



PFAS USER GUIDE

SGS

ANALYSES OF PER- AND POLYFLUORO ALKYL SUBSTANCES (PFAS) BY LC-MS/MS

WHAT ARE PFAS COMPOUNDS?

Per- and Polyfluoroalkyl Substances (PFAS) are classified as contaminants of emerging concern (CECs) based on increasing environmental and health concerns and consequent developing regulatory standards. Comprising a class of over 3,000 identified fluorinated compounds; they are used in the manufacture of many products such as PTFE (polytetrafluoroethylene), textile coatings, firefighting foams, semi-conductors, paper and packaging coating additives, cleaning products, pesticides and metal plating process agents. The C-F bond is the strongest known in organic chemistry, making PFAS persistent in the environment. Longer chain PFAS are bioaccumulative as well. Key PFAS classes of concern include perfluoroalkyl carboxylic acids (PFCAs) such as PFOA, and perfluoroalkyl sulfonic acids (PFSAs) such as PFOS. Many PFAS will transform in the environment or via biological processes to form PFCAs or PFSAs.

There are no federal drinking water standards established for PFAS substances. However, in 2016, the EPA released drinking water health advisories of 70 parts per trillion for the sum of PFOS and PFOA to protect Americans from adverse health effects caused over a lifetime of exposure. Other countries, and select U.S. states have implemented regulations for a broader group of PFAS and the development of regulatory guidance is on-going.

BENEFITS OF SERVICE

As an emerging contaminant requiring evolving analytical methods, it is important that you get the highest degree of positive identification and accurate quantification. Analytical methods must be rugged and use defined best practices updated to reflect current understanding. SGS provides you industry leading testing experience over 16 years and more than 80,000 processed PFAS samples. SGS has multiple facilities in North America with broad accreditation scope including DoD, NELAP, and ISO17025.

We support your PFAS needs by:

- ANALYSIS of PFAS compounds of concern with the widest range of PFAS analytes and matrices available commercially
- INSTRUMENTAL CAPACITY to address growing market demands for volume and turn-around-time with our network of 12 LC/MS/MS instruments available for PFAS analysis
- TOP (Total Oxidizable Precursor) analysis - providing you comprehensive information on unknown precursors at your site
- METHOD DEVELOPMENT - adapting to changing analytical needs. PFAS analytical methodologies and regulations are in a state of rapid transition. SGS AXYS is at the forefront of these changes, through collaboration with leading technical and regulatory groups. As the PFAS analytical requirements change, SGS helps you meet your evolving PFAS data needs.

SGS has a wide variety of analytical options to support many and varied PFAS studies. Your SGS representative can assist you to determine the right service for your needs.

TOTAL OXIDIZABLE PRECURSORS (TOPS)

TOP is an analytical procedure for transforming PFAS Precursors in a sample to measurable perfluorinated carboxylic acids (C4-C14), and is used to estimate potential PFCA contributions from unknown precursors. TOP uses persulfate-mediated hydroxyl radical oxidation to convert precursors to terminal PFCAs. The analysis may be applied with pre- and post-conversion measurements. The measured increase in PFCAs in the post-conversion analysis compared to pre-conversion values, represents a measure of the potential precursors in the sample. This data may be useful to clients concerned with studying overall PFAS in specific environments/sites, and to provide comprehensive assessments of remediation success.

CONTINUED

COMPETITIVE ADVANTAGE

Our unrivalled analytical experience, capabilities and capacity offer you the best choice for your PFAS testing needs.

Consequently, SGS is the first choice for many government agencies, consultants and EHS managers. Our continuous improvement and quality control practices ensure comprehensive, current and defensible data.

Our PFAS Analyses include:

- A wide range of matrices to analyze 24 - 30 PFAS compounds in water, soil, sediments, biosolids and tissues/biofluids.
- Specific analyte lists applicable to air, biological tissue and serum are available
- Specialized tests for precursors such as PAPs, diPAPs, FTCAs, FTUCAs etc, and for isomer speciation.
- Use of isotope dilution/internal standard methods in all matrices except prescriptive EPA 537 drinking water analysis
- Best in class reporting limits for low level PFAS work
- 8 dedicated LC/MS/MS instruments specifically for PFAS analysis in our network
- Technical expertise with more than 30 years of analytical experience and over 80,000 samples processed for PFAS
- Multiple accreditations including DoD, ELAP/TNI and ISO17025
- Demonstrated analytical proficiency demonstrated through regular PE studies and worldwide inter-calibration studies
- The most experienced technical assistance available for SGS clients



PFAS ANALYTES

ANALYTE	ACRONYM	CAS #
PERFLUOROALKYL CARBOXYLIC ACIDS		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorononanoic acid	PFNA	375-95-1
Perfluorodecanoic acid	PFDA	335-76-2
Perfluoroundecanoic acid	PFUnDA or PFUnA	2058-94-8
Perfluorododecanoic acid	PFDoDA or PFDoA	307-55-1
Perfluorotridecanoic acid	PFTriDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
PERFLUOROALKYL SULFONIC ACIDS		
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorononanesulfonic acid	PFNS	474511-07-4
Perfluorodecanesulfonic acid	PFDS	335-77-3
PERFLUOROCTANE SULFONAMIDES		
Perfluorooctane sulfonamide	FOSA or PFOSA	754-91-6
N-Methyl perfluorooctane sulfonamide	N-MeFOSA	31506-32-8
N-Ethyl perfluorooctane sulfonamide	N-EtFOSA	4151-50-2
PERFLUOROCTANE SULFONAMIDO ACETIC ACIDS		
N-Methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
N-Ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6
PERFLUOROCTANE SULFONAMIDO ETHANOLS		
N-Methyl perfluorooctane sulfonamidoethanol	N-MeFOSE	24448-09-7
N-Ethyl perfluorooctane sulfonamidoethanol	N-EtFOSE	1691-99-2
FLUOROTELOMER SULFONATES		
4:2 Fluorotelomer sulfonate	4:2 FTS	757124-72-4
6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
PERFLUOROALKYL ETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)-propanoic acid (GenX)**	HFPO-DA	13252-13-6

*Not routine **Available at SGS Axys & Wilmington laboratories

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REPORT LISTS							CERTS	
PFOA PFOS	UCMR3 LIST	EPA 537 LIST	TEXAS TCEQ LIST	AFCEE PFAS23	AFCEE PFAS25	QSM 5.1 "LIST"	DOD ELAP	FL NELAC
			X	X	X	X	X	X
			X	X	X	X	X	X
		X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
		X	X	X	X	X	X	X
	X	X	X	X	X	X	X	X
						X		
	X	X	X	X	X	X	X	X
				X	X	X	X	X
			X	X	X	X	X	X
				X	X	X	X	X
				X*	X*		X	X
				X*	X*		X	X
		X			X	X	X	X
		X			X	X	X	X
				X*	X*		X	X
				X*	X*		X	X
						X		
				X	X	X	X	X
			X	X	X	X	X	X

Please contact the laboratory for DL, LOD and LOQ

SAMPLING, SHIPPING & HANDLING

MATRIX	CONTAINER	PRESERVATIVE	MATRIX CODE ON COC	METHOD	NOTES
Soil, sediment	1x4 oz. HDPE	none	SO/SED	537MOD	
Groundwater, surface water, water	2x125 ml HDPE	none	GW/SW/WW	537MOD	
Groundwater, surface water, water needing lower RLs	2x250 ml HDPE	none	GW/SW/WW	537MOD	
Effluent	2x125 ml HDPE	TRIZMA	WW or EF	537MOD	Finished samples may need TRIZMA. TRIZMA is a buffer and removes free chlorine.
Drinking water	2x250 ml HDPE or PP	TRIZMA	DW	537	
Drinking water not for compliance	2x250 ml HDPE	TRIZMA	WW	537MOD	Matrix code DW triggers the lab to use method 537 so samples need to be logged as WW.
Air					contact Orlando lab for specifics
Tissue					contact SGS AXYS for specifics

SAMPLING GUIDELINES

When sampling for PFAS, it is recommended that particular care be taken prior to and during sampling to avoid residual PFAS on sampling equipment and cross contamination issues and the need for very low reporting limits. Please speak to your SGS project manager for

current best practices. Using new nitrile gloves, collect the sample for PFAS first, prior to collecting samples for any other parameters into any other containers. This avoids contact with any other type of sample containers, bottles or package materials.

Do not place the sample bottle cap on any other surface when collecting the sample.

Avoid all contact with the inside of the sample bottle or its cap.

When the sample is collected and capped, place the sample bottle(s) in an individual sealed plastic bag (e.g. Ziploc) separate from all other sample parameter bottles.

DO NOT USE ITEMS	DO USE ITEMS
FIELD EQUIPMENT ITEMS	
No Teflon™ containing materials	High-density polyethylene (HDPE) and polypropylene (PP) materials
Do not store samples in containers made of LDPE materials	Acetate liners
No Teflon™ tubing	Silicon tubing
No waterproof field books	Loose paper (non-waterproof)
No plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
No Post-It Notes	Sharpies®, pens
No chemical (blue) ice packs	Regular ice
FIELD CLOTHING AND PPE ITEMS	
No new clothing or water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of synthetic or natural fibers (preferably cotton)
No clothing laundered using fabric softener	No fabric softener
No boots containing Gore-Tex™	Boots made with polyurethane and polyvinyl chloride (PVC)
No Tyvek®	Cotton Clothing
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling	Sunscreens – All Organic Natural Sunscreen, that are “free” or “natural”. Check the label
	Insect Repellents – Natural preparations, DEET (check the label)
SAMPLE CONTAINERS ITEMS	
No LDPE or glass containers	HDPE or polypropylene
No Teflon™-lined caps	Lined or unlined HDPE or polypropylene caps
RAIN GEAR ITEMS	
No waterproof or resistant rain gear	Tent that is only touched or moved prior to & following sampling activities
EQUIPMENT DECONTAMINATION ITEMS	
No Decon 90	Alconox® and/or Liquinox®
No water from an on-site well	Potable water from municipal drinking water supply
FOOD ITEMS	
No food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

SHIPPING

Please include a fully completed chain-of-custody with each shipment. All sample documentation must be received for the samples to be accepted for analysis.

Samples are accepted Monday through Friday from 8 am – 5 pm. Samples are accepted Saturday delivery by Federal Express only. Other arrangements may be made as necessary.

ACCREDITATIONS SUMMARY

STATE	POTABLE WATER (SDWA)	NON-POTABLE WATER (CWA)	SOLID AND CHEMICAL MATERIALS (RCRA)	TISSUE	SERUM PLASMA
Alabama	O* W*	O* W*	O*		
Alaska	O W	O W	O		
Arizona	O	O* W*	O*		
Arkansas	O* W*	O* W*	O*		
California	O	O* W*	O*		
Colorado	O* W*	O* W*	O*		
Connecticut	O* W*	O* W*	O*		
Delaware		O* W*	O*		
DoD ELAP/ISO 17025	W*	S	S		
DoD QSM 5.1, Table b-15		S	S		
Florida	W*	S	S	S	
Georgia	O* W*	O* W*	O*		
Hawaii	O* W*	O* W*	O*		
Idaho		W*			
Illinois	O* W*	O* W*	O*		
Indiana	O* W*	O* W*	O*		
Iowa	O* W*	O* W*	O*		
Kansas		W*			
Kentucky	O* W*	O* W*	O*		
Louisiana	W*				
Maine	W	W*			
Maryland	O* W*	O* W*	O*		
Massachusetts	O* W*	O* W*	O*		
Michigan	O* W*	O* W*	O*		
Minnesota	W	W S	S	S	
Mississippi	O* W*	O* W*	O*		

STATE	POTABLE WATER (SDWA)	NON-POTABLE WATER (CWA)	SOLID AND CHEMICAL MATERIALS (RCRA)	TISSUE	SERUM PLASMA
Missouri		O* W*	O*		
Montana		O* W*	O*		
Nebraska		W*			
Nevada	O	O	O		
New Hampshire	O W	O W	O		
New Jersey	O W	O W S	O S	S	
New Mexico	O* W*	O* W*	O*		
New York	O W	O* W*	O*		
North Carolina	O* W*	O* W*	O*		
North Dakota	O W	O* W*	O*		
Ohio	W*				
Oklahoma	O* W*	O* W*	O*		
Oregon	O W	O	O		
Pennsylvania	O W	O*	O*		
Rhode Island			O*		
South Carolina	O* W*	O* W*	O*		
South Dakota	O* W*	O* W*	O*		
Tennessee		O* W*	O*		
Texas	O* W*	O* W*	O*		
Utah	O	O	O		
Vermont	O W	O* W*	O*		
Virginia	O* W*	O* W*	O*		
Washington	O W	O S	O S		
West Virginia		O*	O*		
Wisconsin	W*	W*			
Wyoming		O* W*	O*		
ISO/IEC 17025		S**	S	S	S

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O Accreditation for Orlando, FL laboratory

S Accreditation for SGS Axys, Sidney, BC laboratory

W Accreditation for Wilmington, NC laboratory

* Accreditation not required under this state program, o is either not needed or is covered under another program (different matrix, NELAP, etc.). SGS is fully qualified to perform work for this program.

GLOSSARY OF TERMS

AFFF	Aqueous film forming foams	ID	Isotope Dilution	PFAS	Perfluoroalkyl and polyfluoroalkyl substance(s)
ASTM	American Society for Testing and Materials	IEC	International Electrotechnical Commission	PFCs	Perfluorinated compounds
CWA	Clean Water Act	ISO	International Organization for Standardization	PFOA	Perfluorooctanoic acid
CoC	Contaminant of concern	LC-MS/MS	Liquid chromatography tandem mass spectrometry	PFOS	Perfluorooctanesulfonic acid
CoPC	Contaminant of potential concern	LDPE	Low-density polyethylene	PHA	Provisional health advisory
DoD	Department of Defense	MCL	Maximum Contaminant Level	PP	Polypropylene
DW	Drinking water	mg/kg	milligram per kilogram	PPE	Personal protective equipment
EPA	Environmental Protection Agency	MS	Matrix spike	ppm	parts per million
FFTA	Firefighting training area	MSD	Matrix spike duplicate	ppt	parts per trillion
FRBs	Field Reagent Blanks	NELAP	National Environmental Laboratory Accreditation Program	PTFE	Polytetrafluoroethylene
FTS	Fluorotelomer sulfonate	QA/QC	Quality Assurance/Quality Control	QSM	Quality systems manual
GC/MS	Gas chromatography/mass spectroscopy	RCRA	Resource Conservation and Recovery Act	RL	Reporting limit
GW	Ground Water	SDWA	Safe Drinking Water Act	SDWA	Safe Drinking Water Act
HAs	Health advisories	SPE	Solid phase extraction	SPE	Solid phase extraction
HDPE	High-density polyethylene	SW	Solid waste	SW	Solid waste
HPLC	High performance liquid chromatography	TOP	Total Oxidizable Precursor	TOP	Total Oxidizable Precursor
HRMS	High resolution mass spectrometry	ug/l	microgram per liter	ug/l	microgram per liter
		PE	Polyethylene		



PFAS FREE DRILLING

SGS's North American Drilling Division has over 30 years of experience with more than 6,500 completed projects within the United States and the U.S. Virgin Islands. Our expansive, diverse fleet of drills ranges from the smallest Geoprobe 420M up to full size Sonic, Air Rotary, Mud Rotary, Dual Rotary and Hollow-Stem rigs.

We are setting standards of excellence in the drilling industry by proudly offering certified PFAS-Free Drilling. All drilling lubricants, consumables, down-hole rod/augers and bits as well as our on-site water supply well have been tested and are certified PFAS-free by SGS. In addition, our staff has practical field experience with PFAS investigation/characterization jobs. We are well versed in preparation requirements to prevent interference from our activities on your project.

These measures are incomparable in the industry and ensure reliably sampled, representative and defensible test results.

NORTH AMERICA PFAS BY FACILITY

ORLANDO, FL USA LABORATORY

- Full Service Regulatory Analysis
- PFAS in Drinking Water by EPA 537 rev. 1.1
- PFAS in Groundwater, NPG and Solids by isotope dilution (ID)
- DoD QSM 5.1 / NELAP / ISO 17025 accredited
- State accreditations for DW, NPW, and Solids where available (see table)

WILMINGTON, NC, USA LABORATORY

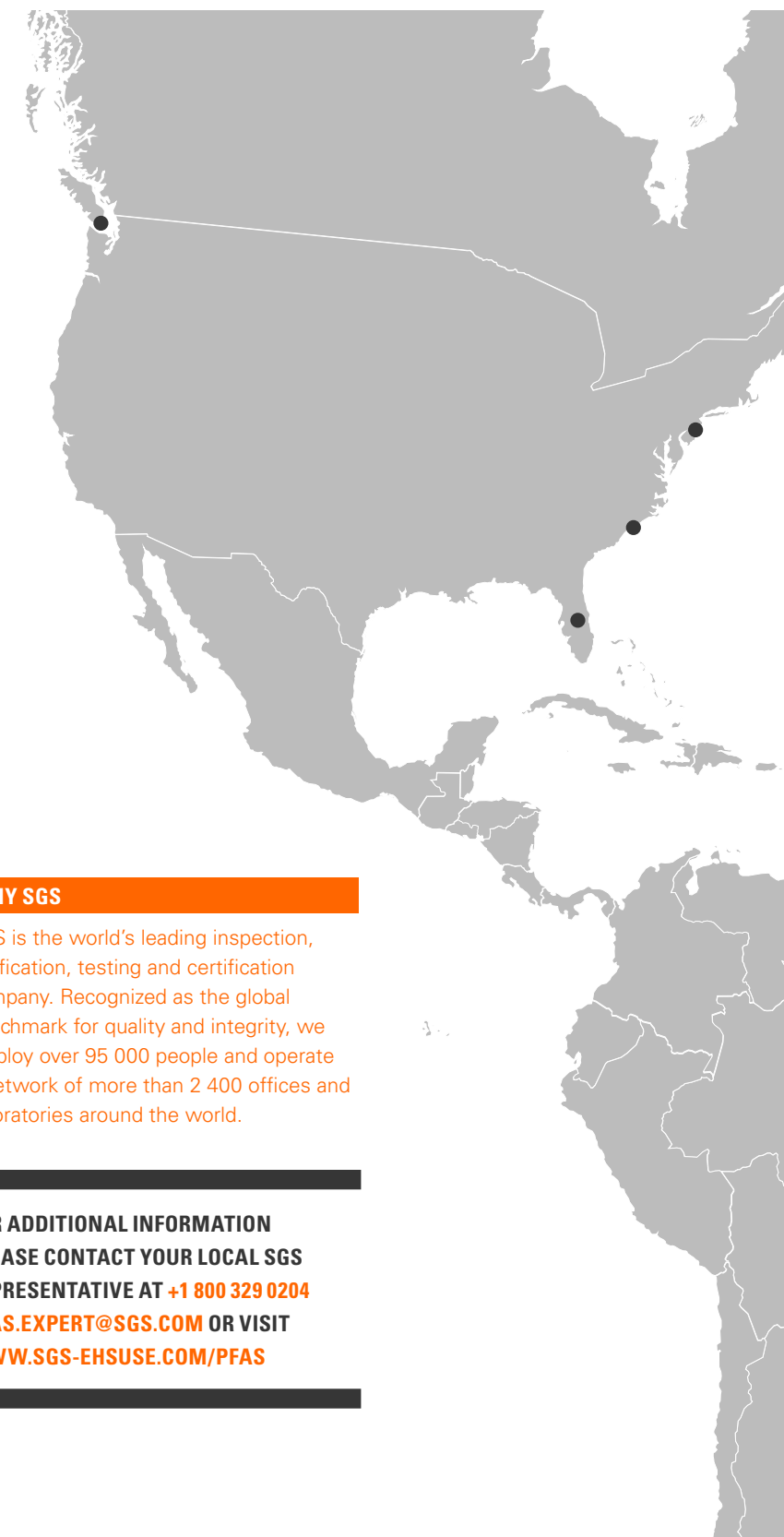
- HRMS Specialty (Dioxin/Furans, PCB Congeners, HRMS PAHs, HRMS Pesticides)
- Source Evaluation, Contaminated-Sites and NPDES analyses
- PFAS in Drinking Water, Water and Solids by internal standard approaches
- DoD QSM 5.1 / NELAP / ISO 17025 accredited

SGS AXYS, SIDNEY, BC, CANADA LABORATORY

- HRMS, LC-MS/MS, GC-MS trace and ultra-trace, all matrices excluding DW
- PFAS in Water, Solids, Tissue, Serum, Method Development (multiple target analyte methods)
- DoD QSM 5.1 / NELAP / ISO 17025 accredited
- Also offers other PFAS analysis (such as polyfluorinated phosphorous compounds, extended precursor list)
- TOP (aqueous, solids)
- AFFF products and manufacturing intermediates

WEST CREEK, NJ, USA DRILLING

- United States, Virgin Islands
- Sampling for PFAS in Drinking Water, Water and Solids
- Certified PFAS Free Drilling



WHY SGS

SGS is the world's leading inspection, verification, testing and certification company. Recognized as the global benchmark for quality and integrity, we employ over 95 000 people and operate a network of more than 2 400 offices and laboratories around the world.

**FOR ADDITIONAL INFORMATION
PLEASE CONTACT YOUR LOCAL SGS
REPRESENTATIVE AT +1 800 329 0204
PFAS.EXPERT@SGS.COM OR VISIT
WWW.SGS-EHSUSE.COM/PFAS**

WWW.SGS.COM

WHEN YOU NEED TO BE SURE

