

Per- & Polyfluoroalkyl Substances (PFAS) General Sampling Guidance

Oklahoma Department of Environmental Quality (DEQ)
General Guidance and Protocols for PFAS Sampling

April 2022



Disclaimer:

This document is for informational purposes only. Any mention of or reference to commercial products, processes, or services by trade name, trademark, manufacturer, or otherwise does not imply an endorsement by the Oklahoma Department of Environmental Quality (DEQ) or the U.S. Environmental Protection Agency (USEPA) and shall not be used for advertising or product endorsement purposes. DEQ does not endorse any commercial products, services, or enterprises.

This document and the associated Standard Operating Procedures were developed by graduate students in the Professional Science Master's Program at Oklahoma State University working under the direction of Dr. Ken Ede. DEQ would like to thank the following graduate students for developing these documents: Gianna Barolin, Debbie Bedingfield, and Lauren Meyer.

TABLE OF CONTENTS

1.0 INTRODUCTION AND OBJECTIVE	5
1.2 Objective	5
2.0 PROJECT PLANNING	5
3.0 POTENTIAL CROSS-CONTAMINATION SOURCES	7
3.1 Field Clothing, Gloves, Boots, and PPE	8
3.2 Sun and Insect Protection	11
3.3 Personal Care Products	12
3.4 Food Containers	13
3.5 Sampling Containers	14
3.6 Sampling Equipment	15
3.7 Field Materials	16
3.8 Decontamination Materials	17
4.0 GENERAL PFAS SAMPLING PROCEDURES	17
4.1 Sample Containers, Handling, and Collection	17
4.2 Sample Shipment	18
4.3 Preferential Sampling Sequence	19
5.0 QUALITY ASSURANCE GUIDELINES	19
6.0 APPENDICES	20
6.1 Supplemental Information Links	20
7.0 REFERENCES	21

LIST OF TABLES

TABLE		PAGE
1	Clothing	10
2	Boots	10
3	Gloves	10
4	PPE	11
5	Suggested Field Clothing and PPE Brand and Product Names	11
6	Brand Names Utilizing PFC-Free Water Repellent Down	12
7	Prohibited Field Clothing and PPE Brand and Product Names	12
8	Sun Protection	13
9	Insect Protection	13
10	Allowed/Approved Sunscreens	13
11	Approved Personal Care Products (Cosmetics and Skincare)	14
12	Approved Personal Care Products (Floss)	14
13	Food Containers	15
14	Sampling Containers	16
15	Sampling Equipment	16
16	Field Materials	17
17	Decontamination Procedures	18
18	Sample Shipment	20

LIST OF ACRONYMS

Acronyms used throughout the Oklahoma Department of Environmental Quality (DEQ) General Guidance and Protocols for PFAS Sampling are as follows:	
BT - Breakthrough	PCTFE – Polychlorotrifluoroethylene
CAA – Clean Air Act	PEHD – Polyethylene high-density
CWA – Clean Water Act	PFAS – Per- and Polyfluoroalkyl Substances
° C – Degrees Celsius	PFC - Perfluorochemical
EB – Rinsate/Equipment Blank	PFOA – Perfluorooctanoic acid
ETFE – Ethylene-tetrafluoroethylene	PFOS – Perfluorooctanesulfonic acid
FB – Field Blank	ppb – Parts per billion
FD – Field Duplicates	PPE – Personal protective equipment
FDA – Food and Drug Administration (United States of America)	ppq – Parts per quadrillion
FRM – Federal Reference Methods	ppt – Parts per trillion
FSMB – Field Sampling Media Blank	PTFE – Polytetrafluoroethylene
FTOH – Fluorotelomer Alcohols	PVC – Polyvinyl chloride
HASP – Health and Safety Plan	PVDF – Polyvinylidene fluoride
HDPE – High-density polyethylene	QA/QC – Quality assurance/quality control
ITRC – Interstate Technology & Regulatory Council	QAPP – Quality Assurance Project Plan
LC-MS/MS - Liquid chromatography/mass spectrometry	SAP – Sampling Analysis Plan
LDPE – Low-density polyethylene	SOP – Standard Operating Procedures
MDEQ – Michigan Department of Environmental Quality	STPB – Sample Train Proof Blank
mL – milliliter	TB – Trip Blank
DEQ – Oklahoma Department of Environmental Quality	TO – Toxic Organic Methods
OTM – Other Test Methods	USEPA – United States Environmental Protection Agency
PCPs – Personal care products	UV - Ultraviolet

1.0 INTRODUCTION AND OBJECTIVE

1.1 Introduction

Per- and polyfluoroalkyl substances (PFAS) are a complex class of man-made chemicals that have been manufactured and used in a variety of products since the 1940s (PFAS Strategic Roadmap, 2021). PFAS exhibit many useful traits, including thermal stability, low reactivity, and hydrophobic/lipophobic surfactant properties. However, PFAS also have the capability for bioaccumulation and the potential to negatively impact human health. These substances are used in many industrial, commercial, and consumer products commonly present or used during a sampling event. Some common examples include stain, grease, and water repellent materials. PFAS guideline values (e.g. state health-based limits) are set at relatively low concentrations, such as in the parts per trillion (ppt) or parts per quadrillion (ppq) range; therefore, precautions must be taken to prevent cross-contamination with PFAS-containing materials, including, but not limited to, field sampling equipment, sample containers, personal care products (PCPs), personal protective equipment (PPE), clothing, and food packaging. PFAS-containing materials could potentially contaminate samples during the collection process, decontamination of sampling equipment, and the shipment and storage of samples. Due to the high probability of PFAS cross-contamination, stringent guidelines must be followed to design and implement effective PFAS sampling processes and procedures.

Currently, the Oklahoma Department of Environmental Quality (DEQ) and the United States Environmental Protection Agency (USEPA) do not regulate PFAS in environmental media. While there are no federal or state regulations, the USEPA has established a lifetime health advisory (HA) for two PFAS, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), separately or combined, of 70 parts per trillion (ppt) in drinking water. With their release of a PFAS Strategic Roadmap in October 2021, the USEPA has set timelines for additional regulatory actions on PFAS within 2022 and 2023.

1.2 Objective

The DEQ Per- & Polyfluoroalkyl Substances (PFAS) General Sampling Guidance document was developed to establish general PFAS sampling guidance protocols and prevent sample cross-contamination with PFAS-containing materials. The DEQ sampling guidance protocol should be reviewed before collecting PFAS samples and implemented accordingly to meet the DEQ PFAS sampling quality objectives. Updates to this DEQ sampling guidance protocol will occur as additional PFAS regulatory advisories and directives are received from the USEPA.

2.0 PROJECT PLANNING

The DEQ recommends that a comprehensive project-specific Quality Assurance Project Plan (QAPP) be developed before conducting a PFAS sampling event. The QAPP should follow EPA Guidance for Quality Assurance Project Plans (QA/G-5) and include project objectives, project organization, responsible parties and related duties, sampling design, sampling methods, sample handling and custody, analytical method requirements, quality control, instrument/equipment testing and maintenance, instrument/equipment calibration and frequency, inspection/acceptance for supplies and consumables, reporting requirements, special training/certification requirements, data management and storage, and data assessment procedures. The QAPP should also clearly state and identify environmental media-specific PFAS sampling processes and procedures, preventative measures required to prevent sample cross-contamination, including the decontamination of sample equipment, acceptable and not acceptable sample containers, field clothing, PPE, PCPs, food packaging, and the shipment and storage of samples.

In addition to the QAPP, a comprehensive site-specific sampling plan or work plan must be written before conducting a PFAS sampling event. A sampling plan will provide guidance for approved supplies and equipment, sampling methods to be conducted at the site, and the sampling sequence order. The sampling plan should also include the setup of the staging area, a checklist of acceptable sampling supplies, field clothing, PPE, and specific procedures to address decontamination processes when moving to and from the staging and sampling area. A detailed site-specific sampling plan can ensure a successful PFAS sampling event and prevent cross-contamination.

Some general guidelines for information that would be useful to include in a QAPP for a PFAS sampling event are as follows:

- The certified laboratory to be used for analysis of samples
- A site map showing sample locations
- Matrix type (e.g. soil, drinking water, surface water, groundwater, air, fish tissue, etc.)
- Number or frequency of samples to be collected per matrix
- A detailed sampling procedure for each matrix which will be assessed
- Number of field, equipment, and trip blanks per matrix
- Analytical parameters (i.e. the list of PFAS to be analyzed) to be measured per matrix
- PFAS analytical methods to be used per matrix with minimum reporting limits achievable by the laboratory
- The laboratory method detection limits for the PFAS compounds to be analyzed

- Number and type of matrix spike and matrix spike duplicate samples to be collected
- Number and type of duplicate samples to be collected
- Sample preservation to be used per analytical method and sample matrix
- Sample container volume and type to be used per analytical method and sample matrix
- Sample holding time to be used per analytical method and sample matrix
- The laboratory Standard Operating Procedure (SOP) for PFAS analysis

General USEPA Guidance for developing Quality Assurance Project Plans can be found at the following web address:

<https://www.epa.gov/quality/guidance-quality-assurance-project-plans-epa-qag-5>

3.0 POTENTIAL CROSS-CONTAMINATION SOURCES

Unlike many contaminants, PFAS are frequently used in everyday products. To maintain sample integrity and avoid cross-contamination, the DEQ has developed general guidance for products that are allowed, not allowed, or need additional research before usage at a sampling site. This section will discuss appropriate items for field clothing and PPE, sun and insect protection, personal care products, food containers, sampling containers, sampling equipment, field materials, and decontamination. A materials screening should be conducted during the QAPP development or the planning phase of the sampling program, and the screening should be conducted for all items and materials that are expected to come in contact with the samples. An equipment blank sample is recommended for any equipment that has unknown PFAS content that will come into contact with sample media, to confirm the equipment is PFAS-free.

The following listings may not be comprehensive, and the addition or omission of a brand does not constitute endorsement or disapproval by the DEQ. The DEQ recommends verifying that the product(s) remain PFAS-free before utilization.

The personal safety of field personnel should be paramount and not compromised due to concern for cross-contamination. However, samplers should make every effort to prevent sample contamination. If PFAS-containing PPE is necessary to ensure the health and safety of field personnel and PFAS-free alternatives are unavailable, the PPE should be used and documented in the field notes and analytical report.

3.1 Field Clothing, Gloves, Boots, and PPE

Table 1 provides guidelines for the selection of clothing. Some kinds of clothing appropriate for fieldwork, particularly weather-resistant clothing, are coated with PFAS. To avoid the potential of shedding PFAS on-site, samplers should follow the recommendations provided in Table 1. Tables 5 and 6 provide additional guidance for selecting PFAS-free field clothing.

Table 1: Clothing ¹		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • Well laundered clothing (recommended six times prior to sampling) • 100% cotton (preferred) • Synthetic fabrics • Polyvinyl Chloride (PVC) • Polyurethane • Uncoated Tyvek® clothing • Wax-coated fabrics. • Rubber/Neoprene 	<ul style="list-style-type: none"> • New/unwashed clothing • Clothing applied/washed with fabric softeners, fabric protectors including ultraviolet (UV) protection, water, dirt or stain-resistant chemicals, or insect-resistant chemicals • Clothing containing Tyvek® • Flame resistant (FR) clothing • Clothing made of Gore-Tex or other known PFAS containing materials. 	<ul style="list-style-type: none"> • Tyvek® suits, clothing that contains Tyvek®, or coated Tyvek®

¹Clothing should be kept dust and fiber free.

Table 2 provides guidelines for the selection of boots. Preferably, samplers should select boots made of known PFAS-free materials, such as PVC or polyurethane. In the case where PFAS-free boots cannot be purchased, samplers may use PFAS-free boot covers. The samplers must wash their hands with PFAS-free water after putting on boot covers and before sampling activities. The boot covers may only be removed in the staging area and after the sampling activities have been completed.

Table 2: Boots		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • Polyurethane boots • PVC boots • PFAS-free boot covers 	<ul style="list-style-type: none"> • Gore-Tex® boots • Boots made from water-resistant synthetics 	

Table 3 below provides guidelines for the selection of gloves.

Table 3: Gloves		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • Powderless nitrile gloves¹ 	<ul style="list-style-type: none"> • Gore-Tex gloves • Any glove made with PFAS-containing materials. 	<ul style="list-style-type: none"> • Latex gloves • Water and dirt-resistant leather gloves • Any special gloves required by a Health and Safety Plan (HASP).

¹Samplers must wash their hands with PFAS-free water before putting on any gloves.

Table 4 below provides guidelines for the selection of other common non-clothing PPE items. Preferably, samplers will need to wear hard hats and safety glasses primarily composed of high-density polyethylene (HDPE). There is minimal research available on these items.

Table 4: PPE¹		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • Hard hats made of HDPE • Hard hat covers/liners (i.e. Head Gaiters) made of cotton or other natural fabric • Safety glasses made of HDPE • Life jackets made of polyethylene foam and nylon shell fabric • Waders made of Neoprene or other PFAS-free material 	<ul style="list-style-type: none"> • Waders made of Gore-Tex or other known PFAS containing materials 	<ul style="list-style-type: none"> • Hard hats or safety glasses not made of HDPE

¹PPE should be kept dust and fiber free.

Table 5 lists approved waxed-cotton products and/or DownTek™ PFC¹-free Water Repellent Down clothing product lines that are PFAS-free. The DownTek™ PFC-free Water Repellent Down Material uses bluesign® approved chemistry that guarantees products are safe for the environment, employees, and users.

Table 5: Suggested Field Clothing and PPE Brand and Product Names	
• Men's L.L.Bean® Upcountry Waxed-Cotton Down Jacket	
• Women's L.L.Bean® Upcountry Waxed-Cotton Down Vest	
• Adults' L.L. Bean® Wool-Lined Waxed-Cotton Fowler's Cap	
• Men's L.L.Bean® Upcountry Waxed-Cotton Down Vest	
• ALPKIT Jura Mountain Smock Men's Jacket	
• ALPKIT Balance Women's Jacket	
• Maier Sports® DIABAS M Outdoor Men's Pants	
• Men's L.L. Bean® Waxed-Canvas Maine Hunting Shoes	
• Women's L.L. Bean® Signature Waxed-Canvas Maine Hunting Shoes	
• Adults' L.L. Bean® Waxed-Cotton Chopper Mittens	
• Big Agnes® Men's Zetto Jacket	

¹Perfluorochemicals (PFC) was the widely used designation for PFAS. While PFAS is currently the accepted nomenclature, some brands and research articles still use the term PFC.

Table 6 lists brands that are incorporating DownTek™ PFC-free Water Repellent Down in their down apparel product lines. The following listing may not be comprehensive, and the addition or omission of a brand does not constitute endorsement or disapproval by the DEQ. The DEQ does recommend verifying that the product(s) chosen remain PFAS-free prior to utilization.

Table 6: Brand Names Utilizing DownTek™ PFC-Free Water Repellent Down	
• ALPKIT LTD®	• L.L. Bean®
• Big Agnes®	• DynaFit®
• Featherstone®	• Fisher+Bake™
• Gordini™	• Jottnar™
• Kammo™	• Kathmandu®
• Maier Sports®	• Reecho®
• Salewa®	• Sync®
• Zajo®	• Zerogram®

Table 7 provides a list of prohibited field clothing brand and product names, adapted from a study conducted in 2015, by the Danish Ministry of the Environment. However, the manufacturer and/or vendor for the field clothing and/or PPE should be contacted to confirm that these brand or product names still contain PFAS. There have been instances where manufacturers have kept the same brand and/or product name, but have changed the chemicals used during the manufacturing of a particular item.

Table 7: Prohibited Field Clothing and PPE Brand and Product Names	
• Ultra Release Teflon®	• High-Performance Release Teflon®
• Repel Teflon® Fabric Protector	• Gore-Tex®
• High-Performance Repel Teflon® Fabric Protector	• Advanced Dual Action Teflon® Fabric Protector
• NK Guard® S Series	• GreenShield®
• Tri-Effects Teflon® Fabric Protector	• Lurotex Protector RL ECO®
• Oleophobol CP®	• Repellan KFC®
• Rucostar® EEE6	• Unidyne™
• Bionic Finish®	• RUCO-GUARD®
• RUCOSTAR®	• RUCO-COAT®
• RUCO-PROTECT®	• RUCOTEC®
• RUCO®	• Resist Spills™
• Resists Spills and Releases Stains™	• Scotchgard™ Fabric Protector
• Release Teflon®	

*Source: Lassen et al., 2015

3.2 Sun and Insect Protection

Tables 8 and 9 below provide guidelines for the selection of sunscreen and insect repellants.

Table 8: Sun Protection		
Allowed	Not Allowed	Needs Additional Research
• Approved Sunscreens (See Table 10) ¹	• No unauthorized sunscreen	• Baby sunscreens that are “free” or “natural.”

Table 9: Insect Protection ¹		
Allowed	Not Allowed	Needs Additional Research
• OFF® Deep Woods • Sawyer® Permethrin		

¹Approved sunscreens and insect repellents should not be applied near the sample collection area. Hands should be well washed after application or handling of these products, and afterwards; an uncontaminated clean/new pair of powderless nitrile gloves should be worn.

Table 10 contains a detailed list of sunscreens that have been analyzed and found to be PFAS-free. The following is not a comprehensive list of allowable sunscreens; other products may meet the requirements for use. The addition or omission of a brand does not constitute endorsement or disapproval by the DEQ. Also, because there is no guarantee that these products will always remain free of PFAS, the DEQ recommends verifying with the manufacturer that the production of these products remain PFAS-free prior to use at a PFAS sampling site.

Table 10: Allowed/Approved Sunscreens
• Banana Boat® for Men Triple Defense Continuous Spray Sunscreen SPF 30
• Banana Boat® Sport Performance Coolzone Broad Spectrum SPF 30
• Banana Boat® Sport Performance Sunscreen Lotion Broad Spectrum SPF 30
• Banana Boat® Sport Performance Sunscreen Stick SPF 50
• Coppertone® Sunscreen Lotion Ultra Guard Broad Spectrum SPF 50
• Coppertone® Sport High-Performance AccuSpray Sunscreen SPF 30
• Coppertone® Sunscreen Stick Kids SPF 55
• L'Oréal® Silky Sheer Face Lotion 50
• Meijer® Clear Zinc Sunscreen Lotion Broad Spectrum SPF 50
• Meijer® Sunscreen Continuous Spray Broad Spectrum SPF 30
• Meijer® Clear Zinc Sunscreen Lotion Broad Spectrum SPF 15, 30 and 50
• Meijer® Wet Skin Kids Sunscreen Continuous Spray Broad Spectrum SPF 70
• Neutrogena® Beach Defense Water+Sun Barrier Lotion SPF 70
• Neutrogena® Beach Defense Water+Sun Barrier Spray Broad Spectrum SPF 30
• Neutrogena® Pure & Free Baby Sunscreen Broad Spectrum SPF 60+
• Neutrogena® UltraSheer Dry-Touch Sunscreen Broad Spectrum SPF 30

3.3 Personal Care Products

Table 11, adapted from the Green Science Policy Institute, and Table 12 provide guidelines for the selection of PCPs (2021). The use of PCPs is considered precautionary due to the potential of cross-contamination of samples; therefore, the DEQ recommends only using approved PCPs during a sampling event. The following list of approved personal care products is not comprehensive, and the addition or omission of a brand does not constitute endorsement or disapproval by the DEQ. The DEQ recommends verifying that the product(s) chosen remains PFAS-free prior to utilization.

If PCP products are used, the sampler must apply these products away from the staging area, sampling bottles, and equipment, and hands shall be thoroughly washed after use and before a sampling event. The sampler must also put on a fresh pair of powderless nitrile gloves before sampling.

Table 11: Approved Personal Care Products (Cosmetics and Skincare)	
• Credo (all products)	
• Sephora (Clean at Sephora Products)	
• Annmarie Skin Care (all products)	
• California Baby (all products)	
• type: A Deodorant (all products)	
• Otter Wax (all body and skincare products)	
• Whole Foods Market (all products)	
• H&M (all store brand products)	
• Ulta Beauty (items on the Conscious Beauty by Ulta Beauty List)	
• Otter Wax (all body and skincare products)	

*Source: Green Science Policy Institute, 2021

Table 12: Approved Personal Care Products (Floss)	
• Coco Floss (all products)	• Radius Floss (All Products)
• Dental Lace (all products)	Rite-Aid (Premium Waxed Mint)
• Dr. Tung's (Smart Floss and Activated Charcoal Floss)	• Tom's of Maine (Antiplaque Spearmint)
• Desert Essence (tea tree oil dental tape)	
• Johnson & Johnson Listerine Cool Mint Reach Mint Waxed Reach Waxed Unflavored Reach Clean Paste Icy Mint Woven	• Oral-B Satin Floss Mint Deep Clean Ultra Mint

3.4 Food Containers

Table 13 provides guidelines for the presence of food and food containers at PFAS sampling sites. PFAS has been used in the food packing industry on paper and paperboards as a protective coating against oil, grease, and water since the 1950s. PFAS can be found in a variety of food products such as paper plates, bags, food containers, and wraps. While the U.S. Food and Drug Administration (FDA) has prohibited the use of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) in packaging materials, other PFAS can still be used, and PFOA/PFOS can still be found in packaging due to usage of recycled materials. Studies have found up to 57% detection of PFAS in food contact materials (Trier et al., 2011; Schaidler et al., 2017). Due to the prevalence of PFAS in food packages, the DEQ recommends the following guidelines.

Staff should move to a designated eating area set up for food and beverage consumption. When finished, staff should wash their hands and put on a fresh pair of powderless nitrile gloves at the staging area before returning to the sampling area. Food packaging and products must not be in the sampling and staging areas during sampling events due to the potential for PFAS cross-contamination.

Table 13: Food Containers		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • Food packaging and products within the staging area 	<ul style="list-style-type: none"> • Food packaging and products in the sampling area 	<ul style="list-style-type: none"> • Bringing foods rewrapped in PFAS-free materials

3.5 Sampling Containers

Table 14 provides guidelines for the selection of sampling containers at PFAS sampling sites. The laboratory performing the PFAS analysis will provide the sampling containers; the laboratory will ensure the containers are PFAS-free. Sampling containers not sourced from the laboratory should not be used. The sampling containers must be kept sealed at all times and only open during the sample collection. The sampling container cap should never be placed on any surface unless it is PFAS-free. The sampling container cap must never be placed directly on the ground.

Table 14: Sampling Containers		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • HDPE, also known as polyethylene high-density (PEHD) • Polypropylene • Stainless Steel • Unlined bottle caps • Low-density polyethylene (LDPE) resealable bags (Ziplock) that will not come in contact with the sample media 	<ul style="list-style-type: none"> • Polytetrafluoroethylene (PTFE) lined bottles or caps (i.e. Teflon® and Hostafion®) • LDPE containers that will contact the sample media • Aluminum foil is not to be used due to the possibility of it being coated with PFAS. Utilize an alternative sample preparation and storage material. 	<ul style="list-style-type: none"> • Glass bottles and containers¹

¹Glass bottles or containers may be used if they are known to be PFAS-free; however, PFAS have been found to adsorb to glass, especially when the sample is in contact with the glass for an extended period of time (e.g., stored in a glass container). If the sample comes into direct contact with the glass for a short period of time (e.g., using a glass container to collect the sample, then transferring the sample to a non-glass sample bottle), the adsorption is minimal. Generally, glass bottles or containers should not be used for PFAS samples.

3.6 Sampling Equipment

Table 15 provides guidelines for the selection of sampling equipment at PFAS sampling sites. Matrix-specific guidelines for sampling equipment can be found in each of their respective corresponding documents.

Table 15: Sampling Equipment		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • HDPE (also PEHD) • Polypropylene • Stainless Steel • Acetate • Silicone 	<ul style="list-style-type: none"> • Polytetrafluoroethylene (PTFE)¹ • Polyvinylidene fluoride (PVDF)² • Polychlorotrifluoroethylene (PCTFE)³ • Ethylene-tetrafluoroethylene (ETFE)⁴ • Low-density polyethylene (LDPE) which will contact the sample media⁵ 	<ul style="list-style-type: none"> • Glass equipment

¹ Polytetrafluoroethylene (PTFE) that includes the trademark Teflon® and Hostafion®, which can be found in many items, including but not limited to the lining of some hoses and tubing, some wiring, certain kinds of gears, and some objects that require the sliding action of parts.

² Polyvinylidene fluoride (PVDF) that includes the trademark Kynar®, which can be found in many items, including but not limited to tubing, films/coatings on aluminum, galvanized or aluminized steel, wire insulators, and lithium-ion batteries.

³ Polychlorotrifluoroethylene (PCTFE) that includes the trademark Neoflon®, which can be found in many items, including but not limited to valves, seals, and gaskets.

⁴ Ethylene-tetrafluoroethylene (ETFE) that includes the trademark Tefzel®, which can be found in many items, including but not limited to the wire and cable insulation and covers, films for roofing and siding, liners in pipes, and some cable tie wraps.

⁵ Low-density polyethylene (LDPE) for any items that will come into direct contact with the sample media. LDPE can be found in many items, including but not limited to containers and bottles, plastic bags, and tubing. (Unless equipment blank has confirmed it to be PFAS-free). LDPE does not contain PFAS in the raw material but may contain PFAS cross-contamination from the manufacturing process.

3.7 Field Materials

Table 16 provides guidelines for the selection of various field materials at PFAS sampling sites.

Table 16: Field Materials		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • Aluminum, polypropylene, or Masonite field clipboards • Rite in the Rain® notebooks • Loose paper (non-waterproof, non-recycled) • Ballpoint pens and pencils 	<ul style="list-style-type: none"> • Clipboards coated with PFAS-containing materials • Notebooks made with PFAS treated paper • PFAS treated loose paper • Post-It® Notes or other adhesive paper products • Sharpie® markers • Coated materials, including paper towels • Aluminum foil is not to be used due to the possibility of it being coated with PFAS. Utilize an alternative sample preparation and storage material. 	<ul style="list-style-type: none"> • Plastic clipboards, binders, or spiral hardcover notebooks • Waterproof field books • All markers not listed as allowable

Field vehicles may have seats treated with stain-resistant products and could represent a source of cross-contamination. If possible, cover treated vehicle seats with a well-laundered cotton blanket or sheet. Never handle sample containers on the vehicle seats. Always change gloves after exiting a field vehicle.

3.8 Decontamination Materials

Table 17 provides guidelines for the selection of decontamination materials. Sampling equipment must always be cleaned and decontaminated before use. Additionally, sampling equipment must be decontaminated after sampling at each location or at the end of the workday. A separate set of sampling containers and equipment dedicated to PFAS sampling is recommended.

Table 17: Decontamination Procedures		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> Alconox®, Liquinox®, or Citranox® Triple rinse with PFAS-free water¹ Cotton cloth or untreated paper towels Polyethylene or PVC brush to remove particulates 	<ul style="list-style-type: none"> Decon 90® PFAS treated paper towels Reusing non-dedicated equipment without decontaminating 	<ul style="list-style-type: none"> Municipal water¹ Recycled or treated paper towels

¹Decontamination procedures should include a triple rinsing with PFAS-free water for equipment such as dippers, balers, spades, etc. Laboratory supplied PFAS-free deionized water is preferred for cleaning and decontamination. Samplers may use commercially available deionized water or municipal drinking water if the water is verified to be PFAS-free.

4.0 GENERAL PFAS SAMPLING PROCEDURES

4.1 Sample Containers, Handling, and Collection

Containers for PFAS sampling should come from an accredited laboratory that will be performing the PFAS analysis. The sampling containers provided must be verified to be PFAS-free. An accredited laboratory must demonstrate awareness and implement processes to eliminate possible cross-contamination from sample containers, laboratory supplies, and equipment used for analyses. The specific sampling containers for each environmental media can be found in their respective documents (e.g., Per- & Polyfluoroalkyl Substances (PFAS) Soil and Sediment Sampling Guidance, etc.)

Before sampling, all staff should be made aware of textiles and fabrics that are treated with PFAS, such as car interiors, carpets, stain-resistant surfaces, and surfaces that repel water. These textiles and fabrics have the potential of being treated with PFAS and could result in the cross-contamination of the sample. All sampling containers and equipment should not come in contact with or be stored on PFAS containing materials after decontamination or during sampling events.

Some general guidelines for sample containers, handling, and collection at a PFAS sampling event are as follows:

- Samplers must put on new and clean powderless nitrile gloves before handling sample containers and equipment, or collecting a sample.
- The sample containers must remain sealed at all times and only opened during the sample collection.
- The sampling container cap or lid should not be placed on a surface that is not PFAS-free and should never be placed directly on the ground.

4.2 Sample Shipment

The documentation in USEPA Method 533, Method 537.1, and Draft Method 1633 (to be finalized in 2022) should be used as guides for thermal preservation (holding temperature) and holding times for all environmental media samples (with the exception of biota samples).

The recommended method for sample storage and shipment is the usage of a cooler with regular ice. Chemical (blue) ice packs present a concern due to a potential to introduce PFAS contamination and should not be used. The sample temperature range during collection and through transit to the laboratory should be between +4 degrees celsius (°C) and -2 °C. The cooler should be taped closed with a custody seal and shipped by overnight courier to ensure the sample(s) arrive within the analytical holding time specified by the laboratory.

Table 18: Sample Shipment		
Allowed/Required	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> • Coolers filled with regular ice • Maintaining sample temperature between + 4 °C and - 2 °C • Double-bagging of samples and ice using bag materials made of HDPE (preferred) or LDPE (if sample does not come in contact) • Chain of Custody and other forms should be single bagged in LDPE (e.g. Ziploc®) storage bags and taped to the inside of the cooler lid. 	<ul style="list-style-type: none"> • Aluminum foil is not to be used due to the possibility of it being coated with PFAS. Utilize an alternative sample preparation and storage material. • Chemical (blue) ice packs 	<ul style="list-style-type: none"> • Chemical (blue) ice packs that are verified PFAS free

4.3 Preferential Sampling Sequence

Before a sampling event, a preferred sampling sequence should be established to reduce the possibility of cross-contamination. Generally, sampling should occur starting from the anticipated least-contaminated areas of the site to the most-contaminated. If the site has been sampled previously, existing data can aid in determining the spatial distribution of PFAS. If no previous data is available, potential sources and migration patterns at the site should be reviewed to aid in determining the sample sequence. For example, sites uphill and upgradient of a source should be examined first, followed by those most downgradient and/or from farthest to nearest the suspected source.

5.0 QUALITY ASSURANCE GUIDELINES

PFAS-containing products are prevalent in many materials; therefore, the potential for cross-contamination during PFAS sampling, transport, and storage of samples is likely. The DEQ recommends collecting several field quality control samples to evaluate whether cross-contamination has occurred during a PFAS sampling event. The project-specific QAPP and Sampling and Analysis Plan or Work Plan should address the frequency and type of quality control samples. Analytical methods for the environmental media tested for PFAS may provide specific instructions on the type and frequency of quality control samples required. A Health and Safety Plan must also be written and approved before sample collection.

5.1 Field Duplicate - Required

Field Duplicates (FD) are replicated samples collected from the sample location, at the same time and under the same circumstances as the field sample. The replicated samples are submitted to the laboratory as two distinct samples to verify field and laboratory precision. While the sampling organization should keep track of duplicates, the laboratory should receive the original and duplicate as two separate, anonymous, distinct samples which are not affiliated with one another.

5.2 Field Blank - Required

Field blank (FB) sample containers and supplies should be prepared and provided by the laboratory before the sampling event. A FB is conducted by pouring PFAS-free reagent water into a sampling container during a sampling event. A FB verifies the sampling site environment does not introduce PFAS cross-contamination during the sampling event including from ambient air and verifies laboratory accuracy.

5.3 Rinsate/Equipment Blank - Required

A rinsate/equipment blank (EB) sample is collected by pouring laboratory-verified PFAS-free water over or through decontaminated field sampling equipment before and between

collecting environmental samples. The rinsing should occur three times, with the third rinsate saved and collected for the rinsate/equipment blank. This process should be conducted on each piece of equipment. The purpose is to assess the adequacy of the decontamination process and evaluate the potential cross-contamination from the equipment used during the sampling event.

5.4 Trip Blank – Required

A trip blank (TB) is a bottle of PFAS-free water, prepared by the laboratory, that is transported from the laboratory to the sampling site and back to the laboratory without ever being exposed to any sampling procedures. A TB is used to evaluate cross-contamination that may have been introduced from the laboratory and during the shipping procedure.

6.0 APPENDICES

6.1 Supplemental Information Links

The following links are provided as supplemental information which may be useful for PFAS sampling. They are not a substitution for the recommended or required practices outlined in this document.

General Information:

- USEPA’s technical guidance
 - https://www.epa.gov/sites/default/files/2020-01/documents/pfas_methods-sampling_tech_brief_7jan2020-update.pdf
- Interstate Technology & Regulatory Council’s (ITRC) PFAS guidance
 - <https://pfas-1.itrcweb.org/navigating-this-web-site/>
- Michigan Department of Environmental Quality General and Media Specific PFAS Sampling Guideline documents
 - https://www.michigan.gov/pfasresponse/0,9038,7-365-88059_91297---,00.htm
- USEPA Field Equipment Cleaning and Decontamination at the FEC LSASDPROC-206
 - https://www.epa.gov/sites/default/files/2016-01/documents/field_equipment_cleaning_and_decontamination_at_fec206_af.r3_1.pdf
- PFAS Analytical Methods Development and Sampling Research
 - <https://www.epa.gov/water-research/pfas-analytical-methods-development-and-sampling-research>
- USEPA’s PFAS Strategic Roadmap: EPA’s Commitments to Action 2021-2024

USEPA Published Methods:

- USEPA Draft Method 1633
 - https://www.epa.gov/system/files/documents/2021-09/method_1633_draft_aug-2021.pdf
- USEPA Method 537.1
 - https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=343042&Lab=NERL
- USEPA SW-846 Test Method 8327
 - <https://www.epa.gov/hw-sw846/sw-846-test-method-8327-and-polyfluoroalkyl-substances-pfas-liquid-chromatographytandem>
- Method TO-13A
 - www.epa.gov/amtic/compendium-methods-determination-toxic-organic-compounds-ambient-air
- Method SW846 0100
 - www.epa.gov/hw-sw846/sw-846-test-method-0010-modified-method-5-sampling-train-0
- Method OTM-45
 - www.epa.gov/sites/default/files/2021-01/documents/otm_45_semivolatile_pfas_1-13-21.pdf
- Method TO-15A
 - www3.epa.gov/ttnamti1/files/ambient/airtox/to-15r.pdf

7.0 REFERENCES

California State Water Quality Resource Control Board. (2020, September). *Per- and polyfluoroalkyl substances (PFAS) sampling guidelines for non-drinking Water*.

https://www.waterboards.ca.gov/pfas/docs/sept_2020_pfas_sampling_guidelines.pdf

Costanza, J., Arshadi, M., Abriola, L. M., Pennell, K. D. (2019). *Accumulation of PFOA and PFOS at the air-water interface*, 6(8), 487-491.

<https://doi.org/10.1021/acs.estlett.9b00355>

Green Science Policy Institute (2021). *PFAS-free products*. PFAS Central.

<https://pfascentral.org/pfas-free-products/>

Interstate Technology & Regulatory Council. (2020). *PFS technical and regulatory guidance document and fact sheets PFAS-1*. Washington, D.C.:

Interstate Technology & Regulatory Council, PFAS Team. <https://pfas-1.itrcweb.org/>

Lassen, C., Jensen, A. A., Warming, M. (2015, August). Polyfluoroalkyl substances (PFAS) in textiles for children. *Survey of chemical substances in consumer products*, (137). Danish Environmental Protection Agency.

[https://www.researchgate.net/publication/299228813 Alternatives to perfluoroalkyl and polyfluoroalkyl substances PFAS in textiles LOUS Survey of chemical substances in consumer products](https://www.researchgate.net/publication/299228813_Alternatives_to_perfluoroalkyl_and_polyfluoroalkyl_substances_PFAS_in_textiles_LOUS_Survey_of_chemical_substances_in_consumer_products)

Michigan Department of Environment, Great Lakes, and Energy. (2019, December). *For technical staff and contractors - residential well PFAS sampling.*
[https://www.michigan.gov/documents/pfasresponse/Residential Well PFAS Sampling Guidance 634601 7.pdf](https://www.michigan.gov/documents/pfasresponse/Residential_Well_PFAS_Sampling_Guidance_634601_7.pdf)

Michigan Department of Environmental Quality. (2018, October 16). *General PFAS sampling guidance.*
[https://www.michigan.gov/documents/pfasresponse/General PFAS Sampling Guidance 634597 7.pdf](https://www.michigan.gov/documents/pfasresponse/General_PFAS_Sampling_Guidance_634597_7.pdf)

Michigan Department of Environmental Quality. (2018, October). *Groundwater PFAS sampling guidance.*
[https://www.michigan.gov/documents/pfasresponse/Groundwater PFAS Sampling Guidance 637871 7.pdf](https://www.michigan.gov/documents/pfasresponse/Groundwater_PFAS_Sampling_Guidance_637871_7.pdf)

Michigan Department of Environmental Quality. (2018, November). *Soil PFAS sampling guidance.*
[https://www.michigan.gov/documents/pfasresponse/Soil PFAS Sampling Guidance 639407 7.pdf](https://www.michigan.gov/documents/pfasresponse/Soil_PFAS_Sampling_Guidance_639407_7.pdf)

Michigan Department of Environmental Quality. (2018, November). *Surface water PFAS sampling guidance.*
[https://www.michigan.gov/documents/pfasresponse/Surface Water PFAS Sampling Guidance 639408 7.pdf](https://www.michigan.gov/documents/pfasresponse/Surface_Water_PFAS_Sampling_Guidance_639408_7.pdf)

New York Department of Environmental Conservation. (2021, June). *Sampling, analysis, and assessment of per- and polyfluoroalkyl substances (PFAS).*
www.dec.ny.gov/docs/remediation_hudson_pdf/pfassampanaly.pdf

Puls, R. W., & Barcelona, M. J. (1996). *Groundwater issue: Low-flow (minimal drawdown) groundwater sampling procedures* (EPA/504/S-95/504). United States Environmental Protection Agency.

https://www.csus.edu/indiv/h/hornert/Geol_210_Summer_2012/Week%20%20readings/Puls%20and%20Barcelona%201996%20Low%20flow%20sampling.pdf

Ryan, J. (2019, June 6). *EPA PFAS air emission measurements: activities and research*. United States Environmental Protection Agency.

https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NRMRL&dirEntryId=345762

Schaider, L. A., Balan, S. A., Blum, A., Andrews, D. Q., Strynar, M. J., Dickinson, M. E., Lunderberg, D. M., Lang, J. R., & Peaslee, G. F. (2017). Fluorinated compounds in U.S. fast food packaging. *Environmental Science & Technology Letters*, 4(3), 105-111. <https://doi.org/10.1021/acs.estlett.6b00435>

Shoemaker, J. A. & Tettenhorst, D. R. (2018, November 2). *Method 537.1: Determination of selected per- and polyfluorinated alkyl substances in drinking water by solid phase extraction and liquid chromatography/tandem mass spectrometry (LC/MS/MS)*. United States Environmental Protection Agency.

Retrieved from

https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=343042&Lab=NREL

Trier, X., Granby, K., & Christensen, J. H. (2011, February 16). Polyfluorinated surfactants (PFS) in paper and board coatings for food packaging. *Environmental*

Science Pollution Research, 18, 1108–1120. <https://doi.org/10.1007/s11356-010-0439-3>

United States Environmental Protection Agency. (2020). *LSASDPROC-300-R4 Operating Procedure Soil Sampling*. <https://www.epa.gov/sites/default/files/2015-06/documents/Soil-Sampling.pdf>

United States Environmental Protection Agency. (2020, January). *Perfluoroalkyl and polyfluoroalkyl substances (PFAS)*. Retrieved August 18, 2021 from https://www.epa.gov/sites/default/files/2020-01/documents/pfas_methods-sampling_tech_brief_7jan2020-update.pdf

United States Environmental Protection Agency. (2020, June 11). *Soil sampling (LSASDPROC-300-R4)*. <https://www.epa.gov/sites/default/files/2015-06/documents/Soil-Sampling.pdf>

United States Environmental Protection Agency. (2021, January 13). *Other test method 45 (OTM-45) measurement of selected per- and polyfluorinated alkyl substances from stationary sources*. https://www.epa.gov/sites/default/files/2021-01/documents/otm_45_semivolatile_pfas_1-13-21.pdf

United States Environmental Protection Agency. (2021, July). *SW-846 test method 8327: Per-and polyfluoroalkyl substances (PFAS) by liquid chromatography/tandem mass spectrometry (LC/MS/MS)*. Retrieved August 18, 2021 from <https://www.epa.gov/hw-sw846/sw-846-test-method-8327-and-polyfluoroalkyl-substances-pfas-liquid-chromatographytandem>

United States Environmental Protection Agency. (2021, August). *Draft method 1633: Analysis of per- and polyfluoroalkyl substances (PFAS) in aqueous, solid,*

biosolids, and tissue samples by LC-MS/MS.

https://www.epa.gov/system/files/documents/2021-09/method_1633_draft_aug-2021.pdf

United States Environmental Protection Agency. (2021, October 18). *PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024*. Retrieved November 23, 2021 from <https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024>
[ic Roadmap: EPA's Commitments to Action 2021-2024 | US EPA](https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024)

United States Environmental Protection Agency. (2021). *CWA analytical methods for per- and polyfluorinated alkyl substances (PFAS)*. Retrieved August 18, 2021 from <https://www.epa.gov/cwa-methods/cwa-analytical-methods-and-polyfluorinated-alkyl-substances-pfas>

United States Environmental Protection Agency. (2021). *PFAS analytical methods development and sampling research*. Retrieved August 18, 2021 from <https://www.epa.gov/water-research/pfas-analytical-methods-development-and-sampling-research>

United States Environmental Protection Agency. (2021). *Status of EPA research and development on PFAS*. Retrieved August 18, 2021 from <https://www.epa.gov/chemical-research/status-epa-research-and-development-pfas#contamination>

United States Geological Survey. (2006, September). *National field manual for the collection of water-quality data - Chapter A4 collection of water samples*. https://pubs.usgs.gov/twri/twri9a4/twri9a4_Chap4_v2.pdf