of Groundwater, and three soil samples (SB137, SB139 and SB142) detected PFOS concentrations above the SGVs for Residential Use, with overall concentrations ranging from 2.27 to 319 ug/kg (ppb).
- Four soil samples (SB134, SB137, SB139, and SB142) initially placed on hold were analyzed from the sixteen-foot to eighteen-foot depth intervals based on the results of the shallower sample intervals. One soil sample (SB139) collected between the sixteen-foot to eighteen-foot depth interval detected PFOA concentrations above the proposed SGVs for Protection of Groundwater, and two soil samples (SB137 and SB142) detected PFOA concentrations above the SGVs for Residential Use, with overall concentrations ranging from 1.12 to 12.8 ug/kg (ppb). One soil sample (SB134) analyzed for PFOA was below SGVs for Unrestricted Use.

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4.2 Community Air Monitoring

Community air monitoring was performed daily for the subject property during soil disturbance events. This included monitoring the downwind perimeter of the work zone for dust and volatile organic vapors. The action level of greater than 150 micrograms per cubic meter ($\mu g/m^3$) for dust and 5 parts per million (ppm) for volatile organic vapors in the breathing zone were enforced during work. Field data sheets for the community air monitoring are included in **Appendix C.**

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5.0 QUALITY ASSURANCE / QUALITY CONTROL

The overall QA/QC objective for the field investigation was to develop and implement procedures that provide data of known and documented quality. QA/QC characteristics for data include precision, accuracy, representativeness, completeness, and comparability. The purpose of the QA/QC activities developed for this site were to verify the integrity of the work performed and data collected is of the appropriate type and quality for the intended use.

5.1 QA/QC Samples

To assess the adequacy of the sample collection and decontamination procedures performed in the field, QA/QC samples were collected and analyzed throughout the field sampling program. In general, QA/QC samples confirmed that the procedures performed in the field were consistent and acceptable. QA/QC samples included field blanks, equipment blanks, blind duplicates, matrix spike (MS), and matrix spike duplicates (MSD).

During the investigations, nine field blanks, nine equipment blanks, 22 MS/MSD, and 17 blind duplicates were prepared and submitted for analysis in accordance with the project Quality Assurance Project Plan (QAPP).

The results of the QA/QC sampling indicates that sample collection procedures and/or ambient conditions are unlikely to have significantly impacted environmental samples collected from the site during implementation of the investigations.

5.2 Data Usability and Validation

In accordance with the approved Site Delineation Investigation Work Plan, independent third-party data validation was performed by Laboratory Data Consultants. Data validation was performed on 5% of the data generated. A copy of the data validation reports are included as **Appendix D**.

Data were deemed acceptable by the data validator, with minor qualifications due to sample matrix or laboratory quality control outliers.

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6.0 NATURE AND EXTENT OF CONTAMINATION

The following section describes the nature and extent of contamination identified at the site.

6.1 Identification of Source Areas

Results of the sampling completed during the SDI confirm the RI results that the main source areas of PFAS are the HAZMAT Response Training Area / Foam Training Area and the Tank Car / Flammable Liquids Pit Training Areas for the shallow and intermediate soils, and the former Flammable Liquids/HAZMAT Response Training Area for the deep soil interval. Historically, AFFF has been used most extensively at these locations. Data from the SDI shows the highest concentrations of PFOA and PFOS in groundwater and soil at these locations.

Additionally, soil sampling data indicate that the Unlined Recharge Basin has also been impacted by PFAS, likely a result of runoff through the onsite stormwater drainage system. The range of PFAS concentrations in shallow soils in the Unlined Recharge Basin is similar to those detected in the fire training areas of the site.

6.2 Extent of Contamination in Soil

A total of 99 soil borings were installed onsite, performed in two rounds. The first round of soil sampling, collected during Phases I and II, included 49 boring locations. Based on the results from the first round of soil samples, 50 soil borings were installed in Phase III to aid in the horizontal and vertical delineation of soil impact. A total of 357 soil samples were collected during the SDI.

Detectable concentrations of PFOS/PFOA were reported in a majority of soil samples collected at the Site. The highest concentrations of PFAS compounds were reported in samples collected from the Active Fire Training Area. The highest concentration of an individual PFOA/PFOS compound was 20,400 µg/kg (PFOS) detected in the sample from SB0048 at four-feet to six-feet (adjacent to the Former Flammable Liquids Pit). Within the Active Fire Training Area concentrations of individual PFAS compounds greater than 100 µg/kg were detected in multiple samples as deep as 16'-18' bgs. In most samples, detectable levels of PFOS were greater than PFOA by at least one order of magnitude. The PFOS and PFOA sampling results

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are summarized on **Figure 3, Figure 4, Figure 5, Figures 6A** through **6C,** and **Figures 7A** through **7C**. These figures present the results of soil samples collected during the RI and SDI combined.

A total of 83 soil samples exceeded the RUSGV for PFOS (8.8 µg/kg) and 23 soil exceeded the CUSGV for PFOS (440 mg/kg). These exceedances were located primarily within the Active Fire Training area, specifically the HAZMAT Response Training Area / Foam Training Area and the Tank Car / Flammable Liquids Pit Training areas. Four soil samples also exceeded the RUSGV for PFOS in the Unlined Recharge Basin area, and two samples exceeded the RUSGV for PFOS in the Field Maintenance Building Area. Concentrations of PFOS decrease as distance away from these source areas increases. **Figures 6A, 6B** and **6C** show the delineated extents of PFOS above the SGVs in shallow (0'-2'), intermediate (4'-6') and deep (10'-12') soil, respectively.

A total of 35 PFOA concentrations exceeded the RUSGV (6.6 µg/kg) in soil samples collected from the Active Fire Training area, specifically the HAZMAT Response Training Area / Foam Training Area and the Tank Car / Flammable Liquids Pit Training Areas. No soil samples exceeded CUSGV for PFOA (500 µg/kg). Concentrations of PFOA decrease as distance away from these source areas increases. **Figures 7A, 7B** and **7C** show the delineated extents of PFOA above the SGVs in shallow (0'-2'), intermediate (4'-6') and deep (10'-12') soil, respectively.

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7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The purpose of the investigations was to further delineate the nature and extent of on-site soil contamination from Per- and poly fluoroalkyl substances (PFAS) associated with historical site operations to support preparation of a Feasibility Study. To perform this work, the following tasks were completed:

- A total of 99 soil borings were installed at the site and a total of 357 soil samples were analyzed.
    - PFOS/PFOA was not detected above SGVs in 44 of the 357 soil samples.
    - PFOS/PFOA were detected above Unrestricted Use SGVs (and below proposed Protection of Groundwater SGVs) in eleven of the 357 soil samples.
    - PFOS/PFOA were detected above proposed Protection of Groundwater SGVs (and below the Residential Use SGVs) in 161 of the 357 soil samples.
    - PFOS/PFOA were detected above Residential Use SGVs (and below the Commercial Use SGVs) in 118 of the 357 soil samples.
    - PFOS/PFOA were detected above Commercial Use SGVs in 23 of the 357 soil samples.
    - There appear to be two hotspots of PFAS contamination at the Site. One is located in the north-central portion, centered over a former HAZMAT Response training area, which was also used as a Foam Training Area from 2008 to 2016. The other hotspot is located farther to the west, located beneath a Flammable Liquids Pit and Car Fire Training Area. Both hotspots are located in areas where AFFF was likely stored and/or implemented. **Figure 2** shows the location of these areas.

- The fate and transport of contaminants identified during these investigations is a function of the properties of the individual contaminants, the geology and hydrogeology of the site, and available pathways for the contaminants to migrate. Elevated concentrations of PFOS and PFOA are present in surface and subsurface soils at the site. Transport mechanisms for identified impact include soil transportation as dust or suspended in storm runoff, vertical transport via precipitation within the vadose zone, and migration of dissolved PFAS on and offsite in groundwater.

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7.2 Recommendations

Based upon the findings of this investigation, PWGC recommends that the findings of the SDI be incorporated into the Draft Feasibility Study being prepared for the site.

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8.0 REFERENCES

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FIGURES

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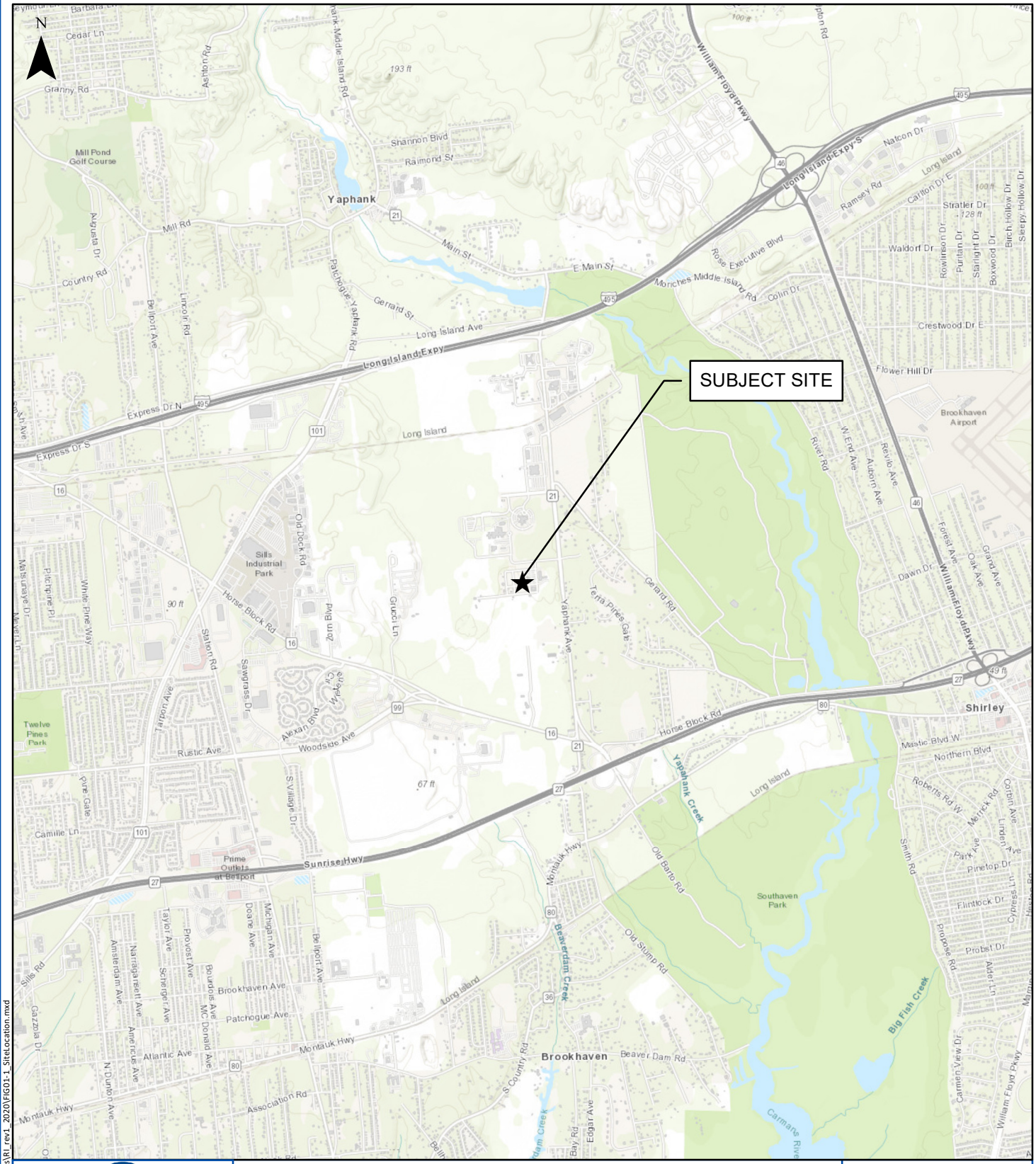

SITE LOCATION

676 MAPLE ST
YAPHANK, NY

0 ½ 1 1½ 2 Miles

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Project:	SHD2205
Date:	3/28/2023
Designed by:	MP
Drawn by:	PH
Approved by:	ZY
Figure No:	1

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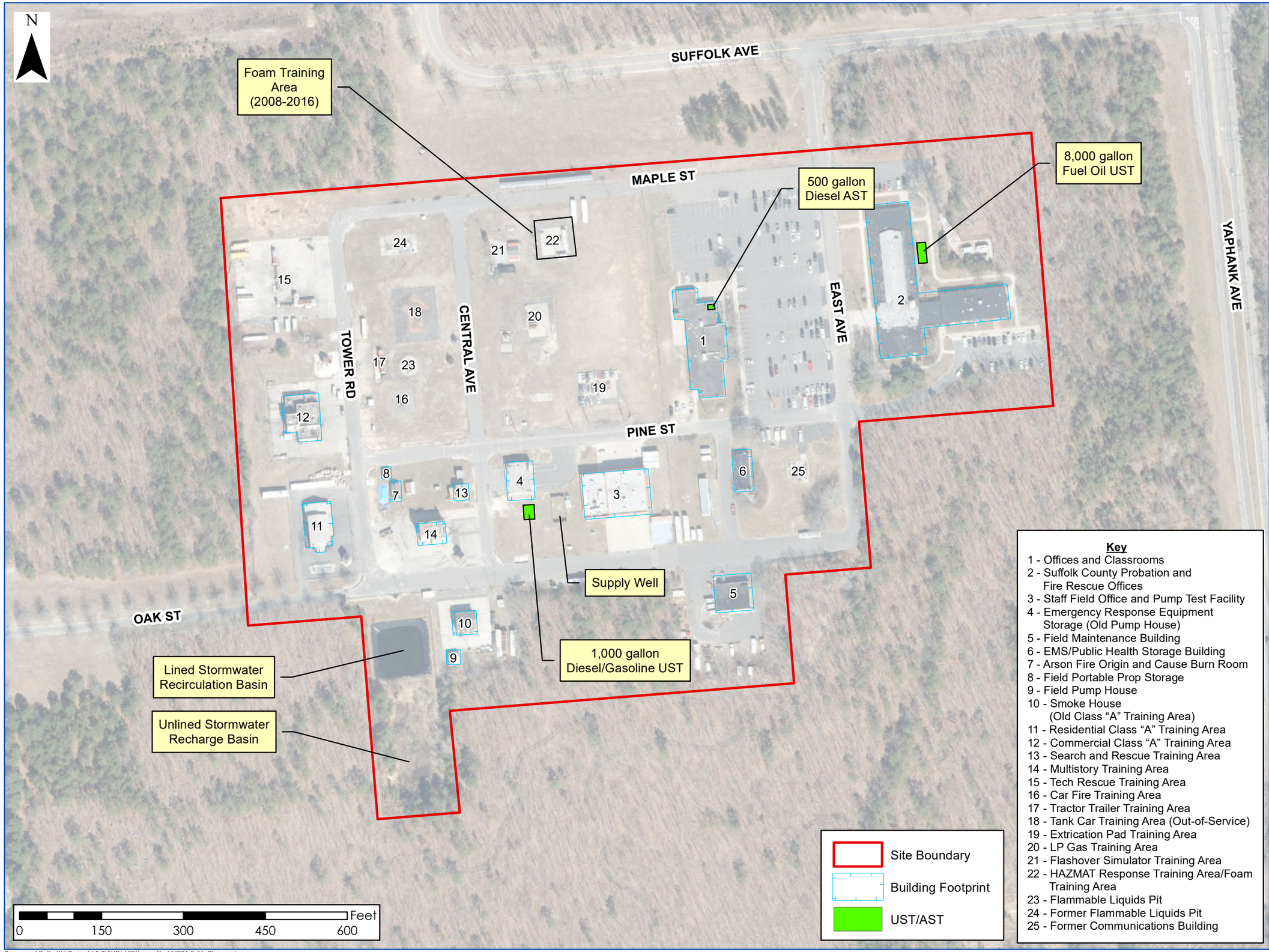

Key

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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Date:	10/12/2021	Drawn by:	PH
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Site Plan

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

2

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SB011			
Analyte	SB011 (0-2")	SB011 (2"-2')	
PFOS	5.7	6.4	F1
PFOA	1.2	1.5	F1

SB006			
Analyte	SB006 (0-2")	SB006 (2"-2')	SB006 (5'-7')
PFOS	6.6	22 D	260 BD
PFOA	0.21	0.87	0.89

SB003				
Analyte	SB003 (0-2")	SB003 (2"-2')	SB003 (5'-7')	SB003 (10'-12')
PFOS	1,780 D	280 D	52 B D	100 B D
PFOA	45 D	4.2	3.8	5.9

SB004			
Analyte	SB004 (0-2")	SB004 (2"-2')	SB004 (5'-7')
PFOS	150 D	340 D	30 B D
PFOA	17	9.1	2.8

SB022		
Analyte	SB022 (0-2")	SB022 (2"-2')
PFOS	4.6	2.2 U
PFOA	0.79	0.42

SB031				
Analyte	SB031 (0-2")	SB031 (2"-2')	SB031 (5'-7')	SB031 (10'-12')
PFOS	3.5	11	1.5 B	0.21 J B
PFOA	0.13 J	0.17 J	0.24	0.088 U

SB002			
Analyte	SB002 (0-2")	SB002 (2"-2')	SB002 (5'-7')
PFOS	21	130 D	26 B D
PFOA	7.6	3.1	2.0

SB042		
Analyte	SB042 (0-2")	
PFOS	1870	D
PFOA	13	

SB021				
Analyte	SB021 (0-2")	SB021 (2"-2')	SB021 (5'-7')	SB021 (10'-12')
PFOS	5.8 B	46 B	0.83 B	0.52 B
PFOA	0.73	2.3	0.095 J	0.089 U

SB010		
Analyte	SB010 (0-2")	SB010 (2"-2')
PFOS	1.6	0.22 U
PFOA	0.72	0.33

SB001		
Analyte	SB005 (0-2")	SB005 (2"-2')
PFOS	17	53 D
PFOA	1.7	4.8

SB024			
Analyte	SB024 (0-2")	SB024 (2"-2')	SB024 (5'-7')
PFOS	8.0 B	53 B	0.81 B
PFOA	2.5	3.4	0.16 J

SB043		
Analyte	SB043 (0-2")	SB043 (2"-2')
PFOS	8.1 B	1.9 B
PFOA	0.35	0.22

SB040		
Analyte	SB040 (0-2")	SB040 (2"-2')
PFOS	1.4	2.3
PFOA	0.28	0.16 J

SB005		
Analyte	SB005 (0-2")	SB005 (2"-2')
PFOS	9.1	3.5
PFOA	0.92	0.97

SB012				
Analyte	SB012 (0-2")	SB012 (2"-2')	SB012 (5'-7')	SB012 (10'-12')
PFOS	120 D	260 D	810 B D	320 D B F2
PFOA	6.9	24 D	1.7	1.3

SB025		
Analyte	SB025 (0-2")	SB025 (2"-2')
PFOS	5.9 B	6.8 B
PFOA	2.5	2.6

SB008			
Analyte	SB008 (0-2')	SB008 (2"-2')	SB008 (5'-7')
PFOS	5.6	120 D	25 B D
PFOA	0.90	1.1	0.26

SB009		
Analyte	SB009 (0-2")	SB009 (2"-2')
PFOS	7.7	0.21 U
PFOA	3.0	0.30

SB044		
Analyte	SB044 (0-2")	SB044 (2"-2')
PFOS	2.7 B	2.3 B
PFOA	0.16 J	0.15 J

SB038		
Analyte	SB038 (0-2")	SB038 (2"-2')
PFOS	2.1	0.56
PFOA	0.15 J	0.091 J

SB039		
Analyte	SB039 (0-2")	SB039 (2"-2')
PFOS	1.5	0.93
PFOA	0.23 J	0.14 J

SB016		
Analyte	SB016 (0-2")	SB016 (2"-2')
PFOS	7.5	8.7
PFOA	0.13 J	0.096 J

SB023		
Analyte	SB023 (0-2")	SB023 (2"-2')
PFOS	2.7 UJ	2.2 UJ
PFOA	0.30	0.35

SB032		
Analyte	SB032 (0-2")	SB032 (2"-2')
PFOS	3.2	6.8
PFOA	0.35	1.4

SB037		
Analyte	SB037 (0-2")	SB037 (2"-2')
PFOS	4.0	2.8
PFOA	0.69	0.31

SB026		
Analyte	SB026 (0-2")	SB026 (2"-2')
PFOS	0.00023 U	0.00022 U
PFOA	0.000097 U	0.00019 J

SB045		
Analyte	SB045 (0-2")	SB045 (2"-2')
PFOS	1.5 B	0.9 B
PFOA	0.094 J	0.12 J

SB033		
Analyte	SB033 (0-2")	SB033 (2"-2')
PFOS	0.60	0.79
PFOA	0.097 U	0.28

SB019		
Analyte	SB019 (0-2")	SB019 (2"-2')
PFOS	3.3	1.3
PFOA	0.19 J	0.18 J

SB017		
Analyte	SB017 (0-2")	SB017 (2"-2')
PFOS	2.4	8.1
PFOA	0.37	0.65

SB015		
Analyte	SB015 (0-2")	SB015 (2"-2')
PFOS	0.28	0.41
PFOA	0.098 U	0.14 J

SB036		
Analyte	SB036 (0-2")	SB036 (2"-2')
PFOS	4.0	3.5
PFOA	0.39	0.35

SB027		
Analyte	SB027 (0-2")	SB027 (2"-2')
PFOS	1.8	0.90
PFOA	0.51	0.64

SB018		
Analyte	SB017 (0-2")	SB017 (2"-2')
PFOS	2.9	3.8
PFOA	0.24	0.21

SB007				
Analyte	SB007 (0-2")	SB007 (2"-2')	SB007 (2'-4')	SB007 (4'-5')
PFOS	6.5	9.5	0.52 U	0.36 J B
PFOA	5.9	27 D	0.14 J	0.15 J

SB013			
Analyte	SB013 (0-2")	SB013 (2"-2')	SB013 (5'-7')
PFOS	64 D	130 D	150 B D
PFOA	0.90	0.63	0.26

SB029		
Analyte	SB029 (0-2")	SB029 (2"-2')
PFOS	2.6	1.6
PFOA	2.7	2.0

SB020		
Analyte	SB020 (0-2")	SB020 (2"-2')
PFOS	0.43	0.65
PFOA	0.094 U	0.11 J

SB030			
Analyte	SB030 (0-2")	SB030 (2"-2')	SB030 (2'-4')
PFOS	48 D	2.9	0.68 B
PFOA	14	2.0	0.92

SB034		
Analyte	SB034 (0-2")	SB034 (2"-2')
PFOS	1.6	3.3
PFOA	0.094 U	0.094 U

SB028		
Analyte	SB028 (0-2")	SB028 (2"-2')
PFOS	4.4	2.1
PFOA	0.58	0.41

SB014		
Analyte	SB014 (0-2")	SB014 (2"-2')
PFOS	1.3	0.74
PFOA	0.13 J	0.092 J

SB035		
Analyte	SB035 (0-2")	SB035 (2"-2')
PFOS	0.92	0.69
PFOA	0.41	0.40

EAST AVE

YAPHANK AVE

Notes:
Concentrations shown are detections greater than or equal to the laboratory MDL with the exception of PFOA and PFOS which also include non-detect concentrations.
All sample results shown are in ug/kg.
B: Compound was found in the blank and sample.
D: Sample results are obtained from a dilution; the surrogate or matrix spike recoveries reported are calculated from diluted samples.
F1: MS/MSD Recovery is outside acceptance limits.
H: Sample was prepared or analyzed beyond the specified holding time.
J: Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U: Indicates the analyte was analyzed for but not detected.

0 200 400 600 800 Feet

Soil Boring (RI)
Site Boundary

Highlighted denotes concentrations exceeding CUSGV
Highlighted denotes concentrations exceeding RUSGV
Highlighted denotes concentrations exceeding POGSGV
Highlighted denotes concentrations exceeding UUSGV

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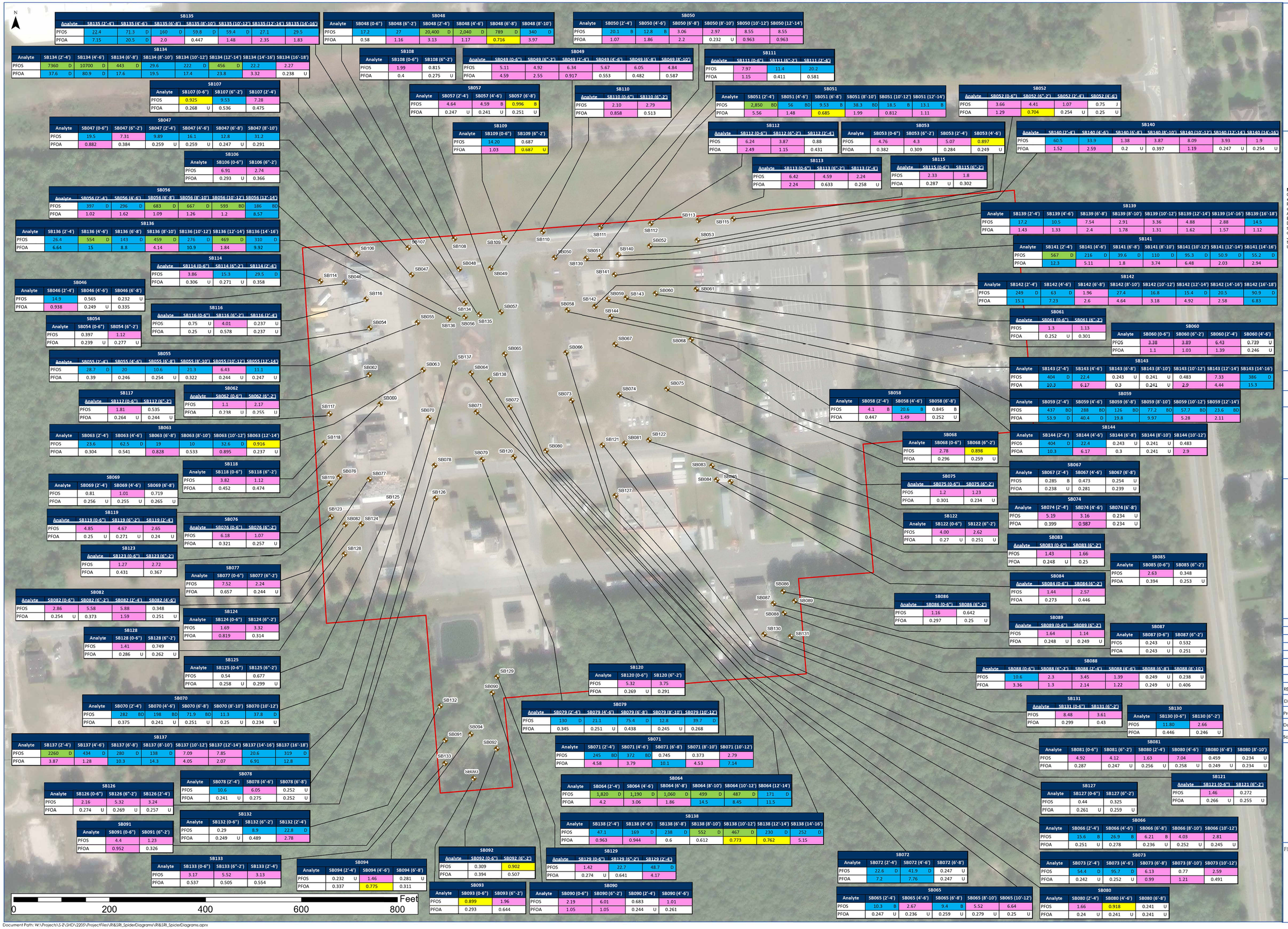
PFAS Results (Remedial Investigation)

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

3



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Soil Borings (SRI)
Site Boundary

Highlighted denotes concentrations exceeding CUSGV
Highlighted denotes concentrations exceeding RUSGV
Highlighted denotes concentrations exceeding POGSGV
Highlighted denotes concentrations exceeding UUSGV

Notes:
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D: Sample results are obtained from a dilution, the surrogate or matrix spike recoveries reported are calculated from diluted samples.
J: Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
U: Indicates the analyte was analyzed for but not detected.

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PFAS RESULTS (Soil Delineation Investigation)

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

4

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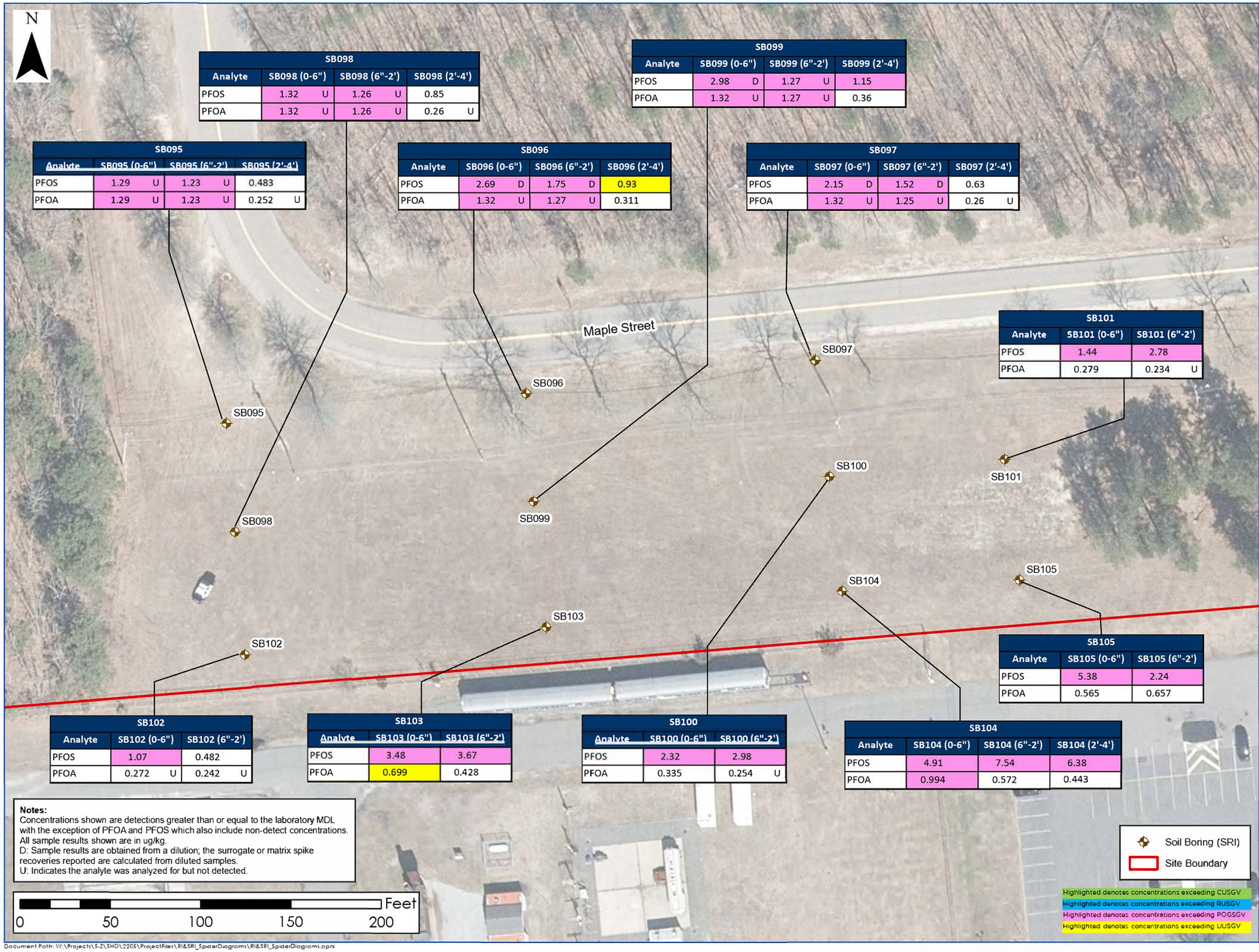

SB098						
Analyte	SB098 (0-6")		SB098 (6"-2')		SB098 (2'-4')	
PFOS	1.32	U	1.26	U	0.85	
PFOA	1.32	U	1.26	U	0.26	U

SB095						
Analyte	SB095 (0-6")		SB095 (6"-2')		SB095 (2'-4')	
PFOS	1.29	U	1.23	U	0.483	
PFOA	1.29	U	1.23	U	0.252	U

SB096						
Analyte	SB096 (0-6")		SB096 (6"-2')		SB096 (2'-4')	
PFOS	2.69	D	1.75	D	0.93	
PFOA	1.32	U	1.27	U	0.311	

SB099						
Analyte	SB099 (0-6")		SB099 (6"-2')		SB099 (2'-4')	
PFOS	2.98	D	1.27	U	1.15	
PFOA	1.32	U	1.27	U	0.36	

SB097						
Analyte	SB097 (0-6")		SB097 (6"-2')		SB097 (2'-4')	
PFOS	2.15	D	1.52	D	0.63	
PFOA	1.32	U	1.25	U	0.26	U

SB101		
Analyte	SB101 (0-6")	SB101 (6"-2')
PFOS	1.44	2.78
PFOA	0.279	0.234 U

SB102				
Analyte	SB102 (0-6")		SB102 (6"-2')	
PFOS	1.07		0.482	
PFOA	0.272	U	0.242	U

SB103		
Analyte	SB103 (0-6")	SB103 (6"-2')
PFOS	3.48	3.67
PFOA	0.699	0.428

SB100		
Analyte	SB100 (0-6")	SB100 (6"-2')
PFOS	2.32	2.98
PFOA	0.335	0.254 U

SB104			
Analyte	SB104 (0-6")	SB104 (6"-2')	SB104 (2'-4')
PFOS	4.91	7.54	6.38
PFOA	0.994	0.572	0.443

SB105		
Analyte	SB105 (0-6")	SB105 (6"-2')
PFOS	5.38	2.24
PFOA	0.565	0.657

Notes:
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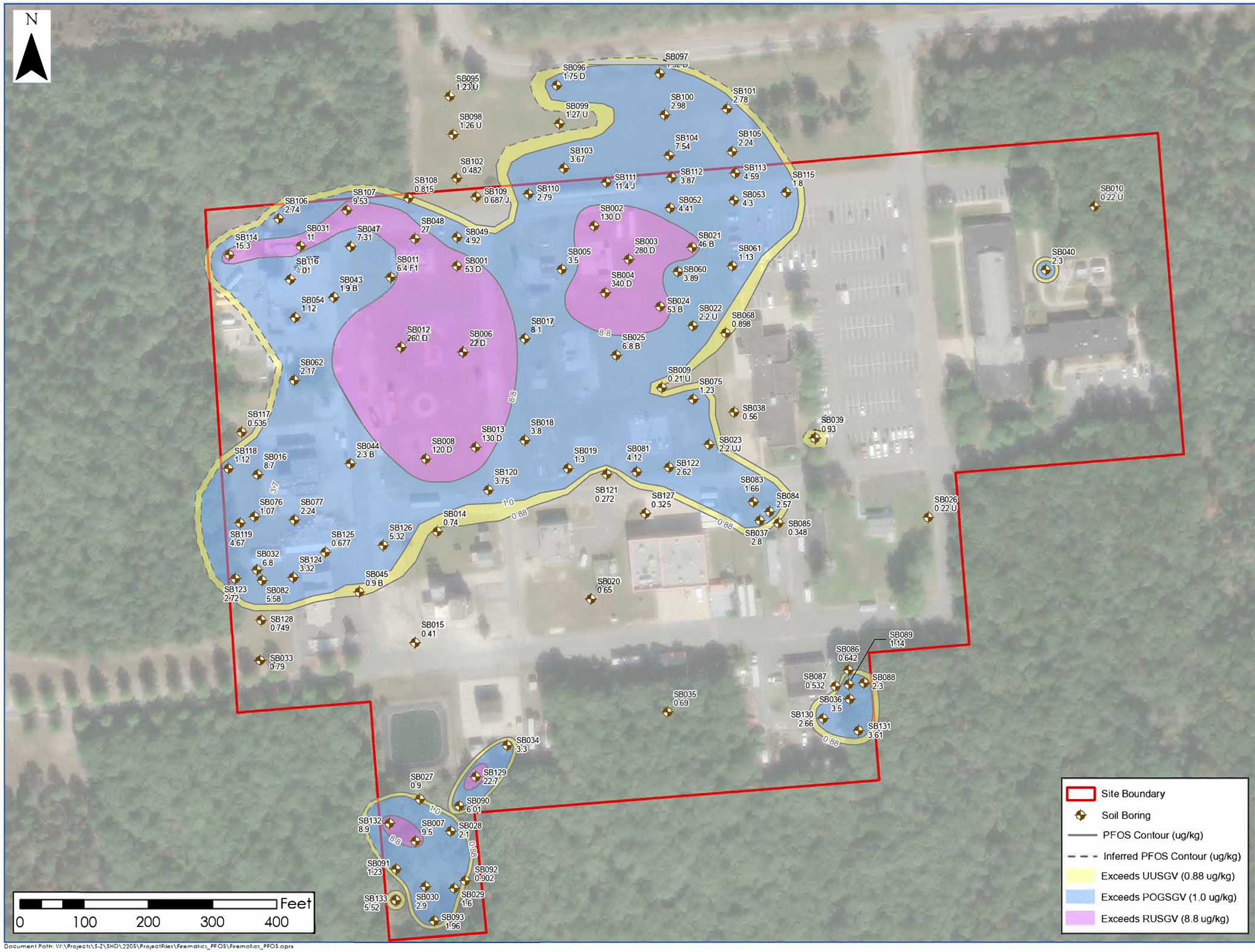
PFAS Results Northern Area (Soil Delineation Investigation)

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

5



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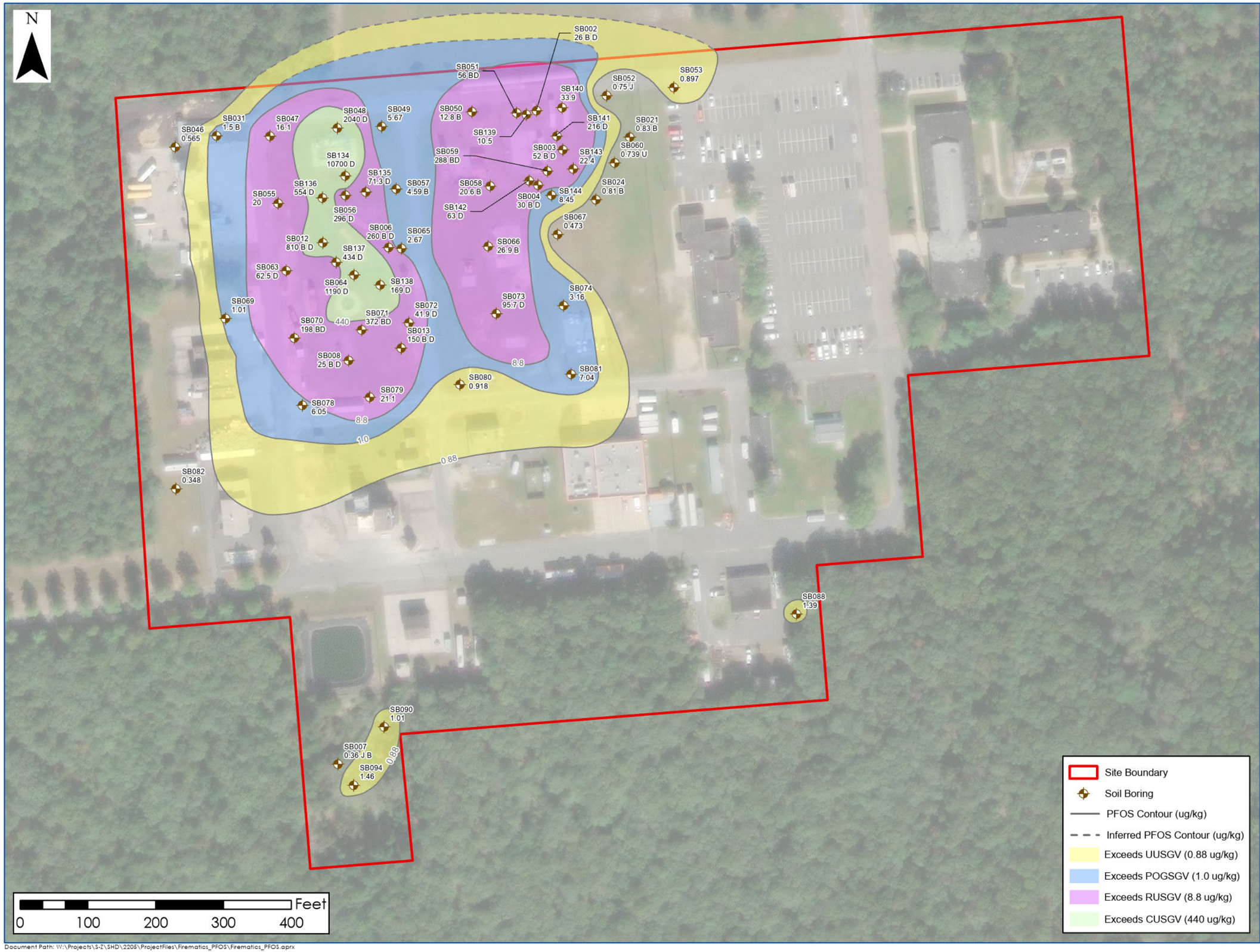
Generalized Extent of PFOS in Shallow Soil (0.5' - 2')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

6A



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Generalized Extent of PFOS in Intermediate Soil (4' - 6')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

6B

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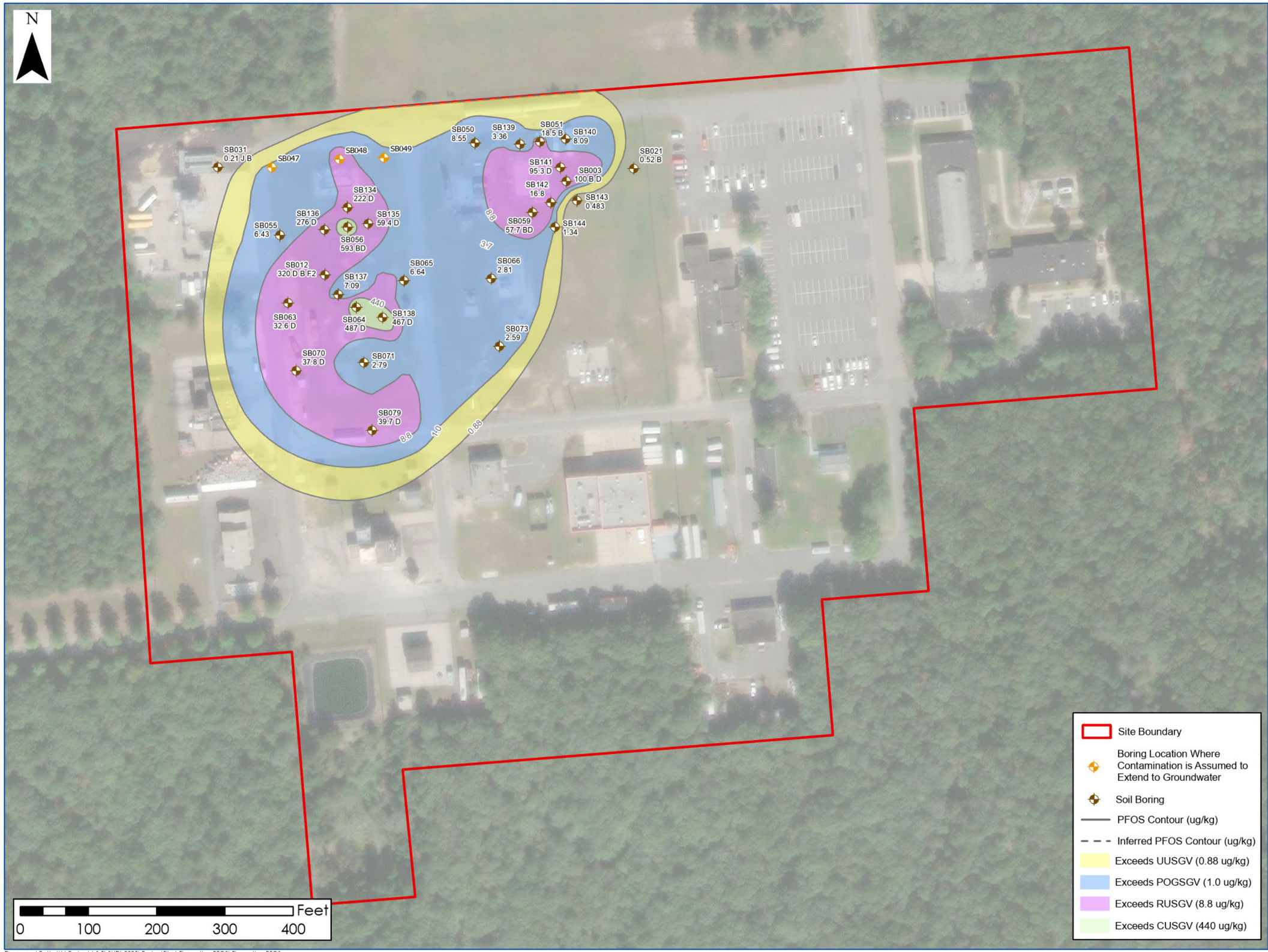

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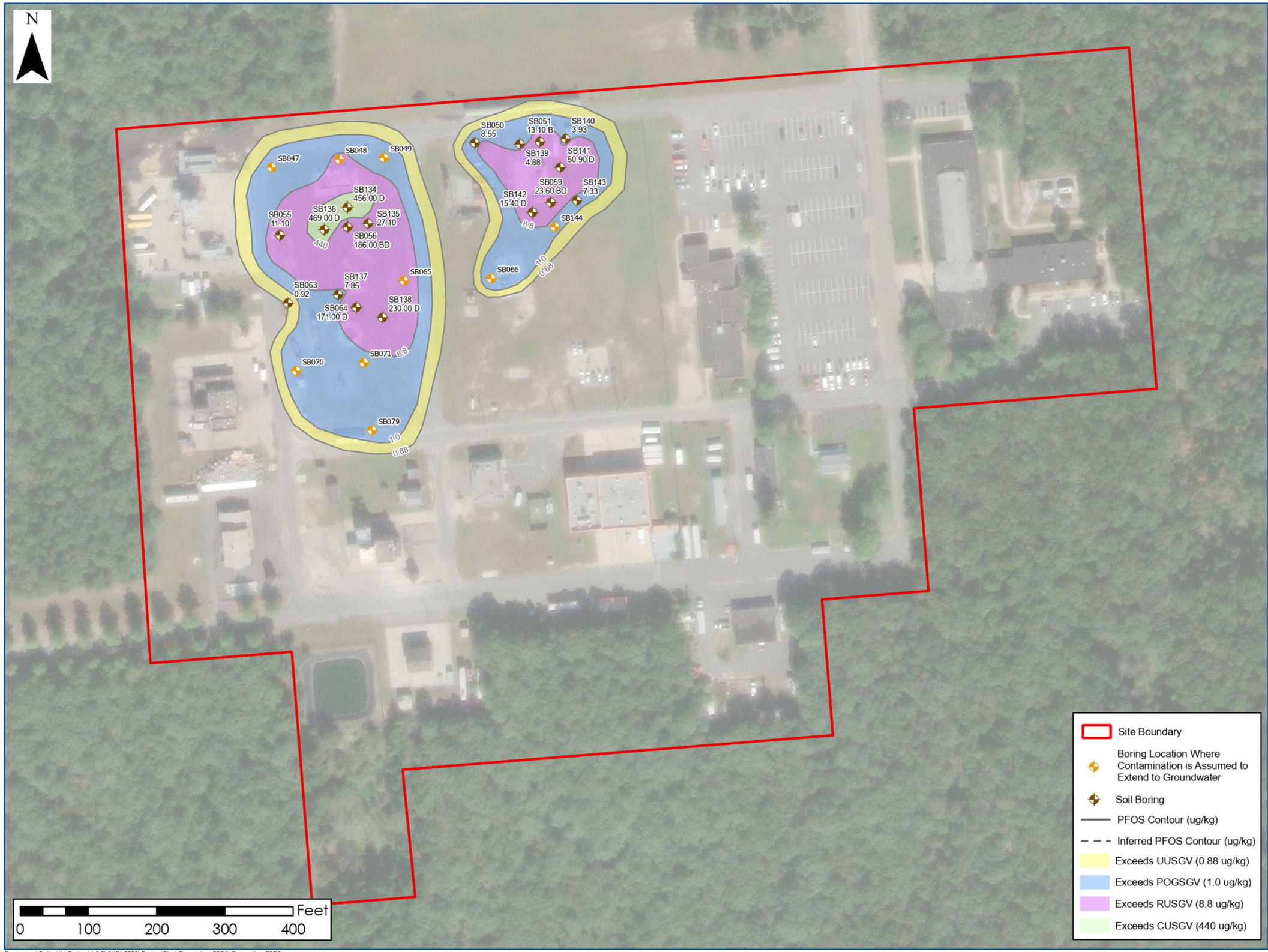
Generalized Extent of PFOS in Deep Soil (10' - 12')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

6C



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Generalized Extent of PFOS in Deep Soil (12' - 14')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

6D

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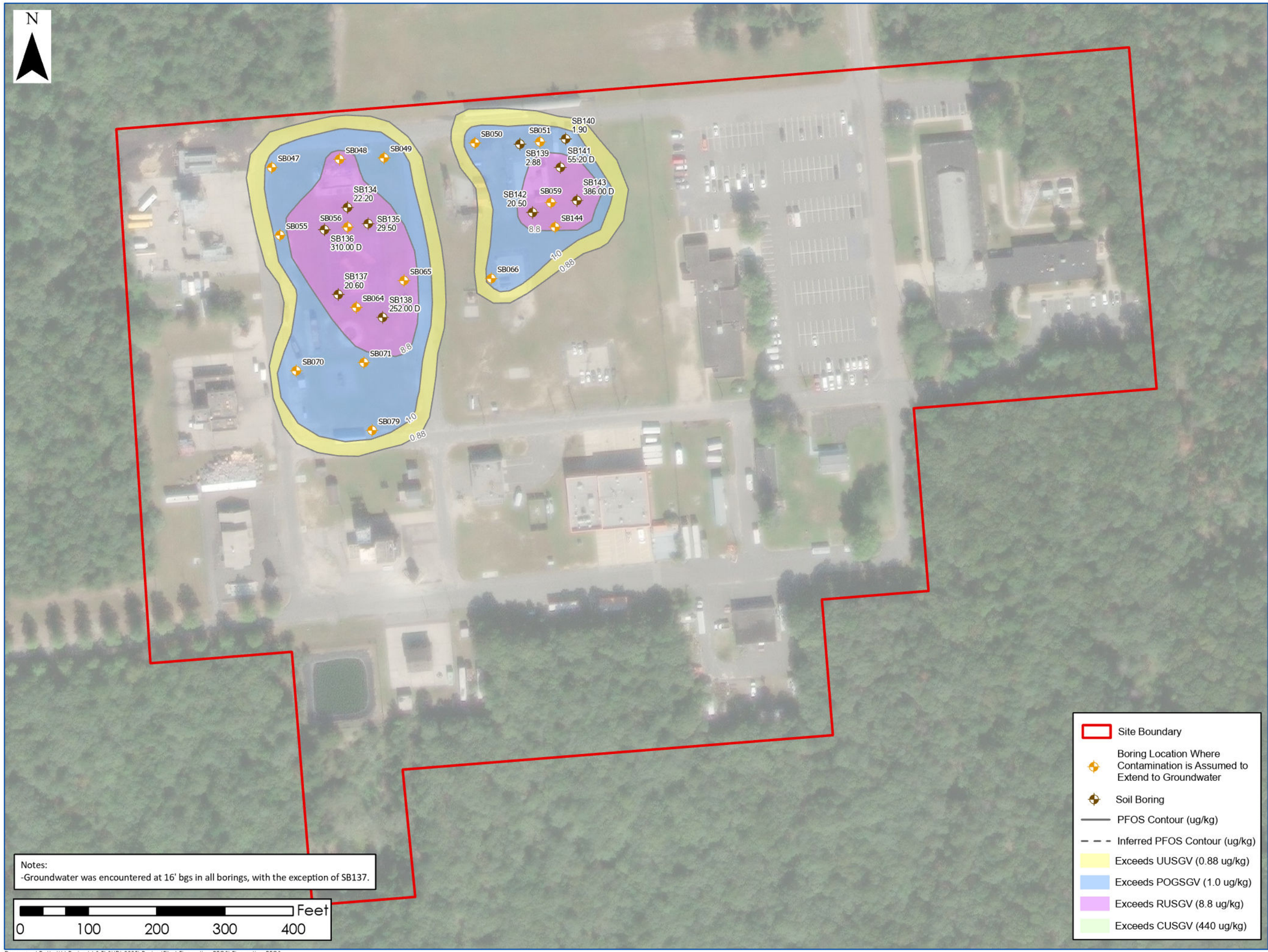

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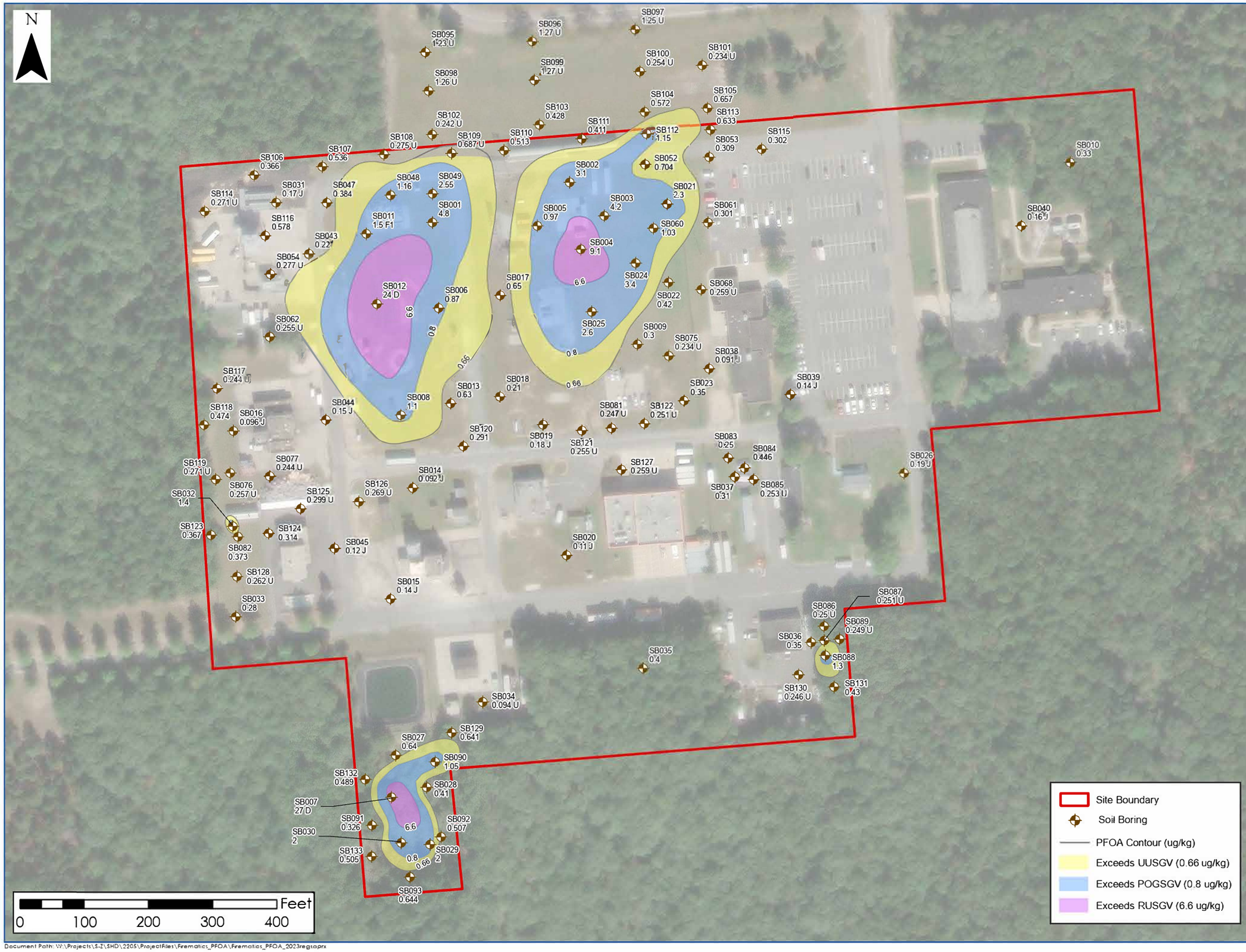
Generalized Extent of PFOS in Deep Soil (14' - 16')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

6E



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Generalized Extent of PFOA in Shallow Soil (0.5' - 2')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

7A

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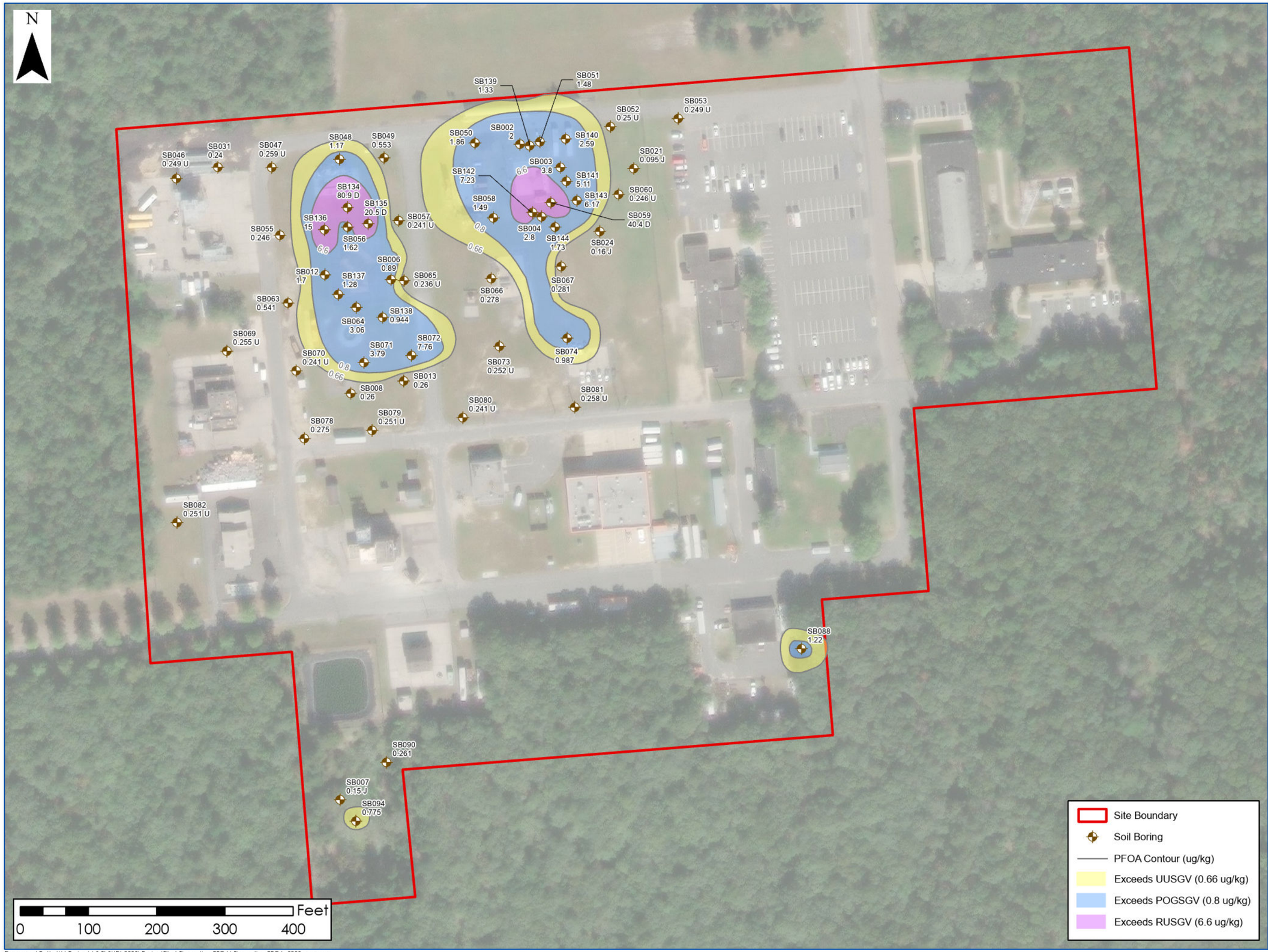

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Generalized Extent of PFOA in Intermediate Soil (4' - 6')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

7B

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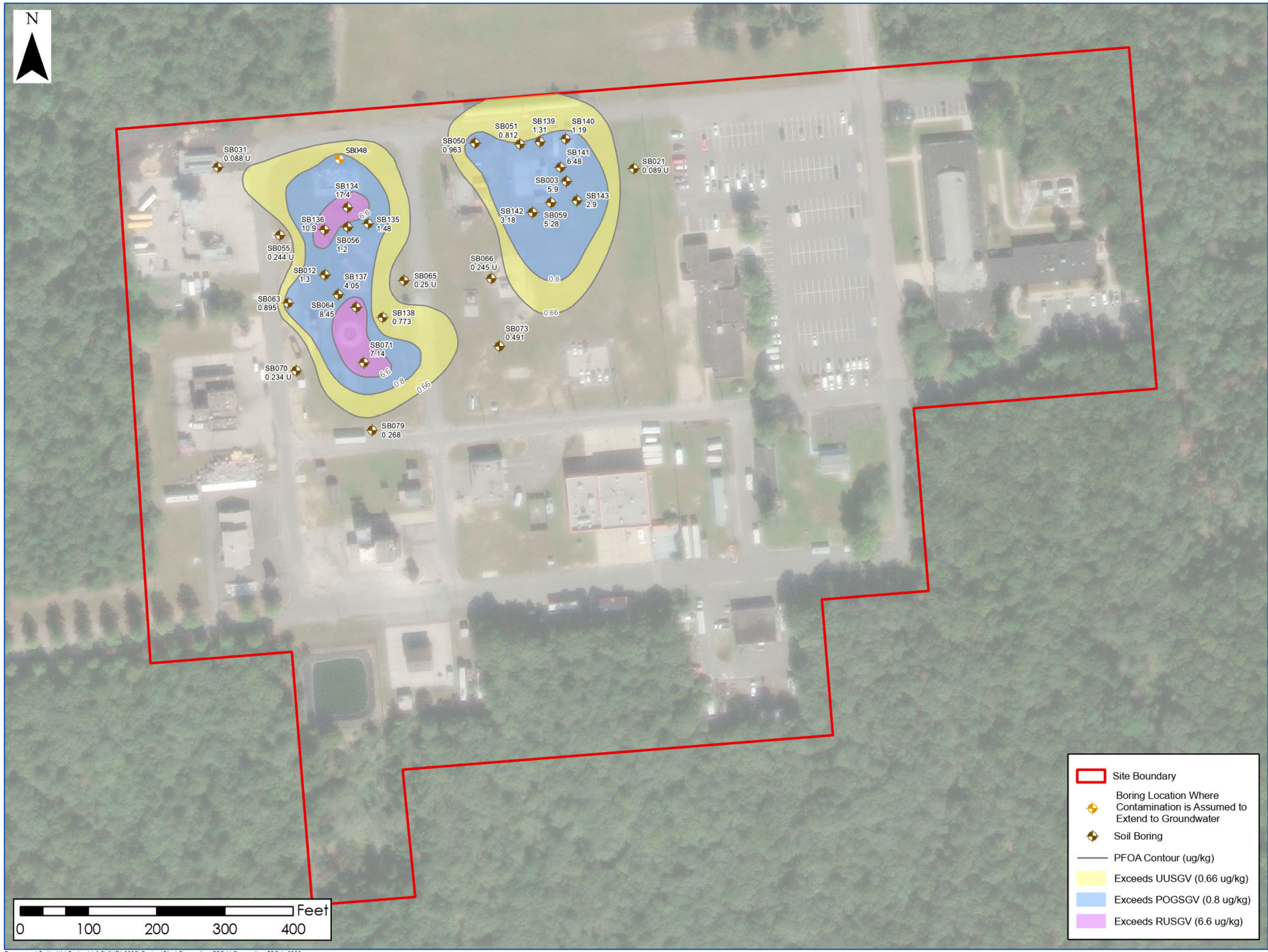

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Generalized Extent of PFOA in Deep Soil (10' - 12')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

7C

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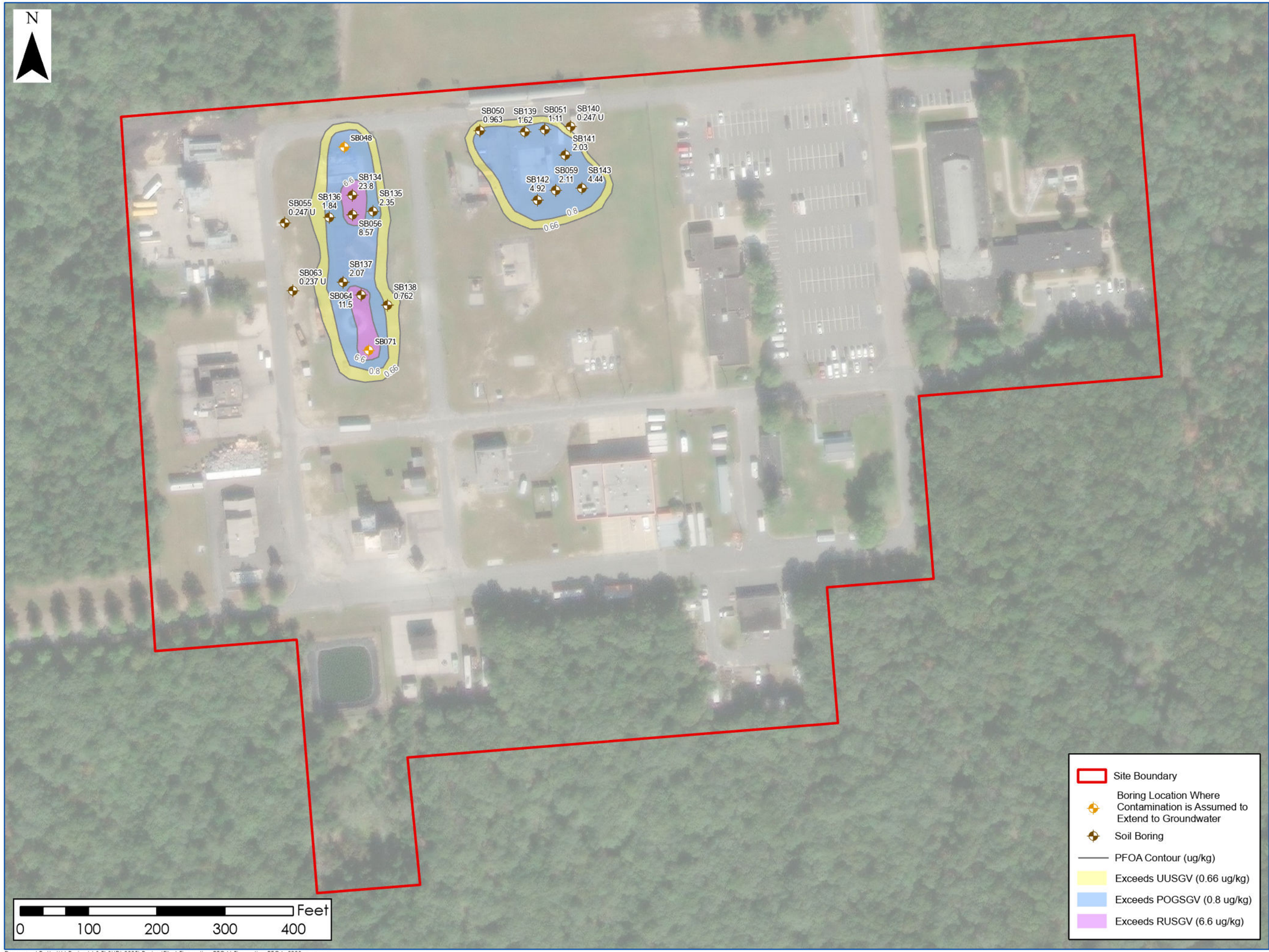

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Generalized Extent of PFOA in Deep Soil (12' - 14')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

7D

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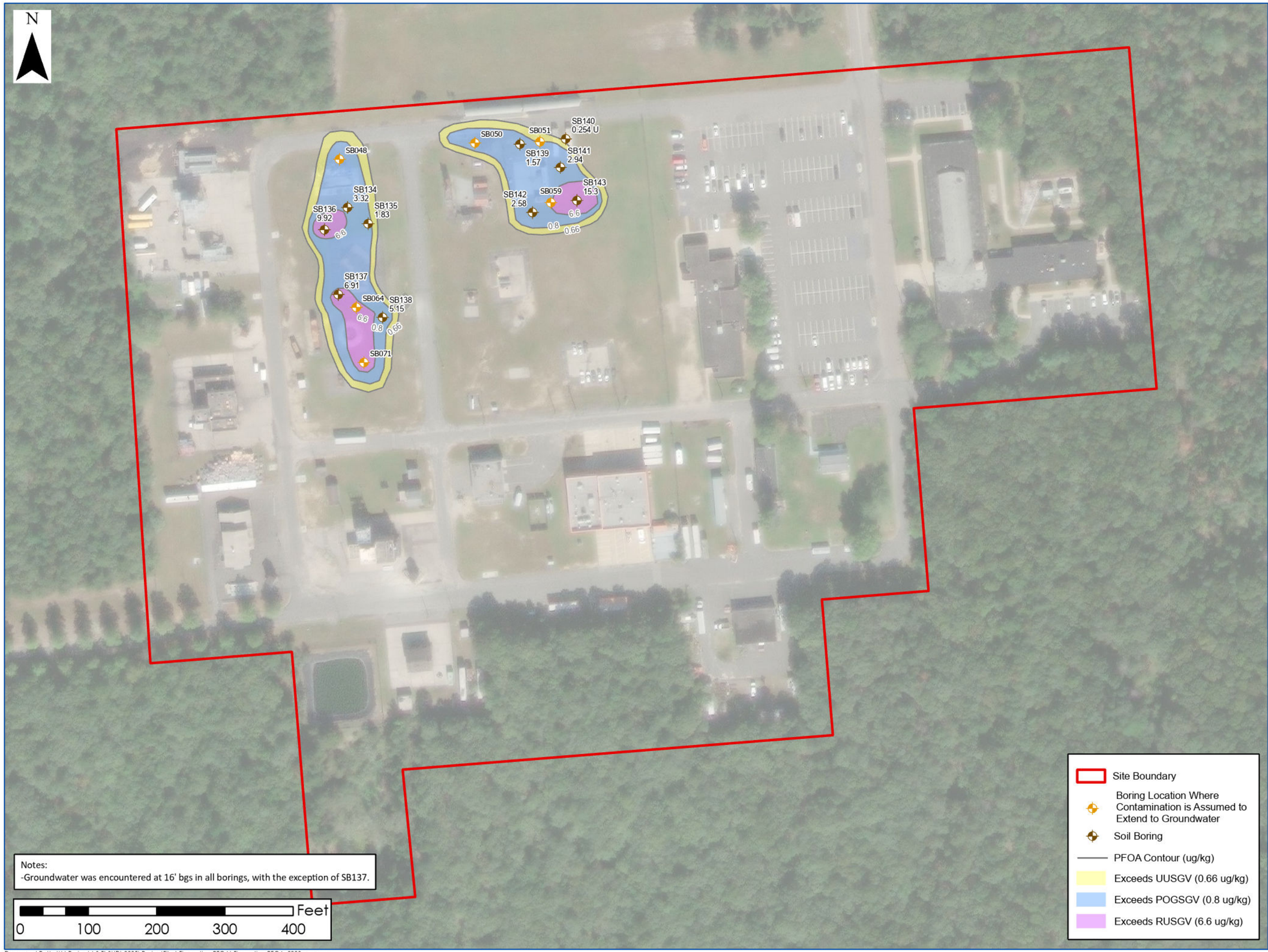

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Generalized Extent of PFOA in Deep Soil (14' - 16')

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

7E

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TABLES

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Table 1

Soil Boring Sampling Summary
PFAS
676 Maple Street, Yaphank, NY

AOC	Sample Type	Soil Boring IDs	Sampling Frequency	Number of Borings	Number of Samples Analyzed	Analytes	Justification
PHASE I SOIL BORINGS							
Former Foam and Fire Training Area	Shallow Soil Boring (0-6" and 6"-2')	SB047, SB048, SB049, SB052, SB053, SB054, SB060, SB061, SB062, SB068, SB075, SB076, SB077, SB081, and SB082	One soil boring per 10,000 SF and/or primarily at the edges of the inferred area of soils above NYSDEC POGSGVs	15	30	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical and lateral extent of PFAS in onsite soils.
	Deep Soil Boring (2-4', 4-6', 6-8', 8-10', and 10-12')	SB046, SB050, SB057, SB058, SB065, SB066, SB067, SB069, SB070, SB071, SB072, SB073, SB074, SB078, SB079, and SB-80		16	48		
	Deep Soil Boring (2-4', 4-6', 6-8', 8-10', 10-12', and 12-14')	SB051, SB055, SB056, SB059. SB063, and SB064		6	36		
SB036	Shallow Soil Boring (0-6" and 6"-2')	SB086, SB087, SB088, and SB089	Four soil borings per hot spot area (SB036)	4	8	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical and lateral extent of PFAS in onsite soils.
SB037	Shallow Soil Boring (0-6" and 6"-2')	SB083, SB084, and SB085	Three soil borings per hot spot area (SB037)	3	6	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical and lateral extent of PFAS in onsite soils.
Unlined Recharge Basin	Shallow Soil Boring in Recharge Basin (0-6" and 6"-2')	SB090, SB091, SB092 and SB093	Four shallow soil borings within the unlined Recharge Basin	4	8	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical and lateral extent of PFAS in onsite soils.
	Deep Soil Boring in Recharge Basin (2-4', 4-6', 6-8', 8-10', and 10-12')	SB094	One deep soil boring within the unlined recharge basin	1	3		
PHASE II SOIL BORINGS							
Former Foam and Fire Training Area	Deep Soil Boring (8'-10' and 10'-12').	SB050, SB065, SB066, SB070, SB071, SB073, and SB079	Held samples from Phase I soil borings which exceeded NYSDEC POGSGVs were analyzed.	7	14	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical extent of PFAS from held samples from Phase I soil borings which exceeded NYSDEC POG SGVs.

Table 1

Soil Boring Sampling Summary
PFAS
676 Maple Street, Yaphank, NY

PHASE III SOIL BORINGS							
Undeveloped Area Adjacent to the North of the Site	Shallow Soil Boring (0-6", 6"-2', 2'-4')	SB095, SB096, SB097, SB098, SB099, SB100, SB101, SB012, SB103, SB105, and SB105.	One soil boring per 10,000 SF	11	28	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical and lateral extent of PFAS in onsite soils.
Former Foam and Fire Training Area	Deep Soil Boring (2-4', 4-6', 6-8', and 8-10')	SB047, SB048, SB049, SB052, SB053, SB060, SB081, SB082	Deep soil boring collected from shallow Phase I soil boring which exceeded NYSDEC POGSGVs	8	24	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical extent of PFAS from shallow samples from Phase I soil borings which exceeded NYSDEC POG SGVs.
SB036		SB088		1	4	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	
Unlined Recharge Basin		SB090		1	2	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	
Former Foam and Fire Training Area	Shallow Soil Boring (0-6", 6"-2', and 2'-4-)	SB106, SB107, SB108, SB109, SB110, SB111, SB112, SB113, SB114, SB115, SB116, SB117, SB118, SB119, SB120, SB121, SB122, SB123, SB124, SB125, SB126, SB127, and SB128	Northern, western, and southern perimeters of the Former Foam and Fire Training Area	23	54	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical and lateral extent of PFAS in onsite soils.
SB036		SB130 and SB131	Two shallow soil borings per hotspot (SB036)	2	4	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	
Unlined Recharge Basin		SB129, SB132, and SB133	Three shallow borings within the unlined recharge basin	3	9	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	
SB051	Deep Soil Boring (2-4', 4-6', 6-8', 8-10', 10-12', 12-14', 14-16' and 16-18')	SB139, SB140, and SB141	Three shallow soil borings per hotspot (SB051)	3	22	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	Delineate the vertical and lateral extent of PFAS in onsite soils.
SB056		SB134, SB135, and SB136	Three shallow soil borings per hotspot (SB056)	3	22	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	
SB059		SB142, SB143, and SB144	Three shallow soil borings per hotspot (SB059)	3	20	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	
SB064		SB137 and SB138	Two shallow soil borings per hotspot (SB064)	2	15	PFAS (PFOA and PFAS) by USEPA Method 537.1 (modified)	

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB046	SB046	SB046	SB047	SB047	SB047	SB047	SB047	SB047	SB048	SB048	SB048	SB048	SB048	SB048
Sample Depth:						2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft
Sampling Date:						9/23/2022	9/23/2022	9/23/2022	9/20/2022	9/20/2022	12/5/2022	12/5/2022	12/5/2022	12/5/2022	9/20/2022	9/20/2022	12/5/2022	12/5/2022	12/5/2022	12/5/2022
Lab Sample ID:						22I1277-03	22I1277-04	22I1277-05	22I1026-01	22I1026-02	22L0228-03	22L0228-04	22L0228-48	22L0228-49	22I1026-04	22I1026-05	22L0228-05	22L0228-06	22L0228-50	22L0228-51
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.694	0.252 U	0.402	0.259 U	0.247 U	0.248 U	2.24	1.01	0.711	1.5	0.246 U	0.241 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.252 U	0.252 U	0.259 U	0.259 U	0.247 U	0.248 U	5.05	1.65	1.14	0.363	0.246 U	0.241 U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.252 U	0.252 U	0.259 U	0.259 U	0.247 U	0.248 U	0.247 U	0.24 U	0.255 U	0.264 U	0.246 U	0.241 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.252 U	0.252 U	0.259 U	0.259 U	0.247 U	0.248 U	0.247 U	0.24 U	0.255 U	0.264 U	0.246 U	0.241 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.285	0.252 U	0.315	0.259 U	0.247 U	0.248 U	0.295	0.24 U	0.255 U	0.264 U	0.246 U	0.241 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.428	0.249 U	0.232 U	0.3	0.252 U	0.259 U	0.259 U	0.247 U	0.248 U	1.2	1.5	14.1	2.95	0.853	24.8
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.266	1.46	0.324	0.259 U	0.247 U	0.248 U	0.247 U	2.08	0.255 U	0.264 U	0.246 U	0.241 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.252 U	0.322	0.259 U	0.259 U	0.247 U	0.248 U	0.247 U	0.592	0.255 U	0.264 U	0.246 U	0.241 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	1.43	4.62	0.869	0.794	0.27	0.248 U	0.778	2.33	8.42	2.55	1.46	0.241 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.252 U	0.252 U	0.765	0.5	0.247 U	0.248 U	0.993	0.464	0.255 U	0.264 U	0.246 U	0.241 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.356	0.249 U	0.232 U	5.46	3.44	0.259 U	0.259 U	0.247 U	0.248 U	0.33	0.348	0.397	0.264 U	0.246 U	0.241 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.372	0.249 U	0.232 U	0.996	0.562	0.519	1.19	1.84	1.96	6.46	5.32	8.84	4.68	2.02	8.39
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.653	0.249 U	0.232 U	0.3	0.252 U	0.259 U	0.259 U	0.247 U	0.248 U	1.45	1.09	0.604	0.485	0.355	0.241 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	1.1	0.249 U	0.232 U	0.252 U	0.27	0.259 U	0.259 U	0.247 U	0.248 U	0.317	0.574	0.255 U	0.264 U	0.246 U	0.241 U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	0.914	0.572	0.259 U	0.469	0.452	2.56	2.91	6.21	27	7.08	13.8	29.5 D
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	14.9	0.565	0.232 U	19.5	7.31	9.89	16.1	12.8	31.2	17.2	27	20,400 D	2,040 D	789 D	340 D
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.938	0.249 U	0.335	0.882	0.384	0.259 U	0.259 U	0.247 U	0.291	0.58	1.16	3.13	1.17	0.716	3.97
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.768	0.249 U	0.232 U	0.252 U	0.252 U	0.259 U	0.259 U	0.247 U	0.248 U	0.247 U	0.24 U	0.255 U	0.264 U	0.246 U	0.241 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	3.02	1.01	0.259 U	0.259 U	0.247 U	0.248 U	0.633	0.811	0.255 U	0.264 U	0.246 U	0.241 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	1.14 D	60.5 D	2.62	6.2	0.247 U	0.248 U	21.5	52.1 D	0.255 U	0.72	0.246 U	0.241 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.26 U	0.249 U	0.232 U	2.23	75 D	155 D	46.8	0.62	0.78	2.23	44 D	1.27	5.98	0.246 U	0.241 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	15.838	0.565	0.335	20.382	7.694	9.89	16.1	12.8	31.491	17.78	28.16	20403.13 D	2041.17 D	789.716 D	343.97 D

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB049	SB049	SB049	SB049	SB049	SB049	SB050	SB050	SB050	SB050	SB050	SB051	SB051	SB051	SB051
Sample Depth:						0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft
Sampling Date:						9/20/2022	9/20/2022	12/5/2022	12/5/2022	12/5/2022	12/5/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022
Lab Sample ID:						22I1026-06	22I1026-07	22L0228-07	22L0228-08	22L0228-52	22L0228-53	22I1355-01	22I1355-02	22I1355-03	22I1355-04	22I1355-05	22I1355-06	22I1355-07	22I1355-08	22I1355-09
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	64.3 D	41.3 D	7.5	7.49	2.87	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	11.6	2.79	0.237 U	0.24 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	8.71 D	4.04 D	1.08	0.342	0.396	0.423	5.19	1.5	2.46	0.232 U	1.19	11.8	4.62	2.4	6.8
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.244 U	0.245 U	0.247 U	0.254 U	0.249 U	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.244 U	0.245 U	0.247 U	0.254 U	0.249 U	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.244 U	0.245 U	0.247 U	0.51	0.249 U	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	2.02	0.939	0.247 U	0.254 U	0.249 U	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.523	0.245 U	4	4.73	1.79	0.236 U	0.27 U	0.255 U	0.237 U	0.258	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	10.6	6.37	0.247 U	0.254 U	0.249 U	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	1.41	0.314	0.237 U	0.24 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	10.3	1.96	1.46	1.28	0.849	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.244 U	0.245 U	0.625	0.509	0.249 U	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	4.48	0.245 U	0.237 U	0.24 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	4.11	1.81	0.47	0.324	0.415	0.439	0.27 U	0.443	0.469	0.875	0.388	0.608	0.291	0.237 U	0.406
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.968	1.52	0.658	0.496	0.466	1.19	1	0.255 U	0.316	1.12	0.455	2.33	0.737	0.328	1.93
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	3.82	1.84	0.634	0.326	0.339	0.333	0.27 U	0.516	0.432	0.947	0.587	0.563	0.245 U	0.237 U	0.24 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	5.74	3.01	0.247 U	0.254 U	0.249 U	0.236 U	1.08	0.379	0.237 U	0.232 U	0.251	14.7	2.93	0.871	1.58
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.901	5.15	0.969	0.829	1.14	0.343	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	5.11	4.92	6.34	5.67	6.05	4.84	20.1 B	12.8 B	3.06	2.97	8.55	2,850 BD	56 BD	9.53 B	38.3 BD
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	4.59	2.55	0.917	0.553	0.482	0.587	1.07	1.86	2.2	0.232 U	0.963	5.56	1.48	0.685	1.99
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	2.49	0.245 U	0.563	0.283	0.342	0.268	0.27 U	0.672	0.65	1	0.667	0.26 U	0.245 U	0.237 U	0.24 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	3.28	0.949	0.247 U	0.254 U	0.249 U	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	21.6	8.7	2.18	6.08	0.249 U	0.236 U	0.27 U	0.255 U	0.237 U	0.232 U	0.246 U	0.26 U	0.245 U	0.237 U	0.24 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	33.8 D	10.1	5.34	7.22	5.09	0.236 U	0.27 U	0.269	0.237 U	0.232 U	0.246 U	0.561	0.38	0.237 U	0.24 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	9.7	7.47	7.257	6.223	6.532	5.427	21.17	14.66	5.26	2.97	9.513	2855.56	57.48	10.215	40.29

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB051	SB051	SB052	SB052	SB052	SB052	SB053	SB053	SB053	SB053	SB054	SB054	SB055	SB055	SB055
Sample Depth:						10 ft to 12 ft	12 ft to 14 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft
Sampling Date:						9/26/2022	9/26/2022	9/20/2022	9/20/2022	12/5/2022	12/5/2022	9/20/2022	9/20/2022	12/5/2022	12/5/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022
Lab Sample ID:						22I1355-10	22I1355-11	22I1026-08	22I1026-09	22L0228-11	22L0228-12	22I1026-10	22I1026-11	22L0228-13	22L0228-14	22I1277-01	22I1277-02	22I1277-08	22I1277-09	22I1277-11
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.254 U	0.246 U	1.06	0.248 U	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.244	0.486	0.235 U	0.244 U	0.254 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	4.89	3.79	0.306	0.248 U	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.239 U	0.994	0.235 U	0.244 U	0.254 U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.254 U	0.246 U	0.262 U	0.248 U	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.254 U	0.246 U	0.262 U	0.248 U	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.254 U	0.246 U	0.262 U	0.248 U	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.254 U	0.246 U	0.861	0.511	0.254 U	0.25 U	0.665	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.254 U	0.246 U	0.262 U	0.248 U	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.254 U	0.246 U	1.87	0.729	0.254 U	0.25 U	0.572	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.254 U	0.246 U	0.733	0.248 U	0.254 U	0.25 U	0.345	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.254 U	0.246 U	0.262 U	0.248 U	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.254 U	0.246 U	0.989	0.473	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	1.04	0.957	0.262 U	0.248 U	0.254 U	0.25 U	0.283	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	1.28	0.852	0.572
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.254 U	0.246 U	0.711	0.438	0.254 U	0.25 U	0.417	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.819	0.582	1.52	1.19	0.254 U	0.25 U	0.894	0.64	0.281 U	0.249 U	0.239 U	0.277 U	0.95	0.509	0.443
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.254 U	0.246 U	0.262 U	0.248 U	0.292	0.25 U	0.255 U	0.252 U	0.739	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	18.5 B	13.1 B	3.66	4.41	1.07	0.75 J	4.76	4.3	5.07	0.897	0.397	1.12	28.7 D	20	10.6
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.812	1.11	1.29	0.704	0.254 U	0.25 U	0.382	0.309	0.284	0.249 U	0.239 U	0.277 U	0.39	0.246	0.254 U
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.254 U	0.246 U	0.899	0.658	0.254 U	0.25 U	0.588	0.51	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.254 U	0.246 U	0.262 U	0.248 U	0.254 U	0.25 U	0.255 U	0.252 U	0.281 U	0.249 U	0.239 U	0.277 U	0.235 U	0.244 U	0.254 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.358	0.246 U	4.07	0.477	0.254 U	0.25 U	2.78	0.647	0.281 U	0.263	0.597	0.277 U	0.421 B	0.244 U	0.254 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.254 U	0.246 U	15.8	4.05	0.393	0.25 U	3.9	1.47	0.386	0.249 U	0.239 U	0.37	0.24	0.244 U	0.254 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	19.312	14.21	4.95	5.114	1.07	0.75 J	5.142	4.609	5.354	0.897	0.397	1.12	28.7	20.246	10.6

Notes:
NS - No standard
NA - Not Analyzed
D - Dilution
B - Analyte is found in the associated analysis batch blank.
J - Estimated Value
U - The compound was not detected at the indicated concentration.
E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.
J - Data Validation Qualifier - A QC analysis failed outside the primary aceptance limits and the data may be biased high or low or the direction of the bias may be indeterminable.
UJ - Data Validation Qualifier - The data may be biased low.
Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020
Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020
Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values
Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB055	SB055	SB055	SB056	SB056	SB056	SB056	SB056	SB056	SB057	SB057	SB057	SB058	SB058	SB058
Sample Depth:						8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft
Sampling Date:						9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022
Lab Sample ID:						22I1277-12	22I1277-13	22I1277-14	22I1277-15	22I1277-16	22I1277-17	22I1277-18	22I1277-19	22I1277-20	22I1277-21	22I1277-22	22I1277-23	22I1277-27	22I1277-28	22I1277-29
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	9.69	3.95	1.27	0.515	1.56	0.249 U	1.66	0.465	0.251 U	0.239 U	0.241 U	0.252 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.43	0.282	0.236 U	0.242 U	0.233 U	1.39	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	1.84	0.645	0.312	0.242 U	0.319	0.249 U	1.02	0.596	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.425	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.587	1.9	0.815	9.45	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.281	0.252 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	1.37	0.612	0.556	2.08	1.79	1.54	0.992	1.11	2.85	0.682	0.508	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.346	0.474	0.236 U	0.242 U	0.819	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.598	0.266	0.352	1.1	1.12	3.37	7.06	4.35	20.8	0.576	0.539	0.251 U	1.02	5.35	0.252 U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	15.5	23.3	2.96	0.66	2.83	2.81	0.303	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**21.3**	**6.43**	**11.1**	**397** D	**296** D	**683** D	**667** D	**593** BD	**186** BD	**4.64**	**4.59** B	**0.996** B	**4.1** B	**20.6** B	0.845 B
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.322	0.244 U	0.247 U	**1.02**	**1.62**	**1.09**	**1.26**	**1.2**	**8.57**	0.247 U	0.241 U	0.251 U	0.447	**1.49**	0.252 U
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.282	0.252 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.253 U	0.256 U	0.236 U	0.242 U	0.233 U	0.249 U	0.247 U	0.241 U	0.251 U	0.239 U	0.241 U	0.252 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	0.705	0.256 U	0.291 B	0.242 U	0.233 U	0.249 U	0.968	0.434	0.251 U	0.239 U	0.241 U	0.252 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.243 U	0.244 U	0.247 U	1.59	1.05	0.237	0.242 U	0.316	0.479	40.3 D	7.03	0.251 U	0.637	0.347	0.252 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	21.622	6.43	11.1	398.02	297.62	684.09	668.26	594.2	194.57	4.64	4.59	0.996	4.547	22.09	0.845

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB059	SB059	SB059	SB059	SB059	SB059	SB060	SB060	SB060	SB060	SB061	SB061	SB062	SB062	SB063
Sample Depth:						2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	0 in to 6 in	6 in to 2 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft
Sampling Date:						9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/20/2022	9/20/2022	12/5/2022	12/5/2022	9/20/2022	9/20/2022	9/21/2022	9/21/2022	9/23/2022
Lab Sample ID:						22I1277-32	22I1277-33	22I1277-34	22I1277-35	22I1277-36	22I1277-37	22I1026-19	22I1026-20	22I0228-15	22I0228-16	22I1026-12	22I1026-13	22I1087-01	22I1087-02	22I1277-60
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	77.2 D	48.5 D	6.15	7.03 D	2.36	5.82	0.344	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	56.9 D	73.6 D	47.5 D	50.2 D	57 D	12.7 D	0.261 U	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.254 U	0.631	0.252 U	0.249 U	0.251 U	0.236 U	0.261 U	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.254 U	0.243 U	0.252 U	0.249 U	0.251 U	0.236 U	0.261 U	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.254 U	0.243 U	0.252 U	2.49 U	0.251 U	0.236 U	0.261 U	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.676	0.753	0.477	2.49 U	0.251 U	0.236 U	0.661	0.553	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.254 U	0.282	0.252 U	0.249 U	0.251 U	0.236 U	0.261 U	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	8.5	4.13	0.754	2.49 U	0.251 U	0.259	1.38	0.259	0.295 U	0.246 U	0.512	0.246 U	0.277	0.346	0.242 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.663	2.22	0.252 U	0.249 U	0.251 U	0.236 U	0.368	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.261	0.255 U	0.242 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	5.95	4.78	0.935	1.13	0.251 U	0.294	0.261 U	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	4.67	5.34	3.69	1.51	0.976	0.398	0.361	0.409	1.03	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	33.4 D	32.6 D	11.7	6.71	3.09	1.42	0.261 U	0.253 U	0.471	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.474
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	2.69	2.26	1.64	0.982	0.599	0.331	0.409	0.294	0.923	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	42.1	33.9 D	55 D	55.1 D	23.2	5.33	1.57	1.58	0.295 U	0.246 U	0.404	0.346	0.238 U	0.286	0.242 U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	7.71	16.5	0.252 U	2.49 U	0.251 U	0.253	0.261 U	0.253 U	0.72	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**437** BD	**288** BD	**126** BD	**77.2** BD	**57.7** BD	**23.6** BD	**3.38**	**3.89**	**6.43**	0.739 U	**1.3**	**1.13**	**1.1**	**2.17**	**23.6**
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**53.9** D	**40.4** D	**19.8**	**9.97**	**5.28**	**2.11**	**1.1**	**1.03**	**1.39**	0.246 U	0.252 U	0.301	0.238 U	0.255 U	0.304
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	1.69	1.02	1.09	0.532	0.251 U	0.313	0.89	0.698	0.744	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.265	0.965	0.252 U	0.249 U	0.251 U	0.236 U	0.261 U	0.253 U	0.295 U	0.246 U	0.252 U	0.246 U	0.238 U	0.255 U	0.242 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	3.67	18.5	0.252 U	0.249 U	0.251 U	0.236 U	2.3	0.253 U	0.295 U	0.246 U	0.252 U	0.385	0.898	0.812	0.242 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	13.8	39.6 D	0.252 U	0.249 U	0.251 U	0.236 U	4.06	0.805	0.383	0.246 U	1.44	0.251	2.14	1.05	0.242 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	490.9	328.4	145.8	87.17	62.98	25.71	4.48	4.92	7.82	ND	1.552	1.431	1.1	2.17	23.904

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB063	SB063	SB063	SB063	SB063	SB064	SB064	SB064	SB064	SB064	SB064	SB065	SB065	SB065	SB065
Sample Depth:						4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft
Sampling Date:						9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022
Lab Sample ID:						22I1277-61	22I1277-62	22I1277-63	22I1277-64	22I1277-65	22I1277-54	22I1277-55	22I1277-56	22I1277-57	22I1277-58	22I1277-59	22I1277-49	22I1277-50	22I1277-51	22I1277-52
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	5.9	2.69	2.11	3.01	3.33	0.573	16.2 D	5.65	12.7 D	9.11
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	3.7	4.51	8.02	28.5 D	18.1 D	15.5	1.16	0.512	1.24	0.551
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.253 U	0.253 U	0.242 U	0.249 U	0.239 U	0.247 U	0.236 U	0.259 U	0.279 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.253 U	0.253 U	0.242 U	0.249 U	0.239 U	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.317	0.253 U	0.255	0.249 U	0.239 U	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.317	0.253 U	0.253 U	0.242 U	0.904	0.239 U	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.253 U	0.253 U	0.242 U	0.249 U	0.239 U	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.253 U	0.253 U	0.242 U	0.249 U	0.239 U	0.669	0.236 U	0.365	0.408
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.253 U	0.253 U	0.242 U	0.249 U	0.239 U	0.247 U	0.236 U	0.259 U	0.279 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.326	1.01	0.251 U	0.887	0.237 U	2.61	1.87	18.7	67.1 D	33.2 D	37 D	0.247 U	0.236 U	0.259 U	0.279 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.706	0.523	0.253 U	0.297	0.302	1.02	0.247 U	0.236 U	0.289	0.279 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	1.47	4.02	2.26	3.14	0.717	10.3	10.6	3.39	24.3	13.7	38.7 D	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.297	0.242 U	0.251 U	0.255 U	0.237 U	0.94	1.16	0.253 U	0.438	1.75	0.811	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.59	0.317	0.251 U	0.573	0.237 U	5.45	9.98	16.7	11.5	25.5	2.47	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.246 U	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.253 U	0.253 U	0.242 U	0.249 U	0.239 U	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**62.5** D	**19**	**10**	**32.6** D	**0.916**	**1.820** D	**1.190** D	**1.060** D	**409** D	**487** D	**171** D	**10.3** B	**2.67**	**9.4** B	**5.52**
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.541	**0.828**	0.533	**0.895**	0.237 U	**4.2**	**3.06**	**1.86**	**14.5**	**8.45**	**11.5**	0.247 U	0.236 U	0.259 U	0.279 U
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.526	0.903	0.253 U	0.242 U	0.727	0.42	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.253 U	0.253 U	0.242 U	0.249 U	0.239 U	0.247 U	0.236 U	0.259 U	0.279 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.316	0.242 U	0.251 U	0.255 U	0.237 U	0.265 U	0.552	0.253 U	0.242 U	0.482	0.239 U	0.499	0.236 U	0.259 U	0.279 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.245 U	0.242 U	0.251 U	0.255 U	0.237 U	0.383	0.986	0.253 U	0.301	0.249 U	0.239 U	1.24	0.236 U	0.697	1.37
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	63.041	19.828	10.533	33.495	1.153	1824.2	1193.06	1061.86	513.5	495.45	182.5	10.3	2.67	9.4	5.52

Notes:

NS - No standard

NA - Not Analyzed

D - Dilution

B - Analyte is found in the associated analysis batch blank.

J - Estimated Value

U - The compound was not detected at the indicated concentration.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

J - Data Validation Qualifier - A QC analysis failed outside the primary acceptance limits and the data may be biased high or low or the direction of the bias may be indeterminable.

UJ - Data Validation Qualifier - The data may be biased low.

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020

Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB065	SB066	SB066	SB066	SB066	SB066	SB067	SB067	SB067	SB068	SB068	SB069	SB069	SB069	SB070
Sample Depth:						10 ft to 12 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	2 ft to 4 ft
Sampling Date:						9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/23/2022	9/20/2022	9/20/2022	9/23/2022	9/23/2022	9/23/2022	9/26/2022
Lab Sample ID:						22I1277-53	22I1277-44	22I1277-45	22I1277-46	22I1277-47	22I1277-48	22I1277-38	22I1277-39	22I1277-40	22I1026-14	22I1026-15	22I1277-66	22I1277-67	22I1277-68	22I1355-12
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.831	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.397	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.319	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.25 U	0.377	0.614	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.715	0.259 U	0.265	0.345	0.265 U	0.267 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.247	0.798	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.25 U	0.479	0.572	0.377	0.252 U	0.272	0.486	0.621	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	2.6
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.316	0.484	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.373
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.25 U	0.784	1.09	0.312	0.252 U	0.249	0.238 U	0.247 U	0.239 U	0.588	0.39	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	6.64	15.6 B	26.9 B	6.21 B	4.03	2.81	0.285 B	0.473	0.254 U	2.78	0.898	0.81	1.01	0.719	282 BD
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.25 U	0.251 U	0.278	0.236 U	0.252 U	0.245 U	0.238 U	0.281	0.239 U	0.296	0.259 U	0.256 U	0.255 U	0.265 U	0.375
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.329	0.544	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.262 U	0.259 U	0.256 U	0.255 U	0.265 U	0.267 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.25 U	0.251 U	0.26 U	0.389	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	0.654	0.264	0.675	0.255 U	0.265 U	0.267 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.25 U	0.362	0.585	0.236 U	0.252 U	0.245 U	0.238 U	0.247 U	0.239 U	1.49	0.305	2.69	4.15	0.265 U	0.267 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	6.64	15.6	27.178	6.21	4.03	2.81	0.523	0.754	0	3.076	1.157	1.066	1.01	0.719	282.375

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB070	SB070	SB070	SB070	SB071	SB071	SB071	SB071	SB071	SB072	SB072	SB072	SB073	SB073	SB073
Sample Depth:						4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft
Sampling Date:						9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022
Lab Sample ID:						22I1355-13	22I1355-14	22I1355-15	22I1355-16	22I1355-17	22I1355-18	22I1355-19	22I1355-20	22I1355-21	22I1355-22	22I1355-23	22I1355-24	22I1355-27	22I1355-28	22I1355-29
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	1.22	0.261 U	0.246 U	0.253 U	0.246 U	0.491	0.595	1.12	0.242 U	0.252 U	0.236 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	6.77 D	11.2	5.24	6.71	12.8	0.278	0.245 U	0.247 U	0.242 U	0.252 U	0.243
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.241 U	0.245 U	0.247 U	0.242 U	0.252 U	0.236 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.241 U	0.245 U	0.247 U	0.242 U	0.252 U	0.236 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.716	0.732	0.247 U	0.242 U	0.252 U	0.236 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.972	0.261 U	0.246 U	0.253 U	0.246 U	0.241 U	0.259	0.247 U	0.242 U	0.252 U	0.236 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.241 U	0.245 U	0.247 U	0.242 U	0.252 U	0.236 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.241 U	0.245 U	0.247 U	0.67	0.252 U	0.236 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.241 U	0.245 U	0.247 U	0.242 U	0.252 U	0.236 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	1.51	3.06	1.42	0.939	6.79	3.49	2.48	0.247 U	0.242 U	0.252 U	0.262
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	1.83	0.935	1.08	0.603	1.37	11.4	8.22	0.289	0.242 U	0.252 U	0.278
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	2.07	1.81	0.646	1.09	19.6	18.2	24.9	9.95	32.4 D	82.3 D	136 D	1.32	0.242 U	0.389	2.79
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	1.2	0.734	0.574	1.05	0.351	3.85	4.29	0.277	0.242 U	0.252 U	0.236 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	4.42	12.7	0.246 U	0.253 U	0.617	7.6	3.25	0.247 U	3.47	22.7	12.1
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.241 U	0.245 U	0.247 U	0.242 U	0.252 U	0.236 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	198 BD	71.9 BD	11.3	37.8 D	245 BD	372 BD	0.745	0.373	2.79	22.6 D	41.9 D	0.247 U	54.4 D	95.7 D	6.13
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.241 U	0.251 U	0.25 U	0.234 U	4.58	3.79	10.1	4.53	7.14	7.2	7.76	0.247 U	0.242 U	0.252 U	0.99
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.91	0.965	0.247 U	0.242 U	0.252 U	0.236 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.241 U	0.245 U	0.247 U	0.242 U	0.252 U	0.236 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.259 U	0.261 U	0.246 U	0.253 U	0.246 U	0.38	0.245 U	0.247 U	0.756	0.28	0.379
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.241 U	0.251 U	0.25 U	0.234 U	0.64	0.302	0.246 U	0.253 U	0.246 U	1.97	1.66	0.247 U	2.59	1.2	0.236 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	198	71.9	11.3	37.8	249.58	375.79	10.845	4.53	7.14	29.8	49.66	0	54.4	95.7	7.12

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB073	SB073	SB074	SB074	SB074	SB075	SB075	SB075	SB076	SB077	SB077	SB078	SB078	SB078	SB079
Sample Depth:						8 ft to 10 ft	10 ft to 12 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	0 in to 6 in	6 in to 2 ft	0 in to 6 in	6 in to 2 ft	0 in to 6 in	6 in to 2 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	2 ft to 4 ft
Sampling Date:						9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022	9/20/2022	9/20/2022	9/20/2022	9/20/2022	9/20/2022	9/20/2022	9/26/2022	9/26/2022	9/26/2022	9/26/2022
Lab Sample ID:						22I1355-30	22I1355-31	22I1355-32	22I1355-33	22I1355-34	22I1026-17	22I1026-18	22I1026-25	22I1026-26	22I1026-27	22I1026-28	22I1355-37	22I1355-38	22I1355-39	22I1355-42
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	1.3	0.234 U	0.285	0.257 U	0.631	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.252	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.24 U	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.24 U	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.24 U	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.364	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.422	0.234 U	0.24 U	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.983	0.373	0.62	0.27	0.809	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.335	0.234 U	0.425	0.257 U	0.58	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.24 U	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.264	0.283	0.255 U	0.328	0.234 U	0.244 U	0.234 U	0.24 U	0.257 U	0.28	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	2.49	2.06	0.255 U	0.382	0.234 U	0.244 U	0.234 U	0.588	0.355	0.891	0.244 U	0.242	0.422	0.252 U	1.98
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.29	0.234 U	0.244 U	0.234 U	0.42	0.257 U	0.532	0.244 U	0.273	0.328	0.252 U	0.457
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	5.07	2.72	0.689	0.285 U	0.234 U	0.444	0.745	0.477	0.264	0.472	0.244 U	0.554	0.388	0.252 U	0.518
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.24 U	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	0.77	2.59	5.19	3.16	0.234 U	1.2	1.23	6.18	1.07	7.52	2.24	10.6	6.05	0.252 U	130 D
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	1.21	0.491	0.399	0.987	0.234 U	0.301	0.234 U	0.321	0.257 U	0.657	0.244 U	0.241 U	0.275	0.252 U	0.345
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.492	0.257 U	0.258 U	0.244 U	0.258	0.282	0.252 U	0.253 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.244 U	0.234 U	0.24 U	0.257 U	0.258 U	0.244 U	0.241 U	0.258 U	0.252 U	0.253 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	0.972	0.234 U	2.1	0.818	1.32	0.563	0.606	0.303	0.252 U	0.253 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.235 U	0.239 U	0.255 U	0.285 U	0.234 U	2.19	0.421	3.96	1.34	3.78	1.33	0.514	0.369	0.252 U	0.253 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	1.98	3.081	5.589	4.147	0	1.501	1.23	6.501	1.07	8.177	2.24	10.6	6.325	0	130.345

Notes:

NS - No standard

NA - Not Analyzed

D - Dilution

B - Analyte is found in the associated analysis batch blank.

J - Estimated Value

U - The compound was not detected at the indicated concentration.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

J - Data Validation Qualifier - A QC analysis failed outside the primary aceptance limits and the data may be biased high or low or the direction of the bias may be indeterminable.

UJ - Data Validation Qualifier - The data may be biased low.

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020

Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB079		SB079		SB079		SB079		SB080		SB080		SB080		SB081		SB081		SB081		SB081		SB081		SB082		SB082	
Sampling Depth:						4 ft to 6 ft		6 ft to 8 ft		8 ft to 10 ft		10 ft to 12 ft		2 ft to 4 ft		4 ft to 6 ft		6 ft to 8 ft		0 in to 6 in		6 in to 2 ft		2 ft to 4 ft		4 ft to 6 ft		6 ft to 8 ft		8 ft to 10 ft		0 in to 6 in		6 in to 2 ft	
Sampling Date:						9/26/2022		9/26/2022		9/26/2022		9/26/2022		9/26/2022		9/26/2022		9/26/2022		9/20/2022		9/20/2022		12/6/2022		12/6/2022		12/6/2022		12/6/2022		9/20/2022		9/20/2022	
Lab Sample ID:						22I1355-43		22I1355-44		22I1355-45		22I1355-46		22I1355-47		22I1355-48		22I1355-49		22I1026-21		22I1026-22		22L0320-30		22L0320-31		22L0320-61		22L0320-62		22I1026-23		22I1026-24	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.426		0.234	U	0.254	U	0.258	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.334		0.28		0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.606		0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.284		0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.313		2.41		1.18		1.23		0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.458	
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.422		0.35		0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.251	U	0.25		0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.557		0.579		0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.776		0.249	U	0.234	U	0.254	U	0.258	U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**21.1**		**75.4**	D	**12.8**		**39.7**	D	**1.66**		**0.918**		0.241	U	**4.92**		**4.12**		**1.63**		**7.04**		0.459		0.234	U	**2.86**		**5.58**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.251	U	0.438		0.245	U	0.268		0.24	U	0.241	U	0.241	U	0.287		0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.373	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.303		0.418		0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.254	U	0.258	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.24	U	0.241	U	0.241	U	0.247	U	0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.878		0.258	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.251	U	0.241	U	0.245	U	0.236	U	0.246		0.241	U	0.241	U	0.844		0.247	U	0.256	U	0.258	U	0.249	U	0.234	U	0.293		0.258	U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	21.1		75.838		12.8		39.968		1.66		0.918		0		5.207		4.12		1.63		7.04		0.459		ND		2.86		5.953	
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB082**		**SB082**		**SB083**		**SB083**		**SB084**		**SB084**		**SB085**		**SB085**		**SB086**		**SB086**		**SB087**		**SB087**		**SB088**		**SB088**	
Sampling Depth:						2 ft to 4 ft		4 ft to 6 ft		0 in to 6 in		6 in to 2 ft		0 in to 6 in		6 in to 2 ft		0 in to 6 in		6 in to 2 ft		0 in to 6 in		6 in to 2 ft		0 in to 6 in		6 in to 2 ft		0 in to 6 in		6 in to 2 ft	
Sampling Date:						12/6/2022		12/6/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022	
Lab Sample ID:						22L0320-32		22L0320-33		22I1087-03		22I1087-04		22I1087-06		22I1087-07		22I1087-08		22I1087-9		22I1087-10		22I1087-11		22I1087-16		22I1087-17		22I1087-12		22I1087-13		22L0320-36	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	4.41		1.01		0.29	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.52		0.25	U	0.243	U	0.251	U	4.39	D	0.981		0.895	
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	0.245	U	0.253	U	0.29	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	0.245	U	0.253	U	0.29	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	0.245	U	0.253	U	0.29	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.311		0.259	U	0.253	U	1.06		0.448		0.243	U	0.251	U	1.3		0.677		0.29	U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	0.245	U	0.253	U	0.29	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.28	U	0.251	U	0.362		0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	1.71		0.366		0.29	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.383		0.281		0.243	U	0.251	U	0.626		0.253	U	0.29	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	0.245	U	0.253	U	0.29	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.276		0.25	U	0.243	U	0.251	U	3.54		1.64		0.839	
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	1.03		0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.279		0.25	U	0.243	U	0.251	U	0.609		0.314		0.29	U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.432		0.25	U	0.243	U	0.251	U	6.01		3.38		1.64	
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.28	U	0.251	U	0.4		0.29		0.252	U	0.255	U	0.407		0.253	U	0.595		0.25	U	0.243	U	0.464		3.09		1.12		0.448	
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.518		0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	0.245	U	0.253	U	2	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**5.88**		0.348		**1.43**		**1.66**		**1.44**		**2.57**		**2.63**		0.348		**1.16**		0.642		0.243	U	0.532		**10.6**		**2.3**		**3.45**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**1.59**		0.251	U	0.248	U	0.25		0.273		0.446		0.394		0.253	U	0.297		0.25	U	0.243	U	0.251	U	**3.36**		**1.3**		**2.14**	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.28	U	0.251	U	0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.336		5.71		2.85		2	
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.28	U	0.324		0.248	U	0.247	U	0.252	U	0.255	U	0.259	U	0.253	U	0.259	U	0.25	U	0.243	U	0.251	U	0.245	U	0.253	U	0.29	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.28	U	0.251	U	0.964		0.247	U	0.252	U	0.255	U	0.284		0.253	U	2.7		2.19		1.16		0.72		6.64		0.253	U	0.29	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.28	U	0.251	U	0.947		0.247	U	0.529		0.255	U	0.259	U	0.253	U	2.35		1.65		1.76		0.759		2.73		0.439		0.29	U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	0.459		0.348		1.43		1.91		1.713		3.016		3.024		0.348		1.457		0.642		0.243		0.336		13.96		4.15		5.59	
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB088**		**SB088**		**SB088**		**SB089**		**SB089**		**SB090**		**SB090**		**SB090**		**SB090**		**SB091**		**SB091**		**SB092**		**SB092**		**SB093**		**SB093**	
Sampling Depth:						4 ft to 6 ft		6 ft to 8 ft		8 ft to 10 ft		0 in to 6 in		6 in to 2 ft		0 in to 6 in		6 in to 2 ft		2 ft to 4 ft		4 ft to 6 ft		0 in to 6 in		6 in to 2 ft		0 in to 6 in		6 in to 2 ft		0 in to 6 in		6 in to 2 ft	
Sampling Date:						12/6/2022		12/6/2022		12/6/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022		12/6/2022		12/6/2022		9/26/2022		9/26/2022		9/21/2022		9/21/2022		9/21/2022		9/21/2022	
Lab Sample ID:						22L0320-37		22L0320-65		22L0320-66		22I1087-14		22I1087-15		22I1087-18		22I1087-19		22L0320-34		22L0320-35		22I1355-52		22I1355-53		22I1087-20		22I1087-21		22I1087-22		22I1087-23	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	7.01		5.36		2.28		1.44		3.8		1.69		2.98		2.74		0.25	U	0.256	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.813		0.249	U	0.238	U	0.248	U	0.249	U	1.39		1.11		0.288		0.36		0.929		0.394		0.393		0.452		0.25	U	0.256	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	0.252	U	0.257	U	0.244	U	0.246	U	0.349		0.251	U	0.25	U	0.257	U	0.25	U	0.256	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	0.252	U	0.257	U	0.244	U	0.246	U	0.257	U	0.251	U	0.25	U	0.257	U	0.25	U	0.256	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	0.252	U	0.257	U	0.244	U	0.246	U	0.257	U	0.251	U	0.25	U	0.257	U	0.25	U	0.256	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.678		0.249	U	0.31		0.3		0.244	U	0.246	U	0.359		0.251	U	0.25	U	0.257	U	0.25	U	0.783	
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	0.252	U	0.257	U	0.536		0.371		0.257	U	0.251	U	0.25	U	0.257	U	0.25	U	0.256	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	1.79		2.43		0.244	U	0.246	U	1.21		0.66		0.748		1.65		1.06		0.256	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	1.71		1.49		0.467		0.315		3.23		1.09		1.75		0.778		0.365		0.256	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	0.252	U	0.257	U	0.244	U	0.246	U	0.257	U	0.251	U	0.25	U	0.257	U	0.25	U	0.256	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	1.28		0.249	U	0.37		0.248	U	0.249	U	0.714		0.625		0.244	U	0.246	U	0.307		0.251	U	0.25	U	0.257	U	0.25	U	0.355	
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.527		0.249	U	0.816		0.955		0.274		0.411		1.21		0.535		0.471		0.771		0.25	U	0.26	
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	2.37		0.588		0.238	U	0.248	U	0.249	U	0.52		0.677		0.244	U	0.246	U	0.61		0.251	U	0.25	U	0.257	U	0.25	U	0.726	
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.312		0.249	U	0.238	U	0.248	U	0.249	U	0.807		1		0.244	U	0.246	U	0.398		0.251	U	0.25	U	0.26		0.312		0.44	
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.455		0.249	U	0.238	U	0.248	U	0.249	U	0.325		0.257	U	0.307		0.251		6.38		2.91		0.25	U	0.542		0.25	U	0.256	U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**1.39**		0.249	U	0.238	U	**1.64**		**1.14**		**2.19**		**6.01**		0.683		**1.01**		**4.4**		**1.23**		0.309		**0.902**		**0.899**		**1.96**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**1.22**		0.249	U	0.406		0.248	U	0.249	U	**1.05**		**1.05**		0.244	U	0.261		**0.952**		0.326		0.394		0.507		0.293		0.644	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	1.98		0.997		0.238	U	0.248	U	0.249	U	0.252	U	0.257	U	0.244	U	0.246	U	0.336		0.251	U	0.25	U	0.257	U	0.25	U	0.256	U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	0.248	U	0.249	U	0.684		0.63		0.244	U	0.246	U	2.04		0.796		0.744		0.392		0.25	U	0.256	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	1.01		0.267		2.76		5.52		3.06		2.97		18.7		9.43		12.2		7.53		1.6		0.256	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.262	U	0.249	U	0.238	U	1.66		1.2		3.5		5.36		0.506		0.511		3.34		1.43		1.89		2.09		1.59		0.263	
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	2.61		ND		0.406		1.64		1.389		3.24		7.06		0.683		1.271		5.352		1.556		0.703		1.409		1.192		2.604	

Notes:

NS - No standard

NA - Not Analyzed

D - Dilution

B - Analyte is found in the associated analysis batch blank.

J - Estimated Value

U - The compound was not detected at the indicated concentration.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

J - Data Validation Qualifier - A QC analysis failed outside the primary aceptance limits and the data may be biased high or low or the direction of the bias may be indeterminable.

UJ - Data Validation Qualifier - The data may be biased low.

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020

Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB094		SB094		SB094		SB095		SB095		SB095		SB096		SB096		SB096		SB097		SB097		SB097		SB098		SB098		SB098	
Sample Depth:						2 ft to 4 ft		4 ft to 6 ft		6 ft to 8 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft	
Sampling Date:						9/26/2022		9/26/2022		9/26/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022		11/23/2022	
Lab Sample ID:						22I1355-54		22I1355-55		22I1355-56		22K1310-01		22K1310-02		22K1314-01		22K1310-03		22K1310-04		22K1314-02		22K1310-05		22K1310-06		22K1314-03		22K1310-07		22K1310-08		22K1314-04	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	4.18		6.89	D	6.07		1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	2.5		3.73		3.19		1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.232	U	0.27	U	0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.232	U	0.27	U	0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.232	U	0.27	U	0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.305		0.865		0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.232	U	0.27	U	0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.234		0.627		0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.854		1.59		0.297		1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.232	U	0.27	U	0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.232	U	0.617		0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.326		0.953		0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.455		1.17		0.475		1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.232	U	0.344		0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.591		1.17		0.525		1.29	U	1.23	U	0.414		1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	0.232	U	**1.46**		0.281	U	**1.29**	U	**1.23**	U	0.483		**2.69**	D	**1.75**	D	0.93		**2.15**	D	**1.52**	D	0.63		**1.32**	U	**1.26**	U	0.85	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.337		**0.775**		0.311		**1.29**	U	**1.23**	U	0.252	U	**1.32**	U	**1.27**	U	0.311		**1.32**	U	**1.25**	U	0.26	U	**1.32**	U	**1.26**	U	0.26	U
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.281		1.25		0.408		1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	1.96		2.89		0.281	U	1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	24.6		36.6	D	2.52		1.29	U	1.23	U	0.252	U	1.32	U	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.232	U	0.768		0.281	U	1.29	U	1.23	U	0.252	U	1.42	D	1.27	U	0.262	U	1.32	U	1.25	U	0.26	U	1.32	U	1.26	U	0.26	U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	0.337		2.235		0.311		ND		ND		0.483		2.69	D	1.75	D	1.241		2.15	D	1.52	D	0.63		ND		ND		0.85	
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB099**		**SB099**		**SB099**		**SB100**		**SB100**		**SB101**		**SB101**		**SB102**		**SB102**		**SB103**		**SB103**		**SB104**		**SB104**		**SB105**	
Sample Depth:						**0 to 6 in**		**6 in to 2 ft**		**2 ft to 4 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**	
Sampling Date:						**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**		**11/23/2022**	
Lab Sample ID:						**22K1310-09**		**22K1310-010**		**22K1314-05**		**22K1310-11**		**22K1310-012**		**22K1310-13**		**22K1314-014**		**22K1310-15**		**22K1310-016**		**22K1310-17**		**22K1310-018**		**22K1310-19**		**22K1310-020**		**22K1314-010**		**22K1310-21**	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.382		0.265	U	0.348		0.247	U	0.269	U	0.264	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	U	0.262	U	0.247	U	0.269	U	0.264	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	*UJ*	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	U	0.262	U	0.247	*UJ*	0.269	U	0.264	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	*UJ*	0.262	U	0.247	U	0.269	U	0.264	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	U	0.262	U	0.247	U	0.269	U	0.264	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	U	0.262	U	0.247	U	0.269	U	0.264	U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	U	0.262	U	0.247	*UJ*	0.269	U	0.264	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	U	0.262	U	0.247	U	0.269	U	0.264	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	1.34		0.254	U	0.783		0.234	U	0.516		0.242	U	1.31		0.265	U	1.63		0.247	U	0.269	U	0.88	
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.338		0.242	U	0.279		0.265	U	0.279		0.247	U	0.269	U	0.291	
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.312		0.265	U	0.396		0.378		0.269	U	0.329	
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	U	0.262	U	0.247	U	0.269	U	0.264	U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	1.32	U	1.27	U	0.281		0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.271		0.265	U	0.491		0.608		0.367		0.485	
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.373		0.265	*J*	0.262	U	0.629		0.275		0.264	U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.422	*UJ*	0.667		0.41		0.354		0.272	U	0.242	U	1.31		0.588	*UJ*	1.24		1.24	*UJ*	1.16		0.902	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**2.98**	D	**1.27**	U	**1.15**		**2.32**		**2.98**		**1.44**		**2.78**		**1.07**		0.482		**3.48**		**3.67**		**4.91**		**7.54**		**6.38**		**5.38**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**1.32**	U	**1.27**	U	0.36		0.335	*J*	0.254	U	0.279		0.234	U	0.272	U	0.242	U	**0.699**		0.428		**0.994**		0.572		0.443		0.565	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	1.32	U	1.27	U	0.312		0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.688		0.394		0.834		0.95		0.419		1.39	
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.247	U	0.234	U	0.272	U	0.242	U	0.269	U	0.265	*UJ*	0.262	U	0.247	*UJ*	0.269	U	0.264	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	0.261	U	0.254	U	0.287		0.234	U	2.69		0.242	U	0.269	U	0.265	U	0.262	U	0.247	*UJ*	0.269	U	0.264	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	1.32	U	1.27	U	0.266	U	1.38		0.254	U	1.11		0.234	U	1.17		1.39		1.79		0.265	U	2.02		0.247	U	0.269	U	2.16	
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	2.98	D	ND		1.51		2.655		2.98		1.719		2.78		1.07		0.482		4.179		4.098		5.904		8.112		6.823		5.945	
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB105**		**SB106**		**SB106**		**SB107**		**SB107**		**SB107**		**SB108**		**SB108**		**SB109**		**SB109**		**SB110**		**SB110**		**SB111**		**SB111**		**SB111**	
Sample Depth:						**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**2 ft to 4 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**0 to 6 in**		**6 in to 2 ft**		**2 ft to 4 ft**	
Sampling Date:						**11/23/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**		**12/8/2022**	
Lab Sample ID:						**22K1310-022**		**22L0493-03**		**22L0493-04**		**22L0493-05**		**22L0493-06**		**22L0493-35**		**22L0493-07**		**22L0493-08**		**22L0493-09**		**22L0493-10**		**22L0493-09**		**22L0493-10**		**22L0493-13**		**22L0493-14**		**22L0493-39**	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.358		0.275	U	0.445		0.262	U	0.398		0.255	U	1.28		0.252	*UJ*	0.255	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	0.307		0.262	U	0.268	U	0.255	U	0.272	U	0.252	U	0.255	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	0.284	U	0.262	U	0.268	U	0.255	U	0.272	U	0.252	U	0.255	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	0.284	U	0.262	U	0.268	U	0.255	U	0.272	U	0.252	U	0.255	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	1.39		0.262	U	0.268	U	0.255	U	0.272	U	0.252	U	0.255	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	0.564		0.262	U	0.268	U	0.255	U	0.272	U	0.252	U	0.255	U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.287		10.1		1.23		0.261	U	0.275	U	9.93		0.564		0.268	U	0.255	U	0.272	U	0.252	*UJ*	0.255	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	0.284	U	0.262	U	0.268	U	0.255	U	0.272	U	0.252	U	0.255	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	0.713		0.262	U	0.942		0.255	U	2.83		0.252	U	0.255	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.787		0.262	*UJ*	0.263	U	0.503		0.275	U	2.32		0.262	*UJ*	0.268	U	0.255	U	0.378		0.252	U	0.255	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.544		0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	0.284	U	0.262	U	0.558		0.366		0.975		0.252	U	0.255	U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.269	U	0.331		0.273	U	0.268	U	0.505	*J*	0.263	U	0.261	U	0.275	U	3.59		0.293	*J*	0.268	U	0.255	U	0.272		0.252	U	0.255	U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.456		0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.362		0.275	U	0.885		0.262	U	0.623		0.438		1.1		0.252	U	0.255	U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.27		0.293	U	0.273	U	0.268	U	0.262	U	0.266		0.319		0.275	U	0.284	U	0.262	U	0.564		0.255	U	1.08		0.252	U	0.255	U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.34		0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.343		0.275	U	0.291		0.262	U	0.984		0.485		1.96		0.857		1.28	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**2.24**		**6.91**		**2.74**		**0.925**		**9.53**		**7.28**		**1.99**		0.815		**14.20**		0.687	*J*	**2.10**		**2.79**		**7.97**		**11.4**	*J*	**20.2**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.657		0.293	U	0.366		0.268	U	0.536		0.475		0.4		0.275	U	**1.03**		**0.687**	U	**0.858**		0.513		**1.15**		0.411		0.581	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.68		0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.384		0.275	U	0.284	U	0.262	U	0.268	U	0.536		1.21		0.37		0.255	U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	0.268	U	0.262	U	0.263	U	0.261	U	0.275	U	0.292		0.262	U	0.268	U	0.255	U	0.272	U	0.252	*UJ*	0.255	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.269	U	0.293	U	0.273	U	6.13		1.81		1.01		2.8		1.7		8.06		1.42		0.268	U	0.255	U	0.675		0.252	U	0.255	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.269	U	1.11		0.489		2.63		4.48	*J*	1.45		2.18		0.375		8.27		0.294		1.5		0.255	U	2.69		0.252	U	0.255	U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	2.897		6.91		3.106		0.925		10.066		7.755		2.39		0.815		15.23		0.687		2.958		3.303		9.12		11.811		20.781	

Notes:

NS - No standard

NA - Not Analyzed

D - Dilution

B - Analyte is found in the associated analysis batch blank.

J - Estimated Value

U - The compound was not detected at the indicated concentration.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

J - Data Validation Qualifier - A QC analysis failed outside the primary aceptance limits and the data may be biased high or low or the direction of the bias may be indeterminable.

UJ - Data Validation Qualifier - The data may be biased low.

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020

Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB112		SB112		SB112		SB113		SB113		SB113		SB114		SB114		SB114		SB115		SB115		SB116		SB116		SB116		SB117	
Sample Depth:						0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in	
Sampling Date:						12/8/2022		12/8/2022		12/8/2022		12/8/2022		12/8/2022		12/8/2022		12/8/2022		12/8/2022		12/8/2022		12/8/2022		12/8/2022		12/5/2022		12/5/2022		12/5/2022		12/9/2022	
Lab Sample ID:						22L0493-17		22L0493-18		22L0493-40		22L0493-19		22L0493-20		22L0493-41		22L0493-01		22L0493-02		22L0493-33		22L0493-21		22L0493-22		22L0228-01		22L0228-02		22L0228-47		22L0602-01	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	1.25		0.267	U	0.258	U	2.11		0.276	U	0.418		0.306	U	0.37		0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.28	U	1.34	U	0.258	U	0.302	U	0.276	U	0.352		0.306	U	0.764		0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.28	U	0.267	U	0.258	U	0.302	U	0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.28	U	0.267	U	0.258	U	0.302	U	0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.28	U	0.267	U	0.258	U	0.502		0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.28	U	0.267	U	0.258	U	0.302	U	0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.28	U	0.267	U	0.258	U	0.302	U	0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.28	U	0.267	U	0.258	U	0.302	U	0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	2.16		0.731		0.258	U	1.39		0.482		0.258	U	0.306	U	0.411		0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.742		0.267	U	0.258	U	0.885		0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	1.38		1.07		0.258	U	1.96		0.921		0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.366		0.267	U	0.258	U	0.595		0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	1.64		1.37		0.369		2.39		0.907		0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	1.17		1.18		0.282		1.36		0.586		0.258	U	0.306	U	0.271	U	0.334		0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	3.48		1.36		0.362		1.53		1.16		0.343		0.306	U	0.407		1.82		0.287	U	0.363		0.25	U	0.431		0.237	U	0.264	U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**6.24**		**3.87**		**0.88**		**6.42**		**4.59**		**2.24**		**3.86**		**15.3**		**29.5**	D	**2.33**		**1.8**		0.75	U	**4.01**		0.237	U	**1.81**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**2.49**		**1.15**		0.431		**2.24**		0.633		0.258	U	0.306	U	0.271	U	0.358		0.287	U	0.302		0.25	U	0.578		0.237	U	0.264	U
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	2.23		1.9		0.372		3.01		1.39		0.332		0.306	U	0.271	U	0.275	U	1.86		0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.28	U	0.267	U	0.258	U	0.302	U	0.276	U	0.258	U	0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	0.258	U	0.237	U	0.264	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	2.29		0.337		0.258	U	2.58		0.485		0.355		0.306	U	0.271	U	0.275	U	0.287	U	0.278	U	0.25	U	1.2		0.237	U	0.264	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	11.7		3.85		0.395		11.1		4.34		0.688		2.6		1.6		0.275	U	0.782		0.278	U	0.25	U	1.06		0.237	U	0.971	
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	8.73		5.02		1.311		8.66		5.223		2.24		3.86		15.3		29.86	D	2.33		2.102		ND		4.59		ND		1.81	
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB117**		**SB118**		**SB118**		**SB119**		**SB119**		**SB119**		**SB120**		**SB120**		**SB121**		**SB121**		**SB122**		**SB122**		**SB123**		**SB123**		**SB124**	
Sample Depth:						6 in to 2 ft		0 to 6 in		6 in to 2 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		0 to 6 in		6 in to 2 ft		0 to 6 in	
Sampling Date:						12/9/2022		12/9/2022		12/9/2022		12/9/2022		12/9/2022		12/5/2022		12/9/2022		12/9/2022		12/9/2022		12/8/2022		12/8/2022		12/9/2022		12/9/2022		12/9/2022	
Lab Sample ID:						22L0602-02		22L0602-03		22L0602-04		22L0602-05		22L0602-06		22L0602-29		22L0602-15		22L0602-16		22L0493-29		22L0493-30		22L0493-27		22L0493-28		22L0602-07		22L0602-08		22L0602-11	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.341		0.271	***UJ***	0.24	U	0.441		0.465	***UJ***	0.612		0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	***UJ***	0.24	U	0.269	U	0.262	U	0.266	U	0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.262	U	0.41		0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.262	U	0.269		0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.262	U	0.266	U	0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.262	U	0.266	U	0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.262	U	0.266	U	0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	*J*	0.24	U	0.269	U	0.262	U	0.266	U	0.255	U	0.314		0.251	U	0.274	U	0.254	U	0.279	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.287		0.24	U	0.362		0.627		0.586		0.255	U	0.312		0.251	U	0.274	U	0.254	U	0.326	
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.599		0.585		0.255	U	0.431		0.251	U	0.274	U	0.254	U	0.279	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.262	U	0.266	U	0.255	U	0.303		0.251	U	0.274	U	0.254	U	0.322	
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.758		0.271	U	0.24	U	0.54		0.36		0.266	U	0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.244	U	0.347		0.287		0.25	U	0.271	U	0.24	U	0.269	U	0.266		0.266	U	0.255	U	0.361		0.251	U	0.274	U	0.254	U	0.286	
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.27		0.78		0.255	U	1.89		0.269		0.274	U	0.254	U	0.373	
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.244	U	0.301		0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.375		0.266	U	0.255	U	0.525		0.528		0.274	U	0.254	U	0.376	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	0.535		**3.82**		**1.12**		**4.85**		**4.67**		**2.65**		**5.32**		**3.75**		**1.46**		0.272		**4.00**		**2.62**		**1.27**		**2.72**		**1.69**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.244	U	0.452		0.474		0.25	U	0.271	U	0.24	U	0.269	U	0.291		0.266	U	0.255	U	0.27	U	0.251	U	0.431		0.367		**0.819**	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.244	U	1.71		0.274	U	0.474		0.271	U	0.24	U	0.269	U	0.346		0.266	U	0.255	U	0.272		0.251	U	1.53		0.403		1.19	
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.25	U	0.271	U	0.24	U	0.269	U	0.262	U	0.83		0.255	U	0.27	U	0.251	U	0.274	U	0.254	U	0.279	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.244	U	0.258	U	0.274	U	0.708		0.271	U	0.24	U	0.524		1.2		0.291		0.255	U	0.666		0.251	U	0.274	U	0.254	U	0.429	
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.363		0.328		0.274	U	1.11		1.03	*J*	0.24	U	0.33		2.71	*J*	0.266	U	1.01		1.56		0.251	U	0.576		0.684		0.69	
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	0.535		4.27		1.59		4.85		4.67		4.67		5.32		4.04		1.46		0.272		4		2.62		1.70		3.09		2.51	
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB124**		**SB125**		**SB125**		**SB125**		**SB126**		**SB126**		**SB126**		**SB127**		**SB127**		**SB128**		**SB128**		**SB129**		**SB129**		**SB130**		**SB130**	
Sample Depth:						6 in to 2 ft		0 to 6 in		6 in to 2 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		0 to 6 in		6 in to 2 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft	
Sampling Date:						12/9/2022		12/6/2022		12/6/2022		12/9/2022		12/9/2022		12/5/2022		12/9/2022		12/9/2022		12/9/2022		12/5/2022		12/9/2022		12/9/2022		12/9/2022		12/6/2022		12/8/2022	
Lab Sample ID:						22L0602-12		22L0320-45		22L0320-46		22L0602-13		22L0602-14		22L0602-33		22L0602-17		22L0602-18		22L0602-09		22L0602-10		22L0602-23		22L0602-24		22L0602-38		22L0493-23		22L0493-24	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.283	U	0.319		0.299	U	0.274	U	0.441		0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.892		1.38		0.266	U	0.923		0.246	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.265	U	0.266	U	0.304	*J*	0.246	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.265	U	0.266	U	0.259	U	0.246	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.265	U	0.266	U	0.259	***UJ***	0.246	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.265	U	0.266	U	0.259	U	0.246	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.265	U	1.58		0.259	U	0.246	U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.265	U	0.266	U	0.259	***UJ***	0.246	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.436		0.265	U	0.266	U	0.259	U	0.246	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.412		0.362		0.602		0.384		0.259	U	0.286	U	0.262	U	0.404		0.415		0.266	U	1.28	*J*	0.392	
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.265	U	0.266	U	1.42		0.246	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.421		0.525		0.456		0.447	*J*	0.246	U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.366		0.54		0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.414		0.638		0.871		0.567	
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.466		0.84		0.438		0.366		0.246	U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.283		0.439		0.268		0.259	U	0.59	
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	2.12		3.95		0.903	***UJ***	0.561	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**3.32**		0.54		0.677		**2.16**		**5.32**		**3.24**		0.44		0.325		**1.41**		0.749		**1.42**		**22.7**		**48.7**	D	**11.80**	*J*	**2.66**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.314		0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.641		**4.17**		0.446		0.246	U
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.464		0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	1.41		0.259	U	1.36		0.377		1.56		1.72		0.664		0.259	U	0.282	
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.283	U	0.258	U	0.299	U	0.274	U	0.269	U	0.257	U	0.261	U	0.259	U	0.286	U	0.262	U	0.274	U	0.265	U	0.266	U	0.365	*J*	0.246	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.347		0.258	U	0.299	U	0.274	U	0.524		0.266		0.261	U	0.259	U	0.286	U	0.262	U	0.391		0.265	U	0.266	U	8.2	*J*	0.246	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.511		0.258	U	0.299	U	0.274	U	0.33		0.71		0.821		0.259	U	0.376		0.262	U	0.799		0.525		0.396		12.6	*J*	0.789	
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	3.63		0.54		0.677		2.16		5.32		3.24		0.70		0.58		1.41		0.75		1.42		23.34		52.87		12.25		2.66	

Notes:

NS - No standard

NA - Not Analyzed

D - Dilution

B - Analyte is found in the associated analysis batch blank.

J - Estimated Value

U - The compound was not detected at the indicated concentration.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

J - Data Validation Qualifier - A QC analysis failed outside the primary aceptance limits and the data may be biased high or low or the direction of the bias may be indeterminable.

UJ - Data Validation Qualifier - The data may be biased low.

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020

Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB131		SB131		SB132		SB132		SB132		SB133		SB133		SB133		SB134		SB134		SB134		SB134		SB134		SB134		SB134	
Sample Depth:						0 to 6 in		6 in to 2 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		0 to 6 in		6 in to 2 ft		2 ft to 4 ft		2 ft to 4 ft		4 ft to 6 ft		6 ft to 8 ft		8 ft to 10 ft		10 ft to 12 ft		12 ft to 14 ft		14 ft to 16 ft	
Sampling Date:						12/8/2022		12/8/2022		12/9/2022		12/9/2022		12/9/2022		12/9/2022		12/9/2022		12/9/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022	
Lab Sample ID:						22L0493-25		22L0493-26		22L0602-21		22L0602-22		22L0602-37		22L0602-19		22L0602-20		22L0602-36		22L0228-17		22L0228-18		22L0228-19		22L0228-20		22L0228-21		22L0228-22		22L0228-52	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.266	U	0.263	U	0.249	U	0.317		0.258	U	0.269	U	0.262	U	0.268	U	0.835		1.48		0.253	U	0.248	U	0.231	U	0.708		0.249	
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.266	U	0.263	U	0.249	U	1.07		0.498		0.269	U	0.262	U	0.268	U	5.8		5.47		0.61		1.46		1.05		3.13		0.245	U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.266	U	0.263	U	0.249	U	0.261	U	0.258	U	0.269	U	0.262	U	0.268	U	0.252	U	0.233	U	0.253	U	0.248	U	0.231	U	0.242	U	0.245	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.266	U	0.263	U	0.249	U	0.261	U	0.258	U	0.269	U	0.262	U	0.268	U	0.252	U	0.233	U	0.253	U	0.248	U	0.231	U	0.242	U	0.245	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.266	U	0.263	U	0.249	U	0.261	U	0.258	U	0.269	U	0.262	U	0.268	U	0.252	U	0.233	U	0.253	U	0.248	U	0.231	U	0.242	U	0.245	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.266	U	0.263	U	0.249	U	0.261	U	0.288		0.269	U	0.262	U	0.268	U	71.6	D	77.5	D	10.6		8.53		24.4		16.2		0.345	
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.266	U	0.263	U	0.249	U	0.409		0.258	U	0.269	U	0.262	U	0.268	U	2.15		1.76		0.253	U	0.248	U	0.231	U	2.25		0.245	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	1.1		0.263	U	0.249	U	0.261	U	0.258	U	0.269	U	0.262	U	0.268	U	0.252	U	0.233	U	0.253	U	0.248	U	0.231	U	0.281		0.245	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.847		0.32		1.02		0.644		0.502		1.08		0.262	U	0.268	U	1.35		1.75		0.298		0.248	U	0.231	U	0.432		0.245	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.825		0.263	U	0.334		0.269		0.258	U	0.269	U	0.262	U	0.268	U	0.252	U	0.233	U	0.253	U	0.248	U	0.231	U	0.242	U	0.245	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.454		0.275		0.249	U	0.261	U	0.415		0.468		0.495		0.268	U	0.828		1.13		0.553		2.38		1.48		0.975		0.793	
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.913		0.503		0.249	U	0.421		2.16		0.638		0.262	U	0.268	U	69.2	D	180	D	9.17		75.5	D	45.3	D	44.4	D	13.3	
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.833		0.572		0.268		0.342		0.633		0.428		0.97		0.628		2.13		2.49		0.591		1.21		1.63		1.6		1.12	
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	5.16		0.967		0.542		0.36		0.569		0.604		0.433		0.268	U	0.326		0.31		0.253	U	0.248	U	0.231	U	0.242	U	0.245	U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.872		0.691		0.249	U	0.415		1.14		0.88		0.619		0.911		121	D	73.6	D	55.1	D	5.19		24.3	D	45.2		4.35	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**8.48**		**3.61**		0.29		**8.9**		**22.8**	D	**3.17**		**5.52**		**3.13**		**7360**	D	**10700**	D	**443**	D	**29.6**		**222**	D	**456**	D	**22.2**	
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.299		0.43		0.249	U	0.489		**2.78**		0.537		0.505		0.554		**37.6**	D	**80.9**	D	**17.6**		**19.5**		**17.4**		**23.8**		**3.32**	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.772		0.438		3.19		0.861		0.829		5.5		1.84		0.268	U	0.776		0.821		0.253	U	0.297		0.449		0.48		0.579	
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.266	U	0.263	U	0.249	U	0.261	U	0.258	U	0.269	U	0.262	U	0.268	U	0.252	U	0.233	U	0.253	U	0.248	U	0.231	U	0.242	U	0.245	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	2.85		0.267		1.34		2.57	J	1.16		0.664		0.262	U	0.268	U	0.684		0.744		0.253	U	0.253		0.231	U	0.242	U	0.245	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	5.36		1.36		1.13		2.02	J	2.13		4.44		0.438		0.268	U	3.66		3.79		0.253	U	0.248	U	0.231	U	0.909		0.245	U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	8.78		4.04		0.29		9.39		25.58		3.71		6.03		3.68		7397.60	D	10780.90	D	460.60	D	49.10		239.40	D	479.80	D	25.52	
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB134**		**SB135**		**SB135**		**SB135**		**SB135**		**SB135**		**SB135**		**SB135**		**SB136**		**SB136**		**SB136**		**SB136**		**SB136**		**SB136**		**SB136**	
Sample Depth:						16 ft to 18 ft		2 ft to 4 ft		4 ft to 6 ft		6 ft to 8 ft		8 ft to 10 ft		10 ft to 12 ft		12 ft to 14 ft		14 ft to 16 ft		2 ft to 4 ft		4 ft to 6 ft		6 ft to 8 ft		8 ft to 10 ft		10 ft to 12 ft		12 ft to 14 ft		14 ft to 16 ft	
Sampling Date:						12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022	
Lab Sample ID:						22L0228-53		22L0228-22		22L0228-23		22L0228-24		22L0228-25		22L0228-26		22L0228-63		22L0228-64		22L0228-27		22L0228-28		22L0228-29		22L0228-30		22L0228-31		22L0228-65		22L0228-66	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.238	U	7.93		5.4		6.18		0.48		0.747		0.679		0.248	U	1.67		1.65		0.25	U	0.231	U	0.254	U	2.65		0.244	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.238	U	0.264		0.411		0.763		0.237	U	0.335		0.243	U	0.248	U	0.248	U	9.01		3.59		3.51		5.05		0.685		12.2	
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	0.24	U	0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	0.24	U	0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	0.405		0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	0.24	U	0.243	U	0.248	U	0.248	U	19.3		9.54		7.74		9.39		2.99		16.3	
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.329		0.241	U	0.264	U	0.244	U	0.237	U	0.999		0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	0.24	U	0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.238	U	4.94		7.34		0.476		0.237	U	2.24		0.478		0.36		1.48		0.244	U	0.25	U	0.231	U	0.254	U	0.488		0.244	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	0.583		0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.238	U	0.241	U	0.395		0.244	U	0.237	U	0.29		0.243	U	0.248	U	0.248	U	0.418		0.765		0.231	U	0.794		0.257	U	0.304	
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.565		0.737		1.14		3.05		1.34		3.06		0.502		0.822		1.5		27	D	33	D	8.62		50.8	D	5.23		9.59	
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.238	U	0.317		0.549		0.244	U	0.237	U	0.707		0.243	U	0.248	U	0.248	U	0.308		0.25	U	0.231	U	0.35		0.461		0.244	U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	0.24	U	0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.597		0.922		1.52		2.85		1.89		0.619		0.704		0.555		0.984		7.39		2.62		6.8		3.44		2.23		15.1	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**2.27**		**22.4**		**71.3**	D	**160**	D	**59.8**	D	**59.4**	D	**27.1**		**29.5**		**26.4**		**554**	D	**143**	D	**459**	D	**276**	D	**469**	D	**310**	D
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.238	U	**7.15**		**20.5**	D	**2.0**		0.447		**1.48**		**2.35**		**1.83**		**6.64**		**15**		**8.8**		**4.14**		**10.9**		**1.84**		**9.92**	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.238	U	0.241	U	0.268		0.244	U	0.237	U	0.264		0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	0.24	U	0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.238	U	0.241	U	0.264	U	0.244	U	0.237	U	1.19		0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.238	U	2.92		1.24		0.334		0.237	U	8.71		0.243	U	0.248	U	0.248	U	0.244	U	0.25	U	0.231	U	0.254	U	0.257	U	0.244	U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	2.27		29.55		91.80	D	162.00	D	60.25	D	60.88	D	29.45		31.33		33.04		569.00	D	151.81	D	463.14	D	286.90	D	470.84	D	319.92	D
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB137**		**SB137**		**SB137**		**SB137**		**SB137**		**SB137**		**SB137**		**SB137**		**SB138**		**SB138**		**SB138**		**SB138**		**SB138**		**SB138**		**SB138**	
Sample Depth:						2 ft to 4 ft		4 ft to 6 ft		6 ft to 8 ft		8 ft to 10 ft		10 ft to 12 ft		12 ft to 14 ft		14 ft to 16 ft		16 ft to 18 ft		2 ft to 4 ft		4 ft to 6 ft		6 ft to 8 ft		8 ft to 10 ft		10 ft to 12 ft		12 ft to 14 ft		14 ft to 16 ft	
Sampling Date:						12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022		12/5/2022	
Lab Sample ID:						22L0228-35		22L0228-36		22L0228-37		22L0228-38		22L0228-39		22L0228-67		22L0228-68		22L0228-69		22L0228-40		22L0228-41		22L0228-42		22L0228-43		22L0228-44		22L0228-70		22L0228-71	
PFAS by EPA 537m (µg/kg)																																			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	10.3		0.841		0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	21.1	D	10.9		7.89		16.6		9.95		5.78		0.233	U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	1.33		3.44		12		11.2		3.35		2.52		0.253	U	0.348		2.41		2.58		0.909		0.689		0.985		1.59		11	
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.274	U	0.263	U	0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	0.278	U	0.252	U	0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.274	U	0.263	U	0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	0.278	U	0.252	U	0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.274	U	0.263	U	0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	0.278	U	0.252	U	0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	1.53		0.922		15.8		9.69		1.63		1.48		3.67		20.8		0.278	U	0.252	U	0.251	U	0.245	U	0.252	U	0.255	U	20.2	
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	2.02		0.678		0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	0.337		0.255		0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.274	U	0.275		0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	0.278	U	0.252	U	0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.636		0.263	U	0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	7.2		2.65		2.1		2.96		2.31		1.4		0.233	U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.274	U	0.263	U	0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	0.278	U	0.336		0.251	U	0.245	U	0.252	U	0.592		0.233	U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.635		0.543		0.486		0.989		0.249		0.248		0.554		0.501		0.432		0.289		0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	8		4.87		13.8		27.5	D	9.5		7.52		12.1		16.4		1.23		1.64		1.36		1.19		1.2		1.52		8.68	
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.741		0.867		0.411		0.468		0.363		0.455		0.594		0.444		0.501		0.291		0.302		0.245	U	0.697		0.561		0.427	
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.274	U	0.263	U	0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	0.278	U	0.252	U	0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	1.21		0.897		1.21		2.21		0.239	U	0.25		0.695		10.6		7.82		6.05		9.25		6.33		8.55		6.05		28.5	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**2260**	D	**434**	D	**280**	D	**138**	D	**7.09**		**7.85**		**20.6**		**319**	D	**47.1**		**169**	D	**238**	D	**552**	D	**467**	D	**230**	D	**252**	D
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**3.87**		**1.28**		**10.3**		**14.3**		**4.05**		**2.07**		**6.91**		**12.8**		**0.963**		**0.944**		0.6		0.612		0.773		0.762		**5.15**	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.337		0.379		0.237	U	0.252	U	0.239	U	0.244	U	0.281		0.241	U	0.278	U	0.252	U	0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.274	U	0.263	U	0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	0.278	U	0.252	U	0.251	U	0.245	U	0.252	U	0.255	U	0.233	U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.274	U	0.263	U	0.237	U	0.252	U	0.239	U	0.257		0.253	U	0.241	U	1.23		2.91		0.251	U	0.246		0.252	U	5.33		0.233	U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.68		0.263	U	0.237	U	0.252	U	0.239	U	0.244	U	0.253	U	0.241	U	28.3		23		4.66		19.3		7.18		13.8		0.233	U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	2263.87	D	435.28	D	290.30	D	152.30	D	11.14		9.92		27.51		331.80	D	48.063		169.944	D	238.594	D	552.612	D	467.773	D	230.762	D	257.15	D

Notes:

NS - No standard

NA - Not Analyzed

D - Dilution

B - Analyte is found in the associated analysis batch blank.

J - Estimated Value

U - The compound was not detected at the indicated concentration.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

J - Data Validation Qualifier - A QC analysis failed outside the primary aceptance limits and the data may be biased high or low or the direction of the bias may be indeterminable.

UJ - Data Validation Qualifier - The data may be biased low.

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020

Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	SB139	SB139	SB139	SB139	SB139	SB139	SB139	SB139	SB140	SB140	SB140	SB140	SB140	SB140	SB140
Sample Depth:						2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	14 ft to 16 ft	16 ft to 18 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	14 ft to 16 ft
Sampling Date:						12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/5/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022
Lab Sample ID:						22L0320-01	22L0320-02	22L0320-03	22L0320-04	22L0320-05	22L0320-47	22L0320-48	22L0320-49	22L0320-26	22L0320-27	22L0320-28	22L0320-29	22L0320-59	22L0320-60	22L0320-70
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	12.2	6.01	2.47	1.17	0.767	1.71	1.44	3.51	0.922	1.07	0.244 U	0.341	0.247 U	0.392	0.254 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	4.15	4.04	8.91	7.3	5.52	6.41	5.67	3.67	9.4	20.8	0.283	0.49	6.64	0.869	0.49
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.434	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	2.22	0.924	0.353	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.641	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.685	0.628	0.877	0.907	0.731	0.414	0.38	0.269	0.582	1.05	0.244 U	0.251 U	0.353	0.247 U	0.254 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	0.276	0.27	0.458	0.363	0.315	0.466	0.407	0.237 U	0.331	1.06	0.244 U	0.251 U	0.469	0.247 U	0.254 U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.344	0.347	0.273	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.391	0.444	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.286	0.333	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	1.91	1.4	2.24	0.895	1.12	1.01	0.871	0.968	3.2	7.54	0.288	1.03	1.34	0.389	0.311
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**17.2**	**10.5**	**7.54**	**2.91**	**3.36**	**4.88**	**2.88**	**14.5**	**60.5**	**33.9**	**1.38**	**3.87**	**8.09**	**3.93**	**1.90**
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**1.43**	**1.33**	**2.4**	**1.78**	**1.31**	**1.62**	**1.57**	**1.12**	**1.52**	**2.59**	0.2 U	0.397	**1.19**	0.247 U	0.254 U
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.396	0.297	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.71	0.72	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.236 U	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.299	0.255 U	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.237 U	0.26 U	0.276 U	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	1.11	0.63	0.246 U	0.253 U	0.247 U	0.237 U	0.244 U	0.454	0.26 U	0.315	0.244 U	0.251 U	0.247 U	0.247 U	0.254 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	18.63	11.83	9.9	4.69	4.67	6.5	4.45	15.62	62.02	36.49	1.38	4.267	9.28	3.93	1.90
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB141**	**SB141**	**SB141**	**SB141**	**SB141**	**SB141**	**SB141**	**SB142**	**SB142**	**SB142**	**SB142**	**SB142**	**SB142**	**SB142**	**SB142**
Sample Depth:						2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	14 ft to 16 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	14 ft to 16 ft	16 ft to 18 ft
Sampling Date:						12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/5/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022
Lab Sample ID:						22L0320-21	22L0320-22	22L0320-23	22L0320-24	22L0320-25	22L0320-57	22L0320-58	22L0320-06	22L0320-07	22L0320-08	22L0320-09	22L0320-10	22L0320-50	22L0320-51	22L0320-52
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	63.2 D	21.2 D	2.36	5.34	14.1	6.5	8.63	33.9 D	11.7 D	0.241 U	1.89	0.752	0.565	0.622	10.1
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	70.9 D	41 D	23.2 D	30.7 D	46.3 D	30.3 D	54.8 D	52.4 D	54.1 D	15.2 D	43.5	31.4 D	62.5 D	28 D	76 D
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.263 U	0.3 U	0.289 U	0.235 U	0.25 U	0.25 U	0.248 U	0.252 U	0.248 U	0.241 U	0.245 U	0.236 U	0.25 U	0.244 U	0.259 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.263 U	0.3 U	0.289 U	0.235 U	0.25 U	0.25 U	0.248 U	0.252 U	0.248 U	0.241 U	0.245 U	0.236 U	0.25 U	0.244 U	0.259 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	2.89	0.3 U	0.289 U	0.235 U	0.25 U	0.25 U	0.248 U	0.252 U	0.248 U	0.241 U	0.245 U	0.236 U	0.25 U	0.244 U	0.259 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	62.6	3.26	0.289 U	0.764	1.02	1.3	1.89	22.9	1.99	0.241 U	0.358	0.675	2.06	1.23	3
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	6.72	0.3 U	0.289 U	0.235 U	0.25 U	0.485	0.813	0.252 U	0.248 U	0.241 U	0.245 U	0.236 U	0.25 U	0.244 U	0.74
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.304	0.3 U	0.289 U	0.235 U	0.25 U	0.25 U	0.248 U	0.252 U	0.248 U	0.241 U	0.245 U	0.236 U	0.25 U	0.244 U	0.259 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	10.1	2.97	0.289 U	0.804	1.74	0.565	0.757	2.08	1.33	0.241 U	0.361	0.236 U	0.25 U	0.244 U	0.952
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	3.19	0.3 U	0.289 U	0.235 U	0.25 U	0.25 U	0.248 U	0.252 U	0.28	0.241 U	0.245 U	0.236 U	0.25 U	0.244 U	0.259 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	1.6	2.08	0.928	0.482	0.974	0.422	0.538	1.87	1.05	1.14	0.84	0.708	1.18	0.539	0.724
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	11.5	2.47	1.65	2.56	3.95	1.99	2.13	4.86	2.28	0.452	2.41	1.17	3.01	1.2	2.43
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	3.84	3.44	1.62	0.449	0.498	0.35	0.407	1.42	0.728	0.333	0.245 U	0.399	0.862	0.848	0.648
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	3.19	0.855	0.645	0.235 U	0.25 U	0.25 U	0.248 U	0.587	0.512	0.241 U	0.245 U	0.236 U	0.25 U	0.266	0.301
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	126	63.9 D	14.5	16.9	23.8	9.48	16.1	306 D	47.3 D	5.27	31.6	33.8 D	63	25.2	56.8
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**567** D	**216** D	**39.6** D	**110** D	**95.3** D	**50.9** D	**55.2** D	**249** D	**63** D	**1.96**	**27.4**	**16.8**	**15.4** D	**20.5**	**90.9** D
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**12.3**	**5.11**	**1.8**	**3.74**	**6.48**	**2.03**	**2.94**	**15.1**	**7.23**	**2.6**	**4.64**	**3.18**	**4.92**	**2.58**	**6.83**
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	3.66	1.86	1.89	0.235 U	0.523	0.308	0.393	1.36	0.873	0.337	0.245 U	0.326	0.629	0.745	0.567
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	1.48	0.3 U	0.289 U	0.235 U	0.25 U	0.25 U	0.248 U	0.252 U	0.248 U	0.241 U	0.245 U	0.236 U	0.25 U	0.244 U	0.259 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	25.1	0.578	0.289 U	0.235 U	0.394	0.625	0.823	1.36	1.18	0.241 U	0.422	0.236 U	0.25 U	0.244 U	0.259 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	56.4 D	2.5	0.393	0.445	2.49	2.99	3.81	5.51	5.78	0.241 U	0.245 U	0.236 U	0.25 U	0.244 U	1.7
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	579.3 D	221.11 D	41.41 D	113.74 D	101.78 D	52.93 D	58.14 D	264.1 D	70.23 D	4.51	32.04	19.98	20.32 D	23.08	97.73 D
Sample ID:	**CAS Number**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020**	**Proposed NYSDEC Protection of Groundwater Guidance Values**	**NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020**	**SB143**	**SB143**	**SB143**	**SB143**	**SB143**	**SB143**	**SB143**	**SB144**	**SB144**	**SB144**	**SB144**	**SB144**	**DUP001**	**DUP002**	**DUP003**
Sample Depth:						2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	12 ft to 14 ft	14 ft to 16 ft	2 ft to 4 ft	4 ft to 6 ft	6 ft to 8 ft	8 ft to 10 ft	10 ft to 12 ft	SB047 (6"-2')	SB064 (0"-6")	SB094 (6"-2")
Sampling Date:						12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	12/6/2022	9/20/2022	9/20/2022	9/21/2022
Lab Sample ID:						22L0320-11	22L0320-12	22L0320-13	22L0320-14	22L0320-15	22L0320-55	22L0320-56	22L0320-16	22L0320-17	22L0320-18	22L0320-19	22L0320-20	22J1026-03	22J1026-16	22J1087-05
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	2.18	0.571	0.243 U	0.241 U	0.244 U	0.342	22 D	3.59	0.45	0.238 U	0.247 U	0.246 U	0.247 U	0.257 U	0.247 U
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	10.4 D	8.47 D	0.585	0.241 U	3.53	8.38	47.5 D	1.66	0.574	0.302	1.47	0.301	0.247 U	0.257 U	0.247 U
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.27 U	0.262 U	0.243 U	0.241 U	0.244 U	0.247 U	0.235 U	0.262 U	0.241 U	0.238 U	0.247 U	0.246 U	0.247 U	0.257 U	0.247 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.27 U	0.262 U	0.243 U	0.241 U	0.244 U	0.247 U	0.235 U	0.262 U	0.241 U	0.238 U	0.247 U	0.246 U	0.247 U	0.257 U	0.247 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.27 U	0.262 U	0.243 U	0.241 U	0.244 U	0.247 U	0.427	0.262 U	0.241 U	0.238 U	0.247 U	0.246 U	0.247 U	0.257 U	0.247 U
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	2.08	1.74	0.243 U	0.241 U	0.354	1.12	29	0.35	0.241 U	0.238 U	0.485	0.246 U	0.247 U	0.257 U	0.247 U
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.917	0.266	0.243 U	0.241 U	0.244 U	0.247 U	1.95	0.323	0.241 U	0.238 U	0.247 U	0.246 U	0.343	0.257 U	0.247 U
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.27 U	0.262 U	0.243 U	0.241 U	0.244 U	0.247 U	0.235 U	0.262 U	0.241 U	0.238 U	0.247 U	0.246 U	0.337	0.75	0.247 U
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.844	0.262 U	0.243 U	0.241 U	0.244 U	0.247 U	3.4	0.486	0.241 U	0.238 U	0.247 U	0.246 U	3.7	0.271	0.247 U
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.27 U	0.262 U	0.243 U	0.241 U	0.244 U	0.247 U	0.235 U	0.263	0.241 U	0.238 U	0.247 U	0.246 U	0.247 U	0.257 U	0.247 U
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	4.32	2.12	0.243 U	0.241 U	1.19	0.891	0.865	1.17	1.04	0.362	1.52	0.251	0.247 U	0.257 U	0.247 U
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	7.52	4.24	0.408	0.241 U	1.97	4.58	16.3	1.05	0.508	0.238 U	0.912	0.246 U	3.26	0.257 U	0.247 U
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	2.01	1.76	0.243 U	0.241 U	0.553	1.17	0.723	0.807	0.458	0.238 U	1.01	0.246 U	0.524	0.257 U	0.247 U
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	1.27	0.7	0.243 U	0.241 U	0.244 U	0.247 U	0.235 U	0.637	0.334	0.238 U	0.547	0.246 U	0.247 U	0.54	0.336
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	26.7	10	0.243 U	0.241 U	0.244 U	0.577	174 D	4.87	1.96	0.363	1.71	0.331	1.16	0.257 U	0.247 U
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**404** D	**22.4**	0.243 U	0.241 U	0.483	**7.33**	**386** D	**18.9**	**8.45**	**1.27**	**7.58**	**1.34**	**3.68**	2.8	2.03
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	**10.3**	**6.17**	0.3	0.241 U	**2.90**	**4.44**	**15.3**	**4.91**	**1.73**	0.6	**2.33**	0.489	0.393	0.257 U	0.257
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	3.23	2.71	0.243 U	0.316	0.679	0.475	0.295	1.42	0.673	0.238 U	1.51	0.246 U	0.247 U	0.257 U	0.247 U
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.27 U	0.262 U	0.243 U	0.241 U	0.244 U	0.247 U	0.235 U	0.262 U	0.241 U	0.238 U	0.247 U	0.246 U	0.593	0.257 U	0.247 U
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.27 U	0.262 U	0.243 U	0.241 U	0.244 U	0.247 U	0.993	0.262 U	0.241 U	0.238 U	0.247 U	0.246 U	49.9	0.942	0.247 U
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.732	0.262 U	0.243 U	0.241 U	0.244 U	0.551	9.87	4.13	0.843	0.238 U	0.247 U	0.246 U	80.1	1.62	0.247 U
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	414.3 D	28.57	0.3	ND	3.383	11.77	401.3 D	23.81	10.18	1.86	9.91	1.829	4.073	2.8	2.287

Notes:

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B - Analyte is found in the associated analysis batch blank.

J - Estimated Value

U - The compound was not detected at the indicated concentration.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

J - Data Validation Qualifier - A QC analysis failed outside the primary aceptance limits and the data may be biased high or low or the direction of the bias may be indeterminable.

UJ - Data Validation Qualifier - The data may be biased low.

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020

Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values

Shaded text denotes concentrations exceeding NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020

Table 2
Soil PFAS Analytical Data
Soil Delineation Project
Suffolk County Fire Training Facility

Sample ID: Sample Depth: Sampling Date: Lab Sample ID:	CAS Number	NYSDEC Part 375 RemedialSoil Guidance PFAS Residential-Oct2020	NYSDEC Part 375 RemedialSoil Guidance PFAS Commercial-Oct2020	Proposed NYSDEC Protection of Groundwater Guidance Values	NYSDEC Part 375 RemedialSoil Guidance PFAS Unrestricted-Oct2020	DUP004 SB055 (2'-4') 9/23/2022 22I1277-10	DUP005 SB057 (6'-8') 9/23/2022 22I1277-26	DUP006 SB067 (6'-8') 9/23/2022 22I1277-41	DUP007 SB073 (4'-6') 9/26/2022 22I1355-59	DUP0008 SB079 (6'-8') 9/26/2022 22I1355-60	DUP-9a SB104 (6"-2') 11/23/2022 22K1310-23	DUP 10 SB048 (4'-6') 12/5/2022 22L0228-09	DUP 11 SB049 (2'-4') 12/5/2022 22L0228-10	DUP 12 SB060 (4'-6') 12/5/2022 22L0228-32	DUP 13 SB135 (2'-4') 12/5/2022 22L0228-33	DUP 14 SB136 (2'-4') 12/5/2022 22L0228-34	DUP 15 SB139 (2'-4') 12/6/2022 22L0320-40	DUP 16 SB144 (4'-6') 12/6/2022 22L0320-41	DUP 17 SB141 (2'-4') 12/6/2022 22L0320-42
PFAS by EPA 537m (µg/kg)																				
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.552	0.253 U	0.254 U	0.65	7.34	0.239 U	12.1	1.61	27.7	0.491	76.4 D
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	2.84	0.253 U	0.254 U	0.627	1.03	0.239 U	0.307	0.645	5.57	0.577	41.8 D
NEtFOSAA	2991-50-6	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.253 U	0.254 U	0.255 U	0.252 U	0.239 U	0.246 U	0.254 U	0.25 U	0.254 U	0.283 U
NMeFOSAA	2355-31-9	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.253 U	0.254 U	0.255 U	0.252 U	0.239 U	0.246 U	0.254 U	0.25 U	0.254 U	0.283 U
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.253 U	0.254 U	0.255 U	0.363	0.239 U	0.246 U	0.721	0.25 U	0.254 U	0.518
Perfluorobutanoic Acid (PFBA)	375-22-4	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.477	0.253 U	0.254 U	3.09	0.252 U	0.239 U	0.246 U	0.254 U	0.25 U	0.254 U	5.77
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.253 U	0.254 U	0.255 U	3.25	0.239 U	0.361	0.959	0.25 U	0.254 U	0.967
Perfluorodecanoic Acid (PFDA)	335-76-2	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.307	0.253 U	0.254 U	0.255 U	0.252 U	0.239 U	0.246 U	0.254 U	0.25 U	0.254 U	0.369
Perfluorododecanoic Acid (PFDoA)	307-55-1	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.253 U	0.464	3.53	1.46	0.239 U	8.77	1.96	3.9	0.254 U	12
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.257	0.254 U	0.255 U	0.526	0.239 U	0.246 U	0.536	0.338	0.254 U	1.62
Perfluoroheptanoic Acid (PFHpA)	375-85-9	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.634	0.253 U	0.633	0.324	0.566	0.239 U	0.339	0.254 U	0.74	0.578	0.708
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	NS	NS	NS	NS	1.27	0.245 U	0.249 U	0.259 U	0.27	0.254 U	5.51	0.818	0.239 U	0.99	2.8	0.415	0.395	5.08
Perfluorohexanoic Acid (PFHxA)	307-24-4	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	1.03	0.253 U	0.871	0.555	0.615	0.239 U	0.471	0.686	0.541	0.43	4.62
Perfluorononanoic Acid (PFNA)	375-95-1	NS	NS	NS	NS	0.885	0.245 U	0.249 U	1.05	18.1	0.952	0.255 U	0.252 U	0.239 U	0.246 U	0.254 U	0.306	0.254 U	2.46
Perfluorooctanesulfonamide (FOSA)	754-91-6	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.253 U	1.48	22.6	0.901	0.239 U	1.64	0.455	3.4	1.88	114
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	8.8	440	1.0	0.88	**40.9**	1.32	0.25 B	**30.5** D	**77.8** D	**10.5**	**8160** D	**7.69**	0.524	**24.5**	**75.2** D	**33.1**	**7.08**	**710** D
Perfluorooctanoic Acid (PFOA)	335-67-1	6.6	500	0.8	0.66	0.542	0.245 U	0.249 U	**2.73**	0.253 U	**0.9**	**1.69**	**0.979**	0.239 U	**11.5**	**1.78**	**2.27**	**1.49**	**8.16**
Perfluoropentanoic Acid (PFPeA)	2706-90-3	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	1.79	0.253 U	1.5	0.255 U	0.603	0.239 U	0.246 U	0.254 U	0.576	0.652	4.48
Perfluorotetradecanoic Acid (PFTA)	376-06-7	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.253 U	0.254 U	0.255 U	0.252 U	0.239 U	0.246 U	0.254 U	0.25 U	0.254 U	0.41
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.253 U	0.254 U	0.986	2.24	0.239 U	0.722	1.62	0.378	0.254 U	5.88
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	NS	NS	NS	NS	0.232 U	0.245 U	0.249 U	0.259 U	0.899	0.41	2.42	6.17	0.239 U	6.13	10.6	1.49	0.555	33.9
PFOA/PFOS, Total	N/A	NS	NS	NS	NS	41.442	1.32	0.25	33.23	78.053	11.4	8161.69 D	8.669	0.524	36	76.98 D	35.37	8.57	718.16 D

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Shaded text denotes concentrations exceeding proposed NYSDEC Protection of Groundwater Guidance Values

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APPENDIX C

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SUFFOLK COUNTY FIREMATICS SITE
NORTH OF MAPLE STREET, YAPHANK, NEW YORK 11980
PORTION OF 0200-742.00-01.00-003.110
NYSDEC SITE: 152246

CONSTRUCTION HEALTH AND SAFETY PLAN

SUBMITTED TO:

New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233-7016

PREPARED FOR:

Suffolk County Department of Health Services
Office of Pollution Control
15 Horseblock Place
Farmingville, New York 11738

PREPARED BY:

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Zeb Youngman, PG, Senior Project Manager zyoungman@pwgrosser.com

PWGC Project Number: SHD2302

APRIL 2024

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FIGURES

FIGURE 1	HOSPITAL ROUTE MAP

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STATEMENT OF COMMITMENT

On-site employees may be exposed to chemical contaminants of concern within the soil/fill during the planned construction activities to be performed at an open lot adjoining the Suffolk County Firematics Site located to the north of 676 Maple Street, Yaphank, New York ("Site"). P.W. Grosser Consulting Engineer & Hydrogeologist, P.C.'s (PWGC's) policy is to minimize the possibility of work-related exposure through awareness and qualified supervision, health and safety training, use of appropriate personal protective equipment, and the following activity specific safety protocols contained in this Construction Health and Safety Plan (CHASP). PWGC has established a guidance program to implement this policy in a manner that protects personnel to the maximum reasonable extent.

This CHASP describes emergency response procedures for actual and potential chemical hazards. Persons are to acknowledge that they understand the potential hazards and the contents of this Health and Safety policy by signing off on receipt of their individual copy of the document. Contractors and suppliers are retained as independent contractors and are responsible for ensuring the health and safety of their own employees as it relates to general construction practices.

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1.0 INTRODUCTION AND SITE ENTRY REQUIREMENTS

This document describes the health and safety guidelines developed by P.W. Grosser Consulting Engineer & Hydrogeologist, P.C. (PWGC) for the proposed Site renovation to be performed at the Site 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 CHASP, including the attachments, addresses safety and health hazards relating to each on-site work activities, as detailed in the Soil and Materials Management Plan for the Site and is based on the best information available. The CHASP may be revised by PWGC upon receipt of new information regarding Site conditions. Changes will be documented by written amendments.

1.1 Site Safety Plan Acceptance, Acknowledgment, and Amendments

The project superintendent and the Site safety officer 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 CHASP. Amendments to the CHASP 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 – Mr. Zeb Youngman, PG
- Site Safety Officer – Mr. Michael Pecoraro or designee

The project manager is responsible for overall project administration and, with guidance from the Site safety officer, for supervising the implementation of this CHASP. The Site safety officer will conduct daily (tail gate or toolbox) safety meetings at the project Site and oversee daily safety issues.

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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 project manager will be consulted.

If the incident involved a construction worker, the General Contractor or subcontractor that employed the worker must report every incident that occurred on every construction site subject to permitting by the Department. Regardless of whether the incident involved a violation of this Code or any other law or rule, the incident must be reported if it resulted in either:

- Fatality to any individual, including a member of the general public or a construction worker; or,
- An injury to any individual, including a member of the general public or a construction worker, that requires transport by emergency medical services or requires immediate emergency care at a hospital or offsite medical clinic.

In addition to these reporting requirements, the project manager is responsible for ensuring that PWGC personnel assigned to the construction site have the appropriate training.

The Site safety officer is responsible for the following:

1. Educating personnel about information in this CHASP 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 project manager.
3. Monitoring the condition and status of known on-site hazards specified in this CHASP.
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 Site safety officer will document these conditions in a bound notebook and maintain a copy of the notebook on-site).
6. Reporting injuries/incidences that occur on Site, regardless of if it includes a PWGC employee or other person on the Site, to the project manager as soon as possible following the incident.

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 Site safety officer or appropriate key personnel.

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2.0 SITE BACKGROUND AND SCOPE OF WORK

The Site is located in Yaphank, New York and is identified as a portion of 0200-742.00-01.00-003.110 on the Suffolk County Tax Map. The Site is approximately 2.41 acres and is bounded by Suffolk Avenue to the north, the Suffolk County Firematics Site to the south, East Avenue to the east, and an undeveloped, wooded area to the west. The Site is currently vacant and undeveloped.

The proposed use of the Site will be for fire training purposes. The work being proposed is to install new utilities (potable water, storm drainage, communications, electric) for the prop structures and cut/fill onsite soils to grade the site for road paving and the prop buildings' foundations.

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3.0 POTENTIAL HAZARDS OF THE SITE

This section presents an assessment of the chemical, biological, and physical hazards that may be encountered.

3.1 Chemical Hazards

It is anticipated that soils beneath the Site are impacted with semi-volatile organic compounds (SVOCs) and metals typical of urban fill. Likely compounds are listed below:

Chemical Hazards

COMPOUND	CAS#	TVL	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

C = Ceiling limit, not to be exceeded
CNS = Central Nervous System
TVL=Threshold limit values
ppm = parts per million
TWA = Time-weighted average (8 hours)

Appendix C includes information sheets for the suspected chemicals that may be encountered at the Site.

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3.2 *Biological Hazards*

Work will be performed in a fire training facility containing several buildings and various props used in fire training exercises in Yaphank, New York. In general, the facility is only occupied while an active training session is taking place. 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 developed area. It is possible that dogs, cats, and rodents 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, if they don't contain PFAS compounds, and PPE, if deemed necessary, when working in areas where insects are expected to be present.

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. 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.** 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 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). If heavy concentrations of ticks or insects are anticipated or encountered, Tyvek coveralls may be utilized for added protection when the potential for heat stress is not a concern.
- Conduct periodic and frequent, (e.g., hourly), surveys of your clothing for the presence of ticks. Remove any tick, save it and report to the clinic with the tick.
- 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, airplanes, 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 D**.

3.3.2 Steam, Heat, and Splashing

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

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. 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 workplace 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.

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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 only true difference among the levels of protection from D thru 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. A summary of prohibited and Acceptable Materials is included in **Appendix E.** Level D PPE consists of:

- standard work uniform, coveralls, or tyvek, as needed;
- steel toe work boots that do not contain Gore-Tex;
- 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 OVA, or equivalent), but are less than 5 ppm. 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. 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 Site safety officer 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 OVA, or equivalent). 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. A summary of prohibited and Acceptable Materials is included in **Appendix E.** Level B PPE consists of:

- supplied air SCBA or air line 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.

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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.

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6.0 TRAINING AND MEDICAL SURVEILLANCE

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

6.1 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of site field personnel directly involved with site activities who 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).

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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 in the command post. 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 CHASP.

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 office.
Fire extinguisher:	On-site, in office or on equipment.

* Horns: Air horns will be supplied to personnel at the discretion of the project superintendent or Site safety officer.

7.2 Emergency Telephone Numbers

General Emergencies	911
Suffolk County Police	911
Brookhaven Memorial Hospital	1-631-654-7100
NYSDEC Spills Division	1-800-457-7362
NYSDEC Hazardous Waste Division	1-718-482-4996
Suffolk County Department of Health	1-631-854-0000
Brookhaven Fire Department	911
National Response Center	1-800-424-8802
Poison Control	1-212-764-7667
PWGC Headquarters	631-589-6353

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Project Manager 631-589-6353

A copy of this page shall be posted in the office.

7.3 *Personnel Responsibilities During an Emergency*

The project manager is primarily responsible for responding to and correcting any emergency situations. However, in the absence of the project manager, the Site safety officer shall act as the project manager'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 Site safety officer 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 fire fighting 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 Site safety officer 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.

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FIGURE

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REVISION	DATE	INITIAL	COMMENTS

DRAWING INFORMATION:

Project:	SHD2302	Designed by:	MP
Date:	4/2/2024	Drawn by:	AM
Scale:	AS SHOWN	Approved by:	MP

Hospital Route Map

Suffolk County Firematics
676 Maple St
Yaphank, NY

FIGURE NO:

1

Document Path: W:\Projects\S-Z\SHD\2302\map files\SHD2302.aprx

APPENDIX A

SITE SAFETY PLAN ACCEPTANCE AND ACKNOWLEDGMENT FORM

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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

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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

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APPENDIX C

CHEMICAL HAZARDS

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Safety Data Sheet
acc. to OSHA HCS

Printing date 03/23/2019 Version Number 2 Reviewed on 03/23/2019

*
1 Identification

· **Product identifier**

· **Trade name: Perfluorooctanoic Acid (PFOA)**

· **Part number:** N-1588
· **CAS Number:**
335-67-1
· **EC number:**
206-397-9
· **Index number:**
607-704-00-2
· **Application of the substance / the mixture** Reagents and Standards for Analytical Chemical Laboratory Use

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Agilent Technologies, Inc.
5301 Stevens Creek Blvd.
Santa Clara, CA 95051 USA

· **Information department:**
Telephone: 800-227-9770
e-mail: pdl-msds_author@agilent.com
· **Emergency telephone number:** CHEMTREC®: 1-800-424-9300

*
2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS08 Health hazard

Carc. 2 H351 Suspected of causing cancer.
Repr. 1B H360 May damage fertility or the unborn child.
STOT RE 1 H372 Causes damage to the liver through prolonged or repeated exposure.

GHS05 Corrosion

Eye Dam. 1 H318 Causes serious eye damage.

GHS07

Acute Tox. 4 H302 Harmful if swallowed.
Acute Tox. 4 H332 Harmful if inhaled.

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

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Trade name: Perfluorooctanoic Acid (PFOA)

(Contd. of page 1)

· **Hazard pictograms**

GHS05 GHS07 GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
perfluorooctanoic acid (PFOA)
· **Hazard statements**
Harmful if swallowed or if inhaled.
Causes serious eye damage.
Suspected of causing cancer.
May damage fertility or the unborn child.
Causes damage to the liver through prolonged or repeated exposure.
· **Precautionary statements**
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.
If swallowed: Call a poison center/doctor if you feel unwell.
Rinse mouth.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.
Continue rinsing.
Immediately call a poison center/doctor.
IF exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.
· **Classification system:**
· **NFPA ratings (scale 0 - 4)**

Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = *3
Fire = 0
Reactivity = 0

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

(Contd. on page 3)

Safety Data Sheet
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Trade name: Perfluorooctanoic Acid (PFOA)

(Contd. of page 2)

· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
335-67-1 perfluorooctanoic acid (PFOA)
· **Identification number(s)**
· **EC number:** 206-397-9
· **Index number:** 607-704-00-2

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Generally the product does not irritate the skin.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:** Use fire fighting measures that suit the environment.
· **Special hazards arising from the substance or mixture**
During heating or in case of fire poisonous gases are produced.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Mount respiratory protective device.
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

(Contd. on page 4)

(Contd. of page 3)

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

· **PAC-1:**
1.1 mg/m³

· **PAC-2:**
12 mg/m³

· **PAC-3:**
75 mg/m³

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
· **Information about protection against explosions and fires:** Keep respiratory protective device available.

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

*
8 Exposure controls/personal protection

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

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
When used as intended with Agilent instruments, the use of the product under normal laboratory conditions and with standard practices does not result in significant airborne exposures and therefore respiratory protection is not needed.
Under an emergency condition where a respirator is deemed necessary, use a NIOSH or equivalent approved device/equipment with appropriate organic or acid gas cartridge.

(Contd. on page 5)

(Contd. of page 4)

· **Protection of hands:**
Although not recommended for constant contact with the chemicals or for clean-up, nitrile gloves 11-13 mil thickness are recommended for normal use. The breakthrough time is 1 hr. For cleaning a spill where there is direct contact of the chemical, butyl rubber gloves are recommended 12-15 mil thickness with breakthrough times exceeding 4 hrs. Supplier recommendations should be followed.
· **Material of gloves**
For normal use: nitrile rubber, 11-13 mil thickness
For direct contact with the chemical: butyl rubber, 12-15 mil thickness
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
For normal use: nitrile rubber: 1 hour
For direct contact with the chemical: butyl rubber: >4 hours
· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	55-56 °C (131-132.8 °F)
Boiling point/Boiling range:	190 °C (374 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure at 20 °C (68 °F):**	0.69 hPa (0.5 mm Hg)
· **Density at 20 °C (68 °F):**	0.9 g/cm³ (7.5105 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.

(Contd. on page 6)

(Contd. of page 5)

· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with Water at 20 °C (68 °F):**	3.4 g/l
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
VOC content:	0.00 % 0.0 g/l / 0.00 lb/gal
Solids content:	100.0 %
· **Other information**	No further relevant information available.

10 Stability and reactivity

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

11 Toxicological information

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

· **LD/LC50 values that are relevant for classification:**

ATE (Acute Toxicity Estimate)

Oral	LD50	500 mg/kg
Inhalative	LC50/4 h	1.5 mg/L

· **Primary irritant effect:**
· **on the skin:** No irritant effect.
· **on the eye:** Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**

2B

· **NTP (National Toxicology Program)**

Substance is not listed.

(Contd. on page 7)

Safety Data Sheet
acc. to OSHA HCS

Trade name: Perfluorooctanoic Acid (PFOA)

(Contd. of page 6)

· **OSHA-Ca (Occupational Safety & Health Administration)**

Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (Assessment by list): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
Danger to drinking water if even small quantities leak into the ground.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

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

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

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	UN3261
· **UN proper shipping name**	
· **DOT**	Corrosive solid, acidic, organic, n.o.s. (perfluorooctanoic acid (PFOA))
· **IMDG, IATA**	CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (perfluorooctanoic acid (PFOA))

(Contd. on page 8)

(Contd. of page 7)

· **Transport hazard class(es)**

· **IATA**

· **Class**	8 Corrosive substances
· **Label**	8
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Warning: Corrosive substances
· **Danger code (Kemler):**	80
· **EMS Number:**	F-A,S-B
· **Segregation groups**	Acids
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: 25 kg On cargo aircraft only: 100 kg
· **IMDG**	
· **Limited quantities (LQ)**	5 kg
· **Excepted quantities (EQ)**	Code: E1 Maximum net quantity per inner packaging: 30 g Maximum net quantity per outer packaging: 1000 g
· **UN "Model Regulation":**	UN 3261 CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (PERFLUOROOCTANOIC ACID (PFOA)), 8, III

15 Regulatory information

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

· **Sara**

· **Section 355 (extremely hazardous substances):**

Substance is not listed.

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

Substance is not listed.

· **TSCA (Toxic Substances Control Act):**

Substance is listed.

· **Proposition 65**

· **Chemicals known to cause cancer:**

Substance is not listed.

· **Chemicals known to cause reproductive toxicity for females:**

Substance is not listed.

(Contd. on page 9)

Safety Data Sheet
acc. to OSHA HCS

Trade name: Perfluorooctanoic Acid (PFOA)

(Contd. of page 8)

· **Chemicals known to cause reproductive toxicity for males:**
Substance is not listed.

· **Chemicals known to cause developmental toxicity:**
Substance is listed.

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**
Substance is not listed.

· **TLV (Threshold Limit Value established by ACGIH)**
Substance is not listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
Substance is not listed.

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

*
16 Other information

The information contained in this document is based on Agilent's state of knowledge at the time of preparation. No warranty as to its accurateness, completeness or suitability for a particular purpose is expressed or implied.

· **Date of preparation / last revision** 03/23/2019 / 1

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Tox. 4: Acute toxicity – Category 4
Eye Dam. 1: Serious eye damage/eye irritation – Category 1
Carc. 2: Carcinogenicity – Category 2
Repr. 1B: Reproductive toxicity – Category 1B
STOT RE 1: Specific target organ toxicity (repeated exposure) – Category 1

· *** Data compared to the previous version altered.**

Safety Data Sheet
acc. to OSHA HCS

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

1 Identification

· **Product identifier**

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

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

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

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

2 Hazard(s) identification

· **Classification of the substance or mixture**

GHS02 Flame

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

GHS06 Skull and crossbones

Acute Tox. 3 H331 Toxic if inhaled.

GHS08 Health hazard

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

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

GHS02 GHS06 GHS08

· **Signal word** Danger

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

(Contd. on page 2)

Safety Data Sheet
acc. to OSHA HCS

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

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

(Contd. of page 1)

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

Health = 3
Fire = 3
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**

Health = *3
Fire = 3
Reactivity = 0

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

3 Composition/information on ingredients

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

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

4 First-aid measures

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

5 Fire-fighting measures

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

6 Accidental release measures

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

(Contd. on page 3)

Safety Data Sheet
acc. to OSHA HCS

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

(Contd. of page 2)

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

7 Handling and storage

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

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

8 Exposure controls/personal protection

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

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

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

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

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

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

Protective gloves

(Contd. on page 4)

Safety Data Sheet
acc. to OSHA HCS

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

(Contd. of page 3)

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

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

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

· **Eye protection:**

Tightly sealed goggles

9 Physical and chemical properties

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

10 Stability and reactivity

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

(Contd. on page 5)

Safety Data Sheet
acc. to OSHA HCS

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

(Contd. of page 4)

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

11 Toxicological information

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

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

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

· **Carcinogenic categories**

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

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

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

12 Ecological information

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

13 Disposal considerations

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

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

14 Transport information

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

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Safety Data Sheet
acc. to OSHA HCS

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

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

(Contd. of page 5)

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

US

(Contd. on page 7)

Safety Data Sheet
acc. to OSHA HCS

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

(Contd. of page 6)

15 Regulatory information

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

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

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

67-56-1	methanol

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

· **Proposition 65**

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

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

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

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

67-56-1	methanol

· **Carcinogenic categories**

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

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

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

· **Protective Action Criteria for Chemicals**

· **PAC-1:**

67-56-1	methanol	530 ppm

· **PAC-2:**

67-56-1	methanol	2,100 ppm

· **PAC-3:**

67-56-1	methanol	7200* ppm

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

GHS02 GHS06 GHS08

· **Signal word** Danger

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

(Contd. on page 8)

Safety Data Sheet
acc. to OSHA HCS

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

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

(Contd. of page 7)

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing SDS:** product safety department
· **Contact:**
SPEX CertiPrep, LLC.
1-732-549-7144
· **Date of preparation / last revision** 12/13/2016 / -
· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
BEI: Biological Exposure Limit
Flam. Liq. 2: Flammable liquids – Category 2
Acute Tox. 3: Acute toxicity – Category 3
Carc. 2: Carcinogenicity – Category 2
Repr. 1: Reproductive toxicity – Category 1
STOT SE 1: Specific target organ toxicity (single exposure) – Category 1

WELLINGTON LABORATORIES

SAFETY DATA SHEET

N-ethylperfluoro-1-octanesulfonamidoacetic acid (N-EtFOSAA)

Wellington Laboratories Inc.

Chemwatch Hazard Alert Code: **4**

Version No: **6.7**
Safety Data Sheet according to WHMIS 2015 requirements

Issue Date: **13/09/2019**
Print Date: **13/09/2019**
S.GHS.CAN.EN

SECTION 1 IDENTIFICATION

Product Identifier

Product name	N-ethylperfluoro-1-octanesulfonamidoacetic acid (N-EtFOSAA)
Synonyms	Methyl alcohol (methanol),Methyl hydrate (methanol),Methylol (methanol)
Proper shipping name	METHANOL
Other means of identification	Not Available

Recommended use of the chemical and restrictions on use

Relevant identified uses	This product is a solution of organic compound(s) in methanol for laboratory use only (see section 3). This material should only be used by those persons trained in the safe handling of hazardous chemicals. Please refer to the Certificate of Analysis (CofA) for further product information. Wellington Laboratories Inc.

Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

Registered company name	**Wellington Laboratories Inc.**
Address	345 Southgate Drive Guelph Ontario N1G 3M5 Canada
Telephone	+1 519 822 2436
Fax	+1 519 822 2849
Website	www.well-labs.com
Email	MSDS@well-labs.com

Emergency phone number

Association / Organisation	**Wellington Laboratories Inc.**
Emergency telephone numbers	1-888-CANUTEC (226-8832) (North American)
Other emergency telephone numbers	1-613-996-6666 (International)

SECTION 2 HAZARD(S) IDENTIFICATION

Classification of the substance or mixture

NFPA 704 diamond

Note: The hazard category numbers found in GHS classification in section 2 of this SDSs are NOT to be used to fill in the NFPA 704 diamond. Blue = Health Red = Fire Yellow = Reactivity White = Special (Oxidizer or water reactive substances)

Classification	Eye Irritation Category 2A, Acute Toxicity (Dermal) Category 3, Specific target organ toxicity - single exposure Category 1, Flammable Liquid Category 2, Acute Toxicity (Inhalation) Category 3, Reproductive Toxicity Category 1B, Acute Toxicity (Oral) Category 3

Label elements

Hazard pictogram(s)	
SIGNAL WORD	DANGER

Hazard statement(s)

H319	Causes serious eye irritation.
H311	Toxic in contact with skin.

Continued...

H370	Causes damage to organs.
H225	Highly flammable liquid and vapour.
H331	Toxic if inhaled.
H360	May damage fertility or the unborn child.
H301	Toxic if swallowed.

Physical and Health hazard(s) not otherwise classified

Not Applicable

Supplementary statement(s)

Not Applicable

CLP classification (additional)

Not Applicable

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P270	Do not eat, drink or smoke when using this product.

Precautionary statement(s) Response

P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/physician/first aider.
P308+P311	IF exposed or concerned: Call a POISON CENTER/doctor/physician/first aider.
P321	Specific treatment (see advice on this label).
P330	Rinse mouth.

Precautionary statement(s) Storage

P403+P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
67-56-1	98.994	methanol
2991-50-6*	0.006	N-ethylperfluoro-1-octanesulfonamidoacetic acid
7732-18-5	0.99	water
1310-73-2	<0.01	sodium hydroxide

SECTION 4 FIRST-AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Immediately flush body and clothes with large amounts of water, using safety shower if available. ▸ Quickly remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor, without delay.

Continued...

Ingestion	▸ Immediately give a glass of water. ▸ First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor. ▸ If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

Indication of any immediate medical attention and special treatment needed

Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically. Mechanical means should be used if it is considered necessary to evacuate the stomach contents; these include gastric lavage after endotracheal intubation. If spontaneous vomiting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours.
For acute and short term repeated exposures to methanol:

- Toxicity results from accumulation of formaldehyde/formic acid.
- Clinical signs are usually limited to CNS, eyes and GI tract Severe metabolic acidosis may produce dyspnea and profound systemic effects which may become intractable. All symptomatic patients should have arterial pH measured. Evaluate airway, breathing and circulation.
- Stabilise obtunded patients by giving naloxone, glucose and thiamine.
- Decontaminate with Ipecac or lavage for patients presenting 2 hours post-ingestion. Charcoal does not absorb well; the usefulness of cathartic is not established.
- Forced diuresis is not effective; haemodialysis is recommended where peak methanol levels exceed 50 mg/dL (this correlates with serum bicarbonate levels below 18 meq/L).
- Ethanol, maintained at levels between 100 and 150 mg/dL, inhibits formation of toxic metabolites and may be indicated when peak methanol levels exceed 20 mg/dL. An intravenous solution of ethanol in D5W is optimal.
- Folate, as leucovorin, may increase the oxidative removal of formic acid. 4-methylpyrazole may be an effective adjunct in the treatment. 8.Phenytoin may be preferable to diazepam for controlling seizure.

[Ellenhorn Barceloux: Medical Toxicology]

BIOLOGICAL EXPOSURE INDEX - BEI

Determinant	Index	Sampling Time	Comment
1. Methanol in urine	15 mg/l	End of shift	B, NS
2. Formic acid in urine	80 mg/gm creatinine	Before the shift at end of workweek	B, NS

B: Background levels occur in specimens collected from subjects **NOT** exposed.

NS: Non-specific determinant - observed following exposure to other materials.

SECTION 5 FIRE-FIGHTING MEASURES

Extinguishing media

Water may be an ineffective extinguishing media for methanol fires; static explosions are reported for aqueous solutions as dilute as 30%. Water may be used to cool containers.

- Alcohol stable foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

Special hazards arising from the substrate or mixture

Fire Incompatibility	▸ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

Special protective equipment and precautions for fire-fighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ May be violently or explosively reactive. ▸ Wear full body protective clothing with breathing apparatus. ▸ Prevent, by any means available, spillage from entering drains or water course.
Fire/Explosion Hazard	▸ Liquid and vapour are highly flammable. ▸ Severe fire hazard when exposed to heat, flame and/or oxidisers. ▸ Vapour may travel a considerable distance to source of ignition. ▸ Heating may cause expansion or decomposition leading to violent rupture of containers. Combustion products include: carbon dioxide (CO_2) formaldehyde other pyrolysis products typical of burning organic material.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	▸ Remove all ignition sources. ▸ Clean up all spills immediately. ▸ Avoid breathing vapours and contact with skin and eyes. ▸ Control personal contact with the substance, by using protective equipment.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ May be violently or explosively reactive. ▸ Wear full body protective clothing with breathing apparatus.

Continued...

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	‣ Containers, even those that have been emptied, may contain explosive vapours. ‣ Do NOT cut, drill, grind, weld or perform similar operations on or near containers. ‣ Avoid all personal contact, including inhalation. ‣ Wear protective clothing when risk of exposure occurs. ‣ Use in a well-ventilated area. ‣ Prevent concentration in hollows and sumps. ‣ **DO NOT** allow clothing wet with material to stay in contact with skin
Other information	‣ Store in original containers in approved flame-proof area. ‣ No smoking, naked lights, heat or ignition sources. ‣ **DO NOT** store in pits, depressions, basements or areas where vapours may be trapped. ‣ Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container	‣ Glass container is suitable for laboratory quantities ‣ Packing as supplied by manufacturer. ‣ Plastic containers may only be used if approved for flammable liquid. ‣ Check that containers are clearly labelled and free from leaks. ‣ For low viscosity materials (i) : Drums and jerry cans must be of the non-removable head type. (ii) : Where a can is to be used as an inner package, the can must have a screwed enclosure. ‣ For materials with a viscosity of at least 2680 cSt. (23 deg. C) ‣ For manufactured product having a viscosity of at least 250 cSt.
Storage incompatibility	Methanol: ‣ reacts violently with strong oxidisers, acetyl bromide, alkyl aluminium salts, beryllium dihydride, bromine, chromic acid, 1-chloro-3,3-difluoro-2-methoxycyclopropene, cyanuric chloride, diethylzinc, isophthaloyl chloride, nitric acid, perchloric acid, potassium-tert-butoxide, potassium sulfur diimide, Raney nickel catalysts, 2,4,6-trichlorotriazine, triethylaluminium, 1,3,3-trifluoro-2-methoxycyclopropene ‣ is incompatible with strong acids, strong caustics, alkaline earth and alkali metals, aliphatic amines, acetaldehyde, benzoyl peroxide, 1,3-bis(di-n-cyclopentadienyl iron)-2-propen-1-one, calcium carbide, chloroform, chromic anhydride, chromium trioxide, dialkylzinc, dichlorine oxide, dichloromethane, ethylene oxide, hypochlorous acid, isocyanates, isopropyl chlorocarbonate, lithium tetrahydroaluminate, magnesium, methyl azide, nitrogen dioxide, palladium, pentafluoroguanidine, perchloryl fluoride, phosphorus pentasulfide, phosphorus trioxide, potassium, tangerine oil, triisobutylaluminium ‣ mixtures with lead perchlorate, sodium hypochlorite are explosive ‣ may react with metallic aluminium at high temperatures ‣ slowly corrodes lead and aluminium ‣ may generate electrostatic charges, due to low conductivity, on flow or agitation ‣ attacks some plastics, rubber and coatings. Static induced flash fires have happened when filling plastic containers with methanol / water solutions with as low as 30% methanol content Alcohols ‣ are incompatible with strong acids, acid chlorides, acid anhydrides, oxidising and reducing agents. ‣ reacts, possibly violently, with alkaline metals and alkaline earth metals to produce hydrogen ‣ react with strong acids, strong caustics, aliphatic amines, isocyanates, acetaldehyde, benzoyl peroxide, chromic acid, chromium oxide, dialkylzincs, dichlorine oxide, ethylene oxide, hypochlorous acid, isopropyl chlorocarbonate, lithium tetrahydroaluminate, nitrogen dioxide, pentafluoroguanidine, phosphorus halides, phosphorus pentasulfide, tangerine oil, triethylaluminium, triisobutylaluminium ‣ should not be heated above 49 deg. C. when in contact with aluminium equipment ‣ Avoid storage with reducing agents.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	methanol	Methyl alcohol (methanol) - Skin	200 ppm / 260 mg/m3	310 mg/m3 / 250 ppm	Not Available	Not Available
Canada - Nova Scotia Occupational Exposure Limits	methanol	Methanol	200 ppm	250 ppm	Not Available	TLV Basis: headache; eye damage. BEI
Canada - Alberta Occupational Exposure Limits	methanol	Methanol (Methyl alcohol)	200 ppm / 262 mg/m3	328 mg/m3 / 250 ppm	Not Available	Not Available
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	methanol	Methyl alcohol (methanol)	200 ppm	250 ppm	Not Available	Skin
Canada - Manitoba Occupational Exposure Limits	methanol	Not Available	200 ppm	250 ppm	Not Available	TLV® Basis: Headache; eye dam; dizziness; nausea; BEI
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	methanol	Methyl alcohol	200 ppm / 262 mg/m3	328 mg/m3 / 250 ppm	Not Available	Not Available
Canada - Northwest Territories Occupational Exposure Limits (English)	methanol	Methyl alcohol (methanol)	200 ppm	250 ppm	Not Available	Skin

Continued...

Canada - British Columbia Occupational Exposure Limits	methanol	Methanol	200 ppm	250 ppm	Not Available	Not Available
Canada - Prince Edward Island Occupational Exposure Limits	methanol	Methanol	200 ppm	250 ppm	Not Available	TLV® Basis: Headache; eye dam; dizziness; nausea; BEI
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	sodium hydroxide	Sodium hydroxide	2 mg/m3	Not Available	Not Available	Not Available
Canada - Nova Scotia Occupational Exposure Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	TLV Basis: upper respiratory tract, eye & skin irritation
Canada - Alberta Occupational Exposure Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - Manitoba Occupational Exposure Limits	sodium hydroxide	Not Available	Not Available	Not Available	2 mg/m3	TLV® Basis: URT, eye, & skin irr
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - Northwest Territories Occupational Exposure Limits (English)	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - British Columbia Occupational Exposure Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - Prince Edward Island Occupational Exposure Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	TLV® Basis: URT, eye, & skin irr

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
methanol	Methyl alcohol; (Methanol)	Not Available	Not Available	Not Available
sodium hydroxide	Sodium hydroxide	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
methanol	6,000 ppm	Not Available
N-ethylperfluoro-1-octanesulfonamidoacetic acid	Not Available	Not Available
water	Not Available	Not Available
sodium hydroxide	10 mg/m3	Not Available

Exposure controls

Appropriate engineering controls

Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
The basic types of engineering controls are:
Process controls which involve changing the way a job activity or process is done to reduce the risk.
Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment.

Personal protection

Eye and face protection

- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task.

Skin protection

See Hand protection below

Hands/feet protection

- Wear chemical protective gloves, e.g. PVC.
- Wear safety footwear or safety gumboots, e.g. Rubber

The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer.
Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.
The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.
Personal hygiene is a key element of effective hand care.

Body protection

See Other protection below

Other protection

- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.

Continued...

- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets).
- Non sparking safety or conductive footwear should be considered. Conductive footwear describes a boot or shoe with a sole made from a conductive compound chemically bound to the bottom components, for permanent control to electrically ground the foot an shall dissipate static electricity from the body to reduce the possibility of ignition of volatile compounds.

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
N-ethylperfluoro-1-octanesulfonamidoacetic acid (N-EtFOSAA)

Material	CPI
BUTYL	A
NEOPRENE	B
BUTYL/NEOPRENE	C
NAT+NEOPR+NITRILE	C
NATURAL RUBBER	C
NATURAL+NEOPRENE	C
NEOPRENE/NATURAL	C
NITRILE	C
NITRILE+PVC	C
PE	C
PE/EVAL/PE	C
PVA	C
PVC	C
PVDC/PE/PVDC	C
SARANEX-23	C
SARANEX-23 2-PLY	C
TEFLON	C
VITON	C
VITON/CHLOROBUTYL	C
VITON/NEOPRENE	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

Respiratory protection

Type AX Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required. Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	AX-AUS	-	AX-PAPR-AUS / Class 1
up to 50 x ES	-	AX-AUS / Class 1	-
up to 100 x ES	-	AX-2	AX-PAPR-2 ^

^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- **Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.**
- **The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.**
- **Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used**

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Not Available

Physical state	Liquid	**Relative density (Water = 1)**	0.791
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	455
pH (as supplied)	Not Applicable	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	-98	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	64.7	**Molecular weight (g/mol)**	32.04
Flash point (°C)	12	**Taste**	Not Available
Evaporation rate	4.1 BuAC = 1	**Explosive properties**	Not Available
Flammability	HIGHLY FLAMMABLE.	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	31	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	6	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	13	**Gas group**	Not Available

Continued...

Solubility in water	Immiscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	1.11	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Static induced flash fires have happened when filling plastic containers with methanol / water solutions with as low as 30% methanol content. ▸ Unstable in the presence of incompatible materials. ▸ Product is considered stable. ▸ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	There is strong evidence to suggest that this material can cause, if inhaled once, very serious, irreversible damage of organs. The material is not thought to produce either adverse health effects or irritation of the respiratory tract following inhalation (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting. Minor but regular methanol exposures may effect the central nervous system, optic nerves and retinae. Symptoms may be delayed, with headache, fatigue, nausea, blurring of vision and double vision. Continued or severe exposures may cause damage to optic nerves, which may become severe with permanent visual impairment even blindness resulting. **WARNING**: Methanol is only slowly eliminated from the body and should be regarded as a cumulative poison which cannot be made non-harmful [*CCINFO*] Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects.
Ingestion	There is strong evidence to suggest that this material can cause, if swallowed once, very serious, irreversible damage of organs. The material is not thought to produce adverse health effects following ingestion (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum. **Toxic effects** may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual. Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733)
Skin Contact	Skin contact with the material may produce toxic effects; systemic effects may result following absorption. There is strong evidence to suggest that this material, on a single contact with skin, can cause very serious, irreversible damage of organs. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected. There is strong evidence to suggest that this material, on a single contact with skin, can cause serious, irreversible damage of organs.
Eye	510meth There is some evidence that material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Moderate inflammation may be expected with redness; conjunctivitis may occur with prolonged exposure.
Chronic	Ample evidence exists, from results in experimentation, that developmental disorders are directly caused by human exposure to the material. Long-term exposure to methanol vapour, at concentrations exceeding 3000 ppm, may produce cumulative effects characterised by gastrointestinal disturbances (nausea, vomiting), headache, ringing in the ears, insomnia, trembling, unsteady gait, vertigo, conjunctivitis and clouded or double vision. Liver and/or kidney injury may also result.

	TOXICITY	IRRITATION
N-ethylperfluoro-1-octanesulfonamidoacetic acid (N-EtFOSAA)	Not Available	Not Available
methanol	TOXICITY	IRRITATION
	Dermal (rabbit) LD50: 15800 mg/kg[2]	Eye (rabbit): 100 mg/24h-moderate
	Inhalation (rat) LC50: 36208.63875 mg/l/1H[2]	Eye (rabbit): 40 mg-moderate
	Oral (rat) LD50: =5300 mg/kg[2]	Eye: no adverse effect observed (not irritating)[1]
		Skin (rabbit): 20 mg/24 h-moderate
		Skin: no adverse effect observed (not irritating)[1]
N-ethylperfluoro-1-octanesulfonamidoacetic acid	TOXICITY	IRRITATION
	Not Available	Not Available
water	TOXICITY	IRRITATION
	Oral (rat) LD50: >90000 mg/kg[2]	Not Available

Continued...

	TOXICITY	IRRITATION
sodium hydroxide	Dermal (rabbit) LD50: 1350 mg/kg[2]	Eye (rabbit): 0.05 mg/24h SEVERE
		Eye (rabbit):1 mg/24h SEVERE
		Eye (rabbit):1 mg/30s rinsed-SEVERE
		Eye: adverse effect observed (irritating)[1]
		Skin (rabbit): 500 mg/24h SEVERE
		Skin: adverse effect observed (corrosive)[1]

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

METHANOL	The material may cause skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin.
WATER	No significant acute toxicological data identified in literature search.
SODIUM HYDROXIDE	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

Acute Toxicity	✔	**Carcinogenicity**	✘
Skin Irritation/Corrosion	✘	**Reproductivity**	✔
Serious Eye Damage/Irritation	✔	**STOT - Single Exposure**	✔
Respiratory or Skin sensitisation	✘	**STOT - Repeated Exposure**	✘
Mutagenicity	✘	**Aspiration Hazard**	✘

Legend: ✘ *– Data either not available or does not fill the criteria for classification*
✔ *– Data available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
N-ethylperfluoro-1-octanesulfonamidoacetic acid (N-EtFOSAA)	Not Available	Not Available	Not Available	Not Available	Not Available

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
methanol	LC50	96	Fish	11-850mg/L	2
	EC50	48	Crustacea	>10-mg/L	2
	EC50	96	Algae or other aquatic plants	16.912mg/L	4
	BCF	24	Algae or other aquatic plants	0.05mg/L	4
	EC0	48	Crustacea	>10-mg/L	2
	NOEC	72	Crustacea	0.1mg/L	4

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
N-ethylperfluoro-1-octanesulfonamidoacetic acid	Not Available	Not Available	Not Available	Not Available	Not Available

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
water	LC50	96	Fish	897.520mg/L	3
	EC50	96	Algae or other aquatic plants	8768.874mg/L	3

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
sodium hydroxide	LC50	96	Fish	125mg/L	4
	EC50	48	Crustacea	40.4mg/L	2
	EC50	96	Algae or other aquatic plants	3180000mg/L	3
	NOEC	96	Fish	56mg/L	4

Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*

Continued...

For Methanol: Log Kow: -0.82 to -0.66; Koc: 1; Henry's Law Constant: 4.55x10-6 atm-cu m/mole; Vapor Pressure: 127 mm Hg; BCF: < 10.
Atmospheric Fate: Methanol is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase methanol is broken down in the atmosphere by reactions with hydroxyl radicals; the half-life for this reaction in air is estimated to be 17 days.
Terrestrial Fate: Methanol is expected to have very high mobility in soil.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
methanol	LOW	LOW
water	LOW	LOW
sodium hydroxide	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
methanol	LOW (BCF = 10)
water	LOW (LogKOW = -1.38)
sodium hydroxide	LOW (LogKOW = -3.8796)

Mobility in soil

Ingredient	Mobility
methanol	HIGH (KOC = 1)
water	LOW (KOC = 14.3)
sodium hydroxide	LOW (KOC = 14.3)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	▸ Containers may still present a chemical hazard/ danger when empty. ▸ Return to supplier for reuse/ recycling if possible. Otherwise: ▸ If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill. ▸ Where possible retain label warnings and SDS and observe all notices pertaining to the product. Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked. A Hierarchy of Controls seems to be common - the user should investigate: ▸ Reduction ▸ Reuse ▸ Recycling ▸ Disposal (if all else fails) This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. ▸ DO NOT allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal. ▸ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first. ▸ Where in doubt contact the responsible authority. ▸ Recycle wherever possible. ▸ Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified. ▸ Dispose of by: burial in a land-fill specifically licensed to accept chemical and / or pharmaceutical wastes or Incineration in a licensed apparatus (after admixture with suitable combustible material). ▸ Decontaminate empty containers.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	NO

Land transport (TDG)

UN number	1230
UN proper shipping name	METHANOL
Transport hazard class(es)	Class: 3 Subrisk: 6.1
Packing group	II

Continued...

Environmental hazard	Not Applicable
Special precautions for user	Special provisions: 43 Explosive Limit and Limited Quantity Index: 1 L ERAP Index: Not Applicable

Air transport (ICAO-IATA / DGR)

UN number	1230
UN proper shipping name	Methanol
Transport hazard class(es)	ICAO/IATA Class: 3 ICAO / IATA Subrisk: 6.1 ERG Code: 3L
Packing group	II
Environmental hazard	Not Applicable
Special precautions for user	Special provisions: A113 Cargo Only Packing Instructions: 364 Cargo Only Maximum Qty / Pack: 60 L Passenger and Cargo Packing Instructions: 352 Passenger and Cargo Maximum Qty / Pack: 1 L Passenger and Cargo Limited Quantity Packing Instructions: Y341 Passenger and Cargo Limited Maximum Qty / Pack: 1 L

Sea transport (IMDG-Code / GGVSee)

UN number	1230
UN proper shipping name	METHANOL
Transport hazard class(es)	IMDG Class: 3 IMDG Subrisk: 6.1
Packing group	II
Environmental hazard	Not Applicable
Special precautions for user	EMS Number: F-E , S-D Special provisions: 279 Limited Quantities: 1 L

Transport in bulk according to Annex II of MARPOL and the IBC code

SOURCE	PRODUCT NAME	POLLUTION CATEGORY	SHIP TYPE
	Methyl alcohol	Y	3

SECTION 15 REGULATORY INFORMATION

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

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

METHANOL IS FOUND ON THE FOLLOWING REGULATORY LISTS

Canada - Alberta Occupational Exposure Limits
Canada - British Columbia Occupational Exposure Limits
Canada - Manitoba Occupational Exposure Limits
Canada - Northwest Territories Occupational Exposure Limits
Canada - Nova Scotia Occupational Exposure Limits
Canada - Prince Edward Island Occupational Exposure Limits
Canada - Quebec Permissible Exposure Values for Airborne Contaminants
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances
Canada Categorization decisions for all DSL substances
Canada Domestic Substances List (DSL)
Canada Forensic Identification Services Chemical Carcinogenicity Evaluation - Table 1 - Chemicals Considered for Assessment
Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS GHS (English)
Canada Transport Dangerous Goods - Schedule 1
Canada Transport Dangerous Goods - Schedule 3
GESAMP/EHS Composite List - GESAMP Hazard Profiles
IMDG Code - Medical First Aid Guide for use in accidents involving Dangerous Goods (MFAG) - Appendix 15 List Of Substances
IMO IBC Code Chapter 17: Summary of minimum requirements
IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk
IMO MARPOL 73/78 (Annex II) - List of Other Liquid Substances
IMO Provisional Categorization of Liquid Substances - List 2: Pollutant only mixtures containing at least 99% by weight of components already assessed by IMO
International Air Transport Association (IATA) Dangerous Goods Regulations
International Maritime Dangerous Goods Requirements (IMDG Code)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

N-ETHYLPERFLUORO-1-OCTANESULFONAMIDOACETIC ACID IS FOUND ON THE FOLLOWING REGULATORY LISTS

Not Applicable

Continued...

WATER IS FOUND ON THE FOLLOWING REGULATORY LISTS

Canada Categorization decisions for all DSL substances
Canada Domestic Substances List (DSL)
Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS GHS (English)
IMO IBC Code Chapter 18: List of products to which the Code does not apply

SODIUM HYDROXIDE IS FOUND ON THE FOLLOWING REGULATORY LISTS

Canada - Alberta Occupational Exposure Limits
Canada - British Columbia Occupational Exposure Limits
Canada - Manitoba Occupational Exposure Limits
Canada - Northwest Territories Occupational Exposure Limits
Canada - Nova Scotia Occupational Exposure Limits
Canada - Prince Edward Island Occupational Exposure Limits
Canada - Quebec Permissible Exposure Values for Airborne Contaminants
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances
Canada Categorization decisions for all DSL substances
Canada Domestic Substances List (DSL)
Canada Forensic Identification Services Chemical Carcinogenicity Evaluation - Table 1 - Chemicals Considered for Assessment
Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS GHS (English)
Canada Transport Dangerous Goods - Schedule 1
Canada Transport Dangerous Goods - Schedule 3
GESAMP/EHS Composite List - GESAMP Hazard Profiles
IMO IBC Code Chapter 17: Summary of minimum requirements
IMO Provisional Categorization of Liquid Substances - List 3: (Trade-named) mixtures containing at least 99% by weight of components already assessed by IMO, presenting safety hazards
International Air Transport Association (IATA) Dangerous Goods Regulations
International Maritime Dangerous Goods Requirements (IMDG Code)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

National Inventory Status

National Inventory	Status
Australia - AICS	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
Canada - DSL	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
Canada - NDSL	No (methanol; water; sodium hydroxide; N-ethylperfluoro-1-octanesulfonamidoacetic acid)
China - IECSC	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
Europe - EINEC / ELINCS / NLP	Yes
Japan - ENCS	Yes
Korea - KECI	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
New Zealand - NZIoC	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
Philippines - PICCS	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
USA - TSCA	Yes
Taiwan - TCSI	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
Mexico - INSQ	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
Vietnam - NCI	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
Russia - ARIPS	No (N-ethylperfluoro-1-octanesulfonamidoacetic acid)
Legend:	*Yes = All CAS declared ingredients are on the inventory* *No = One or more of the CAS listed ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Revision Date	13/09/2019
Initial Date	05/10/2016

SDS Version Summary

Version	Issue Date	Sections Updated
5.7.1.1.1	13/09/2019	Chronic Health, Classification, Exposure Standard, Ingredients

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

Continued...

Powered by AuthorITe, from Chemwatch.

end of SDS

WELLINGTON LABORATORIES

SAFETY DATA SHEET

N-methylperfluoro-1-octanesulfonamidoacetic acid (N-MeFOSAA)

Wellington Laboratories Inc.

Chemwatch Hazard Alert Code: 4

Version No: **6.7**
Safety Data Sheet according to WHMIS 2015 requirements

Issue Date: **13/09/2019**
Print Date: **13/09/2019**
S.GHS.CAN.EN

SECTION 1 IDENTIFICATION

Product Identifier

Product name	N-methylperfluoro-1-octanesulfonamidoacetic acid (N-MeFOSAA)
Synonyms	Methyl alcohol (methanol),Methyl hydrate (methanol),Methylol (methanol)
Proper shipping name	METHANOL
Other means of identification	Not Available

Recommended use of the chemical and restrictions on use

Relevant identified uses	This product is a solution of organic compound(s) in methanol for laboratory use only (see section 3). This material should only be used by those persons trained in the safe handling of hazardous chemicals. Please refer to the Certificate of Analysis (CofA) for further product information. Wellington Laboratories Inc.

Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

Registered company name	**Wellington Laboratories Inc.**
Address	345 Southgate Drive Guelph Ontario N1G 3M5 Canada
Telephone	+1 519 822 2436
Fax	+1 519 822 2849
Website	www.well-labs.com
Email	MSDS@well-labs.com

Emergency phone number

Association / Organisation	**Wellington Laboratories Inc.**
Emergency telephone numbers	1-888-CANUTEC (226-8832) (North American)
Other emergency telephone numbers	1-613-996-6666 (International)

SECTION 2 HAZARD(S) IDENTIFICATION

Classification of the substance or mixture

NFPA 704 diamond

Note: The hazard category numbers found in GHS classification in section 2 of this SDSs are NOT to be used to fill in the NFPA 704 diamond. Blue = Health Red = Fire Yellow = Reactivity White = Special (Oxidizer or water reactive substances)

Classification	Eye Irritation Category 2A, Acute Toxicity (Dermal) Category 3, Specific target organ toxicity - single exposure Category 1, Flammable Liquid Category 2, Acute Toxicity (Inhalation) Category 3, Reproductive Toxicity Category 1B, Acute Toxicity (Oral) Category 3

Label elements

Hazard pictogram(s)	
SIGNAL WORD	DANGER

Hazard statement(s)

H319	Causes serious eye irritation.
H311	Toxic in contact with skin.

Continued...

H370	Causes damage to organs.
H225	Highly flammable liquid and vapour.
H331	Toxic if inhaled.
H360	May damage fertility or the unborn child.
H301	Toxic if swallowed.

Physical and Health hazard(s) not otherwise classified

Not Applicable

Supplementary statement(s)

Not Applicable

CLP classification (additional)

Not Applicable

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.
P270	Do not eat, drink or smoke when using this product.

Precautionary statement(s) Response

P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/physician/first aider.
P308+P311	IF exposed or concerned: Call a POISON CENTER/doctor/physician/first aider.
P321	Specific treatment (see advice on this label).
P330	Rinse mouth.

Precautionary statement(s) Storage

P403+P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
67-56-1	98.994	methanol
2355-31-9*	0.006	N-methylperfluoro-1-octanesulfonamidoacetic acid
7732-18-5	0.99	water
1310-73-2	<0.01	sodium hydroxide

SECTION 4 FIRST-AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Immediately hold eyelids apart and flush the eye continuously with running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. ▸ Transport to hospital or doctor without delay. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Immediately flush body and clothes with large amounts of water, using safety shower if available. ▸ Quickly remove all contaminated clothing, including footwear. ▸ Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre. ▸ Transport to hospital, or doctor.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor, without delay.

Continued...

Ingestion	▸ Immediately give a glass of water. ▸ First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor. ▸ If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

Indication of any immediate medical attention and special treatment needed

Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically. Mechanical means should be used if it is considered necessary to evacuate the stomach contents; these include gastric lavage after endotracheal intubation. If spontaneous vomiting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours.
For acute and short term repeated exposures to methanol:

- Toxicity results from accumulation of formaldehyde/formic acid.
- Clinical signs are usually limited to CNS, eyes and GI tract Severe metabolic acidosis may produce dyspnea and profound systemic effects which may become intractable. All symptomatic patients should have arterial pH measured. Evaluate airway, breathing and circulation.
- Stabilise obtunded patients by giving naloxone, glucose and thiamine.
- Decontaminate with Ipecac or lavage for patients presenting 2 hours post-ingestion. Charcoal does not absorb well; the usefulness of cathartic is not established.
- Forced diuresis is not effective; haemodialysis is recommended where peak methanol levels exceed 50 mg/dL (this correlates with serum bicarbonate levels below 18 meq/L).
- Ethanol, maintained at levels between 100 and 150 mg/dL, inhibits formation of toxic metabolites and may be indicated when peak methanol levels exceed 20 mg/dL. An intravenous solution of ethanol in D5W is optimal.
- Folate, as leucovorin, may increase the oxidative removal of formic acid. 4-methylpyrazole may be an effective adjunct in the treatment. 8.Phenytoin may be preferable to diazepam for controlling seizure.

[Ellenhorn Barceloux: Medical Toxicology]

BIOLOGICAL EXPOSURE INDEX - BEI

Determinant	Index	Sampling Time	Comment
1. Methanol in urine	15 mg/l	End of shift	B, NS
2. Formic acid in urine	80 mg/gm creatinine	Before the shift at end of workweek	B, NS

B: Background levels occur in specimens collected from subjects **NOT** exposed.

NS: Non-specific determinant - observed following exposure to other materials.

SECTION 5 FIRE-FIGHTING MEASURES

Extinguishing media

Water may be an ineffective extinguishing media for methanol fires; static explosions are reported for aqueous solutions as dilute as 30%. Water may be used to cool containers.

- Alcohol stable foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

Special hazards arising from the substrate or mixture

Fire Incompatibility	▸ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

Special protective equipment and precautions for fire-fighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ May be violently or explosively reactive. ▸ Wear full body protective clothing with breathing apparatus. ▸ Prevent, by any means available, spillage from entering drains or water course.
Fire/Explosion Hazard	▸ Liquid and vapour are highly flammable. ▸ Severe fire hazard when exposed to heat, flame and/or oxidisers. ▸ Vapour may travel a considerable distance to source of ignition. ▸ Heating may cause expansion or decomposition leading to violent rupture of containers. Combustion products include: carbon dioxide (CO_2) formaldehyde other pyrolysis products typical of burning organic material.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	▸ Remove all ignition sources. ▸ Clean up all spills immediately. ▸ Avoid breathing vapours and contact with skin and eyes. ▸ Control personal contact with the substance, by using protective equipment.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ May be violently or explosively reactive. ▸ Wear full body protective clothing with breathing apparatus.

Continued...

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ Containers, even those that have been emptied, may contain explosive vapours. ▸ Do NOT cut, drill, grind, weld or perform similar operations on or near containers. ▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs. ▸ Use in a well-ventilated area. ▸ Prevent concentration in hollows and sumps. ▸ **DO NOT** allow clothing wet with material to stay in contact with skin
Other information	▸ Store in original containers in approved flame-proof area. ▸ No smoking, naked lights, heat or ignition sources. ▸ **DO NOT** store in pits, depressions, basements or areas where vapours may be trapped. ▸ Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Glass container is suitable for laboratory quantities ▸ Packing as supplied by manufacturer. ▸ Plastic containers may only be used if approved for flammable liquid. ▸ Check that containers are clearly labelled and free from leaks. ▸ For low viscosity materials (i) : Drums and jerry cans must be of the non-removable head type. (ii) : Where a can is to be used as an inner package, the can must have a screwed enclosure. ▸ For materials with a viscosity of at least 2680 cSt. (23 deg. C) ▸ For manufactured product having a viscosity of at least 250 cSt.
Storage incompatibility	Methanol: ▸ reacts violently with strong oxidisers, acetyl bromide, alkyl aluminium salts, beryllium dihydride, bromine, chromic acid, 1-chloro-3,3-difluoro-2-methoxycyclopropene, cyanuric chloride, diethylzinc, isophthaloyl chloride, nitric acid, perchloric acid, potassium-tert-butoxide, potassium sulfur diimide, Raney nickel catalysts, 2,4,6-trichlorotriazine, triethylaluminium, 1,3,3-trifluoro-2-methoxycyclopropene ▸ is incompatible with strong acids, strong caustics, alkaline earth and alkali metals, aliphatic amines, acetaldehyde, benzoyl peroxide, 1,3-bis(di-n-cyclopentadienyl iron)-2-propen-1-one, calcium carbide, chloroform, chromic anhydride, chromium trioxide, dialkylzinc, dichlorine oxide, dichloromethane, ethylene oxide, hypochlorous acid, isocyanates, isopropyl chlorocarbonate, lithium tetrahydroaluminate, magnesium, methyl azide, nitrogen dioxide, palladium, pentafluoroguanidine, perchloryl fluoride, phosphorus pentasulfide, phosphorus trioxide, potassium, tangerine oil, triisobutylaluminium ▸ mixtures with lead perchlorate, sodium hypochlorite are explosive ▸ may react with metallic aluminium at high temperatures ▸ slowly corrodes lead and aluminium ▸ may generate electrostatic charges, due to low conductivity, on flow or agitation ▸ attacks some plastics, rubber and coatings. Static induced flash fires have happened when filling plastic containers with methanol / water solutions with as low as 30% methanol content Alcohols ▸ are incompatible with strong acids, acid chlorides, acid anhydrides, oxidising and reducing agents. ▸ reacts, possibly violently, with alkaline metals and alkaline earth metals to produce hydrogen ▸ react with strong acids, strong caustics, aliphatic amines, isocyanates, acetaldehyde, benzoyl peroxide, chromic acid, chromium oxide, dialkylzincs, dichlorine oxide, ethylene oxide, hypochlorous acid, isopropyl chlorocarbonate, lithium tetrahydroaluminate, nitrogen dioxide, pentafluoroguanidine, phosphorus halides, phosphorus pentasulfide, tangerine oil, triethylaluminium, triisobutylaluminium ▸ should not be heated above 49 deg. C. when in contact with aluminium equipment ▸ Avoid storage with reducing agents.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	methanol	Methyl alcohol (methanol) - Skin	200 ppm / 260 mg/m3	310 mg/m3 / 250 ppm	Not Available	Not Available
Canada - Nova Scotia Occupational Exposure Limits	methanol	Methanol	200 ppm	250 ppm	Not Available	TLV Basis: headache; eye damage. BEI
Canada - Alberta Occupational Exposure Limits	methanol	Methanol (Methyl alcohol)	200 ppm / 262 mg/m3	328 mg/m3 / 250 ppm	Not Available	Not Available
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	methanol	Methyl alcohol (methanol)	200 ppm	250 ppm	Not Available	Skin
Canada - Manitoba Occupational Exposure Limits	methanol	Not Available	200 ppm	250 ppm	Not Available	TLV® Basis: Headache; eye dam; dizziness; nausea; BEI
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	methanol	Methyl alcohol	200 ppm / 262 mg/m3	328 mg/m3 / 250 ppm	Not Available	Not Available
Canada - Northwest Territories Occupational Exposure Limits (English)	methanol	Methyl alcohol (methanol)	200 ppm	250 ppm	Not Available	Skin

Continued...

Canada - British Columbia Occupational Exposure Limits	methanol	Methanol	200 ppm	250 ppm	Not Available	Not Available
Canada - Prince Edward Island Occupational Exposure Limits	methanol	Methanol	200 ppm	250 ppm	Not Available	TLV® Basis: Headache; eye dam; dizziness; nausea; BEI
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	sodium hydroxide	Sodium hydroxide	2 mg/m3	Not Available	Not Available	Not Available
Canada - Nova Scotia Occupational Exposure Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	TLV Basis: upper respiratory tract, eye & skin irritation
Canada - Alberta Occupational Exposure Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - Manitoba Occupational Exposure Limits	sodium hydroxide	Not Available	Not Available	Not Available	2 mg/m3	TLV® Basis: URT, eye, & skin irr
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - Northwest Territories Occupational Exposure Limits (English)	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - British Columbia Occupational Exposure Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	Not Available
Canada - Prince Edward Island Occupational Exposure Limits	sodium hydroxide	Sodium hydroxide	Not Available	Not Available	2 mg/m3	TLV® Basis: URT, eye, & skin irr

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
methanol	Methyl alcohol; (Methanol)	Not Available	Not Available	Not Available
sodium hydroxide	Sodium hydroxide	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
methanol	6,000 ppm	Not Available
N-methylperfluoro-1-octanesulfonamidoacetic acid	Not Available	Not Available
water	Not Available	Not Available
sodium hydroxide	10 mg/m3	Not Available

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection. The basic types of engineering controls are: Process controls which involve changing the way a job activity or process is done to reduce the risk. Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment.
Personal protection	
Eye and face protection	▸ Safety glasses with side shields. ▸ Chemical goggles. ▸ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task.
Skin protection	See Hand protection below
Hands/feet protection	▸ Wear chemical protective gloves, e.g. PVC. ▸ Wear safety footwear or safety gumboots, e.g. Rubber The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and.has to be observed when making a final choice. Personal hygiene is a key element of effective hand care.
Body protection	See Other protection below
Other protection	▸ Overalls. ▸ PVC Apron. ▸ PVC protective suit may be required if exposure severe. ▸ Eyewash unit.

Continued...

- Some plastic personal protective equipment (PPE) (e.g. gloves, aprons, overshoes) are not recommended as they may produce static electricity.
- For large scale or continuous use wear tight-weave non-static clothing (no metallic fasteners, cuffs or pockets).
- Non sparking safety or conductive footwear should be considered. Conductive footwear describes a boot or shoe with a sole made from a conductive compound chemically bound to the bottom components, for permanent control to electrically ground the foot an shall dissipate static electricity from the body to reduce the possibility of ignition of volatile compounds.

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
N-methylperfluoro-1-octanesulfonamidoacetic acid (N-MeFOSAA)

Material	CPI
BUTYL	A
NEOPRENE	B
BUTYL/NEOPRENE	C
NAT+NEOPR+NITRILE	C
NATURAL RUBBER	C
NATURAL+NEOPRENE	C
NEOPRENE/NATURAL	C
NITRILE	C
NITRILE+PVC	C
PE	C
PE/EVAL/PE	C
PVA	C
PVC	C
PVDC/PE/PVDC	C
SARANEX-23	C
SARANEX-23 2-PLY	C
TEFLON	C
VITON	C
VITON/CHLOROBUTYL	C
VITON/NEOPRENE	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

Respiratory protection

Type AX Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Where the concentration of gas/particulates in the breathing zone, approaches or exceeds the "Exposure Standard" (or ES), respiratory protection is required. Degree of protection varies with both face-piece and Class of filter; the nature of protection varies with Type of filter.

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	AX-AUS	-	AX-PAPR-AUS / Class 1
up to 50 x ES	-	AX-AUS / Class 1	-
up to 100 x ES	-	AX-2	AX-PAPR-2 ^

^ - Full-face
A(All classes) = Organic vapours, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

- **Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.**
- **The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.**
- **Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used**

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Not Available		
Physical state	Liquid	**Relative density (Water = 1)**	0.791
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	455
pH (as supplied)	Not Applicable	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	-98	**Viscosity (cSt)**	Not Available
Initial boiling point and boiling range (°C)	64.7	**Molecular weight (g/mol)**	32.04
Flash point (°C)	12	**Taste**	Not Available
Evaporation rate	4.1 BuAC = 1	**Explosive properties**	Not Available
Flammability	HIGHLY FLAMMABLE.	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	31	**Surface Tension (dyn/cm or mN/m)**	Not Available
Lower Explosive Limit (%)	6	**Volatile Component (%vol)**	Not Available
Vapour pressure (kPa)	13	**Gas group**	Not Available

Continued...

Solubility in water	Immiscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	1.11	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Static induced flash fires have happened when filling plastic containers with methanol / water solutions with as low as 30% methanol content. ▸ Unstable in the presence of incompatible materials. ▸ Product is considered stable. ▸ Hazardous polymerisation will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	There is strong evidence to suggest that this material can cause, if inhaled once, very serious, irreversible damage of organs. The material is not thought to produce either adverse health effects or irritation of the respiratory tract following inhalation (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum and that suitable control measures be used in an occupational setting. Minor but regular methanol exposures may effect the central nervous system, optic nerves and retinae. Symptoms may be delayed, with headache, fatigue, nausea, blurring of vision and double vision. Continued or severe exposures may cause damage to optic nerves, which may become severe with permanent visual impairment even blindness resulting. **WARNING**: Methanol is only slowly eliminated from the body and should be regarded as a cumulative poison which cannot be made non-harmful [*CCINFO*] Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may produce toxic effects.
Ingestion	There is strong evidence to suggest that this material can cause, if swallowed once, very serious, irreversible damage of organs. The material is not thought to produce adverse health effects following ingestion (as classified by EC Directives using animal models). Nevertheless, adverse systemic effects have been produced following exposure of animals by at least one other route and good hygiene practice requires that exposure be kept to a minimum. **Toxic effects** may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual. Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733)
Skin Contact	Skin contact with the material may produce toxic effects; systemic effects may result following absorption. There is strong evidence to suggest that this material, on a single contact with skin, can cause very serious, irreversible damage of organs. Open cuts, abraded or irritated skin should not be exposed to this material Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected. There is strong evidence to suggest that this material, on a single contact with skin, can cause serious, irreversible damage of organs.
Eye	510meth There is some evidence that material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Moderate inflammation may be expected with redness; conjunctivitis may occur with prolonged exposure.
Chronic	Ample evidence exists, from results in experimentation, that developmental disorders are directly caused by human exposure to the material. Long-term exposure to methanol vapour, at concentrations exceeding 3000 ppm, may produce cumulative effects characterised by gastrointestinal disturbances (nausea, vomiting), headache, ringing in the ears, insomnia, trembling, unsteady gait, vertigo, conjunctivitis and clouded or double vision. Liver and/or kidney injury may also result.

	TOXICITY	IRRITATION
N-methylperfluoro-1-octanesulfonamidoacetic acid (N-MeFOSAA)	Not Available	Not Available
methanol	TOXICITY	IRRITATION
	Dermal (rabbit) LD50: 15800 mg/kg[2]	Eye (rabbit): 100 mg/24h-moderate
	Inhalation (rat) LC50: 36208.63875 mg/l/1H[2]	Eye (rabbit): 40 mg-moderate
	Oral (rat) LD50: =5300 mg/kg[2]	Eye: no adverse effect observed (not irritating)[1]
		Skin (rabbit): 20 mg/24 h-moderate
		Skin: no adverse effect observed (not irritating)[1]
N-methylperfluoro-1-octanesulfonamidoacetic acid	TOXICITY	IRRITATION
	Not Available	Not Available
water	TOXICITY	IRRITATION
	Oral (rat) LD50: >90000 mg/kg[2]	Not Available

Continued...

	TOXICITY	IRRITATION
sodium hydroxide	Dermal (rabbit) LD50: 1350 mg/kg[2]	Eye (rabbit): 0.05 mg/24h SEVERE
		Eye (rabbit):1 mg/24h SEVERE
		Eye (rabbit):1 mg/30s rinsed-SEVERE
		Eye: adverse effect observed (irritating)[1]
		Skin (rabbit): 500 mg/24h SEVERE
		Skin: adverse effect observed (corrosive)[1]

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

METHANOL	The material may cause skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin.
WATER	No significant acute toxicological data identified in literature search.
SODIUM HYDROXIDE	Asthma-like symptoms may continue for months or even years after exposure to the material ends. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur after exposure to high levels of highly irritating compound. Main criteria for diagnosing RADS include the absence of previous airways disease in a non-atopic individual, with sudden onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. Other criteria for diagnosis of RADS include a reversible airflow pattern on lung function tests, moderate to severe bronchial hyperreactivity on methacholine challenge testing, and the lack of minimal lymphocytic inflammation, without eosinophilia. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

Acute Toxicity	✔	**Carcinogenicity**	✘
Skin Irritation/Corrosion	✘	**Reproductivity**	✔
Serious Eye Damage/Irritation	✔	**STOT - Single Exposure**	✔
Respiratory or Skin sensitisation	✘	**STOT - Repeated Exposure**	✘
Mutagenicity	✘	**Aspiration Hazard**	✘

Legend: ✘ *– Data either not available or does not fill the criteria for classification*
✔ *– Data available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
N-methylperfluoro-1-octanesulfonamidoacetic acid (N-MeFOSAA)	Not Available	Not Available	Not Available	Not Available	Not Available

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
methanol	LC50	96	Fish	11-850mg/L	2
	EC50	48	Crustacea	>10-mg/L	2
	EC50	96	Algae or other aquatic plants	16.912mg/L	4
	BCF	24	Algae or other aquatic plants	0.05mg/L	4
	EC0	48	Crustacea	>10-mg/L	2
	NOEC	72	Crustacea	0.1mg/L	4

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
N-methylperfluoro-1-octanesulfonamidoacetic acid	Not Available	Not Available	Not Available	Not Available	Not Available

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
water	LC50	96	Fish	897.520mg/L	3
	EC50	96	Algae or other aquatic plants	8768.874mg/L	3

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
sodium hydroxide	LC50	96	Fish	125mg/L	4
	EC50	48	Crustacea	40.4mg/L	2
	EC50	96	Algae or other aquatic plants	3180000mg/L	3
	NOEC	96	Fish	56mg/L	4

Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*

Continued...

For Methanol: Log Kow: -0.82 to -0.66; Koc: 1; Henry's Law Constant: 4.55x10-6 atm-cu m/mole; Vapor Pressure: 127 mm Hg; BCF: < 10.
Atmospheric Fate: Methanol is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase methanol is broken down in the atmosphere by reactions with hydroxyl radicals; the half-life for this reaction in air is estimated to be 17 days.
Terrestrial Fate: Methanol is expected to have very high mobility in soil.
DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
methanol	LOW	LOW
water	LOW	LOW
sodium hydroxide	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
methanol	LOW (BCF = 10)
water	LOW (LogKOW = -1.38)
sodium hydroxide	LOW (LogKOW = -3.8796)

Mobility in soil

Ingredient	Mobility
methanol	HIGH (KOC = 1)
water	LOW (KOC = 14.3)
sodium hydroxide	LOW (KOC = 14.3)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal

- Containers may still present a chemical hazard/ danger when empty.
- Return to supplier for reuse/ recycling if possible.

Otherwise:

- If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
- Where possible retain label warnings and SDS and observe all notices pertaining to the product.

Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use.

- **DO NOT** allow wash water from cleaning or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: burial in a land-fill specifically licensed to accept chemical and / or pharmaceutical wastes or Incineration in a licensed apparatus (after admixture with suitable combustible material).
- Decontaminate empty containers.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	NO

Land transport (TDG)

UN number	1230
UN proper shipping name	METHANOL
Transport hazard class(es)	Class: 3 Subrisk: 6.1
Packing group	II

Continued...

Environmental hazard	Not Applicable
Special precautions for user	Special provisions: 43 Explosive Limit and Limited Quantity Index: 1 L ERAP Index: Not Applicable

Air transport (ICAO-IATA / DGR)

UN number	1230
UN proper shipping name	Methanol
Transport hazard class(es)	ICAO/IATA Class: 3 ICAO / IATA Subrisk: 6.1 ERG Code: 3L
Packing group	II
Environmental hazard	Not Applicable
Special precautions for user	Special provisions: A113 Cargo Only Packing Instructions: 364 Cargo Only Maximum Qty / Pack: 60 L Passenger and Cargo Packing Instructions: 352 Passenger and Cargo Maximum Qty / Pack: 1 L Passenger and Cargo Limited Quantity Packing Instructions: Y341 Passenger and Cargo Limited Maximum Qty / Pack: 1 L

Sea transport (IMDG-Code / GGVSee)

UN number	1230
UN proper shipping name	METHANOL
Transport hazard class(es)	IMDG Class: 3 IMDG Subrisk: 6.1
Packing group	II
Environmental hazard	Not Applicable
Special precautions for user	EMS Number: F-E , S-D Special provisions: 279 Limited Quantities: 1 L

Transport in bulk according to Annex II of MARPOL and the IBC code

SOURCE	PRODUCT NAME	POLLUTION CATEGORY	SHIP TYPE
	Methyl alcohol	Y	3

SECTION 15 REGULATORY INFORMATION

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

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

METHANOL IS FOUND ON THE FOLLOWING REGULATORY LISTS

Canada - Alberta Occupational Exposure Limits
Canada - British Columbia Occupational Exposure Limits
Canada - Manitoba Occupational Exposure Limits
Canada - Northwest Territories Occupational Exposure Limits
Canada - Nova Scotia Occupational Exposure Limits
Canada - Prince Edward Island Occupational Exposure Limits
Canada - Quebec Permissible Exposure Values for Airborne Contaminants
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances
Canada Categorization decisions for all DSL substances
Canada Domestic Substances List (DSL)
Canada Forensic Identification Services Chemical Carcinogenicity Evaluation - Table 1 - Chemicals Considered for Assessment
Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS GHS (English)
Canada Transport Dangerous Goods - Schedule 1
Canada Transport Dangerous Goods - Schedule 3
GESAMP/EHS Composite List - GESAMP Hazard Profiles
IMDG Code - Medical First Aid Guide for use in accidents involving Dangerous Goods (MFAG) - Appendix 15 List Of Substances
IMO IBC Code Chapter 17: Summary of minimum requirements
IMO MARPOL (Annex II) - List of Noxious Liquid Substances Carried in Bulk
IMO MARPOL 73/78 (Annex II) - List of Other Liquid Substances
IMO Provisional Categorization of Liquid Substances - List 2: Pollutant only mixtures containing at least 99% by weight of components already assessed by IMO
International Air Transport Association (IATA) Dangerous Goods Regulations
International Maritime Dangerous Goods Requirements (IMDG Code)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

N-METHYLPERFLUORO-1-OCTANESULFONAMIDOACETIC ACID IS FOUND ON THE FOLLOWING REGULATORY LISTS

Not Applicable

Continued...

WATER IS FOUND ON THE FOLLOWING REGULATORY LISTS

Canada Categorization decisions for all DSL substances
Canada Domestic Substances List (DSL)
Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS GHS (English)
IMO IBC Code Chapter 18: List of products to which the Code does not apply

SODIUM HYDROXIDE IS FOUND ON THE FOLLOWING REGULATORY LISTS

Canada - Alberta Occupational Exposure Limits
Canada - British Columbia Occupational Exposure Limits
Canada - Manitoba Occupational Exposure Limits
Canada - Northwest Territories Occupational Exposure Limits
Canada - Nova Scotia Occupational Exposure Limits
Canada - Prince Edward Island Occupational Exposure Limits
Canada - Quebec Permissible Exposure Values for Airborne Contaminants
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances
Canada Categorization decisions for all DSL substances
Canada Domestic Substances List (DSL)
Canada Forensic Identification Services Chemical Carcinogenicity Evaluation - Table 1 - Chemicals Considered for Assessment
Canada Toxicological Index Service - Workplace Hazardous Materials Information System - WHMIS GHS (English)
Canada Transport Dangerous Goods - Schedule 1
Canada Transport Dangerous Goods - Schedule 3
GESAMP/EHS Composite List - GESAMP Hazard Profiles
IMO IBC Code Chapter 17: Summary of minimum requirements
IMO Provisional Categorization of Liquid Substances - List 3: (Trade-named) mixtures containing at least 99% by weight of components already assessed by IMO, presenting safety hazards
International Air Transport Association (IATA) Dangerous Goods Regulations
International Maritime Dangerous Goods Requirements (IMDG Code)
United Nations Recommendations on the Transport of Dangerous Goods Model Regulations

National Inventory Status

National Inventory	Status
Australia - AICS	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Canada - DSL	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Canada - NDSL	No (methanol; water; N-methylperfluoro-1-octanesulfonamidoacetic acid; sodium hydroxide)
China - IECSC	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Europe - EINEC / ELINCS / NLP	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Japan - ENCS	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Korea - KECI	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
New Zealand - NZIoC	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Philippines - PICCS	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
USA - TSCA	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Taiwan - TCSI	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Mexico - INSQ	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Vietnam - NCI	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Russia - ARIPS	No (N-methylperfluoro-1-octanesulfonamidoacetic acid)
Legend:	*Yes = All CAS declared ingredients are on the inventory* *No = One or more of the CAS listed ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Revision Date	13/09/2019
Initial Date	05/10/2016

SDS Version Summary

Version	Issue Date	Sections Updated
5.7.1.1.1	13/09/2019	Chronic Health, Classification, Exposure Standard, Ingredients

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

Continued...

Powered by AuthorITe, from Chemwatch.

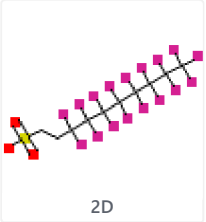
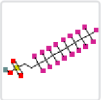
end of SDS

PubChem

COMPOUND SUMMARY

3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-Heptadecafluorodecane-1-sulfonate

Cite Download

PubChem CID	20734545
Structure	 2D Find Similar Structures
Molecular Formula	$C_{10}H_4F_{17}O_3S^-$
Synonyms	8:2 Fluorotelomer sulfonate DTXSID80873416 3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecane-1-sulfonate 481071-78-7
Molecular Weight	527.18
Parent Compound	 CID 3016044 (3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-Heptadecafluorodecanesulphonic acid)
Dates	Modify 2021-05-22 Create 2007-12-05

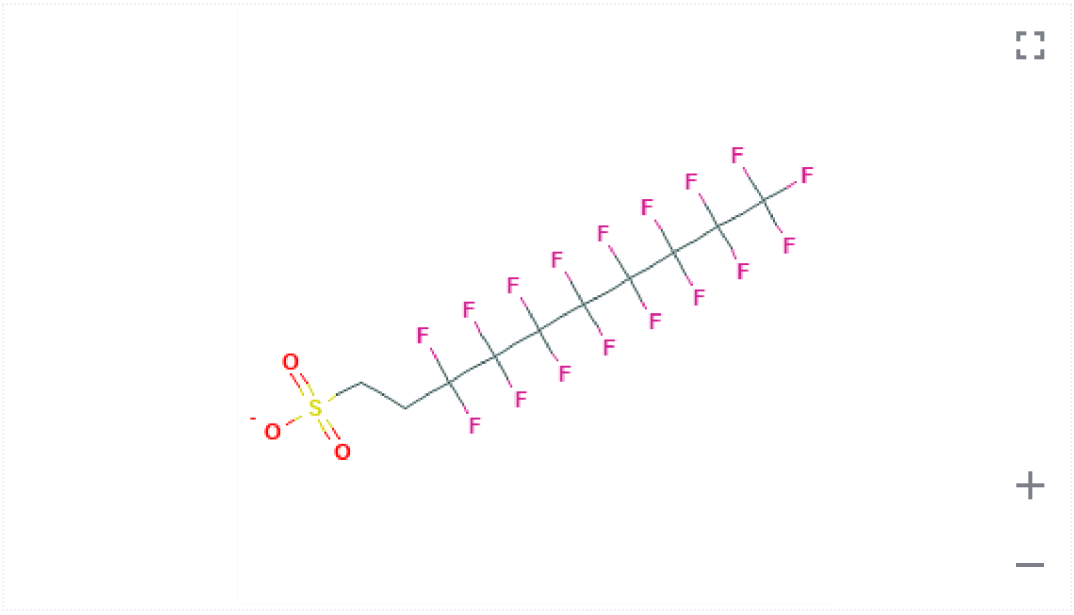
Contents

1 Structures
2 Names and Identifiers
3 Chemical and Physical Properties
4 Related Records
5 Patents
6 Classification
7 Information Sources

1 Structures

1.1 2D Structure

Chemical Structure Depiction



PubChem

1.2 3D Status

Conformer generation failed at clustering step

PubChem

2 Names and Identifiers

2.1 Computed Descriptors

2.1.1 IUPAC Name

3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecane-1-sulfonate

Computed by LexiChem 2.6.6 (PubChem release 2019.06.18)

PubChem

2.1.2 InChI

InChI=1S/C10H5F17O3S/c11-3(12,1-2-31(28,29)30)4(13,14)5(15,16)6(17,18)7(19,20)8(21,22)9(23,24)10(25,26)27/h1-2H2,(H,28,29,30)/p-1

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.3 InChI Key

ALVYVCQIFHTIRD-UHFFFAOYSA-M

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.4 Canonical SMILES

C(CS(=O)(=O)[O-])C(C(C(C(C(C(C(C(F)(F)F)(F)F)(F)F)(F)F)(F)F)(F)F)(F)F)(F)F

Computed by OEChem 2.1.5 (PubChem release 2019.06.18)

PubChem

2.2 Molecular Formula

C10H4F17O3S-

Computed by PubChem 2.1 (PubChem release 2019.06.18)

PubChem

2.3 Other Identifiers

2.3.1 Wikipedia

8:2 Fluorotelomer sulfonate

Wikipedia

2.4 Synonyms

2.4.1 Depositor-Supplied Synonyms

8:2 Fluorotelomer sulfonate
DTXSID80873416
3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-heptadecafluorodecane-1-sulfonate
481071-78-7

PubChem

3 Chemical and Physical Properties

3.1 Computed Properties

Property Name	Property Value	Reference
Molecular Weight	527.18	Computed by PubChem 2.1 (PubChem release 2021.05.07)
XLogP3-AA	5.2	Computed by XLogP3 3.0 (PubChem release 2019.06.18)
Hydrogen Bond Donor Count	0	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Hydrogen Bond Acceptor Count	20	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Rotatable Bond Count	8	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Exact Mass	526.9609689	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Monoisotopic Mass	526.9609689	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Topological Polar Surface Area	65.6 Å²	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Heavy Atom Count	31	Computed by PubChem
Formal Charge	-1	Computed by PubChem
Complexity	747	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Isotope Atom Count	0	Computed by PubChem
Defined Atom Stereocenter Count	0	Computed by PubChem
Undefined Atom Stereocenter Count	0	Computed by PubChem
Defined Bond Stereocenter Count	0	Computed by PubChem
Undefined Bond Stereocenter Count	0	Computed by PubChem
Covalently-Bonded Unit Count	1	Computed by PubChem
Compound Is Canonicalized	Yes	Computed by PubChem (release 2010.01.29)

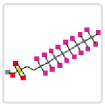
PubChem

4 Related Records

4.1 Related Compounds with Annotation

PubChem

4.2 Parent Compound



CID 3016044 (3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-Heptadecafluorodecanesulphonic acid)

PubChem

4.3 Related Compounds

Same Parent, Exact	11 Records
Mixtures, Components, and Neutralized Forms	1 Record
Similar Compounds	545 Records

PubChem

4.4 Substances

4.4.1 Related Substances

Same	5 Records

PubChem

4.4.2 Substances by Category

PubChem

5 Patents

5.1 Depositor-Supplied Patent Identifiers

PubChem

Link to all deposited patent identifiers

PubChem

5.2 WIPO PATENTSCOPE

Patents are available for this chemical structure:

https://patentscope.wipo.int/search/en/result.jsf?inchikey=ALVYVCQIFHTIRD-UHFFFAOYSA-M

PATENTSCOPE (WIPO)

6 Classification

6.1 Ontologies

6.1.1 EPA DSSTox Classification

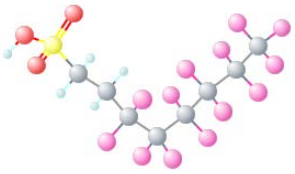
EPA DSSTox

7 Information Sources

FILTER BY SOURCE ALL SOURCES

1. **Wikipedia**
   8:2 Fluorotelomer sulfonate
   https://www.wikidata.org/wiki/Q81978900
2. **PubChem**
   https://pubchem.ncbi.nlm.nih.gov
3. **EPA DSSTox**
   CompTox Chemicals Dashboard Chemical Lists
   https://comptox.epa.gov/dashboard/chemical_lists/
4. **PATENTSCOPE (WIPO)**
   SID 390138071
   https://pubchem.ncbi.nlm.nih.gov/substance/390138071

6:2 Fluorotelomer Sulfonate (6:2 FTS)
TOXICOLOGY AT A GLANCE



6:2 FTS

- In 2012-2015, the U.S. metal plating industry transitioned from PFOS to short-chain fluorotelomers (e.g., 6:2) FTS in their chromium electroplating processes.
- The standard suite of tests conducted for regulatory approval of industry manufacture and use is available for 6:2 FTS.
- Based on currently available data, 6:2 FTS is less toxic and less persistent in the environment compared to PFOS and does not bioaccumulate.

Mammalian Toxicology

- ✓ Several short duration studies show that 6:2 FTS can cause kidney and liver damage in rodent models.
- ✓ 6:2 FTS does not cause DNA damage.
- ✓ 6:2 FTS does not cause damage to the reproductive system or to the developing fetus in available rodent models.
- ✓ No chronic studies are currently available.
- ✓ No studies have been conducted to assess cancer, immune system toxicity, or endocrine disruption following 6:2 FTS exposure.

Ecological Toxicology

- ✓ 6:2 FTS is less toxic than PFOS in studies with fish, algae, water fleas (*Daphnia*), and earthworms.
- ✓ 6:2 FTS does not bioaccumulate in fish.
- ✓ A peer-reviewed aquatic hazard assessment concluded that 6:2 FTS presents little risk to aquatic organisms.

Human Exposure

- ✓ Human exposure is assessed by analyzing blood for the presence of 6:2 FTS; so far, only 4 studies have looked for 6:2 FTS in human blood.
- ✓ Available data indicate that the general population's exposure to 6:2 FTS is low and infrequent.
- ✓ 6:2 FTS has been detected at low levels in some consumer products, drinking water, air, and fish; human exposure may occur through any of these sources.

Environmental Occurrence

- ✓ 6:2 FTS has been found in air, snow, soil, groundwater, and surface water.
- ✓ 6:2 FTS has been detected at sites associated with fluorochemical manufacture or use of certain fire-fighting foams.
- ✓ 6:2 FTS is less persistent than PFOS.
- ✓ 6:2 FTS can degrade to short-chain perfluorinated compounds, but does not degrade to PFOS.
- ✓ Perfluorohexanoic and perfluoropentanoic acids are the primary degradation products, however, not all degradation products have been identified or well-studied.

Toxicology of 6:2 Fluorotelomer Sulfonate (6:2 FTS)

Historically, the metal plating industry has used, and continues to use, per- and polyfluoroalkyl substances (PFAS) in some metal plating applications. Most notably, beginning in the 1980s, perfluorooctanesulfonic acid (PFOS) was used as a mist suppressant in hard and decorative chromium plating, chromic acid anodizing, and chromium etch for plating on plastic processes. Due to concerns relating to toxicity and environmental persistence, the chrome plating industry transitioned from using PFOS to using a newer formulation, primarily using 6:2 fluorotelomer sulfonate (6:2 FTS), between 2012-2015. Compared to PFOS, 6:2 FTS has an improved toxicity profile in both rodent and ecological models, and is less persistent than PFOS in the environment and is not bioaccumulative. Further, available studies indicate that human exposure to 6:2 FTS is low and infrequent; comparatively, PFOS is detected in the blood of >99% of Americans. Collectively, available toxicology studies indicate that 6:2 FTS is a safer alternative to PFOS. However, significant data gaps do exist.

1. Mammalian Toxicology of 6:2 FTS

Hundreds of studies have been conducted on PFAS, such as PFOS, in laboratory animals including mice, rats, and primates. Furthermore, over 100 human epidemiology studies have been published on PFOS. Comparatively, the toxicology database for 6:2 FTS can be considered "limited", however, standard testing for regulatory approval of industry manufacture and use have been completed. Toxicology studies that have been completed for 6:2 FTS include (1) six DNA damage studies; (2) three skin irritation and/or sensitization studies; (3) two acute toxicity studies (i.e., single exposure studies); (4) two systemic toxicity studies (i.e., studies investigating multi-organ toxicity following repeated exposure); (5) one liver toxicity study; and (6) one reproductive and developmental toxicity study. Toxicity data following chronic exposure is currently not available. No human epidemiology studies investigating the relationship between exposure to 6:2 FTS and associated health effects have been conducted. 6:2 FTS has not been assessed for its ability to cause cancer, immune system effects, or endocrine (i.e., hormone) disruption, which are all health effects that have been associated with exposure to some PFAS.

6:2 FTS Toxicology Database

- DNA damage studies x 6
- Skin irritation/sensitization studies x 3
- Acute toxicity studies x 2
- Systemic toxicity studies x 2
- Liver toxicity study x 1
- Reproductive/developmental toxicity study x 1

Collectively, results from toxicology studies indicate that 6:2 FTS does not (1) cause damage to DNA; (2) does not act as a skin sensitizer (i.e., cause allergic skin reactions); and (3) does not cause toxicity to reproductive organs or to the developing fetus. In contrast, several studies have shown that PFOS can cause developmental toxicity. Furthermore, several acute toxicity studies (i.e., single dose studies testing for lethality) have demonstrated that 6:2 FTS is less acutely toxic than PFOS in laboratory animals. 6:2 FTS has been shown to cause skin irritation; however, this effect is unlikely to be relevant for the general population as it requires dermal contact with high concentrations of 6:2 FTS that is likely to only occur in settings with concentrated and specific use. Finally, rodent studies have demonstrated that exposure to 6:2 FTS can cause kidney and liver toxicity; comparatively, PFOS is not typically associated with kidney toxicity, but has been shown to

6:2 FTS does not cause:

- Skin sensitization
- DNA damage
- Reproductive or developmental toxicity

6:2 FTS does cause:

- Skin irritation
- Kidney and liver toxicity

cause adverse liver effects in numerous studies. Although results from these studies indicate that 6:2 FTS can cause kidney and liver toxicity, these results occur at higher exposure levels than typically seen in environmental settings. Laboratory studies of longer duration, multiple exposure levels, and with additional endpoints are still needed.

2. Human Exposure to 6:2 FTS

Human exposure to 6:2 FTS (and other PFAS) can be assessed by collecting and analyzing human blood samples for the presence of 6:2 FTS. Exposure of the general U.S. population to PFAS, such as PFOS, has been closely tracked via several large-scale studies, including the Center for Disease Control's National Health and Nutrition Examination Survey (NHANES); however, 6:2 FTS has not been included in NHANES. Four studies have measured human exposure to 6:2 FTS in populations from Australia, China, Hong Kong, and the United States. All four studies consistently demonstrate that human exposure to 6:2 FTS is low and infrequent, and that the average human blood level of 6:2 FTS is approximately 1000 times lower than that of PFOS. However, results from these studies are nearly a decade old, and it is unknown if trends in human exposure to 6:2 FTS have changed over time. Furthermore, no exposure data is available for workers exposed in occupational settings. More human exposure studies are needed.

Human Exposure to 6:2 FTS

- Human exposure to 6:2 FTS appears to be low and infrequent
- Humans may be exposed to 6:2 FTS through contaminated air, water, food products, or consumer products

Many PFAS, including PFOS, have been measured in both maternal and umbilical cord blood, which indicates that PFAS can cross the placenta, resulting in exposure to the developing fetus. One study has demonstrated that 6:2 FTS can also cross the placenta, although available toxicity data indicate that 6:2 FTS does not cause toxicity to the developing fetus in animal models.

Detection of 6:2 FTS in human blood demonstrates that human exposure occurs; however, the routes by which the general population may be exposed to 6:2 FTS are poorly understood. Exposure may occur through consumption of contaminated drinking water or food products, through inhalation of contaminated air, or through contact with certain consumer products. It is likely that human exposure to 6:2 FTS occurs through a combination of all of these routes, as 6:2 FTS has been detected in consumer products (i.e., polishes, carpets, circuit boards), drinking water, air, and in certain species of edible fish. Finally, there is evidence that certain PFAS used in food packaging products may breakdown to 6:2 FTS, and thus exposure to these "precursor" compounds may also indirectly contribute to human exposure.

3. Ecological Toxicology of 6:2 FTS

Several laboratory studies have been conducted to investigate the toxicity of 6:2 FTS to aquatic organisms such as rainbow trout, *Daphnia magna* (aquatic invertebrates), and green algae following both short-term (i.e., acute) and long-term (i.e., chronic) exposure. For both acute and chronic studies, 6:2 FTS was less toxic than PFOS to aquatic organisms. Further, a peer-reviewed aquatic hazard assessment concluded that 6:2 FTS "*presents little risk to aquatic organisms*[1]."

[1] Hoke et al. 2015. Aquatic hazard, bioaccumulation and screening risk assessment for 6: 2 fluorotelomer sulfonate. *Chemosphere*, *128*, pp.258-265.

The toxicity of 6:2 FTS to terrestrial organisms has been assessed in one species, the earthworm. In short-term acute studies, 6:2 FTS and PFOS caused toxicity at similar exposure levels. Alternatively, in long-term chronic studies, 6:2 FTS was less toxic than PFOS to earthworms. There is uncertainty surrounding the effects that 6:2 FTS may have on terrestrial organisms – more studies are needed.

Bioaccumulation is the accumulation of a chemical in an organism, and occurs when exposure exceeds the rate at which an organism can metabolize and/or excrete a chemical from the body. Bioaccumulation can be problematic, as it can result in the accumulation of a chemical in an organism to a level that may lead to adverse effect on organismal health. Both laboratory and field-based studies indicate that 6:2 FTS is unlikely to be bioaccumulative.

6:2 FTS is not bioaccumulative

- Available laboratory and field-based studies indicate that 6:2 FTS is unlikely to be bioaccumulative.

4. Environmental Occurrence and Fate of 6:2 FTS

PFAS can enter the environment through a variety of routes, including through waste streams (i.e., landfill leachate, wastewater treatment plant effluent), through production and manufacturing processes, or through consumer use. Environmental monitoring studies have reported detection of 6:2 FTS in a variety of environmental media, including air, snow, rain, groundwater, surface water (i.e., rivers, lakes, estuaries, oceans), sediment, and in biota such as amphipods, birds, bird eggs, earthworms, and fish. Environmental monitoring studies indicate that 6:2 FTS occurs at low-levels in the environment at most sites; however, higher levels of 6:2 FTS have been detected in environmental media at sites associated with point-sources of contamination such as fluorochemical manufacturing facilities or fire fighter training sites where PFAS-containing aqueous film forming foam (AFFF) has been used. For example, the highest level of 6:2 FTS reported in surface water not associated with point-sources of contamination is 36 ng/L (parts per trillion, ppt), whereas detection levels of up to 28,700 ng/L (ppt) 6:2 FTS have been detected in surface water in close proximity to sites where AFFF has been used.

Once in the environment, some PFAS such as PFOS are highly persistent and do not degrade. Alternatively, studies have demonstrated that 6:2 FTS can be degraded by bacteria in the environment under certain conditions. Studies have consistently demonstrated that degradation of 6:2 FTS leads to the formation of the short-chain perfluorocarboxylic acids (PFCAs) perfluorohexanoic acid (PFHxA) and perfluoropentanoic acid (PFPeA); however, over a dozen additional intermediate PFAS may also be formed during the degradation process. Although PFHxA has been shown to pose minimal risk to human health[2], very little information on the toxicity of the other PFAS formed during 6:2 FTS degradation is available, and the effects of these PFAS on ecological and human health need to be better understood.

Additional Detailed Information on 6:2 FTS Toxicology – See Appendix 1

[2] Luz et al. 2019. Perfluorohexanoic acid toxicity, part I: Development of a chronic human health toxicity value for use in risk assessment. *Regulatory Toxicology and Pharmacology*, *103*, pp.41-55.
[2] Anderson et al. 2019. Perfluorohexanoic acid toxicity, part II: Application of human health toxicity value for risk characterization. *Regulatory Toxicology and Pharmacology*, *103*, pp.10-20.

Appendix 1. Technical Support Document: 6:2 Fluorotelomer Sulfonate (6:2 FTS)

1. Overview of 6:2 FTS Toxicology

Compared to per- and polyfluoroalkyl substances (PFAS) such as perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), the toxicology database for 6:2 fluorotelomer sulfonate (6:2 FTS) may be considered "limited" even though the standard testing for regulatory approval for industry manufacture and use have been done. These data are available on the European Union (EU)'s REACH dossier and consists of industry-conducted guideline studies that do not appear to have undergone independent expert peer-review (ECHA 2018).

Between the EU dossier and available peer-reviewed publications, the toxicology database for 6:2 FTS consists of:

(1) six genotoxicity studies;

(2) three studies designed to test for skin sensitization and/or irritation;

(3) two acute toxicity studies;

(4) one reproductive/developmental toxicity study;

(5) two sub-chronic systemic toxicity studies; and

(6) one liver toxicity study.

Chronic (2-year) systemic toxicity or carcinogenicity studies, two-generational reproductive toxicity studies, or studies specifically designed to test for immunotoxicity, developmental neurotoxicity, or endocrine disruption have not yet been conducted for 6:2 FTS.

Additionally, several studies have been conducted to assess the ecological toxicity of 6:2 FTS, and include acute toxicity tests conducted with fish, invertebrates (*Daphnia magna*), algae, and earthworms; and chronic toxicity studies conducted with fish and earthworms.

A summary of toxicity studies and the main conclusions, as presented by the study authors, are provided in Table 1.

Appendix 1. Technical Support Document: 6:2 Fluorotelomer Sulfonate (6:2 FTS)

Table 1. Summary of 6:2 FTS Toxicology Studies.

Study	Main conclusion	Reference
Genotoxicity Studies		
OECD 471 - Bacterial reverse mutation assay	▪ 6:2 FTS is not mutagenic	ECHA
OECD 473 - In vitro mammalian chromosome aberration test in CHO cells	▪ 6:2 FTS-related chromosomal aberrations were not observed	ECHA
OECD 474 - Mammalian erythrocyte micronucleus test	▪ 6:2 FTS did not induce micronucleus formation	ECHA
OECD 475 - Mammalian bone marrow chromosome aberration test	▪ 6:2 FTS did not induce chromosomal aberrations	ECHA
OECD 486 - Unscheduled DNA synthesis (UDS) test with mammalian liver cells in vivo	▪ 6:2 FTS did not induce unscheduled DNA synthesis	ECHA
OECD 489 - In vivo mammalian alkaline comet assay	▪ 6:2 FTS did not induce DNA damage in vivo	ECHA
Mammalian Toxicology Studies[1]		
OECD 429 - Skin sensitization (local lymph node assay) - conducted with mice	▪ 6:2 FTS is not a dermal sensitizer	ECHA
OECD 435 - In vitro membrane barrier test method for skin corrosion	▪ 6:2 FTS is irritating to skin ▪ 6:2 FTS is classified as skin corrosive Category 1A with the accompanying hazard statement (H314) "Causes severe skin burns and eye damage."	ECHA
In vivo (rabbit) skin irritation test	▪ 6:2 FTS is not irritating to the skin	Buck, 2015
OECD 402 - Acute (single dose) dermal toxicity - conducted with Sprague Dawley rats	▪ 6:2 FTS is not acutely toxic via the dermal exposure route	ECHA
OECD 420 - Acute (single dose) oral toxicity - fixed dose procedure - conducted with Wistar rats	▪ The oral LD50 is >300, but less than 2,000 mg/kg 6:2 FTS ▪ 6:2 FTS is classified as GHS Category 4, with the hazard statement (H302) "Harmful is swallowed."	ECHA
14-Day oral dose range finding study with Wistar rats	▪ Kidney toxicity observed (i.e., increased kidney weight, altered creatinine and urea levels)	ECHA
OECD 422 - Combined repeated dose (90-day) toxicity study with the reproduction/developmental toxicity screening test - conducted with Wistar rats	▪ 6:2 FTS is not a reproductive or developmental toxicant ▪ Kidney toxicity observed (i.e., elevated urea levels, increased incidence of multi-focal tubular dilation in male and female kidneys)	ECHA
28-Day subchronic study with CD1 mice (only 1 dose used; 5 mg/kg-day)	▪ Exposure to 6:2 FTS (ammonium salt) was associated with liver toxicity (i.e., increased liver weight, increased incidence of necrosis, hepatocellular hypertrophy)	Sheng et al. (2017)
Aquatic Toxicology Studies		
OECD 201 - Freshwater alga and cyanobacteria, growth inhibition test with green alga (*P. subcapitata*)	▪ The 72-hour EC50 ranges from >96 mg/L (potassium salt of 6:2 FTS) to >125 mg/L (6:2 FTS)	ECHA; Hoke et al., 2015
OECD 202 - Daphnia sp. acute immobilization test	▪ The 48-hour EC50 ranges from >109 mg/L (potassium salt of 6:2 FTS) to >112 mg/L (6:2 FTS)	ECHA; Hoke et al., 2015
OECD 203 - Acute toxicity test - conducted with rainbow trout	▪ The 96-hour LC50 ranges from >107 mg/L (potassium salt of 6:2 FTS) to >108 mg/L (6:2 FTS)	ECHA; Hoke et al., 2015
OECD 210 - Fish early-life stage toxicity test (90-day) - conducted with rainbow trout	▪ The 90-day NOEC is 2.62 mg/L 6:2 FTS (potassium salt)	ECHA; Hoke et al., 2015
Conclusions by Hoke et al. (2015)	▪ 6:2 FTS is not expected to pose a risk to aquatic organisms	Hoke et al., 2015

[1] Results from several unpublished toxicology and bioaccumulation studies for 6:2 FTS were presented at the Society of Environmental Toxicology and Chemistry Meeting (SETAC; Buck, 2018). Unpublished toxicology studies included 28-day oral and 4-hour inhalation studies, both conducted with rats. Further, a bioaccumulation study was conducted in rats in which 6:2 FTS was not found to be bioaccumulative.

Abbreviations:
EC50 = effective concentration that elicits 50% of the response; LC50 = lethal concentration that elicits 50% of the response; LD50 = lethal dose that elicits 50% of the response; NOEC = No observable effect concentration

2. Mammalian Toxicology

6:2 FTS is less acutely toxic than PFOS. Results from two acute toxicity studies are listed in the REACH registration dossier for 6:2 FTS (ECHA, 2018), and include oral and dermal exposure studies. 6:2 FTS was not found to be acutely toxic via the dermal route of exposure at doses of up to 2000 mg/kg in an Organization for Economic Cooperation and Development (OECD) Guideline 402 study (OECD 2017; Acute Dermal Toxicity). Alternatively, 6:2 FTS was found to have moderate acute toxicity via the oral exposure route in an OECD Guideline 420 study (OECD, 2002; Acute Oral Toxicity), with an LD50[1] value of between 300 to 2,000 mg/kg. Based on this result, 6:2 FTS was GHS (Globally Harmonized System) classified category 4 for acute oral toxicity, which has the accompanying hazard statement "H302: Harmful if swallowed." Additionally, Field & Seow (2017) report the acute oral LD50 for rats to be 1,871 mg/kg; however, the study authors did not provide a complete reference and this LD50 could not be verified. Comparatively, the acute oral LD50 value for PFOS has been reported to be 251 mg/kg in rats (Dean et al., 1978). These results demonstrate that 6:2 FTS is less acutely toxic than PFOS via the oral exposure route.

6:2 FTS is not genotoxic. No chronic toxicity studies investigating the carcinogenicity of 6:2 FTS have been conducted. However, a variety of *in vitro* and *in vivo* studies investigating the genotoxic and/or mutagenic potential of 6:2 FTS have been conducted and are reported in the REACH registration dossier for 6:2 FTS (ECHA, 2018). Results from these studies indicate that 6:2 FTS is:

- not mutagenic in the bacterial reverse mutation assay (Guideline 471; OECD, 1997a);
- does not cause DNA damage in an *in vivo* mammalian comet assay (Guideline 489; OECD, 2016a);
- does not induce micronuclei formation (indication of chromosomal damage) in a *in vivo* bone marrow assay (Guideline 474; OECD, 2016b);
- does not induce chromosomal aberrations *in vivo* (Guideline 475; OECD, 1997b) or *in vitro* (Guideline 473; OECD, 1997c) test systems;
- does not causes unscheduled DNA synthesis (Guideline 486; OECD, 1997d).

Collectively, these results indicate that 6:2 FTS is not genotoxic or mutagenic. Similarly, numerous studies have demonstrated that PFOS is not genotoxic [reviewed in USEPA, 2016].

6:2 FTS can cause kidney and liver toxicity. Three studies have been conducted that evaluate the toxicity of 6:2 FTS following repeat exposure. These studies include a 14-day dose-range finding study in rats (ECHA, 2018), a 28-day subchronic study in mice (Sheng et al., 2017), and a 90-day subchronic toxicity study in rats (ECHA, 2018). In the 14-day study, male and female

[1] The LD_{50} is the lethal dose that causes 50% mortality.

rats were orally exposed to 10, 50, or 100 mg/kg-day 6:2 FTS. No mortality or clinical signs of toxicity were reported in either sex at any dose. Signs of toxicity included reduced body weight gains and reduced food consumption in male (50 and 100 mg/kg-day treatment groups) and female (100 mg/kg-day group only) rats. Signs of kidney toxicity were observed, and included alterations in serum levels of creatinine and urea, and increased kidney weight in male (50 and 100 mg/kg-day treatment groups) and female (100 mg/kg-day group only) rats (ECHA, 2018).

In the 90-day OECD Guideline 422 study (OECD 1996; combined repeated dose toxicity study with the reproduction/developmental toxicity screening test) male and female rats were orally exposed to 5, 15, or 45 mg/kg-day 6:2 FTS. 6:2 FTS treatment had no effect on mortality, food consumption, or animal behavior, and no gross pathological or neoplastic histopathological findings were reported for either sex at any dose. Treatment-related reduced body weight gains were detected in both sexes in the highest treatment group (45 mg/kg-day). Several clinical signs of toxicity were observed, and included effects related to the skin (sparse hair, encrustations), eye (blepharospasm in one low-dose male rat), and respiratory system (sniffling respiration in two high-dose male rats); however, due to low-incidence and distribution, these effects were not considered treatment-related by the study authors. Hematological findings were reported, including reduced monocytes in male rats (5 mg/kg-day only); however, these effects were not considered treatment-related, as they did not occur in a dose-dependent manner. Mean total protein and albumin serum levels were slightly reduced in male rats (5 and 45 mg/kg-day, but not 15 mg/kg-day group); these effects did not occur in a dose-dependent manner and were not considered treatment-related. Alternatively, a dose-dependent increase in urea levels was reported for high-dose male rats, and was considered treatment related. Additional signs of kidney toxicity were also reported, and these effects were more pronounced in male rats. These effects included increased kidney weight in low- and high-dose male rats, and mild to moderate multifocal tubular dilation in the kidneys of high-dose male (5/12) and female (1/12) rats (ECHA, 2018).

In the 28-day study conducted by Sheng et al. (2017), male CD1 mice were orally exposed to 5.0 mg/kg-day 6:2 FTS, and liver toxicity was investigated. Exposure to 6:2 FTS resulted in increased liver weight, increased serum levels of aspartate transaminase and albumin, and signs of hepatocellular hypertrophy and necrosis. Collectively, these results indicate that 6:2 FTS is hepatotoxic. However, this study has limitations, including the small number of endpoints measured (kidney toxicity not investigated), and only a single exposure group was included in the study, which prevents any dose-response analysis.

Collectively, results from Sheng et al. (2017) and ECHA (2018) indicate that 6:2 FTS can cause kidney and liver toxicity in highly exposed rodent models. Comparatively, the majority of rodent toxicology studies conducted with PFOS do not report kidney toxicity [reviewed in USEPA, 2016], while subchronic and chronic toxicology studies have consistently demonstrated PFOS-induced liver toxicity [reviewed in USEPA, 2016].

6:2 FTS is not a reproductive or developmental toxicant. One study investigating the reproductive and developmental effects of 6:2 FTS has been conducted (ECHA, 2018). The study adhered to OECD Guideline 422 (OECD, 1996; Combined Repeated Dose Toxicity Study with the Reproduction/Developmental Toxicity Screening Test) in which male and female rats were orally exposed to 6:2 FTS (5, 15, or 45 mg/kg-day) prior to mating, during mating, and throughout gestation and lactation for a total of approximately 90-days. For parental rats, no treatment-related changes were reported for any reproductive parameter, such as reproductive organ weight, estrous cyclicity, serum T4 hormone levels, or reproductive performance. Similarly, no clinical signs of toxicity, or treatment-related effects on survival, body weight, sexual maturation, organ weight, gross pathology or hormone levels were reported for pups. Collectively, these results indicate that 6:2 FTS is not a reproductive or developmental toxicant at doses of up to 45 mg/kg-day.

Alternatively, numerous studies have reported developmental effects associated with PFOS exposure in rats, mice, and rabbits [for a comprehensive review of PFOS-related developmental and reproductive effects see USEPA, 2016], and these effects have been reported as exposure levels as low as 1.6 – 10 mg/kg-day (Luebker et al., 2005a,b; Thibodeaux et al., 2003).

6:2 FTS can cause skin irritation, but not sensitization. One study has been conducted with mice to investigate the ability of 6:2 FTS to act as a skin sensitizer (i.e., cause allergic skin reactions). Results from the OECD Guideline 429 study (OECD 2010; Local Lymph Node Assay) indicate that 6:2 FTS is not a skin sensitizer (ECHA, 2018). Alternatively, 6:2 FTS is GHS classified category 1 for skin corrosivity, which has the following hazard statement "H314: Causes severe skin burns and eye damage." The GHS classification is based on results from an *in vitro* OECD Guideline 435 study (OECD, 2006; In Vitro Membrane Barrier Test Method for Skin Corrosion) that indicated 6:2 FTS is corrosive to skin (ECHA, 2018). 6:2 FTS was reported to be not irritating to the skin of rabbits in a non-peer-reviewed book chapter (Buck, 2015); however, no additional study details were provided. The reason for the discrepancies are unclear, but may related to the chemical form of 6:2 FTS administered. 6:2 FTS acid, which was used in the *in vitro* study, is expected to be more irritating/corrosive than non-acidic 6:2 FTS salts, which may have been used in the *in vivo* rabbit study; however, the form of 6:2 FTS used was not reported in Buck (2015).

6:2 FTS is classified as an eye irritant. No formal studies have been conducted to test if 6:2 FTS is an eye irritant. However, based on Regulation No. 1272/2008 skin corrosive chemicals are to be classified as serious eye damage category 1, which has the accompanying hazard statement H318: Causes serious eye damage" (ECHA, 2018). Comparatively, *in vivo* studies have demonstrated that PFOS can also cause severe eye irritation (Riker Laboratories, Inc., 1981).

3. Ecological Toxicology

The acute and chronic toxicity of 6:2 FTS has been investigated in several aquatic (fish, *Daphnia*, algae) and terrestrial (earthworms) species. In general, and as discussed in more detail below, 6:2 FTS is less toxic to aquatic and terrestrial organisms than PFOS (Table 2).

Table 2. Comparison of 6:2 FTS and PFOS ecotoxicity.

	6:2 FTS	PFOS
96-Hour Rainbow Trout LC_{50} (mg/L)	>107[a]	7.8 – 22[b]
48-Hour *Daphnia magna* Immobilization EC_{50} (mg/L)	>109[a]	67.2[b]
72-Hour *Pseudokirchneriella subcapitata* Growth Rate (E_rC_{50}; mg/L)	>96[a]	48.2[b]
72-Hour *Pseudokirchneriella subcapitata* $NOEC_r$ (mg/L)	47.6[a]	42[b]
90-Day Rainbow Trout NOEC (mg/L)	2.62[a]	0.29[b,c]
14-Day Earthworm LC_{50} (mg/kg)	373[d]	365[e]
56-Day Earthworm EC_{50} (mg/kg) - # of cocoons	566[f]	103[f]
56-Day Earthworm EC_{50} (mg/kg) - juvenile weight	253[f]	29[f]

[a] Hoke et al., 2015
[b] Beach et al., 2006
[C] NOEC is for a 47-d test with fathead minnows, not rainbow trout
[d] 3M, 2003
[e] Juong et al. (2010)
[f] Stubberud (2006)

Accronyms: EC_{50} = effective concentration that gives half-maximal response; E_rC_{50} =EC50 in terms of reduced growth rate; LC50 = lethal concentration that causes 50% mortality; NOEC = no observable effect concentration; NOECr = NOEC for growth rate

3.1 Aquatic Toxicology

6:2 FTS is less acutely toxic to aquatic organisms than PFOS. The acute toxicity of 6:2 FTS has been investigated in several species, including *Oncorhynchus mykiss* (rainbow trout), *Daphnia magna* (aquatic invertebrate), and *Pseudokirchneriella subcapitata (green algae).* Compared to PFOS, 6:2 FTS is less acutely toxic to rainbow trout, with a 96-hour LC50 value of >107 mg/L (Hoke et al., 2015), while the 96-hour LC50 value for PFOS ranges from 7.8 to 22 mg/L (Beach et al., 2006). Similarly, *Daphnia* are less sensitive to 6:2 FTS than to PFOS, with EC50 values of >109 mg/L 6:2 FTS (Hoke et al., 2015) and 67.2 mg/L PFOS (Beach et al., 2006). Alternatively, 6:2 FTS and PFOS inhibit green algae growth at similar concentrations, with no observable effect concentrations (NOECs) of 47.6 mg/L for 6:2 FTS (Hoke et al., 2015) and 42 mg/L for PFOS (Beach et al., 2006). However, the concentration at which 6:2 FTS inhibited green algae growth by 50% (EC50) is >96 mg/L (Hoke et al., 2015), while the EC50 for PFOS is 48.2 mg/L (Beach et al., 2006). These results indicate that the slope of the PFOS dose-response curve is steeper than that of 6:2 FTS, which indicates that 6:2 FTS is less toxic to green algae than PFOS.

6:2 FTS is less chronically toxic to fish than PFOS. One study investigating the chronic, 90-day, toxicity of 6:2 FTS in early-life stage rainbow trout has been conducted (Hoke et al., 2015). In this study, the most sensitive toxicological endpoint was embryo hatching, with a NOEC of 2.62 mg/L. No 90-day early-life stage studies with rainbow trout were identified for PFOS. However, results from a 47-day PFOS chronic toxicity study conducted with Fathead minnows is available (Beach et al., 2006). The lowest NOEC identified in this study was 0.29 mg/L. Although the studies were conducted in different species of fish, both were early-life stage chronic toxicity studies. Further, the PFOS NOEC is nearly 10-fold lower than the 6:2 FTS NOEC. This result indicates that fish are more sensitive to chronic PFOS exposure than to chronic 6:2 FTS exposure.

3.2 Terrestrial Toxicology

6:2 FTS and PFOS display similar acute toxicity to earthworms. One study investigating the acute toxicity of 6:2 FTS to terrestrial organisms has been conducted. In a study conducted by 3M (2003), the 14-day LC50 of 6:2 FTS for earthworms was determined to be 373 mg/kg soil (3M, 2003). Similarly, Juong et al. (2010) determined the 14-day LC50 value of PFOS to be 365 mg/kg soil. Both studies were conducted under similar experimental conditions. Thus, these results indicate 6:2 FTS and PFOS are similarly acutely toxic to earthworms.

6:2 FTS is less chronically toxic than PFOS to earthworms. A study by Stubberud (2006) reports results from an earthworm reproduction test in which the number of cocoons laid, hatching success, and juvenile worm weight was reported. The EC50 values for number of cocoons laid and juvenile weight were calculated to be 566 and 253 mg/kg soil, respectively, for 6:2 FTS. Alternatively, EC50 values for PFOS were 103 (cocoons laid) and 29 mg/kg soil (juvenile weight). These results indicate that 6:2 FTS is less chronically toxic to earthworms than PFOS.

More research on the potential terrestrial and mammalian toxicity of 6:2 FTS is needed.

4. Toxicokinetics and Bioaccumulation

6:2 FTS is eliminated more rapidly than PFOS. Toxicokinetics is the study of how the body handles a chemical, and includes analysis of a chemical's rate of adsorption, tissue distribution, metabolism, and excretion. Limited information is available on the toxicokinetics of 6:2 FTS. One *in vivo* toxicokinetics study and one *in vitro* metabolism study are reported in the REACH registration dossier for 6:2 FTS; however, minimal study details are provided (ECHA, 2018). For the toxicokinetic study, two single doses (dosing levels not provided) of 6:2 FTS were administered (species tested was not reported) and then fat, liver, plasma, and urine samples were collected to investigate the distribution and excretion of 6:2 FTS. Fat-to-plasma ratios could not be calculated for females, while ratios were <0.1 (low dose) to 0.1 (high dose) for

males indicating 6:2 FTS does not accumulate in fat. Similarly, liver-to-plasms ratios could not be determined for females, while ratios were 3.0 (low dose) to 3.1 (high dose) for males, indicating partitioning of 6:2 FTS to the liver. 65-68% of the administered dose of 6:2 FTS was recovered in urine 96-hours after dosing, and elimination half-lives ranged from 20.9 to 23.8 hours. Comparatively, the elimination half-life of PFOS following oral administration has been reported to range from 30.5 to 42.8 days for mice and 39.8 to 66.7 days for rats (Chang et al. 2012). These results indicate that 6:2 FTS will be eliminated more rapidly than PFOS.

In vitro studies indicate 6:2 FTS may not be readily metabolized. Two *in vitro* studies investigating the metabolism of 6:2 FTS have been conducted. In the first, 6:2 FTS was incubated with male rat liver S9 microsomes for 2-hours, which is a common *in vitro* method employed to estimate *in vivo* metabolism. No metabolism of 6:2 FTS was detected (ECHA, 2018). In a second study, 6:2 FTS was incubated with rainbow trout hepatocytes for 2-hours; no metabolism of 6:2 FTS was detected (Hoke et al., 2015). However, *in vitro* test systems do not completely replicate *in vivo* metabolism, thus, *in vivo* studies should be conducted to confirm *in vitro* results. Numerous studies have demonstrated that PFOS is recalcitrant to metabolism *in vitro* and *in vivo* [reviewed in USEPA, 2016].

6:2 FTS is not bioaccumulative. Bioaccumulation is the accumulation of a chemical in an organism, and occurs when exposure and adsorption of a chemical occurs at a faster rate than metabolism and/or excretion. Bioaccumulation factors (BAFs) and bioconcentration factors (BCFs) are the ratio of a chemical in an organism to the concentration in the surrounding environment. According to the U.S. EPA, chemicals with BCFs >1000 are considered bioaccumulative, while other regulatory agencies in Canada, the European Union, and the United Nations consider chemicals with BAFs/BCFs of 2,000 to 5,000 to be bioaccumulative (Arnot and Gobas, 2006).

Laboratory- and field-based BCFs/BAFs for 6:2 FTS have been calculated for fish (rainbow trout, white sucker), earthworms, midge, and biofilm. As can be seen in Table 3, all estimated BCFs are below 1000 indicating that 6:2 FTS is not classifiable as bioaccumulative by the most conservative regulatory standard.

Table 3. Summary of 6:2 FTS BCFs and BAFs

Species	Exposure Details	BCF/BAF	Reference
Oncorhynchus mykiss (rainbow trout)	Aqueous exposure to 6:2 FTS	3 - 36	Hoke et al., 2015
	Dietary exposure to 6:2 FTS.[1]	0.3	
Oncorhynchus mykiss (rainbow trout)	Aqueous exposure to 6:2 FTS containing AFFF	ND	Yeung & Mabury, 2013
Chironomus riparius (midge)	Exposure to 6:2 FTS contaminated environmental sediments.	0.018	Bertin et al., 2014
Gammarus s pp. (Crustacea)	Exposure to 6:2 FTS contaminated environmental sediments.	0.88	Bertin et al., 2016
Catostomus commersonii (white sucker)	Field-based estimates	0.23 - 0.95	Munoz et al., 2017
Biofilm[2]	Field-based estimates	148	Munoz et al., 2018
Eisenia fetida (earthworms)	Exposure to 6:2 FTS contaminated soil from fire training facilities.	2.4	NPCA, 2008

[1] Dietary biomagnification factors are estimated for dietary exposures.

[2] Log BCF values were estimated to be 1.4, 1.5, and 3.6 from three different locations for a mean value of 2.17, which is equivalent to a BCF of 148.

ND = Not determined; accumulation was not sufficient for BCFs to be estimated.

Compared to PFOS, 6:2 FTS has reduced binding affinity to some proteins. In contrast to most bioaccummulative chemicals, which are lipophilic and accumulate in fat, PFOS bioaccumulation is associated with binding to proteins such as serum albumin, fatty acid binding protein in the liver, and organic anion transporters in the kidney. One study investigating 6:2 FTS protein binding has been published (Sheng et al. 2018). In this study, a fluorescent displacement assay was used to investigate PFOS and 6:2 FTS binding to human liver FABP (hL-FABP). The concentrations required to cause a 50% fluorescent displacement (IC50) were 1.34 and 78.97 µM for PFOS and 6:2 FTS, respectively, indicating that 6:2 FTS has reduced binding affinity to hL-FABP. Furthermore, Sheng et al. (2018) used molecular docking software to investigate the molecular interactions of PFAS with the hL-FABP binding pocket. Using this approach, no binding of 6:2 FTS to the hL-FABP was observed, whereas PFOS binding could be modelled.

5. Human Exposure to 6:2 FTS

Human exposure to 6:2 FTS appears to be low and infrequent. 6:2 FTS has been detected in human serum, thus demonstrating that exposure to 6:2 FTS can occur (Table 4). However, compared to PFOS, 6:2 FTS human biomonitoring data is limited, and only four studies reporting human serum levels of 6:2 FTS are available. In contrast, 100s of studies investigating

human exposure to PFOS have been conducted. Additionally, results from all 6:2 FTS biomonitoring studies are based on small sample sizes, and were conducted nearly a decade ago. Thus, it is unclear how human exposure to 6:2 FTS has changed over the past decade, or how occupational exposure levels compares to that of the general population. Additional research on the potential sources of 6:2 FTS and extent of human exposure are needed.

Table 4. Summary of 6:2 FTS Biomonitoring Data

Location	Sampling Year	Sample/ gender/ age	N	FOD	LOD (ng/L)	Min (ng/L)	Median (ng/L)	Arithmetic Mean (ng/L)	Max (ng/L)	Reference
U.S.	2009	Serum, M	20	42%	5	<LOD	--	5.91	18.39	Lee & Mabury (2011)[1]
		Serum, F	20	65%	5	<LOD	--	9.28	29.54	
China	2009	Matenal serum	50	64%	3	<LOD	11.55	13.39	48.24	Yang et al. (2016)[2]
		Cord serum	50	68%	3	<LOD	13.53	20.99	90.21	
Hong Kong	--	Blood, M + F	20	100%	--	0.34	1.17	2.19	7.89	Loi et al. (2013)[4]
Australia	2011	Serum, Age: 0-4	4	50%	--	<LOD	--	10	20	Eriksson et al. (2017)[1,3]
		Serum, Age: 5-15	4	0%	--	--	--	--	--	
		Serum, Age: 16-30	4	25%	--	<LOD	--	10	50	
		Serum, Age: 31-45	4	25%	--	<LOD	--	10	30	
		Serum, Age: 46-60	4	0%	--	--	--	--	--	
		Serum, Age: >60	4	0%	--	--	--	--	--	

[1] For purposes for calculating the mean, samples with 6:2 FTS levels below the LOD were substituted with a value of zero.

[2] For puposes of calculating the mean, samples with 6:2 FTS levels below the LOD were substituted with a value of the LOD divided by the square root of two.

[3] N = 4 pooled serum samples; each sample consisted of 100 individual pooled serum samples.

[4] Serum data is reported in units of pg/g, which is equivalent to parts per trillion (ppt); ng/L is also equivalent to ppt

"--" = Value not provided; "FOD" = frequency of detection; "LOD" = limit of detection

One biomonitoring study was conducted in the United States in 2009 (Lee & Mabury, 2011). In this study, 6:2 FTS was detected in the serum of 42% of male participants and 65% of female participants with arithmetic mean serum levels ranging from 5.9 ng/L (males) to 9.3 ng/L (females). These serum levels are significantly lower than the arithmetic mean serum levels of PFOS reported in the general U.S. population. During the 2009-2010 NHANES survey period, PFOS was detected in the serum of >99% of participants with median levels ranging from 7,800 ng/L (females) to 11,800 ng/L (males) (CDC, 2018). These findings indicate that human exposure to 6:2 FTS is lower than that of PFOS.

6:2 FTS can cross the placenta resulting in fetal exposure. One study has demonstrated that 6:2 FTS can cross the placental resulting in exposure to the developing fetus (Yang et al., 2016). In this study, 6:2 FTS was measured in paired maternal and cord serum from 50 Chinese mothers. The frequency of detection and mean serum levels of 6:2 FTS were similar for maternal and cord serum, and the median placental transfer ratio was 1.2:1 indicating that 6:2 FTS can freely cross the placenta. This finding is similar to PFOS, which has also been shown to cross the placenta.

6. Exposure Routes

Human exposure to 6:2 FTS may occur via a variety of routes, including consumption of contaminated drinking water or food products, through inhaling 6:2 FTS in the air, or through contact with consumer products that may contain 6:2 FTS. Field and Seow (2017) recently reviewed available monitoring data, and demonstrated that exposure to 6:2 FTS through these routes is possible, as 6:2 FTS has been detected in (1) consumer products including circuit boards, carpets, and polishes; (2) in drinking water in Spain, Germany, and France; (3) in air; and (4) in certain species of fish (see Field and Seow (2017) for a complete review).

Although, it is apparent that human exposure to 6:2 FTS occurs, it remains unknown whether humans are exposed directly to 6:2 FTS or to PFAS precursors that can degrade to 6:2 FTS. Lee & Mabury (2011) suggest that indirect exposure to 6:2 FTS may occur first through exposure to disubstituted thioether phophates (S-diPAPS; also known as fluorotelomer mercaptoalkyl phosphate esters or FTMAPs), which are used in food packaging products (Trier et al., 2011), and can be metabolized to 6:2 FTS. A wide variety of additional 6:2 FTS precursors have been proposed based on chemical structures (See Table 12 of Field & Seow, 2017), many of which are constituents of firefighting foams (i.e., AFFF); however, little empirical data exists to directly link degradation of these compounds to 6:2 FTS. It is likely that direct exposure to 6:2 FTS and precursors both contribute to human exposure.

7. Environmental Occurrence & Persistence

7.1 Environmental Occurrence

6:2 FTS is detected at low levels and frequencies at sites associated with non-point-sources of contamination. Several studies have monitored the environmental occurrence of 6:2 FTS at both sites associated with non-point sources and with point sources (i.e., firefighting training facilities or fluoropolymer facilities) of contamination [reviewed in Field and Seow, 2017]. 6:2 FTS has been detected in (1) landfill leachate and sediment in Sweden, Norway, Germany, and the U.S.; (2) in wastewater treatment plant influent, effluent, and sludge; (3) in rain and snow; (4) in surface waters including rivers, lakes, estuaries, and oceans; and (5) in organisms including amphipods, birds, bird eggs, worms, and fish. In general, 6:2 FTS is detected at low levels and frequencies in environmental samples collected from sites with non-point sources of contamination, while higher detection frequencies and levels are often reported at sites with known point sources of contamination (Field and Seow, 2017). For example, the highest level of 6:2 FTS reported in surface waters not associated with point sources of contamination is 36 ng/L (Nguyen et al, 2011), while the highest level of 6:2 FTS reported in surface water with known point sources of contaminate (fire-fighting foam) is 28,700 ng/L (Boiteux et al., 2016).

7.2 Environmental Persistence

Biodegradation of 6:2 FTS occurs under aerobic, sulfur-limiting, conditions. Several studies have been conducted to investigate biodegradation of 6:2 FTS under varying conditions. An OECD Guideline 301B (CO_2 Evolution Test; OECD 1992) study was conducted to test whether 6:2 FTS could be utilized as a carbon source by bacteria. Over 28-days a maximum loss of 42% was observed; based on test guidelines this result indicates that 6:2 FTS is not readily biodegradable (ECHA, 2018). Similarly, several studies have demonstrated that 6:2 FTS is not readily biodegradable under anaerobic conditions (Zhang et al. 2016), or in activated sludge from WWTPs under anaerobic or aerobic conditions (Ochoa-Herrera et al., 2016; Wang et al., 2011). Alternatively, several studies have demonstrated that 6:2 FTS can be utilized as a sulfur source by bacteria under aerobic, sulfur-limiting conditions (Key et al., 1998; Shaw et al., 2019; Van Hamme et al., 2013; Zhang et al., 2016). Zhang et al. (2016) report that 6:2 FTS undergoes rapid biodegradation in aerobic sediment, with a biodegradation half-life of less than five days. Biodegradation pathways of 6:2 FTS have also been proposed in several publications, and PFHxA (PFCA with 5 fluorinated carbons), PFPeA (PFCA with 4 fluorinated carbons) and the 5:3 fluorotelomer acid are consistently reported to be the primary terminal degradation products (Shaw et al., 2019; Van Hamme et al., 2013; Wang et al.. 2011; Zhang et al., 2016). However, numerous intermediary PFAS are formed throughout the biodegradation process. Shaw et al. (2019) identified 16 intermediary metabolites, many of which are shown in the proposed major degradation pathway for 6:2 FTS (Figure 1). Major metabolites identified by Shaw et al. (2019) include: 6:2 fluorotelomer (6:2 FT) alcohol (6:2

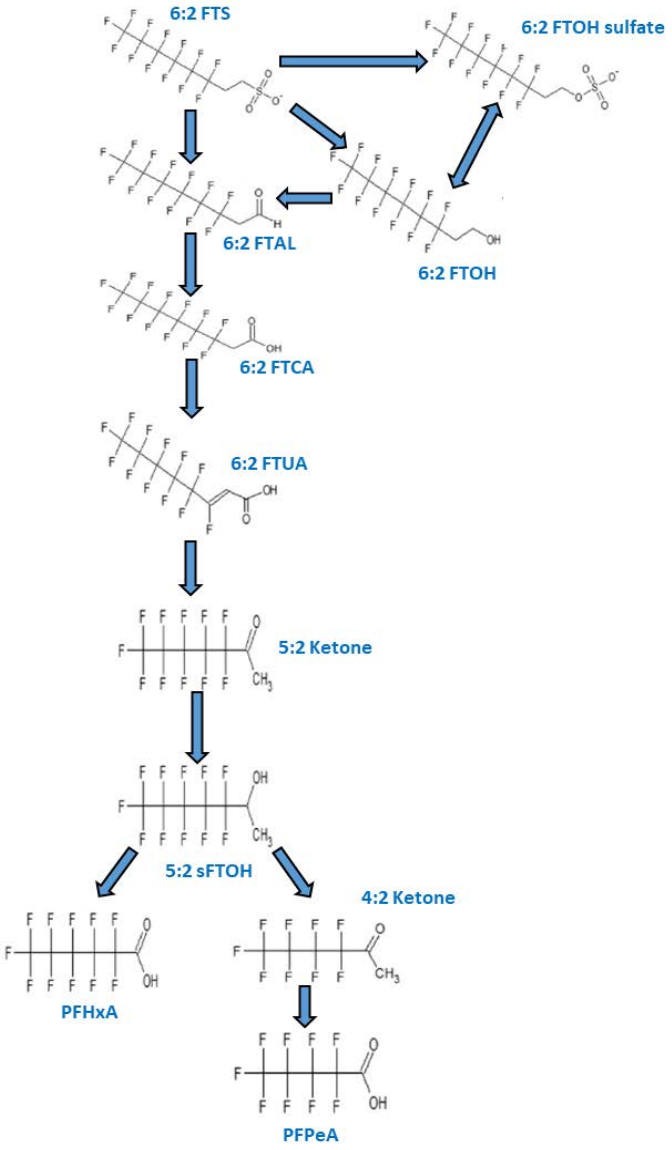


Figure 1. Proposed major degradation pathway for 6:2 FTS. Adapted from Shaw et al. (2019).

FTOH), 6:2 FT alcohol sulfate (6:2 FTOH sulfate), 6:2 FT aldehyde (6:2 FTAL), 6:2 FT acid (6:2 FTAC), 6:2 FT unsaturated acid (6:2 FTUA), 5:2 FT ketone, 5:2 FT secondary alcohol (5:2 sFTOH), 4:2 FT ketone, and the short-chain PFCAs PFHxA and PFPeA. Although, the terminal degradation product PFHxA has been shown to pose minimal risk to human health (Anderson et al., 2019), very little toxicological information is available for the other metabolites formed during 6:2 FTS biodegradation, or the proposed terminal degradation products formed through proposed minor degradation pathways, such as PFBA and 4:2 FTUA (Shaw et al., 2019).

Significant and important data gaps related to the environmental and *in vivo* degradation of 6:2 FTS remain.

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Nonafluorobutane-1-sulfonic acid

sc-236187

Material Safety Data Sheet

Hazard Alert Code Key:	EXTREME	HIGH	MODERATE	LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
Nonafluorobutane-1-sulfonic acid

STATEMENT OF HAZARDOUS NATURE
CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA

SUPPLIER
Santa Cruz Biotechnology, Inc.
2145 Delaware Avenue
Santa Cruz, California 95060
800.457.3801 or 831.457.3800
EMERGENCY:
ChemWatch
Within the US & Canada: 877-715-9305
Outside the US & Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS
C4F9O3HS, "perfluorobutanesulfonic acid (PFBS)", "nonafluorobutane-1-sulfonic acid", "1-butanesulfonic acid, nonafluoro-", "nonafluorobutanesulfonic acid", "pentyl perfluorononabutanoate sulfonate", "1-perfluorobutanesulfonic acid", "1-butanesulfonic acid, 1, 1, 2, 2, 3, 3, 4, 4, 4-nonafluoro-", "C4 sulfonate"

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

		Min	Max
Flammability:	1		
Toxicity:	2		
Body Contact:	3		
Reactivity:	2		
Chronic:	2		

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4

CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW

RISK

Reacts violently with water.
Harmful if swallowed.
Causes burns.
Risk of serious damage to eyes.
Toxic to bees.
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.
■ The material can produce chemical burns within the oral cavity and gastrointestinal tract following ingestion.
■ Ingestion of acidic corrosives may produce burns around and in the mouth.
the throat and esophagus.

EYE

■ The material can produce chemical burns to the eye following direct contact.
Vapors or mists may be extremely irritating.
■ If applied to the eyes, this material causes severe eye damage.
■ Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns.
Mild burns of the epithelia generally recover rapidly and completely.

SKIN

■ The material can produce chemical burns following direct contactwith the skin.
■ Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue.
■ Skin contact is not thought to produce harmful health effects (as classified using animal models).
Systemic harm, however, has been identified following exposure of animals by at least one other route and the material may still produce health damage following entry through wounds, lesions or abrasions.
■ Open cuts, abraded or irritated skin should not be exposed to this material.
■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects.
Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

■ The material can cause respiratory irritation in some persons.
The body's response to such irritation can cause further lung damage.
■ Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage.
There may be dizziness, headache, nausea and weakness.

CHRONIC HEALTH EFFECTS

■ Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs.
Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.
There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment.
Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.
Perfluoroalkylsulfonyl fluoride-based products have included surfactants, paper and packaging treatments, surface protectants (e.g., for carpet, upholstery, textile) and are found in specialised fire-fighting foams (AFFF for example). Depending on the specific functional derivatisation or degree of polymerisation, such products may degrade or metabolize, to an undetermined degree, to perfluoroalkylsulfonates (such a perfluorooctanesulfonate - PFOS), which are stable and persistent end products that have the potential to bioaccumulate. Salts of PFOS are known to cause significant toxic effects, including mortality, in Cynomolgus monkeys (oral doses of 0.75 mg/ kg/ day),12 rabbits (oral doses of 3.75 mg kg/ day), rats (oral doses of 1.6 mg/ kg/day) and zooplankton (10 mg/l)
PFOS is persistent, bioaccumulative and toxic to mammalian species. There are species differences in the elimination half-life of PFOS; the half-life is 100 days in rats, 200 days in monkeys, and years in humans. The toxicity profile of PFOS is similar among rats and monkeys. Repeated exposure results in hepatotoxicity and mortality; the dose-response curve is very steep for mortality. This occurs in animals of all ages, although the neonate may be more sensitive. In addition, a 2-year bioassay in rats has shown that exposure to PFOS results in hepatocellular adenomas and thyroid follicular cell adenomas; the hepatocellular adenomas do not appear to be related to peroxisome proliferation.
In one study which followed exposed workers for 37 years there was a statistically significant risk of death from bladder cancer. Neoplasms of the male reproductive system, of the gastrointestinal tract also appeared to be elevated. Risk ratios were highest in

workers with highest and longest exposure to fluorochemicals. PFOS has not been shown to be genotoxic in a variety of assay systems.
Lower molecular weight homologues such as perfluorobutanesulfonate (PFBS) do not exhibit the levels of toxicity or bioaccumulation of the higher homologues. Studies show PFBS is highly bound to human albumin with indications of a saturated binding to albumin in serum and negligible binding to the other liver-manufactured proteins gamma globulin, alpha globulin, fibrinogen, alpha-2-macroglobulin, transferrin and beta lipoproteins
The results of two in vitro studies and a chromosomal aberration test show no evidence of mutagenicity due to potassium PFBS. Animal data to date does not indicate potassium PFBS is a developmental toxin nor a substance toxic to reproduction, fertility or lactation.
In humans PFBS has a much shorter half-life than PFOS (just over one month vs 5.5 years).

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
perfluorobutanesulfonic acid	375-73-5	>98

Section 4 - FIRST AID MEASURES

SWALLOWED
· For advice, contact a Poisons Information Center or a doctor at once. · Urgent hospital treatment is likely to be needed.

EYE
■ If this product comes in contact with the eyes: · Immediately hold eyelids apart and flush the eye continuously with running water. · Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.

SKIN
■ If skin or hair contact occurs: · Immediately flush body and clothes with large amounts of water, using safety shower if available. · Quickly remove all contaminated clothing, including footwear.

INHALED
· If fumes or combustion products are inhaled remove from contaminated area. · Lay patient down. Keep warm and rested. Inhalation of vapors or aerosols (mists, fumes) may cause lung edema. Corrosive substances may cause lung damage (e.g.

NOTES TO PHYSICIAN
■ For acute or short term repeated exposures to strong acids:
· Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
· Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Not Available
Upper Explosive Limit (%):	Not Available
Specific Gravity (water=1):	Not Available
Lower Explosive Limit (%):	Not Available

EXTINGUISHING MEDIA
· Foam.
· Dry chemical powder.

FIRE FIGHTING
· Alert Emergency Responders and tell them location and nature of hazard.
· Wear full body protective clothing with breathing apparatus.
When any large container (including road and rail tankers) is involved in a fire,
consider evacuation by 800 metres in all directions.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS
· Combustible.
· Slight fire hazard when exposed to heat or flame.
Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), hydrogen fluoride, sulfur oxides (SOx), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY
■ Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids,chlorine bleaches, pool chlorine etc. as ignition may result.

PERSONAL PROTECTION
Glasses:
Full face- shield.
Gloves:
Respirator:

Type AB-P Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
■ Environmental hazard - contain spillage.
· Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material.
· Check regularly for spills and leaks.
· Clean up all spills immediately.
· Avoid breathing vapors and contact with skin and eyes.
MAJOR SPILLS
■ Environmental hazard - contain spillage.
· Clear area of personnel and move upwind.
· Alert Emergency Responders and tell them location and nature of hazard.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
· DO NOT allow clothing wet with material to stay in contact with skin.
· Avoid all personal contact, including inhalation.
· Wear protective clothing when risk of exposure occurs.

RECOMMENDED STORAGE METHODS
■ DO NOT use aluminum or galvanized containers.
Check regularly for spills and leaks.
· Lined metal can, Lined metal pail/drum
· Plastic pail.
For low viscosity materials
· Drums and jerricans must be of the non-removable head type.
· Where a can is to be used as an inner package, the can must have a screwed enclosure.

STORAGE REQUIREMENTS
· Store in original containers.
· Keep containers securely sealed.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

The following materials had no OELs on our records
• perfluorobutanesulfonic acid: CAS:375-73-5

PERSONAL PROTECTION

RESPIRATOR
•Type AB-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

EYE
· Chemical goggles.
· Full face shield.

HANDS/FEET
■ Elbow length PVC gloves.
· When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
· frequency and duration of contact,
· chemical resistance of glove material,
· glove thickness and
· dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).
· When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
· When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374, AS/NZS 2161.10.1 or national equivalent) is recommended.
· Contaminated gloves should be replaced.
Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

OTHER
· Overalls.
· PVC Apron.

ENGINEERING CONTROLS
■ Local exhaust ventilation usually required. If risk of overexposure exists, wear an approved respirator.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Corrosive.
Acid.
Reacts violently with water.

State	LIQUID	Molecular Weight	300.1
Melting Range (°F)	Not Available	Viscosity	Not Available
Boiling Range (°F)	234- 237 (14 mm Hg)	Solubility in water (g/L)	Reacts violently
Flash Point (°F)	Not Available	pH (1% solution)	Not Available
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not Available
Autoignition Temp (°F)	Not Available	Vapour Pressure (mmHG)	Not Available
Upper Explosive Limit (%)	Not Available	Specific Gravity (water=1)	Not Available
Lower Explosive Limit (%)	Not Available	Relative Vapor Density (air=1)	Not Available
Volatile Component (%vol)	Not Available	Evaporation Rate	Not Available

APPEARANCE
Liquid; reacts violently with water.

PFOS has a solubility of approximately 550 mg/l in pure water - the solubility decreases with increased salt content. For example the potassium salt of PFOS has a solubility of 370 mg/l in pure water. Due to surface active properties of PFOS, the log Kow cannot be measured. The potassium salt of PFOS has a low vapour pressure, 3.31 x 10-4 Pa at 20 C.

Material	Value

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY
· Contact with alkaline material liberates heat.
· Presence of incompatible materials.
· Product is considered stable.

STORAGE INCOMPATIBILITY
■ Reacts with mild steel, galvanized steel / zinc producing hydrogen gas which may form an explosive mixture with air.
Segregate from alcohol, water.
Segregate from alkalis, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.
· Avoid strong bases.
· NOTE: May develop pressure in containers; open carefully. Vent periodically.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

perfluorobutanesulfonic acid

TOXICITY AND IRRITATION
PERFLUOROBUTANESULFONIC ACID:
■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.

TOXICITY	IRRITATION
Oral (Rat) LD50: 430 mg/kg	

■ Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

for perfluorinated sulfonates:

Toxicology studies of the C4 fluoroalkyl sulfonate (PFBS), the C8 fluoroalkyl sulfonate (PFOS) and the C8 fluorocarboxylic acid (PFOA) indicate that chain length is an important factor in toxicity, perhaps partially due to pharmacokinetic factors; toxicity and persistence appears to increase with increasing chain length. Human biomonitoring studies have shown that the C6 perfluorosulfonate, PFOS and PFOA are present in the serum of the general US population, and that the levels of the C6 perfluorosulfonate are quite high in children. Other chain lengths have not yet been monitored in the general population. Environmental monitoring studies have demonstrated the presence of the entire series of perfluorinated compounds, as well as some higher homologs. Current hazard and risk assessments have addressed individual chemicals. If there is a common mode of action for these chemicals the latter efforts are likely to underestimate potential hazard and risk to exposed populations.

Extensive pharmacokinetic information is available for PFOS (perfluorooctanesulfonate) and PFOA (perfluorooctanoic acid) and more limited information is available for PFBS (perfluorobutanesulfonate) The existing information for PFOS and PFOA suggest the following issues may be critical determinants of pharmacokinetics and blood dosimetry for other members of the class:

· These compounds are well absorbed.

· The carboxylic acids and sulfonates are cleared by urinary and biliary elimination in rodents with no evidence of metabolism, while the telomer alcohols are metabolised apparently to carboxylic acid derivatives. Extensive enterohepatic recirculation has been demonstrated for both PFOA and PFOS.

· Species and sex differences in clearance are most dramatic for PFOA (female rat (hrs)>>male rat (days)>mouse>monkey (weeks)>human (years)). PFOS demonstrates higher blood levels in female rats than males following repeated exposures and the clearance during week 105 was faster than older intravenous and oral studies would predict. PFBS is rapidly eliminated in several hours in rats. The mechanism(s) for species and sex variation in clearance is ill-defined but may in part be related to differential expression of renal transport proteins.

· Serum protein binding (generally albumin) is extensive resulting in high concentrations in serum. Liver has very high concentrations as well, followed by kidney. Other tissues have generally low concentrations (and the fluorination make this a non-lipophilic compound), but account for a significant fraction of the mass in the body.

There is extensive toxicology information available on PFBS, PFOS and PFOA. Studies of PFOS and PFOA have shown that the developing organism is a primary target. A two generation reproductive toxicity study of PFOS in rats, and several subsequent studies in rats and mice, have shown a very high incidence of mortality in the F1 offspring in the first few days following birth. A two-generation reproductive toxicity study of PFOA in rats has demonstrated mortality in the F1 offspring in the first few days following weaning, as well as a delay in sexual maturation. Preliminary studies of PFOA in mice have shown a mortality pattern very similar to that observed following exposure to PFOS in that mortality occurs in the first few days after birth.

In contrast, these effects were not noted in a two-generation reproductive toxicity study of PFBS in rats or a limited one-generation toxicity study of C6 perfluorosulfonate in rats. To date, there is no information on developmental effects following exposure to chain lengths greater than C8.

In addition, several of the compounds in the perfluorinated series are peroxisome proliferators, and PFOS and PFOA have been shown to be carcinogenic in rats. Chronic studies of PFOA in rats have shown the presence of hepatocellular, Leydig cell and pancreatic acinar cell tumors. PFOA is a demonstrated PPAR-alpha (peroxisome proliferator-activated receptor) agonist and this has been hypothesised to be the mode of action for the hepatocellular adenomas. Chronic exposure of PFOS in rats is also associated with hepatocellular adenomas. PFOS is also a peroxisome proliferator, but studies have not been conducted to firmly establish the role of PPAR-alpha agonism in the induction of the liver adenomas. Chronic exposure studies of PFBS have not yet been conducted. Although preliminary studies indicate that PFBS is a weak peroxisome proliferator at comparatively high doses, only very limited liver toxicity has been noted in a two-generation reproductive toxicity study, and no liver toxicity was noted in 28-day and 90-day studies at comparable doses.

Limited studies of the C9 and C10 perfluorocarboxylic acids indicate that both compounds are peroxisome proliferators. Thus, it is likely that liver adenomas may be expected following chronic exposures to many of the compounds in the proposed series. However, several scientific groups have concluded that PPAR-a agonist induced liver tumors in adult rodents are of questionable relevance to humans. Others have questioned whether chronic exposure to peroxisome proliferators would result in a different outcome if exposures were initiated prenatally rather than in adulthood.

Section 12 - ECOLOGICAL INFORMATION

Toxic to bees.
Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
This material and its container must be disposed of as hazardous waste.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
perfluorobutanesulfonic acid	HIGH	No Data Available	LOW	MED

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information
Corrosivity characteristic: use EPA hazardous waste number D002 (waste code C)

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.
¦ Puncture containers to prevent re-use and bury at an authorized landfill.
Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:
· Reduction
· Reuse
· Recycling
· Disposal (if all else fails)
This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.
DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.
· Recycle wherever possible.
· Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.

Section 14 - TRANSPORTATION INFORMATION

DOT:
Symbols: None Hazard class or Division: 8
Identification Numbers: UN3265 PG: II
Label Codes: 8 Special provisions: B2, IB2,
T11, TP2,
TP27
Packaging: Exceptions: 154 Packaging: Non- bulk: 202
Packaging: Exceptions: 154 Quantity limitations: 1 L
Passenger aircraft/rail:
Quantity Limitations: Cargo 30 L Vessel stowage: Location: B
aircraft only:
Vessel stowage: Other: 40
Hazardous materials descriptions and proper shipping names:
Corrosive liquid, acidic, organic, n.o.s.

Air Transport IATA:

UN/ID Number: 3265 Packing Group: II
Special provisions: A3
Cargo Only
Packing Instructions: 855 Maximum Qty/Pack: 30 L
Passenger and Cargo Passenger and Cargo
Packing Instructions: Y840 Maximum Qty/Pack: 1 L
Passenger and Cargo Limited Quantity Passenger and Cargo Limited Quantity
Packing Instructions: 851 Maximum Qty/Pack: 0.5 L
Shipping Name: CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
*(CONTAINS PERFLUOROBUTANESULFONIC ACID)

Maritime Transport IMDG:

IMDG Class: 8 IMDG Subrisk: None
UN Number: 3265 Packing Group: II
EMS Number: F-A,S-B Special provisions: 274
Limited Quantities: 1 L
Shipping Name: CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.(contains perfluorobutanesulfonic acid)

Section 15 - REGULATORY INFORMATION

perfluorobutanesulfonic acid (CAS: 375-73-5) is found on the following regulatory lists;
"Canada Non-Domestic Substances List (NDSL)","US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE
■ Cumulative effects may result following exposure*.
■ Limited evidence of a carcinogenic effect*.
* (limited evidence).

Denmark Advisory list for selfclassification of dangerous substances
Substance CAS Suggested codes perfluorobutanesulfonic acid 375- 73- 5 Xn; R22

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■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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Issue Date: May-24-2009

Print Date:Jul-15-2011

Safety data sheet

according to 1907/2006/EC, Article 31

Printing date 11.09.2020 *Version number 2* *Revision: 11.09.2020*

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

· **1.1 Product identifier**

· **Product name:** **Perfluorobutanoic acid**

· **Part number:** DRE-C15986520
· **CAS Number:**
375-22-4
· **EC number:**
206-786-3
· **1.2 Relevant identified uses of the substance or mixture and uses advised against**
No further relevant information available.
· **Application of the substance / the mixture** Reference material for laboratory use only

· **1.3 Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**

LGC Limited
Queens Road
Teddington
Middlesex TW11 0LY
UNITED KINGDOM

Tel :+44 (0) 20 8943 7000
Fax :+44 (0) 20 8943 2767
eMail : gb@lgcstandards.com
Web : www.lgcstandards.com

· **Further information obtainable from:**
Product safety department
eMail : sds-request@lgcgroup.com
· **1.4 Emergency telephone number:**
For Hazardous Materials or Dangerous Goods Incident
Spill, Leak, Fire Exposure, or Accident
Call CHEMTREC:
USA & Canada 1-800-424-9300
Rest of the world +1 703-741-5970

SECTION 2: Hazards identification

· **2.1 Classification of the substance or mixture**
· **Classification according to Regulation (EC) No 1272/2008**

GHS05 corrosion

Skin Corr. 1A H314 Causes severe skin burns and eye damage.
Eye Dam. 1 H318 Causes serious eye damage.

· **2.2 Label elements**
· **Labelling according to Regulation (EC) No 1272/2008**
The substance is classified and labelled according to the CLP regulation.

(Contd. on page 2)

Safety data sheet
according to 1907/2006/EC, Article 31

Printing date 11.09.2020 *Version number 2* *Revision: 11.09.2020*

Product name: **Perfluorobutanoic acid**

(Contd. from page 1)

· ***Hazard pictograms***

GHS05

· ***Signal word*** *Danger*
· ***Hazard statements***
H314 Causes severe skin burns and eye damage.
· ***Precautionary statements***
P280 *Wear protective gloves/protective clothing/eye protection/face protection.*
P303+P361+P353 *IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water [or shower].*
P305+P351+P338 *IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.*
P310 *Immediately call a POISON CENTER/doctor.*
P405 *Store locked up.*
P501 *Dispose of contents/container in accordance with local/regional/national/international regulations.*
· ***2.3 Other hazards***
· ***Results of PBT and vPvB assessment***
· ***PBT:*** *Not applicable.*
· ***vPvB:*** *Not applicable.*

SECTION 3: Composition/information on ingredients

· ***3.1 Chemical characterisation: Substances***
· ***CAS No. Description***
375-22-4 Heptafluorobutyric acid
· ***Identification number(s)*** *None*
· ***EC number:*** *206-786-3*
· ***RTECS:*** *ET4025000*
· ***Additional information:*** *For the wording of the listed hazard phrases refer to section 16.*

SECTION 4: First aid measures

· ***4.1 Description of first aid measures***
· ***General information:*** *Immediately remove any clothing soiled by the product.*
· ***After inhalation:*** *Supply fresh air; consult doctor in case of complaints.*
· ***After skin contact:***
Immediately wash with water and soap and rinse thoroughly.
Seek immediate medical advice.
· ***After eye contact:*** *Rinse opened eye for several minutes under running water. Then consult a doctor.*
· ***After swallowing:*** *Rinse mouth. Do not induce vomiting.*
· ***4.2 Most important symptoms and effects, both acute and delayed*** *No further relevant information available.*

(Contd. on page 3)

Safety data sheet
according to 1907/2006/EC, Article 31

Printing date 11.09.2020 *Version number 2* *Revision: 11.09.2020*

Product name: **Perfluorobutanoic acid**

(Contd. from page 2)

· ***4.3 Indication of any immediate medical attention and special treatment needed***
No further relevant information available.

SECTION 5: Firefighting measures

· ***5.1 Extinguishing media***
· ***Suitable extinguishing agents:*** *Use fire extinguishing methods suitable for surrounding conditions.*
· ***5.2 Special hazards arising from the substance or mixture***
Formation of toxic gases is possible during heating or in case of fire.
· ***5.3 Advice for firefighters***
· ***Protective equipment:*** *Wear self-contained respiratory protective device.*

SECTION 6: Accidental release measures

· ***6.1 Personal precautions, protective equipment and emergency procedures***
Wear protective equipment. Keep unprotected persons away.
· ***6.2 Environmental precautions:*** *Do not allow to enter sewers/ surface or ground water.*
· ***6.3 Methods and material for containment and cleaning up:***
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Use neutralising agent.
Dispose of contaminated material as waste according to item 13.
Ensure adequate ventilation.
· ***6.4 Reference to other sections***
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

SECTION 7: Handling and storage

· ***7.1 Precautions for safe handling*** *Store in cool, dry place in tightly closed receptacles.*
· ***Information about fire - and explosion protection:*** *No special measures required.*

· ***7.2 Conditions for safe storage, including any incompatibilities***
· ***Storage:***
· ***Requirements to be met by storerooms and receptacles:***
Please refer to the manufacturer's certificate for specific storage and transport temperature conditions.
Store only in the original receptacle unless other advice is given on the CoA.
Keep container in a well-ventilated place. Keep away from sources of ignition and heat.
· ***Information about storage in one common storage facility:*** *Store away from foodstuffs.*
· ***Further information about storage conditions:*** *Keep container tightly sealed.*
· ***7.3 Specific end use(s)*** *No further relevant information available.*

(Contd. on page 4)

Safety data sheet
according to 1907/2006/EC, Article 31

Printing date 11.09.2020 *Version number 2* *Revision: 11.09.2020*

Product name: **Perfluorobutanoic acid**

(Contd. from page 3)

SECTION 8: Exposure controls/personal protection

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

· ***8.1 Control parameters***
· ***Ingredients with limit values that require monitoring at the workplace:*** *Not required.*
· ***Additional information:*** *Lists used were valid at the time of SDS preparation.*

· ***8.2 Exposure controls***
· ***Personal protective equipment:***
· ***General protective and hygienic measures:***
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing
Wash hands before breaks and at the end of work.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· ***Respiratory protection:***
Not required.
Use suitable respiratory protective device in case of insufficient ventilation.
· ***Protection of hands:***
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation
The protective gloves to be used must comply with the specifications of EC Directive 89/686/EEC and the related standard EN374

Protective gloves

· ***Material of gloves*** *Fluorocarbon rubber (Viton)*
· ***Penetration time of glove material***
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.
· ***Eye protection:***

Tightly sealed goggles

SECTION 9: Physical and chemical properties

· ***9.1 Information on basic physical and chemical properties***
· ***General Information***
· ***Appearance:***

Form:	*Liquid*
Colour:	*Colourless*

(Contd. on page 5)

Safety data sheet

according to 1907/2006/EC, Article 31

Printing date 11.09.2020 *Version number 2* *Revision: 11.09.2020*

Product name: Perfluorobutanoic acid

(Contd. from page 4)

· **Odour:**	Odourless
· **Odour threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/freezing point:	Not determined.
	Not determined.
Initial boiling point and boiling range:	121 °C
· **Flash point:**	Not applicable.
· **Flammability (solid, gas):**	Not determined.
· **Ignition temperature:**	Not determined
· **Decomposition temperature:**	Not determined.
· **Auto-ignition temperature:**	Not determined.
· **Explosive properties:**	Not determined.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapour pressure at 25 °C:**	13 hPa
· **Density at 20 °C:**	1.645 g/cm³
· **Relative density**	Not determined.
· **Vapour density**	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in / Miscibility with water:**	Not determined.
· **Partition coefficient: n-octanol/water:**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **9.2 Other information**	No further relevant information available.

SECTION 10: Stability and reactivity

· **10.1 Reactivity**
Stable under normal conditions.
No further relevant information available.
· **10.2 Chemical stability** Stable under normal conditions.
· **Thermal decomposition / conditions to be avoided:**
Formation of toxic gases is possible during heating or in case of fire.
· **10.3 Possibility of hazardous reactions** No dangerous reactions known.
· **10.4 Conditions to avoid** Heat.

(Contd. on page 6)

Safety data sheet
according to 1907/2006/EC, Article 31

Printing date 11.09.2020 *Version number 2* *Revision: 11.09.2020*

Product name: **Perfluorobutanoic acid**

(Contd. from page 5)

· ***10.5 Incompatible materials:*** *Strong oxidizing agents.*
· ***10.6 Hazardous decomposition products:***
Formation of toxic gases is possible during heating or in case of fire.

SECTION 11: Toxicological information

· ***11.1 Information on toxicological effects***
· ***Acute toxicity*** *Based on available data, the classification criteria are not met.*
· ***Primary irritant effect:***
· ***Skin corrosion/irritation***
Causes severe skin burns and eye damage.
· ***Serious eye damage/irritation***
Causes serious eye damage.
· ***Respiratory or skin sensitisation*** *Based on available data, the classification criteria are not met.*
· ***CMR effects (carcinogenity, mutagenicity and toxicity for reproduction)***
· ***Germ cell mutagenicity*** *Based on available data, the classification criteria are not met.*
· ***Carcinogenicity*** *Based on available data, the classification criteria are not met.*
· ***Reproductive toxicity*** *Based on available data, the classification criteria are not met.*
· ***STOT-single exposure*** *Based on available data, the classification criteria are not met.*
· ***STOT-repeated exposure*** *Based on available data, the classification criteria are not met.*
· ***Aspiration hazard*** *Based on available data, the classification criteria are not met.*

SECTION 12: Ecological information

· ***12.1 Toxicity***
· ***Aquatic toxicity:*** *No further relevant information available.*
· ***12.2 Persistence and degradability*** *No further relevant information available.*
· ***12.3 Bioaccumulative potential*** *No further relevant information available.*
· ***12.4 Mobility in soil*** *No further relevant information available.*
· ***Additional ecological information:***
· ***General notes:***
Water hazard class 1 (German Regulation) (Self-assessment): slightly hazardous for water
Do not allow undiluted product to reach ground water, water course or sewage system.
Must not reach sewage water or drainage ditch undiluted or unneutralised.
· ***12.5 Results of PBT and vPvB assessment***
· ***PBT:*** *Not applicable.*
· ***vPvB:*** *Not applicable.*
· ***12.6 Other adverse effects*** *No further relevant information available.*

SECTION 13: Disposal considerations

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

(Contd. on page 7)

Safety data sheet

according to 1907/2006/EC, Article 31

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Product name: **Perfluorobutanoic acid**

(Contd. from page 6)

· ***European waste catalogue***
Waste disposal key numbers from EWC have to be assigned depending on origin and processing.

· ***Uncleaned packaging:***
· ***Recommendation:*** *Dispose of in accordance with national regulations.*

SECTION 14: Transport information

· ***14.1 UN-Number***	
· ***ADR, IMDG, IATA***	*UN3265*
· ***ADR***	*3265 CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Heptafluorobutyric acid)*
· ***IMDG, IATA***	*CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Heptafluorobutyric acid)*
· ***14.3 Transport hazard class(es)***	
· ***ADR, IMDG, IATA***	

· ***Class***	*8 Corrosive substances.*
· ***Label***	*8*
· ***14.4 Packing group***	
· ***ADR, IMDG, IATA***	*I*
· ***14.5 Environmental hazards:***	*Not applicable.*
· ***14.6 Special precautions for user***	*Warning: Corrosive substances.*
· ***Danger code (Kemler):***	*88*
· ***EMS Number:***	*F-A,S-B*
· ***Segregation groups***	*Acids*
· ***Stowage Category***	*B*
· ***Stowage Code***	*SW2 Clear of living quarters.*
· ***14.7 Transport in bulk according to Annex II of Marpol and the IBC Code***	*Not applicable.*
· ***Transport/Additional information:***	
· ***ADR***	
· ***Limited quantities (LQ)***	*0*
· ***Excepted quantities (EQ)***	*Code: E0* *Not permitted as Excepted Quantity*
· ***Transport category***	*1*
· ***Tunnel restriction code***	*E*

(Contd. on page 8)

Safety data sheet
according to 1907/2006/EC, Article 31

Printing date 11.09.2020 *Version number 2* *Revision: 11.09.2020*

Product name: **Perfluorobutanoic acid**

(Contd. from page 7)

· ***UN "Model Regulation":*** *UN 3265 CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (HEPTAFLUOROBUTYRIC ACID), 8, I*

SECTION 15: Regulatory information

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

· ***Directive 2012/18/EU***
· ***Named dangerous substances - ANNEX I*** *Substance is not listed.*
· ***REGULATION (EC) No 1907/2006 ANNEX XVII*** *Conditions of restriction: 3*
· ***15.2 Chemical safety assessment:*** *A Chemical Safety Assessment has not been carried out.*

SECTION 16: Other information

The information in this safety data sheet (SDS) has been prepared with due care and is true and accurate to the best of our knowledge. The user must determine the suitability of the information for its particular purpose, ensure compliance with existing laws and regulations, and be aware that other or additional safety or performance considerations may arise when using, handling and/ or storing the material. The information in this SDS does not purport to be all inclusive or a guarantee as to the properties of the material supplied, and should be used only as a guide. LGC makes no warranties or representations as to the accuracy and completeness of the information contained herein, shall not be held responsible for the suitability of this information for the user's intended purposes or the consequences of such use, and shall not be liable for any damage or loss, howsoever arising, direct or otherwise.

· ***Abbreviations and acronyms:***
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
GHS: Globally Harmonised System of Classification and Labelling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
Skin Corr. 1A: Skin corrosion/irritation – Category 1A
Eye Dam. 1: Serious eye damage/eye irritation – Category 1
· ***Sources***
Tables 3.1 and 3.2 from Annex 6 of EC 1272/2008, EC 1907/2006, EH40/2005 as amended 2011, Registry of Toxic Effects of Chemical Substances (RTECS), The Dictionary of Substances and their Effects, 1st Edition, IUCLID.
· ***Data compared to the previous version altered.*** *All sections have been updated.*

SAFETY DATA SHEET

Revision Date 14-Feb-2020 **Revision Number** 3

1. Identification

Product Name **Perfluorodecanoic acid**

Cat No. : **B22292**

CAS-No 335-76-2
Synonyms Decanoic acid, nonadecafluoro-; Ndfda; Nonadecafluoro-n-decanoic acid

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

Details of the supplier of the safety data sheet

Company
Alfa Aesar
Thermo Fisher Scientific Chemicals, Inc.
30 Bond Street
Ward Hill, MA 01835-8099
Tel: 800-343-0660
Fax: 800-322-4757
Email: tech@alfa.com
www.alfa.com

Emergency Telephone Number
During normal business hours (Monday-Friday, 8am-7pm EST), call (800) 343-0660.
After normal business hours, call Carechem 24 at (866) 928-0789.

2. Hazard(s) identification

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

Carcinogenicity	Category 2
Reproductive Toxicity	Category 1A
Effects on or via lactation	

Label Elements

Signal Word
Danger

Hazard Statements
Suspected of causing cancer
May damage the unborn child. Suspected of damaging fertility
May cause harm to breast-fed children

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Do not breathe dust/fume/gas/mist/vapors/spray
Avoid contact during pregnancy/while nursing
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Response
IF exposed or concerned: Get medical attention/advice
Storage
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Decanoic acid, nonadecafluoro-	335-76-2	96

4. First-aid measures

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

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

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

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

Ingestion Do NOT induce vomiting. Call a physician or poison control center immediately.

Most important symptoms and effects None reasonably foreseeable.

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray. Carbon dioxide (CO_2). Dry chemical. Alcohol resistant foam.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature Not applicable
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

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

NFPA

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment as required. Avoid dust formation. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas.

Environmental Precautions Should not be released into the environment. See Section 12 for additional Ecological Information.

Methods for Containment and Clean Up Sweep up and shovel into suitable containers for disposal. Avoid dust formation.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Avoid dust formation. Use only under a chemical fume hood. Do not breathe (dust, vapor, mist, gas). Do not ingest. If swallowed then seek immediate medical assistance.

Storage Keep in a dry, cool and well-ventilated place. Refer product specification and/or product label for specific storage temperature requirement. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

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

EN166.

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

Respiratory Protection Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

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

9. Physical and chemical properties

Physical State	Powder Solid
Appearance	White
Odor	Odorless
Odor Threshold	No information available
pH	No information available
Melting Point/Range	77 - 83 °C / 170.6 - 181.4 °F
Boiling Point/Range	218 °C / 424.4 °F @ 740 mmHg
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Specific Gravity	No information available
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	Not applicable
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	C10 H F19 O2
Molecular Weight	514.08

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products.

Incompatible Materials Bases, Reducing Agent

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Gaseous hydrogen fluoride (HF)

Hazardous Polymerization No information available.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Decanoic acid, nonadecafluoro-	LD50 = 57 mg/kg (Rat)	Not listed	Not listed

Toxicologically Synergistic No information available

Products

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

Irritation No information available

Sensitization No information available

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

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Decanoic acid, nonadecafluoro-	335-76-2	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information No information available

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

12. Ecological information

Ecotoxicity

Do not empty into drains.

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility No information available.

13. Disposal considerations

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

14. Transport information

DOT

UN-No UN2811
Proper Shipping Name TOXIC SOLIDS, ORGANIC, N.O.S.
Technical Name Decanoic acid, nonadecafluoro-
Hazard Class 6.1
Packing Group II

TDG

UN-No UN2811
Proper Shipping Name Toxic solid, organic, n.o.s.
Hazard Class 6.1
Packing Group II

IATA

UN-No	UN2811
Proper Shipping Name	Toxic solid, organic, n.o.s.
Hazard Class	6.1
Packing Group	II

IMDG/IMO

UN-No	UN2811
Proper Shipping Name	Toxic solid, organic, n.o.s.
Hazard Class	6.1
Packing Group	II

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Decanoic acid, nonadecafluoro-	335-76-2	X	ACTIVE	S

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule.

TSCA 12(b) - Notices of Export

Component	CAS-No	**TSCA 12(b)** - Notices of Export
Decanoic acid, nonadecafluoro-	335-76-2	Section 5

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

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Decanoic acid, nonadecafluoro-	335-76-2	-	-	206-400-3	-	X	-	-	-

U.S. Federal Regulations

SARA 313 Not applicable

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

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

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

U.S. State Right-to-Know Regulations Not applicable

U.S. Department of Transportation

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

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

Other International Regulations

Mexico - Grade	No information available

16. Other information

Prepared By	Health, Safety and Environmental Department Email: tech@alfa.com www.alfa.com
Revision Date	14-Feb-2020
Print Date	14-Feb-2020
Revision Summary	SDS authoring systems update, replaces ChemGes SDS No. 335-76-2.

Disclaimer

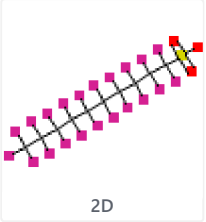
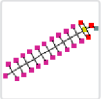
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered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

End of SDS

PubChem

COMPOUND SUMMARY

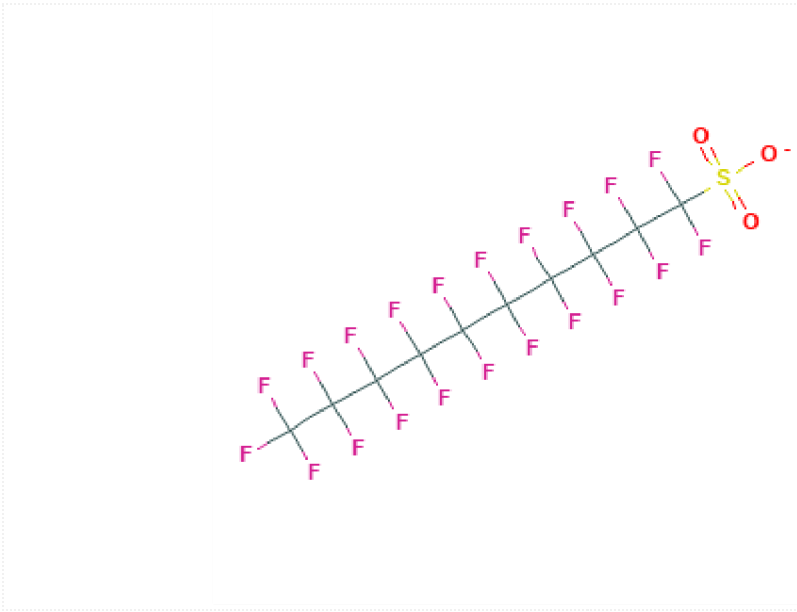
1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-Henicosafluorodecane-1-sulfonate

PubChem CID	3446488
Structure	 2D Find Similar Structures
Molecular Formula	$C_{10}F_{21}O_3S^-$
Synonyms	perfluorodecanesulfonate 1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-henicosafluorodecane-1-sulfonate DTXSID00873014 Henicosafluoro-1-decanesulfonic acid anion 126105-34-8
Molecular Weight	599.14
Parent Compound	 CID 67636 (Perfluorodecane sulfonic acid)
Dates	Modify 2021-05-22 Create 2005-09-08

1 Structures

1.1 2D Structure

Chemical Structure Depiction



PubChem

1.2 3D Status

Conformer generation failed at clustering step

PubChem

2 Names and Identifiers

2.1 Computed Descriptors

2.1.1 IUPAC Name

1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-henicosafluorodecane-1-sulfonate

Computed by LexiChem 2.6.6 (PubChem release 2019.06.18)

PubChem

2.1.2 InChI

InChI=1S/C10HF21O3S/c11-1(12,3(15,16)5(19,20)7(23,24)9(27,28)29)2(13,14)4(17,18)6(21,22)8(25,26)10(30,31)35(32,33)34/h(H,32,33,34)/p-1

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.3 InChI Key

HYWZIAVPBSTISZ-UHFFFAOYSA-M

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.4 Canonical SMILES

C(C(C(C(C(C(F)(F)S(=O)(=O)[O-])(F)F)(F)F)(F)F)(F)F)(C(C(C(C(F)(F)F)(F)F)(F)F)(F)F)(F)F

Computed by OEChem 2.1.5 (PubChem release 2019.06.18)

PubChem

2.2 Molecular Formula

C10F21O3S-

Computed by PubChem 2.1 (PubChem release 2019.06.18)

PubChem

2.3 Other Identifiers

2.3.1 CAS

126105-34-8

EPA DSSTox

2.3.2 DSSTox Substance ID

DTXSID00873014

EPA DSSTox

2.3.3 Wikipedia

Perfluorodecanesulfonate

Wikipedia

2.4 Synonyms

2.4.1 Depositor-Supplied Synonyms

perfluorodecanesulfonate
1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,10-henicosafluorodecane-1-sulfonate
DTXSID00873014
Henicosafluoro-1-decanesulfonic acid anion
126105-34-8

PubChem

3 Chemical and Physical Properties

3.1 Computed Properties

Property Name	Property Value	Reference
Molecular Weight	599.14	Computed by PubChem 2.1 (PubChem release 2021.05.07)
XLogP3-AA	6.3	Computed by XLogP3 3.0 (PubChem release 2019.06.18)
Hydrogen Bond Donor Count	0	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Hydrogen Bond Acceptor Count	24	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Rotatable Bond Count	8	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Exact Mass	598.9232814	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Monoisotopic Mass	598.9232814	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Topological Polar Surface Area	65.6 Å^2	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Heavy Atom Count	35	Computed by PubChem
Formal Charge	-1	Computed by PubChem
Complexity	893	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Isotope Atom Count	0	Computed by PubChem
Defined Atom Stereocenter Count	0	Computed by PubChem
Undefined Atom Stereocenter Count	0	Computed by PubChem
Defined Bond Stereocenter Count	0	Computed by PubChem
Undefined Bond Stereocenter Count	0	Computed by PubChem
Covalently-Bonded Unit Count	1	Computed by PubChem
Compound Is Canonicalized	Yes	Computed by PubChem (release 2011.04.04)

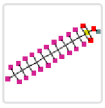
PubChem

4 Related Records

4.1 Related Compounds with Annotation

PubChem

4.2 Parent Compound



CID 67636 (Perfluorodecane sulfonic acid)

PubChem

4.3 Related Compounds

Same Parent, Exact	20 Records
Mixtures, Components, and Neutralized Forms	1 Record
Similar Compounds	84 Records

PubChem

4.4 Substances

4.4.1 Related Substances

Same	9 Records

PubChem

4.4.2 Substances by Category

PubChem

5 Literature

5.1 Chemical Co-Occurrences in Literature

PubChem

5.2 Chemical-Gene Co-Occurrences in Literature

PubChem

5.3 Chemical-Disease Co-Occurrences in Literature

PubChem

6 Patents

6.1 Depositor-Supplied Patent Identifiers

PubChem

Link to all deposited patent identifiers

PubChem

7 Classification

7.1 Ontologies

7.1.1 NORMAN Suspect List Exchange Classification

NORMAN Suspect List Exchange

7.1.2 EPA DSSTox Classification

EPA DSSTox

8 Information Sources

FILTER BY SOURCE ALL SOURCES

1. ## EPA DSSTox

   LICENSE
   https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

   Perfluorodecanesulfonate
   https://comptox.epa.gov/dashboard/DTXSID00873014

   CompTox Chemicals Dashboard Chemical Lists
   https://comptox.epa.gov/dashboard/chemical_lists/

2. ## Wikipedia

   Perfluorodecanesulfonate
   https://www.wikidata.org/wiki/Q81978598

3. ## PubChem

   https://pubchem.ncbi.nlm.nih.gov

4. ## NORMAN Suspect List Exchange

   NORMAN Suspect List Exchange Classification
   https://www.norman-network.com/nds/SLE/

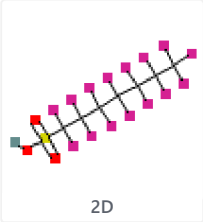
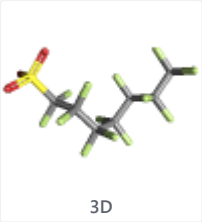
COVID-19 Information
Public health information (CDC) Research information (NIH) SARS-CoV-2 data (NCBI)
Prevention and treatment information (HHS) Español

PubChem

COMPOUND SUMMARY

Perfluoroheptanesulfonic acid

Cite Download

PubChem CID	67820
Structure	 2D  3D Find Similar Structures
Chemical Safety	Corrosive Irritant Laboratory Chemical Safety Summary (LCSS) Datasheet
Molecular Formula	$C_7HF_{15}O_3S$
Synonyms	perfluoroheptanesulfonic acid 375-92-8 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoroheptane-1-sulfonic acid perfluoroheptane sulfonic acid 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-Pentadecafluoroheptane-1-sulphonic acid More...
Molecular Weight	450.12
Dates	Modify 2021-05-22 Create 2005-08-08

Contents

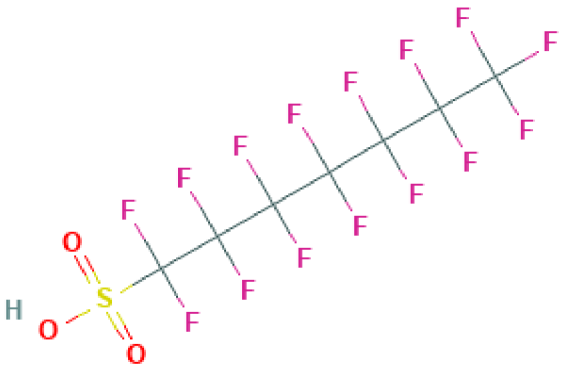
1 Structures
2 Names and Identifiers
3 Chemical and Physical Properties
4 Spectral Information
5 Related Records

6 Chemical Vendors
7 Use and Manufacturing
8 Safety and Hazards
9 Literature
10 Patents
11 Classification
12 Information Sources

1 Structures

1.1 2D Structure

Chemical Structure Depiction



PubChem

1.2 3D Conformer

PubChem

2 Names and Identifiers

2.1 Computed Descriptors

2.1.1 IUPAC Name

1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoroheptane-1-sulfonic acid

Computed by LexiChem 2.6.6 (PubChem release 2019.06.18)

PubChem

2.1.2 InChI

InChI=1S/C7HF15O3S/c8-1(9,2(10,11)4(14,15)6(18,19)20)3(12,13)5(16,17)7(21,22)26(23,24)25/h(H,23,24,25)

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.3 InChI Key

OYGQVDSRYXATEL-UHFFFAOYSA-N

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.4 Canonical SMILES

C(C(C(C(F)(F)F)(F)F)(F)F)(C(C(C(F)(F)S(=O)(=O)O)(F)F)(F)F)(F)F

Computed by OEChem 2.1.5 (PubChem release 2019.06.18)

PubChem

2.2 Molecular Formula

C7HF15O3S

Computed by PubChem 2.1 (PubChem release 2019.06.18)

PubChem

2.3 Other Identifiers

2.3.1 CAS

375-92-8

CAS Common Chemistry; ChemIDplus; EPA Chemicals under the TSCA; EPA DSSTox; European Chemicals Agency (ECHA)

2.3.2 European Community (EC) Number

206-800-8

European Chemicals Agency (ECHA)

2.3.3 DSSTox Substance ID

DTXSID8059920

EPA DSSTox

2.4 Synonyms

2.4.1 Depositor-Supplied Synonyms

perfluoroheptanesulfonic acid
375-92-8
1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoroheptane-1-sulfonic acid
perfluoroheptane sulfonic acid
1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-Pentadecafluoroheptane-1-sulphonic acid
1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-
Pentadecafluoro-1-heptanesulfonic acid
EINECS 206-800-8
SCHEMBL466749
DTXSID8059920
CS-B0913
MFCD28015666
1-Heptanesulfonic acid,1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-
AKOS030255152
ZINC100424529
Perfluoroheptane sulfonic acid (PFHpS)
Perfluoroheptanesulfonic acid 100 microg/mL in Acetonitrile

PubChem

3 Chemical and Physical Properties

3.1 Computed Properties

Property Name	Property Value	Reference
Molecular Weight	450.12	Computed by PubChem 2.1 (PubChem release 2021.05.07)
XLogP3-AA	4.3	Computed by XLogP3 3.0 (PubChem release 2019.06.18)
Hydrogen Bond Donor Count	1	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Hydrogen Bond Acceptor Count	18	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Rotatable Bond Count	6	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Exact Mass	449.9406875	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Monoisotopic Mass	449.9406875	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Topological Polar Surface Area	62.8 Å²	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Heavy Atom Count	26	Computed by PubChem
Formal Charge	0	Computed by PubChem
Complexity	639	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Isotope Atom Count	0	Computed by PubChem
Defined Atom Stereocenter Count	0	Computed by PubChem
Undefined Atom Stereocenter Count	0	Computed by PubChem
Defined Bond Stereocenter Count	0	Computed by PubChem
Undefined Bond Stereocenter Count	0	Computed by PubChem
Covalently-Bonded Unit Count	1	Computed by PubChem
Compound Is Canonicalized	Yes	Computed by PubChem (release 2019.01.04)

PubChem

4 Spectral Information

4.1 Mass Spectrometry

4.1.1 LC-MS

Showing 2 of 3 View More

MoNA ID	AU595851
MS Category	Experimental
MS Type	LC-MS
MS Level	MS2
Precursor Type	[M-H]-
precursor m/z	448.9334
Instrument	Bruker maXis Impact
Instrument Type	LC-ESI-QTOF
Ionization	ESI
Ionization Mode	negative
Collision Energy	20 eV
Retention Time	9.686 min
Splash	splash10-0002-0000900000-b1b456309cf71a49e08b
Thumbnail	
Submitter	Nikolaos Thomaidis, University of Athens

MassBank of North America (MoNA)

MoNA ID	AU595852
MS Category	Experimental
MS Type	LC-MS
MS Level	MS2
Precursor Type	[M-H]-
precursor m/z	448.9334

Instrument	Bruker maXis Impact
Instrument Type	LC-ESI-QTOF
Ionization	ESI
Ionization Mode	negative
Collision Energy	30 eV
Retention Time	9.688 min
Splash	splash10-0002-0000900000-6d7d70ed96726bc23786
Thumbnail	
Submitter	Nikolaos Thomaidis, University of Athens

MassBank of North America (MoNA)

4.1.2 Other MS

MoNA ID	MoNA024593
MS Category	Experimental
Precursor Type	[M-H]-
precursor m/z	448.9334129
Ionization Mode	negative
Splash	splash10-018b-9400200000-d38b5d1b7a909adacd7d
Thumbnail	

Submitter	Arpana Vaniya, UC DAVIS

MassBank of North America (MoNA)

5 Related Records

5.1 Related Compounds with Annotation

PubChem

5.2 Related Compounds

Same Parent, Exact	20 Records
Mixtures, Components, and Neutralized Forms	25 Records
Similar Compounds	38 Records
Similar Conformers	344 Records

PubChem

5.3 Substances

5.3.1 Related Substances

All	147 Records
Same	47 Records
Mixture	100 Records

PubChem

5.3.2 Substances by Category

PubChem

5.4 Entrez Crosslinks

PubMed	4 Records

PubChem

6 Chemical Vendors

- PubChem

7 Use and Manufacturing

7.1 Use Classification

PFAS (per- and polyfluoroalkyl substances) -> OECD Category

*S25 | OECDPFAS | List of PFAS from the OECD | **DOI:10.5281/zenodo.2648775***

▶ NORMAN Suspect List Exchange

7.2 General Manufacturing Information

EPA TSCA Commercial Activity Status

1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-: INACTIVE

https://www.epa.gov/tsca-inventory

▶ EPA Chemicals under the TSCA

EPA TSCA Regulatory Flag

S - indicates a substance that is identified in a final Significant New Use Rule.

https://www.epa.gov/tsca-inventory

▶ EPA Chemicals under the TSCA

8 Safety and Hazards

8.1 Hazards Identification

8.1.1 GHS Classification

Pictogram(s)	Corrosive Irritant
Signal	Danger
GHS Hazard Statements	H302 (100%): Harmful if swallowed [**Warning** Acute toxicity, oral] H312 (100%): Harmful in contact with skin [**Warning** Acute toxicity, dermal] H314 (100%): Causes severe skin burns and eye damage [**Danger** Skin corrosion/irritation] H332 (100%): Harmful if inhaled [**Warning** Acute toxicity, inhalation]
Precautionary Statement Codes	P260, P261, P264, P270, P271, P280, P301+P312, P301+P330+P331, P302+P352, P303+P361+P353, P304+P312, P304+P340, P305+P351+P338, P310, P312, P321, P322, P330, P363, P405, and P501 (The corresponding statement to each P-code can be found at the GHS Classification page.)
ECHA C&L Notifications Summary	*The GHS information provided by 1 company from 1 notification to the ECHA C&L Inventory.*

▸ European Chemicals Agency (ECHA)

8.1.2 Hazard Classes and Categories

Acute Tox. 4 (100%)

Acute Tox. 4 (100%)

Skin Corr. 1B (100%)

Acute Tox. 4 (100%)

▸ European Chemicals Agency (ECHA)

9 Literature

9.1 Springer Nature References

Springer Nature

9.2 Depositor Provided PubMed Citations

PubChem

9.3 Chemical Co-Occurrences in Literature

PubChem

9.4 Chemical-Gene Co-Occurrences in Literature

PubChem

9.5 Chemical-Disease Co-Occurrences in Literature

PubChem

10 Patents

10.1 Depositor-Supplied Patent Identifiers

PubChem

Link to all deposited patent identifiers

PubChem

10.2 WIPO PATENTSCOPE

Patents are available for this chemical structure:

https://patentscope.wipo.int/search/en/result.jsf?inchikey=OYGQVDSRYXATEL-UHFFFAOYSA-N

PATENTSCOPE (WIPO)

11 Classification

11.1 Ontologies

11.1.1 ChemIDplus

ChemIDplus

11.1.2 UN GHS Classification

UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

11.1.3 NORMAN Suspect List Exchange Classification

NORMAN Suspect List Exchange

11.1.4 EPA DSSTox Classification

EPA DSSTox

12 Information Sources

FILTER BY SOURCE ALL SOURCES

1. ## CAS Common Chemistry

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Perfluoroheptanesulfonic acid
https://commonchemistry.cas.org/detail?cas_rn=375-92-8

2. ## ChemIDplus

LICENSE
https://www.nlm.nih.gov/copyright.html

1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-
https://chem.nlm.nih.gov/chemidplus/sid/0000375928

ChemIDplus Chemical Information Classification
https://chem.nlm.nih.gov/chemidplus/

3. ## EPA Chemicals under the TSCA

LICENSE
https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-
https://www.epa.gov/chemicals-under-tsca

4. ## EPA DSSTox

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https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-
https://comptox.epa.gov/dashboard/DTXSID8059920

CompTox Chemicals Dashboard Chemical Lists
https://comptox.epa.gov/dashboard/chemical_lists/

5. ## European Chemicals Agency (ECHA)

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https://echa.europa.eu/web/guest/legal-notice

1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoroheptane-1-sulphonic acid
https://echa.europa.eu/substance-information/-/substanceinfo/100.006.183

1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoroheptane-1-sulphonic acid
https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/31812

6. ## MassBank of North America (MoNA)

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The content of the MoNA database is licensed under CC BY 4.0.
https://mona.fiehnlab.ucdavis.edu/documentation/license

Perfluoroheptane sulfonic acid (PFHpS)
http://mona.fiehnlab.ucdavis.edu/spectra/browse?inchikey=OYGQVDSRYXATEL-UHFFFAOYSA-N

7. ## NORMAN Suspect List Exchange

LICENSE

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1-Heptanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,7,7,7-pentadecafluoro-

NORMAN Suspect List Exchange Classification
https://www.norman-network.com/nds/SLE/

8. **Springer Nature**
https://pubchem.ncbi.nlm.nih.gov/substance/341183449

9. **PubChem**
https://pubchem.ncbi.nlm.nih.gov

10. **UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)**
GHS Classification Tree
http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html

11. **PATENTSCOPE (WIPO)**
SID 388347599
https://pubchem.ncbi.nlm.nih.gov/substance/388347599

SAFETY DATA SHEET

Creation Date 06-Mar-2007 **Revision Date** 19-Jan-2018 **Revision Number** 4

1. Identification

Product Name **Perfluoroheptanoic acid**

Cat No. : **AC277270000; AC277270050; AC277270100**

CAS-No 375-85-9
Synonyms 2,2,3,3,4,4,5,5,6,6,7,7,7,-Tridecafluoroheptanoic acid

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

Details of the supplier of the safety data sheet

Company

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

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

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

2. Hazard(s) identification

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

Acute oral toxicity	Category 4
Skin Corrosion/Irritation	Category 1 B
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
Harmful if swallowed
Causes severe skin burns and eye damage
May cause respiratory irritation

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Do not breathe dust/fume/gas/mist/vapors/spray
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Response
Immediately call a POISON CENTER or doctor/physician
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Ingestion
Rinse mouth
Do NOT induce vomiting
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Heptanoic acid, tridecafluoro-	375-85-9	96

4. First-aid measures

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

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Immediate medical attention is required.

Inhalation Remove from exposure, lie down. Remove to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Immediate medical attention is required.

Ingestion Do NOT induce vomiting. Call a physician immediately.

Most important symptoms and effects Causes burns by all exposure routes. . Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue

	and danger of perforation
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Carbon dioxide (CO_2). Dry chemical. Chemical foam.
Unsuitable Extinguishing Media	No information available
Flash Point	> 110 °C / > 230 °F
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

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

NFPA

Health	Flammability	Instability	Physical hazards
3	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment as required.
Environmental Precautions	See Section 12 for additional Ecological Information.
Methods for Containment and Clean Up	Sweep up and shovel into suitable containers for disposal. Do not let this chemical enter the environment.

7. Handling and storage

Handling	Do not breathe dust. Do not get in eyes, on skin, or on clothing. Do not ingest. If swallowed then seek immediate medical assistance. Handle product only in closed system or provide appropriate exhaust ventilation.
Storage	Keep in a dry, cool and well-ventilated place. Refer product specification and/or product label for specific storage temperature requirement. Keep container tightly closed. Corrosives area.

8. Exposure controls / personal protection

Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.
Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Solid
Appearance	Light yellow
Odor	Odorless
Odor Threshold	No information available
pH	No information available
Melting Point/Range	30 °C / 86 °F
Boiling Point/Range	175 °C / 347 °F @ 760 mmHg
Flash Point	> 110 °C / > 230 °F
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Specific Gravity	1.790
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	C7 H F13 O2
Molecular Weight	364.05

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products.
Incompatible Materials	Strong oxidizing agents, Acids
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO_2), Gaseous hydrogen fluoride (HF)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information
Toxicologically Synergistic Products No information available

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

Irritation Causes burns by all exposure routes

Sensitization No information available

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

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Heptanoic acid, tridecafluoro-	375-85-9	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Endocrine Disruptor Information No information available

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

12. Ecological information

Ecotoxicity
Do not empty into drains.

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility No information available.

13. Disposal considerations

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

14. Transport information

DOT
- **UN-No** UN3261
- **Proper Shipping Name** Corrosive solid, acidic, organic, n.o.s.
- **Technical Name** Heptanoic acid, tridecafluoro-
- **Hazard Class** 8
- **Packing Group** II

TDG

UN-No UN3261
Proper Shipping Name Corrosive solid, acidic, organic, n.o.s.
Hazard Class 8
Packing Group II

IATA

UN-No UN3261
Proper Shipping Name Corrosive solid, acidic, organic, n.o.s.
Hazard Class 8
Packing Group II

IMDG/IMO

UN-No UN3261
Proper Shipping Name Corrosive solid, acidic, organic, n.o.s.
Hazard Class 8
Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Heptanoic acid, tridecafluoro-	375-85-9	X	ACTIVE	-

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

TSCA 12(b) - Notices of Export Not applicable

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

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Heptanoic acid, tridecafluoro-	375-85-9	-	X	206-798-9	-	X	X	-	KE-28149

U.S. Federal Regulations

SARA 313 Not applicable

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

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

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

U.S. State Right-to-Know Regulations Not applicable

U.S. Department of Transportation
Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

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

Other International Regulations

Mexico - Grade	No information available

16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	06-Mar-2007
Revision Date	19-Jan-2018
Print Date	19-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

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

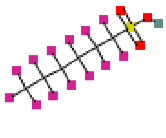
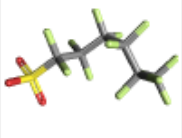
End of SDS

COVID-19 Information
Public health information (CDC) Research information (NIH) SARS-CoV-2 data (NCBI) Prevention and treatment information (HHS)
Español

PubChem

COMPOUND SUMMARY

Perfluorohexanesulfonic acid

PubChem CID	67734
Structure	 2D  3D Find Similar Structures
Chemical Safety	Corrosive Irritant Laboratory Chemical Safety Summary (LCSS) Datasheet
Molecular Formula	$C_6HF_{13}O_3S$
Synonyms	Perfluorohexanesulfonic acid 355-46-4 1,1,2,2,3,3,4,4,5,5,6,6,6-Tridecafluorohexane-1-sulfonic acid Perfluorohexane-1-sulphonic acid perfluorohexane sulfonic acid More...
Molecular Weight	400.12
Dates	Modify 2021-05-22 Create 2005-08-08

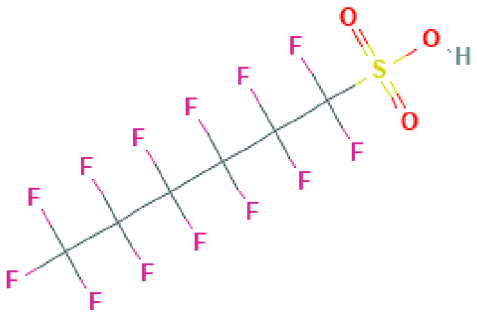
Perfluorohexanesulfonic acid is a perfluoroalkanesulfonic acid that is hexane-1-sulfonic acid in which all thirteen of the hydrogens that are attached to carbons have been replaced by fluorines.

ChEBI

1 Structures

1.1 2D Structure

Chemical Structure Depiction

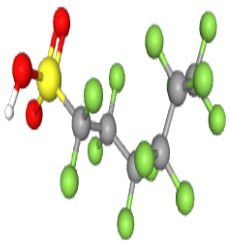


PubChem

1.2 3D Conformer

Interactive Chemical Structure Model

- (•) Ball and Stick
- ( ) Sticks
- ( ) Wire-Frame
- ( ) Space-Filling
- [x] Show Hydrogens
- [ ] Animate



PubChem

2 Names and Identifiers

2.1 Computed Descriptors

2.1.1 IUPAC Name

1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluorohexane-1-sulfonic acid

Computed by LexiChem 2.6.6 (PubChem release 2019.06.18)

PubChem

2.1.2 InChI

InChI=1S/C6HF13O3S/c7-1(8,3(11,12)5(15,16)17)2(9,10)4(13,14)6(18,19)23(20,21)22/h(H,20,21,22)

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.3 InChI Key

QZHDEAJFRJCDMF-UHFFFAOYSA-N

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.4 Canonical SMILES

C(C(C(C(F)(F)S(=O)(=O)O)(F)F)(F)F)(C(C(F)(F)F)(F)F)(F)F

Computed by OEChem 2.1.5 (PubChem release 2019.06.18)

PubChem

2.2 Molecular Formula

C6HF13O3S

Computed by PubChem 2.1 (PubChem release 2019.06.18)

PubChem

2.3 Other Identifiers

2.3.1 CAS

355-46-4

CAS Common Chemistry; ChemIDplus; EPA Chemicals under the TSCA; EPA DSSTox; European Chemicals Agency (ECHA); Hazardous Substances Data Bank (HSDB)

2.3.2 European Community (EC) Number

206-587-1

European Chemicals Agency (ECHA)

2.3.3 UNII

ZU6Y1E592S

FDA/SPL Indexing Data

2.3.4 DSSTox Substance ID

DTXSID7040150

EPA DSSTox

2.3.5 Wikipedia

Perfluorohexanesulphonic acid

Wikipedia

Perfluorohexanesulfonate

Wikipedia

2.4 Synonyms

2.4.1 MeSH Entry Terms

perfluorohexanesulfonate
perfluorohexanesulfonic acid
PFHS cpd

Medical Subject Headings (MeSH)

2.4.2 Depositor-Supplied Synonyms

Perfluorohexanesulfonic acid	C6HF13O3S	AKOS016005064
355-46-4	EINECS 206-587-1	Perfluorohexane sulfonic acid (PFHxS)
1,1,2,2,3,3,4,4,5,5,6,6,6-Tridecafluorohexane-1-sulfonic acid	SCHEMBL332726	LS41238
Perfluorohexane-1-sulphonic acid	CHEMBL1906987	Z-1469
perfluorohexane sulfonic acid	DTXSID7040150	Q26833878
perfluorohexanesulphonic acid	HSDB 8274	Perfluorohexanesulfonic acid 100 microg/mL in Acetonitrile
UNII-ZU6Y1E592S	AMY7161	Perfluorohexanesulfonic acid 50 microg/mL in Methanol:Water
1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-	CHEBI:132448	
perfluorohexanesulfonate	CS-B0907	
ZU6Y1E592S	4434AB	
Perfluorohexane-1-sulfonic acid	ANW-65167	
tridecafluorohexane-1-sulfonic acid	MFCD00042453	
PFHxS	ZINC38141431	

PubChem

3 Chemical and Physical Properties

3.1 Computed Properties

Property Name	Property Value	Reference
Molecular Weight	400.12	Computed by PubChem 2.1 (PubChem release 2021.05.07)
XLogP3-AA	3.7	Computed by XLogP3 3.0 (PubChem release 2019.06.18)
Hydrogen Bond Donor Count	1	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Hydrogen Bond Acceptor Count	16	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Rotatable Bond Count	5	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Exact Mass	399.9438812	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Monoisotopic Mass	399.9438812	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Topological Polar Surface Area	62.8 Å^2	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Heavy Atom Count	23	Computed by PubChem
Formal Charge	0	Computed by PubChem
Complexity	553	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Isotope Atom Count	0	Computed by PubChem
Defined Atom Stereocenter Count	0	Computed by PubChem
Undefined Atom Stereocenter Count	0	Computed by PubChem
Defined Bond Stereocenter Count	0	Computed by PubChem
Undefined Bond Stereocenter Count	0	Computed by PubChem
Covalently-Bonded Unit Count	1	Computed by PubChem
Compound Is Canonicalized	Yes	Computed by PubChem (release 2019.01.04)

PubChem

3.2 Experimental Properties

3.2.1 Boiling Point

238.5 °C

EPA DSSTox

238-239 °C

Kosswig K; Sulfonic Acids, Aliphatic. Ullmann's Encyclopedia of Industrial Chemistry. 7th ed. (1999-2015). New York, NY: John Wiley & Sons. Online Posting Date: Jun 15, 2000.

Hazardous Substances Data Bank (HSDB)

3.2.2 Solubility

In water, 6.2 mg/L at 25 °C (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

Hazardous Substances Data Bank (HSDB)

3.2.3 Density

1.841 g/cu cm

ChemIndex; Perfluorohexane-1-sulphonic Acid. Available from, as of Oct 6, 2015: ***http://www.chemindex.com/355-46-4-cas.html***

Hazardous Substances Data Bank (HSDB)

3.2.4 Vapor Pressure

0.0046 mm Hg at 25 °C (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

Hazardous Substances Data Bank (HSDB)

3.2.5 LogP

log Kow = 3.16 (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

Hazardous Substances Data Bank (HSDB)

3.2.6 Stability/Shelf Life

Chemical stability: Stable under recommended storage conditions. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: ***http://www.sigmaaldrich.com/safety-center.html***

Hazardous Substances Data Bank (HSDB)

3.2.7 Refractive Index

Index of refraction: 1.309

ChemIndex; Perfluorohexane-1-sulphonic Acid. Available from, as of Oct 6, 2015: ***http://www.chemindex.com/355-46-4-cas.html***

Hazardous Substances Data Bank (HSDB)

3.2.8 Dissociation Constants

pKa = 0.14 (est)

ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: ***http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

3.2.9 Collision Cross Section

150.81 $Å^2$ $[M-H]^-$

228.66 $Å^2$ $[2M-H]^-$

S79 | UACCSCEC | Collision Cross Section (CCS) Library from UAntwerp | ***DOI:10.5281/zenodo.4704648***

NORMAN Suspect List Exchange

3.2.10 Other Experimental Properties

Beige crystals /Perfluorohexanesulfonic acid potassium salt/

Sigma-Aldrich; Product Search. Tridecafluorohexane-1-sulfonic acid potassium salt. (3871-99-6). Available from, as of Oct 9, 2015: ***http://www.sigmaaldrich.com/united-states.html***

Hazardous Substances Data Bank (HSDB)

Henry's Law constant: 4.0X10-4 atm cu m/mol at 25 °C (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

- Hazardous Substances Data Bank (HSDB)

Hydroxyl radical reaction rate constant: 1.4X10-13 cu cm/molecule-sec at 25 °C (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

- Hazardous Substances Data Bank (HSDB)

4 Spectral Information

4.1 Mass Spectrometry

4.1.1 LC-MS

Showing 2 of 4 View More

MoNA ID	AU595750
MS Category	Experimental
MS Type	LC-MS
MS Level	MS2
Precursor Type	[M-H]-
precursor m/z	398.9366
Instrument	Bruker maXis Impact
Instrument Type	LC-ESI-QTOF
Ionization	ESI
Ionization Mode	negative
Collision Energy	10 eV
Retention Time	8.837 min
Splash	splash10-0002-0009000000-032b155c5aad417d734a
Thumbnail	
Submitter	Nikolaos Thomaidis, University of Athens

MassBank of North America (MoNA)

MoNA ID	AU595751
MS Category	Experimental
MS Type	LC-MS
MS Level	MS2
Precursor Type	[M-H]-
precursor m/z	398.9366
Instrument	Bruker maXis Impact
Instrument Type	LC-ESI-QTOF
Ionization	ESI
Ionization Mode	negative

Collision Energy	20 eV
Retention Time	8.846 min
Splash	splash10-0002-0009000000-10401c65f3ead0881273
Thumbnail	
Submitter	Nikolaos Thomaidis, University of Athens

MassBank of North America (MoNA)

4.1.2 Other MS

MoNA ID	MoNA024592
MS Category	Experimental
Precursor Type	[M-H]-
precursor m/z	398.9366065
Ionization Mode	negative
Splash	splash10-018b-9402000000-9465cdba153ac41e8185
Thumbnail	
Submitter	Arpana Vaniya, UC DAVIS

MassBank of North America (MoNA)

5 Related Records

5.1 Related Compounds with Annotation

PubChem

5.2 Related Compounds

Same Parent, Exact	50 Records
Mixtures, Components, and Neutralized Forms	97 Records
Similar Compounds	31 Records
Similar Conformers	743 Records

PubChem

5.3 Substances

5.3.1 Related Substances

All	309 Records
Same	72 Records
Mixture	237 Records

PubChem

5.3.2 Substances by Category

PubChem

5.4 Entrez Crosslinks

PubMed	196 Records
Taxonomy	5 Records
OMIM	14 Records
Gene	207 Records

PubChem

5.5 Associated Chemicals

Tridecafluorohexane-1-sulfonic acid potassium salt; 3871-99-6

Hazardous Substances Data Bank (HSDB)

Perfluorohexanesulfonate; 355-46-4

Hazardous Substances Data Bank (HSDB)

6 Chemical Vendors

PubChem

7 Pharmacology and Biochemistry

7.1 Absorption, Distribution and Excretion

/MILK/ The widespread presence of **perfluorooctanesulfonate** (**PFOS**), **perfluorooctanoate** (**PFOA**), and **perfluorohexanesulfonate** (PFHxS) in human general populations and their slow elimination profiles have led to renewed interest in understanding the potential human neonatal exposures of perfluoroalkyls (PFAs) from consumption of human milk. The objective of this study was to evaluate the concentrations of **PFOS**, PFHxS, and **PFOA** in pooled human milk samples obtained in Sweden between 1972 and 2008 (a period representing the most significant period of PFA production) and to see whether the time trend of these analytes parallels that indicated in human serum. Chemical analysis of **PFOS**, PFHxS, and **PFOA** was performed on pooled Swedish human milk samples from 1972 to 2008 after methodological refinements. The 20 samples which formed the 2007 pool were also analyzed individually to evaluate sample variations. Analyses were performed by HPLC-MS/MS. Due to the complexities of the human milk matrix and the requirement to accurately quantitate low pg/mL concentrations, meticulous attention must be paid to background contamination if accurate results are to be obtained. **PFOS** was the predominant analyte present in the pools and all three analytes showed statistically significant increasing trends from 1972 to 2000, with concentrations reaching a plateau in the 1990s. **PFOA** and **PFOS** showed statistically significant decreasing trends during 2001-2008. At the end of the study, in 2008, the measured concentrations of **PFOS**, PFHxS, and **PFOA** in pooled human milk were 75 pg/mL, 14 pg/mL, and 74 pg/mL, respectively. The temporal concentration trends of **PFOS**, PFHxS, and **PFOA** observed in human milk are parallel to those reported in the general population serum concentrations.

PMID:20880590
Sundstrom M et al; Environ Int 37(1):178-83 (2011).

▸ **Hazardous Substances Data Bank (HSDB)**

/MILK/ The presence of perfluoroalkyl acids (PFAAs) in breast milk has been documented, but their lactational transfer has been rarely studied. Determination of the elimination rates of these chemicals during breastfeeding is important and critical for assessing exposure in mothers and infants. We aimed to investigate the association between breastfeeding and maternal serum concentrations of **perfluorooctanoic acid** (**PFOA**), **perfluorooctane sulfonate** (**PFOS**), **perfluorononanoic acid** (**PFNA**), and **perfluorohexane sulfonate** (PFHxS). For a subset of the population, for whom we also have their infants' measurements, we investigated associations of breastfeeding with infant serum PFAA concentrations. The present analysis included 633 women from the C8 Science Panel Study who had a child < 3.5 years of age and who provided blood samples and reported detailed information on breastfeeding at the time of survey. PFAA serum concentrations were available for all mothers and 8% (n = 49) of the infants. Maternal and infant serum concentrations were regressed on duration of breastfeeding. Each month of breastfeeding was associated with lower maternal serum concentrations of PFOA (-3%; 95% CI: -5, -2%), PFOS (-3%; 95% CI: -3, -2%), PFNA (-2%; 95% CI: -2, -1%), and PFHxS (-1%; 95% CI: -2, 0%). The infant PFOA and PFOS serum concentrations were 6% (95% CI: 1, 10%) and 4% (95% CI: 1, 7%) higher per month of breastfeeding. Breast milk is the optimal food for infants, but is also a PFAA excretion route for lactating mothers and exposure route for nursing infants.

PMID:24280536
*Full text: **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3915259***
Mondal D et al; Environ Health Perspect 122(2):187-92 (2014).

▸ **Hazardous Substances Data Bank (HSDB)**

Perfluorooctane sulfonate (**PFOS**) and **perfluorooctanoate** (**PFOA**) are normally the dominant perfluoroalkyl substances (PFASs) in human serum, but here a Canadian family of seven was identified with particularly high exposure to **perfluorohexanesulfonate** (PFHxS). Disproportionately high serum PFHxS concentrations (range 27.5-423 ng/mL) and moderately high **PFOS** (range 15.2-108 ng/mL) and **PFOA** (range 2.40-9.23 ng/mL) concentrations were detected in the family members, with all three chemicals being highest in the youngest children. We therefore sought to identify the source(s) and pathway(s) of this unusual exposure, and to study the excretion of PFASs for this family. Serum, urine, and stool were sampled from family members, carpet, dust, and air were sampled in the home, and a questionnaire was administered. Over 15 years, the family's household carpets were treated 8 times with Scotchgard formulations. Elevated concentrations of PFHxS were detected in household dust (2780 ng/g dust) and in family room carpet (2880 ng/g carpet), and the primary mode of excretion for the major PFASs was through urine. The high PFHxS and moderately high **PFOS** concentrations in serum and household samples are consistent with the known PFAS content of certain Scotchgard formulations, and exposure was likely through dust ingestion and/or inhalation.

PMID:23102093
Beesoon S et al; Environ Sci Technol 46(23): 12960-7 (2012).

▸ **Hazardous Substances Data Bank (HSDB)**

A total of 100 serum samples from 50 new couples (none of the females in this study has ever been pregnant) in Tianjin, North China, were analyzed for eleven perfluoroalkyl acids (PFAAs) with isomer-specific method. Among all samples, total **perfluorooctanesulfonate** (**PFOS**, mean 11.3 ng/mL) was predominant followed by total **perfluorooctanoate** (**PFOA**, 2.95 ng/mL), **perfluorodecanoate** (**PFDA**, 1.17 ng/mL), perfluorononanoate (**PFNA**, 0.93 ng/mL) and **perfluorohexanesulfonate** (PFHxS, 0.67 ng/mL). The mean concentrations of **PFOS** and PFHxS in males (14.2 and 0.89 ng/mL) were significantly higher (p=0.001) than in females (8.36 and 0.45 ng/mL). No statistical difference between

genders was observed for the other PFAAs. This suggests that menstruation is one important elimination pathway for PFOS and PFHxS in females. Linear PFOA was the dominant isomer with mean proportion of 99.7%, suggesting that telomeric PFOA (and its precursors), which contains almost pure linear isomer, might be the dominant exposure source of PFOA in Tianjin. On average, the proportion of linear PFOS (n-PFOS) was 59.2% of PFOS, which was lower than that in technical PFOS products (ca. 70% linear). Except perfluoroisopropyl PFOS, all the other monomethyl branched PFOS isomers were enriched in human serum compared to the commercial products, suggesting the monomethyl branched PFOS precursors were preferentially biotransformed in humans /SRP: or a differential clearance occurred/.

PMID:24747327
Zhang Y et al; Environ Int 68:185-91 (2014).

Hazardous Substances Data Bank (HSDB)

For more Absorption, Distribution and Excretion (Complete) data for Perfluorohexanesulfonic acid (6 total), please visit the HSDB record page.

Hazardous Substances Data Bank (HSDB)

7.2 Biological Half-Life

Perfluorohexanesulfonate (PFHxS) has been found in biological samples from wildlife and humans. The human geometric mean serum PFHxS elimination half-life has been estimated to be 2665 days. A series of studies was undertaken to establish pharmacokinetic parameters for PFHxS in rats, mice, and monkeys after single administration with pharmacokinetic parameters determined by WinNonlin software. Rats and mice appeared to be more effective at eliminating PFHxS than monkeys. With the exception of female rats, which had serum PFHxS elimination half-life of approximately 2 days, the serum elimination half-lives in the rodent species and monkeys approximated 1 month and 4 months, respectively, when followed over extended time periods (10-24 weeks). Collectively, these studies provide valuable insight for human health risk assessment regarding the potential for accumulation of PFHxS in humans.

PMID:21856411
Sundstrom M et al; Reprod Toxicol 33(4): 441-51 (2012).

Hazardous Substances Data Bank (HSDB)

7.3 Mechanism of Action

Perfluorohexanesulfonate (PFHxS) is one of the most widely distributed perfluoroalkyl compounds (PFCs) and its possible neurotoxicity has been suggested. However, the effects of PFHxS on neuronal function remain to be elucidated. In this study, the effects of PFHxS on neuronal cell death and the underlying mechanisms were examined. Cerebellar granule cells (CGCs) were isolated from 7-day old rat pups and maintained in culture for additional 7d. The apoptotic effects of PFHxS were determined by caspase-3 activity and TUNEL staining. PFHxS increased the apoptotic death of CGC in concentration-dependent manner. It also increased the activation of ERK1/2, JNK and p38 MAPK with different temporal activation. PD98059, an inhibitor of ERK1/2 pathway, completely blocked PFHxS-induced apoptosis whereas SP600125, a JNK inhibitor, significantly increased the apoptosis, showing their opposite roles in the apoptosis of CGCs. Treatment of antioxidants, Trolox or N-acetylcysteine (NAC), completely blocked ROS generation by PFHxS but neither of these antioxidants prevented PFHxS-induced apoptosis, suggesting that ROS may not play a key role in the process of apoptosis. PD98059 prevented ROS accumulation by PFHxS but the ERK1/2 activation was not affected by Trolox or NAC. These results indicate that ROS is one of downstream targets of ERK1/2, not vice versa. Taken together, PFHxS increased apoptosis of CGC in ERK1/2-dependent manner, where downstream pathway other than ROS may play a major role.
...

PMID:24125707
Lee YJ et al; Chemosphere 94:121-7 (2014).

Hazardous Substances Data Bank (HSDB)

8 Use and Manufacturing

8.1 Overview

IDENTIFICATION: The **potassium** salt of perfluorohexanesulfonic acid is a beige crystal. Perfluorohexanesulfonic acid is moderately soluble in **water**. USE: Perfluorohexanesulfonic acid is used to make other organic chemicals containing **fluorine**. It was previously used in firefighting foam and to make **water** and stain coatings for carpets, paper and cloth. EXPOSURE: Perfluoroalkyls, which include perfluorohexanesulfonic acid, occur everywhere including the Arctic and open oceans. Workers that use perfluorohexanesulfonic acid may breathe in mists or have direct skin contact. The general population may be exposed from various consumer products, by breathing in air, breathing in indoor dust, eating food and drinking **water**. Perfluorinated compounds, including **perfluorohexanesulfonate**, have been found in human blood, serum and breast milk. If perfluorohexanesulfonic acid is released to the environment it can travel long distances. It will also be in or on particles that eventually fall to the ground. It is not expected to be broken down by light. It will not move into air from moist soil and **water** surfaces. It is expected to move easily through soil and not be degraded by microorganisms. It is expected to build up in aquatic organisms. RISK: Increased risk of asthma and behavioral and learning problems (including attention deficit hyperactive deficit disorder) have been observed in some children with high blood levels of perfluorinated compounds, including perfluorohexanesulfonic acid. Mild liver damage, altered human **cholesterol** and triglyceride levels, and immune system impairments may occur with exposure to perfluorinated compounds (including perfluorohexanesulfonic acid); however, human study results vary widely making it difficult to identify potential health effects. Adverse effects on male and female reproductive health and fetal growth have been associated with exposure to some perfluorinated compounds in several human studies, but very little evidence links perfluorohexanesulfonic acid exposure to adverse reproductive effects or impaired fetal growth. Infertility, abortion, and birth defects were not observed in laboratory animals orally exposed to perfluorohexanesulfonic acid. Altered behavior (decreased activity) was observed in offspring of laboratory animals exposed to perfluorohexanesulfonic acid during pregnancy. Perfluorohexanesulfonic acid levels in the blood have not been associated with incidence of prostate cancer in humans. No other data on the potential for perfluorohexanesulfonic acid to cause cancer in humans or laboratory animals were available. The potential for perfluorohexanesulfonic acid to cause cancer in humans has not been assessed by the U.S. EPA IRIS program, the International Agency for Research on Cancer, or the U.S. National Toxicology Program 13th Report on Carcinogens. (SRC)

FOR MORE INFORMATION: (1) National Library of Medicine Hazardous Substances Data Bank. Available from, as of Oct 9, 2015: ***http://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm*** *(2) ATSDR Toxicological Profile for Perfluoroalkyls. Draft for Public Comment. 2015. Available from, as of Oct 9, 2015:* ***http://www.atsdr.cdc.gov/toxprofiles/index.asp*** *(3) IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Available from, as of Oct 9, 2015:* ***http://monographs.iarc.fr/ENG/Classification/index.php*** *(4) National Toxicology Program. Testing Status of Agents at NTP. RTP No. PFHXS N040005-NTP. Available from, as of Oct 9, 2015:* ***http://ntp.niehs.nih.gov/*** *(5) National Toxicology Program. Thirteenth Report on Carcinogens. Available from, as of Oct 9, 2015:* ***http://ntp.niehs.nih.gov/pubhealth/roc/index.html*** *(6) USEPA/IRIS Integrated Risk Information System. Available from, as of Oct 9, 2015:* ***http://www.epa.gov/iris/***

- **Hazardous Substances Data Bank (HSDB)**

8.2 Use Classification

PFAS (per- and polyfluoroalkyl substances) -> OECD Category

S25 | OECDPFAS | List of PFAS from the OECD | ***DOI:10.5281/zenodo.2648775***

- **NORMAN Suspect List Exchange**

8.3 Uses

EPA CPDat Chemical and Product Categories

EPA Chemical and Products Database (CPDat)

Used mainly as a raw material or precursor for production of PFAS /perfluoroalkyl sulfonate/ based products.

OECD; PFCS: Outcome of the 2009 survey. Survey on the production, use and release of PFOS, PFAS, PFOA PFCA, their related substances and products/mixtures containing these substances. Series on risk management No.24 (Jan 7, 2011). Available from, as of Oct 6, 2015: ***http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=env/jm/mono(2011)1&doclanguage=en***

Hazardous Substances Data Bank (HSDB)

Laboratory applications, manufacture of substances. /**Tridecafluorohexane-1-sulfonic acid potassium salt**/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: ***http://www.sigmaaldrich.com/safety-center.html***

Hazardous Substances Data Bank (HSDB)

Perfluorohexane sulfonate (PFHxS) is a six-**carbon** compound in the perfluoroalkyl family of chemicals. **Perfluorohexane sulfonate** was once used in firefighting foam and carpet treatment solutions. It was once widely used by 3M as a stain and **water** repellent but was phased out due to U.S. Environmental Protection Agency regulations.

Garcia J. S. et al; Perfluoroalkyl Compounds, Hamilton & Hardy's Industrial Toxicology 69 (2015). ***http://onlinelibrary.wiley.com/advanced/search***

Hazardous Substances Data Bank (HSDB)

8.4 Methods of Manufacturing

Perfluoroalkanesulfonyl fluorides are usually made by the Simons electrochemical fluorination process ... in which a hydrocarbon **sulfonyl fluoride** is electrolyzed in anhydrous **hydrogen fluoride** at **nickel** electrodes. The electrochemical yield is excellent for the first member of the series and decreases progressively with the increasing length of the **carbon** chain; the yield for **octanesulfonyl fluoride** is ca. 40%. Alkaline hydrolysis of perfluoroalkanesulfonyl fluorides gives the corresponding salts, which when acidified and distilled from concentrated **sulfuric acid** yield the anhydrous sulfonic acids.

Siegemund G et al; Fluorine Compounds, Organic. Ullmann's Encyclopedia of Industrial Chemistry 7th ed. (1999-2015). NY, NY: John Wiley & Sons. Online Posting Date: June 15, 2000

Hazardous Substances Data Bank (HSDB)

... The commercially important methods of preparations of perfluorinated sulfonic acid derivatives are electrochemical fluorination and **sulfur trioxide** addition to **tetrafluoroethylene** with subsequent ring opening.

Savu P; Fluorine-Containing Polymers, Perfluoroalkanesulfonic Acids. Kirk-Othmer Encyclopedia of Chemical Technology (1999-2015). John Wiley & Sons, Inc. Online Posting Date: December 4, 2000

Hazardous Substances Data Bank (HSDB)

8.5 General Manufacturing Information

EPA TSCA Commercial Activity Status

1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-: ACTIVE

https://www.epa.gov/tsca-inventory

EPA Chemicals under the TSCA

EPA TSCA Regulatory Flag

S - indicates a substance that is identified in a final Significant New Use Rule.

https://www.epa.gov/tsca-inventory

EPA Chemicals under the TSCA

9 Identification

9.1 Analytic Laboratory Methods

Method: EPA-ORD/EPA-OST 537; Procedure: liquid chromatography/tandem mass spectrometry; Analyte: perfluorohexanesulfonic acid; Matrix: drinking water; Detection Limit: 1.6 nanogram/L.

National Environmental Methods Index; Analytical, Test and Sampling Methods. Perfluorohexanesulfonic Acid (355-46-4). Available from, as of September 16, 2015: ***http://www.nemi.gov***

▸ Hazardous Substances Data Bank (HSDB)

9.2 Clinical Laboratory Methods

Perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid, two of the most widely studied polyfluoroalkyl chemicals (PFCs), can cross the placenta. Therefore, data on the exposure to PFCs of the very young are needed to evaluate the potential health effects associated with such exposure. Human serum, especially serum collected from pregnant women and cord serum, may contain endogenous components that can interfere in the separation by high performance liquid chromatography (HPLC) of PFOS and another PFC of interest, perfluorohexane sulfonic acid (PFHxS), from other serum biomolecules. The presence of such interferences may prevent the adequate quantification of PFOS and PFHxS in cord serum or serum collected from pregnant women, and potentially hinder the assessment of gestational exposure to these important PFCs using biomonitoring. We have modified our on-line solid phase extraction-HPLC-isotope dilution-tandem mass spectrometry analytical method for measuring PFCs in serum and developed an approach that allows for the elimination of these potential interferences without compromising analytical sensitivity and throughput. The combination of acetonitrile as the HPLC mobile phase organic solvent and a Betasil C8 HPLC column provided the best separation of PFOS and PFHxS from interferent peaks. In addition to eliminating these interferences, the acetonitrile method has a shorter runtime and is more sensitive for most PFCs (limits of detection were 0.1 ng/mL except for PFOS (0.2 ng/mL)) than our previous method that used methanol for the HPLC separation. The present method should improve the precise and selective analysis of maternal and cord serum for PFCs.

PMID:21084089
Kato K et al; J Chromatogr A.1218(15): 2133-7 (2011).

▸ Hazardous Substances Data Bank (HSDB)

The aim of this study is to evaluate the presence of perfluoroalkyl substances (PFASs) in the blood of 46 residents from Barcelona and to study the factors that affect exposure. Compounds analysed included perfluorooctane sulfonate (PFOS), perfluorohexane sulfonate (PFHxS), perfluorobutane sulfonate (PFBS), perfluorooctanoate acid (PFOA) and perfluorononanoate acid (PFNA). Blood was liquid-liquid extracted and PFASs were determined by liquid chromatography coupled to tandem mass spectrometry. Good recoveries (between 97 +/- 14 and 105 +/- 13 %) were obtained and method detection limits were from 0.03 to 0.07 ng mL(-1). Sum of PFASs ranged from 0.11 to 4.37 ng mL(-1). PFOS was the main compound detected at 0.09-3.35 ng mL(-1), followed by PFOA and PFHxS. PFBS and PFNA were seldom detected. Working conditions, smoking and gender did not cause any significant differences among sums of PFASs levels in the blood while age and parity produced decreased concentrations. On the other hand, laboratory working conditions produced significant higher PFOA levels compared to the general population. Compared to other studies, the PFASs levels in blood from Barcelona residents is low (mean sum of PFASs of 1.67 +/- 0.88 ng mL(-1)) and with little variation among the studied population.

PMID:25163560
Gomez-Canela C et al; Environ Sci Pollut Res Int 22(2): 1480-6 (2015).

▸ Hazardous Substances Data Bank (HSDB)

Fluorinated surfactant-based aqueous film-forming foams (AFFFs) are made up of per- and polyfluorinated alkyl substances (PFAS) and are used to extinguish fires involving highly flammable liquids. The use of perfluorooctanesulfonic acid (PFOS) and other perfluoroalkyl acids (PFAAs) in some AFFF formulations has been linked to substantial environmental contamination. Recent studies have identified a large number of novel and infrequently reported fluorinated surfactants in different AFFF formulations. In this study, a strategy based on a case-control approach using quadrupole time-of-flight tandem mass spectrometry (QTOF-MS/MS) and advanced statistical methods has been used to extract and identify known and unknown PFAS in human serum associated with AFFF-exposed firefighters. Two target sulfonic acids [PFOS and perfluorohexanesulfonic acid (PFHxS)], three non-target acids [perfluoropentanesulfonic acid (PFPeS), perfluoroheptanesulfonic acid (PFHpS), and perfluorononanesulfonic acid (PFNS)], and four unknown sulfonic acids (Cl-PFOS, ketone-PFOS, ether-PFHxS, and Cl-PFHxS) were exclusively or significantly more frequently detected at higher levels in firefighters compared to controls. The application of this strategy has allowed for identification of previously unreported fluorinated chemicals in a timely and cost-efficient way.

PMID:25611076
Rotander A et al; Environ Sci Technol 49(4): 2434-42.

▸ Hazardous Substances Data Bank (HSDB)

10 Safety and Hazards

10.1 Hazards Identification

10.1.1 GHS Classification

Showing 1 of 2 View More

Pictogram(s)	Corrosive Irritant
Signal	Danger
GHS Hazard Statements	H302 (100%): Harmful if swallowed [Warning Acute toxicity, oral] H312 (100%): Harmful in contact with skin [Warning Acute toxicity, dermal] H314 (100%): Causes severe skin burns and eye damage [Danger Skin corrosion/irritation] H332 (100%): Harmful if inhaled [Warning Acute toxicity, inhalation]
Precautionary Statement Codes	P260, P261, P264, P270, P271, P280, P301+P312, P301+P330+P331, P302+P352, P303+P361+P353, P304+P312, P304+P340, P305+P351+P338, P310, P312, P321, P322, P330, P363, P405, and P501 (The corresponding statement to each P-code can be found at the GHS Classification page.)
ECHA C&L Notifications Summary	*The GHS information provided by 1 company from 1 notification to the ECHA C&L Inventory.*

▸ European Chemicals Agency (ECHA)

10.1.2 Hazard Classes and Categories

Acute Tox. 4 (100%)

Acute Tox. 4 (100%)

Skin Corr. 1B (100%)

Acute Tox. 4 (100%)

▸ European Chemicals Agency (ECHA)

10.2 Fire Fighting

10.2.1 Fire Fighting Procedures

Advice for firefighters: Wear self-contained breathing apparatus for firefighting if necessary. /Tridecafluorohexane-1-sulfonic acid potassium salt/

*Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: **http://www.sigmaaldrich.com/safety-center.html***

▸ Hazardous Substances Data Bank (HSDB)

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. /Tridecafluorohexane-1-sulfonic acid potassium salt/

*Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: **http://www.sigmaaldrich.com/safety-center.html***

▸ Hazardous Substances Data Bank (HSDB)

10.3 Accidental Release Measures

10.3.1 Cleanup Methods

Methods and materials for containment and cleaning up: Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

10.3.2 Disposal Methods

SRP: Recycle any unused portion of the material for its approved use or return it to the manufacturer or supplier. Ultimate disposal of the chemical must consider: the material's impact on air quality; potential migration in air, soil or water; effects on animal, aquatic and plant life; and conformance with environmental and public health regulations. If it is possible or reasonable use an alternative chemical product with less inherent propensity for occupational harm/injury/toxicity or environmental contamination.

Hazardous Substances Data Bank (HSDB)

Product: Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Contaminated packaging: Dispose of as unused product. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

10.3.3 Preventive Measures

Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

Personal precautions, protective equipment and emergency procedures: Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

10.4 Handling and Storage

10.4.1 Storage Conditions

Conditions for safe storage, including any incompatibilities: Keep container tightly closed in a dry and well-ventilated place. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

Precautions for safe handling: Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

10.5 Exposure Control and Personal Protection

10.5.1 Personal Protective Equipment (PPE)

Respiratory protection: For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

Body Protection: Impervious clothing, the type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

Skin protection: Handle with gloves. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

Eye/face protection: Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

10.6 Stability and Reactivity

10.6.1 Hazardous Reactivities and Incompatibilities

Incompatible materials: Strong oxidizing agents. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

10.7 Other Safety Information

10.7.1 Toxic Combustion Products

Special hazards arising from the substance or mixture: Carbon oxides, Sulphur oxides, Hydrogen fluoride, Potassium oxides. /Tridecafluorohexane-1-sulfonic acid potassium salt/

Sigma-Aldrich; Material Safety Data Sheet for Tridecafluorohexane-1-sulfonic acid potassium salt, Product Number: 50929, Version 3.6 (Revision Date 12/22/2014). Available from, as of August 18, 2015: http://www.sigmaaldrich.com/safety-center.html

Hazardous Substances Data Bank (HSDB)

10.7.2 History and Incidents

In summer 2008, an accidental release of aqueous film forming foam (AFFF) took place at Schiphol Amsterdam Airport (The Netherlands). After the release, water, fish, and sediment samples were collected and analyzed for perfluoroalkyl sulfonates (PFSAs). In situ perfluorooctane sulfonate (PFOS) sediment-water distribution factor (KD) values, bioaccumulation factor (BAF) values, and biota-sediment accumulation factor (BSAF) values showed a remarkable agreement among reference and impacted sites, 10 weeks after the incident as well as after 3 years.

PMID:24729487

Kwadijk CJ et al; Environ Toxicol Chem 33(8): 1761-5 (2014).

- **Hazardous Substances Data Bank (HSDB)**

11 Toxicity

11.1 Toxicological Information

11.1.1 Toxicity Summary

IDENTIFICATION AND USE: **Perfluorohexane sulfonate** (PFHxS) is a six-**carbon** compound in the perfluoroalkyl family of chemicals. **Perfluorohexane sulfonate** was once used in firefighting foam and carpet treatment solutions. It was once widely used as a stain and **water** repellent but was phased out due to U.S. Environmental Protection Agency regulations. HUMAN EXPOSURE AND TOXICITY: An epidemiological study evaluated the associations between serum levels of PFHxS and diagnosis of attention deficit/hyperactivity disorder (ADHD). In another study, the associations of prenatal serum concentrations (PFHxS) with fetal and postnatal growth in girls was examined. Serum samples were obtained from mothers during pregnancy. PFHxS (median, 1.6 ng/mL) was detected in 100% of samples. On average, girls born to mothers with prenatal concentrations of PFHxS in the upper tertile weighed 108 g less at birth than girls born to mothers with concentrations in the lower tertile in adjusted models. In another study, the association between levels of PFHxS and semen volume, sperm concentration, total sperm count, motility and morphology were assessed. The proportion of morphologically normal cells was 35% lower for the third tertile of PFHxS exposure as compared with the first. In a surveillance study, the serum concentrations of perfluoroalkyl acids (PFAAs) in firefighters was evaluated, and serum concentration of PFHxS was statistically higher in firefighters. Another study reported evidence of a significant association between PFHxS and total **cholesterol** (TC), low-density lipoprotein **cholesterol** (LDL), total **cholesterol**/high density lipoprotein **cholesterol** ratio (TC/HDL) and non-HDL **cholesterol** as well as an elevated odds of high **cholesterol**. In another study, which evaluated the relationship between serum PFCs and thyroid function, increase in natural log-PFHxS was associated with an increase of total T4 by 0.26 ug/mL and total T3 by 4.074 ng/dL in women and a decrease of natural log-free T4 by 0.016 (ng/dL) in men. ANIMAL STUDIES: A subchronic study investigated the mechanism underlying the effect of PFAS surfactants on lipoprotein metabolism. Mice were fed a Western-type diet with PFHxS, (6 mg/kg/day) for 4-6 weeks. PFHxS markedly reduced TG, non-HDL-C, and HDL-C. The decrease in very low-density lipoprotein (VLDL) was caused by enhanced lipoprotein lipase-mediated VLDL-TG clearance and by decreased production of VLDL-TG and VLDL-apolipoprotein B. Reduced HDL production, related to decreased apolipoprotein AI synthesis, resulted in decreased HDL. PFHxS increased liver weight and hepatic TG content. Hepatic gene expression profiling data indicated that these effects were the combined result of peroxisome proliferator-activated receptor alpha and **pregnane** X receptor activation. Another study showed that neonatal exposure to PFHxS can alter neuroprotein levels, e.g. CaMKII, GAP-43, synaptophysin and tau, which are essential for normal brain development in mice. This was measured for both males and females, in hippocampus and cerebral cortex. The results suggest that PFHxS may act as a developmental neurotoxicant and the effects are similar to that of **PFOS** and **PFOA**, but also to other substances such as PCBs, PBDEs and **bisphenol A**. In another study, in ovo effects of PFHxS exposure (maximum dose = 38,000 ng/g egg) on embryonic death, developmental endpoints, tissue accumulation, mRNA expression in liver and cerebral cortex, and plasma TH levels were evaluated. Pipping success was reduced to 63% at the highest dose of PFHxS; additional effects included decreased tarsus length and embryo mass. Plasma TH levels were reduced in a concentration-dependent manner following PFHxS exposure. A subsequent study evaluated the relationship between PFHxS exposure and TH-dependent neurodevelopmental pathways. PFHxS significantly altered the expression of 11 transcripts at the low dose (890 ng/g) and 101 transcripts at the high dose (38,000 ng/g). Functional enrichment analysis showed that PFHxS affected the genes involved in tissue development and morphology, cellular assembly and organization, and cell-to-cell signaling. In another study, the effects of PFHxS on the neuronal cell death and the underlying mechanisms were examined using PC12 cells as a model of dopaminergic neuron. The treatment with PFHxS reduced cell viability in a dose-dependent manner. PFHxS increased cell apoptosis, increased the activations of ERK1/2, JNK and p38 MAPK with different temporal activations. PFHxS exposure also increased ROS formation.

- Hazardous Substances Data Bank (HSDB)

11.1.2 Antidote and Emergency Treatment

/SRP:/ Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR if necessary. Immediately flush contaminated eyes with gently flowing **water**. Do not induce vomiting. If vomiting occurs, lean patient forward or place on the left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention. /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160

- Hazardous Substances Data Bank (HSDB)

/SRP:/ Basic treatment: Establish a patent airway (oropharyngeal or nasopharyngeal airway, if needed). Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if needed. Administer **oxygen** by nonrebreather mask at 10 to 15 L/min. Monitor for pulmonary edema and treat if necessary ... . Monitor for shock and treat if necessary ... . Anticipate seizures and treat if necessary ... . For eye contamination, flush eyes immediately with **water**. Irrigate each eye continuously with 0.9% saline (NS) during transport ... . Do not use emetics. For ingestion,

rinse mouth and administer 5 mL/kg up to 200 mL of **water** for dilution if the patient can swallow, has a strong gag reflex, and does not drool ... . Cover skin burns with dry sterile dressings after decontamination ... . /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160

▸ **Hazardous Substances Data Bank (HSDB)**

/SRP:/ Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious, has severe pulmonary edema, or is in severe respiratory distress. Positive-pressure ventilation techniques with a bag valve mask device may be beneficial. Consider drug therapy for pulmonary edema ... . Consider administering a beta agonist such as **albuterol** for severe bronchospasm ... . Monitor cardiac rhythm and treat arrhythmias as necessary ... . Start IV administration of D5W TKO /SRP: "To keep open", minimal flow rate/. Use 0.9% saline (NS) or lactated Ringer's (LR) if signs of hypovolemia are present. For hypotension with signs of hypovolemia, administer fluid cautiously. Watch for signs of fluid overload ... . Treat seizures with **diazepam** or **lorazepam** ... . Use **proparacaine hydrochloride** to assist eye irrigation ... . /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3rd revised edition, Elsevier Mosby, St. Louis, MO 2007, p. 160-1

▸ **Hazardous Substances Data Bank (HSDB)**

11.1.3 Human Toxicity Excerpts

/EPIDEMIOLOGY STUDIES/ Our limited understanding of how polyfluoroalkyl chemicals (PFCs) may impact on human health suggests the potential for a protective impact on brain health. This study was designed to explore the association between PFCs and cognitive ability in older adults. We assessed the association between four PFCs, **perfluorooctanoic acid** (**PFOA**), **perfluorooctane sulfonic acid** (**PFOS**), **perfluorononanoic acid** (**PFNA**) and perfluorohexane sulfonic acid (PFHxS), and self-reported limitation due to difficulty remembering or periods of confusion using data from participants aged 60-85 years from the 1999-2000 and 2003-2008 National Health and Nutrition Examination Surveys. We also considered whether diabetic status or diabetic medication use modifies this association in light of in vitro evidence that PFCs may act on the same receptors as some diabetic medications. In multivariable adjusted models, point estimates suggest a protective association between PFCs and self-reported cognitive limitation (odds ratio, OR; 95% confidence interval, CI) for a doubling in PFC concentration: **PFOS** (OR, 0.90; 95% CI, 0.78, 1.03), **PFOA** (OR, 0.92; 95% CI, 0.78, 1.09), **PFNA** (OR, 0.91; 95% CI, 0.79, 1.04) and PFHxS (OR, 0.93; 95% CI, 0.82, 1.06). The protective association was concentrated in diabetics, with strong, significant protective associations in non-medicated diabetics. This cross-sectional study suggests that there may be a protective association between exposure to PFCs and cognition in older adults, particularly diabetics.

PMID:23095808
*Full text: **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3658136***
Power MC et al; Neuroepidemiology 40(2): 125-32 (2013).

▸ **Hazardous Substances Data Bank (HSDB)**

/EPIDEMIOLOGY STUDIES/ Associations between perfluoroalkyl acids (PFASs) and human thyroid hormone levels remain unclear, especially during early pregnancy when small changes in maternal thyroid hormones can affect fetal brain development. The objective of this study was to examine associations between maternal serum PFAS levels and maternal thyroid hormone levels in the early 2nd trimester of pregnancy. Participants were euthyroid pregnant women (n=152) enrolled in the Chemicals, Health and Pregnancy (CHirP) study based in Vancouver, Canada. Associations between maternal serum PFASs, including **perfluorohexanesulfonate** (PFHxS), perfluorononanoate (**PFNA**), **perfluorooctanoate** (**PFOA**) and **perfluorooctanesulfonate** (**PFOS**) and repeated measures of maternal thyroid hormones, including free **thyroxine** (fT4), total **thyroxine** (TT4) and thyroid stimulating home (TSH) were examined using mixed effects linear models. Associations were considered in all women, then separately in women with high (greater than or equal to 9 IU/mL) vs normal (<9 IU/mL) levels of thyroid peroxidase antibody (TPOAb), a marker of autoimmune hypothyroidism (Hashimoto's disease). Median PFAS concentrations (ng/mL) in maternal sera were 1.0 (PFHxS), 0.6 (PFNA), 1.7 (PFOA) and 4.8 (PFOS). PFASs were not associated with fT4, TT4 or TSH among women with normal TPOAb. However, among the 9% of women with high TPOAb (n=14), interquartile range (IQR) increases of PFASs were associated with a 46-69% increase in maternal TSH (95% CIs ranging from 8% to 123%) (PFNA, PFOA and PFOS only), and with a 3% to 7% decrease in maternal fT4 (95% CIs ranging from -18% to 5%) (all 4 PFASs). PFNA was also associated with higher maternal TSH in the whole sample. PFASs were positively associated with TSH, and weakly negatively associated with fT4 in the subset of pregnant women with high TPOAb, which occurs in 6-10% of pregnancies. PFASs may exacerbate the already high TSH and low fT4 levels in these women during early pregnancy, which is a critical time of thyroid hormone-mediated fetal brain development. The clinical significance of these findings is not clear. We propose a "multiple hit hypothesis" to explain these findings; this hypothesis deserves evaluation in larger, more representative study samples. /perfluoroalkyl acids/

PMID:25019470
Webster GM et al; Environ Res 133: 338-47 (2014).

▸ **Hazardous Substances Data Bank (HSDB)**

/EPIDEMIOLOGY STUDIES/ Polyfluoroalkyl chemicals (PFCs) have been widely used in consumer products. Exposures in the United States and in world populations are widespread. PFC exposures have been linked to various health impacts, and data in animals suggest that PFCs may be

potential developmental neurotoxicants. We evaluated the associations between exposures to four PFCs and parental report of diagnosis of attention deficit/hyperactivity disorder (ADHD). Data were obtained from the National Health and Nutrition Examination Survey (NHANES) 1999-2000 and 2003-2004 for children 12-15 years of age. Parental report of a previous diagnosis by a doctor or health care professional of ADHD in the child was the primary outcome measure. **Perfluorooctane sulfonic acid** (**PFOS**), **perfluorooctanoic acid** (**PFOA**), **perfluorononanoic acid** (**PFNA**), and perfluorohexane sulfonic acid (PFHxS) levels were measured in serum samples from each child. Parents reported that 48 of 571 children included in the analysis had been diagnosed with ADHD. The adjusted odds ratio (OR) for parentally reported ADHD in association with a 1-ug/L increase in serum **PFOS** (modeled as a continuous predictor) was 1.03 [95% confidence interval (CI), 1.01-1.05]. Adjusted ORs for 1-ug/L increases in **PFOA** and PFHxS were also statistically significant (**PFOA**: OR = 1.12; 95% CI, 1.01-1.23; PFHxS: OR = 1.06; 95% CI, 1.02-1.11), and we observed a nonsignificant positive association with **PFNA** (OR = 1.32; 95% CI, 0.86-2.02). Our results, using cross-sectional data, are consistent with increased odds of ADHD in children with higher serum PFC levels. Given the extremely prevalent exposure to PFCs, follow-up of these data with cohort studies is needed.

PMID:20551004
Full text: ***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3002197***
Hoffman K et al; Environ Health Perspect 118(12): 1762-7 (2010).

Hazardous Substances Data Bank (HSDB)

/EPIDEMIOLOGY STUDIES/ Prenatal exposures to polyfluoroalkyl compounds (PFCs) may be associated with adverse changes in fetal and postnatal growth. We explored associations of prenatal serum concentrations of **perfluorooctane sulfonate** (**PFOS**), **perfluorooctanoate** (**PFOA**), and **perfluorohexane sulfonate** (PFHxS) with fetal and postnatal growth in girls. We studied a sample of 447 singleton girls and their mothers participating in the Avon Longitudinal Study of Parents and Children (ALSPAC). Data on weight and length were obtained at birth and at 2, 9, and 20 months. Serum samples were obtained in 1991-1992, from mothers during pregnancy. We explored associations between prenatal PFC concentrations and weight at birth as well as longitudinal changes in weight-for-age SD scores between birth and 20 months. **PFOS** (median, 19.6 ng/mL), **PFOA** (median, 3.7 ng/mL), and PFHxS (median, 1.6 ng/mL) were detected in 100% of samples. On average, girls born to mothers with prenatal concentrations of **PFOS** in the upper tertile weighed 140 g less [95% confidence interval (CI): -238, -42] at birth than girls born to mothers with concentrations in the lower tertile in adjusted models. Similar patterns were seen for **PFOA** (-133 g; 95% CI: -237, -30) and PFHxS (-108 g; 95% CI: -206, -10). At 20 months, however, girls born to mothers with prenatal concentrations of **PFOS** in the upper tertile weighed 580 g more (95% CI: 301, 858) when compared with those in the lower tertile. No differences in weight were found for **PFOA** and PFHxS. Girls with higher prenatal exposure to each of the PFCs examined were smaller at birth than those with lower exposure. In addition, those with higher exposure to **PFOS** were larger at 20 months.

PMID:22935244
Full text: ***https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3491920***
Maisonet M et al; Environ Health Perspect 120(10): 1432-7 (2012).

Hazardous Substances Data Bank (HSDB)

For more Human Toxicity Excerpts (Complete) data for Perfluorohexanesulfonic acid (17 total), please visit the **HSDB record page**.

Hazardous Substances Data Bank (HSDB)

11.1.4 Non-Human Toxicity Excerpts

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ **Perfluorobutane sulfonate** (**PFBS**), **perfluorohexane sulfonate** (PFHxS), and **perfluorooctane sulfonate** (**PFOS**) are stable perfluoroalkyl sulfonate (PFAS) surfactants, and PFHxS and **PFOS** are frequently detected in human biomonitoring studies. Some epidemiological studies have shown modest positive correlations of serum **PFOS** with non-high-density lipoprotein (HDL)-**cholesterol** (C). This study investigated the mechanism underlying the effect of PFAS surfactants on lipoprotein metabolism. CETP mice were fed a Western-type diet with **PFBS**, PFHxS, or **PFOS** (30, 6, and 3 mg/kg/day, respectively) for 4-6 weeks. Whereas **PFBS** modestly reduced only plasma triglycerides (TG), PFHxS and **PFOS** markedly reduced TG, non-HDL-C, and HDL-C. The decrease in very low-density lipoprotein (VLDL) was caused by enhanced lipoprotein lipase-mediated VLDL-TG clearance and by decreased production of VLDL-TG and VLDL-apolipoprotein B. Reduced HDL production, related to decreased apolipoprotein AI synthesis, resulted in decreased HDL. PFHxS and **PFOS** increased liver weight and hepatic TG content. Hepatic gene expression profiling data indicated that these effects were the combined result of peroxisome proliferator-activated receptor alpha and **pregnane** X receptor activation. In conclusion, the potency of PFAS to affect lipoprotein metabolism increased with increasing alkyl chain length. PFHxS and **PFOS** reduce plasma TG and total **cholesterol** mainly by impairing lipoprotein production, implying that the reported positive correlations of serum **PFOS** and non-HDL-C are associative rather than causal.

PMID:21705711
Bijland S et al; Toxicol Sci 123(1):290-303 (2011).

Hazardous Substances Data Bank (HSDB)

/LABORATORY ANIMALS: Developmental or Reproductive Toxicity/ In a recent egg injection study, we showed that in ovo exposure to **perfluorohexane sulfonate** (PFHxS) affects the pipping success of developing chicken (Gallus gallus domesticus) embryos. We also found evidence of thyroid hormone (TH) pathway interference at multiple levels of biological organization (i.e., somatic growth, messenger RNA expression, and circulating free **thyroxine** levels). Based on these findings, we hypothesize that PFHxS exposure interferes with TH-dependent neurodevelopmental pathways. This study investigates global transcriptional profiles in cerebral hemispheres of chicken embryos following exposure to a solvent control, 890 or 38,000 ng PFHxS/g egg (n = 4-5 per group); doses that lead to the adverse effects indicated above. PFHxS significantly alters the expression (greater than or equal to 1.5-fold, p less than or equal to 0.001) of 11 transcripts at the low dose (890 ng/g) and 101 transcripts at the high dose (38,000 ng/g). Functional enrichment analysis shows that PFHxS affects genes involved in tissue development and morphology, cellular assembly and organization, and cell-to-cell signaling. Pathway and interactome analyses suggest that genes may be affected through several potential regulatory molecules, including integrin receptors, myelocytomatosis viral oncogene, and CCAAT/enhancer-binding protein. This study identifies key functional and regulatory modes of PFHxS action involving TH-dependent and -independent neurodevelopmental pathways. Some of these TH-dependent mechanisms that occur during embryonic development include tight junction formation, signal transduction, and integrin signaling, whereas TH-independent mechanisms include gap junction intercellular communication.

PMID:22790973
Cassone CG et al; Toxicol Sci 129(2):380-91 (2012).

▸ **Hazardous Substances Data Bank (HSDB)**

/DEVELOPMENTAL NEUROTOXICITY/ **Perfluorohexane sulfonate** (PFHxS) is an industrial chemical and belongs to the group of perfluorinated compounds (PFCs). It has recently been shown to cause developmental neurobehavioral defects in mammals. These compounds are commonly used in products such as surfactant and protective coating due to their ability to repel **water**- and oil stains. PFCs are globally found in the environment as well as in human umbilical cord blood, serum and breast milk. In a previous study on other well-known PFCs, i.e. **PFOS** and **PFOA**, it was shown that neonatal exposure caused altered neuroprotein levels in the hippocampus and cerebral cortex in neonatal male mice. The present study show that neonatal exposure to PFHxS, during the peak of the brain growth spurt, can alter neuroprotein levels, e.g. CaMKII, GAP-43, synaptophysin and tau, which are essential for normal brain development in mice. This was measured for both males and females, in hippocampus and cerebral cortex. The results suggest that PFHxS may act as a developmental neurotoxicant and the effects are similar to that of **PFOS** and **PFOA**, but also to other substances such as PCBs, PBDEs and **bisphenol A**.

PMID:23701969
Lee I et al; Neurotoxicology 37:190-6 (2013).

▸ **Hazardous Substances Data Bank (HSDB)**

/ENDOCRINE MODULATION/ Perfluoroalkyl acids (PFAAs), specifically perfluorinated sulfonates and carboxylates, are synthetic substances known for their chemical stability, resistance to degradation, and potential to biomagnify in food chains. The toxicological and biological effects of PFAAs in avian species are not well characterized, although there is some evidence to suggest that they can impact neurodevelopment and hatching success. Our laboratory recently reported significant effects of **perfluorohexane sulfonate** (PFHxS) and **perfluorohexanoate** (PFHxA) on messenger RNA (mRNA) levels of thyroid hormone (TH)-responsive genes in chicken embryonic neuronal cells. In this study, we determined in ovo effects of PFHxS and PFHxA exposure (maximum dose = 38,000 and 9700 ng/g egg, respectively) on embryonic death, developmental endpoints, tissue accumulation, mRNA expression in liver and cerebral cortex, and plasma TH levels. Pipping success was reduced to 63% at the highest dose of PFHxS; no effects were observed for PFHxA. PFHxS exposure (38,000 ng/g) decreased tarsus length and embryo mass. PFHxS and PFHxA accumulated in the three tissue compartments analyzed as follows: yolk sac > liver > cerebral cortex. Type II and type III 5'-deiodinases (D2 and D3) and cytochrome P450 3A37 mRNA levels were induced in liver tissue of chicken embryos exposed to PFHxS, whereas D2, neurogranin (RC3), and octamer motif binding factor 1 mRNA levels were upregulated in cerebral cortex. Plasma TH levels were reduced in a concentration-dependent manner following PFHxS exposure; PFHxA had no effect. This in ovo study successfully validated previous in vitro results concerning the modulation of TH-responsive genes and identified adverse effects associated with TH homeostasis in response to PFHxS treatment.

PMID:22302310
Cassone CG et al; Toxicol Sci 127(1): 216-24 (2012).

▸ **Hazardous Substances Data Bank (HSDB)**

/ALTERNATIVE and IN VITRO TESTS/ **Perfluorohexanesulfonate** (PFHxS) is one of the major perfluoroalkyl compounds (PFCs) found in human blood and its possible neurotoxicity has been suggested. However, the neuronal responses to PFHxS are not much known. Many studies have demonstrated that the early exposure to environmental chemicals increases the risk of neurodegenerative diseases such as Parkinson's disease in later life. In this study, the effects of PFHxS on the neuronal cell death and the underlying mechanisms were examined using PC12 cells as a model of dopaminergic neuron. The treatment with PFHxS reduced cell viability in a dose-dependent manner. PFHxS increased cell apoptosis which was measured by caspase-3 activity and TUNEL staining. **MK801**, a **NMDA** receptor antagonist reduced PFHxS-induced apoptosis. PFHxS increased the activations of ERK1/2, JNK and p38 MAPK with different temporal activations. The treatment with **PD98059**, an ERK inhibitor, significantly reduced apoptosis, whereas **SB203580**, a p38 MAPK inhibitor, had no effect. JNK inhibition by **SP600125** significantly increased apoptosis. PFHxS exposure also increased ROS formation, which was completely blocked by antioxidants, **Trolox** or **N-acetylcysteine** (NAC).

However, neither Trolox nor NAC reduced PFHxS-increased apoptosis, suggesting that ROS may not be a critical mediator for PFHxS-induced apoptosis of cells. Moreover, ERK activation induced by PFHxS was blocked by MK801 but not antioxidants. Taken together, these results have demonstrated that PFHxS induces the apoptosis of dopaminergic neuronal cells, where NMDA receptor-mediated ERK pathway plays a pro-apoptotic role and JNK plays an anti-apoptotic role. Our results may contribute to understanding cellular mechanisms for PFHxS-induced neurotoxicity.

PMID:24534200
Lee YJ et al; Sci Total Environ 491-492: 227-34 (2014).

Hazardous Substances Data Bank (HSDB)

11.1.5 Ecotoxicity Excerpts

/BIRDS and MAMMALS/ This study is aimed to evaluate the presence and distribution of Perfluorinated Compounds (PFCs) in Yellow-legged gull eggs (Larus michahellis) collected from 8 National or Natural Parks from the Iberian Peninsula. In each colony, 12 eggs were randomly collected and pooled from 3 areas of the colony and analyzed using liquid-solid extraction and liquid chromatography coupled to tandem mass spectrometry. Perfluorooctanate sulfonate (PFOS) was the only compound detected in the eggs and its presence was higher in the colonies situated in NE Iberian Peninsula due to the more industrial and mass urbanization in this area compared to the SW Mediterranean or Atlantic colonies. Accordingly, the Medes site, followed by the Ebro Delta and Columbretes, all situated in the NW Mediterranean coast, contained the highest PFOS levels (40.5-54.0ng/g-ww). In all other colonies, PFOS was detected at levels of 10.1-18.6ng/g-ww. Egg shell biometry was studied and it was found that the presence of PFOS did not affect the development of the egg. /perfluorinated Compounds (PFCs)/

PMID:22209369
Vicente J et al; Sci Total Environ 416: 468-75 (2012).

Hazardous Substances Data Bank (HSDB)

11.2 Ecological Information

11.2.1 Environmental Fate/Exposure Summary

Perfluorohexanesulfonic acid's production and use as a raw material or precursor for production of PFAS (perfluoroalkyl sulfonate) based products and use as surfactants may result in its release to the environment through various waste streams. Its former use in firefighting foam and carpet treatment solutions resulted in its release to the environment through various waste streams. Degradation of commercial N-alkyl perfluoroalkyl sulfonamides to yield perfluorosulfonic acids (such as perfluorohexanesulfonic acid) may occur in the atmosphere via reaction with OH radicals. Perfluoroalkyl sulfonamides are degraded to perfluoroalkyl sulfonic acids in water and can be considered a source of the latter in the environment. If released to air, an estimated vapor pressure of 0.0046 mm Hg at 25 °C indicates perfluorohexanesulfonic acid will exist solely as a vapor in the atmosphere. However, monitoring data indicate the compound exists in both vapor and particulate phases in the atmosphere. Vapor-phase perfluorohexanesulfonic acid will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 115 days. Particulate-phase perfluorohexanesulfonic acid will be removed from the atmosphere by wet and dry deposition. Perfluorohexanesulfonic acid is not expected to be susceptible to direct photolysis by sunlight. Detection of perfluorohexanesulfonic acid in remote Arctic and marine air samples indicates the compound can be transported over long global distances. If released to soil, perfluorohexanesulfonic acid is expected to have very high mobility based upon a Koc of 9.3. The estimated pKa of perfluorohexanesulfonic is 0.14, indicating that this compound will exist almost entirely in the anion form in the environment and anions generally do not adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts. Volatilization from moist soil surfaces is not expected to be an important fate process based upon analogy to the PFOS (perfluorooctane sulfonic acid) and because the compound exists as an anion and anions do not volatilize. Perfluorohexanesulfonic acid is not expected to volatilize from dry soil surfaces based upon its vapor pressure. Biodegradation data in soil or water were not available. If released into water, perfluorohexanesulfonic acid is not expected to adsorb to suspended solids and sediment based upon the estimated Koc. A pKa of 0.14 indicates perfluorohexanesulfonic acid will exist almost entirely in the anion form at pH values of 5 to 9 and, therefore, volatilization from water surfaces is not expected to be an important fate process. However, due to the surfactant nature of the perfluoroalkyl compounds (such as perfluorohexanesulfonic acid), some of the amount released to water may form micelles and exist in the associated form despite the low pKa values of these substances. Perfluoroalkyl compounds that associate on water surfaces may volatilize into the atmosphere. A BCF value of 10 and a BAF of 70 suggests bioconcentration in aquatic organisms is low to moderate. Hydrolysis is not expected to be an important environmental fate process based on hydrolysis results for the analogous PFOS. Occupational exposure to perfluorohexanesulfonic acid may occur through inhalation and dermal contact with this compound at workplaces where perfluorohexanesulfonic acid is produced or used. Monitoring data indicate that the general population may be exposed to perfluorohexanesulfonic acid via inhalation of ambient air, dust, ingestion of food and drinking water, and dermal contact with consumer products containing perfluorohexanesulfonic acid. (SRC)

Hazardous Substances Data Bank (HSDB)

11.2.2 Artificial Pollution Sources

Perfluorohexanesulfonic acid's production and use as a raw material or precursor for production of PFAS (perfluoroalkyl sulfonate) based products(1,2) and use as surfactants(2) may result in its release to the environment through various waste streams(SRC). Its former use in firefighting foam and carpet treatment solutions (once widely used by 3M as a stain and **water** repellent)(3) resulted in its release to the environment through various waste streams(SRC). A 2009 survey of manufacturers reported that more than 80% of the releases of PFAS chemicals were to local waterways and very little to air(1); **perfluorohexane sulfonate** (PFHS) contributed the most to PFAS release(1); lesser amounts of the chemicals were transferred off-site, mostly for incineration(1).

(1) OECD; PFCS: Outcome of the 2009 survey. Survey on the production, use and release of PFOS, PFAS, PFOA PFCA, their related substances and products/mixtures containing these substances. Series on risk management No.24 (Jan 7, 2011). Available from, as of Oct 6, 2015: ***http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=env/jm/mono(2011)1&doclanguage=en*** *(2) NTP; Perfluorohexane sulfonate, PFHXS - M040005 (CAS 355-46-4), National Institute of Environmental Health Sciences. Available from, as of Oct 6, 2015:* ***http://ntp.niehs.nih.gov/testing/status/agents/ts-m040005.html*** *(3) Garcia J. S. et al; Perfluoroalkyl Compounds, Hamilton & Hardy's Industrial Toxicology 69 (2015).* ***http://onlinelibrary.wiley.com/advanced/search***

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11.2.3 Environmental Fate

TERRESTRIAL FATE: Based on a classification scheme(1), a Koc value of 9.3(2), determined from field-based monitoring data(2), indicates that perfluorohexanesulfonic acid is expected to have very high mobility in soil(SRC). The estimated pKa of perfluorohexanesulfonic acid is 0.14(3), indicating that this compound will exist almost entirely in anion form in the environment and anions generally do not adsorb more strongly to soils containing organic **carbon** and clay than their neutral counterparts(4). The analogous compound **PFOS** (**perfluorooctanesulfonic acid**) is reported to be essentially nonvolatile from moist soil surfaces(5), and the same is expected for perfluorohexanesulfonic acid(SRC). Perfluorohexanesulfonic acid is not expected to volatilize from dry soil surfaces(SRC) based upon an estimated vapor pressure of 0.0046 mm Hg at 25 °C(SRC), determined from a fragment constant method(6). Biodegradation data in soil were not available(SRC, 2015). However, available screening test results indicate that perfluoroalkyl compounds are resistant to biodegradation(3).

(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) Awad E et al; Environ Sci Technol 45: 8081-89 (2011) (3) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: ***http://www.atsdr.cdc.gov/toxprofiles/index.asp*** *(4) Doucette WJ; pp. 141-188 in Handbook of Property Estimation Methods for Chemicals. Boethling RS, Mackay D, eds. Boca Raton, FL: Lewis Publ (2000) (5) Giesy JP, Kannan K; Environ Sci Technol 36: 147A-152A (2002) (6) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015:* ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

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AQUATIC FATE: Based on a classification scheme(1), a Koc value of 9.3(SRC), determined from field-based monitoring data(2), indicates that perfluorohexanesulfonic acid is not expected to adsorb to suspended solids and sediment(SRC). An estimated pKa of 0.14(2) indicates perfluorohexanesulfonic acid will exist almost entirely in the anion form at pH values of 5 to 9 and, therefore, volatilization from **water** surfaces is not expected to be an important fate process(SRC). However, due to the surfactant nature of the perfluoroalkyl compounds (such as perfluorohexanesulfonic acid), some of the amount released to **water** may form micelles and exist in the associated form despite the low pKa values of these substances(3). Perfluoroalkyl compounds that associate on **water** surfaces may volatilize into the atmosphere(3). According to a classification scheme(4), a BCF of 10(5) and a field-based BAF of 70(2) suggest the potential for bioconcentration in aquatic organisms is low to moderate(SRC). Biodegradation data in soil were not available(SRC, 2015). However, available screening test results indicate that perfluoroalkyl compounds are resistant to biodegradation(3). Hydrolysis is not expected to be an important environmental fate process based on hydrolysis results for the analogous **PFOS**(3).

(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) Awad E et al; Environ Sci Technol 45: 8081-8089 (2011) (3) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: ***http://www.atsdr.cdc.gov/toxprofiles/index.asp*** *(4) Franke C et al; Chemosphere 29: 1501-14 (1994) (5) Conder JM et al; Environ Sci Technol 42: 995-1003 (2008)*

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ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere(1), perfluorohexanesulfonic acid, which has an estimated vapor pressure of 0.0046 mm Hg at 25 °C(SRC), determined from a fragment constant method(2), is expected to exist solely as a vapor in the ambient atmosphere. However, monitoring data indicate the compound exists in both vapor and particulate phases in the atmosphere(3,4). Vapor-phase perfluorohexanesulfonic acid is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals(SRC); the half-life for this reaction in air is estimated to be 115 days(SRC), calculated from its rate constant of 1.4X10-13 cu cm/molecule-sec at 25 °C(SRC) that was derived using a structure estimation method(2). Particulate-phase perfluorohexanesulfonic acid may be removed from the air by wet and dry deposition(SRC). Perfluoroalkyl sulfonic acids are not expected to undergo direct photolysis(5). Detection of perfluorohexanesulfonic acid in remote Arctic and marine air samples(4,5) indicates the compound can be transported over long global distances(SRC).

(1) Bidleman TF; Environ Sci Technol 22: 361-367 (1988) (2) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm*** *(3) Kim SK, Kannan K; Environ Sci Technol 41: 8328-34 (2007) (4) Dreyer A et al; Environ Sci Technol 43: 6507-14 (2009) (5) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015:* ***http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

11.2.4 Environmental Biodegradation

Biodegradation data specific to perfluorohexanesulfonic acid were not available(SRC, 2015). However, available screening test results indicate that perfluoroalkyl compounds are resistant to biodegradation(1).

(1) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: ***http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

11.2.5 Environmental Abiotic Degradation

The rate constant for the vapor-phase reaction of perfluorohexanesulfonic acid with photochemically-produced hydroxyl radicals has been estimated as 1.4X10-13 cu cm/molecule-sec at 25 °C(SRC) using a structure estimation method(1). This corresponds to an atmospheric half-life of about 115 days at an atmospheric concentration of 5X10+5 hydroxyl radicals per cu cm(1). As a class, perfluorinated organic compounds are resistant to hydrolysis and photolysis(2,3). Based on test results for **PFOS** (**perfluorooctanesulfonic acid**), perfluoroalkyl sulfonic acids are not expected to undergo direct photolysis(4). The analogous **PFOS** is also stable to environmental hydrolysis with a half-life of 41 years calculated from measured hydrolysis tests at pHs of 5, 7 and 9(4).

(1) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm*** *(2) Giesy JP, Kannan K; Environ Sci Technol 36: 147A-152A (2002) (3) Beach SA et al; Rev Environ Contam Toxicol 186: 133-74 (2005) (4) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015:* ***http://www.atsdr.cdc.gov/toxprofiles/index.asp***

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11.2.6 Environmental Bioconcentration

A BCF of 10 has been reported for perfluorohexanesulfonic acid(1). Using monitoring data from creek and pond locations in Toronto, Ontario, Canada, a field-based BAF (bioaccumulation factor) of 70 was determined for perfluorohexanesulfonic acid in fish(2). According to a classification scheme(3), these BCF and BAF values suggests the potential for bioconcentration in aquatic organisms is low to moderate(SRC). In living organisms, perfluoroalkyls bind to protein albumin in blood, liver, and eggs and do not accumulate in fat tissue, which may explain why bioconcentration factors (BCFs) are lower than expected in aquatic organisms(4).

(1) Conder JM et al; Environ Sci Technol 42: 995-1003 (2008) (2) Awad E et al; Environ Sci Technol 45: 8081-89 (2011) (3) Franke C et al; Chemosphere 29: 1501-14 (1994) (4) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: ***http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

11.2.7 Soil Adsorption/Mobility

Using monitoring data from creek and pond locations in Toronto, Ontario, Canada, a field-based Koc of 9.3 was determined for perfluorohexanesulfonic acid(1). According to a classification scheme(2), this estimated Koc value suggests that perfluorohexanesulfonic acid is expected to have very high mobility in soil. The estimated pKa of perfluorohexanesulfonic acid is 0.14(3), indicating that this compound will exist almost entirely in anion form in the environment and anions generally do not adsorb more strongly to soils containing organic **carbon** and clay than their neutral counterparts(4). However, it has been suggested that compounds like the analogous **PFOS** (**perfluorooctanesulfonic acid**) may form strong bonds via a chemisorption mechanism(5).

(1) Awad E et al; Environ Sci Technol 45: 8081-89 (2011) (2) Swann RL et al; Res Rev 85: 17-28 (1983) (3) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: ***http://www.atsdr.cdc.gov/toxprofiles/index.asp*** *(4) Doucette WJ; pp. 141-188 in Handbook of Property Estimation Methods for Chemicals. Boethling RS, Mackay D, eds. Boca Raton, FL: Lewis Publ (2000) (5) Beach SA et al; Rev Environ Contam Toxicol 186: 133-74 (2005)*

Hazardous Substances Data Bank (HSDB)

11.2.8 Volatilization from Water/Soil

The estimated pKa of perfluorohexanesulfonic acid is 0.14(1), indicating that this compound will exist almost entirely in the anion form in the environment(SRC). Therefore, volatilization from **water** surfaces is not expected to be an important fate process(SRC). The analogous compound **PFOS** (**perfluorooctanesulfonic acid**) is essentially nonvolatile from **water** and moist soil surfaces(2), and the same is expected for perfluorohexanesulfonic acid(SRC). Perfluorohexanesulfonic acid is not expected to volatilize from dry soil surfaces(SRC) based upon an

estimated vapor pressure of 0.0046 mm Hg(SRC), determined from a fragment constant method(3). However, due to the surfactant nature of the perfluoroalkyl compounds (such as perfluorohexanesulfonic acid), some of the amount released to water may form micelles and exist in the associated form despite the low pKa values of these substances(1). Perfluoroalkyl compounds that associate on water and soil surfaces may volatilize into the atmosphere(1).

*(1) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp** (2) Giesy JP, Kannan K; Environ Sci Technol 36: 147A-152A (2002) (3) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.11. Nov, 2012. Available from, as of Oct 6, 2015: **http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

▸ Hazardous Substances Data Bank (HSDB)

11.2.9 Environmental Water Concentrations

GROUNDWATER: Well water sampled from a 3M facility in Minnesota contained perfluorohexanesulfonic acid concentrations of 6.47-40.0 ug/L(1).

*(1) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

▸ Hazardous Substances Data Bank (HSDB)

DRINKING WATER: Finished drinking water and tap water samples collected from Amsterdam, Netherlands in January and September 2010 contained mean perfluorohexanesulfonic acid concentrations of 0.6 and 1.3 ng/L, respectively(1). Tap water samples collected from Amsterdam, Netherlands between February and April 2011 contained an average perfluorohexanesulfonic acid concentration of 0.55 ng/L(2). Perfluorohexanesulfonic acid concentrations of 0.045-0.15 ng/L were detected in drinking water samples collected from Oslo, Norway between October 2008 and January 2009(3). Perfluorohexanesulfonic acid was detected at 21 of 34 drinking water sampling sites in Australia between August and November 2010 at levels ranging from <0.92 to 9.98 ng/L(4).

(1) Eschauzier C et al; Environ Sci Technol 46(3): 1708-15 (2011) (2) Eschauzier C et al; Chemosphere 90: 36-41 (2013) (3) Haug LS et al; Chemopshere 80: 1137-43 (2010) (4) Thompson J et al; Chemosphere 83: 1320-25 (2011)

▸ Hazardous Substances Data Bank (HSDB)

SURFACE WATER: Water samples collected from 23 sites along 3 rivers in Tianjin, China in Dec 2008 contained perfluorohexanesulfonic acid concentrations of 0.14-1.28 ng/L(1). Water samples collected from Resolute Lake and Meretta Lake in the Canadian Arctic in 2003 and 2004 contained perfluorohexanesulfonic acid concentrations of 1.5-24 ng/L(2). Perfluorohexanesulfonic acid concentrations of <0.25 (detection limit) to 4.05 ng/L were detected in lake water samples collected near Albany, NY in 2006(3). Water samples collected from New York State in July 2004 detected perfluorohexanesulfonic acid in Onondaga Lake (4.2-8.5 ng/L), the Erie Canal (2.5-5.6 ng/L) and other lakes and rivers (0.9-2.8)(4).

(1) Pan Y et al; Bull Environ Contam Toxicol 87(2): 152-57 (2011) (2) Stock NL et al; Environ Sci Technol 41: 3529-36 (2007) (3) Kim SK, Kannan K; Environ Sci Technol 41: 8328-34 (2007) (4) Sinclair E et al; Arch Environ Contam Toxicol 50: 398-410 (2006)

▸ Hazardous Substances Data Bank (HSDB)

SEAWATER: International research cruises undertaken during 2002-2004 detected perfluorohexanesulfonic acid in open seawater at the following concentrations (in pg/L)(1): North Atlantic Ocean (4.1-6.1), Middle Atlantic Ocean (2.6-12), West Pacific Ocean (2.1-2.8), Central to East Pacific Ocean (0.1-1.6). Perfluorohexanesulfonic acid concentrations ranging from <0.2 to 5,600 pg/L have been detected in coastal and ocean waters from Toyko Bay, Hong Kong, Korea and the South China Sea(2).

*(1) Yamashita N et al; Mar Poll Bull 51: 658-68 (2005) (2) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

▸ Hazardous Substances Data Bank (HSDB)

RAIN/SNOW: Perfluorohexanesulfonic acid concentrations of <0.25 (detection limit) to 0.36 ng/L were detected in rain and snow samples collected in Albany, NY during 2006-2007(1).

(1) Kim SK, Kannan K; Environ Sci Technol 41: 8328-34 (2007)

▸ Hazardous Substances Data Bank (HSDB)

11.2.10 Effluent Concentrations

In 2010, effluents from 90 European wastewater treatment plasnts were analyzed for 156 organic contaminants(1); perfluorohexanesulfonic acid was detected in 71% of the effluents at average and maximum concentrations of 48.6 and 922 ng/L, respectively(1). Analysis of influent and effluent waters from 10 WWTPs nationwide in US detected perfluorohexanesulfonic acid concentrations ranging from 2.3-12 ng/L in the influents and 2.4-17 ng/L in the effluents(2). Effluent waters from 6 WWTPs in New York State contained perfluorohexanesulfonic acid concentrations ranging from <2.5 to 39 ng/L(3).

(1) Loos R et al; Water Research 47: 6475-87 (2013) (2) Schultz MM et al; Environ Sci Technol 40: 289-95 (2006) (3) Sinclair E, Kannan K; Environ Sci Technol 40(5): 1408-14 (2006)

Hazardous Substances Data Bank (HSDB)

11.2.11 Sediment/Soil Concentrations

SEDIMENT: Sediment core samples collected from three Canadian Arctic lakes in 2003 and 2005 contained perfluorohexanesulfonic acid concentrations ranging from about 1 to 10 ng/g dry weight(1). Perfluorohexanesulfonic acid was detected in 28% of 84-92 sediment samples collected from the Mississippi shoreline at a maximum concentration of 11.5 ng/g(2).

*(1) Stock NL et al; Environ Sci Technol 41: 3529-36 (2007) (2) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

SOIL: Soil samples collected from 4 suburban sites in Tianjin, China in Dec 2008 contained mean perfluorohexanesulfonic acid concentrations of 0.12-0.36 ng/g dry wt (maximum of 5.86 ng/g(1). Soil samples from a 3M facility in Minnesota contained a maximum perfluorohexanesulfonic acid concentration of 3,470 ng/g(2).

*(1) Pan Y et al; Bull Environ Contam Toxicol 87: 152-57 (2011) (2) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

11.2.12 Atmospheric Concentrations

URBAN/SUBURBAN: Perfluorohexanesulfonic acid concentrations of 0.13-0.44 pg/cu m (mean of 0.31 pg/cu m) were detected in gas-phase air samples collected in Albany, NY during May-July 2006(1); particle-phase air contained concentration of <0.12 pg/cu m(1). Mean perfluorohexanesulfonic acid concentrations of 0.1 and 1.0 pg/cu m were found in air samples from Manchester UK during two sampling sessions(2).

*(1) Kim SK, Kannan K; Environ Sci Technol 41: 8328-34 (2007) (2) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

INDOOR: Indoor air samples (67 samples) collected in Ottawa, Canada contained a mean perfluorohexanesulfonic acid concentration of 391.96 pg/cu m. 112 Indoor air samples collected from North Carolina and Ohio contained a mean perfluorohexanesulfonic acid concentration of 874 pg/cu m(1).

*(1) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

RURAL/REMOTE: Perfluorohexanesulfonic acid was detected in particle-phase air samples collected from research ships in the Atlantic Ocean, Southern Ocean and Baltic Sea in 2007 and 2008 (concentration not reported)(1). Air samples collected on Cornwallis Island in the Canadian Arctic in the summer of 2004 contained a perfluorohexanesulfonic acid concentration of about 2 pg/cu m(2). Mean perfluorohexanesulfonic acid concentrations of 0.05, 0.07 and 0.04 pg/cu m were detected in air samples from Kjeller Norway, Mace Head Ireland and Hazelrigg UK, respectively(3). Marine air samples collected near the east coast of Africa contained a mean level of 0.013 pg/cu m(3).

*(1) Dreyer A et al; Environ Sci Technol 43: 6507-14 (2009) (2) Stock NL et al; Environ Sci Technol 41: 3529-36 (2007) (3) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

11.2.13 Food Survey Values

Food items collected from grocery stores in Oslo, Norway between October 2008 and January 2009 contained the following concentrations of perfluorohexanesulfonic acid in pg/g fresh weight: margarine (1.3), bread (1.7), pork meat (1.2) and egg (3.5)(1).

(1) Haug LS et al; Chemosphere 80: 1137-43 (2010)

Hazardous Substances Data Bank (HSDB)

11.2.14 Fish/Seafood Concentrations

Fish liver from various Japanese fish contained perfluorohexanesulfonic acid concentrations of <8.5 to 11 ng/g wet wt(1). Fish collected from grocery stores in Oslo, Norway between October 2008 and January 2009 contained the following concentrations of perfluorohexanesulfonic acid in pg/g fresh weight: fish sticks (1.6), salmon (5.5), and cod (2.8)(2).

(1) Senthilkumar K et al; Bull Environ Contam Toxicol 79: 427-431 (2007) (2) Haug LS et al; Chemosphere 80: 1137-1143 (2010)

Hazardous Substances Data Bank (HSDB)

11.2.15 Animal Concentrations

Wildlife samples collected from Japan contained the following concentrations of perfluorohexanesulfonic acid in ng/g wet weight: cormorants (<0.06-0.27), racoon dog (0.14-0.16), eagle (0.01-0.40) and large-bill crow (<0.03-0.10)(1).

(1) Senthilkumar K et al; Bull Environ Contam Toxicol 79: 427-31 (2007)

Hazardous Substances Data Bank (HSDB)

11.2.16 Milk Concentrations

ENVIRONMENTAL: Perfluorohexanesulfonic acid was detected in 100% of 48 breast milk samples collected from women in France at mean, median, minimum and maximum concentrations of 0.049, 0.050, 0.04 and 0.066 ug/L, respectively(1). Pooled human milk samples from 2009/2010 in Canada were reported to have an average perfluorohexane sulfonic acid concentration of 0.015 ng/mL(2).

(1) Antignac JP et al; Chemosphere 91: 802-8 (2013) (2) Kubwabo C et al; Chemopshere 91: 771-7 (2013)

Hazardous Substances Data Bank (HSDB)

11.2.17 Other Environmental Concentrations

Indoor dust samples collected from a rural site near Toronto, Canada in 2007 contained a perfluorohexanesulfonic acid level of nearly 1 pg/cu cm(1).

(1) Gerwurtz SB et al; Environ Sci Technol 43: 7317-23 (2009)

Hazardous Substances Data Bank (HSDB)

Perfluoroalkyl chemicals (PFCs) have been used as surfactants and stain repellants in a variety of consumer products for more than 50 years and there is growing concern regarding their persistence and toxicity. Human exposure to these chemicals is essentially universal in North America and researchers have linked them to a variety of health problems ranging from higher rates of cancer, to developmental and reproductive problems, and higher **cholesterol** levels. Major exposure pathways are food and **water** ingestion, dust ingestion via hand to mouth transfer. In an effort to assess residential exposure, the Wisconsin Department of Health Services tested vacuum cleaner contents from thirty-nine homes for 16 perfluoroalkyl chemicals. **PFOS**, **PFOA**, PFHxS, PFHpA and **PFNA** were found in all of the vacuum dust samples and dust from eight homes contained all 16 PFCs included in our analysis. The most commonly detected compounds were **perfluorooctanesulfonate** (**PFOS**), **perfluorohexanesulfonate** (PFHxS) and **perfluorooctanoic acid** (**PFOA**) which together made up 70% of the total PFC residues in dust from these homes. Summed PFC concentrations in these dust samples ranged from 70 to 2513 ng/g (median 280 ng/g). Our investigation suggests that these chemicals may be ubiquitous contaminants in US homes.

PMID:22542201
Knobeloch L et al; Chemosphere 88(7): 779-83 (2012)

Hazardous Substances Data Bank (HSDB)

11.2.18 Probable Routes of Human Exposure

Occupational exposure to perfluorohexanesulfonic acid may occur through inhalation and dermal contact with this compound at workplaces where perfluorohexanesulfonic acid is produced or used. Monitoring data indicate that the general population may be exposed to perfluorohexanesulfonic acid via inhalation of ambient air, dust, ingestion of food and drinking **water**, and dermal contact with consumer products containing perfluorohexanesulfonic acid(1).

*(1) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

11.2.19 Body Burden

In the Fourth National Report on Human Exposure to Environmental Chemicals (Fourth Report), CDC scientists measured 12 PFCs (perfluorochemicals) in the blood serum (the clear portion of blood) of 2,094 participants aged 12 years and older who took part in the National Health and Nutrition Examination Survey (NHANES) during 2003-2004(1). By measuring PFCs in serum, scientists can estimate the amount of PFCs that have entered people's bodies. CDC scientists found four PFCs (**PFOS**, **PFOA**, PFHxS or perfluorohexanesulfonic acid, and **PFNA** or **perfluorononanoic acid**) in the serum of nearly all of the people tested, indicating widespread exposure to these PFCs in the U.S. population(1). Mean concentration of perfluorohexane sulfonic acid declined by 10-30% in the 2003-2004 survey compared to a 1999-2000 survey(2).

*(1) CDC; Perfluorochemicals (PFCs) Fact Sheet, November 2009. Available from, as of Oct 6, 2015: **http://www.cdc.gov/biomonitoring/pdf/PFCs_FactSheet.pdf** (2) ATSDR; Draft Toxicological Profile for Perfluoroalkyls. Atlanta, GA: Agency for Toxic Substances and Disease Registry, US Public Health Service (2015). Available from, as of Oct 5, 2015: **http://www.atsdr.cdc.gov/toxprofiles/index.asp***

Hazardous Substances Data Bank (HSDB)

Perfluorohexanesulfonic acid was detected in 100% of 48 breast milk samples collected from women in France at mean, median, minimum and maximum concentrations of 0.049, 0.050, 0.04 and 0.066 ug/L, respectively(1). Pooled human milk samples from 2009/2010 in Canada were reported to have an average perfluorohexanesulfonic acid concentration of 0.015 ng/mL(2).

(1) Antignac JP et al; Chemosphere 91: 802-8 (2013) (2) Kubwabo C et al; Chempshere 91: 771-7 (2013)

Hazardous Substances Data Bank (HSDB)

Perfluorohexanesulfonic acid concentration in the blood plasma of 105 fisherman from the Lake Mohne area of Germany (2006-2008) ranged from 0.4-17 ug/L(1). Analysis of blood serum collected from 20 adults in Atlanta, GA in July 2003 detected perfluorohexanesulfonic acid concentrations ranging from 0.4-11.2 ug/L(2).

(1) Holzer J et al; Environ Sci Technol 45(19): 8046-52 (2011) (2) Kuklenyik A et al; Environ Sci Technol 38: 3698-704 (2004)

Hazardous Substances Data Bank (HSDB)

12 Associated Disorders and Diseases

- Comparative Toxicogenomics Database (CTD)

13 Literature

13.1 NLM Curated PubMed Citations

PubChem

13.2 Springer Nature References

Springer Nature

13.3 Depositor Provided PubMed Citations

PubChem

13.4 Metabolite References

Human Metabolome Database (HMDB)

13.5 Chemical Co-Occurrences in Literature

PubChem

13.6 Chemical-Gene Co-Occurrences in Literature

PubChem

13.7 Chemical-Disease Co-Occurrences in Literature

PubChem

14 Patents

14.1 Depositor-Supplied Patent Identifiers

PubChem

Link to all deposited patent identifiers

PubChem

14.2 WIPO PATENTSCOPE

Patents are available for this chemical structure:

https://patentscope.wipo.int/search/en/result.jsf?inchikey=QZHDEAJFRJCDMF-UHFFFAOYSA-N

PATENTSCOPE (WIPO)

15 Biomolecular Interactions and Pathways

15.1 Chemical-Gene Interactions

15.1.1 CTD Chemical-Gene Interactions

Comparative Toxicogenomics Database (CTD)

16 Classification

16.1 Ontologies

16.1.1 MeSH Tree

Medical Subject Headings (MeSH)

16.1.2 ChEBI Ontology

ChEBI

16.1.3 ChemIDplus

ChemIDplus

16.1.4 UN GHS Classification

UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

16.1.5 EPA CPDat Classification

EPA Chemical and Products Database (CPDat)

16.1.6 NORMAN Suspect List Exchange Classification

NORMAN Suspect List Exchange

16.1.7 EPA DSSTox Classification

EPA DSSTox

17 Information Sources

FILTER BY SOURCE: ALL SOURCES

1. ## CAS Common Chemistry

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Perfluorohexanesulfonic acid
https://commonchemistry.cas.org/detail?cas_rn=355-46-4

2. ## ChemIDplus

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https://www.nlm.nih.gov/copyright.html

Perfluorohexanesulfonic acid
https://chem.nlm.nih.gov/chemidplus/sid/0000355464

ChemIDplus Chemical Information Classification
https://chem.nlm.nih.gov/chemidplus/

3. ## EPA Chemicals under the TSCA

LICENSE
https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-
https://www.epa.gov/chemicals-under-tsca

4. ## EPA DSSTox

LICENSE
https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

PFHxS
https://comptox.epa.gov/dashboard/DTXSID7040150

CompTox Chemicals Dashboard Chemical Lists
https://comptox.epa.gov/dashboard/chemical_lists/

5. ## European Chemicals Agency (ECHA)

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https://echa.europa.eu/web/guest/legal-notice

Perfluorohexane-1-sulphonic acid
https://echa.europa.eu/substance-information/-/substanceinfo/100.005.989

Perfluorohexane-1-sulphonic acid
https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/10265

6. ## Hazardous Substances Data Bank (HSDB)

Perfluorohexanesulfonic acid
https://pubchem.ncbi.nlm.nih.gov/source/hsdb/8274

7. ## ChEBI

Perfluorohexanesulfonic acid
http://www.ebi.ac.uk/chebi/searchId.do?chebiId=CHEBI:132448

ChEBI Ontology
http://www.ebi.ac.uk/chebi/userManualForward.do#ChEBI%20Ontology

8. ## Comparative Toxicogenomics Database (CTD)

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http://ctdbase.org/about/legal.jsp

http://ctdbase.org/detail.go?type=chem&acc=C471071

9. ## EPA Chemical and Products Database (CPDat)

LICENSE
https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

perfluorohexane-1-sulphonic acid
https://comptox.epa.gov/dashboard/DTXSID7040150#exposure

EPA CPDat Classification
https://www.epa.gov/chemical-research/chemical-and-products-database-cpdat

10. ## FDA/SPL Indexing Data

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https://www.fda.gov/about-fda/about-website/website-policies#linking

ZU6Y1E592S
https://www.fda.gov/ForIndustry/DataStandards/SubstanceRegistrationSystem-UniqueIngredientIdentifierUNII/

11. ## Human Metabolome Database (HMDB)

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http://www.hmdb.ca/citing

Perfluorohexane sulfonic acid
http://www.hmdb.ca/metabolites/HMDB0094700

12. ## MassBank of North America (MoNA)

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https://mona.fiehnlab.ucdavis.edu/documentation/license

Perfluorohexane sulfonic acid (PFHxS)
http://mona.fiehnlab.ucdavis.edu/spectra/browse?inchikey=QZHDEAJFRJCDMF-UHFFFAOYSA-N

13. ## NORMAN Suspect List Exchange

LICENSE
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https://creativecommons.org/licenses/by/4.0/

1-Hexanesulfonic acid, 1,1,2,2,3,3,4,4,5,5,6,6,6-tridecafluoro-

NORMAN Suspect List Exchange Classification
https://www.norman-network.com/nds/SLE/

14. ## Springer Nature
https://pubchem.ncbi.nlm.nih.gov/substance/341186423

15. ## Wikipedia

perfluorohexanesulphonic acid
https://commons.wikimedia.org/wiki/Category:Perfluorohexanesulfonic_acid

Perfluorohexanesulfonate
https://www.wikidata.org/wiki/Q81978596

16. ## PubChem
https://pubchem.ncbi.nlm.nih.gov

17. ## Medical Subject Headings (MeSH)

perfluorohexanesulfonic acid
https://www.ncbi.nlm.nih.gov/mesh/67471071

MeSH Tree
http://www.nlm.nih.gov/mesh/meshhome.html

18. ## UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

GHS Classification Tree
http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html

19. ## PATENTSCOPE (WIPO)

SID 403404669
https://pubchem.ncbi.nlm.nih.gov/substance/403404669

Perfluorohexanoic acid

Safety Data Sheet 2121339

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 11/18/2015 Revision date: 12/06/2018 Version: 1.1

SECTION 1: Identification

1.1. Identification

Product form	:	Substance
Substance name	:	Perfluorohexanoic acid
CAS No	:	307-24-4
Product code	:	2121-3-39
Formula	:	C6HF11O2
Synonyms	:	Undecafluorohexanoic acid
Other means of identification	:	2121-3-39

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

Use of the substance/mixture	:	Laboratory chemicals Manufacture of substances Scientific research and development

1.3. Details of the supplier of the safety data sheet

SynQuest Laboratories, Inc.
P.O. Box 309
Alachua, FL 32615 - United States of America
T (386) 462-0788 - F (386) 462-7097
info@synquestlabs.com - www.synquestlabs.com

1.4. Emergency telephone number

Emergency number	:	(844) 523-4086 (3E Company - Account 10069)

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Skin Corr. 1B	H314 -	Causes severe skin burns and eye damage
Eye Dam. 1	H318 -	Causes serious eye damage
STOT SE 3	H335 -	May cause respiratory irritation

Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS05 GHS07

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) :
H314 - Causes severe skin burns and eye damage
H335 - May cause respiratory irritation

Precautionary statements (GHS-US) :
P260 - Do not breathe fumes, mist, spray, vapors
P264 - Wash skin thoroughly after handling
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P301+P330+P331 - If swallowed: rinse mouth. Do NOT induce vomiting
P303+P361+P353 - If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing
P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor/ physician
P321 - Specific treatment (see supplemental first aid instructions on this label)
P363 - Wash contaminated clothing before reuse
P403+P233 - Store in a well-ventilated place. Keep container tightly closed
P405 - Store locked up
P501 - Dispose of contents/container to an approved waste disposal plant

2.3. Other hazards

No additional information available

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Mono-constituent

Name	Product identifier	%	Classification (GHS-US)
Perfluorohexanoic acid (Main constituent)	(CAS No) 307-24-4	<= 100	Skin Corr. 1B, H314 Eye Dam. 1, H318 STOT SE 3, H335

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Move the affected personnel away from the contaminated area.

First-aid measures after inhalation : Remove person to fresh air and keep comfortable for breathing. If not breathing, give artificial respiration. Get immediate medical advice/attention.

First-aid measures after skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Get immediate medical advice/attention.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice/attention.

First-aid measures after ingestion : Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth out with water. Get immediate medical advice/attention.

4.2. Most important symptoms and effects, both acute and delayed

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

Symptoms/injuries after inhalation : Material is destructive to tissue of the mucuous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.

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

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Alcohol resistant foam. Carbon dioxide. Dry powder. Water spray. Use extinguishing media appropriate for surrounding fire.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Thermal decomposition generates: Carbon oxides. Hydrogen fluoride.

Explosion hazard : Risk of explosion if heated under confinement. Use water spray or fog for cooling exposed containers.

5.3. Advice for firefighters

Firefighting instructions : In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.

Protection during firefighting : Wear gas tight chemically protective clothing in combination with self contained breathing apparatus. For further information refer to section 8: "Exposure controls/personal protection".

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

No additional information available

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	:	Do not handle until all safety precautions have been read and understood. Ensure good ventilation of the work station. Do not breathe fumes, mist, spray, vapors. Wear personal protective equipment. Avoid contact with skin and eyes.
Hygiene measures	:	Handle in accordance with good industrial hygiene and safety procedures. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures	:	Comply with applicable regulations.
Storage conditions	:	Keep container closed when not in use.
Incompatible materials	:	Refer to Section 10 on Incompatible Materials.
Storage area	:	Store in dry, cool, well-ventilated area.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls	:	Ensure good ventilation of the work station. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.
Hand protection	:	Protective gloves. 29 CFR 1910.138: Hand Protection.
Eye protection	:	Chemical goggles or safety glasses. Face shield. 29 CFR 1910.133: Eye and Face Protection.
Skin and body protection	:	Wear suitable protective clothing.
Respiratory protection	:	In case of inadequate ventilation wear respiratory protection. 29 CFR 1910.134: Respiratory Protection.
Other information	:	Safety shoes. 29 CFR 1910.136: Foot Protection.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Liquid
Appearance	:	Low melting solid.
Color	:	No data available
Odor	:	No data available
Odor threshold	:	No data available
pH	:	No data available
Melting point	:	12 - 14 °C
Freezing point	:	No data available
Boiling point	:	157 °C
Flash point	:	No data available
Relative evaporation rate (butyl acetate=1)	:	No data available
Flammability (solid, gas)	:	No data available
Explosion limits	:	No data available
Explosive properties	:	No data available
Oxidizing properties	:	No data available
Vapor pressure	:	No data available
Relative density	:	No data available
Relative vapor density at 20 °C	:	No data available
Specific gravity / density	:	1.762 g/ml (@ 20 °C)
Molecular mass	:	314.05 g/mol

Solubility	:	No data available
Log Pow	:	No data available
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Viscosity	:	No data available
Viscosity, kinematic	:	No data available
Viscosity, dynamic	:	No data available

9.2. Other information

Refractive index : 1.298 (@ 20 °C)

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

The product is stable at normal handling and storage conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

No additional information available

10.5. Incompatible materials

Bases. Oxidizing agents. Reducing agents.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced. Hazardous decomposition products in case of fire, see Section 5.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity	:	Not classified
Skin corrosion/irritation	:	Causes severe skin burns and eye damage.
Serious eye damage/irritation	:	Causes serious eye damage.
Respiratory or skin sensitization	:	Not classified
Germ cell mutagenicity	:	Not classified
Carcinogenicity	:	Not classified
Reproductive toxicity	:	Not classified
Specific target organ toxicity (single exposure)	:	May cause respiratory irritation.
Specific target organ toxicity (repeated exposure)	:	Not classified
Aspiration hazard	:	Not classified
Symptoms/injuries after inhalation	:	Material is destructive to tissue of the mucuous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.

SECTION 12: Ecological information

12.1. Toxicity

No additional information available

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment methods : Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber.

Waste disposal recommendations : Dispose of contents/container in accordance with licensed collector's sorting instructions.

Additional information : Recycle the material as far as possible.

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

Transport document description : UN3265 Corrosive liquid, acidic, organic, n.o.s., 8, II

UN-No.(DOT) : UN3265

Proper Shipping Name (DOT) : Corrosive liquid, acidic, organic, n.o.s.

Transport hazard class(es) (DOT) : 8 - Class 8 - Corrosive material 49 CFR 173.136

Hazard labels (DOT) : 8 - Corrosive

Packing group (DOT) : II - Medium Danger

DOT Packaging Non Bulk (49 CFR 173.xxx) : 202

DOT Packaging Bulk (49 CFR 173.xxx) : 242

DOT Symbols : G - Identifies PSN requiring a technical name

DOT Special Provisions (49 CFR 172.102) : B2 - MC 300, MC 301, MC 302, MC 303, MC 305, and MC 306 and DOT 406 cargo tanks are not authorized.
IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized.
T11 - 6 178.274(d)(2) Normal..... 178.275(d)(3)
TP2 - a. The maximum degree of filling must not exceed the degree of filling determined by the following: (image) Where: tr is the maximum mean bulk temperature during transport, tf is the temperature in degrees celsius of the liquid during filling, and a is the mean coefficient of cubical expansion of the liquid between the mean temperature of the liquid during filling (tf) and the maximum mean bulk temperature during transportation (tr) both in degrees celsius. b. For liquids transported under ambient conditions may be calculated using the formula: (image) Where: d15 and d50 are the densities (in units of mass per unit volume) of the liquid at 15 C (59 F) and 50 C (122 F), respectively.
TP27 - A portable tank having a minimum test pressure of 4 bar (400 kPa) may be used provided the calculated test pressure is 4 bar or less based on the MAWP of the hazardous material, as defined in 178.275 of this subchapter, where the test pressure is 1.5 times the MAWP.

DOT Packaging Exceptions (49 CFR 173.xxx) : 154

DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : 1 L

DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75) : 30 L

DOT Vessel Stowage Location : B - (i) The material may be stowed ''on deck'' or ''under deck'' on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) ''On deck only'' on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.

DOT Vessel Stowage Other : 40 - Stow ''clear of living quarters''

Other information : No supplementary information available.

TDG

No additional information available

Transport by sea

UN-No. (IMDG)	:	3265
Proper Shipping Name (IMDG)	:	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Class (IMDG)	:	8 - Corrosive substances
Packing group (IMDG)	:	II - substances presenting medium danger

Air transport

UN-No. (IATA)	:	3265
Proper Shipping Name (IATA)	:	Corrosive liquid, acidic, organic, n.o.s.
Class (IATA)	:	8 - Corrosives
Packing group (IATA)	:	II - Medium Danger

SECTION 15: Regulatory information

15.1. US Federal regulations

Perfluorohexanoic acid (307-24-4)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

15.2. International regulations

CANADA

Perfluorohexanoic acid (307-24-4)
Listed on the Canadian NDSL (Non-Domestic Substances List)

EU-Regulations

No additional information available

National regulations

Perfluorohexanoic acid (307-24-4)
Listed on the AICS (Australian Inventory of Chemical Substances) Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory Listed on the Korean ECL (Existing Chemicals List)

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer and/or reproductive harm

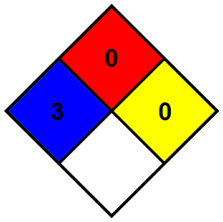
SECTION 16: Other information

Revision date : 12/06/2018

Full text of H-phrases:

Eye Dam. 1	Serious eye damage/eye irritation Category 1
Skin Corr. 1B	Skin corrosion/irritation Category 1B
STOT SE 3	Specific target organ toxicity (single exposure) Category 3
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H335	May cause respiratory irritation

NFPA health hazard	:	3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.
NFPA fire hazard	:	0 - Materials that will not burn.
NFPA reactivity	:	0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health	:	3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given
Flammability	:	0 Minimal Hazard - Materials that will not burn
Physical	:	0 Minimal Hazard - Materials that are normally stable, even under fire conditions, and will NOT react with water, polymerize, decompose, condense, or self-react. Non-Explosives.

SDS US (GHS HazCom 2012)

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is offered solely for your consideration, investigation, and verification. It does not represent any guarantee of the properties of the product nor that the hazard precautions or procedures described are the only ones which exist. SynQuest shall not be held liable or any damage resulting from handling or from contact with the above product.

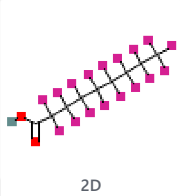
COVID-19 Information
Public health information (CDC) Research information (NIH) SARS-CoV-2 data (NCBI) Prevention and treatment information (HHS)
Español

PubChem

COMPOUND SUMMARY

Perfluorononanoic acid

Cite Download

PubChem CID	67821
Structure	 2D 3D Find Similar Structures
Chemical Safety	Corrosive Irritant Laboratory Chemical Safety Summary (LCSS) Datasheet
Molecular Formula	$C_9HF_{17}O_2$
Synonyms	Perfluorononanoic acid 375-95-1 heptadecafluorononanoic acid Perfluoro-n-nonanoic acid PFNA More...
Molecular Weight	464.08
Dates	Modify 2021-05-22 Create 2005-03-26

Perfluorononanoic acid is a fluoroalkanoic acid that is nonanoic acid in which all of the hydrogens in the alkyl chain are replaced by fluorines. It has a role as a persistent organic pollutant, a xenobiotic and a surfactant. It derives from a nonanoic acid.

ChEBI

Contents

1 Structures
2 Names and Identifiers
3 Chemical and Physical Properties
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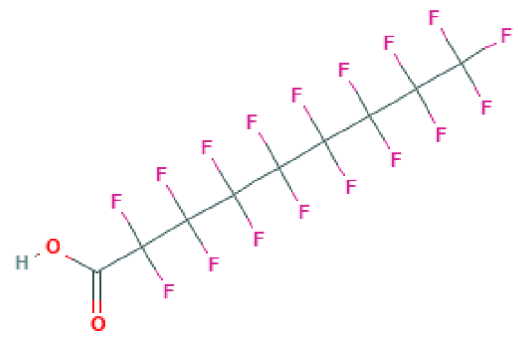
6 Chemical Vendors
7 Pharmacology and Biochemistry
8 Use and Manufacturing
9 Safety and Hazards
10 Toxicity
11 Associated Disorders and Diseases
12 Literature
13 Patents
14 Biomolecular Interactions and Pathways
15 Biological Test Results
16 Classification
17 Information Sources

1 Structures

1.1 2D Structure

Chemical Structure Depiction



PubChem

1.2 3D Conformer

PubChem

2 Names and Identifiers

2.1 Computed Descriptors

2.1.1 IUPAC Name

2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluorononanoic acid

Computed by LexiChem 2.6.6 (PubChem release 2019.06.18)

PubChem

2.1.2 InChI

InChI=1S/C9HF17O2/c10-2(11,1(27)28)3(12,13)4(14,15)5(16,17)6(18,19)7(20,21)8(22,23)9(24,25)26/h(H,27,28)

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.3 InChI Key

UZUFPBIDKMEQEQ-UHFFFAOYSA-N

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.1.4 Canonical SMILES

C(=O)(C(C(C(C(C(C(C(C(F)(F)F)(F)F)(F)F)(F)F)(F)F)(F)F)(F)F)(F)F)O

Computed by OEChem 2.1.5 (PubChem release 2019.06.18)

PubChem

2.2 Molecular Formula

C9HF17O2

Computed by PubChem 2.1 (PubChem release 2019.06.18)

PubChem

2.3 Other Identifiers

2.3.1 CAS

375-95-1

CAS Common Chemistry; ChemIDplus; EPA Chemicals under the TSCA; EPA DSSTox; European Chemicals Agency (ECHA); Hazardous Substances Data Bank (HSDB)

2.3.2 Related CAS

4149-60-4 (ammonium salt)

ChemIDplus

2.3.3 European Community (EC) Number

206-801-3

European Chemicals Agency (ECHA)

2.3.4 UNII

5830Z6S63M

FDA/SPL Indexing Data

2.3.5 DSSTox Substance ID

DTXSID8031863

EPA DSSTox

2.3.6 Wikipedia

Perfluorononanoic acid

Wikipedia

2.4 Synonyms

2.4.1 MeSH Entry Terms

C9-PFA
perfluoro-n-nonanoic acid
perfluoro-n-nonanoic acid, ammonium salt
perfluoro-n-nonanoic acid, lithium salt
perfluoro-n-nonanoic acid, potassium salt
perfluoro-n-nonanoic acid, sodium salt

Medical Subject Headings (MeSH)

2.4.2 Depositor-Supplied Synonyms

Perfluorononanoic acid	Heptadecafluornonansaeure	ACMC-209iu9
375-95-1	Heptadekafluornonansaeure	C8F17COOH
heptadecafluorononanoic acid	CHEBI:38397	DSSTox_CID_11863
Perfluoro-n-nonanoic acid	MFCD00039605	DSSTox_RID_78893
PFNA	5830Z6S63M	DSSTox_GSID_31863
Perfluorononan-1-oic acid	Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-	SCHEMBL23557
Nonanoic acid, heptadecafluoro-	NSC676910	Perfluorononanoic acid, 97%
2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-Heptadecafluorononanoic acid	EINECS 206-801-3	CHEMBL426404
Heptadecafluoropelargonic Acid	PERFLURONONANOICACID	DTXSID8031863
Perfluornonansaeure	Perfluorononanoic acid (PFNA)	Tox21_300380
n-Heptadecafluorononanoic acid	HSDB 8040	ANW-28687
UNII-5830Z6S63M	Perfluoropelargonic Acid	ZINC38141429

PubChem

3 Chemical and Physical Properties

3.1 Computed Properties

Property Name	Property Value	Reference
Molecular Weight	464.08	Computed by PubChem 2.1 (PubChem release 2021.05.07)
XLogP3-AA	5.6	Computed by XLogP3 3.0 (PubChem release 2019.06.18)
Hydrogen Bond Donor Count	1	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Hydrogen Bond Acceptor Count	19	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Rotatable Bond Count	7	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Exact Mass	463.9705080	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Monoisotopic Mass	463.9705080	Computed by PubChem 2.1 (PubChem release 2021.05.07)
Topological Polar Surface Area	37.3 Å^2	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Heavy Atom Count	28	Computed by PubChem
Formal Charge	0	Computed by PubChem
Complexity	615	Computed by Cactvs 3.4.6.11 (PubChem release 2019.06.18)
Isotope Atom Count	0	Computed by PubChem
Defined Atom Stereocenter Count	0	Computed by PubChem
Undefined Atom Stereocenter Count	0	Computed by PubChem
Defined Bond Stereocenter Count	0	Computed by PubChem
Undefined Bond Stereocenter Count	0	Computed by PubChem
Covalently-Bonded Unit Count	1	Computed by PubChem
Compound Is Canonicalized	Yes	Computed by PubChem (release 2019.01.04)

PubChem

3.2 Experimental Properties

3.2.1 Solubility

In water, 6.25X10-2 mg/L at 25 °C (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Jan, 2011. Available from, as of Jul 26, 2012: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

Hazardous Substances Data Bank (HSDB)

3.2.2 Vapor Pressure

8.3X10-2 mm Hg at 25 °C (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Jan, 2011. Available from, as of Jul 26, 2012: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

Hazardous Substances Data Bank (HSDB)

3.2.3 LogP

log Kow = 5.48 (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Jan, 2011. Available from, as of Jul 26, 2012: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

Hazardous Substances Data Bank (HSDB)

3.2.4 Dissociation Constants

pKa = -0.21

*SPARC; pKa/property server. Ver 3. Jan, 2006. Available from, as of July 9, 2012: **http://archemcalc.com/sparc/***

▸ Hazardous Substances Data Bank (HSDB)

3.2.5 Collision Cross Section

165.06 Å² [M-H]⁻

240.71 Å² [2M-H]⁻

147.05 Å² [M-H-CO2]⁻

*S79 | UACCSCEC | Collision Cross Section (CCS) Library from UAntwerp | **DOI:10.5281/zenodo.4704648***

▸ NORMAN Suspect List Exchange

3.2.6 Kovats Retention Index

Semi-standard non-polar	1091

▸ NIST Mass Spectrometry Data Center

3.2.7 Other Experimental Properties

Hydroyl radical reaction rate constant = 5.2X10-11 cu cm/molec-sec at 25 °C (est)

*US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Jan, 2011. Available from, as of Jul 26, 2012: **http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

▸ Hazardous Substances Data Bank (HSDB)

4 Spectral Information

4.1 Mass Spectrometry

Showing 2 of 4 View More

Source of Spectrum	NP-19-337-0
Copyright	Copyright © 2020 John Wiley & Sons, Inc. All Rights Reserved.
Thumbnail	

SpectraBase

Source of Spectrum	NP-15-4322-0
Copyright	Copyright © 2020 John Wiley & Sons, Inc. All Rights Reserved.
Thumbnail	

SpectraBase

4.1.1 GC-MS

Showing 2 of 3 View More

NIST Number	375808
Library	Main library
Total Peaks	110

m/z Top Peak	131
m/z 2nd Highest	69
m/z 3rd Highest	45

Thumbnail

NIST Mass Spectrometry Data Center

NIST Number	237633
Library	Replicate library
Total Peaks	111
m/z Top Peak	131
m/z 2nd Highest	69
m/z 3rd Highest	45

Thumbnail

NIST Mass Spectrometry Data Center

4.1.2 MS-MS

MS-MS	MS-MS Spectrum 435959 - Perfluorononanoic acid (HMDB0061739) MS-MS Spectrum 435960 - Perfluorononanoic acid (HMDB0061739) MS-MS Spectrum 435961 - Perfluorononanoic acid (HMDB0061739) MS-MS Spectrum 435962 - Perfluorononanoic acid (HMDB0061739) MS-MS Spectrum 435963 - Perfluorononanoic acid (HMDB0061739) MS-MS Spectrum 435964 - Perfluorononanoic acid (HMDB0061739)

MS-MS Spectrum 435965 - Perfluorononanoic acid (HMDB0061739)
MS-MS Spectrum 435966 - Perfluorononanoic acid (HMDB0061739)

▸ Human Metabolome Database (HMDB)

4.1.3 LC-MS

Showing 2 of 5 View More

MoNA ID	EA271851
MS Category	Experimental
MS Type	LC-MS
MS Level	MS2
Precursor Type	[M-H]-
precursor m/z	462.9632
Instrument	LTQ Orbitrap XL Thermo Scientific
Instrument Type	LC-ESI-ITFT
Ionization	ESI
Ionization Mode	negative
Collision Energy	35 % (nominal)
Retention Time	13.9 min
Splash	splash10-014i-0000900000-7a30a5904591700ff4a1
Thumbnail	
Submitter	Eawag Team, Eawag - Swiss Federal Institute of Aquatic Science and Technology

▸ MassBank of North America (MoNA)

MoNA ID	EA271852
MS Category	Experimental
MS Type	LC-MS
MS Level	MS2
Precursor Type	[M-H]-
precursor m/z	462.9632
Instrument	LTQ Orbitrap XL Thermo Scientific
Instrument Type	LC-ESI-ITFT
Ionization	ESI
Ionization Mode	negative

Collision Energy	15 % (nominal)
Retention Time	13.9 min
Splash	splash10-014i-0020900000-3a30d00e24e965e23f97
Thumbnail	
Submitter	Eawag Team, Eawag - Swiss Federal Institute of Aquatic Science and Technology

MassBank of North America (MoNA)

4.1.4 Other MS

MoNA ID	MoNA024628
MS Category	Experimental
Precursor Type	[M-H]-
precursor m/z	462.963234
Ionization Mode	negative
Splash	splash10-014i-0994900000-944aefc1a791dd7e806f
Thumbnail	
Submitter	Arpana Vaniya, UC DAVIS

MassBank of North America (MoNA)

4.2 IR Spectra

4.2.1 ATR-IR Spectra

Source of Sample	Aldrich
Catalog Number	394459
Copyright	Copyright © 2018-2020 Sigma-Aldrich Co. LLC. - Database Compilation Copyright © 2018-2020 John Wiley & Sons, Inc. All Rights Reserved.
Thumbnail	

SpectraBase

4.3 Other Spectra

In water, 6.25X10-2 mg/L at 25 °C (est)

US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Jan, 2011. Available from, as of Jul 26, 2012: ***http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm***

Hazardous Substances Data Bank (HSDB)

5 Related Records

5.1 Related Compounds with Annotation

PubChem

5.2 Related Compounds

Same Connectivity	4 Records
Same Parent, Connectivity	40 Records
Same Parent, Exact	37 Records
Mixtures, Components, and Neutralized Forms	50 Records
Similar Compounds	175 Records
Similar Conformers	155 Records

PubChem

5.3 Substances

5.3.1 Related Substances

All	247 Records
Same	99 Records
Mixture	148 Records

PubChem

5.3.2 Substances by Category

PubChem

5.4 Entrez Crosslinks

PubMed	217 Records
Taxonomy	7 Records
OMIM	8 Records
Gene	1,248 Records

PubChem

6 Chemical Vendors

- PubChem

7 Pharmacology and Biochemistry

7.1 Absorption, Distribution and Excretion

Using nuclear magnetic resonance (NMR) spectroscopy, we investigated the importance of **carbon** chain length with regard to the hepatic effects associated with perfluoro-n-carboxylic acids. Male F-344 rats were administered a single intraperitoneal dose of either **perfluoro-n-heptanoic acid** (C7-PFA), perfluoro-n-nonanoic acid (C9-PFA), or **perfluoro-n-undecanoic acid** (C11-PFA). Data from previous studies involving **perfluoro-n-octanoic acid** (C8-PFA) and **perfluoro-n-decanoic acid** (C10-PFA) are included for comparison. Food consumption/body weight was monitored daily for all groups. C9- and C11-PFA treatment yields a prolonged hypophagic response while C7-PFA shows a more acute response. Fluorine-19 NMR spectra of urine and bile samples show no evidence of fluorometabolites and suggest that the distribution of perfluorocarbons into urine or bile is dependent upon **carbon** chain length. The aqueous solubility of C7-PFA appears to facilitate rapid urinary excretion, similar to that observed for C8-PFA. The relative hydrophobicity of C9- and C11-PFA appears to favor biliary enterohepatic recirculation, yielding a more protracted toxicity, similar to C10-PFA. **Phosphorus-31** NMR studies of liver in vivo and liver extracts show that perfluorocarbons of > or = C9 carbons produce a significant increase in liver **phosphocholine** concentration. These data are discussed with regard to the impact of these chemicals on hepatic phospholipid metabolism. Hepatic peroxisomal fatty acyl **CoA**-oxidase activity (FAO) was measured to determine if C7-, C9-, and C11-PFA are peroxisome proliferators. Data indicate that the induction of peroxisomal enzyme activity by perfluorocarbons requires a chain length greater than seven carbons. In general, these results demonstrate the significance of **carbon** chain length in the hepatotoxic response and provide clues toward understanding the processes involved in the biological activities associated with exposure to these compounds.

PMID:8831811
Goecke-Flora CM, Reo NV; Chem Res Toxicol. 9 (4): 689-95 (1996)

▸ **Hazardous Substances Data Bank (HSDB)**

Perfluorononanoic acid (PFNA) is a fluorinated organic chemical found at low levels in the environment, but is detectable in humans and wildlife. The present study compared the pharmacokinetic properties of PFNA in two laboratory rodent species. ... CD-1 mice were given a single oral dose of PFNA of 1 or 10mg/kg, and 4 males and 4 females were killed at /1, 2, 3, 4, 7, 16, 21, 28, 35, 42 and 50 days after treatment/; trunk blood, liver and kidney were collected. Serum and tissue concentrations of PFNA were determined by LC-MS/MS. ... In the mouse, the rates of PFNA serum elimination are non-linear with exposure dose and are slightly faster in females than males, with terminal estimated serum half-life of 25.8-68.4 days and 34.3-68.9 days, respectively. PFNA is also stored preferentially in the mouse liver but not in the kidneys. Hepatic uptake appears to be more efficient and storage capacity greater in male mice than in females. These data suggest that (1) PFNA is more persistent in the mouse than in the rat; (2) there is a major sex difference in the serum elimination of PFNA in the rat, but much less so in the mouse; and (3) there is a significantly higher hepatic accumulation of PFNA in male mice than in females.

PMID:21237237
Tatum-Gibbs K et al; Toxicology. 281 (1-3): 48-55 (2011)

▸ **Hazardous Substances Data Bank (HSDB)**

Perfluorononanoic acid (PFNA) is a fluorinated organic chemical found at low levels in the environment, but is detectable in humans and wildlife. The present study compared the pharmacokinetic properties of PFNA in two laboratory rodent species. Male and female Sprague-Dawley rats were given a single dose of PFNA by oral gavage at 1, 3, or 10mg/kg, and blood was collected from the tail vein at 1, 2, 3, 4, 7, 16, 21, 28, 35, 42 and 50 days after treatment. In addition, livers and kidneys were collected for PFNA analysis at the terminal time point. ... Serum and tissue concentrations of PFNA were determined by LC-MS/MS. Serum elimination of PFNA is by and large linear with exposure doses in the rat; however, like **PFOA**, a major sex difference in the rate of elimination is observed, with an estimated half-life of 30.6 days for males and 1.4 days for females. PFNA is stored preferentially in the liver but not in the kidneys. ... These data suggest that (1) PFNA is more persistent in the mouse than in the rat; (2) there is a major sex difference in the serum elimination of PFNA in the rat, but much less so in the mouse; and (3) there is a significantly higher hepatic accumulation of PFNA in male mice than in females.

PMID:21237237
Tatum-Gibbs K et al; Toxicology. 281 (1-3): 48-55 (2011)

▸ **Hazardous Substances Data Bank (HSDB)**

7.2 Biological Half-Life

CD-1 mice were given a single oral dose of perfluorononanoic acid (PFNA) of 1 or 10mg/kg, and 4 males and 4 females were killed at /1, 2, 3, 4, 7, 16, 21, 28, 35, 42 and 50 days after treatment./ ... In the mouse, the rates of PFNA serum elimination are non-linear with exposure dose and are slightly faster in females than males, with terminal estimated serum half-life of 25.8-68.4 days and 34.3-68.9 days,

PMID:21237237
Tatum-Gibbs K et al; Toxicology. 281 (1-3): 48-55 (2011)

▸ **Hazardous Substances Data Bank (HSDB)**

Male and female Sprague-Dawley rats were given a single dose of perfluorononanoic acid (PFNA) by oral gavage at 1, 3, or 10mg/kg, and blood was collected from the tail vein at 1, 2, 3, 4, 7, 16, 21, 28, 35, 42 and 50 days after treatment. ... Serum elimination of PFNA is by and large linear with exposure doses in the rat ... with an estimated half-life of 30.6 days for males and 1.4 days for females.

PMID:21237237
Tatum-Gibbs K et al; Toxicology. 281 (1-3): 48-55 (2011)

▸ Hazardous Substances Data Bank (HSDB)

7.3 Mechanism of Action

The potency of the induction of peroxisomal beta-oxidation was compared between perfluorinated fatty acids (PFCAs) with different carbon chain lengths in the liver of male and female rats. In male rats, perfluoroheptanoic acid (PFHA) has little effect, although perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA) and perfluorodecanoic acid (PFDA) potentially induced the activity. By contrast, PFHA and PFOA did not induce the activity of peroxisomal beta-oxidation in the liver of female rats while PFNA and PFDA effectively induced the activity. The induction of the activity by these PFCAs was in a dose-dependent manner, and there is a highly significant correlation between the induction and hepatic concentrations of PFCAs in the liver regardless of their carbon chain lengths. These results strongly suggest that the difference in their chemical structure is not the cause of the difference in the potency of the induction. Hepatic concentrations of PFOA and PFNA was markedly higher in male compared with female rats. Castration of male rats reduced the concentration of PFNA in the liver and treatment with testosterone entirely restored the reduction. In contrast to the results obtained from the in vivo experiments, the activity of peroxisomal beta-oxidation was induced by PFDA and PFOA to the same extent in cultured hepatocytes prepared from both male and female rats. These results, taken together, indicate that difference in accumulation between PFCAs in the liver was responsible for the different potency of the induction of peroxisomal beta-oxidation between PFCAs with different carbon chain lengths and between sexes.

PMID:10670823
Kudo N et al; Chem Biol Interact. 124 (2): 119-32 (2000)

▸ Hazardous Substances Data Bank (HSDB)

Perfluorononanoate (PFNA), a perfluorinated alkyl acid containing nine carbon chains, has been detected in abiotic and biotic matrices worldwide. Although a few studies have reported toxic effects of PFNA, little information of the mechanism has been offered. In this study, the effects of PFNA exposure on thymus and the related mechanisms were investigated. Male rats were orally dosed with 0, 1, 3, or 5 mg PFNA/kg/day for 14 days. A significant decrease of body weight and thymus weight were observed in the rats receiving 3 or 5 mg PFNA/kg/day. Histopathological examination revealed dose-dependent increases in thymocyte apoptosis. Rats receiving 3 or 5 mg PFNA/kg/day exhibited increased interleukin (IL)-1 and decreased IL-2 concentrations in sera, whereas elevated IL-4 and cortisol levels only occurred in the highest dose group. Quantitative real-time PCR indicated that expression of peroxisome proliferator-activated receptor alpha (PPAR-alpha) was increased in the thymi of all dosed rats, and a similar trend occurred for PPAR-gamma in the two highest dose groups. The mRNA levels of c-Jun NH(2)-terminal kinase (JNK), nuclear factor-kappa B, p65 subunit, and inhibitory protein IkappaBalpha were unchanged; however, increased and decreased mRNA levels of p38 kinase were found in rats exposed to 3 or 5 mg PFNA/kg/day, respectively. Decreased Bcl-2 mRNA levels were observed in rats receiving 5 mg PFNA/kg/day. A significant increase in protein levels of phospho-JNK was found in all PFNA-treated rats. Phospho-p38 was significantly enhanced in 1 and 3 mg PFNA/kg/day groups, whereas phospho-IkappaBalpha remained consistent in all rats studied. Together, these data suggested that apart from the activation of PPARs, PFNA exposure in rats lead to the alteration of serum cytokines, which subsequently activated mitogen-activated protein kinase signaling pathways and potentially modulated the immune system. Additionally, increased serum cortisol and decreased expression of Bcl-2 in thymus likely contributed to the PFNA-induced thymocyte apoptosis.

PMID:19196829
Fang X et al; Toxicol Sci. 108 (2): 367-76 (2009)

▸ Hazardous Substances Data Bank (HSDB)

... This study explored the possible involvement of apoptotic signaling pathways in a nine-carbon-chain length PFAA-perfluorononanoic acid (PFNA)-induced splenocyte apoptosis. After a 14-day exposure to PFNA, rat spleens showed dose-dependent levels of apoptosis. The production of pro-inflammatory and anti-inflammatory cytokines was significantly increased and decreased, respectively. However, protein levels of tumor necrosis factor receptor 1 (TNFR1), fas-associated protein with death domain (FADD), caspase 8 and caspase 3, which are involved in inflammation-related and caspase-dependent apoptosis, were discordant. Peroxisome proliferator-activated receptors alpha (PPARalpha) and PPARgamma genes expression was up-regulated in rats treated with 3 or 5 mg/kg/day of PFNA, and the level of hydrogen peroxide (H2O2) increased concurrently in rats treated with the highest dose. Moreover, superoxide dismutase (SOD) activity and Bcl-2 protein levels were dramatically decreased in spleens after treatment with 3 and 5 mg/kg/day of PFNA. However, protein levels of Bax were unchanged. Apoptosis-inducing factor (AIF), an initiator of caspase-independent apoptosis, was significantly increased in all PFNA-dosed rats. Thus, oxidative stress and the activation of a caspase-independent apoptotic signaling pathway contributed to PFNA-induced apoptosis in rat splenocytes.

PMID:19878704
Fang X et al; Toxicology. 267 (1-3): 54-9 (2010)

▸ Hazardous Substances Data Bank (HSDB)

8 Use and Manufacturing

8.1 Use Classification

PFAS (per- and polyfluoroalkyl substances) -> OECD Category

S25 | OECDPFAS | List of PFAS from the OECD | DOI:10.5281/zenodo.2648775

▸ NORMAN Suspect List Exchange

8.2 Uses

EPA CPDat Chemical and Product Categories

▸ EPA Chemical and Products Database (CPDat)

Long-chain perfluoroalkanecarboxylic acids and their salts are surface-active chemicals (surfactants), which greatly reduce the surface tension (surface energy) of water, aqueous solutions, and organic liquids even at low concentrations. These acids (C6- C12) and derivatives are used as wetting, dispersing, emulsifying, and foaming agents. /Long-chain perfluoroalkanecarboxylic acids/

Siegemund G et al; Ullmann's Encyclopedia of Industrial Chemistry 7th ed. (1999-2012). NY, NY: John Wiley & Sons; Fluorine Compounds, Organic. Online Posting Date: June 15, 2000

▸ Hazardous Substances Data Bank (HSDB)

8.3 Methods of Manufacturing

Long-chain perfluorocarboxylic acids are prepared by the Simons electrochemical fluorination of the corresponding acyl halide ... The acids are obtained by hydrolysis of the perfluoroacyl fluoride, followed by distillation. Some carbon-carbon bond scission occurs to form lower homologous acids along with inert fluorocarbons and cyclic ethers. The acid yield decreases with increasing chain length. /Long-chain perfluorocarboxylic acids/

Siegemund G et al; Ullmann's Encyclopedia of Industrial Chemistry 7th ed. (1999-2012). NY, NY: John Wiley & Sons; Fluorine Compounds, Organic. Online Posting Date: June 15, 2000

▸ Hazardous Substances Data Bank (HSDB)

8.4 General Manufacturing Information

EPA TSCA Commercial Activity Status

Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-: ACTIVE

https://www.epa.gov/tsca-inventory

▸ EPA Chemicals under the TSCA

EPA TSCA Regulatory Flag

S - indicates a substance that is identified in a final Significant New Use Rule.

https://www.epa.gov/tsca-inventory

- **EPA Chemicals under the TSCA**

9 Safety and Hazards

9.1 Hazards Identification

9.1.1 GHS Classification

Showing 1 of 3 View More

Pictogram(s)	Corrosive Irritant
Signal	Danger
GHS Hazard Statements	H314 (12.5%): Causes severe skin burns and eye damage [**Danger** Skin corrosion/irritation] H315 (87.5%): Causes skin irritation [**Warning** Skin corrosion/irritation] H319 (87.5%): Causes serious eye irritation [**Warning** Serious eye damage/eye irritation] H335 (87.5%): May cause respiratory irritation [**Warning** Specific target organ toxicity, single exposure; Respiratory tract irritation]
Precautionary Statement Codes	P260, P261, P264, P271, P280, P301+P330+P331, P302+P352, P303+P361+P353, P304+P340, P305+P351+P338, P310, P312, P321, P332+P313, P337+P313, P362, P363, P403+P233, P405, and P501 (The corresponding statement to each P-code can be found at the GHS Classification page.)
ECHA C&L Notifications Summary	*Aggregated GHS information provided by 48 companies from 6 notifications to the ECHA C&L Inventory. Each notification may be associated with multiple companies.* *Information may vary between notifications depending on impurities, additives, and other factors. The percentage value in parenthesis indicates the notified classification ratio from companies that provide hazard codes. Only hazard codes with percentage values above 10% are shown.*

▸ European Chemicals Agency (ECHA)

9.1.2 Hazard Classes and Categories

Showing 2 of 3 View More

Skin Corr. 1C (12.5%)

Skin Irrit. 2 (87.5%)

Eye Irrit. 2 (87.5%)

STOT SE 3 (87.5%)

▸ European Chemicals Agency (ECHA)

Carcinogenicity - category 2

Reproductive toxicity - category 1B

Reproductive toxicity - effects on or via lactation

Acute toxicity - category 4

Acute toxicity - category 4

Specific target organ toxicity (repeated exposure) - category 1

Eye damage - category 1

▸ Hazardous Chemical Information System (HCIS), Safe Work Australia

9.1.3 Substance of Very High Concern (SVHC)

REACH SVHC Substance

Substance: Perfluorononan-1-oic-acid
Reason: Toxic for reproduction (Article 57c), PBT (Article 57d)
Decision Document: PDF Link

European Chemicals Agency (ECHA)

9.2 Accidental Release Measures

9.2.1 Disposal Methods

SRP: The most favorable course of action is to use an alternative chemical product with less inherent propensity for occupational harm/injury/toxicity or environmental contamination. Recycle any unused portion of the material for its approved use or return it to the manufacturer or supplier. Ultimate disposal of the chemical must consider: the material's impact on air quality; potential migration in soil or water; effects on animal and plant life; and conformance with environmental and public health regulations.

Hazardous Substances Data Bank (HSDB)

9.3 Regulatory Information

9.3.1 Clean Water Act Requirements

Monitoring requirements for unregulated contaminants. This section specifies the monitoring and quality control requirements that must be followed if you own or operate a public water system (PWS) that is subject to the Unregulated Contaminant Monitoring Regulation (UCMR), as specified in paragraphs (a)(1) and (2) of this section. Perfluorononanoic acid (PFNA) is included on this list.

40 CFR 141.40 (USEPA); U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from, as of June 8, 2012: http://www.ecfr.gov

Hazardous Substances Data Bank (HSDB)

10 Toxicity

10.1 Toxicological Information

10.1.1 Antidote and Emergency Treatment

/SRP:/ Immediate first aid: Ensure that adequate decontamination has been carried out. If patient is not breathing, start artificial respiration, preferably with a demand valve resuscitator, bag-valve-mask device, or pocket mask, as trained. Perform CPR if necessary. Immediately flush contaminated eyes with gently flowing **water**. Do not induce vomiting. If vomiting occurs, lean patient forward or place on the left side (head-down position, if possible) to maintain an open airway and prevent aspiration. Keep patient quiet and maintain normal body temperature. Obtain medical attention. /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3Rd edition, Elsevier Mosby, St. Louis, MO 2005, p. 160

▸ **Hazardous Substances Data Bank (HSDB)**

/SRP:/ Basic treatment: Establish a patent airway (oropharyngeal or nasopharyngeal airway, if needed). Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if needed. Administer **oxygen** by nonrebreather mask at 10 to 15 L/min. Monitor for pulmonary edema and treat if necessary ... . Monitor for shock and treat if necessary ... . Anticipate seizures and treat if necessary ... . For eye contamination, flush eyes immediately with **water**. Irrigate each eye continuously with 0.9% saline (NS) during transport ... . Do not use emetics. For ingestion, rinse mouth and administer 5 mL/kg up to 200 mL of **water** for dilution if the patient can swallow, has a strong gag reflex, and does not drool ... . Cover skin burns with dry sterile dressings after decontamination ... . /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3Rd edition, Elsevier Mosby, St. Louis, MO 2005, p. 160

▸ **Hazardous Substances Data Bank (HSDB)**

/SRP:/ Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious, has severe pulmonary edema, or is in severe respiratory distress. Positive-pressure ventilation techniques with a bag valve mask device may be beneficial. Consider drug therapy for pulmonary edema ... . Consider administering a beta agonist such as **albuterol** for severe bronchospasm ... . Monitor cardiac rhythm and treat arrhythmias as necessary ... . Start IV administration of D5W /SRP: "To keep open", minimal flow rate/. Use 0.9% saline (NS) or lactated Ringer's if signs of hypovolemia are present. For hypotension with signs of hypovolemia, administer fluid cautiously. Watch for signs of fluid overload ... . Treat seizures with **diazepam** or **lorazepam** ... . Use **proparacaine hydrochloride** to assist eye irrigation ... . /Poisons A and B/

Currance, P.L. Clements, B., Bronstein, A.C. (Eds).; Emergency Care For Hazardous Materials Exposure. 3Rd edition, Elsevier Mosby, St. Louis, MO 2005, p. 160-1

▸ **Hazardous Substances Data Bank (HSDB)**

10.1.2 Human Toxicity Excerpts

/EPIDEMIOLOGY STUDIES/ /The investigators/ analyzed 458 plasma samples of New York State (NYS) employees and National Guard personnel assigned to work in the vicinity of the WTC between September 11 and December 23, 2001, to assess exposure to perfluorochemicals released in dust and smoke. The plasma samples collected from NYS WTC responders were grouped based on estimated levels of exposure to dust and smoke, as follows: more dust exposure (MDE), less dust exposure (LDE), more smoke exposure (MSE), and less smoke exposure (LSE). Furthermore, samples were grouped, based on self-reported symptoms at the time of sampling, as symptomatic and asymptomatic. Eight perfluorochemicals were measured in 458 plasma samples. **PFOS**, **PFOA**, **perfluorohexanesulfonate** (PFHxS), and perfluorononanoic acid (PFNA), were consistently detected in almost all samples. ... Concentrations of PFNA were significantly higher in the MSE group than in the LSE group. ... A significant negative correlation existed between plasma lipid content and concentrations of certain perfluorochemicals. ...

PMID:18522136
Tao L et al; Environ Sci Technol. 42 (9): 3472-8 (2008)

▸ **Hazardous Substances Data Bank (HSDB)**

/BIOMONITORING/ /Reaserchers/ studied occurrence and levels of PFCs in human milk in relation to maternal serum together with the temporal trend in milk levels between 1996 and 2004 in Sweden. Matched, individual human milk and serum samples from 12 primiparous women in Sweden were analyzed together with composite milk samples (25-90 women/year) from 1996 to 2004. Eight PFCs were detected in the serum samples, and five of them were also above the detection limits in the milk samples. **Perfluorooctanesulfonate** (**PFOS**) and **perfluorohexanesulfonate** (PFHxS) were detected in all milk samples at mean concentrations of 0.201 ng/mL and 0.085 ng/mL, respectively. **Perfluorooctanesulfonamide** (**PFOSA**), **perfluorooctanoic acid** (**PFOA**), and perfluorononanoic acid (PFNA) were detected less frequently. The total PFC concentration in maternal serum was 32 ng/mL, and the corresponding milk concentration was 0.34 ng/mL. The **PFOS** milk level was on average 1% of the corresponding serum level. There was a strong association between increasing serum concentration and increasing milk concentration for **PFOS** (r(2) = 0.7) and PFHxS (r(2) = 0.8). **PFOS** and PFHxS levels in composite milk samples were relatively unchanged between 1996 and 2004, with a total variation of 20 and 32%

coefficient of variation, respectively. The calculated total amount of PFCs transferred by lactation to a breast-fed infant in this study was approximately 200 ng/day. Lactation is a considerable source of exposure for infants, and reference concentrations for hazard assessments are needed.

PMID:17384769
Full text: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1831521
Karrman A et al; Environ Health Perspect. 115 (2): 226-30 (2007)

▸ Hazardous Substances Data Bank (HSDB)

10.1.3 Non-Human Toxicity Excerpts

/LABORATORY ANIMALS: Developmental or Reproductive Toxicity/ Male rats were orally dosed for 1, 3 and 5 mg/kg/day PFNA or with vehicle for 14 days. In the present study, serum **testosterone** levels were decreased, while **estradiol** levels were increased dramatically in rats receiving 5 mg PFNA/kg/day. Spermatogenic cells from rats that received 5 mg PFNA/kg/day exhibited apoptotic features including crescent chromatin condensation and chromatin margination. Flow cytometric analysis and TUNEL assays revealed a dose-dependent increase of apoptotic cell numbers. In addition, expression of Fas and Bax mRNA levels were upregulated significantly, and Bcl-2 mRNA levels were downregulated markedly in the 3 and 5 mg/kg/day groups. A dose-dependent increase in levels of active caspase-8 and no significant changes of active caspase-9 were observed. ...PFNA exposure can lead to cell apoptosis in rat testis, and this apoptosis was probably associated with the Fas death receptor-dependent apoptotic pathway.

PMID:19646514
Feng Y et al; Toxicol Lett 190 (2): 224-30 (2009)

▸ Hazardous Substances Data Bank (HSDB)

/ENDOCRINE MODULATION/ In this study, male rats were exposed to 0, 0.2, 1 or 5 mg/kg/day PFNA for 14 days to explore the specific effect of PFNA on hepatic glycometabolism and its underlying mechanisms. The results showed that administration of 5 mg/kg/day PFNA significantly increased serum **glucose** and hepatic **glycogen** in rats. Quantitative real-time PCR analysis showed that PFNA exposure changed the expression levels of several genes related to hepatic **glucose** metabolism, such as the **glucose**-6-phosphatase (G6PC) gene and the **glucose** transporter 2 (GLUT2) gene, which were upregulated, and the glucokinase (GCK) gene and the phosphoinositide-3-kinase, catalytic, alpha polypeptide (PI3Kca) gene, which were decreased. The protein expression levels of phospho-insulin receptor 1(IRS1), phospho-PI3K, phospho-AKT and phospho-phosphoinositide-dependent kinase 1 (PDK1) were decreased in the livers of rats that received 5 mg/kg/day PFNA. The expression of phospho-**glycogen** synthase kinase-3 beta (GSK3beta, Ser 9) was increased, which explains the augment of hepatic **glycogen**. Significant increases in **hydrogen peroxide** (H(2)O(2)) and **malondialdehyde** (MDA) were found in the livers of 5 mg/kg/day PFNA-treated rats. Thus, exposure to PFNA disordered **glucose** metabolism via inhibiting hepatic insulin signal pathway, accelerating the output of **glucose** and increasing **glycogen** synthesis in the rat liver. Furthermore, the oxidative stress induced by PFNA may be involved in this process.

PMID:22387981
Fang X et al; Toxicology 294 (2-3): 109-15 (2012)

▸ Hazardous Substances Data Bank (HSDB)

/ALTERNATIVE and IN VITRO TESTS/ The aim of this study was to investigate the effects of PFNA exposure on cell junction molecules and factors specifically secreted by Sertoli cells. Primary Sertoli cells from 20- to 21-day-old rats were exposed to increasing PFNA concentrations (0, 1, 10, 25, 50, or 75 uM) for 24 hr. No significant changes in the expression of cytoskeleton-associated molecules were noted, although the mRNA levels of vimentin were upregulated dramatically in cells exposed to 50 and 75 uM PFNA. Meanwhile, the mRNA levels of Sertoli cell-specific secretions, such as Mullerian inhibiting substance (MIS), androgen binding protein (ABP), inhibin B, transferrin, and follicle-stimulating hormone receptor (FSH-R) changed significantly in experimental groups. Wilms' tumor gene (WT1), a transcription factor, was upregulated significantly in cells exposed to 1-75 uM PFNA. In additional studies, male rats were exposed to 0, 1, 3, or 5 mg/kg/day PFNA for 14 days. Vacuoles in the cytoplasm of Sertoli cells were observed in the ultrastructure of testis. Furthermore, the changes in the concentrations of MIS and inhibin B in serum and the protein levels of WT1 and transferrin in testis were similar to the mRNA expression levels of those observed after in vitro treatment. In conclusion, these findings demonstrated that PFNA treatment led to the damage of specific secretory functions of Sertoli cells and that these effects might be an underlying cause of the male-specific reproductive toxicity of PFNA.

PMID:20580666
Feng Y et al; Reprod Toxicol 30 (3): 429-37 (2010)

▸ Hazardous Substances Data Bank (HSDB)

10.1.4 Ecotoxicity Excerpts

/AQUATIC SPECIES/ Perfluorinated surfactants (PFSs) in Asian freshwater fish species were analyzed to investigate tissue distribution, temporal trends, extent of pollution, and level of PFS exposure through food intake. Freshwater fish species, namely carp, snakehead, and catfish, were

collected in Japan, Vietnam, India, Malaysia, and Thailand, and 10 PFSs, including perfluorooctanesulfonate (PFOS) and perfluorooctanoate, were analyzed by liquid chromatography-tandem mass spectrometry. PFSs in carp in Tokyo were more concentrated in kidneys (sum of 10 PFSs = 257 +/- 95 ng/g wet weight [ww]) and livers (119 +/- 36 ng/g ww) than in ovaries (43 +/- 2 ng/g ww) and muscles (24 +/- 17 ng/g ww). Concentrations of PFOS and its precursor, perfluorooctane sulfonamide, in livers of carp and in waters in Tokyo showed a dramatic decrease during the last decade, probably because of 3 M's phasing-out of the manufacture of perfluorooctanesulfonyl-fluoride-based products in 2000. In contrast, continuing contamination by long-chain perfluorocarboxylates (PFCAs) with > or =9 fluorinated carbons was seen in multiple media, suggesting that these compounds continue to be emitted. PFS concentrations in freshwater fish species in tropical Asian countries were generally lower than those in developed countries, such as Japan, e.g., for PFOS in muscle, Vietnam < 0.05-0.3 ng/g ww; India < 0.05-0.2 ng/g ww; Malaysia < 0.05-0.2 ng/g ww; Thailand < 0.05 ng/g ww; and Japan (Tokyo) = 5.1-22 ng/g ww. Daily intake of short-chain PFCAs with < or =8 fluorinated carbons from freshwater fish species in Japan was approximately one order of magnitude lower than that from drinking water, whereas daily intake of PFOS and long-chain PFCAs with > or =9 fluorinated carbons from freshwater fish species was comparable with or greater than that from drinking water. Because the risk posed by exposure to these compounds through intake of fish species is a matter of concern, we recommend the continued monitoring of PFS levels in Asian developing countries. /Perfluorinated surfactants/

PMID:21424221

Murakami M et al; Arch Environ Contam Toxicol 61 (4): 631-41 (2011)

▸ Hazardous Substances Data Bank (HSDB)

10.1.5 Ongoing Test Status

The following link will take the user to the National Toxicology Program (NTP) Test Agent Search Results page, which tabulates all of the "Standard Toxicology & Carcinogenesis Studies", "Developmental Studies", and "Genetic Toxicity Studies" performed with this chemical. Clicking on the "Testing Status" link will take the user to the status (i.e., in review, in progress, in preparation, on test, completed, etc.) and results of all the studies that the NTP has done on this chemical.[Available from, as of June 21, 2012: http://ntp-apps.niehs.nih.gov/ntp_tox/index.cfm?fuseaction=ntpsearch.searchresults&searchterm=375-95-1]

▸ Hazardous Substances Data Bank (HSDB)

10.2 Ecological Information

10.2.1 Environmental Fate/Exposure Summary

Perfluorochemicals like perfluoro-n-nonanoic acid have been widely used since the 1950s in many industrial and consumer products, including protective coatings for fabrics and carpet, paper coatings, insecticide formulations, and surfactants. Perfluoro-n-nonanoic acid's production and use may result in its release to the environment through various waste streams. If released to air, an estimated vapor pressure of 8.3X10-2 mm Hg at 25 °C indicates perfluoro-n-nonanoic acid will exist solely as a vapor in the atmosphere. Vapor-phase perfluoro-n-nonanoic acid will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 31 days. Perfluoro-n-nonanoic acid does not contain chromophores that absorb at wavelengths >290 nm and, therefore, is not expected to be susceptible to direct photolysis by sunlight. If released to soil, perfluoro-n-nonanoic acid is expected to have no mobility based upon an estimated Koc of 1.2X10+5. The pKa of perfluoro-n-nonanoic acid is -0.21, indicating that this compound will exist entirely in anion form in the environment and anions generally do not adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts. Volatilization from moist soil is not expected because the acid exists as an anion and anions do not volatilize. Perfluoro-n-nonanoic acid is not expected to volatilize from dry soil surfaces based upon its estimated vapor pressure. Organic fluorochemical compounds, such as perfluoro-n-nonanoic acid, are expected to be resistant to biodegradation in soil and water. If released into water, perfluoro-n-nonanoic acid is expected to adsorb to suspended solids and sediment based upon the estimated Koc. Volatilization from water surfaces is not expected to be an important fate process based upon this compound's estimated pKa. An estimated BCF of 9100 suggests the potential for bioconcentration in aquatic organisms is very high, provided the compound is not metabolized by the organism. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions. Occupational exposure to perfluoro-n-nonanoic acid may occur through inhalation and dermal contact with this compound at workplaces where perfluoro-n-nonanoic acid is produced or used. Monitoring data indicate that the general population may be exposed to perfluoro-n-nonanoic acid via inhalation of ambient air, ingestion of food and drinking water, and dermal contact with products containing perfluoro-n-nonanoic acid. (SRC)

▸ Hazardous Substances Data Bank (HSDB)

10.2.2 Artificial Pollution Sources

Perfluorochemicals like perfluoro-n-nonanoic acid have been widely used since the 1950s in many industrial and consumer products, including protective coatings for fabrics and carpet, paper coatings, insecticide formulations, and surfactants(1). Perfluoro-n-nonanoic acid's production and use may result in its release to the environment through various waste streams(SRC).

(1) Calafat AM et al; Environ Sci Technol 40: 2128-34 (2006)

▸ Hazardous Substances Data Bank (HSDB)

10.2.3 Environmental Fate

TERRESTRIAL FATE: Based on a classification scheme(1), an estimated Koc value of 1.2X10+5(SRC), determined from a structure estimation method(2), indicates that perfluoro-n-nonanoic acid is expected to be immobile in soil(SRC). The pKa of perfluoro-n-nonanoic acid is -0.21(3), indicating that this compound will exist entirely in anion form in the environment and anions generally do not adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts(4). Volatilization of perfluoro-n-nonanoic acid from moist soil surfaces is not expected to be an important fate process(SRC) based on the pKa(3). Perfluoro-n-nonanoic acid is not expected to volatilize from dry soil surfaces(SRC) based upon an estimated vapor pressure of 8.3X10-2 mm Hg at 25 °C(SRC), determined from a fragment constant method(5). Organic fluorochemical compounds, such as perfluoro-n-nonanoic acid, are expected to be resistant to biodegradation(6).

*(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Jan, 2011. Available from, as of July 9, 2012: **http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm** (3) SPARC; pKa/property server. Ver 3. Jan, 2006. Available from, as of July 9, 2012: **http://archemcalc.com/sparc/** (4) Doucette WJ; pp. 141-188 in Handbook of Property Estimation Methods for Chemicals. Boethling RS, Mackay D, eds. Boca Raton, FL: Lewis Publ (2000) (5) Lyman WJ; p. 31 in Environmental Exposure From Chemicals Vol I, Neely WB, Blau GE, eds, Boca Raton, FL: CRC Press (1985) (6) Hanson KJ et al; Environ Sci Technol 35: 766-70 (2001)*

▸ Hazardous Substances Data Bank (HSDB)

AQUATIC FATE: Based on a classification scheme(1), an estimated Koc value of 1.2X10+5(SRC), determined from a structure estimation method(2), indicates that perfluoro-n-nonanoic acid is expected to adsorb to suspended solids and sediment(SRC). A pKa of -0.21(3) indicates perfluoro-n-nonanoic acid will exist entirely in the anion form at pH values of 5 to 9 and therefore volatilization from water surfaces is not expected to be an important fate process(SRC). According to a classification scheme(4), an estimated BCF of 9100(SRC), from an estimated log Kow of 5.48(5) and a regression-derived equation(6), suggests the potential for bioconcentration in aquatic organisms is very high(SRC). Perfluoro-n-nonanoic acid is not expected to undergo hydrolysis in the environment due to the lack of functional groups that hydrolyze under environmental conditions(7). Organic fluorochemical compounds, such as perfluoro-n-nonanoic acid, are expected to be resistant to biodegradation(8).

*(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Jan, 2011. Available from, as of July 9, 2012: **http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm** (3) SPARC; pKa/property server. Ver 3. Jan, 2006. Available from, as of July 9, 2012: **http://archemcalc.com/sparc/** (4) Franke C et al; Chemosphere 29: 1501-14 (1994) (5) Meylan WM, Howard PH; J Pharm Sci 84: 83-92 (1995) (6) Meylan WM et al; Environ Toxicol Chem 18: 664-72 (1999) (7) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 7-4, 7-5 (1990) (8) Hanson KJ et al; Environ Sci Technol 35: 766-70 (2001)*

▸ Hazardous Substances Data Bank (HSDB)

ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere(1), perfluoro-n-nonanoic acid, which has an estimated vapor pressure of 8.3X10-2 mm Hg at 25 °C(SRC), determined from a fragment constant method(2), is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase perfluoro-n-nonanoic acid is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals(SRC); the half-life for this reaction in air is estimated to be 31 days(SRC), calculated from its rate constant of 5.2X10-11 cu cm/molecule-sec at 25 °C(SRC) that was derived using a structure estimation method(3). Perfluoro-n-nonanoic acid does not contain chromophores that absorb at wavelengths >290 nm(4) and, therefore, is not expected to be susceptible to direct photolysis by sunlight(SRC).

(1) Bidleman TF; Environ Sci Technol 22: 361-367 (1988) (2) Lyman WJ; p. 31 in Environmental Exposure From Chemicals Vol I, Neely WB, Blau GE, eds, Boca Raton, FL: CRC Press (1985) (3) Meylan WM, Howard PH; Chemosphere 26: 2293-99 (1993) (4) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 8-12 (1990)

▸ Hazardous Substances Data Bank (HSDB)

10.2.4 Environmental Biodegradation

AEROBIC: Organic fluorochemical compounds, such as perfluoro-n-nonanoic acid, are expected to be resistant to biodegradation(1). A related compound, perfluorooctanoic acid, present at 100 mg/L, reached 5% of its theoretical BOD in 4 weeks using an activated sludge inoculum at 30 mg/L in the Japanese MITI test(2), indicating perfluoro-n-nonanoic acid will also not biodegrade(SRC).

*(1) Hanson KJ et al; Environ Sci Technol 35: 766-70 (2001) (2) NITE; Chemical Risk Information Platform (CHRIP). Biodegradation and Bioconcentration. Tokyo, Japan: Natl Inst Tech Eval. Available from, as of July 9, 2012: **http://www.safe.nite.go.jp/english/db.html***

▸ Hazardous Substances Data Bank (HSDB)

10.2.5 Environmental Abiotic Degradation

The rate constant for the vapor-phase reaction of perfluoro-n-nonanoic acid with photochemically-produced hydroxyl radicals has been estimated as 5.2X10-11 cu cm/molecule-sec at 25 °C(SRC) using a structure estimation method(1). This corresponds to an atmospheric half-life of about 31

days at an atmospheric concentration of 5X10+5 hydroxyl radicals per cu cm(1). Perfluoro-n-nonanoic acid is not expected to undergo hydrolysis in the environment due to the lack of functional groups that hydrolyze under environmental conditions(2). Perfluoro-n-nonanoic acid does not contain chromophores that absorb at wavelengths >290 nm(2) and, therefore, is not expected to be susceptible to direct photolysis by sunlight(SRC).

(1) Meylan WM, Howard PH; Chemosphere 26: 2293-99 (1993) (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 7-4, 7-5, 8-12 (1990)

Hazardous Substances Data Bank (HSDB)

10.2.6 Environmental Bioconcentration

An estimated BCF of 9100 was calculated in fish for perfluoro-n-nonanoic acid(SRC), using an estimated log Kow of 5.48(1) and a regression-derived equation(2). According to a classification scheme(3), this BCF suggests the potential for bioconcentration in aquatic organisms is very high(SRC). The log bioaccumulation factors (BAF) for perfluoro-n-nonanoic acid in lake trout from Lake Superior, Lake Huron, Lake Erie and Lake Ontario were 3.7, 3.6, 3.8 and 3.1, respectively, the average log BAF was 3.6(4). The average Log BAF in eel (A anguilla) from 23 locations in The Netherlands was 2.52 with a range of 2.02 to 3.14(5). The steady state biota sediment accumulation factor for perfluoro-n-nonanoic acid in Lumbriculus variegatus was found to be 55(6). Bioaccumulation factors of lake trout in Lake Ontario samples were 5.3, 0.62 and 0.13 based on prey of alewife, smelt and sculpin, respectively, the diet weighted BAF was 2.3 based on all prey(7). Trophic level biomagnification factors were reported as: ringed seal:cod 1.2, beluga:cod 12.9, beluga:herring 5.8, beluga:Artic cisco 2.9, cod:Calanus hyperboreus 0.7, cod:Themisto libellula 0.3(8).

(1) Meylan WM, Howard PH; J Pharm Sci 84: 83-92 (1995) (2) Meylan WM et al; Environ Toxicol Chem 18: 664-72 (1999) (3) Franke C et al; Chemosphere 29: 1501-14 (1994) (4) Furdui VI; Environ Sci Technol 42: 4739-44 (2008) (5) Kwadijk CJAF et al; Environ Sci Technol 44: 3746-51 (2010) (6) Higgins CP et al; Environ Sci Technol 41: 4600-6 (2007) (7) Martin JW et al; Environ Sci Technol 38: 5379-85 (2004) (8) Tomy GT et al; Environ Sci Technol 43: 4076-81 (2009)

Hazardous Substances Data Bank (HSDB)

10.2.7 Soil Adsorption/Mobility

Using a structure estimation method based on molecular connectivity indices(1), the Koc of perfluoro-n-nonanoic acid can be estimated to be 1.2X10+5(SRC). According to a classification scheme(2), this estimated Koc value suggests that perfluoro-n-nonanoic acid is expected to be immobile in soil. The pKa of perfluoro-n-nonanoic acid is -0.21(3), indicating that this compound will exist in anion form in the environment and anions generally do not adsorb more strongly to soils containing organic carbon and clay than their neutral counterparts(4). The log Koc for perfluoro-n-nonanoic acid in three sediments was reported as 2.4(5) and 3.69 in 23 sediments(6).

*(1) US EPA; Estimation Program Interface (EPI) Suite. Ver. 4.1. Jan, 2011. Available from, as of July 9, 2012: **http://www.epa.gov/oppt/exposure/pubs/episuitedl.htm** (2) Swann RL et al; Res Rev 85: 17-28 (1983) (3) SPARC; pKa/property server. Ver 3. Jan, 2006. Available from, as of July 9, 2012: **http://archemcalc.com/sparc/** (4) Doucette WJ; pp. 141-188 in Handbook of Property Estimation Methods for Chemicals. Boethling RS, Mackay D, eds. Boca Raton, FL: Lewis Publ (2000) (5) Higgins CP, Luthy RG; Environ Sci Technol 40: 7251-6 (2006) (6) Kwadijk CJAF et el; Environ Sci Technol 44:3746-51 (2010)*

Hazardous Substances Data Bank (HSDB)

10.2.8 Volatilization from Water/Soil

A pKa of -0.21(1) indicates perfluoro-n-nonanoic acid will exist entirely in the anion form at pH values of 5 to 9 and therefore volatilization from water and moist soil surfaces is not expected to be an important fate process(SRC). Perfluoro-n-nonanoic acid is not expected to volatilize from dry soil surfaces(SRC) based upon an estimated vapor pressure of 8.3X10-2 mm Hg(SRC), determined from a fragment constant method(2).

*(1) SPARC; pKa/property server. Ver 3. Jan, 2006. Available from, as of July 9, 2012: **http://archemcalc.com/sparc/** (2) Lyman WJ; p. 31 in Environmental Exposure From Chemicals Vol I, Neely WB, Blau GE, eds, Boca Raton, FL: CRC Press (1985)*

Hazardous Substances Data Bank (HSDB)

10.2.9 Environmental Water Concentrations

GROUND WATER: Perfluoro-n-nonanoic acid was detected in one of 19 well water samples at 25.7 ng/L, samples were taken around Decatur, AL, from area farms that have a history of being treated with fluorochemical industry impacted biosolids(1). Perfluoro-n-nonanoic acid was detected in groundwater samples from the Highland Creek watershed, Canada, taken Feb to March 2010 at 0.071 to 0.54 ng/L(2). Perfluoro-n-nonanoic acid was detected in 15 ground water samples taken in the city of Tokyo, Japan, Sept to Nov 2006; concentrations were 0.1 to 94 ng/L(3).

(1) Lindstrom AM et al; Environ Sci Technol 45: 8015-21 (2011) (2) Meyer T et al; Environ Sci Technol 45: 8113-9 (2011) (3) Murakami M et al; Environ Sci Technol 43: 3480-6 (2009)

Hazardous Substances Data Bank (HSDB)

DRINKING WATER: Drinking water samples from seven waste water treatment plants throughout the US tested positive in four for perfluoro-n-nonanoic acid at 1.0-9.7 ng/L(1). Perfluoro-n-nonanoic acid was not detected (detection limit 10 ng/L) in the finish water from four wastewater

treatment plants in New York State, but was detected in two others at 4 to 376 ng/L(2). Perfluoro-n-nonanoic acid was not detected (detection limit 0.22 ng/L) in drinking water samples collected in three homes that receive water from different water works in Oslo, Norway, samples were collected between Oct 2008 and Jan 2009(3). Perfluoro-n-nonanoic acid was detected in 79% of 43 tap water samples taken from homes, schools, offices, restaurants, commercial centers, hotels and an airport in 2006 and 2008 from 10 cities in China(4).

(1) Quinones O, Snyder SA: Environ Sci Technol 43: 9089-95 (2009) (2) Sinclair E, Kannan K; Environ Sci Technol 40: 1408-14 (2006) (3) Haug LS et al; Chemosphere 80: 1137-43 (2010) (4) Mak YL et al; Environ Sci Technol 43: 4824-9 (2009)

Hazardous Substances Data Bank (HSDB)

SURFACE WATER: Surface water samples taken from US streams in the Great Lakes basin tested positive for perfluoro-n-nonanoic acid in 38% of 8 samples taken 1994 to 2000 at concentrations of 0.00003 to 0.0004 ug/L(1). Perfluoro-n-nonanoic acid was detected in creek and river samples collected throughout Canada at concentrations of <125 to 3000 pg/L(2). Perfluoro-n-nonanoic acid was detected in nine of 32 surface water samples at 12.4 to 286 ng/L, samples were taken around Decatur, AL, from area ponds and streams near farms that have a history of being treated with fluorochemical industry impacted biosolids(3). Perfluoro-n-nonanoic acid was detected in surface water samples from the Highland Creek watershed, Canada, collected Feb to March 2010 at 0.80 to 2.4 ng/L(4). Out of 100 samples taken from 80 sites in the Cape Fear River Basin, North Carolina, the 11 samples with the highest total perfluorinated organic compound concentrations had perfluoro-n-nonanoic acid concentrations of 2.24-194 ng/L, samples were collected in the spring of 2006(5).

(1) Klecka G et al; Rev Environ Contam Toxicol 207: 1-93 (2010) (2) D'eon JC et al; Environ Toxicol Chem 28: 2101-7 (2009) (3) Lindstrom AB et al; Environ Sci Technol 45: 8015-21 (2011) (4) Meyer T et al; Environ Sci Technol 45: 8113-9 (2011) (5) Nakayama S et al; Environ Sci Technol 41: 5271-6 (2007)

Hazardous Substances Data Bank (HSDB)

SURFACE WATER: Lake water samples from four lakes on Cornwallis Island, Nunavut, Canada were tested for perfluoro-n-nonanoic acid(1).

Location	Sample Date	Mean (ng/L)	Range (ng/L)
Amituk Lake	Aug 2003	0.3	0.2-0.4
Char Lake	Aug 2003	0.5	not detected-1.4
	July 2005	1.5	0.3-2.5
Resolute Lake	Aug 2003	2.0	not detected-6.1
	July 2005	1.7	1.2-2.3
	Aug 1, 2005	2.8	2.5-3.0
	Aug 8, 2005	1.7	0.9-2.9
Meretta Lake	July 2005	4.1	3.8-4.4
Outflow from Meretta	July 2005	3.5	3.0-4.2

(1) Stock NL et al; Environ Sci Technol 41: 3529-36 (2007)

Hazardous Substances Data Bank (HSDB)

SURFACE WATER: Perfluoro-n-nonanoic acid was detected in open ocean water at <5.1-107, <5.1-35 and <5.1 pg/L in 40 samples from the North Atlantic, 10 samples from the Middle Atlantic and 10 samples from the South Atlantic Ocean, respectively, samples were collected April, Oct and Nov of 2007(1). Perfluoro-n-nonanoic acid was detected in seawater samples taken from Finland, Denmark and Iceland, and in lake water from Norway, concentrations were not reported(2). Perfluoro-n-nonanoic acid was not detected (detection limit 1.6 ng/L) in river water samples collected from the Glatt River at Schwerzenbach, Oberglatt and Rheinsfelden, Switzerland(3). Perfluoro-n-nonanoic acid was detected in all 20 rivers studied throughout Japan from Nov 8 to Dec 12, 2005 at concentrations of 0.25 to 53 ng/L(4). Five streams flowing into Lake Shihwa, Korea had perfluoro-n-nonanoic acid concentrations of 0.83 to 6.95 ng/L, concentrations in Lake Shihwa were 0.63 to 10.86 ng/L and in Gyeonggi Bay were 0.94 to 3.29 ng/L, all samples were collected in Dec of 2004(5). Water samples taken from tributaries of the Pearl River in Guangzhou and along the Yangtze River had perfluoro-n-nonanoic acid concentrations of <0.13-3.1 and <0.005-10 ng/L, respectively(6). Perfluoro-n-nonanoic acid was detected in sea water samples from six locations around Hong Kong, eight locations from the Pearl River Delta and South China Sea at <0.02-0.69 pg/mL, samples were collected July and Sept 2003 and Jan 2004(7). Water samples collected from 11 locations along the west and south coasts of South Korea contained perfluoro-n-nonanoic acid at 0.24-320 pg/mL(7).

(1) Ahrens L et al; Environ Sci Technol 43: 3122-7 (2009) (2) Berger U et al; Organohalogen Compounds 66: 4046-52 (2004) (3) Huset CA et al; Environ Sci Technol 42: 6369-77 (2008) (4) Murakami M et al; Environ Sci Technol 42: 6566-72 (2008) (5) Rostkowski P et al; Environ Toxicol Chem 25: 2374-80 (2006) (6) So MK et al; Chemosphere 68: 2085-95 (2007) (7) So MK et al; Environ Sci Technol 38: 4056-63 (2004)

Hazardous Substances Data Bank (HSDB)

RAIN/SNOW/FOG: Perfluoro-n-nonanoic acid was detected in 81.8% of 11 urban rain water samples and 71.4% of 21 snow samples at <0.25-3.48 and <0.25-4.94 ng/L, samples were taken Aug 2006 to March 2007 and Feb 2006, Jan to March 2007, respectively(1). Perfluoro-n-nonanoic acid was detected in bulk snow samples from the Highland Creek watershed, Canada, taken Feb to March 2010 at 0.079 to 0.99 ng/L(2).

(1) Kim S, Kannan K; Environ Sci Technol 41: 8328-34 (2007) (2) Meyer T et al; Environ Sci Technol 45: 8113-9 (2011)

Hazardous Substances Data Bank (HSDB)

RAIN/SNOW/FOG: Summary range of perfluoro-n-nonanoic acid from precipitation samples(1).

Location	Site	Date Sampled	No. Samples	Concentration (ng/L)
Japan	Tsukuba	June 2006-April 2008	15	0.91-17.5
	Kawaguchi	June 2006-June 2008	16	0.16-6.77
USA	Slingerlands (NY)	June 2006-June 2007	6	0.21-4.81
	Albany	June 2006-June 2007	6	0.24-5.39
China	Hong Kong	May 2007	5	0.13-0.44
India	Patna	Sept 2008	2	<0.06-0.16
France	Toulouse	Oct 2008	2	0.18-0.24

(1) Kwok KY et al; Environ Sci Technol 44: 7043-9 (2010)

Hazardous Substances Data Bank (HSDB)

RAIN/SNOW/FOG: Precipitation samples from nine North American locations were tested for perfluoro-n-nonanoic acid(1).

Location	Category	Year	Concentration (ng/L)
Smith Island, MD	near urban	1998	0.1-20
		1999	<0.1-2.6
Lewes, DE	near urban	1998	0.1-77
		1999	<0.1-4.9
Ithaca, NY	rural	1998	0.1-3.2
		1999	<0.1-2.6
Underhill, VT	rural	1999	<0.1-1.9
Kejimkujik, Nova Scotia	remote	2002	<0.1-3.3
Algoma, Ontario	remote	2002	<0.1-7.6
Saturna Island, British Columbia	rural	2002	<0.1-2.8
Egbertt, Ontario	near urban	2003-4	0.4-4.1
North Toronto, Ontario	urban	2003-4	0.5-9.7

(1) Scott BF et al; Environ Sci Technol 40: 7167-74 (2006)

Hazardous Substances Data Bank (HSDB)

10.2.10 Effluent Concentrations

Perfluoro-n-nonanoic acid was detected in sewage effluent samples from Norway and the Faeroe Islands and in landfill effluent samples taken from Finland and Norway, concentrations were not reported(1). Perfluoro-n-nonanoic acid was detected in waste **water** treatment sludge from six plants located across Ontario, Canada, collected in 2002, at <0.0625-0.61 ng/g(2). Perfluoro-n-nonanoic acid concentration was reported in influent, effluent and digested sludge from a waste water treatment plant as 1.1 ng/L, 3.4 ng/L and 9.9 ug/kg, respectively(3). Perfluoro-n-nonanoic acid was not detected (detection limit 1.6 ng/L) in the influent or effluent of the waste water treatment plants along the Glatt Valley Watershed, Switzerland, in Faelianden, Bassersdorf, Niederglatt, Buelach or Glattfelden(4). However, perfluoro-n-nonanoic acid was detected in the influent of Duebendorf at 2.6 to 26 ng/L and in the effluent of Duebendorf and Kloten-Opfikon at <1.6-2.6 and <1.6-5.6 ng/L, respectively, all samples were collected Feb to March 2006(4). Two municipal waste water treatment plants in Taipei had perfluoro-n-nonanoic acid concentrations of 10.6 and 0.4 ng/L in their influent samples and <0.1 and 0.3 ng/L in their effluent samples(5). Perfluoro-n-nonanoic acid was also measured at 10.4 ng/L in the effluent of an industrial waste water treatment plant located in Hsinchu Science Park, Taiwan(5).

(1) Berger U et al; Organohalogen Compounds 66: 4046-52 (2004) (2) D'eon JC et al; Environ Sci Technol 43: 4589-94 (2009) (3) Heidler J, Halden RU; Environ Sci Technol 42: 6324-32 (2008) (4) Huset CA et al; Environ Sci Technol 42: 6369-77 (2008) (5) Lin AC et al; Chemosphere 80: 1167-74 (2010)

Hazardous Substances Data Bank (HSDB)

10.2.11 Sediment/Soil Concentrations

SEDIMENT: Perfluoro-n-nonanoic acid was not detected (detection limit 0.10 ng/g) in sediment samples from 11 sites in the Daliao River system of northeast China, samples were collected in April 2008(1). Perfluoro-n-nonanoic acid was not detected in 13 sediment samples from the Zhujiang River in Guangzhou and nine sediment samples from the Huangpu River in Shanghai, China, samples were collected March 2009(2). Sediment samples, collected from the Hudson Bay region of northeastern Canada May to Sept 1999 to 2003, had perfluoro-n-nonanoic acid concentrations in 33% of <0.06-0.14 ng/g dry weight(3). Perfluoro-n-nonanoic acid was detected at 0.33-0.55 ng/g dry weight in five sediment samples taken from the Ariake Sea in Jan 2004(4).

(1) Bao J et al; Chemosphere 77: 652-7 (2009) (2) Bao J et al; Chemosphere 80: 123-30 (2010) (3) Kelly BC et al; Environ Sci Technol 43: 4037-43 (2009) (4) Nakata H et al; Environ Sci Technol 40: 4916-21 (2006)

Hazardous Substances Data Bank (HSDB)

SEDIMENT: Perfluoro-n-nonanoic acid was analyzed at different depths in sediment samples from four lakes on Cornwallis Island, Nunavut, Canada(1).

Depth	Location	Concentration (ng/g dry weight)
0-1 cm	Resolute Lake	3.2
1-2 cm		<3.1
2-3 cm		<2.55
0-1 cm	Char Lake	<0.55
1-2 cm		not detected
2-3 cm		<0.55
0-1.5 cm	Amituk Lake	0.35
1.5-2.5 cm		0.23
2.5-3.5 cm		<0.059

(1) Stock NL et al; Environ Sci Technol 41: 3529-36 (2007)

Hazardous Substances Data Bank (HSDB)

SEDIMENT: Perfluoro-n-nonanoic acid was detected in a sediment core sample form Tokyo Bay, Japan, sample was taken May 2008(1).

Depth (cm)	Time Interval	Concn (pg/g dry weight)	Est Flux (pg/sq m/yr)
0-3	2006-2008	14	3.4
3-6	2004-2006	9.3	2.7
6-9	2002-2004	4.6	1.6
9-11	2001-2002	3.4	1.3
13-15	1998-1999	3.7	1.4
17-19	1995-1997	<1	<0.6
21-23	1993-1994	1.1	0.6
25-27	1990-1991	0.7	0.3
29-35	1985-1989	<1	<0.5
37-47	1978-1983	<1	<0.6
49-59	1969-1975	<1	<0.7
61-75	1959-1967	<1	<0.8
77-79	1956-1958	<1	<0.7

(1) Ahrens L et al; Environ Sci Technol 43: 6959-75 (2009)

Hazardous Substances Data Bank (HSDB)

10.2.12 Atmospheric Concentrations

URBAN/SUBURBAN: Perfluoro-n-nonanoic acid was detected in 3% of atmospheric samples from Barsbuttel, Germany at a maximum concentration of 0.1 pg/cu m, the study was run April 2007 to June 2008(1). Perfluoro-n-nonanoic acid was detected in atmospheric samples from a location in Albany, NY at 0.16-0.31 pg/cu m, samples were taken May to July 2006(2). Perfluoro-n-nonanoic acid was not detected (detection limit 0.02 pg/cu m) in outdoor air samples from six homes in Vancouver, Canada, samples were collected 2007 to 2008(3).

(1) Dreyer A et al; Environ Sci Technol 43: 6507-14 (2009) (2) Kim S, Kannan K; Environ Sci Technol 41: 8328-34 (2007) (3) Shoeib M et al; Environ Sci Technol 45: 7999-8005 (2011)

Hazardous Substances Data Bank (HSDB)

RURAL/REMOTE: Perfluoro-n-nonanoic acid had an average concentration of 0.3 pg/cu m in 8% of 141 atmospheric samples from the Atlantic and Southern Oceans and coastal areas of the Baltic sea, the study was run April 2007 to Jan 2009(1).

(1) Dreyer A et al; Environ Sci Technol 43: 6507-14 (2009)

Hazardous Substances Data Bank (HSDB)

INDOOR: Perfluoro-n-nonanoic acid was not detected in 40 indoor air samples from Oslo, Norway households(1). Perfluoro-n-nonanoic acid was detected at <0.02 to 2.166 pg/cu m in indoor air samples from 59 homes in Vancouver, Canada, samples were collected 2007 to 2008(2).

(1) Haug LS et al; Environ Sci Technol 45: 7991-8 (2011) (2) Shoeib M et al; Environ Sci Technol 45: 7999-8005 (2011)

Hazardous Substances Data Bank (HSDB)

10.2.13 Food Survey Values

Seven types of seafood were purchased from local markets in Zhoushan and Guangzhou, China in 2004, perfluoro-n-nonanoic acid was only detected in sand swimming crab and swimming crab at 0.28 and 0.61 ng/g wet weight, respectively(1). Perfluoro-n-nonanoic acid was sampled in food, tea and milk purchased in grocery stores in Oslo, Norway between Oct 2008 and Jan 2009, concentrations were (pg/g fresh weight): cheese (16), bread (9.5), strawberry jam (3.7), pork meat (5.5), beef (15), chicken meat (6.8), salmon (10), cod (5.9) and cod liver (14)(2). All other products (lettuce, carrot, potato, margarine, milk, egg, fish sticks, canned mackerel) were listed at less than detection limit (detection limits varied)(2). In Nov 2009, food products of 15 food categories were randomly purchased in several Dutch retail stores, perfluoro-n-nonanoic acid was detected as follows (pg/g product); fatty fish (5), lean fish (77), crustaceans (58), butter (2), cheese (7), milk (<1), eggs (6), pork (2), beef (4), chicken/poultry (1), bakery products (1), vegetables/fruit (1), flour (15), vegetable oil (<0.1), industrial oil (<0.3)(3). Concentrations of perfluoro-n-nonanoic acid in food products sampled for the 2004 Canadian Total Diet Study were 3.75 and 1.72 ng/g wet weight in cold cuts and cookies, <0.75, <0.79, <1.43, <0.74, <0.74 and <0.78 ng/g wet weight in processed cheese, peppers, canned lunch meats, pizza, cheese and beef frozen dinner, respectively(4). Perfluoro-n-nonanoic acid was detected in one of three popcorn packaging paper before and after cooking at 2.1 and 2.5 ng/sq cm, respectively(5).

(1) Gulkowska A et al; Environ Sci Technol 40: 3736-41 (2006) (2) Haug LS et al; Chemosphere 80:1137-43 (2010) (3) Noorlandr Cwet al; J Agric Food Chem 59: 7496-505 (2011) (4) Ostertag SK et al; J Agric Food Chem 57: 8534-44 (2009) (5) Sinclair E et al; Environ Sci Technol 41: 1180-5 (2007)

Hazardous Substances Data Bank (HSDB)

Concentration of perfluoro-n-nonanoic acid in aquatic traditional Inuit foods collected between 1997 and 1999 in Nunavut, Canada(1).

Food	Part	Preparation	Concn (ng/g)
Ringed Seal	liver	raw	1.9-2.1
	blood	raw	1.2
	meat	boiled	0.5
		raw	0.9
	blubber	raw	<=0.2
Polar Bear	meat	frozen	0.8
Beluga	blubber	raw	0.4
	meat	dried	0.6-0.9
	muktuk	raw	<0.4
Narwhal	blubber	raw	<0.1
	muktuk	raw	0.5
	muktuk	frozen	<0.4
Bearded Seal	intestine	boiled	0.3-1.2
	meat	boiled	<0.3
Walrus	blubber	aged	0.4
	kauk	raw	0.6
	meat	raw	0.6-0.8
	meat	aged	<0.3

Food	Part	Preparation	Concn (ng/g)
Eider duck	whole	boiled	<0.1
Black duck	meat	boiled	<0.3
Arctic char	whole	raw	0.2
Lake trout	whole	raw	<0.3
Seaweed	whole	raw	<0.3
Clams	whole	raw	0.5

(1) Ostertag SK et al; Chemosphere 75: 1165-72 (2009)

Hazardous Substances Data Bank (HSDB)

Concentration of perfluoro-n-nonanoic acid in terrestrial traditional Inuit foods collected between 1997 and 1999 in Nunavut, Canada(1).

Food	Part	Preparation	Concn (ng/g)
Caribou	liver	baked	1.6
		raw	2.0
	meat	boiled	<0.1-0.8
		dried	<0.9-1.0
		raw	0.3
		roasted	1.0
	bone marrow	boiled	0.6
	heart blood	raw	0.8
	fat	raw	<0.3
	kidneys	raw	0.2
		boiled	<0.3
	stomach	raw	0.1
	tongue	raw	0.6
Ptarmigan	whole	raw	<0.6
Arctic hare	meat	raw	<0.3
Snow goose	meat	raw	1.2
Berries	whole	raw	<0.3

(1) Ostertag SK et al; Chemosphere 75: 1165-72 (2009)

Hazardous Substances Data Bank (HSDB)

10.2.14 Fish/Seafood Concentrations

Perfluoro-n-nonanoic acid was detected in whole body homogenates of lake trout from Lake Superior, Lake Michigan, Lake Huron, Lake Erie and Lake Ontario at mean concentrations of 1.0, 0.57, 2.8, 2.9 and 1.1 ng/g wet weight, respectively, samples were collected in 2001(1). Fish samples, collected from the Hudson Bay region of northeastern Canada May to Sept 1999 to 2003, had the following perfluoro-n-nonanoic acid concentrations: 71% of capelin (whole body) at 0.01-0.73 ng/g, 100% of cod (muscle) at <0.09-1.3 ng/g and 67% of salmon (muscle) at 0.05-8.0 ng/g(2).

(1) Furdui VI et al Environ Sci Technol 41: 1554-9 (2007) (2) Kelly BC et al; Environ Sci Technol 43: 4037-43 (2009)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid was detected in freshwater fish (pike, perch, trout) samples taken from Finland, Sweden and Norway, but not in burbot samples taken from Norway(1). Perfluoro-n-nonanoic acid was also detected in all marine **water** fish (cod, flounder, eelpout, herring, long rough dab) samples from Sweden, Denmark and Iceland, but not in sculpin, dab, and Arctic char samples from Iceland and the Faeroe Islands(1). Blood samples from 18 cod (Gadus morhua), collected from the Gulf of Gdansk in Feb 2003, contained perfluoro-n-nonanoic acid at 100-2100 pg/mL(2). Seven types of seafood were purchased from local markets in Zhoushan and Guangzhou, China in 2004, perfluoro-n-nonanoic acid was only detected in sand swimming crab and swimming crab at 0.28 and 0.61 ng/g wet weight, respectively(3). Ten herring, about the size a common guillemot would eat, sampled from Landsort, Baltic Sea in 2005 contained perfluoro-n-nonanoic acid at concentrations of 0.34 to 0.74 ng/g wet

weight(4). Perfluoro-n-nonanoic acid was detected at one of five sites at <1.06-24.6 ng/g wet weight(detection limit 1.06 ng/g wet weight) in brown mussels from Guanabara Bay, Brazil(5). Perfluoro-n-nonanoic acid was not detected in liver (detection limit 0.49 ng/g wet weight) or muscle (detection limit 1.41 ng/g wet weight) samples of scabbardfish, croaker and mullet from Paraiba do Sul River and Guanavara Bay, Brazil(5).

(1) Berger U et al; Organohalogen Compounds 66:4046-52 (2004) (2) Falandysz J et al; Environ Sci Technol 40: 748-51 (2006) (3) Gulkowska A et al; Environ Sci Technol 40: 3736-41 (2006) (4) Holmstrom KE, Berger U; Environ Sci Technol 42: 5879-84 (2008) (5) Quinete N et al; Chemosphere 77: 863-9 (2009)

▸ Hazardous Substances Data Bank (HSDB)

The concentration of perfluoro-n-nonanoic acid was reported in fish sampled from Lake Vattern, Sweden and the Baltic Sea in 2001 with the following results in ng/g fresh weight(1).

Fish	Lake Vattern	Baltic Sea
Perch	0.22-0.51	0.14-0.22
Burbot	0.33-1.0	0.14-0.47
Whitefish	<0.08-0.71	0.18-0.38
Salmon	0.12-0.20	0.10-0.19
Brown trout	0.08-0.26	<0.08-0.18

(1) Berger U et al; Chemosphere 76: 799-804 (2009)

▸ Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid in aquatic organisms from the Ariake Sea, Japan, 2000-2003(1).

Location	Species/speciman	No. Sampled	Concn (ng/g wet weight)
Shallow water	filefish	5	<1.5
	sea bream	5	<1.5
	red sea bream	5	<1.5
	right eye flounder	5	<1.5
	hammerhead shark	1	<1.5
Tidal Flat	oyster	5	<1.5
	mussel	5	<1.5
	clam	6	<1.5
	lugworm	5	<1.5
	crab	2	<1.5
	mudskipper	10	<1.5

(1) Nakata H et al; Environ Sci Technol 40: 4916-21 (2006)

▸ Hazardous Substances Data Bank (HSDB)

10.2.15 Animal Concentrations

The mean concentration of perfluoro-n-nonanoic acid in herring gull eggs collected in 2007 from 15 colonies in the Laurentian Great Lakes (Granite, Big Sister, Gull, Channel-Shelter, Double, Chantry, Fighting, Middle, Snake and Strachan Islands, Agawa Rocks, Port Colborne, Niagara River, Hamilton and Toronto Harbor) was 0.64-9.6 ng/g wet weight(1). Archived liver samples for northern sea otters (Enhydra lutris kenyoni) from south-central Alaska had perfluoro-n-nonanoic acid concentrations of 1.3, <0.9, 8.0, 3.4, 2.8, 2.1, 1.9, 2.3, 6.0, 5.6, 5.9, <2.0, 3.9, 4.3 and 9.4 ng/g wet weight in 1992, 1993, 1994, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006 and 2007, respectively(2). An average concentration of 2.1 ng/g wet weight (range <1-16 ng/g wet weight) of perfluoro-n-nonanoic acid was found in 80 female sea otters from the California coast samples from 1992 to 2002(3). Perfluoro-n-nonanoic acid was detected at 0.07-3.0 ng/g wet weight in little brown bats (Myotis lucifugus) that had signs of white nose syndrome, collected from caves in eastern New York State from Feb to March 2008(4). Perfluoro-n-nonanoic acid was detected in serum samples from 58 of 73 loggerhead turtles at <100-4420 pg/mL and in all six Kemp's ridley sea turtles at 258-6500 pg/mL, turtles were caught off the US southeastern coast(5). Eider duck and white winged scoter liver samples, collected from the Hudson Bay region of northeastern Canada, May to Sept 1999 to 2003, contain perfluoro-n-nonanoic acid at <0.02-1.1 and 0.24-27.3 ng/g wet weight, respectively(6). Perfluoro-n-nonanoic acid was detected in 26 of 27 beluga whale liver samples at <0.502-5.67 ng/g, collected from Cook Inlet, AK from 1992 to 2006 and in 38 of 41 beluga whale liver samples at <0.180-5.46 ng/g, collected from Chukchi Sea, AK from 1989 to 2000(7).

(1) Gebbink WA et al; Environ Sci Technol 43: 7443-9 (2009) (2) Hart K et al; Arch Environ Contam Toxicol 56: 607-14 (2009) (3) Kennan K et al; Environ Sci Technol 40: 4943-8 (2006) (4) Kannan K et al; Chemosphere 80: 613-8 (2010) (5) Keller JM et al; Environ Sci Technol 39: 9101-8 (2005) (6) Kelly BC et al; Environ Sci Technol 43: 4037-43 (2009) (7) Reiner JL et al; Environ Sci Technol 45: 8129-36 (2011)

Hazardous Substances Data Bank (HSDB)

Reported perfluoro-n-nonanoic acid concentrations in beluga whales collected from the Hudson Bay region of northeastern Canada, May to Sept 1999 to 2003(1).

	Tissue	No. collected	% Positive	Concn (ng/g wet weight)
Female	blood	9	89	0.29-2.4
	muscle	9	0	<0.02
	liver	9	100	0.69-6.58
	milk	6	50	0.26-5.16
	fetus	2	50	<0.04-0.58
Male	blood	9	100	0.27-5.81
	muscle	9	0	<0.02
	liver	13	100	0.81-5.20
	blubber	6	0	<0.9

(1) Kelly BC et al; Environ Sci Technol 43: 4037-43 (2009)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid concentrations in plasma of free-range bottlenose dolphins from the Gulf of Mexico and the Atlantic Ocean were studied June to Sept 2003(1).

Location	Number Samples	Concentration (ng/g wet weight)	Arithmatic Mean (ng/g wet weight)	Geometric Mean (ng/g wet weight)
Sarasota Bay	13	5.3-74	25	19
Bermuda	2	12-21	17	16
Indian River Lagoon	42	3-51	13	11
Charleston	47	11-214	63	51
Delaware Bay	5	211-547	326	305

(1) Houde M et al; Environ Sci Technol 45: 7962-73 (2011)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid was detected in all the marine mammal (grey seal, minke whale, pilot whale) samples taken from Sweden, Denmark, Iceland and the Faeroe Islands(1). Perfluoro-n-nonanoic acid was detected in thick-billed murres collected 1975 (5 samples), 1993 (10 samples) and 2004 (10 samples) at 0.02-0.16, 0.01-0.24 and 0.07-0.60 ng/g wet weight, respectively, and in northern fulmars collected 1975 (9 samples), 1987 (8 samples), 1993 (10 samples) and 2003 (9 samples) at concentrations of <0.19, 0.02-0.97, 0.03-0.44 and 0.01-0.09 ng/g wet weight, respectively, all waterfowl were from Prince Leopold Island, Nunavut, Canada(2). Perfluoro-n-nonanoic acid was not detected (detection limit 7.6 ng/g dry weight) in liver samples of Tucuxi dolphins (Sotalia guianensis), samples were taken from 23 dolphins from Guanabara Bay and six were collected off the coast of Rio de Janeiro state, Brazil at other locations(3). Blood samples from 16 eider duck (Sommateria mollisima), collected from the Gulf of Gdansk in Feb 2003, contained perfluoro-n-nonanoic acid at 300-900 pg/mL(4). The concentration of perfluoro-n-nonanoic acid in melon headed whales stranded along the Japanese coast was <1.1 ng/g wet weigh in 1982, 5.2-15.5 ng/g wet weight in 2001/2002 and 9.5-20.5 ng/g wet weight in 2006(5). Perfluoro-n-nonanoic acid was not detected in 10 guillemot egg samples collected from Vestmannaeyjar, Iceland, Sandoy Faroe, Islands, Sklinna and Hjelmsoy, Norway but was detected in five of 10 egg samples collected from Stora Karlso, Sweden at <32 to 120 ng/g wet weight, samples were collected in 2005(6). Dolphin samples from Paraiba do Sul River, Brazil had perfluoro-n-nonanoic acid concentrations of <0.49-1.70, <1.46-1.60 and <1.76 ng/g wet weight in liver, muscle and kidney tissue, respectively(7). Liver samples from 29 polar bear captured in eastern Greenland contained a mean concentration of 236 ng/g wet weight of perfluoro-n-nonanoic acid(8). The mean concentration of perfluoro-n-nonanoic acid was 12.2 to 540 ng/g wet weight in liver tissue from polar bears collected at seven locations in the North American and European Arctic(9). Harbor porpoises from the Black Sea coast, collected 1997 and 1998, contained perfluoro-n-nonanoic acid at 1.4-7.2 ng/g wet weight(10). Perfluoro-n-nonanoic acid was detected in the egg yolks of 17 little ringed plover at 6.4-106.7 ng/g wet weight, seven parrot bill at 5.7-97.3 and 20 little egret at 3.9-68.6 ng/g wet weight, samples were collected around Lake Shihwa, Korea in May 2006(11).

(1) Berger U et al; Organohalogen Compounds 66: 4046-52 (2004) (2) Butt CM et al; Environ Sci Technol 41: 3521-8 (2007) (3) Dorneles PR et al; Environ Sci Technol 42: 5368-73 (2008) (4) Falandysz J et al; Environ Sci Technol 40: 748-51 (2006) (5) Hart K et al; Environ Sci Technol 42:7132-7 (2008) (6) Lofstrand K et al; Chemosphere 72: 1475-80 (2008) (7) Quinete N et al; Chemosphere 77: 863-9 (2009) (8) Smithwick M et al; Environ Toxicol Chem 24: 981-6 (2005) (9) Smithwick M et al; Environ Sci Technol 39: 5517-23 (2005) (10) van de Vijver KI et al; Environ Sci Technol 41: 315-320 (2007) (11) Yoo H et al; Environ Sci Technol 42: 5821-7 (2008)

Hazardous Substances Data Bank (HSDB)

Average concentration and ranges of perfluoro-n-nonanoic acid in liver tissue of harbor seals (Phoca vitulina) collected from the German Bight(1).

Year	No. Collected	Concn (ng/g wet weight)
1988	2	4.1-5.2
1996	2	4.8-12
1999	5	1.0-23
2000	6	2.5-27
2001	7	1.0-27
2002	6	3.2-17
2003	5	1.6-19
2004	1	9.3
2005	5	2.6-18
2006	8	0.3-19
2007	13	5.1-21
2008	3	6.2-9.7

(1) Ahrens L et al; Chemosphere 76: 151-8 (2009)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid was studied in ringed seal (Phoca hispida) liver tissue from the east and west sides of Greenland(1).

Location	Year	% Detected	Concn (ng/g wet weight)
Ittoqqortoormilt	1986	0	<1.4
	1994	40	3.1-4
	1999	90	1.9-7.5
	2003	100	2.8-6.4
Qeqertarsuaq	1982	20	2.1-2.4
	1994	10	2.1-2.1
	1999	40	1.4-2.3
	2003	60	1.5-3.0

(1) Bossi R et al; Environ Sci Technol 39: 7416-22 (2005)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid was studied in ringed seal (Phoca hispida) liver tissue from the Canadian Arctic(1).

Location	Year	No. Sampled	Concn (ng/g wet weight)
Arvait	1992	6	1.2-2.5
	1998	10	2.0-8.1
	2003	10	3.0-12.0
	2005	10	1.4-9.1
Resolute Bay	1972	2	0.15-0.51
	1993	9	0.8-3.2
	2000	9	1.6-8.7
	2004	9	2.0-9.3
	2005	9	2.4-10.9

(1) Butt CM et al; Environ Sci Technol 41: 42-9 (2007)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid was detected in common guillemot (Uria aalge) samples from Stora Karlso Island in the Baltic Sea collected in 1989(1).

Tissue	No. Sampled	Concn (ng/g wet weight)

Tissue	No. Sampled	Concn (ng/g wet weight)
Muscle	8	0.17-0.42
Kidney	10	1.2-5.7
Adult Liver	13	1.3-5.8
Chick Liver	10	0.96-4.7
Egg	8	0.76-1.8

(1) Holmstrom KE, Berger U; Environ Sci Technol 42: 5879-84 (2008)

Hazardous Substances Data Bank (HSDB)

Harbor seals collected in 2002 from the Dutch coasts and analyzed for perfluoro-n-nonanoic acid; LOD (limit of detection) not specified(1).

Tissue	No. Analyzed	Concn (ng/g wet weight)
kidney	18	<LOD-60.41
liver	24	<LOD-14
blubber	17	<LOD
muscle	17	<LOD-11.99
tracheo-branchial muscle	1	69.82
spleen	4	<LOD-22.77

(1) Van de Vijuer et al; Environ Sci Technol 39: 6978-84 (2005)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid in organisms from the Ariake Sea area, Japan(1).

Species/speciman	Sample Date	No. Sampled	Concn (ng/g wet weight)
finless porpoise	1999-2002	5	8.3-44
mallard	2000-2001	11	<1.5
blackheaded gull	2001	2	<1.5

(1) Nakata H et al; Environ Sci Technol 40: 4916-21 (2006)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid concentrations in waterbird eggs from South China, Quanzhou and Xiamen samples were collected March to May 2004 and Hong Kong samples were collected March to May 2006(1).

Species	Location	Concn (ng/g wet weight)	Mean (ng/g wet weight)
little egret	Quanzhou	2.03-4.13	3.08
	Xiamen	1.16-1.50	1.33
night heron	Quanzhou	0.552-0.643	0.597
	Xiament	0.956-1.66	1.37
	Hong Kong	0.0720-1.31	0.447
great egret	Hong Kong	0.225-0.427	0.313

(1) Wang Y et al; Environ Sci Technol 42: 8146-51 (2008)

Hazardous Substances Data Bank (HSDB)

10.2.16 Milk Concentrations

Perfluoro-n-nonanoic acid was not detected (detection limit 2.1 pg/g) in milk samples purchased at grocery stores in Oslo, Norway between Oct 2008 and Jan 2009(1). In Nov 2009, milk samples randomly purchased in several Dutch retail stores did not contain perfluoro-n-nonanoic acid (detection limit <1 pg/g)(2). Perfluoro-n-nonanoic acid was not detected (detection limit 2.20 pg/mL) in 21 infant formula samples purchased from retail stores in Washington, DC and Boston, MA in 2007, or in 12 dairy milk samples purchased from retail stores and local farms in Albany, NY in 2008(3).

(1) Haug LS et al; Chemosphere 80: 1137-43 (2010) (2) Noorlander CW et al; J Agric Food Chem 59: 7496-505 (2011) (3) Tao L et al; Environ Sci Technol 42: 8597-602 (2008)

Hazardous Substances Data Bank (HSDB)

In 12 sets of maternal serum, cord serum and milk samples from mothers that gave birth at the National Hospital in Torshavn, Faroe Islands, perfluoro-n-nonanoic acid was not detected in transitional milk samples taken 3-5 days after delivery(1).

(1) Needham LL et al; Environ Sci Technol 45: 1121-6 (2011)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid concentrations in breast milk samples from seven Asian Countries, samples, collected 1999 to 2005, primarily from women living in major cities(1).

County	No. Samples	% Positive	Concn pg/mL)
Japan	24	13	<8.82-23.9
Malaysia	13	8	<8.82-14.9
Philippines	24	17	<8.82-25.0
Indonesia	20	5	<8.62-135
Vietnam	40	5	<8.82-10.9
Cambodia	24	13	<8.82-12.3
India	39	0	<8.82

(1) Tao L et al; Environ Sci Technol 42: 8597-602 (2008)

Hazardous Substances Data Bank (HSDB)

10.2.17 Other Environmental Concentrations

Perfluoro-n-nonanoic acid was detected in paper fiber from three paper mills in Ontario, Canada at 2.0-3.0 ng/g, samples were collected 2002, 2003 and 2008(1). Perfluoro-n-nonanoic acid concentrations on window film in a suburban area was greatest on a sheltered window in the summer followed by a sheltered window in the winter, a lower concentration was found on an unsheltered window in the winter (13 mm precipitation), and the lowest concentration was found on an unsheltered window in the summer (47 mm precipitation)(2). Perfluoro-n-nonanoic acid was detected at <0.06 to 680 ng/g in dust samples from 140 homes in Vancouver, Canada, samples were collected 2007 to 2008(3). Perfluoro-n-nonanoic acid was detected in 41 dust samples from Norwegian households at 3.9 to 92 ng/g(4). Dust samples were collected in 2000 to 2001 from vacuum cleaner bags during the US Environmental Protection Agency's Children's Total Exposure to Persistent Pesticides and Other Persistent Organic Pollutants study, 102 homes and 10 daycare centers in North Carolina and Ohio were sampled, perfluoro-n-nonanoic acid was detected in 42.9% of the samples at a mean concentration of 22.1 ng/g and a maximum of 263 ng/g(5). Perfluoro-n-nonanoic acid was found in indoor dust samples with a mean value of 3.43 ng/g dry weight and a range of 0.66 to 7.32 ng/g dry weight, samples were collected from homes in Nanchang, Shanghai, Beijing and Tianjin, China(6).

(1) D'eon JC et al; Environ Sci Technol 43: 4589-94 (2009) (2) Gewurtz SB et al; Environ Sci Technol 43: 7317-23 (2009) (3) Shoeib M et al; Environ Sci Technol 45: 7999-8005 (2011) (4) Haug LS et al; Environ Sci Technol 45: 7991-8 (2011) (5) Strynar MJ, Lindstrom AB; Environ Sci Technol 42: 3751-6 (2008) (6) Zhang T et al; Environ Sci Technol 44: 3572-9 (2010)

Hazardous Substances Data Bank (HSDB)

10.2.18 Probable Routes of Human Exposure

Occupational exposure to perfluoro-n-nonanoic acid may occur through inhalation and dermal contact with this compound at workplaces where perfluoro-n-nonanoic acid is produced or used. Monitoring data indicate that the general population may be exposed to perfluoro-n-nonanoic acid via inhalation of ambient air, ingestion of food and drinking **water**, and dermal contact with products containing perfluoro-n-nonanoic acid. (SRC)

Hazardous Substances Data Bank (HSDB)

10.2.19 Average Daily Intake

The average daily intake of perfluoro-n-nonanoic acid in Canadians in the late 1990s ranged from 0.5 to 1.2 ng/kg of body weight/day, in 2004 the estimated value was 1.1 ng/kg of body weight/day(1).

(1) Ostertag SK et al; J Agric Food Chem 57: 8534-44 (2009)

Hazardous Substances Data Bank (HSDB)

10.2.20 Body Burden

Perfluoro-n-nonanoic acid was detected in all serum samples from the US population (1562 participants) as studied in the National Health and Nutrition Examination Survey (NHANES) conducted 1999 thru 2000, with a mean concentration of 0.5 ng/mL and concentration range of 0.5-0.7 ng/mL(1). In the NHANES survey conducted 2003 thru 2004 perfluoro-n-nonanoic acid was detected at a mean concentration of 1.0 ng/mL and concentration range of 0.8-1.1 ng/mL in 100% of the 2094 serum samples analyzed(2). Perfluoro-n-nonanoic acid was detected in 20 pooled blood samples (at least 10 individual donors per sample) at concentrations of 0.34 to 1.8 ug/L, samples were obtained from donors across the Midwestern US in 2004, 2005 and 2008(3). Pooled serum samples from participants of NHANES 2001 to 2002, based on age and demographics had perfluoro-n-nonanoic acid concentrations of 0.7-15.2 and 0.6-1.4 ng/mL in 3-5 and 6-11 year olds, respectively(4). The concentration of perfluoro-n-nonanoic acid in the serum of 20 Atlanta, GA residents was 1.3 to 4.4 ng/mL, samples were collected July 2003(6). Perfluoro-n-nonanoic acid was not detected (detection limit 1.0 ng/mL) in two human milk samples, collection information was not provided(6).

(1) Calafat AM et al; Environ Sci technol 41: 2237-42 (2007) (2) Calafat AM et al; Environ Health Perspect 115: 1596-1602 (2007) (3) D'eon JC et al; Environ Sci Technol 43: 4589-94 (2009) (4) Kato K et al; Environ Sci Technol 45: 8037-45 (2011) (6) Kuklenyik Z et al; Environ Sci Technol 38: 3698-704 (2004)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid levels in New York State infants using Newborn Screening Programs dried blood spots analysis(1).

Sample date	Mean concn (ng/mL)	Range (ng/mL)
01/02/97	0.31	0.1-0.58
06/28/97	0.37	0.16-0.56
12/30/97	0.37	0.17-0.64
12/29/99	0.35	0.13-0.77
06/29/01	0.43	0.29-0.63
12/29/01	0.43	0.23-0.93
12/30/02	0.51	0.15-0.73
12/29/04	0.33	0.25-0.42
06/27/05	0.27	0.14-0.41
06/26/06	0.39	0.26-0.62
01/08/07	0.39	0.13-0.93

(1) Spliethoff HM et al; Environ Sci Technol 42: 5361-7 (2008)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid concentration was <0.050 ng/mL (1977), increased to 1.7 ng/mL (1986), and then stabilized at 0.55 to 1.2 ng/mL (1988-2006) in 24 pooled serum samples from men, age 40 to 50 years, representing 1977 to 2006(1). Perfluoro-n-nonanoic acid was found in 40 pooled serum samples collected from 3802 Australian residents collected Nov 2002 to April 2003 at 0.4 to 2.0 ng/mL(2). Perfluoro-n-nonanoic acid was detected in 61 of 66 human blood samples collected from 11 counties in Sweden during the period of 1997 to 2000, concentrations were <0.1-1.9 ng/mL(3). From March to Sept 2008, 138 human blood samples were taken from donors from seven cities in Liaoning province, China, perfluoro-n-nonanoic acid was detected as follows - city (ng/mL): Fuxin (0.24-2.2), Jinzhou (<0.013-1.8), Shenyang (<0.013-1.75), Anshan (0.16-1.02), Yingkou (0.17-2.88), Dalian (0.16-1.44) and Huludao (0.16-1.58)(4). In 12 sets of maternal serum, cord serum and milk samples from mothers that gave birth at the National Hospital in Torshavn, Faroe Islands, the average concentrations of perfluoro-n-nonanoic acid were 0.76 and 0.37 ng/mL in maternal and cord serum, it was not detected in transitional milk samples taken 3-5 days after delivery(5). From 2006 to 2008, 233 human blood samples were taken from donors from the capital cities of 12 provinces or districts of China, perfluoro-n-nonanoic acid was detected as follows - city (ng/mL): Harbin (0.522), Hohhot (0.429), Lanzhou (0.545), Taiyuan (0.221), Shijiazhuang (0.852), Qingdao (0.657), Ningbo (0.984), Changsha (0.295), Chengdu (0.430), Chongqing (0.564), Kumming (3.39) and Guizhou (2.29)(6). Perfluoro-n-nonanoic acid was detected in 100% of 84 pools of human blood serum taken from 2420 Queensland, Australia donors in 2006 to 2007, concentrations reported were 0.1-1.4 ng/mL(7). Human blood samples from volunteer donors from five Chinese cities (Shenyang, Beijing, Gulyang, Jintan, Nanjing) collected in 2004 had perfluoro-n-nonanoic acid concentrations of 0.0630 to 1.34 ng/mL(8).

(1) Haug LS et al; Environ Sci Technol 43: 2131-6 (2009) (2) Karrman A et al; Environ Sci Technol 40: 3742-8 (2006) (3) Karrman A et al; Chemosphere 64: 1582-91 (2006) (4) Liu H et al; Environ Sci Technol 43: 4044-8 (2009) (5) Needham LL et al; Environ Sci Technol 45: 1121-6 (2011) (6) Pan Y et al; Environ Toxicol Chem 29: 2695-701 (2010) (7) Toms LL et al; Environ Sci Technol 43: 4194-9 (2009) (8) Yeung LWY et al; Environ Sci Technol 42: 8140-5 (2008)

Hazardous Substances Data Bank (HSDB)

Concentration of perfluoro-n-nonanoic acid in adult (age 19-62) human blood, 15 samples from each category, taken from citizens of Gdansk, Poland and nearby villages. Blood donations were all collected July 2003(1).

Parameter	Dockers	Farmers	Fish-dish fanciers	Reference Group
mean (pg/mL)	400	560	1700	610
median (pg/mL)	360	590	1600	490
range (pg/mL)	160-820	300-810	410-3800	300-1500

(1) Falandysz J et al; Environ Sci Technol 40: 748-51 (2006)

Hazardous Substances Data Bank (HSDB)

Fifty-three pregnant women participated in a serum study for perfluoro-n-nonanoic acid in Munich, Germany, the study was run Dec 2007 to Oct 2009(1).

Table: Mother

Parameter	Pregnancy (34-37 weeks)	At delivery	6 mo after delivery
N (%> limit of quantitation)	44 (86)	38 (83	47 (83)
Mean (ug/L)	0.8	0.8	0.7
Median (ug/L)	0.6	0.6	0.5
95th percentile	2.8	3.0	2.0

(1) Fromme H et al; Environ Sci Technol 44: 7123-9 (2010)

Hazardous Substances Data Bank (HSDB)

Fifty-three pregnant women participated in a serum study for perfluoro-n-nonanoic acid in Munich, Germany, the study was run Dec 2007 to Oct 2009. Fetus data was reported(1).

Table: Fetus/Infant

Parameter	cord blood	6 mo after birth	19 mo after birth
N (%>limit of quantitation)	33 (30)	40 (90)	24 (83)
Mean (ug/L)	0.4	1.1	0.7
Median (ug/L)	<0.4	1.0	0.6
95th percentile	1.5	2.3	1.4

(1) Fromme H et al; Environ Sci Technol 44: 7123-9 (2010)

Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid was studied in wax technicians employed by the Swedish and US national cross-country ski teams. Whole blood samples were taken pre-season (pre) Sept 2007, during the World Cup season (during) Dec 2007 to Mar 2008 and post-season (post) April to Aug 2008. Number of years (years) working as a wax technician and occupations for the off season (April to Nov) are given, one technician is a full-time employee at Swedish Ski Association; NP- sample not provided(1).

Occupation	Years	pre (ng/mL)	during (ng/mL)	post (ng/mL)
student	3	0.86	0.76-2.2	1.7-2.8
carpenter	6	3.8	3.5-5.7	6.1-7.1
full-time w/ Ski Assoc	6	14	15-18	15-20
gardener	10	21	18-21	17-19
fire fighter	5	1.7	2.0-3.7	NP
carpenter	15	NP	56-65	45-57
carpenter	7	NP	10-12	NP
engineer	12	145	133-163	104-128

(1) Nilsson H et al; 44: 2150-5 (2010)

Hazardous Substances Data Bank (HSDB)

Concentration of perfluoro-n-nonanoic acid in serum of Farese children(1).

Age	Sample Date	% Detections	Mean (ng/mL)	Range (ng/mL)
7 years	1993-1994	99	0.9	<0.1-4.8
14 years	2000-2001	100	0.9	0.4-4.8

(1) Weihe P et al; Environ Sci Technol 42: 6291-5 (2008)

Hazardous Substances Data Bank (HSDB)

Concentration of perfluoro-n-nonanoic acid in serum of 12 Faroese mothers and their five year old children(1).

	Sample date	% Detections	Mean (ng/mL)	Range (ng/mL)
mothers	2000	100	0.6	0.1-1.2
children	2005	100	1.4	0.6-3.0

(1) Weihe P et al; Environ Sci Technol 42: 6291-5 (2008)

Hazardous Substances Data Bank (HSDB)

11 Associated Disorders and Diseases

- Comparative Toxicogenomics Database (CTD)

12 Literature

12.1 NLM Curated PubMed Citations

- PubChem

12.2 Springer Nature References

- Springer Nature

12.3 Wiley References

Wiley

12.4 Depositor Provided PubMed Citations

PubChem

12.5 Chemical Co-Occurrences in Literature

PubChem

12.6 Chemical-Gene Co-Occurrences in Literature

PubChem

12.7 Chemical-Disease Co-Occurrences in Literature

PubChem

13 Patents

13.1 Depositor-Supplied Patent Identifiers

PubChem

Link to all deposited patent identifiers

PubChem

13.2 WIPO PATENTSCOPE

Patents are available for this chemical structure:

https://patentscope.wipo.int/search/en/result.jsf?inchikey=UZUFPBIDKMEQEQ-UHFFFAOYSA-N

PATENTSCOPE (WIPO)

14 Biomolecular Interactions and Pathways

14.1 Drug-Gene Interactions

▸ Drug Gene Interaction database (DGIdb)

14.2 Chemical-Gene Interactions

14.2.1 CTD Chemical-Gene Interactions

▸ Comparative Toxicogenomics Database (CTD)

15 Biological Test Results

15.1 BioAssay Results

PubChem

16 Classification

16.1 Ontologies

16.1.1 MeSH Tree

- Medical Subject Headings (MeSH)

16.1.2 ChEBI Ontology

- ChEBI

16.1.3 ChemIDplus

ChemIDplus

16.1.4 UN GHS Classification

UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

16.1.5 EPA CPDat Classification

EPA Chemical and Products Database (CPDat)

16.1.6 NORMAN Suspect List Exchange Classification

NORMAN Suspect List Exchange

16.1.7 EPA DSSTox Classification

EPA DSSTox

17 Information Sources

FILTER BY SOURCE ALL SOURCES

1. ## CAS Common Chemistry

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Perfluorononanoic acid
https://commonchemistry.cas.org/detail?cas_rn=375-95-1

2. ## ChemIDplus

LICENSE
https://www.nlm.nih.gov/copyright.html

Perfluoro-n-nonanoic acid
https://chem.nlm.nih.gov/chemidplus/sid/0000375951

ChemIDplus Chemical Information Classification
https://chem.nlm.nih.gov/chemidplus/

3. ## EPA Chemicals under the TSCA

LICENSE
https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-
https://www.epa.gov/chemicals-under-tsca

4. ## EPA DSSTox

LICENSE
https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

PFNA
https://comptox.epa.gov/dashboard/DTXSID8031863

CompTox Chemicals Dashboard Chemical Lists
https://comptox.epa.gov/dashboard/chemical_lists/

5. ## European Chemicals Agency (ECHA)

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https://echa.europa.eu/web/guest/legal-notice

Perfluorononan-1-oic acid
https://echa.europa.eu/substance-information/-/substanceinfo/100.006.184

Perfluorononan-1-oic acid
https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/31321

Perfluorononan-1-oic-acid
https://www.echa.europa.eu/candidate-list-table

6. ## Hazardous Substances Data Bank (HSDB)

Perfluoro-n-nonanoic acid
https://pubchem.ncbi.nlm.nih.gov/source/hsdb/8040

7. ## ChEBI

Perfluorononanoic acid
http://www.ebi.ac.uk/chebi/searchId.do?chebiId=CHEBI:38397

ChEBI Ontology
http://www.ebi.ac.uk/chebi/userManualForward.do#ChEBI%20Ontology

8. ## Comparative Toxicogenomics Database (CTD)

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http://ctdbase.org/about/legal.jsp

http://ctdbase.org/detail.go?type=chem&acc=C101816
http://ctdbase.org/detail.go?type=chem&acc=C584865

9. ## Drug Gene Interaction database (DGIdb)

LICENSE

The data used in DGIdb is all open access and where possible made available as raw data dumps in the downloads section.
http://www.dgidb.org/downloads

https://www.dgidb.org/drugs/CHEMBL426404

10. ## EPA Chemical and Products Database (CPDat)

LICENSE

https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

perfluorononan-1-oic acid
https://comptox.epa.gov/dashboard/DTXSID8031863#exposure

EPA CPDat Classification
https://www.epa.gov/chemical-research/chemical-and-products-database-cpdat

11. ## Hazardous Chemical Information System (HCIS), Safe Work Australia

perfluorononan-1-oic acid
http://hcis.safeworkaustralia.gov.au/HazardousChemical/Details?chemicalID=5697

12. ## NITE-CMC

Perfluorononanoic acid - FY2016
https://www.nite.go.jp/chem/english/ghs/16-mhlw-0011e.html

13. ## FDA/SPL Indexing Data

LICENSE

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https://www.fda.gov/about-fda/about-website/website-policies#linking

5830Z6S63M
https://www.fda.gov/ForIndustry/DataStandards/SubstanceRegistrationSystem-UniqueIngredientIdentifierUNII/

14. ## Human Metabolome Database (HMDB)

LICENSE

HMDB is offered to the public as a freely available resource. Use and re-distribution of the data, in whole or in part, for commercial purposes requires explicit permission of the authors and explicit acknowledgment of the source material (HMDB) and the original publication (see the HMDB citing page). We ask that users who download significant portions of the database cite the HMDB paper in any resulting publications.
http://www.hmdb.ca/citing

Perfluorononanoic acid
http://www.hmdb.ca/metabolites/HMDB0061739

15. ## MassBank of North America (MoNA)

LICENSE

The content of the MoNA database is licensed under CC BY 4.0.
https://mona.fiehnlab.ucdavis.edu/documentation/license

Perfluorononanoic acid
http://mona.fiehnlab.ucdavis.edu/spectra/browse?inchikey=UZUFPBIDKMEQEQ-UHFFFAOYSA-N

16. ## NIST Mass Spectrometry Data Center

Perfluorononanoic acid
http://www.nist.gov/srd/nist1a.cfm

17. ## NORMAN Suspect List Exchange

LICENSE

Data: CC-BY 4.0; Code (hosted by ECI, LCSB): Artistic-2.0
https://creativecommons.org/licenses/by/4.0/

Nonanoic acid, 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,9-heptadecafluoro-

NORMAN Suspect List Exchange Classification
https://www.norman-network.com/nds/SLE/

18. ## SpectraBase

Perfluoroonanoic acid
https://spectrabase.com/spectrum/4ErOuFkbHl2

Perfluoroonanoic acid

https://spectrabase.com/spectrum/8yUkIeIkZeD

Perfluoroonanoic acid
https://spectrabase.com/spectrum/KCO52uduRF2

Perfluoroonanoic acid
https://spectrabase.com/spectrum/9aMiDIt3spM

Perfluorononanoic acid
https://spectrabase.com/spectrum/JmfYIufB4VD

19. **Springer Nature**

20. **Wikipedia**

perfluorononanoic acid
https://en.wikipedia.org/wiki/Perfluorononanoic_acid

21. **Wiley**
https://pubchem.ncbi.nlm.nih.gov/substance/?source=wiley&sourceid=114372

22. **PubChem**
https://pubchem.ncbi.nlm.nih.gov

23. **Medical Subject Headings (MeSH)**

perfluoro-n-nonanoic acid
https://www.ncbi.nlm.nih.gov/mesh/67101816

MeSH Tree
http://www.nlm.nih.gov/mesh/meshhome.html

24. **UN Globally Harmonized System of Classification and Labelling of Chemicals (GHS)**

GHS Classification Tree
http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html

25. **PATENTSCOPE (WIPO)**

SID 403400333
https://pubchem.ncbi.nlm.nih.gov/substance/403400333

SAFETY DATA SHEET

Creation Date 02-Jul-2015 **Revision Date** 18-Aug-2020 **Revision Number** 4

1. Identification

Product Name **Perfluorooctanesulfonamide**

Cat No. : **AC459640000; AC459640010; AC459640050**

CAS-No 754-91-6
Synonyms No information available

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

Details of the supplier of the safety data sheet

Company

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

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

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

2. Hazard(s) identification

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

Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Warning

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause respiratory irritation

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Heptadecafluorooctanesulphonamide	754-91-6	<100

4. First-aid measures

General Advice If symptoms persist, call a physician.

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

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation Remove to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.

Ingestion Clean mouth with water and drink afterwards plenty of water. Get medical attention if symptoms occur.

Most important symptoms and effects None reasonably foreseeable.

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray, carbon dioxide (CO2), dry chemical, alcohol-resistant foam.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature No information available
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Do not allow run-off from fire-fighting to enter drains or water courses.

Hazardous Combustion Products
None known.
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	1	0	N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment as required. Avoid dust formation.
Environmental Precautions Should not be released into the environment.

Methods for Containment and Clean Up Sweep up and shovel into suitable containers for disposal. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Do not get in eyes, on skin, or on clothing. Avoid dust formation. Ensure adequate ventilation. Avoid ingestion and inhalation.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

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

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

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

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

9. Physical and chemical properties

Physical State	Solid
Appearance	No information available
Odor	No information available
Odor Threshold	No information available
pH	No information available
Melting Point/Range	154 - 155 °C / 309.2 - 311 °F
Boiling Point/Range	No information available
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Specific Gravity	No information available
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	C8 H2 F17 N O2 S
Molecular Weight	499.15

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products None under normal use conditions

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Heptadecafluorooctanesulphonamide	LD50 > 172 mg/kg (Rat)	Not listed	Not listed

Toxicologically Synergistic No information available

Products

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

Irritation No information available

Sensitization No information available

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

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Heptadecafluorooctanesulphonamide	754-91-6	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information No information available

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

12. Ecological information

Ecotoxicity

Do not empty into drains.

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility No information available.

13. Disposal considerations

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

14. Transport information

DOT Not regulated
TDG Not regulated
IATA Not regulated
IMDG/IMO Not regulated

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags

Heptadecafluorooctanesulphonamide	754-91-6	-	-	-

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

TSCA 12(b) - Notices of Export

Component	CAS-No	**TSCA 12(b)** - Notices of Export
Heptadecafluorooctanesulphonamide	754-91-6	Section 5

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

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Heptadecafluorooctanesulphonamide	754-91-6	-	-	212-046-0	X	-	-	X	-

U.S. Federal Regulations

SARA 313 Not applicable

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

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

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

U.S. State Right-to-Know Regulations Not applicable

U.S. Department of Transportation
Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

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

Other International Regulations

Mexico - Grade No information available

16. Other information

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

Creation Date 02-Jul-2015

Revision Date	18-Aug-2020
Print Date	18-Aug-2020
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

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

End of SDS

Perfluoropentanoic acid

sc-250679

Material Safety Data Sheet

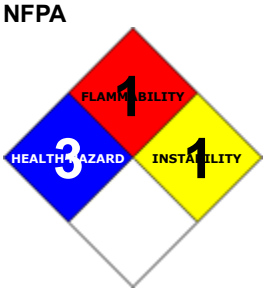
Hazard Alert Code Key:	EXTREME	HIGH	MODERATE	LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
Perfluoropentanoic acid

STATEMENT OF HAZARDOUS NATURE
CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER
Santa Cruz Biotechnology, Inc.
2145 Delaware Avenue
Santa Cruz, California 95060
800.457.3801 or 831.457.3800

EMERGENCY
ChemWatch
Within the US & Canada: 877-715-9305
Outside the US & Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS
C5HF9O2, CF3(CF2)3CO2H

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

		Min	Max
Flammability:	1		
Toxicity:	0		
Body Contact:	4		
Reactivity:	1		
Chronic:	2		

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4

CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW

RISK

Causes severe burns.
Risk of serious damage to eyes.
Harmful to aquatic organisms.
Vapours potentially cause drowsiness and dizziness*.
Cumulative effects may result following exposure*.
Limited evidence of a carcinogenic effect*.
* (limited evidence).

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

■ Ingestion of acidic corrosives may produce burns around and in the mouth, the throat and oesophagus.
Immediate pain and difficulties in swallowing and speaking may also be evident.
■ The material has NOT been classified by EC Directives or other classification systems as "harmful by ingestion".
This is because of the lack of corroborating animal or human evidence.

EYE

■ The material can produce severe chemical burns to the eye following direct contact. Vapours or mists may be extremely irritating.
■ If applied to the eyes, this material causes severe eye damage.
■ Direct eye contact with acid corrosives may produce pain, tears, sensitivity to light and burns.
Mild burns of the epithelia generally recover rapidly and completely.

SKIN

■ The material can produce severe chemical burns following direct contactwith the skin.
■ Skin contact with acidic corrosives may result in pain and burns; these may be deep with distinct edges and may heal slowly with the formation of scar tissue.
■ Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions.
■ Open cuts, abraded or irritated skin should not be exposed to this material.
■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects.
Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

■ The material can cause respiratory irritation in some persons.
The body's response to such irritation can cause further lung damage.
■ Corrosive acids can cause irritation of the respiratory tract, with coughing, choking and mucous membrane damage.
There may be dizziness, headache, nausea and weakness.
■ Inhalation of vapours may cause drowsiness and dizziness.
This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo.
■ Inhalation hazard is increased at higher temperatures.
■ The material has NOT been classified by EC Directives or other classification systems as "harmful by inhalation".
This is because of the lack of corroborating animal or human evidence.
■ Inhalation of high concentrations of gas/vapour causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination.

CHRONIC HEALTH EFFECTS

■ Repeated or prolonged exposure to acids may result in the erosion of teeth, swelling and/or ulceration of mouth lining. Irritation of airways to lung, with cough, and inflammation of lung tissue often occurs. Chronic exposure may inflame the skin or conjunctiva.
Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.
There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment.
Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.
Long chain PCFAs are present in the environment of most developed countries, and have the potential to adversely affect animal and human health. In tests on laboratory animals, one PFCA (perfluorooctanoic acid, PFOA) has been shown to cause tumours and damage the immune system, and cause moderate to high toxicity in the medium term if given by mouth. Because they are cleared more slowly and have more potential to accumulate in the body, longer chain PFCAs are expected to be of greater concern than PFOA.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
nonafluoropentanoic acid	2706-90-3	>98

Section 4 - FIRST AID MEASURES

SWALLOWED
- For advice, contact a Poisons Information Centre or a doctor at once.
- Urgent hospital treatment is likely to be needed.
- If swallowed do NOT induce vomiting.
- If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

EYE
If this product comes in contact with the eyes:
- Immediately hold eyelids apart and flush the eye continuously with running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes.
- Transport to hospital or doctor without delay.

SKIN
If skin or hair contact occurs:
- Immediately flush body and clothes with large amounts of water, using safety shower if available.
- Quickly remove all contaminated clothing, including footwear.
- Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Centre.
- Transport to hospital, or doctor.

INHALED
- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Inhalation of vapours or aerosols (mists, fumes) may cause lung oedema.
- Corrosive substances may cause lung damage (e.g. lung oedema, fluid in the lungs).
- As this reaction may be delayed up to 24 hours after exposure, affected individuals need complete rest (preferably in semi-recumbent posture) and must be kept under medical observation even if no symptoms are (yet) manifested.
- Before any such manifestation, the administration of a spray containing a dexamethasone derivative or beclomethasone derivative may be considered.

NOTES TO PHYSICIAN
■ Treat symptomatically.

For acute or short term repeated exposures to strong acids:
- Airway problems may arise from laryngeal edema and inhalation exposure. Treat with 100% oxygen initially.
- Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling
- Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
- Strong acids produce a coagulation necrosis characterised by formation of a coagulum (eschar) as a result of the dessicating action of the acid on proteins in specific tissues.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Not Available
Upper Explosive Limit (%):	Not available.
Specific Gravity (water=1):	1.713
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA
- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.

FIRE FIGHTING
- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Use fire fighting procedures suitable for surrounding area.

When any large container (including road and rail tankers) is involved in a fire, consider evacuation by 800 metres in all directions.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS
- Combustible.
- Slight fire hazard when exposed to heat or flame.
- Acids may react with metals to produce hydrogen, a highly flammable and explosive gas.
- Heating may cause expansion or decomposition leading to violent rupture of containers.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), hydrogen fluoride, other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY

- Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Drains for storage or use areas should have retention basins for pH adjustments and dilution of spills before discharge or disposal of material.
- Check regularly for spills and leaks.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.

MAJOR SPILLS

- Clear area of personnel and move upwind.
- Alert Fire Brigade and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

- DO NOT allow clothing wet with material to stay in contact with skin
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.

RECOMMENDED STORAGE METHODS

- DO NOT use aluminium or galvanised containers
- Check regularly for spills and leaks
- Lined metal can, lined metal pail/ can.
- Plastic pail.
- Polyliner drum.
- Packing as recommended by manufacturer.

For low viscosity materials

- Drums and jerricans must be of the non-removable head type.
- Where a can is to be used as an inner package, the can must have a screwed enclosure.

<.

STORAGE REQUIREMENTS

- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
US ACGIH Threshold Limit Values (TLV)	nonafluoropentanoic acid (Fluorides, as F)		2.5						TLV® Basis: Bone dam; fluorosis ; BEI

PERSONAL PROTECTION

RESPIRATOR

- Type A-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

EYE

- Safety glasses with unperforated side shields may be used where continuous eye protection is desirable, as in laboratories; spectacles are not sufficient where complete eye protection is needed such as when handling bulk-quantities, where there is a danger of splashing, or if the material may be under pressure
- Chemical goggles.whenever there is a danger of the material coming in contact with the eyes; goggles must be properly fitted
- Full face shield (20 cm, 8 in minimum) may be required for supplementary but never for primary protection of eyes; these afford face protection.
- Alternatively a gas mask may replace splash goggles and face shields.

HANDS/FEET

- Elbow length PVC gloves
- When handling corrosive liquids, wear trousers or overalls outside of boots, to avoid spills entering boots.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity
- Neoprene gloves

OTHER

- Overalls.
- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.

ENGINEERING CONTROLS

■ Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
The basic types of engineering controls are:
Process controls which involve changing the way a job activity or process is done to reduce the risk.
Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Does not mix with water.
Sinks in water.
Corrosive.
Acid.

State	LIQUID	Molecular Weight	264.05
Melting Range (°F)	Not available	Viscosity	Not Available
Boiling Range (°F)	284	Solubility in water (g/L)	Partly miscible
Flash Point (°F)	None	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapour Pressure (mmHG)	Not Available
Upper Explosive Limit (%)	Not available.	Specific Gravity (water=1)	1.713
Lower Explosive Limit (%)	Not available	Relative Vapour Density (air=1)	>1
Volatile Component (%vol)	Not Available	Evaporation Rate	Not applicable

APPEARANCE

Liquid; does not mix well with water.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

- Contact with alkaline material liberates heat
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

STORAGE INCOMPATIBILITY

- Avoid strong bases.
- Segregate from alkalies, oxidising agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.
- Reacts with mild steel, galvanised steel / zinc producing hydrogen gas which may form an explosive mixture with air.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

nonafluoropentanoic acid

TOXICITY AND IRRITATION

■ Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound.
No significant acute toxicological data identified in literature search.

CARCINOGEN

Fluorides, as F	US ACGIH Threshold Limit Values (TLV) - Carcinogens	Carcinogen Category	A4

Section 12 - ECOLOGICAL INFORMATION

Harmful to aquatic organisms.
This material and its container must be disposed of as hazardous waste.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
nonafluoropentanoic acid	HIGH	No Data Available	LOW	MED

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

A. General Product Information
Corrosivity characteristic: use EPA hazardous waste number D002 (waste code C)

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.
Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

- DO NOT allow wash water from cleaning or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible.
- Consult manufacturer for recycling options or consult local or regional waste management authority for disposal if no suitable treatment or disposal facility can be identified.
- Treat and neutralise at an approved treatment plant. Treatment should involve: Neutralisation with soda-ash or soda-lime followed by: burial in a land-fill specifically licenced to accept chemical and / or pharmaceutical wastes or Incineration in a licenced apparatus
- Decontaminate empty containers with 5% aqueous sodium hydroxide or soda ash, followed by water. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

DOT:

Symbols:	None	Hazard class or Division:	8
Identification Numbers:	UN3265	PG:	II
Label Codes:	8	Special provisions:	B2, IB2, T11, TP2, TP27
Packaging: Exceptions:	154	Packaging: Non-bulk:	202
Packaging: Exceptions:	154	Quantity limitations: Passenger aircraft/rail:	1 L
Quantity Limitations: Cargo aircraft only:	30 L	Vessel stowage: Location:	B
Vessel stowage: Other:	40		

Hazardous materials descriptions and proper shipping names:
Corrosive liquid, acidic, organic, n.o.s.

Air Transport IATA:

ICAO/IATA Class:	8	ICAO/IATA Subrisk:	None
UN/ID Number:	3265	Packing Group:	II
Special provisions:	A3		
Cargo Only			
Packing Instructions:	855	Maximum Qty/Pack:	30 L
Passenger and Cargo		Passenger and Cargo	
Packing Instructions:	851	Maximum Qty/Pack:	1 L
Passenger and Cargo Limited Quantity		Passenger and Cargo Limited Quantity	
Packing Instructions:	Y840	Maximum Qty/Pack:	0.5 L

Shipping name:CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.(contains nonafluoropentanoic acid)

Maritime Transport IMDG:

IMDG Class:	8	IMDG Subrisk:	None
UN Number:	3265	Packing Group:	II
EMS Number:	F-A,S-B	Special provisions:	274
Limited Quantities:	1 L		

Shipping name:CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.(contains nonafluoropentanoic acid)

Section 15 - REGULATORY INFORMATION

nonafluoropentanoic acid (CAS: 2706-90-3) is found on the following regulatory lists;
"Canada - Alberta Ambient Air Quality Guidelines","Canada - Alberta Ambient Air Quality Objectives","Canada - Prince Edward Island Occupational Exposure Limits","Canada List of Prohibited and Restricted Cosmetic Ingredients (The Cosmetic Ingredient ""Hotlist"")","Canada Non-Domestic Substances List (NDSL)","International Maritime Dangerous Goods Requirements (IMDG Code) - Substance Index","US - California Air Toxics ""Hot Spots"" List (Assembly Bill 2588) Substances for Which Emissions Must Be Quantified","US - Georgia Primary Maximum Contaminant Levels for Drinking Water - Inorganics","US - Hawaii Air Contaminant Limits","US - Massachusetts Drinking Water - Inorganic Maximum Contaminant Levels (MCLs)","US - Massachusetts Drinking Water - Secondary Contaminants Maximum Contaminant Levels (MCLs)","US - North Dakota Air Pollutants - Guideline Concentrations","US - South Dakota Drinking Water Standards - Inorganic Chemicals","US - Utah Primary Drinking Water Standards - Inorganic Contaminants","US - Utah Secondary Drinking Water Standards - Inorganic Contaminants","US - Washington Toxic air pollutants and their ASIL, SQER and de minimis emission values","US ACGIH Threshold Limit Values (TLV)","US ACGIH Threshold Limit Values (TLV) - Carcinogens","US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory","WHO Guidelines for Drinking-water Quality - Guideline values for chemicals that are of health significance in drinking-water"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

■ Cumulative effects may result following exposure*.
■ Limited evidence of a carcinogenic effect*.
■ Vapours potentially cause drowsiness and dizziness*.
* (limited evidence).

Denmark Advisory list for selfclassification of dangerous substances

Substance	CAS	Suggested codes
nonafluoropentanoic acid	2706- 90- 3	Xn; R22

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

■ The (M)SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

■ For detailed advice on Personal Protective Equipment, refer to the following U.S. Regulations and Standards:
OSHA Standards - 29 CFR:
1910.132 - Personal Protective Equipment - General requirements
1910.133 - Eye and face protection
1910.134 - Respiratory Protection
1910.136 - Occupational foot protection
1910.138 - Hand Protection
Eye and face protection - ANSI Z87.1
Foot protection - ANSI Z41
Respirators must be NIOSH approved.

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www.Chemwatch.net

Issue Date: Jan-28-2009

Print Date:Mar-20-2012

Perfluorotetradecanoic acid

Safety Data Sheet 2121331

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 01/16/2017 Version: 1.0

SECTION 1: Identification

1.1. Identification

Product form	:	Substance
Substance name	:	Perfluorotetradecanoic acid
CAS No	:	376-06-7
Product code	:	2121-3-31
Formula	:	C14HF27O2
Synonyms	:	Perfluoromyristic acid
Other means of identification	:	MFCD00153263

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

Use of the substance/mixture	:	Laboratory chemicals Manufacture of substances Scientific research and development

1.3. Details of the supplier of the safety data sheet

SynQuest Laboratories, Inc.
P.O. Box 309
Alachua, FL 32615 - United States of America
T (386) 462-0788 - F (386) 462-7097
info@synquestlabs.com - www.synquestlabs.com

1.4. Emergency telephone number

Emergency number	:	(844) 523-4086 (3E Company - Account 10069)

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Acute Tox. 4 (Oral)	H302 - Harmful if swallowed
Skin Irrit. 2	H315 - Causes skin irritation
Eye Irrit. 2A	H319 - Causes serious eye irritation
STOT SE 3	H335 - May cause respiratory irritation

Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS07

Signal word (GHS-US) : Warning

Hazard statements (GHS-US) :
H302 - Harmful if swallowed
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H335 - May cause respiratory irritation

Precautionary statements (GHS-US) :
P261 - Avoid breathing dust, mist, spray
P264 - Wash skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P301+P312 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell
P302+P352 - If on skin: Wash with plenty of soap and water
P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing
P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P312 - Call a POISON CENTER or doctor/physician if you feel unwell
P321 - Specific treatment (see supplemental first aid instructions on this label)
P330 - Rinse mouth
P332+P313 - If skin irritation occurs: Get medical advice/attention

P337+P313 - If eye irritation persists: Get medical advice/attention
P362+P364 - Take off contaminated clothing and wash it before reuse
P403+P233 - Store in a well-ventilated place. Keep container tightly closed
P405 - Store locked up
P501 - Dispose of contents/container to an approved waste disposal plant

2.3. Other hazards

No additional information available

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Mono-constituent

Name	Product identifier	%	Classification (GHS-US)
Perfluorotetradecanoic acid (Main constituent)	(CAS No) 376-06-7	<= 100	Acute Tox. 4 (Oral), H302 Skin Irrit. 2, H315 Eye Irrit. 2A, H319 STOT SE 3, H335

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Move the affected personnel away from the contaminated area.

First-aid measures after inhalation : Remove person to fresh air and keep comfortable for breathing. If not breathing, give artificial respiration. Get immediate medical advice/attention.

First-aid measures after skin contact : Wash with plenty of soap and water. Get immediate medical advice/attention.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice/attention.

First-aid measures after ingestion : Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth out with water. Get immediate medical advice/attention.

4.2. Most important symptoms and effects, both acute and delayed

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

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

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Alcohol resistant foam. Carbon dioxide. Dry powder. Water spray. Use extinguishing media appropriate for surrounding fire.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Thermal decomposition generates: Carbon oxides. Hydrogen fluoride.

5.3. Advice for firefighters

Firefighting instructions : In case of fire: Evacuate area.

Protection during firefighting : Wear gas tight chemically protective clothing in combination with self contained breathing apparatus. For further information refer to section 8: "Exposure controls/personal protection".

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Evacuate unnecessary personnel. Ensure adequate air ventilation. Do not breathe dust.

6.1.1. For non-emergency personnel

Emergency procedures : Only qualified personnel equipped with suitable protective equipment may intervene.

6.1.2. For emergency responders

Protective equipment	:	Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

Avoid release to the environment. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment	:	Stop leak if safe to do so.
Methods for cleaning up	:	Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust.
Other information	:	For disposal of solid materials or residues refer to section 13 : "Disposal considerations".

6.4. Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	:	Do not handle until all safety precautions have been read and understood. Ensure good ventilation of the work station. Do not breathe dust, mist, spray. Wear personal protective equipment. Avoid contact with skin and eyes.
Hygiene measures	:	Handle in accordance with good industrial hygiene and safety procedures. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures	:	Comply with applicable regulations.
Storage conditions	:	Keep container closed when not in use.
Incompatible materials	:	Refer to Section 10 on Incompatible Materials.
Storage area	:	Store in dry, cool, well-ventilated area.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls	:	Ensure good ventilation of the work station. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.
Hand protection	:	Protective gloves. 29 CFR 1910.138: Hand Protection.
Eye protection	:	Chemical goggles or safety glasses. Face shield. 29 CFR 1910.133: Eye and Face Protection.
Skin and body protection	:	Wear suitable protective clothing.
Respiratory protection	:	In case of inadequate ventilation wear respiratory protection. 29 CFR 1910.134: Respiratory Protection.
Other information	:	Safety shoes. 29 CFR 1910.136: Foot Protection.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Solid
Color	:	No data available
Odor	:	No data available
Odor threshold	:	No data available
pH	:	No data available
Melting point	:	130 - 131 °C
Freezing point	:	No data available
Boiling point	:	192 °C (@ 60 mm Hg)
Flash point	:	No data available
Relative evaporation rate (butyl acetate=1)	:	No data available
Flammability (solid, gas)	:	No data available
Explosion limits	:	No data available
Explosive properties	:	No data available

Oxidizing properties	:	No data available
Vapor pressure	:	0 mm Hg (@ 20 °C)
Relative density	:	No data available
Relative vapor density at 20 °C	:	No data available
Molecular mass	:	714.11 g/mol
Solubility	:	No data available
Log Pow	:	No data available
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Viscosity	:	No data available
Viscosity, kinematic	:	No data available
Viscosity, dynamic	:	No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

The product is stable at normal handling and storage conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Keep away from heat, sparks and flame.

10.5. Incompatible materials

Strong bases. Strong oxidizing agents.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced. Hazardous decomposition products in case of fire, see Section 5.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity	:	Oral: Harmful if swallowed.
Skin corrosion/irritation	:	Causes skin irritation.
Serious eye damage/irritation	:	Causes serious eye irritation.
Respiratory or skin sensitization	:	Not classified
Germ cell mutagenicity	:	Not classified
Carcinogenicity	:	Not classified
Reproductive toxicity	:	Not classified
Specific target organ toxicity (single exposure)	:	May cause respiratory irritation.
Specific target organ toxicity (repeated exposure)	:	Not classified
Aspiration hazard	:	Not classified

SECTION 12: Ecological information

12.1. Toxicity

No additional information available

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment methods : Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber.

Waste disposal recommendations : Dispose of contents/container in accordance with licensed collector's sorting instructions.

Additional information : Recycle the material as far as possible.

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

Not regulated for transport

TDG

No additional information available

Transport by sea

No additional information available

Air transport

No additional information available

SECTION 15: Regulatory information

15.1. US Federal regulations

Perfluorotetradecanoic acid (376-06-7)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
EPA TSCA Regulatory Flag	S - S - indicates a substance that is identified in a proposed or final Significant New Uses Rule.

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

15.2. International regulations

CANADA

Perfluorotetradecanoic acid (376-06-7)
Listed on the Canadian NDSL (Non-Domestic Substances List)

EU-Regulations

No additional information available

National regulations

Perfluorotetradecanoic acid (376-06-7)
Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer and/or reproductive harm

SECTION 16: Other information

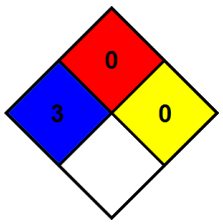
Full text of H-phrases:

Acute Tox. 4 (Oral)	Acute toxicity (oral) Category 4
Eye Irrit. 2A	Serious eye damage/eye irritation Category 2A
Skin Irrit. 2	Skin corrosion/irritation Category 2
STOT SE 3	Specific target organ toxicity (single exposure) Category 3
H302	Harmful if swallowed
H315	Causes skin irritation
H319	Causes serious eye irritation
H335	May cause respiratory irritation

NFPA health hazard : 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 2 Moderate Hazard - Temporary or minor injury may occur

Flammability : 0 Minimal Hazard - Materials that will not burn

Physical : 0 Minimal Hazard - Materials that are normally stable, even under fire conditions, and will NOT react with water, polymerize, decompose, condense, or self-react. Non-Explosives.

SDS US (GHS HazCom 2012)

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is offered solely for your consideration, investigation, and verification. It does not represent any guarantee of the properties of the product nor that the hazard precautions or procedures described are the only ones which exist. SynQuest shall not be held liable or any damage resulting from handling or from contact with the above product.

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Atlanta, GA 30318
United States of America
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Fax +1 (404) 586-6820
www.hpc-standards.us
sales@hpc-standards.us

HPC Standards Inc

Safety Data Sheet

according to Regulation (EC) No 1907/2006 (REACH)
Classifications according to Regulation (EC) No 1272/2008.
Printdate May 28, 2021

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product name:

Perfluorotridecanoic acid

1.1. Catalog No.:

676954

1.2. Relevant identified uses of the substance or mixture

Identified: Laboratory chemical
uses: R&D

1.3. Uses advised against:

HPC Standards GmbH
Am Wieseneck 7

04451 Cunnersdorf
Deutschland

Tel. +49 34291 3372-36
Fax. +49 34291 3372-39
contact@hpc-standards.com

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
Not a hazardous substance or mixture according to Regulation (EC) No. 1272/2008.
This substance is not classified as dangerous according to Directive 67/548/EEC.

2.2. Label elements

2.2.1. Pictogram

2.2.2.

2.2 Label elements
The product does not need to be labelled in accordance with EC directives or respective national laws.
2.3 Other hazards - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Formula : C13HF25O2
Molecular Weight : 664,11 g/mol

3.1.1. Formula

C13HF25O2

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HPC Standards Inc

3.1.2. Molecular Weight (g/mol)

664.11

3.1.3. CAS- No.

72629-94-8

4. FIRST AID MEASURES

4.1 Description of first aid measures
If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration.
In case of skin contact
Wash off with soap and plenty of water.
In case of eye contact
Flush eyes with water as a precaution. If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water.
4.2 Most important symptoms and effects, both acute and delayed
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
4.3 Indication of any immediate medical attention and special treatment needed
no data available

5. FIRE- FIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen fluoride
5.3 Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.
5.4 Further information
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapors, mist or gas.
6.2 Environmental precautions
Do not let product enter drains.
6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Keep in suitable, closed containers for disposal.
6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection.
7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place.
7.3 Specific end use(s)
no data available

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
8.2 Exposure controls
Appropriate engineering controls
General industrial hygiene practice.
Personal protective equipment
Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices.
Wash and dry hands. Body Protection

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Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.
Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties
a) Appearance Form: solid
b) Odour no data available
c) Odour Threshold no data available
d) pH no data available
e) Melting point/freezing point
Melting point/range: 112 - 123 °C - lit.
f) Initial boiling point and boiling range
no data available
g) Flash point no data available
h) Evaporation rate no data available
i) Flammability (solid, gas) no data available
j) Upper/lower flammability or explosive limits
no data available
k) Vapour pressure no data available
l) Vapour density no data available
m) Relative density no data available
n) Water solubility no data available
o) Partition coefficient: noctanol/water
no data available
p) Auto-ignition temperature
no data available
q) Decomposition temperature
no data available
r) Viscosity no data available
s) Explosive properties no data available
t) Oxidizing properties no data available
9.2 Other safety information
no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available
10.2 Chemical stability
no data available
10.3 Possibility of hazardous reactions
no data available
10.4 Conditions to avoid
no data available
10.5 Incompatible materials
Strong oxidizing agents
10.6 Hazardous decomposition products
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects
Acute toxicity
no data available
Skin corrosion/irritation
no data available
Serious eye damage/eye irritation
no data available
Respiratory or skin sensitization
no data available
Germ cell mutagenicity

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no data available
Carcinogenicity
IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
Reproductive toxicity
no data available
Specific target organ toxicity - single exposure
no data available
Specific target organ toxicity - repeated exposure
no data available
Aspiration hazard
no data available
Potential health effects
Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion May be harmful if swallowed.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Signs and Symptoms of Exposure
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Additional Information
RTECS: Not available

12. ECOLOGICAL INFORMATION

12.1 Toxicity
no data available
12.2 Persistence and degradability
no data available
12.3 Bioaccumulative potential
no data available
12.4 Mobility in soil
no data available
12.5 Results of PBT and vPvB assessment
no data available
12.6 Other adverse effects
no data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods
Product
Offer surplus and non-recyclable solutions to a licensed disposal company.
Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

14.1 UN number
ADR/RID: - IMDG: - IATA: -
14.2 UN proper shipping name
ADR/RID: Not dangerous goods
IMDG: Not dangerous goods
IATA: Not dangerous goods
14.3 Transport hazard class(es)
ADR/RID: - IMDG: - IATA: -
14.4 Packaging group
ADR/RID: - IMDG: - IATA: -
14.5 Environmental hazards
ADR/RID: no IMDG Marine Pollutant: no IATA: no
14.6 Special precautions for user
no data available

15. REGULATORY INFORMATION

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.
15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
no data available
15.2 Chemical Safety Assessment
no data available

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16. OTHER INFORMATION

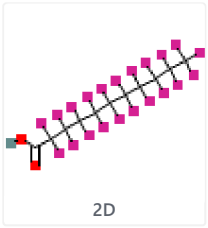
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. For lab use only!

COVID-19 Information
Public health information (CDC) Research information (NIH) SARS-CoV-2 data (NCBI)
Prevention and treatment information (HHS) Español

PubChem

COMPOUND SUMMARY > LABORATORY CHEMICAL SAFETY SUMMARY (LCSS)

Perfluoroundecanoic acid

PubChem CID	77222
Structure	 2D Find Similar Structures
Synonyms	Perfluoroundecanoic acid 2058-94-8 Henicosafluoroundecanoic acid Perfluoro-n-undecanoic acid 2,2,3,3,4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,11-henicosafluoroundecanoic acid More...
Molecular Formula	$C_{11}HF_{21}O_2$
Molecular Weight	564.09

Learn More About LCSS Project >

1 GHS Classification

Pictogram(s)	Irritant
Signal	**Warning**
GHS Hazard Statements	H302 (95.12%): Harmful if swallowed [**Warning** Acute toxicity, oral] H312 (95.12%): Harmful in contact with skin [**Warning** Acute toxicity, dermal] H315 (100%): Causes skin irritation [**Warning** Skin corrosion/irritation] H319 (100%): Causes serious eye irritation [**Warning** Serious eye damage/eye irritation] H332 (95.12%): Harmful if inhaled [**Warning** Acute toxicity, inhalation]
Precautionary Statement Codes	P261, P264, P270, P271, P280, P301+P312, P302+P352, P304+P312, P304+P340, P305+P351+P338, P312, P321, P322, P330, P332+P313, P337+P313, P362, P363, and P501 (The corresponding statement to each P-code can be found at the GHS Classification page.)
ECHA C&L Notifications Summary	*Aggregated GHS information provided by 44 companies from 4 notifications to the ECHA C&L Inventory. Each notification may be associated with multiple companies.* *Reported as not meeting GHS hazard criteria by 3 of 44 companies. For more detailed information, please visit ECHA C&L website.* *Of the 3 notification(s) provided by 41 of 44 companies with hazard statement code(s).* *Information may vary between notifications depending on impurities, additives, and other factors. The percentage value in parenthesis indicates the notified classification ratio from companies that provide hazard codes. Only hazard codes with percentage values above 10% are shown.*

▸ European Chemicals Agency (ECHA)

2 Identifiers

2.1 CAS

2058-94-8

CAS Common Chemistry; ChemIDplus; EPA DSSTox; European Chemicals Agency (ECHA)

2.2 InChI

InChI=1S/C11HF21O2/c12-2(13,1(33)34)3(14,15)4(16,17)5(18,19)6(20,21)7(22,23)8(24,25)9(26,27)10(28,29)11(30,31)32/h(H,33,34)

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

2.3 InChI Key

SIDINRCMMRKXGQ-UHFFFAOYSA-N

Computed by InChI 1.0.5 (PubChem release 2019.06.18)

PubChem

3 Additional Considerations

3.1 Substance of Very High Concern (SVHC)

REACH SVHC Substance

Substance: Henicosafluoroundecanoic acid
Reason: vPvB (Article 57e)
Decision Document: **PDF Link**

▸ **European Chemicals Agency (ECHA)**

4 Information Sources

FILTER BY SOURCE ALL SOURCES

1. ## CAS Common Chemistry

LICENSE

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https://creativecommons.org/licenses/by-nc/4.0/

Perfluoroundecanoic acid

https://commonchemistry.cas.org/detail?cas_rn=2058-94-8

2. ## ChemIDplus

LICENSE

https://www.nlm.nih.gov/copyright.html

Perfluoro-n-undecanoic acid

https://chem.nlm.nih.gov/chemidplus/sid/0002058948

3. ## EPA DSSTox

LICENSE

https://www.epa.gov/privacy/privacy-act-laws-policies-and-resources

Perfluoroundecanoic acid

https://comptox.epa.gov/dashboard/DTXSID8047553

4. ## European Chemicals Agency (ECHA)

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https://echa.europa.eu/web/guest/legal-notice

Henicosafluoroundecanoic acid

https://echa.europa.eu/substance-information/-/substanceinfo/100.016.515

Henicosafluoroundecanoic acid

https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/86728

Henicosafluoroundecanoic acid

https://www.echa.europa.eu/candidate-list-table

5. ## PubChem

https://pubchem.ncbi.nlm.nih.gov

APPENDIX D

HEAT AND COLD PROTOCOLS

P.W. GROSSER CONSULTING, INC• P.W. GROSSER CONSULTING ENGINEER & HYDROGEOLOGIST, PC
631.589.6353 • WWW.PWGROSSER.COM • PWGC.INFO@PWGROSSER.COM
BOHEMIA • MANHATTAN • SARATOGA SPRINGS • MONTICELLO • SYRACUSE • SHELTON, CT

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.

(1) Reproduced from American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1985-1986, p.01.

APPENDIX E

SUMMARY OF PROHIBITED AND ACCEPTABLE MATERIALS

P.W. GROSSER CONSULTING, INC• P.W. GROSSER CONSULTING ENGINEER & HYDROGEOLOGIST, PC
631.589.6353 • WWW.PWGROSSER.COM • PWGC.INFO@PWGROSSER.COM
BOHEMIA • MANHATTAN • SARATOGA SPRINGS • MONTICELLO • SYRACUSE • SHELTON, CT

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 F

FIELD ACCIDENT REPORT

P.W. GROSSER CONSULTING, INC• P.W. GROSSER CONSULTING ENGINEER & HYDROGEOLOGIST, PC
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PWGC
CLIENT DRIVEN SOLUTIONS

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

_____

_____

_____