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By Email

April 2, 2021

Mr. Steven M. Scharf, P.E.
New York State Department of Environmental Conservation
Remedial Bureau A
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233-7015

RE: Emerging Contaminant Sampling Work Plan - NYSDEC Site No 526022 - Malta Rocket Test Site Town of Malta, Saratoga County

Dear Mr. Scharf:

This letter responds to the February 10, 2021 letter from the New York State Department of Environmental Conservation (NYSDEC) requesting that the General Electric Company (GE) collect and analyze groundwater samples for 1,4-dioxane and per- and polyfluoroalykyl substances (PFAS) at the Malta Rocket Test Site (the Site) in the Town of Malta, New York. GE understands that NYSDEC is requesting that all sites with ongoing monitoring screen for these constituents, and a focused sampling program for 1,4-dioxane and PFAS is proposed below for that purpose.

SITE HISTORY/BACKGROUND INFORMATION

The former Test Station is located off Plains Road in the towns of Malta and Stillwater, New York. The Test Station was established in 1945 by the U.S. Government and was owned by the New York State Energy Research and Development Authority until 1984 when it was sold to Wright Malta Corporation. Wright Malta Corporation sold the former Test Station to the Luther Forest Technology Campus Economic Development Corporation (LFTCEDC). The Test Station area and portions of the recently developed surrounding areas comprise the Site.

Due to the discovery of chlorinated volatile organic compounds (CVOCs) in groundwater and other contaminants of concern in soils, in July 1987, the USEPA listed the Site on the National Priorities List. After the NPL listing, at the New York State Department of Environmental Conservation's (NYSDEC's) request, the USEPA assumed the regulatory lead for the Site and has been overseeing the remediation program work. Groundwater monitoring is currently conducted in accordance with an EPA approved monitoring plan. In September 1989, EPA unilaterally issued an Administrative Order to eight potentially responsible parties for the performance of a remedial investigation and feasibility study (RI/FS).

Following issuance of EPA's Record of Decision (ROD) in July 1996, a Consent Decree (CD) was signed in September 1997 by settling federal agencies and seven defendants for performance of remedial design and remedial action. The CD was entered into the US District Court for the Northern District of New York in March of 1998, docket number 98-CV-0014. In USEPA's 1999 5-year review, which included the "Site Close-Out Report", USEPA determined that the Remedial Party had constructed the remedy in accordance with the remedial design plans and specifications and that the remaining response action at the Site consists of long-term operation, maintenance, and monitoring (OM&M).

The site layout and sampling locations are provided on Figure 1 along with parcel boundaries and the Environmental Restriction Zone (ERZ) boundary. The ERZ is an institutional control implemented through a permanent easement which explicitly prohibits the extraction or use of groundwater from the site. The ongoing routine remedial activities consist of semi-annual groundwater sampling of 11 shallow (DGC-3S, DGC-4S, 4S, 10S, 13S, MW-1, MW-4, M-25S, M-26S, M-28S, and M-29S) and 9 deep (4D, 11D, 13D, M-24DR, M-25D, M-26D, M-27D, M-28D, and M-29D) monitoring wells that are part of the Early Warning Monitoring System (EWMS).

SCOPE OF WORK FOR SCREENING

As requested, GE is prepared to implement a focused sampling and analysis program for 1,4-dioxane and PFAS in groundwater to determine the presence or absence of these constituents at the Malta Rocket Test Site.[1] To accomplish the screening-level assessment, samples will be collected from three shallow wells including the most impacted well currently sampled (MW-25S) and wells upgradient (MW-26S) and downgradient (DGC-4S) of well MW-25S. The samples will be collected using low-flow sampling procedures which include a PFAS-free bladder pump with HDPE tubing. Field observations will be documented on a field sampling form.

Laboratory analysis for 1,4-dioxane will employ USEPA Method 8270 with Selective Ion Monitoring (SIM), with a reporting limit at or below 0.28 ppb. For this screening level assessment, analysis for PFAS will use modified USEPA Method 537.1 with quantitation of the PFAS Target Analyte List (Table 1) provided by NYSDEC. Quality control (QC) samples will also be collected for both 1,4-dioxane and PFAS analysis, and full Category B analytical data packages will be requested from the laboratories. A data usability review will be completed in accordance with NYSDEC Division of Environmental Remediation guidance DER-10, Appendix 2B for Data Usability Summary Reports (DUSR).

SAMPLE COLLECTION AND HANDLING

Using a bladder pump, water samples will be collected from each of the designated wells into pre-labelled, laboratory-provided bottle ware. Polypropylene or HDPE, Teflon®-free, bottles will be used to collect the PFAS sample, and the PFAS sample will be collected before the 1,4-dioxane sample. Samples will be collected while wearing appropriate personal protective equipment (PPE). Additionally, special PFAS-related precautions will be taken during the sampling to minimize sample contamination, as outlined in the attached SOP.

Once filled, each water sample bottle will be immediately placed into a cooler containing regular ice. The sample identifier, location, date, time, and sample collector will be recorded on a water sampling form and a chain-of-custody form. Sample coolers will be delivered to the TestAmerica (TA) shipping center in

[1] GE does not own the property, nor does it conduct any operations on the property and has not done so for approximately 35 years. GE is assuming that the property owner continues to consent to access for sampling purposes even though this sampling event is not mandated in the Consent Decree or USEPA approved work plans.

Syracuse, New York. From there, the cooler with the PFAS samples will be shipped to TA's lab in Sacramento, California, and the cooler with the 1,4-dioxane samples will be shipped to TA's lab in Buffalo, New York.

QUALITY CONTROL SAMPLES

One set of QC samples will be collected during the sampling event for the PFAS and 1,4- dioxane analyses. The QC samples for the PFAS analyses will include one blind duplicate sample, one matrix spike/matrix spike duplicate (MS/MSD) sample pair, one equipment blank (collected from the bladder pump), and one field reagent blank (lab-supplied water transferred to lab-supplied container at time of sampling). The QC samples for the 1,4-dioxane analyses will include one blind duplicate sample, one MS/MSD sample pair and one equipment blank.

LABORATORY ANALYSES

The water samples and associated QC samples will be analyzed by TA in accordance with the following methods:

• PFAS – USEPA Method 537.1 (modified; low level) with a reporting limit equal to or below 2 ppt for each of the six PFAS

• 1,4-Dioxane – USEPA Method 8270 SIM with a reporting limit equal to or below 0.28 ppb.

A standard turnaround time will be requested, with analytical results available within 20 business days from sample receipt by the laboratory. Full Category B analytical data packages will be obtained from TA to support preparation of the DUSR. An electronic data deliverable (EDD) file will also be obtained.

MANAGEMENT OF INVESTIGATION DERIVED WASTES (IDW)

IDW generated during the sampling event will include the disposable bladders and tubing and PPE. They will be containerized with other PPE and debris from the site for transportation and proper off-site disposal.

REPORTING

Following receipt of the complete analytical data packages, a letter report will be prepared for submittal to NYSDEC. This report will document the sampling activities, provide the completed field forms and field measurements, and summarize the results of the analyses. The complete analytical data packages will be provided in an appendix to the report and the EDD will be uploaded to the state database. A copy of the report will also be provided to the USEPA and the property owners.

SCHEDULE

It is anticipated that the sampling will be performed during the same mobilization to the site and prior to the May 2021 semi-annual groundwater monitoring event, provided GE receives approval of the scope of work at least 15 days prior to the event scheduled for early May. However, if approval is delayed, the next semi-annual sampling event scheduled for October 2021 could serve as an alternative. The letter report will be submitted to NYSDEC (and others) within 45 days of receiving the complete analytical data package(s).

Should you have any questions pertaining to this scope of work, please contact me.

Sincerely,

Matthew Calacone

Matthew Calacone
Senior Project Manager

attachments

cc: Eric Merrifield, GE
Richard Mustico, NYSDEC
John Swartwout, NYSDEC
Charlotte Bethony, NYSDOH
James Sullivan, NYSDOH
Patricia Pierre, USEPA
Tom Roohan, Luther Forrest TCEDC
Andrew Lacorciere, Global Foundries
Darren O'Connor, Town of Malta
Michael Noel, TetraTech

Proposed PFAS & 1,4-D Sampling Locations

230.-1-72.111
LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC DEV CORP.

230.-1-72.113
GLOBAL FOUNDRIES US INC

230.-1-12
MACKAY CAROL L LE
MACKAY ALEXANDER L TRUSTEE

230.-1-16.11
LUTHER FOREST CORP

242.-1-96.11
THE LUTHER FOREST CORP

230.-1-75.12
NYSERDA

230.-1-75.13
NYSERDA

230.-1-75.11
NYSERDA

230.-1-72.12
COUNTY OF SARATOGA IDA
GLOBAL FOUNDRIES US INC

230.-1-76.112
LUTHER FOREST TECHNOLOGY

230.-1-76.12
GLOBAL FOUNDRIES US INC

230.-1-24
GLOBAL FOUNDRIES US INC

230.-1-23
COUNTY OF SARATOGA IDA

230.-1-73.1
JENNAS FOREST HOMEOWNERS

241.-1-3.112
GLOBAL FOUNDRIES US INC

241.-1-48
LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC

230.-1-76.111
LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC DEV CORP.

241.-1-5
LUTHER FOREST TECHNOLOGY CAMP

241.-1-1.112
TOWN OF MALTA

241.-1-50
LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC

241.-1-4
LUTHER FOREST TECHNOLOGY CAMP

241.-1-49
LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC

241.-1-3.3
LUTHER FOREST TECHNOLOGY CAMP

241.-1-53
LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC

241.-1-52
LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC

241.-1-51
THE LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC

241.-1-55
LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC

242.-1-96.11
THE LUTHER FOREST CORP.

TOWN OF MALTA
TOWN OF STILLWATER

SW-A SW-B SW-D SW-E SW-F SW-G

MW-22 MW-21 MW-20 4S 4D MW-24DR MW-26S MW-26D 11S 11D MW-28S MW-28D MW-15 MW-29S MW-29D MW-25S MW-25D 3S 3D MW-17 MW-31D MW-18 MW-31S 2D 2S MW-19 MW-30 MW-35S MW-35D MW-32 1D 10S 10D MW-23 MW-4 MW-16 MW-1 14D 13S 13D MW-27D MW-27S MW-2 MW-3 DGC-1S DGC-1D DGC-2S DGC-2D DGC-4S DGC-4D DGC-3S DGC-3D

EXPLANATION

- SW-A — SURFACE WATER LOCATION
- M-17 — MONITORING WELL LOCATION
- ENVIRONMENTAL RESTRICTION ZONE
- PARCEL BOUNDARY
- STILLWATER/MALTA TOWN LINE

NOTES:

1) AERIAL REFERENCE: ESRI WORLD IMAGERY.
2) PARCEL BOUNDARIES: SARATOGA COUNTY PLANNING DEPARTMENT.
3) TAX MAP ID'S: SARATOGA COUNTY IMAGE MATE ONLINE.
4) ENVIRONMENTAL RESTRICTION ZONE; EXHIBIT MAP X, DEVELOPMENT AREA NO. 1 LUTHER FOREST TECHNOLOGY CAMPUS ECONOMIC DEVELOPMENT CORPORATION, TOWNS OF MALTA AND STILLWATER, SARATOGA COUNTY, NEW YORK, C.T. MALE ASSOCIATES, P.C., FEBRUARY 5, 2008 AND ENVIRONMENTAL RESTRICTION EASEMENT AND DECLARATION OF RESTRICTIVE COVENANTS ON THE LANDS OF WRIGHT - MALTA CORPORATION, GILBERT VANGUILDER & ASSOCIATES, FEBRUARY 19, 1999. ZONE CONSIDERED APPROXIMATE.

0 1000 2000
SCALE IN FEET

SOURCES:
Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
APTIM Figure, Environmental Restriction Zone Property Map, MALTA Rocket Fuel Area Site, Malta, New York

S:\CAD\GE\MALTA\2-23-18\SITE LAYOUT AND SAMPLING LOCATIONS.DWG

TITLE:
SITE LAYOUT AND SAMPLING LOCATIONS

LOCATION:
MALTA ROCKET FUEL AREA SITE
MALTA, NEW YORK

TETRA TECH

APPROVED	MN
DRAFTED	CP
PROJECT#	117-2204275
DATE	2-26-18

FIGURE 1

Table 1. Full PFAS Target Analyte List			
Group	**Chemical Name**	**Abbreviation**	**CAS Number**
Perfluoroalkyl sulfonates	**Perfluorobutanesulfonic acid**	**PFBS**	375-73-5
	Perfluorohexanesulfonic acid	**PFHxS**	**355-46-4**
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	**PFOS**	**1763-23-1**
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	**PFHpA**	**375-85-9**
	Perfluorooctanoic acid	**PFOA**	**335-67-1**
	Perfluorononanoic acid	**PFNA**	**375-95-1**
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Bold entries depict the 6 original UCMR3 chemicals

TETRA TECH	STANDARD OPERATING PROCEDURE	Number SA-1.8	Page 1 of 13
		Effective Date 05/18/2018	Revision 4
		Applicability Tetra Tech, Inc., NUS Operating Unit	
		Prepared Earth Sciences Department	
Subject SAMPLE ACQUISITION FOR PERFLUOROALKYL AND POLYFLUOROALKYL SUBSTANCES (PFAS) ANALYSIS		Approved T. Johnston	

TABLE OF CONTENTS

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the methods and protocols to be used for collecting and handling samples to be analyzed for per- and polyfluoroalkyl substances (PFAS). PFAS are present in many consumer products including some typical sampling equipment and are widely present in the environment.

Low regulatory criteria and high cross-contamination potential require special precautions to be implemented to avoid compromising sample integrity. Instructions are provided herein for collection of environmental samples without contaminating them. This SOP is designed to supplement but not replace existing sampling SOPs SA-1.1, SA-1.2, SA-1.3, SA-1.7, and SA-5.1. In addition, some clients and/or projects may have specific PFAS-related sampling requirements that extend beyond the procedures described in this SOP. Such additional requirements typically are documented in work plans or similar documents.

2.0 SCOPE AND APPLICABILITY

This document provides information on selection of proper sampling equipment and techniques for groundwater, surface water, sediment, soil, and water supply sampling for PFAS analysis. Sampling of air or biota is not addressed in this SOP, but similar principles would apply for those media.

3.0 BACKGROUND

PFAS have been used since the 1940s as manufacturer-applied oil and water repellants on products such as clothing, upholstery, paper, and carpets and in making fluoropolymers for non-stick cookware. They are found in textiles and leather products, mist suppressants for metal plating, materials used in the photography industry, photolithography, semi-conductors, paper and packaging, coatings, cleaning products, pesticides, and cosmetics. They have been used in well-known consumer products including Teflon, StainMaster, Scotchgard, and GoreTex. In the 1960s, aqueous film-forming foam (AFFF) containing PFASs was developed for fighting flammable liquid fires, particularly petroleum-fueled (Class B) fires (ATSDR, 2009). The two most researched and most prevalent PFAS in the environment are perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) (ATSDR, 2009).

Military uses of PFAS have been primarily related to fire fighting and electroplating. AFFF meeting MIL-F-24385 specifications was developed by various manufacturers for use in extinguishing fires at military bases, airports, commercial facilities, and fire-fighting training facilities throughout the United States. Beginning in the late 1960s the United States Department of Defense (DoD) used large quantities of AFFF for shipboard and shore facility fire-suppression systems, on fire-fighting vehicles, and at fire-training facilities. AFFF concentrate that contains PFAS may still be in use at DoD facilities, and large quantities of AFFF may have been released to the environment at some facilities.

PFAS are persistent in the environment, tend to bioaccumulate, and demonstrate toxicity in laboratory animals, enough to raise concerns about their presence in the environment. Some areas where PFAS may have been released to the environment include the following:

- Fire-fighting training areas
- Areas where fire-fighting products/materials are stored (e.g., fire stations)
- Aircraft crash sites
- Refineries
- DoD sites/military bases
- Landfills (leaching from consumer products)
- Biosolids land applications

- Rail yards
- Textile/carper manufacturing sites
- Septic systems
- Metal coating and plating facilities
- Water treatment systems and receiving water bodies
- Airport hangars and other facilities storing fire-fighting foams
- Chemical facilities, especially fluorochemical manufacturing, use, and disposal facilities

PFAS are ubiquitous in consumer products and are present in or on some materials used in environmental sampling (e.g., Teflon tubing, waterproof logbooks, and GoreTex field clothing). Laboratory detection limits are low for PFAS, and contact of sample material or sampling equipment with any one of the multitude of PFAS sources could result in detectable contamination. In addition, PFAS tend to adsorb to glass and some plastics, so certain glass or plastic sample collection containers are inappropriate for use in PFAS sample collection. Adsorption to sample containers may result in a low bias for measured PFAS concentrations.

Collection and analysis of quality control blanks is an important aspect of verifying that samples have not been contaminated during sample collection and handling. Use of additional blanks or blanks of a different type than usual may be required in some circumstances, and the governing project planning documents should be consulted. Consult Section 7.7 of this SOP for instructions regarding collection of field reagent blanks (FRBs).

4.0 DEFINITIONS

AFFF – Aqueous film-forming foam.

Emerging Contaminant – An emerging contaminant is a chemical or material that is characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards (U.S. EPA, 2014). A contaminant may also be "emerging" because a new source or a new pathway for human exposure has been discovered or a new detection method or treatment technology has been developed (DoD, 2011).

FRB – Field Reagent Blank. A blank sample prepared in the field by transferring laboratory-supplied, chemically preserved, "PFAS-free" deionized water to an empty, laboratory-supplied, collection bottle. FRBs are typically analyzed only for PFAS and are treated as site samples in all respects, including shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all PFAS analytical procedures. The purpose of FRBs is to indicate whether PFAS measured in corresponding site samples may have been introduced during sample collection and handling.

PFAS – Per- and Polyfluoroalkyl Substances. A reference term currently in use, replacing "PFCs" in recent scientific and other technical literature. The term is inclusive of both perfluorinated chemicals like PFOA and PFOS and polyfluoroalkyl substances like fluorinated telomers.

PFCs – Perfluorinated Compounds or Chemicals. PFCs are a family of man-made chemicals that have been used for commercial, industrial, and military applications because they resist thermal degradation and repel oil, stains, grease, and water.

PFOA – Perfluorooctanoic Acid. PFOA is used as an aqueous dispersion agent (surfactant) and in the manufacture of fluoropolymers (including Teflon) used in industrial components such as electrical wire casings, fire- and chemical-resistant tubing, and plumbing seal tape. PFOA is used in surface treatment products (e.g., paints) to impart oil, stain, grease, and water resistance. PFOA can also be produced by the breakdown of some fluorinated telomers.

PFOS – Perfluorooctane Sulfonate. PFOS was a key ingredient in Scotchgard and used in the manufacture of Class B AFFF used per DoD military specifications. Phase out of AFFF by 3M occurred in 2002.

5.0 SAFETY PRECAUTIONS

Sample acquisition activities shall be conducted in accordance health and safety requirements identified in the project-specific Health and Safety Plan (HASP), Accident Prevention Plan (APP), and corporate health and safety policies. Alteration may be necessary to allow sample collection without cross contamination as dictated by site-specific conditions.

Caution

The use of personal protective equipment (PPE) containing PFAS (e.g., some insect repellants, sunscreens, traffic safety vests, etc.) should be avoided if possible or, if deemed necessary to control hazards, should be carefully considered as they can pose a potential cross-contamination risk for samples. Extra care (e.g., changing outer gloves) must be exercised to ensure that PFAS is not transferred directly or indirectly from PPE to samples or sample containers.

The Tetra Tech Project Manager (PM), in coordination with the Tetra Tech NUS Operating Unit Health and Safety Group, shall ensure that the development of project-specific plans balances the need to control exposure to safety hazards as well as address PFAS contamination risks.

6.0 PERSONNEL RESPONSIBILITIES, QUALIFICATIONS, AND TRAINING

Project Manager (PM) – The PM along with the management team are responsible for determining sampling objectives, initial sampling locations, and field procedures used in the collection of samples of environmental media. Additionally, in consultation with other project personnel (geologist, hydrogeologist, etc.), the PM is responsible for selecting and detailing the specific sampling techniques and equipment to be used and for providing detailed input in this regard to the project planning documents. The PM has the overall responsibility for ensuring that sampling activities are properly conducted by appropriately trained staff.

Site Safety and Health Officer (SSHO) – The SSHO (or a qualified designee) is responsible for providing the technical support necessary to implement the project HASP, APP, or equivalent. The SSHO or SSHO designee may also be required to advise the Field Operations Leader (FOL) on safety-related matters regarding sampling, such as measures to mitigate potential hazards, hazardous objects, or conditions.

Project Geologist/Sampler – The project geologist/sampler is responsible for proper acquisition of samples in accordance with this SOP and other project-specific governing documents. In addition, this individual is responsible for the completion of all required paperwork (e.g., sample log sheets, field notebook, boring logs, container labels, custody seals, and chain-of-custody forms) associated with the collection of those samples.

Field Operations Leader (FOL) – This individual is primarily responsible for the execution of the field sampling program in accordance with the project planning documents. This is accomplished through management of a field sampling team for the proper acquisition of samples.

Personnel implementing this SOP must read and understand this SOP prior to collection of samples designated for PFAS analysis.

7.0 PROCEDURES

The following sampling procedure establishes requirements for collection of samples designated for PFAS analysis while minimizing potential cross contamination of the samples and other materials.

7.1 Selection of Equipment

It is important to research available equipment and materials at the project planning stage to avoid last-minute problems in the field, for example, ensuring compatibility of high-density polyethylene (HDPE) tubing with fittings for use in a peristaltic or other pump, or ensuring that equipment (e.g., a bladder pump) does not contain Teflon.

Sampling Equipment:

Note: PFAS cross-contamination of samples can be minimized through decontamination or conditioning of equipment left in a well. Use of dedicated equipment also is helpful so that handling during decontamination is unnecessary.

- Decontamination – All reusable equipment used in sample acquisition should be adequately decontaminated prior to use. Consult Safety Data Sheets (SDSs) to verify that soaps or detergents used in decontamination do not contain fluorosurfactants.

- Unless project requirements indicate otherwise, use sampling equipment made of stainless steel, acetate, silicone, or HDPE. This applies to tubing, pumps and pump components, tape for plumbing fittings, trowels, mixing bowls, or other equipment that could contact the sample media. Gasket and O-ring components of sampling equipment may also contain fluoropolymers.

Note: PFAS on purchased or rented items is likely to occur predominantly in newly manufactured or rented items treated with chemicals containing PFAS. Therefore, all rental equipment that will make direct contact with the material being sampled must be thoroughly decontaminated prior to use, especially if the equipment items are new. Be cognizant of the potential for continued leaching of PFAS or other chemicals — even after decontamination.

- During sample handling, mobilization, and demobilization, avoid using sampling equipment that includes or contains polyvinylidene fluoride (PVDF) or contains “fluoro” in the name such as:
    - Polytetrafluoroethylene (PTFE)
    - Teflon (DuPont brand name)
    - Fluorinated ethylene propylene (FEP)
    - Ethylene tetrafluoroethylene (ETFE).

- Use products that are not made of low-density polyethylene products (LDPE) if contamination from those products can be transferred to environmental samples or QC samples.

- For collecting drinking water samples to be analyzed using United States Environmental Protection Agency (U.S. EPA) Method 537, use polypropylene sample bottles with a polypropylene screw cap; for all other samples, use HDPE containers with unlined plastic screw caps.

Non-Sampling Field Equipment:

- Non-waterproof loose-leaf paper or notebooks are acceptable. Avoid using waterproof field books or paper during sampling activities. Do not use plastic clipboards, binders, or spiral hard-cover notebooks that may be coated; use Masonite or aluminum clipboards instead.

- Avoid using Post-it notes or similar removable notes during sample handling or mobilization/demobilization activities.

- Use ballpoint pens or pencils for note taking and sample bottle labeling. Avoid using Sharpies or similar indelible markers.

- Avoid the use of aluminum foil.

Field Personnel Clothing and Protective Gear:

- Wear clothing that has been washed at least six times without fabric softener to remove possible stain-resistant coatings. Clothing made of natural fibers such as cotton is preferred to other fabrics. Protective clothing must be washed in accordance with manufacturer recommendations to ensure that the protective properties necessary to control safety hazards (e.g., fire-retardant clothing) are not compromised.

- Avoid unnecessary contact with upholstery in vehicles because many such fabrics may be treated with stain-resistant materials that could contain PFAS. Typically, rental vehicles are newer and more likely to pose a contamination risk to samples. Well-washed towels or rags may be placed on the seats to prevent contact with car seats and other materials that could transfer PFAS to clothing worn by samplers. If practical, cover clothing and skin that has been in contact with such upholstery with non-fluorinated clothing.

- During wet weather, use rain gear made from polyurethane or wax-coated materials.

- Avoid wearing water-resistant (e.g., Gore-Tex or similar material) clothing or footwear (e.g., boots) immediately prior to or during sample collection and management.

- Avoid wearing coated Tyvek or similar coated PPE suits.

- Wear un-powdered nitrile gloves at all times while collecting and handling samples, and change gloves often. Anecdotal evidence indicates that changing gloves is one of the most effective methods of reducing or eliminating sample contamination potential; therefore, change to a new pair of gloves prior to collecting each sample.

- Avoid wearing cosmetics, shampoos, hair conditioners, moisturizers, hand cream, or other similar personal care products on the day of sampling.

- As necessary, use sunscreens and insect repellants that are made with 100-percent natural ingredients and that the Air Force Civil Engineer Center has identified as acceptable for use. ***These products must be used in accordance with manufacturer recommendations and in combination with controls in the project-specific HASP, APP, and corporate health and safety policies***. ***Multiple applications of these products per work shift may be required to ensure their effectiveness.***

    - Sunscreens: Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss My Face, baby sunscreens that are “free” or “natural.”

    - Sunscreen and insect repellant: Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion

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

Notes: The suitability of these items has not been independently verified. Products containing N-diethyl-meta-toluamide **(**DEET), picaridin, and IR3535 and some oil of lemon eucalyptus (OLE) and para-menthane-diol products are known to provide longer-lasting protection than others. One of the products recommended by the Air Force Civil Engineer Center and listed above, Repel Lemon Eucalyptus Insect Repellant, contains OLE and is most likely to be effective.

An independent study (Bartlett and Davis, 2018) of three insect repellents (Sawyer® do-it-yourself permethrin treatment for clothing, Off! Deep Woods® spray for clothing/skin, and Insect Shield® pretreated clothing) determined that these products were free of PFAS compounds (17 compounds were tested for), thus they may be suitable for use on a project-specific basis.

Sample Containers and Shipping Materials:

- Avoid the use of glass or LDPE sample containers, which are believed to result in loss of PFAS through adsorption to the container inner walls.

- Collect samples in clean, laboratory-supplied, plastic bottles only, typically polypropylene for drinking water or HDPE for other matrices.

- Confirm that Teflon-lined caps are not used in sample containers; unlined polypropylene screw caps must be used. It is best to segregate sample containers with Teflon components (e.g., Teflon-lined septa) from PFAS sample containers.

- Avoid using Blue Ice or similar items to cool samples and avoid placing such items in sample coolers for shipping. Use commercially available (e.g., from convenience stores or supermarkets) double-bagged ice instead.

Caution: Samples designated for PFAS analysis must be cooled to achieve a storage temperature of less than 6 ^{0}C. Cooling to this temperature may take several hours, and sample temperatures may not achieve 6 ^{0}C by the time they arrive at the laboratory. If sample temperatures upon arrival at the laboratory are not less than 10 ^{0}C, the laboratory may conclude that sample preservation was compromised and may reject the samples. Therefore, place samples on ice as soon after collection as possible. On warm days, or when a representative from a nearby laboratory picks up the samples, take extra care (e.g., use more ice or delay shipment, if necessary) to ensure that sample temperatures will not exceed 10 ^{0}C when the samples arrive at the laboratory.

- Use of commercially available plastic bags (e.g., 3-mil-thick trash can liners) for lining coolers to prevent leakage and to separate potential melt water from chain-of-custody forms is allowed.

7.2 Other Precautions for Sample Handling

- Wash hands thoroughly before sampling and after handling fast food, carryout food, snacks, or other items that may contain PFAS. Do not carry pre-packaged food items such as candy bars or microwave popcorn into sampling areas.

- Assume that shipping tape used for securing coolers could contain PFAS; therefore, take care not to transfer PFAS from tape to samples.

- Minimize exposure of samples to light. This can be done by placing the collected samples into a cooler (with ice) and closing the cooler lid.

- If in doubt about a particular product or item that comes into contact with environmental media to be sampled or is near to sampling operations, consider collecting and analyzing a rinsate blank using laboratory-supplied PFAS-free water to test the item for contamination potential. Consult the Tetra Tech PM in these cases to verify whether collection of additional blanks is warranted.

- Support personnel that are within 3 meters of the sample processing area are considered subject to the same restrictions related to precautionary measures for clothing and food as applied to sampling personnel.

These precautions must be observed during sampling activities, especially during water sample collection (groundwater, water supply, and surface water), given the high solubilities of PFAS in water. Examples of how these precautions may be applied to sampling of specific media are provided in the following sections.

7.3 Groundwater Sample Acquisition

The precautions and requirements identified in Sections 7.1 and 7.2 must be observed for groundwater sampling. Do not proceed any further without reviewing each of those precautions and requirements.

- Collect groundwater samples for PFAS analyses in accordance with this SOP, SOP SA-1.1, and/or project- or client-specific requirements.

- If non-dedicated non-disposable equipment is used between sampling locations, it should be decontaminated with Alconox or Liquinox, unless 1,4-dioxane (a potential component of Liquinox) is also a contaminant of concern. In that case, Liquinox should not be used. Products such as Decon 90, which contains fluorosurfactants, should not be used. Alconox or Liquinox rinses should be followed by a potable water rinse then deionized water rinse. The final decontamination rinse for DoD projects must be with water certified by the laboratory to be PFAS-free.

- If sampling for multiple analytes using PFAS-appropriate equipment, collect samples for PFAS analysis last to ensure adequate purging and conditioning of sampling equipment. If practical to do so, suitable PPE (especially gloves) may also be changed out for PFAS sampling. For example, purge and sample a monitoring well for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals using a peristaltic pump with HDPE and silicone tubing, then collect the material for PFAS analysis. If either the proper sampling sequence or proper equipment is unclear, consult the FOL or Tetra Tech PM and record the actual sequence in the field notes.

- If sampling wells that have or had dedicated Teflon or FEP tubing that potentially contained PFAS, remove the dedicated tubing and, using silicone or HDPE tubing, remove at least one well volume from the target sampling interval prior to sampling. Accomplish this removal in a manner that is rigorous enough to remove the entire water column from the well and not just a limited vertical interval of the water column. This will minimize the potential for collecting a sample that was in contact with the Teflon/FEP tubing.

- The use of detergents must be avoided during decontamination of drilling or other heavy equipment. All equipment must be scrubbed with a plastic brush or steam cleaned with potable water, and rinsed thoroughly in potable water to clean away any debris or material on exposed surfaces.

- Sample(s) representing any water collected at the point of use (e.g., water truck or tank on site) used by the driller for drilling purposes must be analyzed for PFAS. See Section 7.8 for guidance on waste management.

- Collect drinking water samples to be analyzed using U.S. EPA Method 537 in clean polypropylene sample bottles with a polypropylene screw cap; for all other samples, use clean, laboratory-supplied, HDPE bottles with unlined plastic screw caps.

7.4 Soil Sample Acquisition

The precautions and requirements identified in Sections 7.1 and 7.2 must be observed for soil sampling. Do not proceed any further without reviewing each of those precautions and requirements.

- Collect soil samples for PFAS analyses in accordance with this SOP, SOP SA-1.3, and/or project- or client-specific requirements. Review client–specific (e.g., DoD component) guidance or previously approved Sampling and Analysis Plans (SAPs).

- Soil sampling equipment should not be constructed of or contain Teflon or other materials likely to contain or be coated with PFAS. Acceptable materials for sampling include stainless steel, acetate, and HDPE.

- If non-dedicated non-disposable equipment is used between sampling locations, it should be decontaminated with Alconox or Liquinox, unless 1,4-dioxane (a potential component of Liquinox) is also a contaminant of concern. In that case, Liquinox should not be used. Products such as Decon 90, which contains fluorosurfactants, should not be used. Alconox or Liquinox rinses should be followed by a potable water rinse then deionized water rinse. The final decontamination rinse for DoD projects must be with water certified by the laboratory to be PFAS-free.

- Collect samples in laboratory-provided HDPE containers specifically designated for PFAS analysis. Do not use glass jars typically used for soil sample collection because some PFAS may irreversibly adsorb to the glass and could create a negative bias in the measured PFAS concentrations.

7.5 Surface Water and Sediment Sample Acquisition

The precautions and requirements identified in Sections 7.1 and 7.2 must be observed for surface water and sediment sampling. Do not proceed any further without reviewing each of those precautions and requirements.

- Collect surface water and sediment samples for PFAS analysis in accordance with this SOP, SOP SA-1.2, and/or project- or client-specific requirements.

- Surface water and sediment sampling equipment should not be constructed of or contain Teflon or LDPE materials. Acceptable materials for sampling include HDPE, silicone, stainless steel, and acetate. Do not use glass. The bottleware should be supplied clean by the laboratory and specifically designated for PFAS analysis. If transfer bottles are required for collection of surface water samples, the transfer bottles used should be of the same material as the containers designated for submission to the laboratory.

- For surface water sample collection, invert the capped sample bottle, with the opening pointing downward, at least 10 cm below the water surface, at least 10 cm above the bottom of the water body, and as close to the center of the channel or water body as practical. To collect the sample,

uncap the bottle underneath the water surface and point the bottle upward so that gloved hands, sample container, and sampler are downstream of where the sample is being collected.

- For aquatic samples collected from the shoreline or via wading, ensure that waders are constructed of fabric that has not been treated with waterproofing coatings, and stand downstream of the sample bottle during sample collection.

- If non-dedicated non-disposable sampling equipment is used between sampling locations, it should be decontaminated with Alconox or Liquinox, unless 1,4-dioxane (a potential component of Liquinox) is also a contaminant of concern. In that case, Liquinox should not be used. Products such as Decon 90, which contains fluorosurfactants, also should not be used. Alconox or Liquinox rinses should be followed by a potable water rinse then deionized water rinse. The final decontamination rinse for DoD projects must be with water certified by the laboratory to be PFAS-free.

- Avoid reusing non-stainless-steel equipment (e.g., porewater observation devices consisting of slotted PVC pipe and silicone tubing) when collecting porewater samples.

7.6 Water Supply Sampling

This section applies to sampling from taps, spigots, faucets, or similar devices for PFAS analysis. The precautions and requirements identified in Sections 7.1 and 7.2 must be observed for water supply sampling. Do not proceed any further without reviewing each of those precautions and requirements.

- Collect water supply samples for PFAS analysis in accordance with applicable portions of SOP SA-1.7 and/or project- or client-specific requirements.

- Water supply sampling equipment (if needed) should not be constructed of or contain Teflon or LDPE materials. Acceptable materials for sampling include HDPE, polypropylene (drinking water sampling only), small amounts of silicone (e.g., short runs of silicone tubing used in peristaltic pumps), stainless steel, and acetate. Non-drinking water supply samples should be collected in clean, laboratory-supplied, HDPE bottleware specifically designated for PFAS analysis (not glass). Collect drinking water samples in clean polypropylene bottles supplied by the laboratory.

- Ensure that sample bottles used to collect chlorinated water samples contain the proper Trizma preservative (5 g/L to remove chlorine). Non-chlorinated water does not require chemical preservatives designed to remove chlorine.

- If non-dedicated non-disposable equipment is used between sample locations, it should be decontaminated with Alconox or Liquinox unless 1,4-dioxane (a potential component of Liquinox) is also a contaminant of concern. In that case, Liquinox should not be used. Products such as Decon 90, which contains fluorosurfactants, also should not be used. Alconox or Liquinox rinses should be followed by a potable water rinse then deionized water rinse. The final decontamination rinse for DoD projects must be with water certified by the laboratory to be PFAS-free.

- Locate the sampling point. If a specific sampling point has already been designated (e.g., a kitchen tap), plan to collect the sample from that point. Otherwise, identify a location in the water supply line that is as close as possible to the water's point of origination (e.g., a well or other water source) and upstream of any local water treatment unit(s) that could affect PFAS levels (e.g., water softeners, activated carbon, or reverse osmosis treatment units). If a treatment unit is in use, a post-treatment sample may also be required in some cases, per project requirements.

Note: If treatment that could affect PFAS levels (e.g., carbon filtration or reverse osmosis) is part of the water distribution system, often a spigot will be present in the plumbing line between the water source and the treatment unit, and this spigot should be used for sample collection.

- Remove any aerator/diffuser from the faucet, if possible. If removal is not possible, record this observation in the field notes.

- Allow the water to run freely from the tap until water quality parameter stabilization per project-specific requirements is achieved, or as otherwise required by project-specific requirements. This will often require purging for 3 to 5 minutes.

- Reduce the water flow rate to minimize aeration of the sample. The water stream should be no wider than the diameter of a pencil.

- Fill the sample bottle (typically 250 mL) directly from the tap to the bottom of the neck of the bottle, and cap the bottle immediately.

- After collecting the sample, cap the bottle and, if preservative is included, agitate by hand until the preservative is dissolved.

- Do not use filters when collecting samples because the filters may introduce PFAS contamination or absorb PFAS and thus reduce PFAS concentrations in the samples.

7.7 Field Reagent Blank Collection

Note: If PFAS are detected in site samples, FRBs may be analyzed to assess whether PFAS in site samples could be non-site-related contamination and whether resampling is necessary. U.S. EPA Method 537 and modifications or derivatives thereof for PFAS analysis require an FRB to be handled along with each sample set. A sample set is described as samples collected from the same sample site and at the same time, but “sample site” and “same time” are not precisely defined. Therefore, it is important to verify that the correct number of FRBs will be collected. The intent is to be able to verify whether samples have been contaminated and to help identify the source of contamination. In general, collecting one FRB at each sampling point is recommended when sampling drinking water; fewer FRBs are recommended when sampling non-drinking water matrices. The actual number will depend on project needs. *Collection of an FRB at every sampling point may be required.*

- Verify the number of FRBs to be collected for the project and where those samples must be collected. This should be described in the project planning documents such as work plans or SAPs. If it is not, consult the PM.

Note: Chemical preservative may not be included in FRBs that are used when sampling non-drinking water matrices.

- At the sampling site, when ready to collect an FRB, open the bottle of chemically preserved FRB reagent water provided by the laboratory and a corresponding clean empty bottle, also provided by the laboratory.

- Pour the preserved FRB reagent water into the empty sample bottle, close the cap, and label this filled bottle as the FRB.

- Pack and ship the FRB along with site samples and required documentation (e.g., chain-of-custody form) to the laboratory.

Note: Although chain-of-custody forms will indicate that FRBs must be analyzed for PFAS, analysis of an FRB will be required only if site samples contain PFAS greater than a certain concentration. If an FRB is analyzed and any PFAS concentration in the FRB exceeds one-third of the laboratory minimum reporting limit (or equivalent), all samples collected with that FRB may be considered invalid and may require recollection and reanalysis. Consult the project planning documents governing sample collection for specifics as to whether resampling is necessary. Care in collection and handling of site samples and FRBs in a way that avoids contamination cannot be overemphasized.

Note: It will be necessary to associate individual FRBs with corresponding site samples; otherwise, decisions about which samples to recollect (if recollection is indicated) could be compromised. Associations between FRBs and corresponding site samples may be accomplished by marking chain-of-custody forms with the associations, but other methods also may be useful. Consult the governing planning document or the PM for guidance, if necessary.

7.8 Disposal of Investigation-Derived Waste Potentially Containing PFAS

PFAS are not hazardous wastes as defined in the Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act. It may be possible to dispose of PFAS-containing solid waste as non-hazardous, but sampling solid waste material for PFAS analysis is not advised. Consult the client PM or on-site point of contact to verify their current disposal acceptance criteria, and indicate on waste manifests that the waste potentially contains PFAS. Waste water potentially containing PFAS should be analyzed for PFAS to determine the appropriate disposal option. If the sum of PFOA and PFOS concentrations is less than 70 ng/L the water may be disposed of without special handling if no other enforceable regulations apply; otherwise, the water should be treated to reduce the PFOA + PFOS concentration to an acceptable level or should be directed to an appropriate treatment facility for disposal. On-site treatment (e.g., granular activated carbon filtration) may be appropriate. Consult the client PM or on-site point of contact for direction regarding disposal.

Note: If aqueous investigation-derived waste (IDW) is expected to contain greater than 70 ng/L combined PFOA and PFOS (e.g., captured residual AFFF or AFFF concentrate from an accidental release in a hangar), special actions may be necessary and the client PM should be consulted. For wastes that are dewatered and potentially contain PFAS, containerize the waste water and analyze it for PFAS prior to disposal.

8.0 REFERENCES

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