2020

Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines for Non-Drinking Water

CALIFORNIA STATE WATER QUALITY CONTROL BOARD

DIVISION OF WATER QUALITY

SWRCB PFAS Website: https://www.waterboards.ca.gov/pfas/
DDW PFAS Website: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html

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INTRODUCTION AND PURPOSE OF SAMPLING GUIDE

Per- and polyfluoroalkyl substances (PFAS) are a class of manufactured compounds that are extensively used to make everyday items more resistant to stains, grease, and water. These chemicals have been used in a variety of industrial, commercial, and consumer products and some of these products are present and/or used during routine sampling events. Use of these products could potentially contaminate samples during preparation of the sampling site, sample collection, decontamination of sample equipment, or shipment and storage of samples. With a relatively high probability of PFAS cross-contamination, care must be taken to design and implement effective PFAS sampling procedures. Therefore, this guidance document was developed to outline steps to take during PFAS sampling events to prevent or minimize sample contamination.

The Water Boards recognizes that there may be different sampling procedures that are recommended by a laboratory or in other guidance documents or standard operating procedures for PFAS sampling. However, this guidance document has been developed to assist samplers during PFAS sampling events to meet the quality objectives of the State Water Board and should be reviewed prior to collecting PFAS samples for State Water Board programs or projects. Users of this guide should make every effort to implement these sampling recommendations. There may be updates to this guidance document as more is learned about the sources of PFAS and effective measures or sampling procedures to prevent PFAS contamination during sampling events.

2.0 PROJECT PLANNING

The Water Boards recommend that a project-specific Quality Assurance Project Plan (QAPP) be developed and approved for PFAS sampling events prior to conducting the sampling. For compliance to the PFAS sampling requirements in the Recycled Water Policy, the development and approval of a QAPP is required. The QAPP should include, at minimum, the project objectives, a project organization with responsible individuals and respective duties identified, sampling design and procedures, analytical methods requirements, reporting requirements, and data assessment procedures. Additionally, the QAPP should clearly identify the PFAS-specific sampling procedures and necessary preventative measures required to prevent sample contamination from sources of PFAS, including sample equipment decontamination procedures and information on prohibited and acceptable sample containers, field clothing, personal protective equipment (PPE), personal products, food packaging, and sampling conditions.

Additional guidelines for the preparation of a QAPP can be found at:

- Water Board's QAPP Development Resources website, and
- U.S. Environmental Protection Agency's (EPA) *Guidance for Quality Assurance Project Plans*, EPA QA/G-5 (December 2002).

In the absence of a QAPP, it is important that a thorough, site-specific sampling plan is developed prior to sampling for PFAS. Since PFAS are prevalent in everyday products, the risk for cross contamination is elevated and preventing or minimizing contamination during sampling events will require extra steps to the sampling procedure. This sampling guide should be fully reviewed and can be used as a resource when preparing a sampling plan or QAPP. This will ensure that acceptable sampling supplies and sampling equipment are used and activities on site are performed in the correct order and location. The plan should include a setup of the staging area, including a checklist of sampling supplies and personal protective equipment, as well as the procedure for decontamination when moving in and out of the staging area. A site-specific sampling plan will help prevent errors and ensure a successful PFAS sampling event.

3.0 PRE-SAMPLING CONSIDERATIONS

Sampling materials and field supplies like plastic bags and sample containers, as well as, waterproof pens and paper, personal protective equipment, clothing, food packaging, and personal care products all have been known to contain PFAS compounds. Since PFAS are used in many traditional sampling equipment, materials, or products, and can be sources of contamination, this guidance document has divided commonly used sampling materials and field supplies into three categories:

1. ***Acceptable materials***: These materials are not known to be sources of PFAS cross contamination and can be used during all sampling stages and in the immediate sampling environment.
2. ***Staging area-only materials***: These materials may contain PFAS and should not come into direct contact with the sample but can be used in the staging area. However, these materials should be used away from sample bottles and equipment, and care should be taken to thoroughly wash hands and use new gloves after handling any of these materials.
3. ***Prohibited materials***: These materials are known to contain PFAS that may present a threat to the integrity of the sample and should not be used during any stage of the sampling event.

3.1 Sampling Equipment

Sampling equipment used for PFAS sampling must be made from acceptable materials, which include high-density polyethylene (HDPE), polypropylene, silicone, stainless steel, nylon, polyvinyl chloride (PVC), acetate, and cotton. Sampling equipment that contain PFAS-based (fluoropolymers) parts that would be in direct contact with the sample or sampling environment are prohibited. These fluoropolymers include, but are not limited to:

- Polytetrafluoroethylene (PTFE), including the trademark Teflon® and Hostaflon®, which can be in ball check-valves on certain bailers, lining of some hoses and tubing, wiring, certain kinds of gears, lubricant, and some objects that require the sliding action of parts.
- Polyvinylidene fluoride (PVDF), including the trademark Kynar®, which can be in tubing, films/coatings on aluminum, galvanized or aluminized steel, wire insulators, and lithium-ion batteries.
- Polychlorotrifluoroethylene (PCTFE), including the trademark Neoflon®, which can be in many valves, seals, gaskets, and food packaging.
- Ethylene-tetrafluoro-ethylene (ETFE), including the trademark Tefzel®, which can be in many wire and cable insulation and covers, films for roofing and siding, liners in pipes, and some cable tie wraps.
- Fluorinated ethylene propylene (FEP), including the trademarks Teflon® FEP and Hostaflon® FEP, and may also include Neoflon®, which can be in wire and cable insulation and covers, pipe linings, and some labware.

Equipment that contain PFAS-coated parts (e.g. Teflon-coated parts) can be used if the PFAS-coated part is internal to the equipment and is not in direct contact with the external environment or the sample. Sampling equipment that have parts made of low-density polyethylene (LDPE) should be avoided if the part comes in direct contact with the sample. However, if it is absolutely necessary, equipment that have parts made of LDPE may be used if an equipment blank has confirmed it to be PFAS-free.

Sampling equipment used for grab sampling, including cable ties, extension rods, and couplings, should be made of materials that are known to be PFAS-free. Recommended materials for this sampling equipment include:

- Cable ties made of natural rubber or nylon or uncoated metal springs.
- Extension rods made of materials that are known to be PFAS-free.

- Stainless-steel couplings

Automatic sampling has an increased potential for cross-contamination because the tubing, valves, strainers, suction lines, distribution nozzles, and other parts may be made from PFAS (fluoropolymers). Automatic sampling should only be used if a representative sample cannot otherwise be collected. If automatic sampling is used, then parts made from preferable materials including high-density, polyethylene (HDPE), polypropylene, silicone, stainless steel, nylon, PVC, and acetate should be used when possible. It is recommended that parts on the sampler be screened prior to sampling by reviewing the safety data sheets (if available) and collecting an equipment blank to verify that the parts are PFAS-free. Additionally, the strainer should be decontaminated or replaced between each sampling event.

Regardless of the sampling set-up or equipment selected, an equipment blank must be taken to verify that the equipment is not contaminating the sample.

3.2 Sample Containers

All sample containers used for PFAS sampling should come from the laboratory that is performing the PFAS analysis. High-density polyethylene (HDPE) or polypropylene sample bottles with Teflon®-free caps are the preferred sampling containers for PFAS sampling. PFAS may adsorb to glass containers and therefore should not be used for water, leachate, or other aqueous samples. Glass containers may be used for dry or solid samples, provided that adsorbed PFAS can be extracted by laboratory as part of the sample preparation procedure. Sample containers made from low-density polyethylene (LDPE) should not be used as PFAS are used in the manufacturing process of these containers. LDPE can be found in many sample containers including bottles and plastic bags.

3.3 Personal Protective Equipment and Field Clothing

PFAS are used to coat various clothing and personal protective equipment (PPE) to repel water, oil, and dirt. While preparing for sampling, pay attention to clothing or PPE that is advertised to have waterproof, water-repellant, or dirt and/or stain resistant characteristics because these types of clothing may have had PFAS used in their manufacturing and can be a source of contamination. However, personal safety is paramount and should not be compromised to prevent cross-contamination. Therefore, if the use of PPE is necessary to ensure the health and safety of sampling personnel and no PFAS-free alternative is available, then record the use of the PPE in the field notes and/or the chain of custody and discuss in the final analytical report, if necessary.

There are several industry standard PPE items that may be required during sampling events that have not been evaluated for PFAS, including hard hats, safety glasses, and uncoated Tyvek® products. If these items are used during the sampling event, then they should be screened by collecting an equipment blank prior to use. Additionally, if PPE is used and it is unknown if PFAS are used in its manufacturing, then collecting an equipment blank prior to use is recommended. For reference purposes, Table 1 below lists examples of clothing and personal protective equipment that should and should not be used during PFAS sampling events.

Table 1. Examples of Clothing and PPE Acceptable to Prohibited during PFAS Sampling

Acceptable materials	Staging area materials	Prohibited materials
• Synthetic or 100% cotton clothing that has been well-laundered (without use of fabric softener) • Waterproof clothing made with polyurethane, PVC, wax-coated fabrics, rubber, or neoprene • Boots made of polyurethane and/or PVC • Powderless nitrile gloves	• Non PFAS-free boots (e.g. steel-toed) • First-aid adhesive wrappers Note: Hands should be washed and gloves changed after handling these products.	• Water/stain/dirt-resistant treated clothes (including but not limited to Gore-Tex™, Scotchgard™, and RUCO®) • New unwashed clothing • Clothes recently washed with fabric softeners • Clothes chemically treated for insect resistance and ultraviolet protection • Coated Tyvek® • Latex gloves

3.4 Sun and Biological Protection

Biological hazards (UV from sun, mosquitos, ticks, etc.) may be encountered during sampling, so the elimination of specific clothing materials, sunscreens and insect repellants that are known to contain PFAS may not be possible because it could pose a health and safety hazard to field staff. While the potential for sunscreen, insect repellants, and personal products to contaminate PFAS samples is an active area of research, the personal safety of field staff is of top priority. Therefore, any deviation from this guidance document, including those necessary to ensure the health and safety of

field staff, should be recorded in field notes and/or the chain of custody and discussed in the final analytical report.

Sunscreens may be needed if field staff are subject to prolonged sun exposure. Sunscreens may have been manufactured using PFAS and could potential be a source of cross-contamination. Similarly, protection against insects may require the use of insect repellant, which also may have been manufactured with PFAS. Therefore, it is important to be aware of the sunscreen or insect repellant selected for use during a PFAS sampling events. The words "natural" and/or "organic" in a product name or used to describe the product does not mean that the product is PFAS-free. More information on sunscreens and insect repellants can be found in Michigan's PFAS Sampling Quick Reference Field Guide. Note that this is not a comprehensive list of sunscreens or insect repellants so other products not listed may meet the requirements for use. Listing or omission of any product does not imply endorsement or disapproval of the product. Also, there is no guarantee that these products will always remain PFAS-free.

If sunscreens or insect repellants are used during a PFAS sampling event, then the product should be applied in the staging area. Hands should be washed and new gloves used following application.

3.5 Personal Care Products

Many personal care products, including cosmetics, moisturizers, fragrances, and creams may contain PFAS or may become contaminated with PFAS from the containers they are supplied in. For this reason, the use of such products should be avoided or minimized on the day of sampling, and 24 hours prior to sampling. The words "natural" and/or "organic" in a product name or used to describe the product does not mean that the product is PFAS-free. More information on personal care products can be found in The Environmental Working Group's Skin Deep Guidance. Note that this is not a comprehensive listing of personal care products. Listing or omission of any product does not imply endorsement or disapproval of the product. Also, there is no guarantee that products will always remain PFAS-free, or maintain their status as possibly containing PFAS.

3.6 Food Packaging

PFAS are known to be prevalent in food packaging, including paper plates, aluminum foil, paper towels, food containers, bags, and wraps. Although long-chain PFAS have been banned for use in the manufacturing of contact food materials in the United States, short-chain PFAS have not been banned. Therefore, these products could be source of PFAS contamination. If food or beverages are to be consumed during the sampling event, then a dedicated eating area should be included in the sampling site plan (see Section 5.1 below).

4.0 DECONTAMINATION

Sampling equipment must be cleaned and decontaminated prior to use. Conventional procedures for cleaning and decontaminating sampling equipment can be used but must include a triple rinsing with PFAS-free water and adhere to the following decontamination guidance:

- Use of laboratory supplied PFAS-free deionized water is preferred for cleaning and decontamination.
- Commercially available deionized water may be used for cleaning and decontamination if the water is verified to be PFA-free.
- Municipal drinking water may be used for cleaning or decontamination if the water is known to be PFAS-free.
- Do not use Decon 90®
- Alconox®, Liquinox®, and Citranox® can be used for equipment cleaning and decontamination.
- Sampling equipment can be scrubbed using a polyethylene or Polyvinyl chloride (PVC) brush to remove particulates.

5.0 SAMPLING PROCEDURES

Conventional sampling procedures can be used to collect samples for PFAS analysis. However, there are PFAS-specific considerations and preventative measures that must be followed to prevent contamination of samples. It is recommended that supplies used for PFAS sampling that will come in direct contact with PFAS samples; including sample containers, pumps/tubing/collection equipment, and DI water be stored separately from other sampling supplies. These items should also be handled minimally, to reduce the risk of cross contamination from other field equipment. Hands must be washed and cleaned. Powderless nitrile gloves must be worn on hands before collecting samples, handling sample containers, or handling sampling equipment.

5.1 Site Set-Up

The sampling site should be evaluated prior to sampling to identify potential contamination risks and to select dedicated eating, staging, and sampling areas.

- ***Eating Area***: The eating area is separate from the sampling and staging areas, and the only place where food and drink should be stored and consumed. Food packaging must not be in the sampling and staging areas during sampling due to the potential for PFAS cross-contamination.
- ***Staging Area***: The staging area is where equipment is set-up and personal protective equipment is put on and taken off. PFAS-free over-boots and PPE should be put on in the staging area prior to sampling activities
- ***Sampling Area***: Sampling areas are the areas of the field where samples are collected. When staff requires a break to eat or drink, they should move to the staging area before removing gloves, coveralls, and any other appropriate PPE, if worn. Staff should move to the designated eating area for food and beverage consumption. When finished, staff should wash their hands and put on a fresh pair of powderless nitrile gloves and appropriate PPE at the staging area, before returning to the sampling area.

Before sampling begins, a sampling sequence should be established. To prevent cross-contamination, sampling should start in areas suspected to be least contaminated and continue to areas suspected to be most contaminated. If there is no existing sampling data from the area, potential PFAS sources and transport paths should be reviewed to help inform the best sampling sequence.

If multiple samples will be collected in an area where PFAS has been documented, SAMPLING SHOULD BEGIN IN AREAS THAT ARE KNOWN TO BE UPGRADIENT FROM THE SUSPECTED SOURCE, FOLLOWED BY THOSE THAT ARE FURTHEST DOWNGRADIENT. DOWNGRADIENT LOCATIONS SHOULD BE PROGRESSIVELY SAMPLED FROM THE FURTHEST DOWNGRADIENT TO THE CLOSEST SUSPECTED PFAS SOURCE.

5.2 Sample Collection

Sample collection procedures should include standard best practices for environmental sampling to prevent contamination and ensure a representative sample is collected. In addition, the following protocols should be followed when collecting PFAS samples:

- The sample container must be kept sealed and only opened during sample collection. The sampling container cap or lid should never be placed on the ground or on any other surface unless it is PFAS-free.
- When collecting and handling water samples, do not insert or let tubing or any materials inside the sample bottle. Dust and fibers must be kept out of sample bottles.

- If sample filtration is necessary, it should be performed by the laboratory. The laboratory may also be able to perform other methods, such as centrifuging, to reduce the need for filtration. Field filtration is not advised due to risks of contamination and sorption of PFAS to sampling media.

5.3 Sample Labeling and Field Documentation

Additional considerations should be taken when labelling samples and documenting field activities to prevent contamination including the following:

- Regular/thick size markers (Sharpie® or otherwise) should be avoided as they may contain PFAS.
- Fine and Ultra-Fine point Sharpie® markers are acceptable to label the empty sample bottle while in the staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling.
- Ballpoint pens may be used when labeling sample containers. If ballpoint pens do not write on the sample container labels, preprinted labels from the laboratory may be used.
- Do not use sticky notes (e.g. Post-it Notes®), plastic clipboards, or waterproof paper and notebooks in the sampling area.
- Rite in the Rain® notebooks are acceptable to use in the staging area provided gloves are changed after note taking.

5.4 Sample Shipment and Storage

Samples must be chilled during storage and shipment. Temperatures must not exceed 50°F (10°C) during the first 48 hours after collection. Chemical or blue ice should not be used for storage or shipment of PFAS samples. When preparing samples for transportation or shipment, the samples and ice should be double bagged using bags made of materials that do not present a PFAS contamination risk, such as HDPE, if possible. LDPE bags may be used for bagging samples if special precautions are taken. LDPE bags should be kept separate from other sampling supplies in the staging area and should not come into direct contact with the sample media. Gloves should be changed after handling LDPE bags.

6.0 MATRIX-SPECIFIC SAMPLING CONSIDERATIONS

The following sections provide general guidelines to follow for matrix-specific sampling. The matrices included in this guide are not all inclusive but are those matrices currently being included per State Water Board's Investigative Orders (order).

6.1 General Guidelines

Although PFAS sampling guidance is provided in this document, field staff should refer to the project-specific QAPP and/or applicable analytical method for sample testing, collection, preservation, holding times, and storage requirements. If sampling is occurring under an order, refer to the order in addition to this document for additional requirements or guidance on sampling.

6.2 Wastewater

The point in the waste stream that should be sampled will be determined in the order or in a project-specific QAPP. The laboratory performing the PFAS analysis should be consulted before sampling to develop the sampling strategy. When selecting the best means for achieving a representative sample (automatic composite, grab-composite, single grab), consult with the laboratory performing the analysis. The laboratory may have to comply with specific requirements in the analytical method that determine the sample volume, number of samples, container types, and/or ability to dilute samples for analysis. Additionally, the number of samples sufficient to comprise a representative composite sample will vary depending on the project and should be determined through discussions with the regulator and laboratory.

PFAS are expected to accumulate at the air/water interface. Therefore, unless specifically required in the QAPP, it is not advisable to collect samples from the very top layer of any wastewater, as it is may not be representative of the bulk wastewater.

6.3 Surface water

Unless specifically required by the project objectives, surface water samples should not be taken at the top layer of the water body or of surface scums. PFAS are expected to accumulate at the surface water air interface or be present in the surface runoff, so samples taken at the surface are likely to result in high biased results that may not be representative of the bulk surface water.

6.4 Groundwater Wells

Prior to purging, the water level in the well and the total depth of the well should be measured to determine the volume of water in the well. Record the well purging method and field parameters (i.e. temperature, electrical conductivity, pH, and turbidity).

- ***Supply Wells*** - Activate the well and flush until the water temperature has stabilized, or until a minimum of one well casing volume has been flushed out. Wells should be allowed to flow for a minimum of 15 minutes before sampling to ensure that the sample reflects the water quality of the source. The sample tap should be flushed for a minimum of 5 minutes to ensure the impact of local sources of PFAS cross-contamination, such as tape and valve seats, are minimized.

- ***Monitoring Wells*** - Low-flow purge methods are preferred. For more information on groundwater sampling procedures, including suggestions for low-flow sampling methods, refer to the DTSC Guide for Representative Sampling of Groundwater for Hazardous Substances. (https://dtsc.ca.gov/wp-content/uploads/sites/31/2018/09/Representative_Sampling_of_GW_for_Haz_Subst.pdf)

  If low-flow sampling is not possible, then a submersible pump (dedicated or non-dedicated) or bailer can be used to sample the well. Ensure any purging components (pumps, bailers) or tubing are PFAS free. If it is uncertain whether the pump and/or tubing components are PFAS free, an equipment blank is recommended to determine the potential PFAS contribution by the equipment in contact with the sample. Nylon or cotton are recommended materials for the line attached to bailers for sample collection.

Purging should continue until the selected indicator parameters have stabilized. For suggested stabilization criteria, please refer to Table 2 below.

TABLE 2. Suggested Well Purge Stabilization Criteria for Water-Quality-Indicator Parameters (selected from DTSC's *Representative Sampling of Groundwater for Hazardous Substances,* 2008*)*

Parameter	Stabilization Criteria	Reference
Temperature	± 3% of reading (minimum of ± 0.2° C	SAM 2002
pH	+/- 0.1	Puls and Barcelona, 1996; USGS 2006
specific electrical conductance (SEC)	+/- 3%	Puls and Barcelona, 1996

6.5 Biosolids

If sampling is occurring under an order, always refer to the order for additional requirements or guidance on sampling, including the point in the waste stream that should be sampled.

Biosolids (and/or sewage sludge) typically contain both liquid and solid fractions. Therefore, as a general rule, samples should be collected with the highest solids content possible. When selecting the best means for achieving a representative biosolids sample (composite or single grab), consult with the laboratory performing the analysis prior to sampling. The laboratory may have to comply with specific requirements in the analytical method that determine the sample volume, number of samples, container types, and/or specific guidelines for biosolids samples, such as solids content percentage thresholds. Additionally, the number of samples sufficient to comprise a representative composite sample will vary depending on the project and should be determined through discussion with the regulator and laboratory.

Samples should be collected after treatment processes and prior to disposal (leaving the facility). If liquids are present, a representative whole sample aliquot that includes both liquid and solid fractions should be collected. However, samples with the least amount of liquid are preferred.

To ensure that biosolids samples are representative, consider whether it is appropriate to take a grab sample or a composite sample. A stream from a mechanical or treatment process where the biosolids and sludge are expected to be well mixed, is more likely to be representative of the composition of the stream. In this case, a single grab sample may sufficiently represent the composition of the biosolid stream passing through the sampling point. In cases where biosolids have undergone dewatering and have been stored in locations such as drying beds, various storage tanks, or compost piles; a composite sample may be more representative. If a composite sample is to be collected, consider requesting the laboratory to prepare the composite prior to analysis.

The following information should be collected and recorded during biosolids sampling, in addition to any other items required by the order, QAPP, laboratory, or project workplan.

- An estimate of the moisture content of each sample, reported as percentage by weight of solid for a given volume of sample.
- The sample location (if compositing used, a representative single location should be reported)
- A description of the sample location, biosolids classification, and step within the treatment plant's material processing sequence that the sample was taken.

- Moisture content should be tested by the laboratory on the biosolids sample
- All biosolids and sludge samples, including those with low solids content, should be analyzed as solids and reported in nanograms per kilogram (ng/kg) on a dry weight basis. This dry weight basis reporting requirement should be specified on the chain-of-custody sent to the laboratory.

6.6 Soil and Sediment

High-density polyethylene (HDPE) or polypropylene sample bottles with Teflon®-free caps are the preferred sampling containers for PFAS sampling. Glass containers may be used for dry or solid samples, provided that adsorbed PFAS can be extracted by laboratory as part of the sample preparation procedure. Bags used to store soil or sediment samples should be verified to be PFAS-free prior to using for storage.

Sampling equipment used to collect soil or sediment samples for PFAS analysis must be made from acceptable materials. If collecting core samples, liners for core samplers should be made of acetate or other materials known to be PFAS-free.

7.0 FIELD QUALITY CONTROL SAMPLES

Due to the prevalence of PFAS in a wide range of materials, there may be a greater likelihood for cross-contamination during sampling, transport, and storage of samples. As such, it is recommended to collect field quality control samples to evaluate whether or not cross-contamination has occurred. The type and frequency of quality control samples should be identified in the project-specific QAPP. Additionally, analytical methods for PFAS analysis may provide instructions on the frequency and type of quality control samples required per sampling event.

7.1 Field Duplicate - Recommended

Field duplicates are replicate samples collected in the field and submitted to the laboratory as two distinct samples. Field duplicates are used to verify the precision of field and laboratory activities. The Field Duplicate (FD) is a sample collected from a sample location at the same time and under identical circumstances as the field sample and treated the same throughout field and laboratory procedures.

7.2 Field Blank - Required

A Field Blank (FB) is collected to verify that the sampling environment does not introduce PFAS and cross-contaminate samples during the sampling event. For the analysis of aqueous matrices, the field blank is collected by pouring PFAS-free reagent

water that is stored in an acceptable sample container for PFAS sampling into an empty, clean sample container at the sampling site. The sample containers and supplies to process a field blank should be prepared and provided by the laboratory prior to the sampling event. The field blank is treated the same throughout field and laboratory procedures.

7.3 Equipment Blank - Required

Equipment blank samples are collected by passing laboratory-verified PFAS-free water over or through decontaminated field sampling equipment before the collection of field samples to assess the adequacy of the decontamination process and/or to evaluate potential contamination from the equipment used during sampling.

7.4 Trip Blank – Not Required

Trip blanks are a bottle of PFAS-free water that is prepared in the laboratory, travels from the laboratory to the site, and then gets transported back to the laboratory without having been exposed to any sampling procedures. The trip blank sample is used to assess cross-contamination introduced from the laboratory and during shipping procedures.

8.0 APPENDICES

8.1 Useful Links

The following links are provided to be supplemental information to this guidance document and may be useful for PFAS sampling. Information from these resources must not be used as a substitute for the required or recommended practices outlined in this guidance document, nor the project-specific QAPP or analytical method for PFAS analysis.

- US EPA PFAS methods and guidance for sampling and analyzing water and other environmental media (Technical Brief)
- US EPA PFAS Website
- The State of Michigan Department of Environmental Quality (MDEQ) PFAS sampling guides
- MDEQ PFAS Sampling Quick Reference Field Guide
- Interstate Technology and Regulatory Council (ITRC) PFAS Technical and Regulatory Guidance Document website

8.2 Entering Data in Geotracker

For some PFAS sampling projects, the geographic locations of sample sites must be recorded in the field in the form of latitudes/longitudes and then uploaded into GeoTracker. These points can be non-surveyed field points, meaning that a licensed surveyor is not necessary to measure these points; a handheld GPS device or obtaining the coordinates using a readily available mapping program on the internet is sufficient. Step-by-step instructions for creating and uploading non-surveyed field points can be found in the document "How Do I Upload? Electronic Submittal of Information (ESI) Guide" under the "Getting Started" section. Templates and data formatting requirements can be found on the Electronic Submittal of Information (ESI) for GeoTracker home page (https://www.waterboards.ca.gov/ust/electronic_submittal/index.html).

When uploading the PFAS data into GeoTracker, the PARLABELs/CAF numbers for each unique PFAS is needed. The GeoTracker PARLABELs/CAF numbers are listed at the end of this guide but can also be found on the State Water Resources Control Board's Per- and Polyfluoroalkyl Substances (PFAS) webpage in the information and resources for Non-Drinking Water.

9.0 REFERENCES

Bartlett, Samuel A. and Davis, Katherine L. "Evaluating PFAS cross contamination issues." *Remediation*. 2018; 28:53-57.

Department of Defense Environmental Data Quality Workgroup. "*Bottle Selection and other Sampling Considerations When Sampling for Per and Poly-Fluoroalkyl Substances (PFAS)*." 2017. (https://www.denix.osd.mil/edqw/home/what-s-new/unassigned/edqw-pfas-sampling-factsheet-rev-1-2-july-2017/EDQW%20PFAS%20Sampling%20Factsheet%20Rev%201.2%20July%202017.pdf)

Department of Toxic Substances Control. "*Representative Sampling of Groundwater for Hazardous Substances*." Revised February 2008 (https://dtsc.ca.gov/wp-content/uploads/sites/31/2018/09/Representative_Sampling_of_GW_for_Haz_Subst.pdf)

Government of Western Australia, Department of Environment Regulation. "*Interim Guideline on the Assessment and Management of Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)*." January 2017. (https://www.der.wa.gov.au/images/documents/your-environment/contaminated-sites/guidelines/Guideline_on_Assessment_and_Management_of_PFAS_v2.1.pdf)

Heads of EPAs Australia and New Zealand. "PFAS National Environmental Management Plan." January 2018. (https://www.epa.vic.gov.au/-/media/epa/files/for-community/pfas-national-environmental-management-plan/final_pfas-nemp-20180110.pdf)

Interstate Regulatory Technology Council (ITRC). "Site Characterization Considerations, Sampling Precautions, and Laboratory Analytical Methods for Per- and Polyfluoroalkyl Substances (PFAS)." April 2020. (https://pfas-1.itrcweb.org/wp-content/uploads/2020/04/PFAS_Fact_Sheet_Site_Characterization_April2020.pdf)

Michigan Department of Environmental Quality. "General PFAS Sampling Guidance." 16 October 2018. (https://www.michigan.gov/documents/pfasresponse/General_PFAS_Sampling_Guidance_634597_7.pdf)

Michigan Department of Environmental Quality "Groundwater PFAS Sampling Guidance." October 2018. (https://www.michigan.gov/documents/pfasresponse/Groundwater_PFAS_Sampling_Guidance_637871_7.pdf)

Michigan Department of Environmental Quality "Biosolids and Sludge PFAS Sampling Guidance." November 2019. (https://www.michigan.gov/documents/pfasresponse/Biosolids_and_Sludge_PFAS_Sampling_Guidance_+_Quick_Reference_Field_Guide_679307_7.pdf)

Michigan Department of Environmental Quality "Soil PFAS Sampling Guidance." November 2018. (https://www.michigan.gov/documents/pfasresponse/Soil_PFAS_Sampling_Guidance_639407_7.pdf)

Michigan Department of Environmental Quality "Wastewater PFAS Sampling Guidance". October 2018. (https://www.michigan.gov/documents/pfasresponse/Wastewater_PFAS_Sampling_Guidance_636791_7.pdf)

Naval Facilities Engineering Command (NAVFAC). "Interim Per- and Polyfluoroalkyl Substances (PFAS) Site Guidance for NAVFAC Remedial Project Managers (RPMs)/September 2017 Update." September 2017.

Puls, R.W., and M.J. Barcelona. 1996. "Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures." U.S. EPA Superfund Groundwater Issue, EPA/504/S-95/504. (https://www.csus.edu/indiv/h/hornert/Geol_210_Summer_2012/Week%202%20readings/Puls%20and%20Barcelona%201996%20Low%20flow%20sampling.pdf)

United States Geological Survey, "National Field Manual for the Collection of Water-Quality Data, Chapter A4 Collection of Water Samples". September 2006. https://pubs.usgs.gov/twri/twri9a4/twri9a4_Chap4_v2.pdf

Chemical Name/ Abbreviation	Geotracker PARLABEL	Chemical Abstracts Service (CAS) No.
Perfluorobutanoic acid (PFBA)	PFBTA	375-22-4
Perfluoropentanoiic acid (PFPeA)	PFPA	2706-90-3
Perfluorohexanoic acid (PFHxA)	PFHA	307-24-4
Perfluoroheptanoic acid (PFHpA)	PFHPA	375-85-9
Perfluorooctanoic acid (PFOA)	PFOA	335-67-1
Perfluorononanoic acid (PFNA)	PFNA	375-95-1
Perfluorodecanoic acid (PFDA)	PFNDCA	335-76-2
Perfluoroundecanoic acid (PFUnDA, PFUda, PFUnA)	PFUNDCA	2058-94-8
Perfluorododecanoic acid (PFDoDA, PFDoA)	PFDOA	307-55-1
Perfluorotridecanoic acid (PFTrDA)	PFTRIDA	72629-94-8
Perfluorotetradecanoic acid (PFTeDA, PFTA)	PFTEDA	376-06-7
Perfluorohexadecanoic acid (PFHxDA)	PFHXDA	67905-19-5
Perfluorooctadecanoic acid (PFODA)	PFODA	16517-11-6
Perfluorobutane sulfonic acid (PFBS)	PFBSA	375-73-5
Perfluoropentane sulfonoic acid (PFPeS)	PFPES	2706-91-4
Perfluorohexane sulfonic acid (PFHxS)	PFHXSA	355-46-4
Perfluoroheptane sulfonic acid (PFHpS)	PFHPSA	375-92-8
Perfluorooctane sulfonic acid (PFOS)	PFOS	1763-23-1

Chemical Name/ Abbreviation	Geotracker PARLABEL	Chemical Abstracts Service (CAS) No.
Perfluorononane sulfonic acid (PFNS)	PFNS	474511-07-4
Perfluorodecane sulfonic acid (PFDS)	PFDSA	335-77-3
Perfluorooctanesulfonamide (PFOSA, PFOSAm, FOSA)	PFOSA	754-91-6
N-Ethyl perfluorooctane sulfonamide ethanol (EtFOSE)	ETFOSE	1691-99-2*
N-Methyl perfluorooctane sulfonamide ethanol (MeFOSE)	MEFOSE	24448-09-7
N-Ethyl perfluorooctane sulfonamide (EtFOSA, EtFOSAm)	ETFOSA	4151-50-2
N-Methyl perfluorooctane sulfonamide (MeFOSA, MeFOSAm)	MEFOSA	31506-32-8
N-Methyl perfluorooctane sulfonamidoacetic acid (NMeFOSAA)	NMEFOSAA	2355-31-9
N-Ethyl perfluorooctane sulfonamidoacetic acid (NEtFOSAA)	NETFOSAA	2991-50-6
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	4:2FTS	757124-72-4
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	6:2FTS	27619-97-2
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	8:2FTS	39108-34-4
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	10:2FTS	120226-60-0

Chemical Name/ Abbreviation	Geotracker PARLABEL	Chemical Abstracts Service (CAS) No.
2H,2H,3H,3H-Perfluorohexanoic acid (3:3 FTCA)	3:3FTCA	356-02-5
2H,2H,3H,3H-Perfluorooctanoic acid (5:3 FTCA)	5:3FTCA	914637-49-3
2H,2H,3H,3H-Perfluorodecanoic acid (7:3 FTCA)	7:3FTCA	812-70-4
Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	HFPA-DA	13252-13-6
4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	ADONA	919005-14-4
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS)	9ClPF3ONS	756426-58-1
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS)	11ClPF3OUdS	763051-92-9
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	NFDHA	151772-58-6
Perfluoro(2-ethoxyethane) sulfonic acid (PFEESA)	PFEESA	113507-82-7
Perfluoro-3-methoxypropanoic acid (PFMPA)	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid (PFMBA)	PFMBA	863090-89-5

ng/L = nanogram per liter
µg/kg = microgram per kilogram