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Technical BRIEF

INNOVATIVE RESEARCH FOR A SUSTAINABLE FUTURE

Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS)

Methods and guidance for sampling and analyzing water and other environmental media

Background

Per- and polyfluoroalkyl substances (PFAS) are a group of synthetic chemicals that have been in use since the 1940s. PFAS are found in a wide array of consumer and industrial products. PFAS manufacturing and processing facilities, facilities using PFAS in production of other goods, airports, and military installations are some of the contributors of PFAS releases into the air, soil, and water. Due to their widespread use and persistence in the environment, most people in the United States have been exposed to PFAS. There is evidence that continued exposure above specific levels to certain PFAS may lead to adverse health effects. The U.S. Environmental Protection Agency (EPA) will continue to partner with other federal agencies, states, tribes, and local communities to protect human health and, where necessary and appropriate, to limit human exposure to potentially harmful levels of PFAS in the environment.

EPA's methods for analyzing PFAS in environmental media are in various stages of development and validation. The Agency is working to develop validated analytical methods for groundwater, surface water, wastewater, and solids, including soils, sediments, biota, and biosolids.

Drinking Water

Analysis of PFAS using Method 537.1

To assess for potential human exposure to PFAS in drinking water, EPA's validated Method 537.1 will ensure that both government and private laboratories can effectively measure 18 PFAS in drinking water, which is a critical step for estimating exposure and potential health risks to PFAS. EPA Method 537 was first published in 2009 to initially determine 14 different PFAS. In 2018, the method was updated to include 4 more PFAS, including the GenX chemical hexafluoropropylene oxide dimer acid (HFPO-DA).

Analysis of Short-Chain PFAS using Method 533

EPA developed and validated EPA Method 533 to target "short chain" PFAS (none greater than C_{12}), including perfluorinated acids, sulfonates, fluorotelemers, and poly/perfluorinated ether carboxylic acids. Many of these could not be analyzed using 537.1 due to physicochemical properties. In December 2019, EPA published Method 533, which includes a total of 25 PFAS (14 of the 18 PFAS in 537.1 plus an additional 11 "short chain" PFAS) and specifies isotope dilution quantitation.

In 2019, EPA published validated SW-846 Method 8327 for non-potable water and Method 533 for analysis of short-chain PFAS in drinking water.

Health Advisories

In May 2016, EPA issued drinking water health advisories for two types of PFAS: perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). EPA's health advisories are non-regulatory and non-enforceable, and are intended to provide technical information to state agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination.

Non-Potable Water

Analysis of PFAS using SW-846 Method 8327

EPA developed a direct injection liquid chromatography tandem mass spectrometry method, EPA SW-846 Method 8327, that utilizes external calibration for analysis of 24 PFAS in non-potable water (not of drinking quality). After a multi-lab validation in surface water, groundwater, and wastewater effluent, EPA posted the validated SW-846 Method 8327 in June 2019 for public comment.

EPA SW-846 Method 8327 is available for public use while EPA is adjudicating public comments. Consistent with most SW-846 methods, EPA provides the method as guidance; the use of this method is not specified in any federal testing requirements. Method 8327 is designed for high-throughput applications and supports interim recommendations for groundwater contaminated with PFOA and PFOS; however, for some analytes and matrices, it may not be sensitive enough for very low-level (i.e., single ng/L) project requirements.

Non-Potable Water and other Environmental Media

Validation of SPE-ID Method for PFAS Analysis

EPA is collaborating with the Department of Defense's Naval Seas Systems Command Laboratory Quality and Accreditation Office and SGS-AXYS to validate a solid-phase extraction/isotope dilution (SPE-ID) method. The method will include solid matrices (e.g., soil, sediment, fish tissue, biosolids) in addition to non-drinking water aqueous matrices.

In addition to the 24 analytes included in draft SW-846 Method 8327, EPA plans to include additional analytes for the SPE-ID Method to include analytes recently added to EPA Method 537. Single-laboratory validation of the SPE-ID protocol is targeted for winter 2020 and multi-laboratory validation will likely follow in 2021.

Evaluating Methods for Total PFAS Assessments

EPA will also begin evaluating methods for total organic fluoride (TOF) analyses in 2020. An effective TOF method will facilitate broad assessments of total PFAS in environmental samples.

Developing Sampling and Storage Methods

EPA ran time-based studies on degradation or loss of target analytes during sample storage (45 days) and assessed the effects of different sample vessel materials (e.g., plastic, glass) on analyte recovery. Based on these sampling and storage studies, EPA methods under development will recommend using PFAS-free, plastic containers (e.g., high-density polyethylene containers); whole sample preparation; and sample holding times of 28 days. EPA will also develop guidelines for field sampling, which are critical for minimizing sample contamination and optimizing data quality for site characterization and remediation.

Due to the widespread use of PFAS, many materials normally used in field and laboratory operations contain PFAS. For example, polytetrafluoroethylene products (tubing, sample containers, and sampling tools) are often used in sampling; however, since these products can contain PFAS, they cannot be used in sampling for PFAS. In addition, many consumer goods brought to a sampling site may contain PFAS that can contaminate samples. Field sampling and laboratory hygiene protocols are critical to ensuring that testing results reflect actual PFAS levels in the analyzed media. The Interstate Technology and Regulatory Council has summarized site characterization, sampling precautions, and analytical method issues and options through their fact sheet series.

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Additional Information

- **EPA Method 537.1**: *cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=343042&Lab=NERL*
- **EPA Method 533:** *epa.gov/dwanalyticalmethods/method-533-determination-and-polyfluoroalkyl-substances-drinking-water-isotope*
- **SW-846 Method 8327:** *epa.gov/hw-sw846/validated-test-method-8327-and-polyfluoroalkyl-substances-pfas-using-external-standard*
- **PFOA & PFOS Drinking Water Health Advisories:** *epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos*
- **UCMR3:** *epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule*
- **Interstate Technology and Regulatory Council PFAS Fact Sheets:** *pfas-1.itrcweb.org/fact-sheets/*
- **PFAS in Your Environment:** *epa.gov/pfas*
- **Clean-Up Information:** *clu-in.org/*