

**Oklahoma Department of Environmental Quality**  
**Protocols for PFAS Sampling**  
**Standard Operating Procedures**

**Groundwater Sampling SOP**

**July 2025**



**Acknowledgement:**

This SOP, other associated SOPs, and documents were developed in 2022 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.

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<b>Revision Number</b>	<b>Revision Date</b>	<b>Notes</b>
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## **1.0 General**

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. Multiple groundwater samples may need to be collected from the sampling site to determine the extent of any plume which might be present. This SOP is based on DEQ's research, USEPA Method 537.1, and USEPA Method 1633A. The PFAS General Sampling Guidance should be referred to for what to include in a QAPP for PFAS sampling, information on cross-contamination, additional information on field clothing, and many other details. References for this SOP and the other associated PFAS SOPs can be found in the PFAS General Sampling Guidance document.

## **2.0 Field Clothing and PPE**

Field clothing and other personal protective equipment (PPE) may consist of PFAS-containing materials, especially those advertised as water-resistant, water repellent, or stain-resistant. Refer to Tables 1-7 for general guidance regarding field clothing and PPE.

Sunscreen and biological protection, cosmetics, and skincare also require screening, and recommendations are provided in Tables 8-12. DEQ does not recommend the use of fragrances (e.g., perfumes, colognes) during PFAS sampling, because they can contain PFAS.

While PFAS-containing apparel and PPE should be avoided, the safety of samplers should never be compromised. Any deviation from DEQ's guidance should be recorded in the field notes.

## **3.0 Equipment**

All equipment and materials (e.g., tubing) used during sample collection should be assessed for the presence of PFAS to eliminate or reduce the probability of cross-contamination. Refer to Table 14 for details on sampling containers that are and are not allowed. For groundwater sampling, complex equipment with multiple components may be used. Equipment specifications can be found in each respective USEPA laboratory method document referenced (Method 1633A and 846-SW Method 8327). For groundwater sampling, stainless steel, high-density polyethylene (HDPE), polypropylene, and/or silicone materials are recommended for collection. Refer to Table 15 for a list of common sampling materials that may be present in groundwater sampling equipment, such as bailers and pumps. Food packaging can contain PFAS, so food packaging and products should be kept in a designated eating area as noted in Table 13.

Additional information to consider when selecting sampling equipment is as follows:

- Keep sampling equipment in its original packing material.
- Use PFAS-free nylon lines or cotton strings for raising and lowering equipment.
- Use PFAS-free interface meters (e.g. oil and water interface probes, depth to water gauges).
- Avoid glass equipment for aqueous samples.

- Internal pump components that do not come into contact with the sample have a low potential for cross-contamination.
- Use dedicated sampling equipment for each well to avoid cross-contamination.

## 4.0 Sampling Techniques and Collection Methods

The following section provides guidance for groundwater sample collection for PFAS analysis. DEQ approves multiple groundwater sampling techniques. The selected sampling technique may vary depending on what is most suitable for the sampling entity, selected laboratory, site characterization, and release type. The well depth and volume will also determine the appropriate sampling technique and equipment. USEPA 846-SW Method 8327 and USEPA Method 1633A are the acceptable laboratory analysis methods for groundwater, and the differences in sampling methods are highlighted below. Sample preparations should be outlined in a site-specific sampling plan, such as a Sampling Analysis Plan (SAP).

*Method 1633A Sampling Equipment:* Use 500-mL HDPE sampling containers with (HDPE or polypropylene) linerless screw caps.

*846-SW Method 8327 Sampling Equipment:* Use polypropylene or HDPE sampling containers with polypropylene (or HDPE) screw caps. Laboratory protocol will indicate which size sample containers to use; always avoiding over-sizing to eliminate the need for subsampling.

### 4.1 General Groundwater Sampling Guidelines

- Before sampling, decontaminate the sampling equipment per recommended guidance in the Decontamination section.
- If multiple wells are being sampled, start purging and sampling the least contaminated wells and end with the most contaminated wells based on previous screening results.
- Samplers must take appropriate water quality parameter measurements before purging, as shown in Table A.
- Purging will be conducted in full accordance with EPA's SOP 2007 Groundwater Well Sampling and DEQ Land Protection Division SOP-7 Monitoring Well Sampling with a Low-Flow Peristaltic Pump.
- Sample containers must remain sealed until time of sample collection. The sampling container cap should never be placed on any surfaces unless they are PFAS-free. The sampling container cap must never be placed directly on the ground.
- **Supply Well Collection:** If collecting from a supply well, run water from the spigot for at least 15 minutes, or approximately the volume of the well casing, to collect a representative sample.

- **Monitoring Well Collection:** If collecting from a monitoring well, purge using either low-flow methods, bailers, or submersible pumps. DEQ's preferred method for purging is the low-flow method. If this is not possible, bailers, submersible pumps, or other purging equipment may be used as long as the components that come into contact with the sample are PFAS-free. Low-flow purging is preferred since other methods may increase turbidity and an influx of particulate matter in the representative water sample. Since PFAS tends to adsorb to material, this could contaminate the sample and bias the analytical results low. Use the parameters in Table A to ensure adequate purging has occurred if using low-flow methods.
- After groundwater has stabilized, take the appropriate water quality parameter measurements prior to sampling.

If further information regarding each sampling technique is desired before sampling, please reference the respective USEPA method documents mentioned.

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Note: The EPA's SOP 2007 – Groundwater Well Sampling can be found on the EPA On-Scene Coordinator ERT Standard Operating Procedures webpage.

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## 5.0 Decontamination

Refer to Table 17 for guidance on decontamination methods and materials which are allowed or prohibited while sampling. The following general decontamination principles for PFAS sampling should be followed:

- Sampling equipment must be decontaminated after sampling at each location and at the end of the workday.
- Wash hands with PFAS-free water and put on new powderless nitrile gloves before decontamination.
- Decontaminate equipment with a triple rinse of verified PFAS-free water and remove particulates with a polyethylene or PVC brush.
- PFAS-free detergents such as Alconox®, Liquinox®, Luminol®, or Citranox® may be used.
- Dry equipment with a cotton cloth, untreated paper towels, or place decontaminated equipment on a PFAS-free surface to air-dry.

## 6.0 Quality Assurance / Quality Control

DEQ recommends following the Quality Assurance/Quality Control (QA/QC) Guidelines outlined in Section 5.0 of the General PFAS Sampling document to ensure project-specific Quality Assurance Project Plan (QAPP), Standard Operating Procedures (SOP), and Sampling Analysis Plan (SAP) consistency between sampling events. Additionally, the following guidelines should be followed for ground water-specific sampling events.

- Collect a rinsate/equipment blank at the rate of 1 per day per sampling team to ensure the sampling has not introduced PFAS cross-contamination to the sampling results. This process should be conducted on each piece of equipment. (Required)
- Laboratory sources of water used for equipment decontamination and blank sample collection should be certified PFAS-free or addressed for background concentrations of PFAS. (Required)
- Collect field quality control samples such as duplicates collected at the rate of 1 per 10 samples, trip blanks collected at the rate of 1 per cooler, and field blanks collected at the rate of 1 per day per sampling team to assist in evaluating groundwater sampling and handling activities at the investigation site. (Required)
- If possible, a control sample (background sample) should be collected from an area not affected by the possible contaminants of concern and submitted with the other samples. The background sample should be collected from the same aquifer or water source.

**Note:** Duplicate samples must have a similar sample number to the other samples to disguise them from the laboratory. The field notes must indicate which sample numbers are duplicates and of which sample number they are a duplicate.

DEQ recognizes that EPA Methods 537, 537.1 V1, and 537.1 V2 have varying requirements for field QC samples as compared to DEQ's.

## 7.0 Documentation

Keep a sampling log during the sampling event. In the sample log, record the following:

- Date and time of sample collection
- Weather conditions
- Well location
- Sample point location
- Owner's Contact Information (if applicable)
- Sampling equipment
- Dissolved oxygen, temperature, specific conductivity, pH, oxygen reduction potential, and turbidity readings
- Duration of purge
- Duplicate sample(s)

- Visual description of samples
- Use of any unapproved PPE
- Other sampling specific (applicable) observations

Ensure documentation materials are PFAS-free; refer to Table 16. Pre-printed labels for sample containers are preferred.

## **8.0 Shipment**

The following is recommended for sample shipment. Information is also provided in Table 18.

- Use regular ice, double-bagged, in place of chemical (blue) ice and maintain temperature between +4°C and - 2 °C in a cooler.
- Check the cooler periodically to ensure samples are well iced and at the proper temperature.
- The cooler should be taped closed with a custody seal.
- Double bag Chain of Custody and other applicable forms and tape to the inside of the cooler lid. Include the appropriate Monitoring Well and Groundwater Data documents.
- Ship within 48 hours or per the holding time determined by the laboratory or the selected laboratory analysis method.



## Tables

**Table A: Suggested Well Purge Stabilization Criteria for Water Quality Indicator Parameters**

Parameter	Stabilization Criteria	Reference
Temperature	$\pm 3\%$ of reading (minimum of $\pm 0.2^\circ \text{C}$ )	SAM 2004
pH	$\pm 0.1$	Puls and Barcelona 1996; USGS 2006
Specific electrical conductance (SEC)	$\pm 0.3\%$	Puls and Barcelona, 1996

Note: See DEQ's PFAS General Sampling Guidance for reference citations.

## DEQ PFAS Sampling Quick Reference Field Guide

**Table 1: Clothing<sup>1</sup>**

Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>Well laundered clothing (recommended six times prior to sampling)</li> <li>100% cotton (preferred)</li> <li>Synthetic fabrics<sup>2</sup></li> <li>Polyvinyl Chloride (PVC)<sup>2</sup></li> <li>Polyurethane</li> <li>Uncoated Tyvek® clothing</li> <li>Wax-coated fabrics</li> <li>Rubber/Neoprene</li> <li>Expanded polyethylene (ePE) Gore-Tex<sup>3</sup></li> </ul>	<ul style="list-style-type: none"> <li>New/unwashed clothing</li> <li>Clothing applied/washed with fabric softeners, fabric protectors including ultraviolet (UV) protection, water, dirt or stain-resistant chemicals, or insect-resistant chemicals</li> <li>Clothing containing Tyvek®</li> <li>Flame resistant (FR) clothing</li> <li>Clothing made of Gore-Tex<sup>3</sup> (except ePE line of products) or other known PFAS containing materials.</li> </ul>	<ul style="list-style-type: none"> <li>Tyvek® suits, clothing that contains Tyvek®, or coated Tyvek®</li> </ul>

<sup>1</sup>Clothing should be kept dust and fiber free.

<sup>2</sup>Some brands of PVC and synthetic clothing contain PFAS. Check clothing makers' websites to confirm that clothing is PFAS-free.

<sup>3</sup> Gore-Tex generally contains PFAS, but they do have a PFAS-free line of products containing ePE (expanded polyethylene).

**Table 2: Boots**

Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>Polyurethane boots</li> <li>PVC boots</li> <li>PFAS-free boot covers<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>Gore-Tex® boots</li> <li>Boots made from water-resistant synthetics</li> </ul>	

<sup>1</sup>Samplers must wash their hands with PFAS-free soap and water after putting on boot covers. Boot covers may only be removed in the staging area and after the sampling activities have been completed.

Table 3: Gloves		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>• Powderless nitrile gloves<sup>1</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Gore-Tex gloves</li> <li>• Any glove made with PFAS-containing materials.</li> </ul>	<ul style="list-style-type: none"> <li>• Latex gloves</li> <li>• Water and dirt-resistant leather gloves</li> <li>• Any special gloves required by a Health and Safety Plan (HASP).</li> </ul>

<sup>1</sup>Samplers must wash their hands with PFAS-free soap and water before putting on any gloves.

Table 4: PPE <sup>1</sup>		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>• Hard hats made of HDPE</li> <li>• Hard hat covers/liners (i.e. Head Gaiters) made of cotton or other natural fabric</li> <li>• Safety glasses made of HDPE</li> <li>• Life jackets made of polyethylene foam and nylon shell fabric</li> <li>• Waders made of Neoprene or other PFAS-free material</li> </ul>	<ul style="list-style-type: none"> <li>• Waders made of Gore-Tex or other known PFAS containing materials</li> </ul>	<ul style="list-style-type: none"> <li>• Hard hats or safety glasses not made of HDPE</li> </ul>

<sup>1</sup>PPE should be kept dust and fiber free.

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® FOIDIT 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	

Note: Perfluorochemicals (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: Brand Names Utilizing DownTek™ PFC-Free Water Repellent Down	
• ALPKIT LTD®	• L.L. Bean®
• Big Agnes®	• Kathmandu®
• Cotopaxi™	• Maier Sports®
• DynaFit®	• Patagonia®
• Fjallraven™	• Salewa®
• Gordini™	• Sync®
• Jottnar™	• Zajo®

Table 7: Prohibited Water-Resistant Field Clothing and PPE Brand and Product Names	
• Ultra Release Teflon®	• Release Teflon®
• Repel Teflon® Fabric Protector	• High-Performance Release Teflon®
• 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®
• Oleophobic 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
• GoreTex® <sup>1</sup>	

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

<sup>1</sup>Approved sunscreens must not be applied near the sample collection area. Hands must be well washed with PFAS-free soap and water after application or handling of these products, and afterwards; an uncontaminated clean/new pair of powderless nitrile gloves should be worn.

Table 9: Insect Protection <sup>1</sup>		
Allowed	Not Allowed	Needs Additional Research
• OFF® Deep Woods • Sawyer® Permethrin	• No unauthorized insect protection	

<sup>1</sup>Approved insect repellents must not be applied near the sample collection area. Hands must be well washed with PFAS-free soap and water after application or handling of these products, and afterwards; an uncontaminated clean/new pair of powderless nitrile gloves should be worn.

Table 10: Allowed/Approved Sunscreens <sup>1</sup>
• 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 SPF 50+
• Meijer® Sunscreen Lotion Broad Spectrum SPF 30
• 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

<sup>1</sup>Baby sunscreens that are “free” or “natural” are not guaranteed PFAS-free and need additional research.

Table 11: Approved Personal Care Products (Cosmetics and Skincare) <sup>1</sup>	
• Credo (all products)	
• Sephora (Clean at Sephora Products)	
• Annmarie Skin Care (all products)	
• California Baby (all products)	
• Crunchi (all products)	
• Fluency Beauty (all products)	
• H&M (all store brand products)	
• Hydropeptide (all products)	
• Mi Coco es su Coco (all products)	
• Otter Wax (all body and skincare products)	
• Reed + Gwen (all personal care products)	
• Whole Foods Market (all products)	
• X'Factor Skincare By Pharmacists (all products)	

\*Source: Green Science Policy Institute, 2025

<sup>1</sup>If Personal Care Products are used, the sampler must apply these products away from the staging area, sampling bottles, and equipment, and hands shall be thoroughly washed with PFAS-free soap and water after use and before a sampling event. The sampler must also put on a fresh pair of powderless nitrile gloves before sampling.

Table 12: Approved Personal Care Products (Floss) <sup>1</sup>	
• 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 (Anti plaque Spearmint)
• Desert Essence (tea tree oil dental tape)	• Hello Products (all floss)
• Johnson & Johnson Listerine Cool Mint Reach Mint Waxed Reach Waxed Unflavored Reach Clean Paste Icy Mint Woven	• Oral-B Satin Floss Mint

\*Source: Green Science Policy Institute, 2025

<sup>1</sup>If Personal Care Products are used, the sampler must apply these products away from the staging area, sampling bottles, and equipment, and hands shall be thoroughly washed with PFAS-free soap and water after use and before a sampling event. The sampler must also put on a fresh pair of powderless nitrile gloves before sampling.

Table 13: Food Containers <sup>1</sup>		
Allowed	Not Allowed	Needs Additional Research
• Food packaging and products in a designated eating area set up for food and beverage consumption	• Food packaging and products in the staging or sampling areas	• Bringing foods rewrapped in PFAS-free materials

<sup>1</sup>After coming into contact with food packaging, samplers must wash their hands with PFAS-free soap and water and put on a fresh pair of powderless nitrile gloves at the staging area before returning to the sampling area.

Table 14: Sampling Containers <sup>2</sup>		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>• HDPE also known as polyethylene high-density (PEHD)</li> <li>• Polypropylene</li> <li>• Stainless Steel</li> <li>• Unlined bottle caps</li> <li>• Low-density polyethylene (LDPE) resealable bags (Ziplock) that will not come in contact with the sample media</li> </ul>	<ul style="list-style-type: none"> <li>• Polytetrafluoroethylene (PTFE) lined bottles or caps (i.e. Teflon® and Hostaflon®)</li> <li>• LDPE containers that will contact the sample media</li> <li>• 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.</li> </ul>	<ul style="list-style-type: none"> <li>• Glass bottles and containers<sup>1</sup></li> </ul>

<sup>1</sup>Glass 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.

<sup>2</sup>Sampling containers must remain sealed until point of 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 15: Sampling Equipment		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>• HDPE (also PEHD)</li> <li>• Polypropylene</li> <li>• Stainless Steel</li> <li>• Acetate</li> <li>• Silicone</li> </ul>	<ul style="list-style-type: none"> <li>• Polytetrafluoroethylene (PTFE)</li> <li>• Polyvinylidene fluoride (PVDF)</li> <li>• Polychlorotrifluoroethylene (PCTFE)</li> <li>• Ethylene-tetrafluoroethylene (ETFE)</li> <li>• Low-density polyethylene (LDPE) which will contact the sample media</li> <li>• Fluorinated ethylene-propylene (FEP)</li> </ul>	<ul style="list-style-type: none"> <li>• Glass equipment</li> </ul>

Table 16: Field Materials <sup>1</sup>		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>• Aluminum, polypropylene, or Masonite field clipboards</li> <li>• Rite in the Rain® notebooks</li> <li>• Loose paper (non-waterproof, non-recycled)</li> <li>• Ballpoint pens and pencils</li> <li>• Interface Meters (a.k.a. oil and water interface probes, depth to water gauges) that are made with PFAS-free materials</li> </ul>	<ul style="list-style-type: none"> <li>• Clipboards coated with PFAS-containing materials</li> <li>• Notebooks made with PFAS treated paper</li> <li>• PFAS treated loose paper</li> <li>• Post-It® Notes or other adhesive paper products</li> <li>• Sharpie® markers</li> <li>• Coated materials, including paper towels</li> <li>• 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.</li> <li>• Interface Meters (a.k.a. oil and water interface probes, depth to water gauges) that are made with PFAS-containing materials</li> </ul>	<ul style="list-style-type: none"> <li>• Plastic clipboards, binders, or spiral hardcover notebooks</li> <li>• Waterproof field books</li> <li>• All markers not listed as allowable</li> </ul>

<sup>1</sup>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.

Table 17: Decontamination Procedures <sup>1</sup>		
Allowed	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>• Alconox®, Liquinox®, Luminex®, or Citranox®</li> <li>• Triple rinse with PFAS-free water<sup>1</sup></li> <li>• Cotton cloth or untreated paper towels</li> <li>• Polyethylene or PVC brush to remove particulates</li> </ul>	<ul style="list-style-type: none"> <li>• Decon 90®</li> <li>• PFAS treated paper towels</li> <li>• Reusing non-dedicated equipment without decontaminating</li> </ul>	<ul style="list-style-type: none"> <li>• Municipal water<sup>1</sup></li> </ul>

<sup>1</sup>Decontamination procedures should include decontaminating equipment with an allowed detergent and 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. However, commercially available deionized water may be used for cleaning and decontamination if the water is verified to be PFAS-free. Municipal drinking water may be used for cleaning or decontamination if the water is known to be PFAS-free. Non-dedicated sampling equipment must be cleaned and decontaminated before each use.

Table 18: Sample Shipment		
Allowed/Required	Not Allowed	Needs Additional Research
<ul style="list-style-type: none"> <li>• Coolers filled with regular ice</li> <li>• Maintaining sample temperature between +4°C and -2°C</li> <li>• Double-bagging of samples and ice using bag materials made of HDPE (preferred) or LDPE (if sample does not come in contact)</li> <li>• 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.</li> </ul>	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Chemical (blue) ice packs</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical (blue) ice packs that are verified PFAS free</li> </ul>

**Attachment 1**

**SOP-7 Monitoring Well Sampling with a Low-Flow  
Peristaltic Pump**

## Standard Operating Procedure (SOP) SOP - 7

### Monitoring Well Sampling with a Low-Flow Peristaltic Pump

Prepared and  
Approved by:

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Quality Assurance Coordinator

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Date

Approved by:

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Jon Reid  
Voluntary Cleanup Program Manager

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Aron Samwel  
Brownfields Program Manager

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Kelsey Bufford  
Superfund Program Manager

\_\_\_\_\_  
Date

Approved by:

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Brian Stanila  
Tar Creek Program Manager

\_\_\_\_\_  
Date

Note: This version of the SOP was intentionally left unsigned to protect personal information, since this will be posted on DEQ's website.



Oklahoma Department of Environmental Quality (DEQ)  
Land Protection Division  
Site Restoration & Revitalization and Risk Management & Groundwater Units

## **1.0 Scope and Application**

- 1.1 The Site Restoration & Revitalization and Risk Management & Groundwater units, which include the Site Cleanup Assistance Program (SCAP), Voluntary Cleanup Program (VCP), Chemical Reporting & Preparedness, Superfund, and Brownfields programs of the Land Protection Division (LPD) follow EPA 2.0 Groundwater Well Sampling: SOP #2007. Sample collection is conducted in full accordance with the methods described in SOP #2007.
- 1.2 The purpose of this Standard Operating Procedure (SOP-7) is to describe the procedures for collecting representative groundwater samples from monitoring wells with a low-flow peristaltic pump.
- 1.3 The peristaltic pump has limited sampling depth of 25 feet to 30 feet.
- 1.4 Sample preservation, containers, handling, storage, QA/QC samples, data validation, and health and safety issues are discussed in the EPA SOP #2007 and will be followed by LPD personnel during all types of groundwater sampling.

## **2.0 Groundwater Sampling**

### *2.1 Sampling equipment*

Sampling equipment may include:

- Sampling containers as per the Sampling and Analysis Plan
- Sample labels and tags
- Field Logbook
- Chain-of-Custody Forms
- Jars and bottles
- Zip-lock bags
- Packing foam and tape
- Ice and coolers
- Indelible marking pen
- Disposable Nitrile gloves
- Paper towels
- Utility knives
- Disposable protective suits
- Cameras
- GPS units
- Monitoring Instruments

- Organic Vapors Analyzer (OVA)
- Photoionization Detector (PID)
- Turbidity meter
- Conductivity/pH/temperature multiparameter meter (YSI)
- Chemical field test kits
- Water level indicator
- Peristaltic Pump
- Flow-through cell
- Polyethylene tubing (if not already in wells)
- Garbage bags
- Decontamination equipment (Alconox soap, deionized (DI) water, spray bottles, scrub brush)
- Plastic sheeting
- Charged battery for pump
- Silicone tubing (flexible tubing)
- Connectors for tubing
- Graduated cylinder
- Fresh buffering solutions for pH and conductivity
- Buckets
- Drum for purge water
- Funnel
- Sock wrench set (for flush mount wells)
- A wire hanger (in case tubing can't be reached)
- Keys to unlock monitor wells
- Filters (if needed)

## 2.2 *Sample Collection*

### **Pump Setup**

- 2.2.1 Calibrate the YSI multiparameter meter for dissolved oxygen (DO), pH, and conductivity within one to three days prior to the date of the sampling event and then again daily for subsequent sampling days. Calibrate turbidimeter before sampling event.
- 2.2.2 Lay plastic sheeting down around monitoring well.
- 2.2.3 Place sampling equipment on plastic sheeting.
- 2.2.4 Unlock monitoring well (if flush mount bring socket wrench). After removing cap from a monitoring well, allow at least 15–30 minutes for the groundwater to equalize with the atmosphere, ensuring a representative sample.
- 2.2.5 Place water level indicator down well and, if necessary, record the depth to water. The depth to water shall be measured relative to a

reference/measuring point marked at the top of the innermost well casing. If a measuring point has not already been marked, the measuring point shall be assumed to be at the top of the north side of the innermost casing. *Note:* Procedure for measuring depth to water is adapted from EPA SOP 2007 (rev. 0.0).

- 2.2.6 Unless specified differently in the project-specific sampling plan, the suction end of the sampling tubing should typically be positioned in the middle of the well screen. If the well already has dedicated tubing left inside the well from a prior sampling event, and that tubing has been properly marked (to mark where the tubing should be aligned with the well's top of casing during sampling), pull out the dedicated tubing until the tubing's "middle of well screen" mark aligns with the top of casing. If the middle of the well screen has not been previously marked, add an alignment mark onto the side of the tubing. To measure, align, and mark the tubing properly, use (a) the measuring tape on the water level indicator, (b) a Sharpie pen (unless prohibited by the sampling plan, e.g., when sampling for PFAS), and (c) your knowledge of the well's screened interval depth.
  - 2.2.6.1 If the well does not have existing/dedicated tubing, clean polyethylene tubing must be inserted into the well with the suction end properly positioned at the middle of the well screen. During installation, ensure the tubing doesn't get caught on a seam or other obstruction.
- 2.2.7 Connect dedicated silicone (soft) tubing to a connector and/or adapter that will fit the polyethylene (hard) tubing in the well, connect silicone and polyethylene tubing to the connector/adapter.
- 2.2.8 Assemble flow-through cell using o ring, then twist YSI into it and turn YSI power on.
- 2.2.9 Connect dedicated silicone tubing to the bottom port of flow-through cell.
- 2.2.10 Connect discharge silicone tubing to the top port.
- 2.2.11 Connect pump to battery (make sure battery is charged beforehand).
- 2.2.12 With the pump off and the pump head lever up, place the silicone tubing into the pump head, and lower the lever to secure the tubing within the pump head.
- 2.2.13 Ensure discharge tubing will discharge into a 5-gallon bucket.
- 2.2.14 Toggle pump reverse/forward switch to direct flow from well towards YSI.
- 2.2.15 Record initial depth to water in logbook.

### **Purging Procedures**

- 2.2.16 Turn pump on high until water begins to flow through the flow-through cell, and then turn speed down such that pump discharge rate is less than or equal to well recharge rate. (The goal is to maintain a steady depth to water while pumping and sampling.) Record in the logbook the time that the pump was started.
- 2.2.17 Once flow-through cell is full, fill a 100 mL graduated cylinder in 30 seconds. (Have a “timekeeper” sample team member time how long it takes to fill the graduated cylinder). The flow rate should be less than 200 mL/min. Record the initial flow rate in the logbook. If you change the flow rate later, also record the new flow rate each time it changes.
- 2.2.18 Record these readings every 5 minutes (include units):

<b>Parameter</b>	<b>Tolerance (on three consecutive readings)</b>	<b>Source</b>
Time	record hour and minute	various
Temperature	±1 °C	YSI meter
Conductivity	±10% NTU	YSI meter
Dissolved Oxygen (DO)	±10% if > 0.5 mg/L, or stable if < 0.5 mg/L	YSI meter
pH	±0.1 units	YSI meter
Oxidation Reduction Potential (RRP)	±10 mV	YSI meter
Depth to Water Table	±0.01 ft	water level
Turbidity	±10% for values > 50 NTU, or stable if < 50 NTU	portable turbidimeter

- 2.2.19 When readings are stable (three readings in a row within the specified tolerance) such that equilibrium has been reached, which helps to ensure that samples collected will be representative of the groundwater formation, unhook dedicated silicone tubing from YSI flow-through cell and take the sample directly from that dedicated tubing (not the discharge tubing still connected to the YSI).

**Sample Collection**

- 2.2.20 Fill all sample containers with minimal turbulence (and no air bubbles in the tubing) by allowing the groundwater to flow from the tubing gently down the inside of the container.
- 2.2.21 Fill sample containers in the order specified in the project Sampling and Analysis Plan (SAP). Fill any VOC samples such that a meniscus is formed over the mouth of the vial and there is no formation of air bubbles and no head space remains after the vial is capped. Cap the vials immediately after filling the vials.
- 2.2.22 Collect filtered samples last. If filtered metal samples are to be collected, attach the in-line filter to the end of the discharge tubing and collect the sample from the filter discharge.
- 2.2.23 Transfer the sample containers to the appropriate sample cooler.
- 2.2.24 Record the sampling activities as per LPD SOP-1 (Field Logbooks). Write down sample time, sample #, sampler's name, sample description (i.e., clear water, no odor), and lab method requested in logbook.
- 2.2.25 Estimate the purge volume that was required to reach equilibrium and record the purge volume in logbook.
- 2.2.26 Disconnect and decontaminate flow-through cell between each well. Decontaminate graduated cylinder and turbidity cylinder after sampling event. Follow EPA SOP #2006 for decontamination procedures.
- 2.2.27 Disconnect silicone tubing and connector from the well's polyethylene tubing. Discard silicone tubing and connector or place in Ziploc bag and write the well number on it with a sharpie. Fold polyethylene tubing and place back down the well such that it can be reached again (e.g., such that a wire hanger can be used to retrieve tubing). Replace the plug and lock the well.