



PFAS USER GUIDE

SGS

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

WHAT ARE PFAS COMPOUNDS?

Per- and Polyfluoroalkyl Substances (PFAS) compounds are classified as emerging environmental contaminants based on increasing environmental and health concerns as well as developing regulatory standards related to these compounds. They are a class of fluorinated chemicals with over 3,000 identified compounds. PFAS substances are used in many industrial and consumer products for their surfactant properties and durability. They may be used in the manufacture of many products such as PTFE (polytetrafluorethylene), textile coatings, firefighting foams, metal plating processing, semi-conductors, paper and packaging coating additives, cleaning products and pesticides. The C-F bond is the strongest known in chemistry. PFAS compounds are persistent and some are bioaccumulative. PFAS compounds have many classes. Key classes of concern are perfluoroalkyl carboxylic acids (PFCAs) such as PFOA, and perfluoroalkyl sulfonic acids (PFSAs) such as PFOS. Many PFAS compounds will transform in the environment or biological processes to PFCAs and 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 compounds. The development of regulatory guidance for PFAS compounds is an ongoing process.

BENEFITS OF SERVICE

As an emerging contaminant and analytical method, it is important you get the highest degree of positive identification and accurate quantification from methods using defined best practices. We offer you extensive testing experience with over 80,000 processed PFAS samples from our multiple facilities in North America. We possess multiple accreditations including DoD, NELAP, and ISO17025 that demonstrate quality and accuracy using accepted methods.

Our superior service helps you:

- Analyze your PFAS compounds of concern with the widest range of PFAS analytes and matrices available of any commercial lab
- Meet the growing market demands for volume and turn-around-time with our network of 8 LC/MS/MS instruments dedicated to PFAS analysis
- Provide clients with comprehensive information regarding the total amount of PFCA compounds that can potentially be produced from environments with complex PFAS chemistry through Total Oxidizable Precursors (TOPs) available from SGS AXYS
- Adapt to changing analytical needs as PFAS analytical methodologies and PFAS regulations are in a rapid state of transition. SGS AXYS is at the forefront of these changes, interactions with technical and regulatory groups. As the PFAS analytical requirements change, SGS will help you meet the many new challenges every step of the way.

SGS has a wide variety of analytical options to support PFAS studies of all sorts. Your SGS representative will help you determine the right service for your needs.

TOTAL OXIDIZABLE PRECURSORS (TOPS)

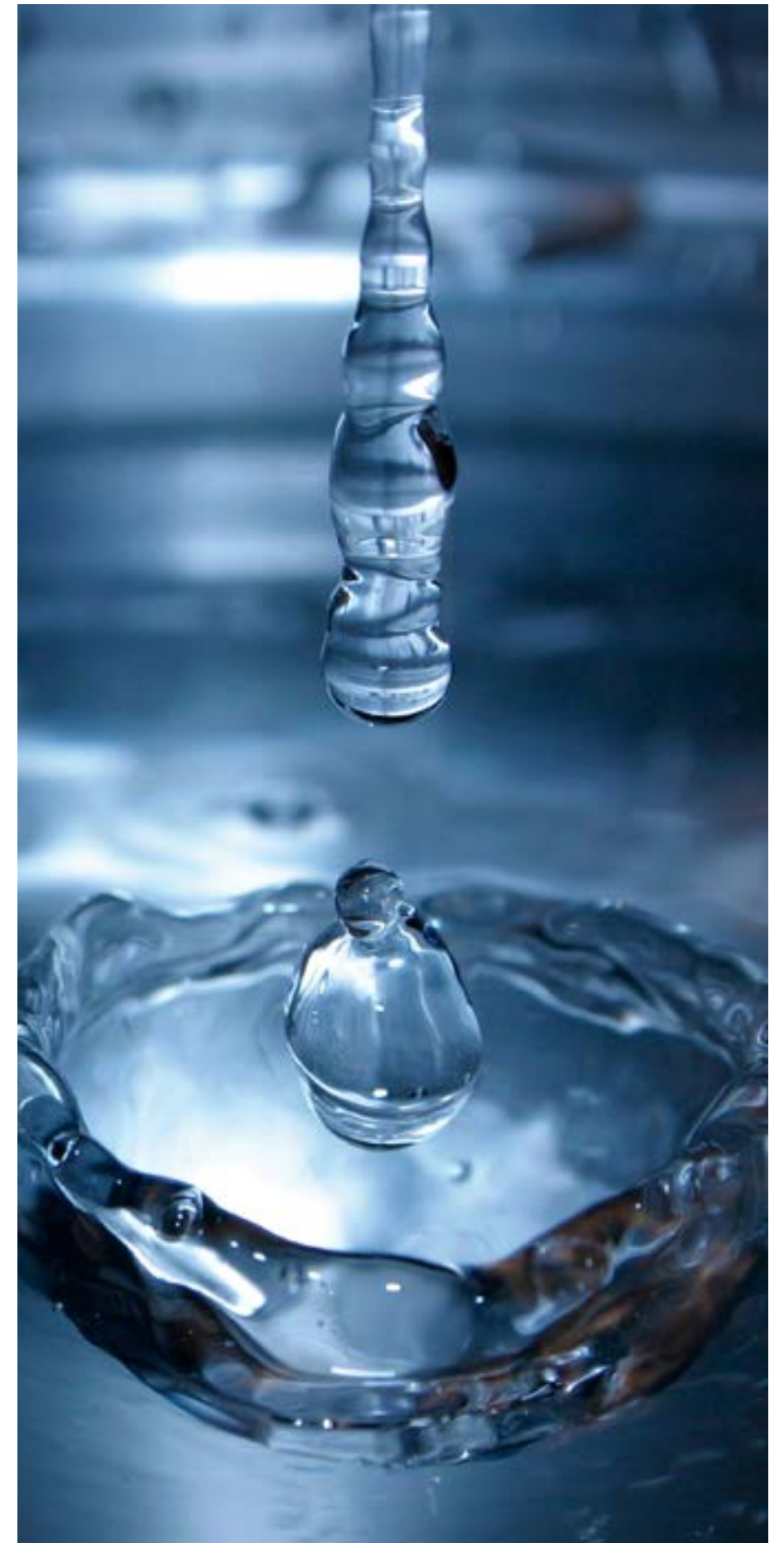
TOP is a process of transforming PFAS Precursors in a sample to measurable perfluorinated carboxylic acids (C4-C14) which can be measured to evaluate potential PFCA contributions from unmeasured compounds. The sample plus persulfate and heat converts precursors to terminal PFCAs. The analysis may be applied with pre- and post-conversion measurements. The increase in PFCAs for the post conversion analysis represents a measure of the potential precursors in the sample. This may be used for many informational purposes by those studying PFAS in the environment.

CONTINUED COMPETITIVE ADVANTAGE

Our unrivalled analytical experience, capabilities and capacity offer you a sound choice for your PFAS testing needs. That is why we are the first choice for many government agencies, consultants and EHS managers. Our continuous improvement and quality control practices assure your defensible data results.

Our PFAS Analyses includes:

- A wide range of matrices to analyze 24 - 29 PFAS compounds in water, soil, sediments and biosolids. Specific analyte lists applicable to air, biological tissue and serum are available
- Specialized tests for precursor compounds such as PAPs, diPAPs, FTUCAs etc.
- Use of isotope dilution / internal standard methods in all matrices except prescriptive EPA 537 drinking water analysis
- Best in class reporting limits are available 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, ECAP and ISO17025
- Analytical proficiency demonstrated through PE studies and worldwide inter-calibration studies
- Experienced technical assistance 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	PFTrDA	72629-94-8
Perfluorotetradecanoic acid	PFTeDA	376-06-7
PERFLUOROALKYL SULFONATES		
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

Updated August 15, 2017 - Orlando, Wilmington & Dayton laboratories only

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

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 additional and/or more frequent field/equipment blanks be collected prior to and during sampling to check for residual PFAS on sampling equipment due to the potential for cross-contamination issues and the need for very low reporting limits.

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 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 (preferable 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 – Various natural one, 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)
Alabama	✓*	✓*	✓*
Alaska	✓*	✓*	✓*
Arizona	✓	✓*	✓*
Arkansas		✓*	✓*
California	In Progress	✓*	✓*
Colorado	✓*	✓*	✓*
Connecticut			
Delaware		✓*	✓*
DoD ELAP/ISO 17025	✓	✓	✓
Florida	✓	✓	✓
Georgia	✓*	✓*	✓*
Hawaii	✓*	✓*	✓*
Idaho		✓*	✓*
Illinois	✓*	✓*	✓*
Indiana	✓*	✓*	✓*
Iowa	✓*		
Kansas	✓	✓*	✓*
Kentucky	✓*		✓*
Louisiana	✓	✓	✓
Maine	✓	✓*	✓*
Maryland	✓*	✓*	✓*
Massachusetts		✓*	✓*
Michigan		✓*	✓*
Minnesota	✓*	✓	✓
Mississippi	In Progress	✓*	✓*
Missouri		✓*	✓*

STATE	POTABLE WATER (SDWA)	NON-POTABLE WATER (CWA)	SOLID AND CHEMICAL MATERIALS (RCRA)
Montana	In Progress	✓*	✓*
Nebraska	In Progress	✓*	✓*
Nevada	✓	✓	✓
New Hampshire	✓	✓	✓
New Jersey	✓	✓	✓
New Mexico		✓*	✓*
New York	✓	✓*	✓*
North Carolina	✓*	✓*	✓*
North Dakota	✓	✓*	✓*
Ohio	✓*		
Oklahoma	✓*	✓*	✓*
Oregon	✓	✓	✓
Pennsylvania	✓	✓*	✓*
Rhode Island	✓*		✓*
South Carolina	✓*	✓*	✓*
South Dakota	✓*		
Tennessee		✓*	✓*
Texas	✓*	✓*	✓*
Utah	✓	✓*	✓*
Vermont	✓	✓*	✓*
Virginia	✓*	✓*	✓*
Washington	✓	✓	
West Virginia		✓*	✓*
Wisconsin			

✓* Not required under this state program, so 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	ng/l	nanogram/liter	QA/QC	Quality Assurance/Quality Control
GC/MS	Gas chromatography/mass spectroscopy	NPDES	National Pollution Discharge Elimination System	QSM	Quality systems manual
GW	Ground Water	PAH	Polynuclear aromatic hydrocarbon	RCRA	Resource Conservation and Recovery Act
HAs	Health advisories	PE	Polyethylene	RL	Reporting limit
HDPE	High-density polyethylene			SDWA	Safe Drinking Water Act
HPLC	High performance liquid chromatography			SPE	Solid phase extraction
HRMS	High resolution mass spectrometry			SW	Solid waste
				TOP	Total Oxidizable Precursor
				ug/l	microgram per liter



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 Orlando, FL. 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 worry-free, accurate test results.

NORTH AMERICA PFAS BY FACILITY

ORLANDO, FL & DAYTON, NJ USA LABORATORIES

- 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 LABORTAORY

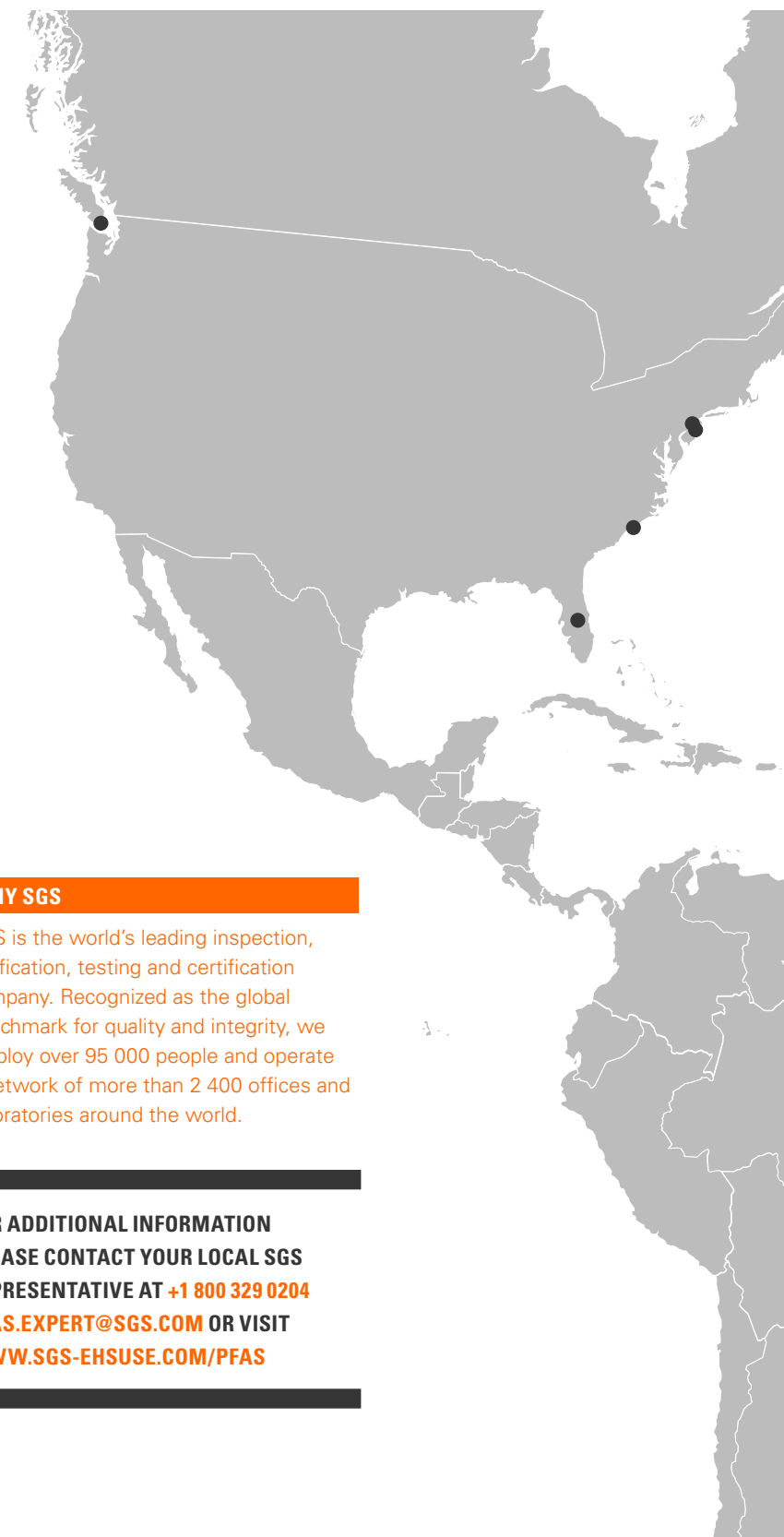
- HRMS Specialty (Dioxin/Furans, PCB Congeners, HRMS PAHs)
- Source Evaluation, Contaminated Sites and NPDES
- PFAS in Drinking Water, Water and Solids by internal standard
- DoD QSM 5.1 / NELAP / ISO 17025 accredited

SGS AXYS, VICTORIA, BC, CANADA LABORATORY

- HRMS, LC/MS/MS, GC/MS ultra-trace only, 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 offering other PFAS analysis (such as polyflourinated 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
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PFAS.EXPERT@SGS.COM OR VISIT
WWW.SGS-EHSUSE.COM/PFAS**

WWW.SGS.COM

WHEN YOU NEED TO BE SURE

