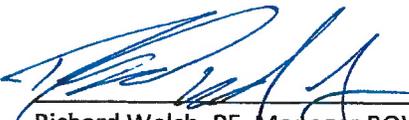
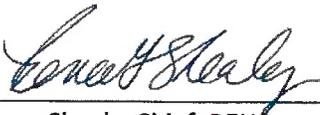


**Drinking Water PFAS Sampling and Analysis Project  
Quality Assurance Project Plan (QAPP)**

**Conducted By:** South Carolina Department of Health & Environmental Control  
SCDHEC; (the Department)  
Bureau of Water (BOW)  
Bureau of Environmental Health Services (BEHS)

**A1 Approvals:**

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Date

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QA Manager:   
David Graves, QAM, EA 5/29/20  
Date

This QAPP becomes effective on the date of the last signature.



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(\*) Located at SCDHEC/State Park, SC; all else located at SCDHEC 2600 Bull Street, Columbia, SC except where noted

### A4 Project Task Organization

#### Project Manager

Central point-of-contact for the assessment of PFAS in drinking water:

- Directs and coordinates sampling with central office staff, regional office staff and laboratories;
- Reviews and validates data;
- Maintains communications between the project and participating parties;
- Coordinates with BOW management, BOW public engagement representative and BOW PFAS web page contact for clear public presentation of the data.

#### Public Communications

Communicates testing plans and results to the sampled water systems and will ensure that BOW PFAS web page and social media, when accessed, stay current with progress of the sampling program.

#### Web Page and Social Media

Maintains the BOW PFAS web page as directed by BOW management.

#### Quality Assurance Manager (QAM)

Reviews and approves this QAPP and provides collaborative guidance on resolution of QA issues that may arise during the project.

#### Remediation Consultation

Technical resource for community water systems to discuss actions they may wish to take to mitigate PFAS presence in water supplies.

### Sampling Logistics

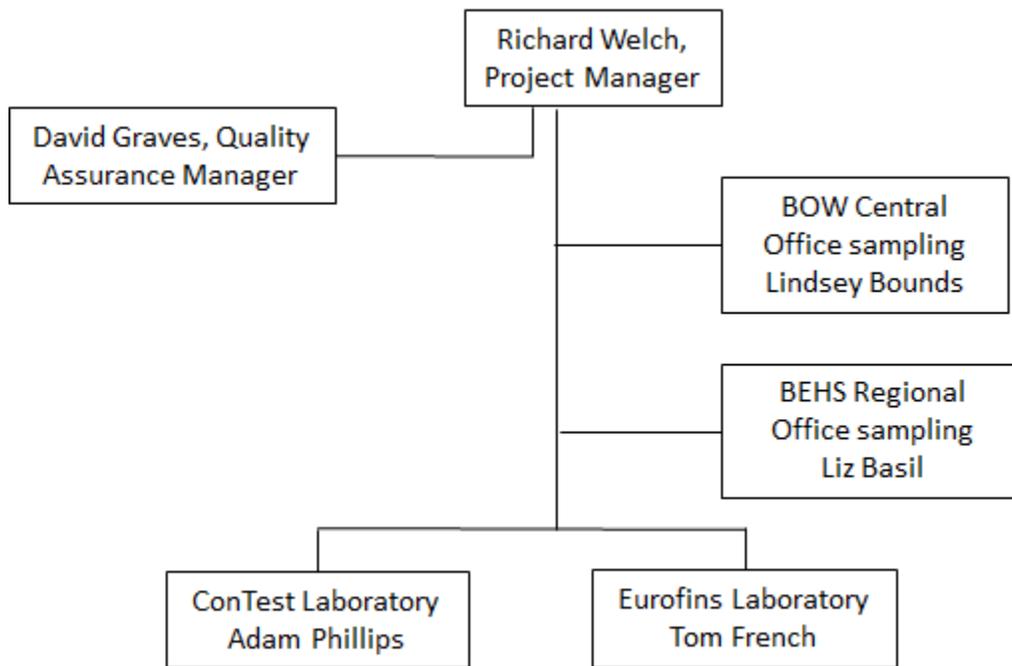
Works with the Project Manager to coordinate sample activities including laboratory timing, shipping, sample collection training and other necessary logistic activities.

### Recordkeeping

Ensures a central repository is created, maintained and kept current to house PFAS documents generated during this project.

### Sampling Teams

Staff responsible for ensuring that field activities are conducted in accordance with this QAPP.



## **A5 Problem Definition/Background**

### Problem Background

Per- and polyfluoroalkyl substances (PFAS) are synthetic, industrial chemicals known for their oil, heat, and water-resistant properties. PFAS have been produced and used worldwide since the 1940s. Though PFAS chemicals are no longer produced in the United States, they can be imported via food, commercial household products, packaging, plastics, textiles, and living organisms. Perfluoro-n-octanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) have been the most studied of PFAS. Studies on PFOA and PFOS indicate that, in general, PFAS are extremely persistent and difficult to break down in the environment and in the human body. While they do not occur in nature, PFAS have been found to bioaccumulate in people, wildlife and fish. Studies suggest exposure to PFAS may affect developmental stages in infants and children, lower a woman's chances of getting pregnant, disrupt the body's hormones and increase risk of cancer. The potential negative health outcomes appear to be dependent upon exposure to specific PFAS (i.e., all PFAS analytes are not indicated to result in a monolithic response).

Because PFAS are man-made chemicals, they can be found where they have been manufactured or commercially used. For instance, in addition to a wide variety of consumer products, PFAS can be associated with landfills, wastewater treatment facilities and/or facilities used for firefighter training. Currently, there is no enforceable regulatory standard for PFAS in drinking water. In 2016 the United States Environmental Protection Agency (USEPA) issued a Lifetime Health Advisory (LHA) of 70 ppt (parts per trillion) for PFOA and PFOS, either discretely or in sum.

A drinking water Health Advisory is intended to identify the concentration of an analyte less than which adverse health effects are not anticipated to occur over a lifetime of exposure. If an analyte concentration in drinking water is greater than a Health Advisory, it cannot be stated with confidence that there will not be a negative health impact due to long-term exposure. Accordingly, Health Advisories, though not enforceable, are developed to assist and guide federal, state, tribal and local officials in protection of public health.

### *Surface Water*

There are a few scenarios where PFAS could impact a surface water intake:

- Intake located downstream from wastewater treatment facility effluent that contains PFAS.
- Intake located in a relatively low-flow stream and upstream from where a PFAS-contaminated groundwater plume is discharging to the stream.
- Intake located in a stream impacted by PFAS flowing into the State from a neighboring state.

Currently, there are 70 surface water intakes that supply 61 surface water treatment plants in South Carolina.

### Groundwater

Moderate to deep groundwater wells are believed to be less susceptible to PFAS contamination than shallow wells or surface waters. For groundwater source systems, the first stage of implementation of the BOW's ***Strategy to Assess the Impact of Per- and Polyfluoroalkyl Substances on Drinking Water in South Carolina*** (Strategy) (Appendix A) will be to sample all community water systems [i.e., those that have fifteen (15) or more taps or serve more than 25 persons]. There are 370 community ground water systems in the State that have 931 active water sources. Private (i.e., individual homeowner) wells serve approximately 1.3 million residents. Private wells may be addressed using a separate QAPP once the community water system assessment phase has been completed.

### Pre-Existing PFAS Data

Community water systems have been canvassed to request that if PFAS analysis has been performed on their water supplies, those results be provided to the Department. Systems that have no PFAS data and systems that evince PFAS issues based on their extant data will be prioritized for sampling and analyses.

### Problem Definition

The Department used recent studies regarding PFAS contamination and institutional knowledge of drinking water systems to evaluate the more probable PFAS substance sources throughout South Carolina and the potential vulnerability of a given drinking water source. This work was formalized into a Strategy to assess drinking water in the State for PFAS (Appendix A).

The purpose of this QAPP is to memorialize means and methods that will be used for implementation of the Strategy for acquisition of empirical data to evaluate:

1. The presence of PFAS in South Carolina drinking water, and

2. The portion of the population that may be exposed to PFAS in drinking water.

This information will lead to a better understanding of potential public health concerns from PFAS exposure and more informed decisions regarding the need to regulate PFAS in drinking water and the environment.

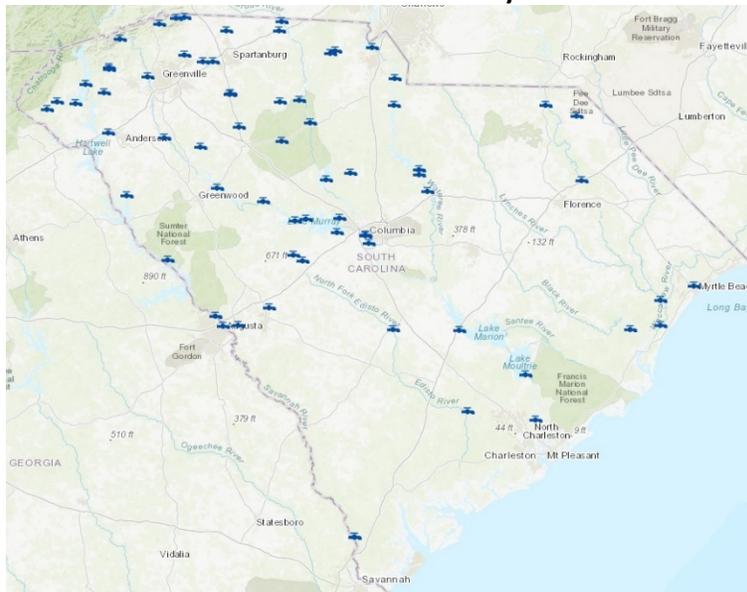
#### **A6 Project Task Description/Objective**

The Department plans on testing drinking water provided by all community water systems for PFAS using EPA Methods 537.1 and/or 533. Method 537.1 returns results for 18 PFAS. Method 533 returns results for 25 PFAS. For groundwater sources, samples will be analyzed using EPA Method 537.1. If there is a detection in the groundwater source, the sample will be re-collected and analyzed using EPA Method 533. For surface water sources, samples will be analyzed using both EPA Method 537.1 and Method 533. Con Test Labs will perform all analyses for Method 537.1 and Eurofins will perform all analyses for Method 533.

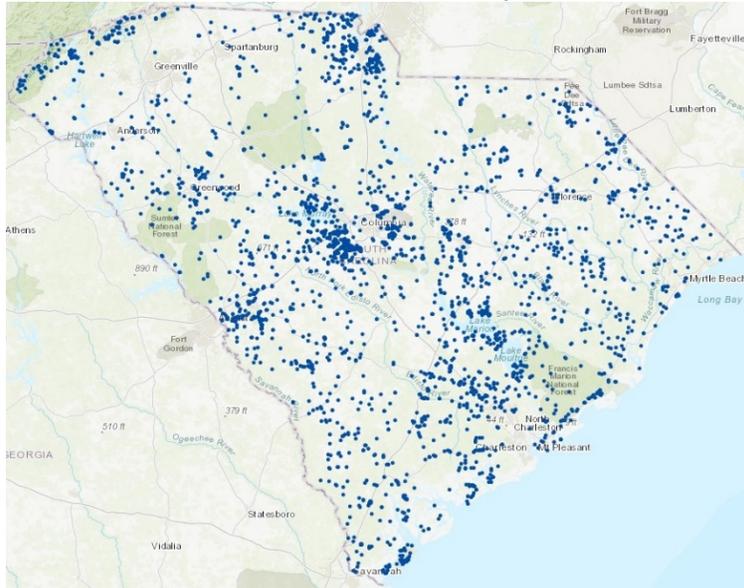
The Department intends to collect and have analyzed the surface water system samples in the early summer 2020. It is anticipated that the surface water sampling will take six-weeks or less. Teams will sample Monday through Wednesday in order to ship samples to the labs. After this initial phase of the project has been completed, the ground water sampling will begin. It is expected that the ground water sampling will begin mid-summer 2020 and continue until all ground water systems have been analyzed. The ground water sampling will be performed by the regional staff at their discretion and at the availability of their schedules. Teams will sample Monday through Wednesday in order to ship the samples to the labs. The intent of this project is for one round of sampling at each water system. Each of the contract labs has indicated that there are no resource or time constraints.

Upon analysis, each lab will send an electronic report to the Project Manager for review and validation. Data will be reviewed and assessed against the EPA Health Advisory Levels for PFAS. Depending on the results, the Department will initiate further steps outlined in this QAPP.

#### **Surface Water Treatment Systems**



## Ground Water Treatment Systems



### A7 Quality Objectives and Criteria for Measurement Data

#### Precision

Refer to EPA Method 537.1 and EPA Method 533.

#### Bias

Refer to EPA Method 537.1 and EPA Method 533.

#### Representativeness

The sampling effort is designed to evaluate the community public drinking water systems in South Carolina for PFAS. Samples will be collected from the systems before any added treatment.

#### Comparability

The analytical methodology for this project has been validated by the USEPA for testing in drinking water. Results will be used to assess whether the water system contains PFAS in the respective analytical methods parametric coverage and whether PFOA and PFOS exceed the USEPA LHA of 70 ppt.

#### Completeness

In order to satisfy the objective of the project, samples will be collected from 100 percent of community drinking water systems, as described in this QAPP. One hundred percent (100%) of collected samples will be analyzed and reported. Any samples lost after collection will be resampled.

#### Sensitivity

The Laboratory's Reporting Limit (RL) for the determination of PFAS in drinking water samples, using EPA Method 537.1 and/or Method 533 is 2.0 ppt.

#### Samples Outside Quality Objectives

Samples that fall outside of the quality objectives will be flagged for possible recollection and analysis.

## **A8 Special Training/Certifications**

BOW will coordinate an online special training session on PFAS sample collection and handling procedures compliant with USEPA Method 537.1 and Method 533 and this QAPP. All sampling team members will attend and complete this training. The Project Manager will ensure that the Central Office sampling team has met the training requirement and will keep records electronically. The BEHS drinking water program contacts will ensure that the regional office sampling teams have met this training requirement and keep records accordingly. No special certification is required.

## **A9 Documentation & Records**

### Data Reporting Package Format and Documentation Control

The format of all data reporting will be consistent with the requirements and procedures for an Analytical Support Level (ASL) II data quality assessment. This will consist of the results, certificates of analyses, completed Chain-of-Custody (COC) form and sample narrative.

### Data Reporting Package Archiving and Retrieval

Data will be submitted via email to the Project Manager. Data will be stored and backed up by the laboratory and the BOW per each entity's normal procedures and retention schedules.

### Report to Management

As information is returned from the labs, summary reports will be submitted via email to management. Upon project completion, the Project Manager will submit a written report to BOW management that details the results. This report will be stored and maintained electronically in accordance with the Department's record retention policy.

## **Section B Measurement / Data Acquisition**

### **B1 Sampling Process Design**

There are numerous factors that determine the potential impact of a given PFAS source on the vulnerability of a drinking water system to PFAS. Appendix A contains the BOW's PFAS Water Strategy. Section V of the document details the rationale for where to collect PFAS samples. Additionally, section A7 of this QAPP further states that samples will be collected from 100 percent of the community drinking water systems in South Carolina. Samples will be collected at these locations before any treatment. If the sample sites are inaccessible, the Project Manager will be consulted to determine an alternate location. Sample scheduling is detailed in this QAPP in section A6.

### **B2 Sampling Methods**

Equipment and supplies that will be needed to perform the sampling are certified pre-cleaned polyethylene 250-milliliter (mL) sample containers, weather- and waterproof labels, Chain-of-Custody (COC) forms, indelible ink pen/marker and shipping coolers with prepaid labels for return to lab.

Because PFAS are used in a wide variety of consumer products, *e.g.*, cosmetics, water- and oil-repellent clothing, laundry softeners, fast food wrappings, *etc.*, the sampling teams will be made aware of proper preparation, collection and handling during the pre-mobilization training session.

In addition to proper pre-sampling personal preparation (*e.g.*, clothing, cosmetics, *etc.*), the sampling teams will wash hands before sampling each system and will wear nitrile gloves during sample collection.

As stated in section A6 of this document, DHEC staff from the Central office and the Regional offices will be collecting the samples and shipping them to the two contract labs. The sample collection procedures will be followed according to the Methods used and the shipping will be completed using the appropriate lab protocols that have been shared with the Project Manager.

Sampling containers with EPA Method-specific preservatives added, PFAS-free certified water for field blanks and COC forms will be provided by the laboratories.

For analysis by EPA Method 537.1

Sample will be collected in a 250-mL polypropylene container containing laboratory-added preservative [5.0 grams per liter (g/L) Trizma®] fitted with a polypropylene screw-cap. The point-of-sampling in the water system will be opened and the system will be allowed to flush until the temperature stabilizes, typically three (3) to five (5) minutes, prior to sampling. The sample container will be filled slowly and carefully as to not flush the preservation reagent from the sample container. After collection, the container will be capped; the sample agitated to dissolve the preservative; and, the sample then be placed and kept on wet ice ( $\leq 10.0^{\circ}\text{C}$ ) until delivered to the laboratory.

For analysis by EPA Method 533

Sample will be collected in a 250-mL polypropylene container fitted with a polypropylene screw-cap. Based on the plan to fill a 250 mL container, ammonium acetate in solid form will be added to the sample containers by the laboratory to achieve a concentration of 1 gram per liter (g/L) to sequester free chlorine by forming chloramine. The point-of-sampling in the water system will be opened and the system will be allowed to flush until the temperature stabilizes, typically three (3) to five (5) minutes, prior to sampling. The sample container will be filled slowly and carefully as to not flush the preservation reagent from the sample container. After collection, the container will be capped and the sample then be placed and kept on wet ice ( $\leq 10.0^{\circ}\text{C}$ ) ice until delivered to the laboratory.

Field Quality Control

A field blank will accompany each daily sample collection for each sample team. This field blank will be formed by dispensing PFAS-free water provided by the laboratory into a sample container in the field, preserved and sent with field samples. That is, this blank will be handled just as the investigative samples are handled so as to detect problems in the field collection methodology. After collection, the container will be capped and the sample then be placed and kept on wet ice ( $\leq 10.0^{\circ}\text{C}$ ) ice until delivered to the laboratory.

Sampling SOP's

The following table lists the applicable SOP's sampling teams will follow.

<b>SOP</b>	<b>Version and date</b>
Method 533; Section 8.3	November 2019
Method 537.1; Section 8.2	Ver. 2.0 March 2020
Con-Test Labs SC DHEC 2020 User Guide	Informal guide, April 2020
Eurofins Eaton Analytical Sampling Instruction No. 48	July 2018

**B3 Sample Handling and Custody Requirements**

The COC forms (Appendix B) will be used for this project. The COC forms must be completed in entirety and accompany each sample received in the laboratory. Samples received without a corresponding and complete chain-of-custody will be rejected.

All samples will be disposed of in accordance with the laboratory Safety Manual. The samples received by the Laboratory for each water system, including any extracts, will be eligible for disposal once the data have been quality-reviewed for acceptance by the BOW. Samples including any sample extracts will not be retained and stored unless a written request is provided to the laboratory.

**B4 Analytical Requirements**

PFAS Analytical Method	Sample Matrix	Health Advisory Level (ppt)	Method Detection Limit (ppt)	Reporting Limit (ppt)
EPA 537.1	Drinking Water	70 for PFOA/PFOS combined & individually	2.0 ng/L (ppt)	2.0 ng/L (ppt)
EPA 533			2.0 ng/L (ppt)	2.0 ng/L (ppt)

The turnaround times from the labs will be approximately 10 days. There is no expectation to get the samples sooner.

**B5 Analytical Quality Control**

The USEPA has established protocols for the analysis of Quality Control (QC) samples with each analytical batch of samples, generally defined as a maximum of twenty samples. All QC results must be assessed and evaluated by the laboratory on an on-going basis. Method-specific QC acceptance criteria must be used to determine the validity of the data. The on-going QC samples must meet the acceptance criteria specified in Table 17 of EPA 533 and Table 13 of EPA 537.1.

For analytical testing, the laboratory includes positive control samples (Laboratory Fortified Blank) to evaluate the total analytical system. Negative control samples [Laboratory Reagent Blanks (LRB)] are used to assess the preparation batch for possible contamination during the preparation and processing steps. A blank is considered contaminated with any result equal to or greater than the analyte reporting limit. Specific control samples [Laboratory Fortified Matrix (LFM)] are used to indicate the effect of the sample matrix. Replicates (LFM, LFM duplicate) are performed to assess the precision of the results generated.

Specific information regarding the frequency, composition, acceptance criteria and corrective actions is documented in the laboratory’s specific standard operation procedure (SOP) for implementation of Method 537.1 and Method 533. Samples that have exceeded the holding time or temperature requirements will be flagged and analyzed. Analytical results will be reviewed to determine if sample recollection is necessary.

**B6 Instrument and Equipment Testing, Inspection and Maintenance**

All laboratory equipment will be tested, calibrated, and maintained in accordance with any existing SOPs maintained by the contract laboratories. There are no field instruments anticipated for this project.

**B7 Instrument and Equipment Calibration and Frequency**

Will be performed as specified in EPA Methods 537.1 and 533.

**B8 Inspection and Acceptance of Supplies and Consumables**

Sample containers are purchased pre-cleaned. Sample containers are one-time use. Laboratory provides certified cleaned sample containers with appropriate preservative(s) added.

Laboratory Testing Procedure

Laboratories will follow testing and reporting procedures and will use testing equipment in accordance with Method 537.1 and Method 533, per sample analysis direction from the BOW.

**B9 Non-Direct Measurement**

Internal/external secondary data is not required for this project.

**B10 Data Management**

Following sample collection, lab procedures outlined in section B2 will be followed to pack samples and completed chain of custody forms for shipment to the contract labs. Analytical results in the form of a final report for each sample delivery group, including the ASL II data packages, will be sent via electronic mail from the laboratory to the project manager. Results will be maintained on the Department's internal server which is backed up daily. All processes which involve data handling have been reviewed to ensure that data integrity is maintained by the Department's IT Department.

**Section C Assessments and Oversight**

**C1 Assessments/Oversight**

Identification of problems related to technical performance is the responsibility of all project team members. The Project Manager will assess problems that arises in the field. If necessary, modifications to technical procedures may be considered. Such indicated changes in technical procedures will be documented; evaluated to determine the impact(s), if any, to the data; discussed with and approved by the QAM; and, clearly explained in the Final Project Report.

The Laboratories will perform self-audit(s) and institute corrective action(s) in accordance with their respective written procedures.

**Section D Data Reporting, Validation, and Usability**

**D1 Data Review, Verification and Validation**

The Project Manager will evaluate the laboratory data packages against the final analytical results to determine if any field observations may have contributed to lower or higher analytical results. The Project Manager will review the analytical results and determine any limitations on the use of the data and include these limitations in the Final Project Report.

**D2 Validation and Verification Methods**

Data quality review of all laboratory-generated data is performed by a second laboratory analyst not associated with the actual measurement operations for the given analytical batch, but knowledgeable in the analytical processes employed. It is the responsibility of the reviewer to ensure that all data generated are correct and of known and documented quality. Once the review is completed, the reviewer will sign

and date the appropriate QA/QC checklist according to the Laboratory SOP. Limitations on the use of data will be communicated to the Laboratory Director and to the Project Manager.

**D3 Reconciliation with User Requirements**

As long as the review stages prescribed in this QAPP are satisfied and the data are concluded to be sound, the data will be determined to be useable for the purpose intended and no further assessment will be required. If any data are assessed to be unusable by the Project Manager, those data will be removed from the project database; re-sampling may be considered.

**D4 Reporting, Documents and Records**

All documents will be maintained electronically by the Project Manager on Departmental servers.

-----  
**Revision History**

Date	Revision No.	Revision	Section

**Appendix A – Bureau of Water Drinking Water PFAS Strategy**

# Strategy to Assess the Impact of Per- and Polyfluoroalkyl Substances on Drinking Water in South Carolina

Bureau of Water

South Carolina Department of  
Health & Environmental Control

2600 Bull Street  
Columbia, South Carolina 29201



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Mike Marcus, PhD, Chief  
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January 30, 2020



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(\*\*) DWTAC member who participated in review/discussion of Strategy

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## ACRONYMS USED

3M	3M Company
AFFF	Aqueous Film-Forming Foam
AOC	Airport Operating Certificate
ARFF	Aircraft Rescue and Firefighting
ATSDR	Agency for Toxic Substances and Disease Registry
BLWM	Bureau of Land and Waste Management (SCDHEC)
BOW	Bureau of Water (SCDHEC)
C&D	Construction and Demolition
CASRN	Chemical Abstract Services Registry Number
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOD	US Department of Defense
DOE	US Department of Energy
FP	Fluoropolymer
FR	Federal Register
FY	Fiscal Year
GAC	Granular Activated Carbon
HA	Health Advisory
ITRC	Interstate Technology Regulatory Council
MCL	Maximum Contaminant Level
MRL	Method Reporting Limit
MSW	Municipal Solid Waste
ND	No Discharge
NHANES	National Health and Nutrition Examination Survey
NPDES	National Pollutant Discharge Elimination System
OCPSF	Organic Chemical, Plastics and Synthetic Fibers
ppt	Parts per Trillion
PFAA	Perfluoroalkyl acid
PFAS	Per- and Polyfluoroalkyl Substance
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PWS	Public Water System(s)
RCRA	Resource Conservation and Recovery Act
SCDHEC	South Carolina Department of Health and Environmental Control; the Department
SCSFA	South Carolina State Firefighters' Association
SDWA	Safe Drinking Water Act
SIC	Standard Industrial Classification
SRS	Savannah River Site
UCMR	Unregulated Contaminant Monitoring Rule
USEPA	US Environmental Protection Agency
WHPA	Wellhead Protection Area
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

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## EXECUTIVE SUMMARY

Per- and polyfluoroalkyl substances are a complex family of more than 4,000 commercially-available, manmade chemicals, the earliest of which were produced in the late 1940s. Per- and polyfluoroalkyl substances have been used in coatings for textiles, paper products, metal plating, cookware, and to formulate some firefighting foams, among other things. The unique chemical properties of per- and polyfluoroalkyl substances make their environmental fate and transport complex and difficult to predict. Their effect on human and environmental health are relatively unknown, but current science suggests there may be negative health effects from long-term exposure. The purpose of this Strategy is to guide the South Carolina Department of Health and Environmental Control's efforts to evaluate the impact of those chemicals on the State's drinking water.

The United States Environmental Protection Agency established a drinking water lifetime health advisory [*i.e.*, consuming four (4) liters of water per day for 70 years] for perfluorooctanoic acid and perfluorooctanesulfonic acid on May 25, 2016. This health advisory is 70 parts per trillion for either of those individual chemicals or for both in combination. Health advisories are non-regulatory guidance; they are not enforceable federal standards. A health advisory identifies the concentration of a substance in drinking water at or less than which adverse health effects are not anticipated to occur over a lifetime of exposure. It is protective of most typical water users including pregnant/nursing women, young children and the elderly.

In February 2019, the United States Environmental Protection Agency published its Action Plan that described their approach to: (a) identify and understand per- and polyfluoroalkyl substances; (b) address current per- and polyfluoroalkyl substance contamination; (c) prevent future contamination; and, (d) effectively communicate with the public. These actions should assist the development of more technical information to better inform regulatory decisions on these emerging contaminants.

There are no current facilities in South Carolina known to produce per- and polyfluoroalkyl substances. However, due to their unique chemical properties, per- and polyfluoroalkyl substances may be used in the production of other goods at industries throughout South Carolina and the Nation. Per- and polyfluoroalkyl substances are a key ingredient in Class B firefighting foams that are used to extinguish flammable liquid and gas fires. The presence of per- and polyfluoroalkyl substances in many consumer items [*e.g.*, nonstick cookware, food packaging (microwave popcorn bags, fast food wrappers, sliced cheese wrappers, pizza boxes), stain-resistant carpets and fabrics and water-resistant clothing, paints, varnishes and sealants, cosmetics, dental floss, firefighting foams] further increases public exposure to these chemicals at home and throughout the environment.

The Interstate Technology Research Council describes the four most probable, significant per- and polyfluoroalkyl substance sources as: fire training/fire rescue sites, industrial sites, landfills and wastewater treatment plants. These sectors and their presence in South Carolina are described in Part III of this document.

Recent studies regarding per- and polyfluoroalkyl substance contamination and institutional knowledge of drinking water systems were used to evaluate the more probable per- and polyfluoroalkyl substance sources throughout South Carolina and the potential vulnerability of a given drinking water source. This document presents a Strategy for acquisition of empirical data to evaluate: (1) the presence of per- and polyfluoroalkyl substances in South Carolina drinking water and (2) the portion of the population that may be exposed to per- and polyfluoroalkyl substances in drinking water. This information will lead to a better understanding of potential public health concerns from per- and polyfluoroalkyl substance exposure and more informed decisions regarding the need to regulate per- and polyfluoroalkyl substances in drinking water and the environment.

## I. INTRODUCTION

### A. What are PFAS?

Per- and polyfluoroalkyl substances (PFAS) are a complex family of more than 3,000 commercially-available, manmade chemicals, the earliest of which were produced in the late 1940s (Wang *et al.* 2017). PFAS are used to make products that resist heat, oil, stains, grease and water. They are a common and widespread chemical residual of modern society. The nomenclature for unique PFAS analytes tends to be long and complex. A list of the quantifiable PFAS measured using the United States Environmental Protection Agency (USEPA) Methods 533 and 537.1, their acronyms (that will be used throughout this document) and their chemical abstract services registry number (CASRN) is provided in Table 1.

As awareness has grown regarding the potential public health implications of these chemicals, various entities have taken steps to reduce production and pollution. For example, 3M Company (3M) announced in 2000, and completed in 2002, that it would voluntarily phase out and find substitutes for PFOS chemistry used to produce a range of products in the United States (USEPA 2000). At that time 3M was the sole US manufacturer of PFOS. Also, in 2006, eight (8) major producers in the U.S. agreed to phase out production of PFOA and PFOA-related chemicals by 2015. Nonetheless, PFAS have been found throughout the environment at concentrations that are concerning to some health professionals. As a result, PFAS have been and are the focus of many studies on the presence in the environment and associated effect(s) on human and environmental health.

Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) were the two most commonly-produced and are the most commonly-studied of the PFAS analytes. Generally, chemicals in the PFAS class:

- do not occur naturally yet are widespread in the environment because of their broad uses
- are found in people, wildlife and fish world-wide
- are stable and do not break down easily in the environment (they are persistent)
- can build up in biological tissues over time (people, wildlife, fish) if exposure continues (they bioaccumulate)

### B. Sources of PFAS

PFAS are man-made, so there are no natural sources in the environment. PFAS can be found near areas where they are manufactured; in some industrial applications (*e.g.*, electroplating, textiles, pulp and paper); and/or, in some manufactured products. Although PFOA and PFOS are no longer manufactured in the U.S., some consumer and industrial products may still contain them as well as other PFAS analytes. Common products where PFAS was used and may still be used in their production include some:

- nonstick cookware
- food packaging (*e.g.*, microwave popcorn bags, fast food wrappers, sliced cheese wrappers, pizza boxes)
- stain-resistant carpets and fabrics
- water-resistant clothing
- paints, varnishes and sealants
- cosmetics
- dental floss
- firefighting foams

Exposure to PFAS by way of drinking water occurs only if the source water supply has been contaminated by a PFAS source such as a PFAS manufacturer, some types of wastewater treatment facilities, landfills or firefighter training facilities. The preponderance of human exposure to PFAS is through use of the many commercial products in which PFAS are present.

**Table 1. List of Quantifiable PFAS by USEPA Methods 533 and 537.1**

Analyte	Acronym	CASRN	Method 533	Method 537.1
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6	√	√
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	--	√
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	--	√
Perfluorononanoic acid	PFNA	375-95-1	√	√
Perfluorodecanoic acid	PFDA	335-76-2	√	√
Perfluorododecanoic acid	PFDoA	307-55-1	√	√
Perfluoroheptanoic acid	PFHpA	375-85-9	√	√
Perfluorohexanoic acid	PFHxA	307-24-4	√	√
Perfluorohexanesulfonic acid	PFHxS	355-46-4	√	√
Perfluorononanoic acid	PFNA	375-95-1	√	√
Perfluorooctanoic acid	PFOA	335-67-1	√	√
Perfluorooctanesulfonic acid	PFOS	1763-23-1	√	√
Perfluorotetradecanoic acid	PFTA	376-06-7	--	√
Perfluorotridecanoic acid	PFTTrDA	72629-94-8	--	√
Perfluoroundecanoic acid	PFUnA	2058-94-8	√	√
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	√	√
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1	√	√
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	√	√
Perfluorobutanesulfonic acid	PFBS	375-73-5	√	√
Perfluorobutanoic acid	PFBA	375-22-4	√	--
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	√	--
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	√	--
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	√	--
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	√	--
Perfluoropentanoic acid	PFPeA	2706-90-3	√	--
Perfluoropentane sulfonic acid	PFPeS	2706-91-4	√	--
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	√	--
1H, 1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4	√	--
1H, 1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2	√	--
1H, 1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4	√	--

### **C. Environmental Fate and Transport**

The class-specific chemical properties of PFAS make their environmental fate and transport complex and difficult to predict. Some PFAS transform into perfluoroalkyl acids (PFAA), such as PFOA and PFOS, in the environment through various biotic and abiotic processes (ITRC 2018b). PFAA are mobile, persistent, bioaccumulative and are not known to break down under ambient environmental conditions (NTP 2016). Much of the research on the fate and transport of PFAS up to this point has focused on PFAA.

Transport in groundwater is typically driven by advection, *i.e.*, moving at the general speed and direction of groundwater flow (ITRC 2018b). Other phenomena, such as sorption to various media (Guelfo and Higgins 2013) and the preference of PFAS to mobilize at the air-water interface (Krafft and Riess 2015) make predicting their transport difficult, particularly in unsaturated conditions where advection may be retarded (Brusseau 2018). Downward leaching can also significantly impact transport during unsaturated conditions, particularly in situations involving surface-applied materials containing PFAS (Sepulvado *et al.* 2011).

### **D. Human Health Effects**

The US Centers for Disease Control and Prevention (CDC) has found four (4) PFAS (PFOS, PFOA, PFNA and PFHxS) in the blood serum of nearly all Americans tested through the National Health and Nutrition Examination Survey (NHANES) since 1999 (CDC 2019). A temporal review of the NHANES data shows that the average concentration of PFAS in blood serum has steadily declined since 1999, but the ubiquitous presence of these PFAS in humans was noteworthy and has raised potential health outcome concerns.

The CDC stresses that finding a measurable amount of PFAS in blood serum does not imply that a certain level of PFAS exposure will cause an adverse health effect. However, because such a high percentage of the population is exposed to and bioaccumulates PFAS, a better understanding of the human health impacts of PFAS is needed to determine if the presence of these chemicals in humans is a significant health concern.

The Agency for Toxic Substances and Disease Registry (ATSDR) has reported that although specific human health impacts of PFAS are uncertain and more research is needed (ATSDR 2017), some studies have suggested that certain PFAS may:

- affect growth, learning, and behavior of infants and older children
- lower a woman's chance of getting pregnant
- interfere with the body's natural hormones
- increase cholesterol levels
- affect the immune system
- increase the risk of cancer (PFOA)
- thyroid hormone disruption (PFOS)

### **E. Ecological Health Effects**

The South Carolina Department of Health and Environmental Control (the Department) is the regulatory agency authorized by USEPA to implement and manage promulgated federal regulations for the protection of environmental quality in the State. The apparent ubiquitous nature of PFAS throughout the environment implies that living organisms have been and are, to varying extents, routinely exposed to some level of PFAS. New-generation analytical chemistry tools now present opportunities to detect and quantify PFAS (and other analytes of emerging concern) heretofore unachievable. However, much less is known about either the individual or combined (*i.e.*, interactive) toxicity of various PFAS at environmentally-relevant concentrations (Ahrens and Bundschuh 2014).

PFAS can bioaccumulate in the environment potentially leading to both acute and chronic health effects on living organisms (Giesy *et al.* 2010; Ding and Peijnenburg 2013). For example, the survival, growth and emergence of *Chironomus tentans* (midges) were found to be inhibited by 50% at PFOS exposures on the order of 100,000 (10<sup>5</sup>) parts per trillion (ppt) (MacDonald *et al.* 2004). However, the authors noted that this was approximately two (2) orders of magnitude greater than those concentrations typically observed in aquatic environments. The bioaccumulation and subsequent elimination of PFAS by living organisms has been shown to depend on the species, gender and reproductive status of a given individual (Lee and Schultz 2010; Sharpe *et al.* 2010).

A review of current research on the effects of PFAS in aquatic environments noted a lack of research on multi-generation PFAS exposure and how the transfer of PFAS through food webs may affect ecotoxicity (Ahrens and Bundschuh 2014). Species-specific bioaccumulation of PFAS, thence entry into the human food chain is important for human health protection because humans consume meats, fish and seafood, vegetation and other plant- and animal-derived products throughout their lifetime. More knowledge on exposure point/pathway dynamics and food web transport dynamics is important for a better understanding of the environmental ramifications of PFAS exposure.

The Department will monitor future research as it pertains to environmental toxicity. At this time, the limited national regulatory guidance regarding health implications are limited to the USEPA Health Advisory (HA) for PFOA and PFOS in drinking water for humans (see Part II.A). The path forward detailed herein focuses on evaluation of public health protection relative to PFAS from the drinking water exposure pathway.

#### **F. Purpose of Strategy**

As with a number of other states, there are unknowns concerning the presence of PFAS throughout South Carolina, including source location, strength, coverage and proximity to drinking water sources. The purpose of this Strategy is to establish a methodical and rational process, based on the current state of accumulated knowledge, for the evaluation of PFAS impact on drinking water in the State. The Strategy identifies and accounts for various risk components that accumulate into a vulnerability assessment for drinking water sources. This Strategy then cascades the water supplies into succeeding levels of decreasing (apparent) risk and then uses this to establish sampling and analysis priorities.

The Department's Bureau of Water (BOW) will test for PFAS in drinking water sources to determine:

- the presence and concentrations of the quantifiable PFAS under USEPA Methods 533 and 537.1
- whether PFOA and PFOS are present at a combined concentration greater than the USEPA HA of 70 ppt

#### Special Note:

The BOW recognizes the importance and need to assess surface waters for ecological health impacts from PFAS as well as uptake and bioaccumulation by organisms that may be consumed by the public (*e.g.*, fish, crabs, oysters and clams). This element of the BOW's statewide ambient surface waters PFAS assessment will be addressed subsequent to the implementation of the drinking water assessment described herein. The conceptual framework and approach proposed in California will be used as one of the guidances, where adaptable and applicable to the South Carolina environment, in establishing the surface waters assessment strategy (Maruya *et al.* 2014, Anderson *et al.* 2012).

## II. REGULATORY OVERVIEW AND STATUS

### A. The USEPA Public Health Advisory

Public Health Advisories are developed to assist federal, state, tribal and local officials and managers of drinking water systems protect public health. They are non-regulatory technical guidance; *i.e.*, they are not legally-enforceable federal standards. A drinking water HA is intended to identify the concentration of an analyte less than which adverse health effects are not anticipated to occur over a lifetime of exposure based on current knowledge about the analyte. In other words, if an analyte concentration in drinking water is greater than a HA, it cannot be stated with confidence that there will not be a negative health impact due to long-term exposure.

USEPA established a lifetime HA of 70 ppt for discrete or combined concentrations of PFOA and PFOS via notice in the Federal Register (FR) on May 25, 2016 (81 FR 33250). A HA is just that, an advisory. It is not an enforceable regulatory standard as is a primary drinking water standard (also called a *Maximum Contaminant Level*, or MCL) under the Safe Drinking Water Act (SDWA). The HA for PFOA and PFOS is protective of most typical water users including pregnant/nursing women, young children and the elderly.

USEPA is currently evaluating the need for a nationwide MCL for PFOA and PFOS (see Section II.C). Some individual states have established regulatory, advisory and/or guidance values for various PFAS while others are evaluating the need for state-specific regulatory, advisory and guidance values [see Section II.E] (ITRC 2019).

### B. Unregulated Contaminant Monitoring

In 1996, amendments to the SDWA known as the Unregulated Contaminant Monitoring Rule (UCMR) required that, once every five (5) years, USEPA issue a new list of no more than 30 unregulated contaminants to be monitored by public water systems (PWS) throughout the United States. There have been four (4) UCMR contaminant lists up to this point:

- UCMR 1 (64 FR 50556) monitored 26 contaminants between 2001 and 2003;
- UCMR 2 (72 FR 367) monitored 25 contaminants between 2008 and 2010;
- UCMR 3 (77 FR 26071) monitored 30 contaminants between 2013 and 2015; and,
- UCMR 4 (81 FR 92666) will monitor 30 contaminants between 2018 and 2020.

During UCMR 3, six (6) PFAS were monitored at 4,920 PWS nationwide (USEPA 2017), the results of which are summarized in Table 2.

**Table 2. UCMR 3 Nationwide PFAS Data Summary from Public Water Systems**

PFAS	MRL <sup>A</sup> (ppt)	No. PWS with result >MRL	% PWS with result >MRL	No. PWS with result >HA <sup>B</sup>	% PWS with result >HA <sup>B</sup>
PFOS	40	95	1.9	46	0.9
PFOA	20	117	2.4	13	0.3
PFNA	20	14	0.3	NA <sup>C</sup>	NA <sup>C</sup>
PFHxS	30	55	1.1	NA <sup>C</sup>	NA <sup>C</sup>
PFHpA	10	86	1.7	NA <sup>C</sup>	NA <sup>C</sup>
PFBS	90	8	0.2	NA <sup>C</sup>	NA <sup>C</sup>

A.MRL = Method Reporting Limit; ppt = parts per trillion

B. HA = USEPA Health Advisory (70 ppt for PFOA, PFOS or ΣPFOA & PFOS)

C. NA = Not applicable because no current HA for specified PFAS

In South Carolina under UCMR 3, the Department conducted testing for the six (6) specified PFAS at all public water systems that served greater than 10,000 people and at some small systems randomly selected by USEPA. The UCMR 3 results for the State were:

- A total of 498 samples from 82 PWS were collected and analyzed.
- Of those 498 samples, one (1) sample from the Woodruff-Roebuck Water District (PWS SC4220007) returned detections of 12 ppt for PFHpA and 24 ppt for PFOA.
- The Department conducted three (3) subsequent follow-up sample events at that system; all follow-up results were non-detects.
- The noted detections did not exceed the USEPA HA of 70 ppt PFOA and PFOS (separately or in sum)

UCMR 3 included a small fraction of PWS; therefore, this does not mean that PFAS exposure in drinking water is necessarily limited to one (1)% to two (2)% of PWS. In Michigan, a total of 92 PWS were sampled for PFAS during UCMR 3, two (2) of which were found to contain PFOS in at least one (1) sampling event (USEPA 2017). Since then, the Michigan Department of Environment, Great Lakes and Energy commissioned a 2018 Statewide PFAS Sampling Program of community and select non-community water supplies. This effort resulted in 1,741 facilities sampled and found at least one (1) PFAS in 118 facilities (approximately 10%), two (2) of which contained PFOA and PFOS greater than the USEPA HA of 70 ppt (AECOM 2019).

### C. USEPA PFAS Action Plan

In February 2019, USEPA published its PFAS Action Plan that described the Agency's approach to: identify and understand PFAS; address current PFAS contamination; prevent future contamination; and, effectively communicate with the public about PFAS (USEPA 2019a). The Action Plan details concerns and challenges and outlines short- and long-term actions USEPA is taking or will take to address these concerns and challenges.

In addition to actions towards improving the understanding, cleanup, and communication of PFAS, USEPA is targeting specific actions involving drinking water, such as:

- proposing a national drinking water regulatory determination on PFOA and PFOS (this proposal, as yet not public, was submitted to the Office of Management and Budget by USEPA on December 4, 2019);
- expanding analytical methods to accurately test for PFAS in drinking water and other media (USEPA announced the addition of EPA Method 533 on December 19, 2019; allows for testing of 11 short-chain [chains of four (4) to 12 carbons] PFAS;
- incorporating the latest research results for additional PFAS into USEPA's online drinking water treatability database;
- developing toxicity values for additional PFAS;
- utilizing newer analytical methods to detect more PFAS and at lower MRLs during the next UCMR monitoring cycle; and,
- building an interactive map that displays publicly-available data on potential PFAS sources and occurrence.

As of the release date of this Strategy, the present status of USEPA's Action Plan commitments can be found at: <https://www.epa.gov/newsreleases/epa-moves-forward-key-drinking-water-priority-under-pfas-action-plan>

In September 2019, as follow-on to delivery of commitments under the Action Plan, USEPA awarded grants to eight (8) organizations *to expand the understanding of the environmental risks posed by per- and poly-fluoroalkyl substances (PFAS) in waste streams and identify practical approaches to manage the potential impacts as PFAS enters the environment.* (<https://www.epa.gov/newsreleases/epa-awards-6-million-research-potential-environmental-impacts-pfas-substances-waste>).

Those organizations and their scopes of inquiry are:

- **New York State Department of Health - Health Research Inc., Menands, N.Y.** – to build a dataset by analyzing samples from approximately 150 landfills in the State of New York. This data will be used to understand the types and concentrations of PFAS that are found in and around landfills, as well as the key landfill attributes that contribute to release of PFAS.
- **North Carolina State University, Raleigh, N.C.** – to collect landfill gas (LFG) samples from over 400 landfills across the U.S. to determine if PFAS from LFG is a significant source of PFAS released into the atmosphere.
- **University of Florida, Gainesville, Fla.** – to study the role of waste type, management strategies, and treatment methods on the occurrence, source and fate of PFAS in landfills. The study will identify the sources of PFAS compounds in the current US domestic waste stream using laboratory-scale batch leaching, and landfill simulation studies.
- **Clemson University, Clemson, S.C.** – to examine the chemical process for the destruction of PFAS in leachate and groundwater. This project will assess degradation kinetics, test hypothesized process modifications, and conduct trials of leachate treatment.
- **Purdue University, West Lafayette, Ind.** – to develop methods to decrease PFAS concentrations in both municipal wastewater treatment plant effluent and sludge. The study will determine the technical and economic feasibility of using a treatment approach consisting of nanofiltration followed by electrochemical oxidation.
- **Texas A&M AgriLife Research, College Station, Texas** – to investigate the feasibility of electron beam technology for the destruction of PFAS compounds during the remediation of groundwater, wastewater, sewage sludges, and soils.
- **Texas Tech University, Lubbock, Texas** – to identify and quantify the occurrence of PFAS in landfill leachate, investigate the fate of PFAS passing through typical landfill liner systems, and test the ability to break down PFAS in landfill leachate using soundwaves.
- **University of North Dakota, Grand Forks, N.D.** – to develop practical strategies for removing legacy and emerging PFAS from leachate and groundwater by studying the adsorption, desorption, and biodegradation of PFAS and precursor compounds in landfills.

#### **D. The Department's Response to USEPA PFAS Action Plan**

The BOW welcomed the actions announced by USEPA to address PFAS and agrees with USEPA that the development of more technical information is necessary so that defensible science informs regulatory decisions on this class of analytes. USEPA actions are a step in the right direction towards further protecting and promoting the health of the public and the environment. The Department will remain engaged at the national level and with stakeholders on this important issue.

As USEPA implements their Action Plan, the BOW will continue to:

- focus on source water protection as the key to preservation of quality drinking water;
- protect South Carolina's waters for fishable/swimmable uses and for healthy and balanced indigenous aquatic communities; and,
- follow the science-based progress in knowledge about PFAS to make informed decisions regarding the health of the public and environment.

#### **E. Other State Approaches**

Because of the heightened focus in media and among some segments of the population and the unsettled regulatory climate due to absence of an integrated nationwide regulatory framework approach, some states have taken various steps to address and/or regulate PFAS (Table 3). Not surprisingly, the chosen paths do not

align with each other. Consequently, this fragmentation leads to further doubt and concern among citizens over proper and equitable health and environmental protection.

**Table 3. State Actions on Numeric Limits and Guidances for PFAS in Drinking Water**

State	Action	Analyte	Concentration (ppt)
California	Interim Response Level	Σ PFOA+PFOS	70
	Notification Level	PFOA	5.1
		PFOS	6.5
Connecticut	Action Level	Σ PFOA+PFOS+PFNA+PFHxS+PFHpA	70
Massachusetts	Proposed Groundwater Cleanup Standard and Drinking Water MCL Process Initiation	Σ PFOA+PFOS+PFNA+PFHxS+PFHpA+PFDA	20
Michigan	Proposed Drinking Water MCLs	PFOA	8
		PFOS	16
		PFNA	6
		PFHxS	51
		PFBS	420
		PFHxA	400,000
		GenX	370
Minnesota	Health Based Guidance Value (HBV) for Water (Surrogate of PFOS HBV)	PFOA	35
		PFOS	15
		PFHxS	47
New Hampshire	MCL	PFOA	12
		PFOS	15
		PFHxS	18
		PFHA	11
New Jersey	MCL	PFNA	13
		PFOA	14
		PFOS	13
New York	MCL Rulemaking Underway	PFOA	10
		PFOS	10
North Carolina	Health Advisory	GenX	140
Vermont	Health Advisory	Σ PFOA+PFOS+PFNA+PFHxS+PFHpA	20

Source: <https://www.asdwa.org/pfas/>

### III. POTENTIAL PFAS SOURCES IN SOUTH CAROLINA

There are no current facilities in South Carolina known to manufacture PFAS or fluoropolymers (FP). However, due to their unique chemical properties, PFAS or FP may be used in the production of other goods at industries throughout South Carolina. PFAS are also a key ingredient in certain firefighting foams that are used to extinguish high-hazard fires. The presence of PFAS in many consumer items further increases exposure to these chemicals at home and the chemicals' availability throughout the environment as waste products. For example, PFAS have been used in pesticides and herbicides (ITRC 2017).

The Interstate Technology Research Council (ITRC) describes the four (4) major PFAS sources: fire training/fire rescue sites, industrial sites, landfills and wastewater treatment plants (WWTP) (ITRC 2018b). These sectors and their presence in South Carolina are described below. Although not an exhaustive compilation of all potential PFAS sources throughout South Carolina, these four (4) main source categories likely address the more-probable sources based on currently-available information.

#### A. Fire Training/Fire Rescue Sites

Aqueous film-forming foam (AFFF) has been used since the late 1960s to fight high-hazard flammable liquid fires by producing an aqueous film that effectively covers and extinguishes the flame and prevents re-ignition (ITRC 2018a). Typical locations where AFFF might be or have been used include:

- chemical plants
- flammable liquid storage and processing facilities
- merchant operations (oil tankers, offshore platforms)
- municipal services (fire departments, firefighting training centers)
- oil refineries, terminals, and bulk fuel storage farms
- aviation operations (aircraft rescue and firefighting, hangars)
- military facilities

AFFF is commonly used for firefighting training, particularly at military facilities, airports and firefighting training facilities. As such, these locations are individually discussed below.

#### Military and Other Federal Facilities

Based on the well-documented history of AFFF use at Department of Defense (DOD) facilities, the US Air Force began investigating and addressing PFAS contamination in 2014. Since then, the other branches of the military have followed suit and taken steps to detect and address PFAS contamination at their facilities. As of December 31, 2016, the DOD had spent over \$200 million on PFOA and PFOS sampling, analysis and cleanup at various military facilities (DOD 2017).

DOD facilities in South Carolina that operated during the time that PFAS may have been used are listed in Table 4. Preliminary Assessments to determine whether AFFF foam was used at a given facility have been completed by the facilities for all but one (1) of the DOD facilities in Table 4. The remaining facility is scheduled to have its Preliminary Assessment/Site Investigation completed in fiscal year (FY) 2020. For those facilities where AFFF is known to have been used, more in-depth site investigations have been or will be performed by the facilities to determine the extent of environmental contamination that may have occurred.

South Carolina is also home to a large Department of Energy (DOE) facility, the Savannah River Site (SRS). This facility was constructed in the 1950's to produce the basic materials used in the fabrication of nuclear weapons. Through recent conversations with SRS staff, it was noted that AFFF had been used at SRS for fire training

activities. The BOW does not yet know the extent, duration and frequency of those activities. The DOE is in the process of procuring a sampling team to evaluate PFAS at SRS.

**Table 4. DOD and DOE Facilities in South Carolina**

Facility Name	Owner	City	Active/ Inactive	PFAS Present at Site? <sup>A</sup>
Charleston Naval Complex	Navy	Charleston	Inactive	TBD <sup>B</sup>
Fort Jackson	Army	Columbia	Active	TBD <sup>C</sup>
Joint Base Charleston - Air	Air Force	Charleston	Active	Confirmed
Joint Base Charleston - Weapons	Air Force	Charleston	Active	No Potential <sup>D</sup>
Marine Corps Air Station	Marines	Beaufort	Active	TBD <sup>E</sup>
Marine Corps Recruit Depot	Marines	Port Royal	Active	TBD <sup>F</sup>
McEntire Joint National Guard Base	Air National Guard Bureau	Sumter	Active	Confirmed
Myrtle Beach Air Force Base	Air Force	Myrtle Beach	Inactive	Confirmed
North Auxiliary Airfield <sup>G</sup>	Air Force	Orangeburg	Active	Confirmed
Poinsett Electronic Combat Range	Air Force	Wedgefield	Active	No Potential <sup>D</sup>
Shaw Air Force Base	Air Force	Sumter	Active	Confirmed
Savannah River Site	DOE	Jackson	Active	TBD <sup>H</sup>

- A. status of DOD facilities current as of September 13, 2019, per BLWM
- B. awaiting results of groundwater monitoring during Site Investigation
- C. Preliminary Assessment/Site Investigation planned for FY 2020
- D. no potential AFFF release areas identified in DOD Preliminary Assessment at Weapons site
- E. Preliminary Assessment currently under review
- F. Site Investigation planned
- G. associated with Joint Base Charleston - Air
- H. the DOE is in the process of procuring a sampling team to evaluate PFAS at the site

**Airports**

Title 14 Code of Federal Regulations (CFR), Part 139 (14 CFR Part 139) requires an Airport Operating Certificate (AOC) for certain US airports serving scheduled flights with more than nine passenger seats and unscheduled flights with at least 31 passenger seats. All Part 139 certified airports must have aircraft rescue and firefighting (ARFF) capabilities, which includes the proper equipment (e.g., AFFF), personnel, and training.

Part 139 certified airports are indexed based on a combination of the length of the aircrafts that utilize the airport and the average number of daily departures for said aircraft lengths. The index values range from A (smallest aircrafts) to E (largest aircrafts). Airports routinely serving larger aircrafts are required to demonstrate higher ARFF capabilities. As such, Index E airports will likely have significantly more AFFF onsite than Index D, and so-on down to Index A which may not have AFFF onsite at all. Many small, rural airports are not required to have an AOC or ARFF capabilities through 14 CFR Part 139.

Regardless of index, ARFF personnel are required to receive recurrent instruction every 12 consecutive calendar months and must participate in at least one (1) live-fire drill prior to initial performance of ARFF duties and every

12 consecutive calendar months thereafter. The training does not have to be at the specific airport; it can be at a military facility or other firefighting training facility that offers ARFF training. For example, the South Carolina Fire Academy is a Federal Aviation Administration Regional ARFF fire training center.

The eight (8) Part 139 certified airports in South Carolina are listed in Table 5 by descending ARFF Index, then Class, then alphabetically. The higher (*i.e.*, C vs. B vs. A) the ARFF index, the more likely an airport is to have more AFFF opportunity.

**Table 5. 14 CFR Part 139-Certified Airports in South Carolina**

Airport Name (ID)	City	PART 139 Class	ARFF Index
Charleston International (CHS) <sup>A</sup>	Charleston	Class I	C
Greenville-Spartanburg International (GSP)	Greer	Class I	C
Myrtle Beach International (MYR)	Myrtle Beach	Class I	C
Columbia Metropolitan (CAE) <sup>B</sup>	Columbia	Class I	B
Florence Regional (FLO)	Florence	Class I	A
Hilton Head (HXD)	Hilton Head Island	Class I	A
Anderson Regional (AND)	Anderson	Class IV	A
Donaldson Center (GYH) <sup>C</sup>	Greenville	Class IV	A

- A. Charleston International Airport is adjacent to Joint Base Charleston
- B. South Carolina Fire Academy was previously located near Columbia Metropolitan Airport
- C. prior to 1963, this facility was owned by the DOD under the name Donaldson Air Force Base.

Firefighting Training Facilities

According to the South Carolina State Firefighters Association (SCSFA) member directory, nearly 500 individual fire departments make up the membership of the association (SCSFA 2019). The total number of fire departments in South Carolina is certainly larger, as not all fire departments are members of the SCSFA. Many of these fire departments could have AFFF stored onsite, but its use for routine training activities at a given fire department is not currently known by the BOW.

The South Carolina Fire Academy’s current facility, covering 208 acres just north of Columbia, South Carolina, is declared to be the *most comprehensive* state fire training facility in the nation (SC Fire Academy 2019). The facility is one (1) of a select few in the nation to feature state-of-the-art, computerized, propane-fueled props. ARFF training and training for the use of firefighting foam is advertised as two (2) of the training opportunities at the facility. Based on the expense and complexity of AFFF training, it is plausible that most, if not all, firefighters in South Carolina could be trained to use AFFF at the South Carolina Fire Academy. Given the size, longevity and training resources of the facility, this site is a plausible PFAS-source candidate.

The BOW’s overall knowledge of other current and former firefighting training facilities in South Carolina is lacking at this time, but collaboration with the Office of the State Fire Marshal may lead to the identification of additional sites of interest. Before moving to its current location, the South Carolina Fire Academy was located near the Columbia Metropolitan Airport. Based on the probable use of AFFF, this site is also a plausible candidate source of concern.

## B. Industrial Facilities

Industrial sources of PFAS include primary manufacturing facilities that produce PFAS or FP and secondary manufacturing facilities that use PFAS or FP in the production processes. As previously stated, there are no known current primary manufacturing facilities in South Carolina. There are, however, secondary manufacturing facilities in South Carolina.

USEPA's PFAS Action Plan presents four (4) industrial sectors as potential PFAS sources of interest (USEPA 2019a):

- Organic Chemicals, Plastics and Synthetic Fibers (OCPSF)
- Pulp and Paper
- Textiles
- Airports (see Section A immediately above)

ITRC also lists leather, rubber, metal plating and etching, wire manufacturing, industrial surfactants, resins, molds, photolithography and semiconductors as potential sources of PFAS (ITRC 2017). In order to distinguish between industries that may or may not be secondary manufacturing facilities, the standard industrial classification (SIC) code(s) will be used because SIC codes provide a descriptor of the types of activities that occur at a given industry.

The BOW used two (2) criteria to assess industrial facilities in South Carolina who may use PFAS or FP in their production processes, both of which must be met to be considered a more likely industrial PFAS source in this Strategy:

- process wastewater from the industry is discharged into a surface water through a National Pollutant Discharge Elimination System (NPDES) permit, onto the land through a No Discharge (ND) permit, or to a municipal WWTP through a pretreatment permit; and
- the industry falls under a pertinent SIC code as described by USEPA or that the BOW believes indicates that PFAS or FP could be utilized in the production process(es).

Using the aforementioned criteria, there are 384 industries where PFAS or FP may be or have been used in production (Table 6).

**Table 6. Currently-Permitted Potential PFAS Source industries by SIC Code**

SIC Descriptor	Total by SIC Descriptor	Total
Organic Chemicals, Plastics and Synthetic Fibers	65	384
Pulp and Paper	11	
Textiles	68	
Airport and Other	240	

## C. Landfills

The widespread use of PFAS in many consumer, construction and industrial products results in the end-of-life cycle (*i.e.*, disposal) fate to be a landfill. Cell leachate, if not properly contained, handled and disposed, may serve as a contaminant source to the surrounding environment, including nearby drinking water supplies.

Data from the Department's Bureau of Land and Waste Management (BLWM) reports that there are 79 Class 2 landfills and 28 Class 3 landfills currently permitted to accept waste in South Carolina (Table 7). Class 2 landfills

only accept construction and demolition (C&D) debris while Class 3 landfills can accept municipal solid waste (MSW), C&D debris and industrial solid waste. There are also many inactive landfills that operated after 1940 but no longer accept waste.

**Table 7. Active/Inactive Permitted Landfills by Type**

Status	Classification	Total by Classification	Total by Status	Total
Active	Class 2	79	107	677
	Class 3	28		
Inactive <sup>A</sup>	Class 2 <sup>B</sup>	133	570	
	Class 3 <sup>B</sup>	228		
	Industrial <sup>C</sup>	208		
	RCRA <sup>D</sup> Subtitle C	1		

- A. closed landfills with inactive permits and landfills that no longer accept waste but may still have an active permit
- B. inactive landfills may not have been specifically classified as Class 2 or Class 3, but this summary associates those inactive landfills with the most appropriate current classification based on the types of waste they accepted
- C. legacy landfills may have been permitted for industrial waste only
- D. Resource Conservation and Recovery Act; Subtitle C – hazardous waste landfills; the lone instance in the State is the now-closed and in post-closure care Subtitle C landfill in Pinewood, SC

**D. Wastewater Treatment Plants**

Domestic/municipal WWTP may accept wastewater from residential and industrial sources, both of which may contain PFAS. The Department classifies privately-owned WWTP as *Domestic* and publicly-owned WWTP as *Municipal*. A WWTP discharge may be covered under an individual or general discharge permit. An individual discharge permit contains site-specific permit conditions whereas a general discharge permit may contain generalized permit conditions for a group of WWTP that share commonalities. The amount of PFAS in WWTP effluent and sludge will be highly dependent upon the percentage of residential vs. industrial inputs and the specific activities at those sources. Municipal WWTP meeting certain criteria may also have a pretreatment program that helps manage the collective inputs of industrial waste into the WWTP.

There are 362 currently-permitted domestic/municipal WWTP in South Carolina. This number does not include those WWTP covered under the *Domestic Wastewater Treatment Plant Dischargers* general NPDES permit because coverage under this permit is for smaller WWTP that meet certain criteria. WWTP covered by this general permit could be sources of PFAS, but their impact on the surrounding environment is likely small relative to domestic/municipal WWTP with individual permit coverages.

A summary of current domestic/municipal WWTPs with individual permit coverages is presented in Table 8 by type and, in the case of municipal WWTP, the presence or absence of a pretreatment program. Industrial WWTP of interest were accounted for in Part III.B above.

**Table 8. Currently-Permitted Domestic/Municipal WWTP by Type**

WWTP Type	Total by Type	Total
Domestic	146	362
Municipal with Pretreatment Program	90	
Municipal without Pretreatment Program	126	

**E. Land Application of Wastewater and Sludge**

Domestic/municipal and industrial WWTPs typically form solid by-products, commonly referred to as *sludge*, from their treatment processes. This sludge may contain substances that were once suspended or dissolved in the water column, such as PFAS. Sludge is often sent to a landfill for disposal, but it may also be permitted to be applied to land across South Carolina at approved application rates if both the sludge and land application site meet certain requirements. WWTP effluent may also be applied to land across South Carolina at approved application rates if both the effluent and land application site meet certain requirements. Up to this point, PFAS have not been regulated and, therefore, not evaluated in the decisions to permit land application of effluent or sludge. These sites could contain PFAS if there were PFAS inputs to a WWTP that partitioned into the sludge or passed through the WWTP and exited through the effluent.

The number of land application sites and the amount of effluent or sludge applied to individual sites is difficult to compile as the specific land application rates and sites can change across permit cycles. The BOW is more easily able to quantify the sources of land-applied effluent or sludge, which is summarized in Table 9. By considering WWTP that may have received higher levels of PFAS inputs, individual land application sites that received effluent or sludge from those WWTP can be prioritized. The BOW believes this methodology is the most efficient way to develop the vulnerability risk of drinking water supplies to this potential contaminant source.

**Table 9. Active WWTP Currently-Permitted to Land-Apply Effluent and Sludge**

WWTP Type	Waste Type	Total by Waste Type
Domestic	Effluent	63
	Sludge	10
Municipal	Effluent	49
	Sludge	60
Industrial	Effluent	137
	Sludge	23

#### IV. FACTORS INFLUENCING THE VULNERABILITY OF DRINKING WATER TO PFAS

##### A. PFAS Sources

The potential for any given PFAS source to impact a nearby drinking water source is dependent upon many variables, such as source type, specific activity at the site, duration of the activity, proximity to a drinking water receptor and hydrologic setting (e.g., local groundwater mobility characteristics), among others. A recent study from Brown University reviewed and summarized pertinent peer-reviewed articles on measured groundwater PFAS contamination to help guide future research and management strategies (Guelfo *et al.* 2018).

One objective of the Brown University study was a prioritization of those PFAS sources that represent the highest risk of occurrence in finished drinking water. The authors compiled the measured ranges of PFAS concentrations in groundwater at various sites as documented in peer-reviewed articles throughout the world (by order of magnitude). PFAS contamination at the most probable PFAS source types ranged from highly variable [eight (8) orders of magnitude at DOD facilities] to relatively consistent [(2) orders of magnitude near septic systems]. This speaks to the relative uncertainty of predicting PFAS concentration in groundwater based solely on the general activity at or near a given location.

The ranges of PFAS concentrations found in the groundwater at various sources, as adopted from the Brown University study, are presented in Table 10. Of note are the upper magnitude of these ranges, which depict the highest PFAS contamination found at a given source type during their literature review. The source types in Table 9 are arranged in order from higher maximum PFAS contamination to lower maximum PFAS contamination.

**Table 10. Variability of PFAS Concentrations by Source Type**

Source Type	Magnitude of PFAS (ppt) <sup>A</sup>	PFAS Source Type
DOD Facilities	10 <sup>0</sup> -10 <sup>7</sup>	AFFF Use
PFAS or FP Manufacturing	10 <sup>1</sup> -10 <sup>6</sup>	PFAS or FP Manufacturing
Landfills <sup>B</sup>	10 <sup>0</sup> -10 <sup>6</sup>	Waste Stream(s)
Airports	10 <sup>0</sup> -10 <sup>5</sup>	AFFF Use
Fire Training Areas <sup>C</sup>	10 <sup>0</sup> -10 <sup>5</sup>	AFFF Use
Petroleum Refineries	10 <sup>0</sup> -10 <sup>4</sup>	AFFF Use
Industrial Sites <sup>D</sup>	10 <sup>0</sup> -10 <sup>4</sup>	PFAS or FPs Used in Production Processes
Municipal Sludge <sup>E</sup>	10 <sup>1</sup> -10 <sup>3</sup>	Waste Stream (sludge)
Septic Systems	10 <sup>0</sup> -10 <sup>1</sup>	Waste Stream

- adapted from Guelfo *et al.* 2018

A. groundwater concentrations at contaminated sites; ppt = parts per trillion

B. review found 10<sup>6</sup> ppt at landfills that accepted waste from a PFAS manufacturer. Other landfills had max of 10<sup>3</sup> ppt

C. represents fire training areas at municipal or private fire training institutions

D. reviewed industrial sites included textiles, furniture, paper and rubber/plastics

E. wastewater inputs to the reviewed municipal WWTP included industries that produce or use PFAS or FP

Another potential PFAS source, WWTP effluent, was not evaluated in the Brown University review (this review only included data from actual groundwater contamination). The BOW reviewed previous studies that measured effluent data from a total of 33 domestic/municipal WWTP and 13 industrial WWTP for the presence of certain

PFAS (3M 2001; Bossi *et al.* 2008, Clara *et al.* 2008). It was unclear as to how many of the domestic/municipal WWTP in these three (3) studies received any amount of wastewater from an industry producing or using PFAS or FP, but at least one (1) WWTP received wastewater from a PFAS or FP manufacturer. None of the 13 the industrial facilities in these studies manufactured PFAS or FP, but all were believed to use PFAS or FP in their production processes.

The combined data from these three (3) studies indicated that effluent from the 33 domestic/municipal WWTPs ranged from  $10^1$ - $10^3$  ppt of a given PFAS and effluent from the 13 industrial WWTPs ranged from  $10^0$ - $10^3$  ppt of a given PFAS. At these concentrations, WWTP effluent would likely only be a concern in effluent-dominated streams, which are streams whose flow consists mostly, or entirely, of WWTP effluent, or at sites where WWTP effluent is land-applied.

A brief literature search on groundwater contamination following the land application of industrial sludge failed to reveal any published studies. Lindstrom *et al.* (2011) found PFAS contamination of groundwater by municipal sludge cited in the Brown University study to be on the order of  $10^1$ - $10^3$  ppt. This is comparable to what the previously noted studies found for PFAS concentrations in domestic/municipal WWTP effluent. Based on the similarities in PFAS concentrations at sites with contaminated groundwater from municipal sludge and in domestic/municipal WWTP effluent and in the absence of site-specific information, it is appropriate to make a similar comparison between industrial WWTP effluent and the potential for land applied industrial sludge to contaminate groundwater.

## **B. Drinking Water Sources**

If a drinking water source contains PFOA and PFOS at concentrations greater than the USEPA HA, actions may need to be taken to ensure the protection of public health. Typical water treatment processes (*i.e.*, conventional treatment) are ineffective at the removal of PFOA and PFOS from source waters (USEPA 2019b). More advanced treatment, such as granular activated carbon (GAC), membrane separation or ion exchange is required to remove PFOA and PFOS from drinking water. Few water treatment plants (WTP) in the State are presently equipped at the scale that would be needed for effective treatment.

### Surface Water Sources

Surface waters that typically have abundant flows throughout the year are used for supply by some WTP. There are currently 70 surface water intakes that supply the 61 surface WTP in South Carolina. Many, if not all, of the surface waters that contain an intake could be described as non-effluent dominated; meaning only a small portion of the water within them comes from direct effluent discharge from domestic/municipal or industrial WWTP. Water within these surface sources also typically comes from large watersheds. The influence of a given direct discharge or contaminated groundwater plume would likely be small relative to the amount of assumed PFAS-free (or lower concentrated) water throughout the watershed feeding the surface water.

There are a few scenarios where PFAS could impact a surface water intake. The first would be an intake in an effluent-dominated stream, downstream from a domestic/municipal or industrial WWTP discharge with PFAS-containing effluent. The Department has source water protection areas upstream of each surface water intake. In these areas, a more conservative approach is taken towards the development of WWTP effluent limits. With limited information on PFAS inputs to WWTP and guidance on in-stream regulatory criteria, WWTP effluent limits for PFAS have not been considered up to this point. Another scenario of concern would be an intake in a stream with a relatively low flow that contains a significant PFAS-containing groundwater plume feeding the surface water directly upstream of the intake. A third scenario is the inflow of surface waters from a neighboring state that may be impacted by PFAS in that state.

## Groundwater Sources

In an overall sense, groundwater wells are used to supply drinking water to two (2) different types of systems in the State: public wells serving more than one (1) residence and private wells serving a single residence. There are approximately 585 active public wells and hundreds of thousands of private wells in South Carolina. A contaminated groundwater plume is typically slow moving (on the order of  $10^0$ - $10^1$  feet per year) and the effect on a groundwater well can be long and concentrated.

In certain parts of South Carolina, private wells may be more vulnerable to surface and shallow sub-surface inputs than the public wells. The typical depths of each well type are dependent upon their location. For example, private and public wells in the Piedmont region of South Carolina tend to be drilled at roughly the same depths; whereas private wells in the Lower Coastal Plain and Upper Coastal Plain are often drilled shallower than public wells. Therefore, private wells tend to be more vulnerable to surface and shallow sub-surface inputs than public wells in the Lower Coastal Plain and Upper Coastal Plain.

The Department seeks to prevent public wells from becoming contaminated by identifying areas of concern regarding pollution sources through a wellhead protection area (WHPA) delineation. The WHPA delineation requires a 100-ft *pollution-free* radius around a well and only considers currently known real and potential pollution sources; WHPA does not protect against new pollution sources that arise following the evaluation. WHPA delineations are also limited to public wells; the same scrutiny is not put on new private wells. Collective efforts from a myriad of the Department's regulatory programs also use source water protection of aquifers to protect all drinking water wells.

### **C. Aquifers**

South Carolina can generally be divided into three (3) regions, each with differing vulnerability to surface and shallow sub-surface inputs: Piedmont, Upper Coastal Plain and Lower Coastal Plain. The most vulnerable aquifers tend to be in:

- the Upper Coastal Plain, which is characterized by relatively thin, unconsolidated sand aquifers overlain by sandy soils. Private and public wells, by necessity, are relatively shallow here.
- the Piedmont region above the Fall Line, which consists of fractures in igneous and metamorphic crystalline rock and is moderately vulnerable to surface inputs due to the relatively shallow occurrence of the fractures.

Aquifers of the Lower Coastal Plain tend to be the least vulnerable due to their greater depth below the surface and better confinement below beds of low permeability. Most public wells in this region are deeper than 300 feet and can reach depths of over 2,000 feet. Private wells in this region are usually much shallower than public wells and are often above the protective confining layer.

Although generalizations can be made about the varying regions, the actual vulnerability of a given aquifer or drinking water source is extremely variable. Sub-surface geology and hydrology can be wildly heterogeneous and unpredictable over relatively short distances. The creation of a hardline map to delineate these regions would be impractical and, ultimately, imprecise. The BOW uses a general understanding of these regions to make broad assumptions about the vulnerability of a given aquifer. If available, data on the soils and depths of actual drinking water wells in an area can help deduce the vulnerability of a drinking water source to influence from the surface and shallow sub-surface.

## V. STRATEGY TO ASSESS DRINKING WATER VULNERABILITY TO PFAS

### A. Source Impact and Drinking Water Vulnerability Index

Numerous factors determine the potential impact of a given PFAS source on the vulnerability of a given drinking water system to PFAS. The BOW believes the three (3) most significant pragmatic factors in vulnerability are:

- PFAS source type
- drinking water source type
- groundwater aquifer system type

As discussed herein, statewide review of these factors revealed a variety of potential PFAS sources; hundreds of thousands of individual drinking water (*i.e.*, private well) sources; and, three (3) major groundwater aquifer systems along with surface water systems. The permutations and combinations of these large factors yields a vast number of possible and plausible public exposure pathways. To better direct the use of limited resources, each PFAS source type, drinking water source type and groundwater aquifer type were ranked by their potential influence on drinking water vulnerability to PFAS, as discussed below.

#### PFAS Source Type

Current and past research has shown that PFAS source type (*i.e.*, activity at a given site) is a large factor in the probability of PFAS exposure from that source. Information from Part IV.A was used to rank the more likely source types. The rankings in Table 11 generally follow the upper magnitude of PFAS groundwater contamination described by Guelfo *et al.* (2018). Septic tanks are absent from the rankings based on their relatively low potential for PFAS exposure in the literature.

**Table 11. Ranking of PFAS Source Type on Drinking Water Vulnerability**

Source Type	Impact Rank	Approximate Number of Known Sites
DOD/DOE Facilities	1	12
PFAS or FP Manufacturing <sup>A</sup>	2	0
Landfills	3	677
Part 139 Airports	4	8
Fire Training Areas <sup>B</sup>	5	>2 <sup>C</sup>
Petroleum Refineries <sup>A</sup>	6	0
Industrial Sites <sup>D</sup>	7	384
WWTP <sup>E</sup>	8	746

A. no known facilities in South Carolina

B. represents fire training areas at municipal or private fire training institutions

C. presently, there are two (2) known past/present fire training areas in South Carolina

D. industries that use or are believed to use PFAS or FP in their production processes and have either a direct discharge of their wastewater (NPDES/ND permit) to surface waters or send wastewater to a municipal WWTP that has a pretreatment program

E. domestic/municipal and industrial WWTP that produce treated effluent and sludge. Industrial WWTP here are limited to those WWTP at industries that use or are tentatively indicated to use PFAS or FP in their production processes

Note: land application sites will be identified through their Industrial or WWTP sources

Groundwater contamination at land application sites reviewed by Lindstorm *et al.* (2011) was limited to sludge from municipal WWTP. No literature was found to suggest that a land application site receiving municipal sludge was a higher risk than one receiving industrial sludge, industrial effluent or domestic/municipal effluent. Similarly, the available literature on PFAS in WWTP effluent did not suggest a significant difference between domestic/municipal effluent and industrial effluent. The WWTP source type in Table 10 combines domestic/municipal or industrial WWTPs of interest, regardless of disposal method, into one (1) broad source type since there is no information from the literature to rank one (1) of these unique scenarios over another. If a given WWTP is indicated to be a likely source of PFAS, then the areas that may be impacted by effluent and sludge (*i.e.*, surface waters, land application areas) will be elevated in the vulnerability conclusion for evaluation of drinking water if users (*i.e.*, receptors) are present.

The groundwater contamination data in the literature was highly variable within each source type. The upper magnitudes within a given source type were often driven by a worst-case scenario (*e.g.*, waste from a PFAS manufacturer). However, in the absence of site-specific information, this approach is adopted as the more logical and defensible way to rank source types given the present state of the scientific knowledge on this issue.

Drinking Water Source Type

The characteristics of a given drinking water source will also influence the potential for PFAS exposure. Based on the general characteristics outlined in Part IV.B for each type of drinking water source, it may be assumed that a groundwater well near a PFAS source would be higher risk than a surface water intake which generally receives inputs from large watersheds. As such, groundwater well vulnerability is ranked higher than surface water intakes in Table 12.

There are similarities between private and public wells. In some aquifers, these can be at similar depths and their vulnerability to surface contamination may be comparable. However, private wells in other aquifers tend to be much shallower than public wells. Therefore, private wells are ranked as the more vulnerable drinking water source type than public system wells.

**Table 12. Ranking of Drinking Water Source Type on Drinking Water Vulnerability**

Drinking Water Source Type	Impact Rank	Approximate Population <sup>A</sup>
Private Wells	1	1,000,000
Public Wells	2	1,000,000
Surface Water Intakes	3	3,000,000

A. estimate of population to show approximate portion of population served by each drinking water source type

Groundwater Aquifer Type

Based on the aquifer characteristics described in Part IV.C, it is reasonably and defensibly assumed that the wells in the Upper Coastal Plain and Piedmont are more vulnerable to surface and shallow sub-surface contamination than those in the Lower Coastal Plain (Table 13). If PFAS are present at the surface or shallow sub-surface, the potential for PFAS to migrate into an aquifer is highly dependent upon localized geology and hydrology. However, in the absence of localized geologic and hydrologic information, but based on the general and area-related knowledge of the lithology and stratigraphy for the main aquifer units, this ranking is the most logical and defensible way to rank aquifer vulnerability.

**Table 13. Ranking of Groundwater Aquifer Areal Zone on Drinking Water Vulnerability**

Aquifer	Impact Rank
Upper Coastal Plain	1
Piedmont	2
Lower Coastal Plain	3

**B. Assessment Design**

An investigation of individual potential PFAS sources as the sole trigger for drinking water assessment will be resource-intensive and will require a significant period of duration for execution. For present public health purposes, it is more pressing to determine if PFAS are present in a drinking water source than assignment of the source(s) of PFAS, if found in drinking water. Based on the Strategy described herein, different approaches will be adopted for public systems and private wells to meet the following goals:

- to be fit-for-purpose;
- to be resource-efficient (time and money); and,
- to provide actionable and extendable data on a timely basis for public health decision-making.

Private Wells

Based on the foregoing discussion, the BOW believes the more important questions for determining the vulnerability of a drinking water source, but especially for private wells, to PFAS are:

- *How difficult is it for surface and/or shallow sub-surface inputs to reach a drinking water source?*
- *Is there a likely source of PFAS near a drinking water source?*

Consequently, development of answers to these two (2) questions will drive the BOW’s assessment design to prioritize PFAS sampling for private wells in the State.

The existence of hundreds of thousands of private wells across the State make it infeasible to sample and analyze each well. Accordingly, the BOW plans to implement the Strategy discussed herein on a technical evaluation basis to prioritize identifying the more (apparent) at-risk private wells. The identified wells will then be sampled and analyzed, pending receipt of owner permission. The Strategy will be implemented by:

- the more vulnerable aquifers (upper Coastal Plain and Piedmont) will be the initial focus
- potential PFAS sources over that aquifer and private wells near those sources will be located. PFAS sources will be evaluated in the rank order from Table 10 unless other information becomes available that would merit a modification to the Strategy.
- For example, private wells near DOD sites in the Upper Coastal Plain would be evaluated first.
  - Identified at-risk wells will then be sampled and analyzed for PFAS.
  - Next, private wells near Class 2 and Class 3 landfills in that aquifer, and so-on until each potential source type within the aquifer has been addressed.
  - The process would then be repeated for the Piedmont and then for the Lower Coastal Plain.

Public Systems

Consequently, in order to meet the goals of resources efficiency as to extend the application of the data acquired as far as defensible for public health decision-making, the BOW plans to:

- sample and analyze the finished water at the filter/treatment plants for the 583 community water systems (CWS), but prior to final technology treatment such as GAC or reverse osmosis, for the presence of PFAS.

- A CWS is a system that has more than 15 taps or serves more than 25 year-round residents.

This strategy-based element of the assessment design affords the BOW the ability to evaluate the status of PFAS exposure in drinking water for approximately 80% of the State's population per Table 11.

The BOW is aware that other groups are performing site investigations for PFAS contamination (*e.g.*, DOD) and that some community water systems are performing PFAS analyses on their own initiative. Accordingly, the BOW notes that it will be crucial to collaborate appropriately with these groups to ensure that collective efforts are not duplicated.

## VI. PATH FORWARD

### A. Current Known Issues and Previously-Identified Vulnerable Drinking Water Systems

The BLWM has been working closely with the DOD on their military base investigations. DOD policy is to investigate PFAS as an emerging contaminant under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). BLWM is included in the DOD process as a stakeholder to review DOD activities and findings. If PFAS is found in groundwater at DOD facilities, the DOD performs follow-up assessments to ascertain if nearby drinking water user (*i.e.*, receptors) have been impacted. To date, no complete pathways for ingestion of PFAS-affected drinking water have been identified (Table 14).

**Table 14. PFAS Impacts on Drinking Water at South Carolina DOD Facilities**

Facility	City	Known Impact to Off-Base Wells <sup>A</sup>	Known Impact to On-Base Wells <sup>A</sup>
Charleston Naval Complex	Charleston	None	None; No Wells – Public Supply
Fort Jackson	Columbia	None	None; No Wells - Public Supply
Joint Base Charleston - Air	Charleston	None	None; No Wells - Public Supply
Joint Base Charleston - Weapons	Charleston	None	None; No Wells - Public Supply
Marine Corps Air Station	Beaufort	None	None; No Wells - Public Supply
Marine Corps Recruit Depot	Port Royal	None	None; No Wells -- Public Supply
McEntire Joint National Guard Base	Eastover	None	None; No Wells -- Public Supply
Myrtle Beach Air Force Base	Myrtle Beach	None	None; No Wells -- Public Supply
North Auxiliary Airfield	Orangeburg	None	None; No Wells -- Public Supply
Poinsett Electronic Combat Range	Wedgefield	None	None; No Wells - Public Supply
Shaw Air Force Base	Sumter	Assessment Planned by DOD	None <sup>B</sup>

A. per DOD reporting to BLWM as of January 27, 2020.

B. five (5) wells present; all have been sampled three (3) times over the past year with all reporting non-detects.

Five (5) private wells proximate to the Able Contracting response action project in Jasper County were sampled and analyzed in September 2019 for PFAS by USEPA Method 537.1 due to the nature of the material (*i.e.*, construction and demolition debris) on the project site. All wells returned non-detects for all 18 analytes in the suite with no elevated detection or reporting limits.

The USEPA (lead agency) and BLWM are currently continuing to assess some land application sites in the Pee Dee Region of the State where there has been some PFAS impact on private well water.

## **B. Implementation Schedule**

The BOW's Strategy for the evaluation of PFAS in drinking water will be implemented along the flow of the following schedule:

### First Quarter (January-March) 2020

- prepare and award procurement for external laboratory analyses
- produce geographic information system exhibits that show the locations of potential PFAS sources and their proximity to known drinking water sources
- prepare and obtain approval of Quality Assurance Project Plan
- ascertain and acquire PFAS data from CWS that have performed those analyses
- develop schedule for CWS sampling and coordinate activities with CWS
- commence CWS sampling and analyses
- evaluate sample results against the USEPA HA for PFOA and PFOS
- evaluate sample results for other PFAS analytes in the suite
- notify CWS of sample results and provide technical support, as necessary
- update Department web page with received data

### Second Quarter (April-June) 2020

- continue CWS sampling and analyses
- evaluate sample results against the USEPA HA for PFOA and PFOS
- evaluate sample results for other PFAS analytes in the suite
- notify CWS of sample results and provide technical support, as necessary
- update Department web page with received data
- identify initial round of private wells to be sampled

### Third Quarter (July - September) 2020

- continue CWS sampling and analyses
- obtain permission, then collect and analyze samples in initial round of private wells
- evaluate sample results against the USEPA HA for PFOA and PFOS
- evaluate sample results for other PFAS analytes in the suite
- notify CWS of sample results and provide technical support, as necessary
- notify private well owners of sample results and provide technical support, as necessary
- update Department web page with received data

### Fourth Quarter (October - December) 2020

- continue CWS sampling and analyses
- obtain permission, then collect and analyze samples in initial round of private wells
- evaluate sample results against the USEPA HA for PFOA and PFOS
- evaluate sample results for other PFAS analytes in the suite
- notify CWS of sample results and provide technical support, as necessary
- notify private well owners of sample results and provide technical support, as necessary
- update Department web page with received data

### First Quarter (January - March) 2021

- assess effectiveness of Strategy; determine if adjustments to the Strategy and resource utilization should be made
- prepare and issue a summary report for 2020 describing work performed and results obtained with discussion of consequential public health outcomes

### **C. Other Considerations and Outcomes**

In this Strategy the BOW is most concerned with protecting public health. Accordingly, resources will be focused on the analysis of drinking water being provided as opposed to discovering exact PFAS-source locations. If it is determined that a drinking water supply has been impacted by PFAS, then at that time, a source investigation will be designed and implemented.

Although only PFOA and PFOS are addressed by the USEPA HA, the data provided on other PFAS from USEPA Methods 533 and 537.1 will have value in that they will provide a broader evaluation of the presence of absence of PFAS in water supplies, irrespective of the USEPA HA.

The wide ranges of PFAS contamination at different source types not only highlights heterogeneity between source types, but also those sites used for similar activities. For instance, there is no rule that all DOD sites are a higher risk than all landfills. Without case-specific information about PFAS use or disposal at a given site, the BOW believes this Strategy is the more efficient way to discover drinking water contaminated by PFAS. If information becomes available for a specific water source that would heighten the apparent risk associated with PFAS in that source, such sources will be prioritized over sites with limited or no information.

### **D. Adaptability**

The BOW reserves the right to alter this Strategy as new or updated information is presented. The assessment of the Strategy's effectiveness at the end of the PWS sampling phase (first and second quarters in 2020 will help guide future efforts in the private well phases later in 2020 and there on). The Strategy is expected to continue as described in Section V.B, unless new information becomes known that would alter the Strategy. Similarly, an evaluation of resource use and availability will direct future implementation of the Strategy.

### **E. Communications Plan**

The BOW commits that the results of this Strategy will be communicated in a timely, consistent and transparent fashion. Throughout the implementation of this Strategy, the BOW will communicate with water systems and the public in the following manner:

- a BOW PFAS Strategy webpage will be developed and maintained current on the BOW website, which will contain pertinent documents and data.
- the BOW will notify each PWS and/or private well owner of sample results within seven (7) days of receiving the final data from the laboratory.
- the BOW will post PWS sample results to the BOW PFAS Strategy webpage within 15 days of receiving the final data analysis from the laboratory.
- sample results from private wells will be summarized by county (i.e., individual well owner identification will remain confidential) on the BOW PFAS Strategy webpage within 15 days of receiving the final data analysis from the laboratory.

The general messaging spines for the resulting data from the non-regulatory, voluntary sampling will be:

- Concentrations of PFOA and PFOS exceed 70 ppt, either individually or combined:
  - CWS – the Department will expect the CWS to notify their customers of the findings and will encourage the CWS to develop a plan to address mitigation of PFAS analytes in the system’s finished water.
  - Private well – the Department will advise that an alternate water source be used for consumption (*e.g.*, drinking, cooking, brushing teeth, preparing infant formula).
- Concentrations of PFOA and PFOS do not exceed 70 ppt, either combined or individually:
  - CWS – the Department will expect the CWS to notify their customers of the findings and to inform the Department of how the CWS has chosen to handle this scenario regarding their finished water.
  - Private well -- the Department will advise the user to become informed on the presence of PFAS in their water in order to make a personal decision of continued consumption of the water.
- Concentrations of PFOA and PFOS are non-detect, but other PFAS analytes are detected:
  - CWS – the Department will encourage the CWS to notify their customers of the findings.
  - Private well -- the Department will advise the user to become informed on the presence of PFAS in their water in order to make a personal decision of continued consumption of the water.
- No PFAS analytes are detected:
  - CWS and Private well – the Department will advise that there does not appear to be an unacceptable risk to the user of the water, within the context of the PFAS parameter coverage and time of the testing.

Based on the present regulatory status of PFAS (*i.e.*, non-regulated), the Department’s role at this time is to make community water systems management and private well owners aware of data obtained from their water supplies and to advise about available information that can be used to make decisions for addressing a situation revealed by the acquired data. Under this present regulatory status, the choices for addressing PFAS-related issues in drinking water remain with the community water systems and private well owner.

## VII. REFERENCES CITED

- 3M Company Environmental Laboratory. 2001. Environmental Monitoring – Multi-City Study Water, Sludge, Sediment, POTW Effluent and Landfill Leachate Samples. 3M. St. Paul, MN.
- AECOM. 2019. 2018 PFAS Sampling of Drinking Water Supplies in Michigan. AECOM. Grand Rapids, MI.
- Agency for Toxic Substances and Disease Registry. 2017. Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS) Frequently Asked Questions. Fact Sheet. Agency for Toxic Substances and Disease Registry. Atlanta, GA. Updated August 22, 2017.
- Anderson, P.D., N.D Denslow, J.E. Drewes, A. W. Olivieri, D. Schlenk, G.I. Scott and S.A. Snyder. 2012. Monitoring Strategies for Chemicals of Emerging Concern (CECs) in California's Aquatic Ecosystems. Recommendations of a Scientific Advisory Panel. Technical report 692 by the Southern California Coastal water Research Project, Costa mesa, CA to the California Water Resources Control Board. 215pp.
- Arhens, L. and M. Bundschuh. 2014. Fate and Effects of Poly- and Perfluoroalkyl Substances in the Aquatic Environment: A Review. *Environmental Toxicology and Chemistry*, 33 (9): 1921-1929.
- Bossi, R., J. Strand, O. Sortkjær and M.M. Larsen. 2008. Perfluoroalkyl Compounds in Danish Wastewater Treatment Plants and Aquatic Environments. *Environment International*, 34 (4): 443-450.
- Brusseau, M.L. 2018. Assessing the Potential Contributions of Additional Retention Processes to PFAS Retardation in the Subsurface. *Science of the Total Environment*, 613: 176-185.
- Centers for Disease Control and Prevention. 2019. Fourth National Report on Human Exposure to Environmental Chemicals, Updated Tables, January 2019, Volume One. Atlanta, GA.
- Clara, M., C. Scheffknecht, S. Scharf, S. Weiss and O. Gans. 2008. Emissions of Perfluorinated Alkylated Substances (PFAS) from Point Sources – Identification of Relevant Branches. *Water Science and Technology*, 58 (1): 59-66.
- Ding, G. and W.J.G.M. Peijnenburg. 2013. Physicochemical Properties and Aquatic Toxicity of Poly- and Perfluorinated Compounds. *Critical Reviews in Environmental Science and Technology*, 43 (6): 598-678.
- Giesy, J.P., J.E. Naile, J.S. Khim, P.D. Jones and J.L. Newsted. 2010. Aquatic Toxicology of Perfluorinated Chemicals. *Reviews of Environmental Contamination and Toxicology*, 202: 1-52.
- Guelfo, J.L. and C.P. Higgins. 2013. Subsurface Transport Potential of Perfluoroalkyl Acids at Aqueous Film-Forming Foam (AFFF)-impacted Sites. *Environmental Science and Technology*, 50 (19): 10554-10561.
- Guelfo, J.L., T. Marlow, D.M. Klein, D.A. Savitz, S. Frickel, M. Crimi and E.M. Suuberg. 2018. Evaluation and Management Strategies for Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water Aquifers: Perspectives from Impacted U.S. Northeast Communities. *Environmental Health Perspectives*, 126 (6): 065001.
- International Technology and Regulatory Council. 2019. Regulations, Guidance, and Advisories for Per- and Polyfluoroalkyl Substances (PFAS), Section 4 Tables. Interstate Technology Regulatory Council. Washington, DC. Updated June 30, 2019.

International Technology and Regulatory Council. 2018a. Aqueous Film-Forming Foam (AFFF). Fact Sheet. Interstate Technology Regulatory Council. Washington, DC.

International Technology and Regulatory Council. 2018b. Environmental Fate and Transport for Per- and Polyfluoroalkyl Substances. Fact Sheet. Interstate Technology Regulatory Council. Washington, DC.

International Technology and Regulatory Council. 2017. History and Use of Per- and Polyfluoroalkyl Substances (PFAS). Fact Sheet. Interstate Technology Regulatory Council. Washington, DC.

Krafft, M.P. and J.G. Riess. 2015. Selected Physicochemical Aspects of Poly- and Perfluoroalkylated Substances Relevant to Performance, Environment and Sustainability – Part One. *Chemosphere*, 129: 4-19.

Lee, J.L. and I.R. Schultz. 2010. Sex Differences in the Uptake and Disposition of Perfluorooctanoic Acid in Fathead Minnows after Oral Dosing. *Environmental Science and Technology*, 44 (1): 491-496.

Lindstrom, A.B., M.J. Strynar, A.D. Delinsky, S.F. Nakayama, L. McMillan, E.L. Libelo, M. Neill and L. Thomas. 2011. Application of WWTP Biosolids and Resulting Perfluorinated Compound Contamination of Surface and Well Water in Decatur, Alabama, USA. *Environmental Science and Technology*, 45 (19): 8015-8021.

MacDonald, M.M., A.L. Warne, N.L. Stock, S.A. Mabury, K.R. Solomon and P.K. Sibley., 2004. Toxicity of Perfluorooctane Sulfonic and Perfluorooctanoic Acid to *Chironomus tentans*. *Environmental Toxicology and Chemistry*, 23 (9): 2116-2123.

Maruya, K.A., D. Schlenk, P.D. Anderson, N.D. Denslow, J.E. Drewes, A.W. Olivieri, G.I. Scott and S.A. Snyder. 2014. An Adaptive, Comprehensive Monitoring Strategy for Chemicals of Emerging Concern (CECs) in California's Ecosystems. *Integr. Environ. Assess. Manag.* 10(1): 69-77.

National Toxicology Program. 2016. Monograph on Immunotoxicity Associated with Exposure to Perfluorooctanoic Acid (PFOA) or Perfluorooctane Sulfonate (PFOS). Office of Health Assessment and Translation, National Toxicology Program. National Institute of Environmental Health Services. Durham, NC.

South Carolina Fire Academy. 2019. Facilities and Props. South Carolina Fire Academy Website. <http://www.scfa.state.sc.us/InsideSCFA/index.asp?file=facility.htm>. Accessed August 1, 2019.

South Carolina State Firefighters' Association. 2019. 2019 Department Directory. South Carolina State Firefighters' Association. Columbia, SC.

Sepulvado, J.G., A.C. Blaine, L.S. Hundal and C.P. Higgins. 2011. Occurrence and Fate of Perfluorochemicals in Soil Following the Land Application of Municipal Biosolids. *Environmental Science and Technology*, 45 (19): 8106-8112.

Sharpe, R.L., J.P. Benskin, A.H. Laarman, S.L. MacLeod, J.W. Martin, C.S. Wong and G.G. Goss. 2010. Perfluorooctane Sulfonate Toxicity, Isomer-Specific Accumulation, and Maternal Transfer in Zebrafish (*Danio rerio*) and Rainbow Trout (*Oncorhynchus mykiss*). *Environmental Toxicology and Chemistry*, 29 (9): 1957-1966.

United States Department of Defense. 2017. Aqueous Film Forming Foam. Report to Congress. Department of Defense. Washington, DC.

United States Environmental Protection Agency. 2000. EPA and 3M Announce Phase Out of PFOS. Press Release. US Environmental Protection Agency. Released May 16, 2000.

United States Environmental Protection Agency. 2019a. EPA's Per- and Polyfluoroalkyl Substances (PFAS) Action Plan. EPA 823-R-18-004. Office of Water. US Environmental Protection Agency. Washington, DC.

United States Environmental Protection Agency. 2019b. <https://iaspub.epa.gov/tdb/pages/general/home.do>. Accessed August 6, 2019.

United States Environmental Protection Agency. 2017. The Third Unregulated Contaminant Monitoring Rule (UCMR 3): Data Summary, January 2017. EPA 815-S-17-001. Office of Water. US Environmental Protection Agency. Washington, DC.

Wang, Z., J.C. DeWitt, C.P. Higgins and I.T. Cousins. 2017. A Never-Ending Story of Per- and Polyfluoroalkyl Substances (PFAS)? *Environmental Science & Technology*, 51: 2508-2518.

**Appendix B – Laboratory Chain of Custody Forms**





Eaton Analytical

# CHAIN OF CUSTODY RECORD

EUROFINS EATON ANALYTICAL USE ONLY:

750 Royal Oaks Drive, Suite 100  
Monrovia, CA 91016-3629

Phone: 626 386 1100  
Fax: 626 386 1101

800 566 LABS (800 566 5227)

Website: [www.EatonAnalytical.com](http://www.EatonAnalytical.com)

<b>LOGIN COMMENTS:</b> _____	<b>SAMPLES CHECKED AGAINST COC BY:</b> _____
	<b>SAMPLES LOGGED IN BY:</b> _____
<b>SAMPLE TEMP RECEIVED AT:</b>	<b>SAMPLES REC'D DAY OF COLLECTION?</b> <input type="checkbox"/> (check for yes)
<input type="checkbox"/> _____ (Other) IR Gun ID = _____ (Observation= _____ °C) (Corr.Factor _____ °C) (Final = _____ °C)	
<input type="checkbox"/> Monrovia IR Gun ID = _____ (Observation= _____ °C) (Corr.Factor _____ °C) (Final = _____ °C)	
<b>Compliance Acceptance Criteria:</b> (Chemistry: 4 ± 2 °C) (Microbiology: < 10°C )	
<b>TYPE OF ICE:</b> Real _____ Synthetic _____ No Ice _____	<b>CONDITION OF ICE:</b> Frozen _____ Partially Frozen _____ Thawed _____ N/A _____
<b>METHOD OF SHIPMENT:</b> Pick-Up / Walk-In / FedEx / UPS / DHL / Area Fast / Top Line / Other: _____	

TO BE COMPLETED BY SAMPLER:

<b>COMPANY/AGENCY NAME:</b> _____		<b>PROJECT CODE:</b> _____		(check for yes) <input type="checkbox"/>				(check for yes) <input type="checkbox"/>													
				<b>COMPLIANCE SAMPLES</b> <input type="checkbox"/>				<b>NON-COMPLIANCE SAMPLES</b> <input type="checkbox"/>													
				- Requires state forms <input type="checkbox"/>				REGULATION INVOLVED: _____													
				Type of samples (circle one): <b>ROUTINE</b> <b>SPECIAL</b> <b>CONFIRMATION</b>				(eg. SDWA, NPDES, etc.)													
<b>EEA CLIENT CODE:</b> _____		<b>COC ID:</b> _____		<b>SAMPLE GROUP:</b> _____		<b>SEE ATTACHED KIT ORDER FOR ANALYSES</b> <input type="checkbox"/> (check for yes), <b>OR</b>															
						<b>List ALL ANALYSES REQUIRED</b> (enter number of bottles sent for each test for each sample)															
<b>TAT requested: rush by adv notice only</b>		STD _____ 1 wk _____ 3 day _____ 2 day _____ 1 day _____										<b>SAMPLER COMMENTS</b>									
SAMPLE DATE	SAMPLE TIME	SAMPLE ID	CLIENT LAB ID	MATRIX *	FIELD DATA	FIELD DATA															

\* **MATRIX TYPES:** **RSW** = Raw Surface Water    **CFW** = Chlor(am)inated Finished Water    **SEAW** = Sea Water    **BW** = Bottled Water    **SO** = Soil    **O** = Other - Please Identify  
**RGW** = Raw Ground Water    **FW** = Other Finished Water    **WW** = Waste Water    **SW** = Storm Water    **SL** = Sludge

SIGNATURE	PRINT NAME	COMPANY/TITLE	DATE	TIME
SAMPLED BY: _____	_____	_____	_____	_____
RELINQUISHED BY: _____	_____	_____	_____	_____
RECEIVED BY: _____	_____	_____	_____	_____
RELINQUISHED BY: _____	_____	_____	_____	_____
RECEIVED BY: _____	_____	_____	_____	_____

**Appendix C – EPA Method 533 and 537.1**



METHOD 533: DETERMINATION OF PER- AND  
POLYFLUOROALKYL SUBSTANCES IN DRINKING WATER BY  
ISOTOPE DILUTION ANION EXCHANGE SOLID PHASE  
EXTRACTION AND LIQUID CHROMATOGRAPHY/TANDEM  
MASS SPECTROMETRY

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Office of Water (MS-140)

EPA Document No. 815-B-19-020

EPA contract EP-C-17-014

November 2019

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## Acknowledgements

Alan Zaffiro, APTIM (Cincinnati, OH)

The following organizations completed a validation study in their laboratories using this method, provided valuable feedback on the method procedures and reviewed the draft method manuscript:

Babcock Laboratories, Inc. (Riverside, CA)

Eurofins Eaton Analytical, LLC (South Bend, IN)

Eurofins TestAmerica (Sacramento, CA)

Merit Laboratories, Inc. (East Lansing, MI)

Shimadzu Scientific Instruments (Columbia, MD)

Thermo Fisher Scientific (Sunnyvale, CA)

Weck Laboratories, Inc. (City of Industry, CA)

Vogon Laboratory Services Ltd. (Cochrane, Alberta, Canada)

## Disclaimer

This analytical method may support a variety of monitoring applications, which include the analysis of multiple short-chain per- and polyfluoroalkyl substances (PFAS) that cannot be measured by Method 537.1. This publication meets an agency commitment identified within the 2019 EPA [PFAS Action Plan](#). Publication of the method, in and of itself, does not establish a requirement, although the use of this method may be specified by the EPA or a state through independent actions. Terms such as "must" or "required," as used in this document, refer to procedures that are to be followed to conform with the method. References to specific brands and catalog numbers are included only as examples and do not imply endorsement of the products. Such reference does not preclude the use of equivalent products from other vendors or suppliers.

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## 1 Scope and Application

This is a solid phase extraction (SPE) liquid chromatography-tandem mass spectrometry (LC-MS/MS) method for the determination of select per- and polyfluoroalkyl substances (PFAS) in drinking water. Method 533 requires the use of MS/MS in Multiple Reaction Monitoring (MRM) mode to enhance selectivity. Accuracy and precision data have been generated in reagent water and drinking water for the compounds included in the Analyte List.

This method is intended for use by analysts skilled in the performance of solid phase extractions, the operation of LC-MS/MS instrumentation, and the interpretation of the associated data.

### Analyte List

Analyte <sup>a</sup>	Abbreviation	CASRN
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Perfluorobutanoic acid	PFBA	375-22-4
Perfluorobutanesulfonic acid	PFBS	375-73-5
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4
Perfluorodecanoic acid	PFDA	335-76-2
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluoroheptanoic acid	PFHpA	375-85-9
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Perfluorononanoic acid	PFNA	375-95-1
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorooctanoic acid	PFOA	335-67-1
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluoroundecanoic acid	PFUnA	2058-94-8

<sup>a</sup> Some PFAS are commercially available as ammonium, sodium, and potassium salts. This method measures all forms of the analytes as anions while the identity of the counterion is inconsequential. Analytes may be purchased as acids or as any of the corresponding salts.

## 1.1 Detection of PFAS Isomers

Both branched and linear PFAS isomers may be found in the environment. This method includes procedures for summing the contribution of multiple isomers to the final reported concentration. In those cases where standard materials containing multiple isomers are commercially available, laboratories should obtain such standards for the method analytes.

## 1.2 Lowest Concentration Minimum Reporting Limits

The lowest concentration minimum reporting level (LCMRL) is the lowest concentration for which the future recovery is predicted to fall between 50 and 150% with high confidence (99%). Single-laboratory LCMRLs determined for the method analytes during method development are reported in [Table 7](#). It should be noted that most of the LCMRL values determined during the second laboratory evaluation were lower than the values listed in [Table 7](#). The values that a laboratory can obtain are dependent on the design and capability of the instrumentation used. The procedure used to determine the LCMRL is described elsewhere.<sup>1,2</sup> Laboratories using this method are not required to determine LCMRLs, but they must demonstrate that they are able to meet the minimum reporting level (MRL) ([Sect. 3.15](#)) for each analyte per the procedure described in [Section 9.1.4](#).

## 1.3 Method Flexibility

The laboratory may select LC columns, LC conditions, and MS conditions different from those used to develop the method. At a minimum, the isotope dilution standards and the isotope performance standards specified in the method must be used, if available. The laboratory may select the aqueous sample volume within the range of 100–250 mL that meets their objectives. During method development, 250 mL aqueous samples were extracted using a 500 mg solid phase extraction (SPE) sorbent bed volume. The ratio of sorbent mass to aqueous sample volume may not be decreased. If a laboratory uses 100 mL aqueous samples, the sorbent mass must be at least 200 mg. Changes may not be made to sample preservation, the quality control (QC) requirements, or the extraction procedure. The chromatographic separation should minimize the number of compounds eluting within a retention window to obtain a sufficient number of scans across each peak. Instrumental sensitivity (or signal-to-noise) will decrease if too many compounds are permitted to elute within a retention time window. Method modifications should be considered only to improve method performance. In all cases where method modifications are proposed, the analyst must perform the procedures outlined in the Initial Demonstration of Capability (IDC, [Sect. 9.1](#)), verify that all QC acceptance criteria in this method ([Sect. 9.2](#)) are met, and verify method performance in a representative sample matrix ([Sect. 9.3.2](#)).

## 2 Method Summary

A 100–250 mL sample is fortified with isotopically labeled analogues of the method analytes that function as isotope dilution standards. The sample is passed through an SPE cartridge containing polystyrene divinylbenzene with a positively charged diamino ligand to extract the method analytes and isotope dilution analogues. The cartridge is rinsed with sequential washes of aqueous ammonium acetate followed by methanol, then the compounds are eluted from the solid phase sorbent with methanol containing ammonium hydroxide. The extract is concentrated to dryness with nitrogen in a heated water bath. The extract volume is adjusted to 1.0 mL with 20% water in methanol (v/v), and three isotopically labeled isotope performance standards are added. Extracts are analyzed by LC-MS/MS

in the MRM detection mode. The concentration of each analyte is calculated using the isotope dilution technique. For QC purposes, the percent recoveries of the isotope dilution analogues are calculated using the integrated peak areas of isotope performance standards, which are added to the final extract and function as traditional internal standards, exclusively applied to the isotope dilution analogues.

## 3 Definitions

### 3.1 Analysis Batch

A set of samples that are analyzed on the same instrument during a 24-hour period that begins and ends with the analysis of the appropriate Continuing Calibration Check (CCC) standards. Additional CCCs may be required depending on the length of the Analysis Batch and the number of field samples.

### 3.2 Calibration Standard

A solution of the method analytes, isotope dilution analogues, and isotope performance standards prepared from the Primary Dilution Standards and stock standards. The calibration standards are used to calibrate the instrument response with respect to analyte concentration.

### 3.3 Continuing Calibration Check (CCC)

A calibration standard that is analyzed periodically to verify the accuracy of the existing calibration.

### 3.4 Extraction Batch

A set of up to 20 field samples (not including QC samples) extracted together using the same lot of solid phase extraction devices, solvents, and fortifying solutions.

### 3.5 Field Duplicates (FD)

Separate samples collected at the same time and sampling location, shipped and stored under identical conditions. Method precision, including the contribution from sample collection procedures, is estimated from the analysis of Field Duplicates. Field Duplicates are used to prepare Laboratory Fortified Sample Matrix and Laboratory Fortified Sample Matrix Duplicate QC samples. For the purposes of this method, Field Duplicates are collected to support potential repeat analyses (if the original field sample is lost or if there are QC failures associated with the analysis of the original field sample).

### 3.6 Field Reagent Blank (FRB)

An aliquot of reagent water that is placed in a sample container in the laboratory and treated as a sample in all respects, including shipment to the sampling site, exposure to sampling site conditions, storage, and all analytical procedures. The purpose of the FRB is to determine if method analytes or other interferences are introduced into the sample from shipping, storage, and the field environment.

### 3.7 Isotope Dilution Analogues

Isotopically labeled analogues of the method analytes that are added to the sample prior to extraction in a known amount. Note: Not all target PFAS currently have an isotopically labelled analogue. In these cases, an alternate isotopically labelled analogue is used as recommended in **Table 5**.

### 3.8 Isotope Dilution Technique

An analytical technique for measuring analyte concentration using the ratio of the peak area of the native analyte to that of an isotopically labeled analogue, added to the original sample in a known amount and carried through the entire analytical procedure.

### 3.9 Isotope Performance Standards

Quality control compounds that are added to all standard solutions and extracts in a known amount and used to measure the relative response of the isotopically labelled analogues that are components of the same solution. For this method, the isotope performance standards are three isotopically labeled analogues of the method analytes. The isotope performance standards are indicators of instrument performance and are used to calculate the recovery of the isotope dilution analogues through the extraction procedure. In this method, the isotope performance standards are not used in the calculation of the recovery of the native analytes.

### 3.10 Laboratory Fortified Blank (LFB)

An aliquot of reagent water to which known quantities of the method analytes and isotope dilution analogues are added. The results of the LFB verify method performance in the absence of sample matrix.

### 3.11 Laboratory Fortified Sample Matrix (LFSM)

An aliquot of a field sample to which known quantities of the method analytes and isotope dilution analogues are added. The purpose of the LFSM is to determine whether the sample matrix contributes bias to the analytical results. Separate field samples are required for preparing fortified matrix so that sampling error is included in the accuracy estimate.

### 3.12 Laboratory Fortified Sample Matrix Duplicate (LFSMD)

A Field Duplicate of the sample used to prepare the LFSM that is fortified and analyzed identically to the LFSM. The LFSMD is used instead of the Field Duplicate to assess method precision when the method analytes are rarely found at concentrations greater than the MRL.

### 3.13 Laboratory Reagent Blank (LRB)

An aliquot of reagent water fortified with the isotope dilution analogues and processed identically to a field sample. An LRB is included in each Extraction Batch to determine if the method analytes or other interferences are introduced from the laboratory environment, the reagents, glassware, or extraction apparatus.

### 3.14 Lowest Concentration Minimum Reporting Level (LCMRL)

The single-laboratory LCMRL is the lowest spiking concentration such that the probability of spike recovery in the 50% to 150% range is at least 99%.<sup>12</sup>

### 3.15 Minimum Reporting Level (MRL)

The minimum concentration that may be reported by a laboratory as a quantified value for a method analyte. For each method analyte, the concentration of the lowest calibration standard must be at or

below the MRL and the laboratory must demonstrate its ability to meet the MRL per the criteria defined in [Section 9.1.4](#).

### 3.16 Precursor Ion

The gas-phase species corresponding to the method analyte that is produced in the electrospray ionization interface. During tandem mass spectrometry, or MS/MS, the precursor ion is mass selected and fragmented by collision-activated dissociation to produce distinctive product ions of smaller mass to charge ( $m/z$ ) ratio. For this method, the precursor ion is usually the deprotonated molecule ( $[M - H]^-$ ) of the method analyte, except for HFPO-DA. For this analyte, the precursor ion is formed by decarboxylation of HFPO-DA.

### 3.17 Primary Dilution Standard (PDS)

A solution that contains method analytes (or QC analytes) prepared from stock standards. PDS solutions are used to fortify QC samples and diluted to prepare calibration standards.

### 3.18 Product Ion

One of the fragment ions that is produced in MS/MS by collision-activated dissociation of the precursor ion.

### 3.19 Quality Control Standard (QCS)

A calibration standard prepared independently from the primary calibration solutions. For this method, the QCS is a repeat of the entire dilution scheme starting with the same stock materials (neat compounds or purchased stock solutions) used to prepare the primary calibration solutions. Independent sources and separate lots of the starting materials are not required, provided the laboratory has obtained the purest form of the starting materials commercially available. The purpose of the QCS is to verify the integrity of the primary calibration standards.

### 3.20 Quantitative Standard

A quantitative standard of assayed concentration and purity traceable to a Certificate of Analysis.

### 3.21 Stock Standard Solution

A concentrated standard that is prepared in the laboratory using assayed reference materials or that is purchased from a commercial source with a Certificate of Analysis.

### 3.22 Technical-Grade Standard

As defined for this method, a technical-grade standard includes a mixture of the branched and linear isomers of a method analyte. For the purposes of this method, technical-grade standards are used to identify retention times of branched and linear isomers of method analytes.

## 4 Interferences

### 4.1 Labware, Reagents and Equipment

Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts or

elevated baselines in the chromatograms. The analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, deactivated syringes, SPE sample transfer lines, etc.<sup>3</sup> Laboratories must demonstrate that these items are not contributing to interference by analyzing LRBs as described in [Section 9.2.1](#).

## 4.2 Sample Contact with Glass

Aqueous samples should not come in contact with any glass containers or pipettes as PFAS analytes can potentially adsorb to glass surfaces. Standards dissolved in organic solvent may be purchased in glass ampoules. These standards in organic solvent are acceptable and subsequent transfers may be performed using glass syringes and pipets. Following extraction, the eluate must be collected in a polypropylene tube prior to concentration to dryness. Concentration to dryness in glass tubes may cause poor recovery.

## 4.3 Matrix Interferences

Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and fulvic material may be co-extracted during SPE and high levels may cause enhancement or suppression in the electrospray ionization source.<sup>4</sup> Inorganic salts may cause low recoveries during the anion-exchange SPE procedure.

### 4.3.1 Co-extracted Organic Material

Under the LC conditions used during method development, matrix effects due to co-extracted organic material enhanced the ionization of 4:2 FTS appreciably. Total organic carbon (TOC) is a good indicator of humic content of the sample.

### 4.3.2 Inorganic Salts

The authors confirmed acceptable method performance for matrix ion concentrations up to 250 mg/L chloride, 250 mg/L sulfate, and 340 mg/L hardness measured as CaCO<sub>3</sub>. Acceptable performance was defined as recovery of the isotope dilution analogues between 50–200%.

### 4.3.3 Ammonium Acetate

Relatively large quantities of ammonium acetate are used as a preservative. The potential exists for trace-level organic contaminants in this reagent. Interferences from this source should be monitored by analysis of LRBs, particularly when new lots of this reagent are acquired.

### 4.3.4 SPE Cartridges

Solid phase extraction cartridges may be a source of interferences. The analysis of LRBs provides important information regarding the presence or absence of such interferences. Each brand and lot of SPE devices must be monitored to ensure that contamination does not preclude analyte identification and quantitation. SPE cartridges should be sealed while in storage to prevent ambient contamination of the SPE sorbent.

## 4.4 Bias Caused by Isotopically Labeled Standards

During method development, no isotopically labeled standard solution yielded any signal that gave the same mass and retention time as any native analyte. However, due to isotopic impurity, the  $^{13}\text{C}_3$ -PFBA isotope performance standard contained a small amount of  $^{13}\text{C}_4$ -PFBA, slightly contributing to the signal of the isotope dilution analogue. Further, due to natural abundance of  $^{34}\text{S}$ , the native telomer sulfonates produced a small contribution to the  $^{13}\text{C}_2$  labeled telomer sulfonate isotope dilution analogues. The effects on quantitation are insignificant. However, these cases are described below in [Sections 4.4.2](#) and [4.4.3](#) to alert the user that these situations could occur.

### 4.4.1 Method Analytes

At the concentrations used to collect method performance data, the authors could not detect any contribution from the isotope dilution analogues or isotope performance standards to the corresponding native analyte response. However, the user should evaluate each source of isotopically labeled analogues and isotope performance standards to verify that they do not contain any native analyte at concentrations greater than 1/3 of the MRL.

### 4.4.2 Isotopic purity of $^{13}\text{C}_3$ -PFBA

In this method,  $^{13}\text{C}_3$ -PFBA is used as an isotope performance standard and  $^{13}\text{C}_4$ -PFBA is used as an isotope dilution analogue. Both share the same product ion,  $m/z$  172. Ten nanograms per liter of  $^{13}\text{C}_4$ -PFBA is added to the sample prior to extraction (10 ng/mL extract concentration assuming 100% recovery), and 10 ng/mL of  $^{13}\text{C}_3$ -PFBA is added to the final extract. Because the natural abundance of  $^{13}\text{C}$  is 1.1%, there is a 1.1% contribution to the  $^{13}\text{C}_4$ -PFBA area from the lone, unlabeled  $^{12}\text{C}$  atom in  $^{13}\text{C}_3$ -PFBA. The authors confirmed this contribution empirically. Users of this method may consider this bias to the area of the PFBA isotope dilution analogue insignificant.

### 4.4.3 Isotopic purity of $^{13}\text{C}_4$ -PFBA

A trace amount of  $^{13}\text{C}_3$ -PFBA was detected in the  $^{13}\text{C}_4$ -PFBA. The contribution was no greater than 1%. The contribution of the isotope performance standard to the isotope dilution analogue is insignificant.

### 4.4.4 Telomer Sulfonates

Each of the three telomer sulfonates in the analyte list (4:2FTS, 6:2FTS, and 8:2FTS) are referenced to their  $^{13}\text{C}_2$  isotope dilution analogue. The mass difference between the telomer sulfonates and the isotope dilution analogues is 2 mass units. The single sulfur atom in each of the unlabeled molecules has a naturally occurring M+2 isotope ( $^{34}\text{S}$ ) at 4.25%. Thus, the precursor ions of the  $^{13}\text{C}_2$  isotopically labeled analogues and the naturally occurring  $^{34}\text{S}$  analogues present in the native analytes have the same nominal masses. The product ions of the telomer sulfonate isotope dilution analogues listed in [Table 6](#) would contain a small contribution from the  $^{34}\text{S}$  analogue of the native telomer sulfonates. At the concentrations used in this study, the contribution of the  $^{34}\text{S}$  analogue to the isotope dilution analogue was not greater than 2.7%. Alternate product ions may be used if there is sufficient abundance.

## 5 Safety

Each chemical should be treated as a potential health hazard and exposure to these chemicals should be minimized. Each laboratory is responsible for maintaining an awareness of OSHA regulations regarding

safe handling of chemicals used in this method. A reference file of safety data sheets should be made available to all personnel involved in the chemical analysis.

## 6 Equipment and Supplies

References to specific brands and catalog numbers are included as examples only and do not imply endorsement of the products. Such reference does not preclude the use of equivalent products from other vendors or suppliers. Due to potential adsorption of analytes onto glass, polypropylene containers were used for sample preparation and extraction steps. Other plastic materials (e.g., polyethylene) that meet the QC requirements of [Section 9](#) may be substituted.

### 6.1 Sample Containers

Polypropylene bottles with polypropylene screw caps (for example, 250 mL bottles, Fisher Scientific, Cat. No. 02-896-D or equivalent).

### 6.2 Polypropylene Vials

These vials are used to store stock standards and PDS solutions (4 mL, VWR Cat. No. 16066-960 or equivalent).

### 6.3 Centrifuge Tubes

Conical polypropylene centrifuge tubes (15 mL) with polypropylene screw caps for storing standard solutions and for collection of the eluate during the extraction procedure (Thomas Scientific Cat. No. 2602A10 or equivalent).

### 6.4 Autosampler Vials

Polypropylene autosampler vials (ThermoFisher, Cat. No. C4000-14) with polypropylene caps (ThermoFisher, Cat. No. C5000-50 or equivalent). Note: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, creating the potential for evaporation to occur after injection. Multiple injections from the same vial are not permissible unless the cap is replaced immediately after injection.

### 6.5 Micro Syringes

Suggested sizes include 10, 25, 50, 100, 250, 500 and 1000  $\mu$ L.

### 6.6 Pipets

Polypropylene or glass pipets may be used for methanolic solutions.

### 6.7 Analytical Balance

Capable of weighing to the nearest 0.0001 g.

### 6.8 Solid Phase Extraction (SPE) Apparatus

#### 6.8.1 SPE Cartridges

SPE cartridges containing weak anion exchange, mixed-mode polymeric sorbent (polymeric backbone and a diamino ligand), particle size approximately 33  $\mu$ m. The SPE sorbent must have a pKa above 8 so that it remains positively charged during extraction. SPE cartridges containing 500 mg sorbent

(Phenomenex Cat. No. 8B-S038-HCH) were used during method development. Use of 200 mg cartridges is acceptable for the extraction of 100 mL samples.

### 6.8.2 Vacuum Extraction Manifold

Equipped with flow and vacuum control [Supelco Cat. No. 57030-U, UCT Cat. No. VMF016GL (the latter requires UCT Cat. No. VMF02116 control valves), or equivalent systems]. Automated devices designed for use with SPE cartridges may be used; however, all extraction and elution steps must be the same as in the manual procedure. Care must be taken with automated SPE systems to ensure that Teflon tubing and other PTFE components commonly used in these systems, do not contribute to unacceptable analyte concentrations in LRBs.

### 6.8.3 Sample Delivery System

Use of large volume sampling lines, constructed with polyethylene tubing, are recommended, but not mandatory. Large volume sample transfer lines, constructed with PTFE tubing, are commercially available for standard extraction manifolds (Supelco Cat. No. 57275 or equivalent). The PTFE tubing can be replaced with 1/8" o.d. x 1/16" i.d. polyethylene tubing [Freelin-Wade (McMinnville, Oregon) LLDPE or equivalent] cut to an appropriate length. This prevents potential contamination from PTFE transfer lines. Other types of non-PTFE tubing may be used provided it meets the LRB and LFB QC requirements. PTFE tubing may be used, but an LRB must be run on each individual transfer line and the QC requirements in [Section 9.2.1](#) must be met. In the case of automated SPE, the removal of PTFE lines may not be feasible; therefore, acceptable performance for the LRB must be met for each port during the IDC ([Sect 9.1.1](#)). LRBs must be rotated among the ports during routine analyses thereafter. Plastic reservoirs are difficult to rinse during elution and their use may lead to lower recovery.

## 6.9 Extract Concentration System

Extracts are concentrated by evaporation with high-purity nitrogen using a water bath set no higher than 60 °C [N-Evap, Model 11155, Organomation Associates (Berlin, MA), Inc., or equivalent].

## 6.10 Laboratory Vacuum System

Sufficient capacity to maintain a vacuum of approximately 15 to 20 inches of mercury for extraction cartridges.

### 6.11 pH Meter

Used to verify the pH of the phosphate buffer and to measure the pH of the aqueous sample prior to anion exchange SPE.

## 6.12 LC-MS/MS System

### 6.12.1 LC System

The LC system must provide consistent sample injection volumes and be capable of performing binary linear gradients at a constant flow rate. On some LC systems, PFAS may build up in PTFE transfer lines when the system is idle for more than one day. To prevent long delays in purging high levels of PFAS from the LC solvent lines, it may be useful to replace PTFE tubing with PEEK™ tubing and the PTFE solvent frits with stainless steel frits. These modifications were not used on the LC system used for method development. However, a delay column, HLB Direct Connect 2.1 x 30 mm (Waters 186005231),

was placed in the mobile phase flow path immediately before the injection valve. This direct connect column may have reduced the co-elution of PFAS originating from sources prior to the sample loop from the PFAS injected in the sample. It may not be possible to remove all PFAS background contamination.

### 6.12.2 Analytical Column

C18 liquid chromatography column (2 x 50 mm) packed with 3  $\mu\text{m}$  C18 solid phase particles (Phenomenex Part Number 00B-4439-B0 or equivalent).

### 6.12.3 Electrospray Ionization Tandem Mass Spectrometer (ESI-MS/MS)

The mass spectrometer must be capable of electrospray ionization in the negative ion mode. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is needed to ensure adequate precision. Some ESI-MS/MS instruments may not be suitable for PFAS analysis. See the procedures in [Section 10.1.2.1](#) to ensure that the selected MS/MS platform is capable of monitoring all the required MS/MS transitions for the method analytes.

### 6.12.4 MS/MS Data System

An interfaced data system is required to acquire, store, and output MS data. The computer software must have the capability of processing stored data by recognizing a chromatographic peak within a given retention time window. The software must allow integration of the abundance of any specific ion between specified time or scan number limits. The software must be able to construct a linear regression or quadratic regression calibration curve and calculate analyte concentrations using the internal standard technique.

## 7 Reagents and Standards

Reagent grade or better chemicals must be used. Unless otherwise indicated, all reagents must conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society (ACS), where such specifications are available. Other grades may be used if the reagent is demonstrated to be free of analytes and interferences and all requirements of the IDC are met when using these reagents.

### 7.1 Reagent Water

Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than one-third of the MRL for each method analyte. It may be necessary to flush the water purification unit to rinse out any build-up of PFAS in the system prior to collection of reagent water.

### 7.2 Methanol

$\text{CH}_3\text{OH}$ , CASRN 67-56-1, LC grade (Fisher Scientific, Cat. No. A456 or equivalent).

### 7.3 Ammonium Acetate

$\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$ , CASRN 631-61-8, HPLC grade, molecular weight equals 77.08 g/mole.

### 7.3.1 20 mM Ammonium Acetate

Chromatographic mobile phase. To prepare 1 L, add 1.54 g ammonium acetate to 1 L of reagent water. This solution is volatile and must be replaced at least once per week. More frequent replacement may be necessary if unexplained losses in sensitivity or retention time shifts are encountered.

### 7.3.2 1 g/L Ammonium Acetate

Used to rinse SPE cartridges after loading the aqueous sample and prior to the methanol rinse. Prepare in reagent water.

## 7.4 Concentrated Ammonium Hydroxide Reagent

NH<sub>4</sub>OH, CASRN 1336-21-6, approximately 56.6% in water as ammonium hydroxide (w/w), approximately 28% in water as ammonia, approximately 14.5 N (Fisher Scientific, Cat. No. A669, Certified ACS Plus grade, or equivalent).

## 7.5 Solution of Ammonium Hydroxide in Methanol

Used for elution of SPE cartridges. Dilute 2 mL of concentrated ammonium hydroxide (56.6% w/w) in 100 mL methanol. This solution should be made fresh on the day of extraction.

## 7.6 Sodium Phosphate Dibasic (Na<sub>2</sub>HPO<sub>4</sub>)

Used for creating the aqueous buffer for conditioning the SPE cartridges. Dibasic sodium phosphate may be purchased in either the anhydrous or any hydrated form. The formula weight will vary based on degree of hydration.

## 7.7 Sodium Phosphate Monobasic (NaH<sub>2</sub>PO<sub>4</sub>)

Used for creating the aqueous buffer for conditioning the SPE cartridges. Monobasic sodium phosphate may be purchased in either the anhydrous or any hydrated form. The formula weight will vary based on degree of hydration.

## 7.8 0.1 M Phosphate Buffer pH 7.0

Mix 500 mL of 0.1 M dibasic sodium phosphate with approximately 275 mL of 0.1 M monobasic sodium phosphate. Verify that the solution pH is approximately 7.0.

## 7.9 Nitrogen

### 7.9.1 Nitrogen Nebulizer Gas

Nitrogen used as a nebulizer gas in the ESI interface and as collision gas in some MS/MS platforms should meet or exceed the instrument manufacturer's specifications.

### 7.9.2 Nitrogen used for Concentrating Extracts

Ultra-high-purity-grade nitrogen should be used to concentrate sample extracts.

## 7.10 Argon

Used as collision gas in MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen may be used as the collision gas if recommended by the instrument manufacturer.

## 7.11 Sodium Hydroxide

May be purchased as pellets or as aqueous solution of known concentration. Added to methanolic solutions of PFAS to prevent esterification.

## 7.12 Acetic Acid (glacial)

May be necessary to adjust pH of aqueous samples. The pH of the aqueous sample containing 1 g/L ammonium acetate must be between 6 and 8.

## 7.13 Standard Solutions

### 7.13.1 Stability of Methanolic Solutions

Fluorinated carboxylic acids will esterify in anhydrous acidic methanol. To prevent esterification, standards must be stored under basic conditions. If base is not already present, this may be accomplished by the addition of sodium hydroxide (approximately 4 mole equivalents) when standards are diluted in methanol. When calculating molarity for solutions containing multiple PFAS, the molecular weight can be estimated as 250 atomic mass units (amu). It is necessary to include sodium hydroxide in solutions of both isotopically labeled and native analytes. The amount of sodium hydroxide needed may be calculated using the following equation:

$$\frac{\text{Total PFAS mass (g)} \times 160 \left(\frac{\text{g}}{\text{mol}}\right)}{250 \left(\frac{\text{g}}{\text{mol}}\right)} = \text{Mass of NaOH Required (g)}$$

### 7.13.2 Preparation of Standards

When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. Sorption of PFAS analytes in methanol solution to glass surfaces after prolonged storage has not been evaluated. PFAS analyte and isotopically labeled analogues commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be stored in polypropylene containers.

Solution concentrations listed in this section were used to develop this method and are included as examples. Alternate concentrations may be used as necessary depending on instrument sensitivity and the calibration range used. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples. Laboratories should use standard QC practices to determine when standards need to be replaced. The analyte supplier's guidelines may be helpful when making this determination.

## 7.14 Storage Temperatures for Standards Solutions

Store stock standards at less than 4 °C unless the vendor recommends otherwise. The Primary Dilution Standards may be stored at any temperature, but cold storage is recommended to prevent solvent evaporation. During method development, the PDS was stored at -20 °C and no change in analyte concentrations was observed over a period of 6 months.

## 7.15 Isotope Performance Standards

This method requires three isotope performance standards listed in the table below. These isotopically labeled compounds were chosen during method development to include the analogues of three method analytes: two carboxylates with different chain lengths and a sulfonate.

Obtain the isotope performance standards as certified standard solutions, if available, or as the neat compounds. During method development, the isotope performance standards were obtained from Wellington Laboratories (Guelph, ON, Canada) as certified stocks in basic methanol. Note that Chemical Abstracts Registry Numbers are not currently available for these compounds. The concentrations of the stocks supplied by Wellington are listed in the table below.

Isotope Performance Standards	Abbreviation	Wellington Stock, µg/mL	PDS, ng/µL
Perfluoro- <i>n</i> -[2,3,4- <sup>13</sup> C <sub>3</sub> ]butanoic acid	<sup>13</sup> C <sub>3</sub> -PFBA	50	1.0
Perfluoro-[1,2- <sup>13</sup> C <sub>2</sub> ]octanoic acid	<sup>13</sup> C <sub>2</sub> -PFOA	50	1.0
Sodium perfluoro-1-[1,2,3,4- <sup>13</sup> C <sub>4</sub> ]octanesulfonate	<sup>13</sup> C <sub>4</sub> -PFOS	50 <sup>a</sup>	3.0

<sup>a</sup>. 47.8 µg/mL as the anion.

All the isotope performance standards listed in this section must be used, if available. Additional isotope performance standards may be used provided they are isotopically labeled analytes or labeled analytes with similar functional groups as the method analytes. Linear isomers are recommended to simplify peak integration. Method modification QC requirements must be met ([Sect. 9.3](#)) whenever additional isotope performance standards are used.

### 7.15.1 Isotope Performance Standard PDS

Prepare the isotope performance standard PDS in methanol and add sodium hydroxide if not already present to prevent esterification as described in [Section 7.13.1](#). The PDS concentrations used to develop the method are listed in the table above ([Sect. 7.15](#)). During collection of method performance data, the final extracts were fortified with 10 µL of the PDS to yield a concentration of 10 ng/mL for <sup>13</sup>C<sub>3</sub>-PFBA and <sup>13</sup>C<sub>2</sub>-PFOA, and 30 ng/mL for <sup>13</sup>C<sub>4</sub>-PFOS (28.7 ng/mL as the anion).

## 7.16 Isotope Dilution Analogues

Obtain the isotopically labeled analogues listed in the table in this section as individual certified standard solutions or as certified standard mixes. All listed isotope dilution analogues must be used, if available. Linear isomers are recommended to simplify peak integration. During method development, the isotope dilution analogues were obtained from Wellington Laboratories (Guelph, ON, Canada) as certified stocks in basic methanol. These analogues were chosen during method development because they encompass most of the functional groups, as well as the molecular weight range of the method analytes. Note that Chemical Abstracts Registry Numbers are not currently available for these isotopically labeled analogues.

Isotope Dilution Standards	Abbreviation	PDS, ng/ $\mu$ L <sup>a</sup>
Perfluoro- <i>n</i> -[1,2,3,4- <sup>13</sup> C <sub>4</sub> ]butanoic acid	<sup>13</sup> C <sub>4</sub> -PFBA	0.50
Perfluoro- <i>n</i> -[1,2,3,4,5- <sup>13</sup> C <sub>5</sub> ]pentanoic acid	<sup>13</sup> C <sub>5</sub> -PFPeA	0.50
Sodium perfluoro-1-[2,3,4- <sup>13</sup> C <sub>3</sub> ]butanesulfonate	<sup>13</sup> C <sub>3</sub> -PFBS	0.50
Sodium 1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -perfluoro-1-[1,2- <sup>13</sup> C <sub>2</sub> ]hexane sulfonate	<sup>13</sup> C <sub>2</sub> -4:2FTS	2.0
Perfluoro- <i>n</i> -[1,2,3,4,6- <sup>13</sup> C <sub>5</sub> ]hexanoic acid	<sup>13</sup> C <sub>5</sub> -PFHxA	0.50
2,3,3,3-Tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy- <sup>13</sup> C <sub>3</sub> -propanoic acid	<sup>13</sup> C <sub>3</sub> -HFPO-DA	0.50
Perfluoro- <i>n</i> -[1,2,3,4- <sup>13</sup> C <sub>4</sub> ]heptanoic acid	<sup>13</sup> C <sub>4</sub> -PFHpA	0.50
Sodium perfluoro-1-[1,2,3- <sup>13</sup> C <sub>3</sub> ]hexanesulfonate	<sup>13</sup> C <sub>3</sub> -PFHxS	0.50
Sodium 1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -perfluoro-1-[1,2- <sup>13</sup> C <sub>2</sub> ]-octane sulfonate	<sup>13</sup> C <sub>2</sub> -6:2FTS	2.0
Perfluoro- <i>n</i> -[ <sup>13</sup> C <sub>8</sub> ]octanoic acid	<sup>13</sup> C <sub>8</sub> -PFOA	0.50
Perfluoro- <i>n</i> -[ <sup>13</sup> C <sub>9</sub> ]nonanoic acid	<sup>13</sup> C <sub>9</sub> -PFNA	0.50
Sodium perfluoro-[ <sup>13</sup> C <sub>8</sub> ]octanesulfonate	<sup>13</sup> C <sub>8</sub> -PFOS	0.50
Sodium 1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -perfluoro-1-[1,2- <sup>13</sup> C <sub>2</sub> ]-decane sulfonate	<sup>13</sup> C <sub>2</sub> -8:2FTS	2.0
Perfluoro- <i>n</i> -[1,2,3,4,5,6- <sup>13</sup> C <sub>6</sub> ]decanoic acid	<sup>13</sup> C <sub>6</sub> -PFDA	0.50
Perfluoro- <i>n</i> -[1,2,3,4,5,6,7- <sup>13</sup> C <sub>7</sub> ]undecanoic acid	<sup>13</sup> C <sub>7</sub> -PFUnA	0.50
Perfluoro- <i>n</i> -[1,2- <sup>13</sup> C <sub>2</sub> ]dodecanoic acid	<sup>13</sup> C <sub>2</sub> -PFDoA	0.50

<sup>a</sup>. Concentrations used during method development.

As additional isotopically labelled PFAS analogues become commercially available they may be integrated into the method provided they have similar functional groups as the method analytes or are isotopically labeled analogues of the method analytes. Method modification QC requirements must be met ([Sect. 9.3](#)) whenever new analogues are proposed.

### 7.16.1 Isotope Dilution Analogue PDS

Prepare the isotope dilution analogue PDS in methanol and add sodium hydroxide if not already present to prevent esterification as described in [Section 7.13.1](#). The PDS concentrations used during method development are listed in the table above. Method performance data were collected using 20  $\mu$ L of this PDS to yield concentrations of 40–160 ng/L in the 250 mL aqueous samples. Note that the concentrations of sulfonates in the isotope dilution analogue PDS is based on the weight of the salt. It is not necessary to account for difference in the formula weight of the salt compared to the free acid for sample quantitation.

### 7.17 Analyte Standard Materials

Analyte standards may be purchased as certified standard solutions or prepared from neat materials of assayed purity. If available, the method analytes should be purchased as technical-grade (as defined in [Sect. 3.22](#)) to ensure that linear and branched isomers are represented. Standards or neat materials that contain only the linear isomer can be substituted if technical-grade analytes are not available as quantitative standards.

During method development, analyte standards were obtained from AccuStandard, Inc. (New Haven, CT), Absolute Standards (Hamden, CT), Wellington Laboratories (Guelph, Ontario, Canada), Santa Cruz Biotechnology (Dallas, TX), and Synquest Laboratories, Inc. (Alachua, FL). Stock standards are made by dilution in methanol containing 4 mole equivalents of sodium hydroxide as described in [Section 7.13.1](#)

### 7.17.1 PFOA

A quantitative standard for PFOA is currently available only for the linear isomer; however, a technical-grade standard ([Sect. 3.22](#)) is available for PFOA that contains the linear and branched isomers (Wellington Labs, Cat. No. T-PFOA, or equivalent). This product or a similar technical-grade PFOA standard must be used to identify the retention times of the branched and linear PFOA isomers. However, the linear-only PFOA standard must be used for quantitation until a quantitative PFOA standard containing the branched and linear isomers becomes commercially available.

### 7.17.2 PFHxS and PFOS

Technical grade, quantitative PFHxS and PFOS standards containing branched and linear isomers must be used when available.

### 7.17.3 Correction for Analytes Obtained in the Salt Form

This method measures all forms of the analytes as anions while the identity of the counterion is inconsequential. Analytes may be commercially available as neat materials or as certified stock standards as their corresponding ammonium, sodium, or potassium salts. These salts are acceptable standards provided the measured mass, or concentration, is corrected for the salt content. The equation for this correction is provided below.

$$\text{mass}(\text{acid form}) = \text{mass}(\text{salt form}) \times \frac{MW_{\text{acid}}}{MW_{\text{salt}}}$$

### 7.17.4 Analyte PDS

The analyte PDS is used to prepare the calibration standards and to fortify the LFBs, LFSMs and LFSMDs with the method analytes. Prepare the analyte PDS by combining and diluting the analyte stock standards in 100% methanol and add sodium hydroxide if not already present to prevent esterification as described in [Section 7.13.1](#). Select nominal analyte concentrations for the PDS such that between 5 and 100  $\mu\text{L}$  of the PDS is used to fortify samples and prepare standard solutions. More than one PDS concentration may be necessary to meet this requirement. During method development, the analyte PDS was prepared at an identical concentration for all analytes, 0.5  $\text{ng}/\mu\text{L}$ . The user may modify the concentrations of the individual analytes based on the confirmed MRLs and the desired monitoring range. If the PDS is stored cold, warm the vials to room temperature and vortex prior to use.

### 7.17.5 Calibration Standards

Prepare a series of calibration standards of at least five levels by diluting the analyte PDS into methanol containing 20% reagent water. The lowest calibration standard must be at or below the MRL for each analyte. The calibration standards may also be used as Continuing Calibration Checks (CCCs). Using the PDS solutions, add a constant amount of the isotope performance standards and the isotope dilution analogues to each calibration standard. The concentration of the isotope dilution analogues should match the concentration of the analogues in sample extracts, assuming 100% recovery through the extraction process. During method development, the concentrations of the isotope dilution analogues were 40  $\text{ng}/\text{mL}$  extract concentration (160  $\text{ng}/\text{L}$  in the aqueous sample) for 4:2FTS, 6:2FTS and 8:2FTS, and 10  $\text{ng}/\text{mL}$  (40  $\text{ng}/\text{L}$ ) for all others. The analyte calibration ranged from approximately 0.50  $\text{ng}/\text{mL}$  to 25  $\text{ng}/\text{mL}$  extract concentration.

## 8 Sample Collection, Preservation, and Storage

### 8.1 Sample Bottles

Samples must be collected in plastic bottles: polypropylene bottles fitted with polypropylene screw-caps, or polyethylene bottles with polypropylene screw caps. Discard sample bottles after a single use. The bottle volume should approximate the volume of the sample. Subsampling from a single bottle is not permitted except as described in [Section 12.5](#).

### 8.2 Sample Preservation

Based on sample volume, add ammonium acetate to each sample bottle as a solid (prior to shipment to the field or immediately prior to sample collection) to achieve a 1g/L concentration of ammonium acetate. Ammonium acetate will sequester free chlorine to form chloramine.

### 8.3 Sample Collection

#### 8.3.1 Precautions against Contamination

Workers must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. Users should seek to minimize accidental contamination of the samples.

#### 8.3.2 Collection Procedure

Open the tap and allow the system to flush until the water temperature has stabilized. Collect samples from the flowing system. Samples do not need to be collected headspace free. After collecting the sample, cap the bottle and agitate by hand until the preservative is dissolved. Keep the sample sealed from time of collection until extraction.

### 8.4 Field Reagent Blanks (FRB)

Each sample set must include an FRB. A sample set is defined as samples collected from the same site and at the same time. The same lot of preservative must be used for the FRBs as for the field samples.

#### 8.4.1 Analysis of Reagent Water used for FRBs

Reagent water used for the FRBs must be analyzed prior to shipment to ensure the water has minimal residual PFAS. Extract an LRB prepared with reagent water using the same lot of sample bottles destined for shipment to the sampling site and ensure that analyte concentrations are less than one-third the MRL, as described in [Section 9.2.1](#). This will ensure that any significant contamination detected in the FRBs originated from exposure in the field.

#### 8.4.2 Field Reagent Blank Procedure

In the laboratory, fill the FRB sample bottle with the analyzed reagent water ([Sect. 8.4.1](#)), then seal and ship to the sampling site with the sample bottles. For each FRB shipped, a second FRB sample bottle containing only preservative must also be shipped. At the sampling site, open the FRB bottle and pour the reagent water into the second sample bottle containing preservative; seal and label this bottle as the FRB with the date, time and location of the site.

## 8.5 Sample Shipment and Storage

Samples must be shipped on ice. Samples are valid if any ice remains in the cooler when it is received at the laboratory or bottles are received within 2 days of collection and below 10 °C. Once at the laboratory, samples must be stored at or below 6 °C until extraction. Samples must not be frozen.

## 8.6 Sample and Extract Holding Times

Analyze samples as soon as possible. Samples must be extracted within 28 days of collection. Extracts are generally stored at room temperature and must be analyzed within 28 days after extraction.

# 9 Quality Control

QC procedures include the IDC and ongoing QC requirements. This section describes each QC parameter, its required frequency, and the performance criteria that must be met in order to satisfy method objectives. The QC criteria discussed in the following sections are summarized in **Table 16** and **Table 17**. These QC requirements are considered the minimum for an acceptable QC program. Laboratories are encouraged to institute additional QC practices to meet their specific needs.

## 9.1 Initial Demonstration of Capability

The IDC must be successfully performed prior to analyzing field samples. The IDC must be repeated if changes are made to analytical parameters not previously validated during the IDC. This may include, for example, changing the sample volume, selecting alternate quantitation ions, extending the calibration range, adding additional isotope performance standards, or adding additional isotope dilution analogues. Prior to conducting the IDC, the analyst must meet the calibration requirements outlined in [Section 10](#). The same calibration range used during the IDC must be used for the analysis of field samples.

### 9.1.1 Demonstration of Low System Background

Analyze an LRB immediately after injecting the highest calibration standard in the selected calibration range. Confirm that the blank is free from contamination as defined in [Section 9.2.1](#). If an automated extraction system is used, an LRB must be extracted on each port to fulfil this requirement.

### 9.1.2 Demonstration of Precision

Prepare, extract, and analyze seven replicate LFBs in a valid Extraction Batch (seven LFBs and an LRB). Fortify the LFBs near the midpoint of the initial calibration curve. The percent relative standard deviation (%RSD) of the concentrations of the replicate analyses must be less than 20% for all method analytes.

### 9.1.3 Demonstration of Accuracy

Using the same set of replicate data generated for [Section 9.1.2](#), calculate the average percent recovery. The average recovery for each analyte must be within a range of 70–130%.

### 9.1.4 Minimum Reporting Level (MRL) Confirmation

Establish a target concentration for the MRL ([Sect. 3.15](#)) based on the intended use of the method. If there is a programmatic MRL requirement, the laboratory MRL must be set at or below this level. In doing so, one should consider that establishing the MRL concentration too low may cause repeated failure of ongoing QC requirements.

Perform initial calibration following the procedures in [Section 10.3](#). The lowest calibration standard used to establish the initial calibration (as well as the low-level CCC) must be at, or below, the MRL. Confirm the laboratory's ability to meet the MRL following the procedure outlined below.

#### 9.1.4.1 Prepare and Analyze MRL Samples

Fortify, extract, and analyze seven replicate LFBs at, or below, the proposed MRL concentration.

#### 9.1.4.2 Calculate MRL Statistics

Calculate the mean and standard deviation for each analyte in these replicates. Determine the Half Range for the Prediction Interval of Results ( $HR_{PIR}$ ) using the following equation:

$$HR_{PIR} = 3.963S$$

Where,

$S$  = the standard deviation and 3.963 is a constant value for seven replicates.<sup>1</sup>

Calculate the Upper and Lower Limits for the Prediction Interval of Results ( $PIR = Mean \pm HR_{PIR}$ ) as shown below. These equations are only defined for seven replicate samples.

$$Upper\ PIR\ Limit = \frac{Mean + HR_{PIR}}{Fortified\ Concentration} \times 100$$

$$Lower\ PIR\ Limit = \frac{Mean - HR_{PIR}}{Fortified\ Concentration} \times 100$$

#### 9.1.4.3 MRL Acceptance Criteria

The laboratory's ability to meet the MRL is confirmed if the *Upper PIR Limit* is less than, or equal to, 150%; and the *Lower PIR Limit* is greater than, or equal to, 50%. If these criteria are not met, the MRL has been set too low and must be confirmed again at a higher concentration.

#### 9.1.5 Calibration Verification

Analyze a QCS ([Sect. 9.2.9](#)) to confirm the accuracy of the primary calibration standards.

### 9.2 Ongoing QC Requirements

This section describes the ongoing QC elements that must be included when processing and analyzing field samples.

#### 9.2.1 Laboratory Reagent Blank (LRB)

Analyze an LRB with each Extraction Batch. Background concentrations of method analytes must be less than one-third the MRL. If method analytes are detected in the LRB at concentrations greater than or equal to this level, then all positive field sample results (i.e., results at or above the MRL) for those analytes are invalid for all samples in the Extraction Batch. Subtracting blank values from sample results is not permitted.

### 9.2.1.1 Estimating Background Concentrations

Although quantitative data below the MRL may not be accurate enough for data reporting, such data are useful in determining the magnitude of background interference. Therefore, the analyte concentrations in the LRB may be estimated by extrapolation when results are below the MRL.

### 9.2.1.2 Influence of Background on Selection of MRLs

Because background contamination can be a significant problem, some MRLs may be background limited.

### 9.2.1.3 Evaluation of Background when Analytes Exceed the Calibration Range

After analysis of a sample in which method analytes exceed the calibration range, one or more LRBs must be analyzed (to detect potential carryover) until the system meets the LRB acceptance criteria. If this occurs during an automated sequence, examine the results of samples analyzed following the sample that exceeded the calibration range. If the analytes that exceeded the calibration range in the previous sample are detected at, or above, the MRL, these samples are invalid. If the affected analytes do not exceed the MRL, these subsequent samples may be reported.

## 9.2.2 Continuing Calibration Check (CCC)

Analyze CCC standards at the beginning of each Analysis Batch, after every tenth field sample, and at the end of the Analysis Batch. See [Section 10.4](#) for concentration requirements and acceptance criteria for CCCs.

## 9.2.3 Laboratory Fortified Blank

An LFB is required with each Extraction Batch. The concentration of the LFB must be rotated between low, medium, and high concentrations from batch to batch.

### 9.2.3.1 LFB Concentration Requirements

Fortify the low concentration LFB near the MRL. The high concentration LFB must be near the high end of the calibration range.

### 9.2.3.2 Evaluate Analyte Recovery

Results for analytes fortified at concentrations near or at the MRL (within a factor of two times the MRL concentration) must be within 50–150% of the true value. Results for analytes fortified at all other concentrations must be within 70–130% of the true value. If the LFB results do not meet these criteria, then all data for the problem analytes must be considered invalid for all samples in the Extraction Batch.

## 9.2.4 Isotope Performance Standard Areas

The analyst must monitor the peak areas of the isotope performance standards in all injections of the Analysis Batch. The isotope performance standard responses (as indicated by peak area) in any chromatographic run must be within 50–150% of the average area measured during the initial calibration. Random evaporation losses have been observed with the polypropylene caps causing high-biased isotope performance standard areas. If an isotope performance standard area for a sample does not meet these criteria, reanalyze the extract in a subsequent Analysis Batch. If the isotope performance standard area fails to meet the acceptance criteria in the repeat analysis, extraction of the sample must be repeated, provided the sample is still within holding time.

### 9.2.5 Isotope Dilution Analogue Recovery

Calculate the concentration of each isotope dilution analogue in field and QC samples using the average area in the initial calibration and the internal standard technique. Calculate the percent recovery (%R) for each analogue as follows:

$$\%R = \frac{A}{B} \times 100$$

Where,

A = measured concentration of the isotope dilution analogue, and

B = fortification concentration of the isotope dilution analogue.

The percent recovery for each analogue must be within a range of 50–200%.

#### 9.2.5.1 Corrective Action for Failed Analogue Recovery

If an isotope dilution analogue fails to meet the recovery criterion, evaluate the area of the isotope performance standard to which the analogue is referenced and the recovery of the analogues in the CCCs. If necessary, recalibrate and service the LC-MS/MS system. Take corrective action, then analyze the failed extract in a subsequent Analysis Batch. If the repeat analysis meets the 50–200% recovery criterion, report only data for the reanalyzed extract. If the repeat analysis fails the recovery criterion after corrective action, extraction of the sample must be repeated provided a sample is available and still within the holding time.

### 9.2.6 Laboratory Fortified Sample Matrix (LFSM)

Within each Extraction Batch, analyze a minimum of one LFSM. The native concentrations of the analytes in the sample matrix must be determined in a separate field sample and subtracted from the measured values in the LFSM. If various sample matrices are analyzed regularly, for example, drinking water processed from ground water and surface water sources, collect performance data for each source.

#### 9.2.6.1 Prepare the LFSM

Prepare the LFSM by fortifying a Field Duplicate with an appropriate amount of the analyte PDS ([Sect. 7.17.4](#)) and isotope dilution analogue PDS ([Sect. 7.16.1](#)). Generally, select a spiking concentration that is greater than or equal to the native concentration for the analytes. Selecting a duplicate aliquot of a sample that has already been analyzed aids in the selection of an appropriate spiking level. If this is not possible, use historical data when selecting a fortifying concentration.

#### 9.2.6.2 Calculate the Percent Recovery

Calculate the percent recovery (%R) using the equation:

$$\%R = \frac{(A - B)}{C} \times 100$$

Where,

A = measured concentration in the fortified sample,

B = measured concentration in the unfortified sample, and

C = fortification concentration.

In order to obtain meaningful percent recovery results, correct the measured values in the LFSM and LFSMD for the native levels in the unfortified samples, even if the native values are less than the MRL.

### 9.2.6.3 Evaluate Analyte Recovery in the LFSM

Results for analytes fortified at concentrations near or at the MRL (within a factor of two times the MRL concentration) must be within 50–150% of the true value. Results for analytes fortified at all other concentrations must be within 70–130% of the true value. If the accuracy for any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCCs and in the LFB, the recovery is judged matrix biased. Report the result for the corresponding analyte in the unfortified sample as “suspect–matrix”.

### 9.2.7 Laboratory Fortified Sample Matrix Duplicate (LFSMD) or Field Duplicate (FD)

Within each Extraction Batch, analyze a minimum of one Field Duplicate or one Laboratory Fortified Sample Matrix Duplicate. If the method analytes are not routinely observed in field samples, analyze an LFSMD rather than an FD.

#### 9.2.7.1 Calculate the RPD for the LFSM and LFSMD

If an LFSMD is analyzed instead of a Field Duplicate, calculate the RPD using the equation:

$$RPD = \frac{|LFSMD - LFSM|}{(LFSMD + LFSM)/2} \times 100$$

#### 9.2.7.2 Acceptance Criterion for the RPD of the LFSM and LFSMD

RPDs for duplicate LFSMs must be less than, or equal to, 30% for each analyte. Greater variability may be observed when the matrix is fortified at analyte concentrations near or at the MRL (within a factor of two times the MRL concentration). LFSMs at these concentrations must have RPDs that are less than or equal to 50%. If the RPD of an analyte falls outside the designated range, and the laboratory performance for the analyte is shown to be in control in the CCCs and in the LFB, the precision is judged matrix influenced. Report the result for the corresponding analyte in the unfortified sample as “suspect–matrix”.

#### 9.2.7.3 Calculate the RPD for Field Duplicates

Calculate the relative percent difference (RPD) for duplicate measurements. (FD1 and FD2) using the equation:

$$RPD = \frac{|FD_1 - FD_2|}{(FD_1 + FD_2)/2} \times 100$$

#### 9.2.7.4 Acceptance Criterion for Field Duplicates

RPDs for Field Duplicates must be less than, or equal to, 30% for each analyte. Greater variability may be observed when Field Duplicates have analyte concentrations that are near or at the MRL (within a factor of two times the MRL concentration). At these concentrations, Field Duplicates must have RPDs that are less than or equal to 50%. If the RPD of an analyte falls outside the designated range, and the laboratory performance for the analyte is shown to be in control in the CCC and in the LFB, the precision is judged matrix influenced. Report the result for the corresponding analyte in the unfortified sample as “suspect–matrix”

### 9.2.8 Field Reagent Blank (FRB)

The purpose of the FRB is to ensure that PFAS measured in the field samples were not inadvertently introduced into the sample during sample collection and handling. The FRB is processed, extracted, and analyzed in exactly the same manner as a field sample. Analysis of the FRB is required only if a field

sample contains a method analyte or analytes at, or above, the MRL. If a method analyte found in the field sample is present in the FRB at a concentration greater than one-third of the MRL, then the results for that analyte are invalid for all samples associated with the failed FRB.

### 9.2.9 Calibration Verification using QCS

A QCS must be analyzed during the IDC, and then quarterly thereafter. For this method, the laboratory is not required to obtain standards from a source independent of the primary calibration standards. Instead, the laboratory should acquire the best available quantitative standards ([Sect. 3.20](#)) and use these to prepare both the primary calibration standards and the QCS. The QCS must be an independent dilution beginning with the common starting materials. Preparation by a second analyst is recommended. The acceptance criterion for the QCS is 70–130% of the true value. If the accuracy for any analyte fails the recovery criterion, prepare fresh standard dilutions and repeat the Calibration Verification.

### 9.3 Method Modification QC Requirements

The analyst is permitted to modify the chromatographic and MS/MS conditions. Examples of permissible method modifications include alternate LC columns, MRM transitions, and additional QC analytes proposed for use with the method. Any method modifications must be within the scope of the established method flexibility and must retain the basic chromatographic elements of this method ([Sect. 2](#)). The following are required after a method modification.

#### 9.3.1 Repeat the IDC

Establish an acceptable initial calibration ([Sect. 10.3](#)) using the modified conditions. Repeat the procedures of the IDC ([Sect. 9.1](#)).

#### 9.3.2 Document Performance in Representative Sample Matrices

The analyst is also required to evaluate and document method performance for the modifications in real matrices that span the range of waters that the laboratory analyzes. This additional step is required because modifications that perform acceptably in the IDC, which is conducted in reagent water, could fail ongoing method QC requirements in real matrices. This is particularly important for methods subject to matrix effects, such as LC-MS/MS-based methods. For example, a laboratory may routinely analyze finished drinking water from municipal treatment plants that process ground water, surface water, or a blend of surface and ground water. In this case, the method modification requirement could be accomplished by assessing precision ([Sect. 9.1.2](#)) and accuracy ([Sect. 9.1.3](#)) in finished drinking waters derived from a surface water with moderate to high total organic carbon (e.g., 2 mg/L or greater) and from a hard ground water (e.g., 250 mg/L as calcium carbonate (CaCO<sub>3</sub>) equivalent, or greater).

## 10 Calibration and Standardization

Demonstration and documentation of acceptable MS calibration and initial analyte calibration are required before performing the IDC and prior to analyzing field samples. The initial calibration should be repeated each time a major instrument modification or maintenance is performed.

## 10.1 MS/MS Optimization

### 10.1.1 Mass Calibration

Calibrate the mass spectrometer with the calibration compounds and procedures specified by the manufacturer.

### 10.1.2 MS Parameters

During the development of this method, instrumental parameters were optimized for the precursor and product ions listed in **Table 6**. Product ions other than those listed may be selected; however, the analyst should avoid using ions with lower mass or common ions that may not provide sufficient discrimination between the analytes of interest and co-eluting interferences.

#### 10.1.2.1 Requirement for Branched Isomers

There have been reports that not all product ions in the linear PFOS are produced in all branched PFOS isomers.<sup>5</sup> (This phenomenon may exist for many of the PFAS.) For this method, the  $m/z$  80 product ion must be used for PFOS and PFHxS to minimize this problem and promote comparability between laboratories. Some MS/MS instruments, may not be able to scan a product ion with such a wide mass difference from the precursor ion. These instruments may not be used for this method if PFOS or PFHxS analysis is to be conducted.

#### 10.1.2.2 Precursor Ion

Optimize the response of the precursor ion ( $[M - H]^-$  or  $[M - CO_2 - H]^-$ ) for each analyte following manufacturer's guidance. Analyte concentrations of 1.0  $\mu\text{g/mL}$  were used for this step during method development. Vary the MS parameters (source voltages, source and desolvation temperatures, gas flows, etc.) until optimal analyte responses are determined. The electrospray parameters used during method development are listed in **Table 2**. The analytes may have different optimal parameters, requiring some compromise on the final operating conditions. See **Table 6** for ESI-MS conditions used to collect method performance data.

#### 10.1.2.3 Product Ion

Optimize the product ion for each analyte following the manufacturer's guidance. Typically, the carboxylic acids have similar MS/MS conditions and the sulfonic acids have similar MS/MS conditions. See **Table 6** for MS/MS conditions used to collect method performance data.

## 10.2 Chromatographic Conditions

Establish LC operating parameters that optimize resolution and peak shape. Suggested LC conditions can be found in **Table 1**. Modifying the solvent composition of the standard or extract by increasing the aqueous content to better focus early eluting compounds on the column is not permitted. A decrease in methanol concentration could lead to lower or imprecise recovery of the more hydrophobic method analytes, while higher methanol concentration could lead to the precipitation of salts in some extracts. The peak shape of the early eluting compounds may be improved by increasing the volume of the injection loop or increasing the aqueous content of the initial mobile phase composition.

### 10.2.1 Minimizing PFAS Background

LC system components, as well as the mobile phase constituents, may contain many of the analytes in this method. Thus, these PFAS will build up on the head of the LC column during mobile phase equilibration. To minimize the background PFAS peaks and to keep baseline levels constant, the time the LC column sits at initial conditions must be kept constant and as short as possible (while ensuring reproducible retention times). In addition, priming the mobile phase and flushing the column with at least 90% methanol before initiating a sequence may reduce background contamination.

### 10.2.2 Establishing Branched vs. Linear Isomer Profiles

Prepare and analyze the technical-grade standard of PFOA, discussed in [Section 7.17.1](#), at a mid- to high-level concentration. Identify the retention times of the branched isomers of PFOA present in the technical-grade PFOA standard. When PFOA is chromatographed on a reversed-phase column, the branched isomers elute prior to the linear isomer. Repeat the procedure in this section for PFHxS and PFOS discussed in [Section 7.17.2](#), and any other analytes for which technical-grade standards have been acquired. The branched isomer identification checks must be repeated any time chromatographic changes occur that alter analyte retention times.

### 10.2.3 Establish LC-MS/MS Retention Times and MRM Segments

Inject a mid- to high-level calibration standard under optimized LC-MS/MS conditions to obtain the retention times of each method analyte. Divide the chromatogram into segments that contain one or more chromatographic peaks. For maximum sensitivity, minimize the number of MRM transitions that are simultaneously monitored within each segment. Ensure that the retention time window used to collect data for each analyte is of sufficient width to detect earlier eluting branched isomers. The retention times observed during collection of the method performance data are listed in [Table 3](#), [Table 4](#), and [Table 5](#).

## 10.3 Initial Calibration

This method has three isotope performance standards that are used as reference compounds for the internal standard quantitation of the isotope dilution analogues. The suggested isotope performance standard reference for each isotope dilution analogue is listed in [Table 4](#). The sixteen isotope dilution analogues are used as reference compounds to quantitate the native analyte concentrations. The suggested isotope dilution analogue references for the native analytes are listed in [Table 5](#).

### 10.3.1 Calibration Standards

Prepare a set of at least five calibration standards as described in [Section 7.17.5](#). The analyte concentrations in the lowest calibration standard must be at or below the MRL.

### 10.3.2 Calibration Curves of Native Analytes

Quantitate the native analytes using the internal standard calibration technique. The internal standard technique calculates concentration based on the ratio of the peak area of the native analyte to that of the isotope dilution analogue. Calibrate the LC-MS/MS and fit the calibration points with either a linear or quadratic regression. Weighting may be used. Forcing the calibration curve through the origin is mandatory for this method. Forcing zero allows for a better estimate of the background levels of

method analytes. The MS/MS instrument used during method development was calibrated using weighted (1/x) quadratic regression with forced zero.

### 10.3.3 Calibration of Isotope Dilution Analogues

The isotope dilution analogues are quantified using the internal standard calibration technique. Because isotope dilution analogues are added at a single concentration level to the calibration standards, calibrate for each of these using an average response factor.

### 10.3.4 Calibration of Isotope Performance Standards

Because Isotope performance standards are added at a single concentration level to the calibration standards, calibrate for each of these using an average response factor.

### 10.3.5 Calibration Acceptance Criteria

Evaluate the initial calibration by calculating the concentration of each analyte as an unknown against its regression equation. For calibration levels that are less than or equal to the MRL, the result for each analyte should be within 50–150% of the true value. All other calibration points should be within 70–130% of their true value. If these criteria cannot be met, the analyst could have difficulty meeting ongoing QC criteria. In this case, corrective action is recommended such as reanalyzing the calibration standards, restricting the range of calibration, or performing instrument maintenance. If the cause for failure to meet the criteria is due to contamination or standard degradation, prepare fresh calibration standards and repeat the initial calibration.

## 10.4 Continuing Calibration

Analyze a CCC to verify the initial calibration at the beginning of each Analysis Batch, after every tenth field sample, and at the end of each Analysis Batch. The beginning CCC for each Analysis Batch must be at, or below, the MRL for each analyte. This CCC verifies instrument sensitivity prior to the analysis of samples. If standards have been prepared such that all low calibration levels are not in the same solution, it may be necessary to analyze two standards to meet this requirement. Alternatively, the nominal analyte concentrations in the analyte PDS may be customized to meet these criteria. Alternate subsequent CCCs between the mid and high calibration levels. Verify that the CCC meets the criteria in the following sections.

### 10.4.1 CCC Isotope Performance Standard Responses

The absolute area of the quantitation ion for each of the three isotope performance standards must be within 50–150% of the average area measured during the initial calibration. If these limits are exceeded, corrective action is necessary ([Sect. 10.5](#)).

### 10.4.2 CCC Isotope Dilution Analogue Recovery

Using the average response factor determined during the initial calibration and the internal standard calibration technique, calculate the percent recovery of each isotope dilution analogue in the CCC. The recovery for each analogue must be within a range of 70–130%. If these limits are exceeded, corrective action is necessary ([Sect. 10.5](#)).

### 10.4.3 CCC Analyte Responses

Calculate the concentration of each method analyte in the CCC. Each analyte fortified at a level less than or equal to the MRL must be within 50–150% of the true value. The concentration of the analytes in CCCs fortified at all other levels must be within 70–130%. If these limits are exceeded, then all data for the failed analytes must be considered invalid. Any field samples analyzed since the last acceptable CCC that are still within holding time must be reanalyzed after an acceptable calibration has been restored.

#### 10.4.3.1 Exception for High Recovery

If the CCC fails because the calculated concentration is greater than 130% (150% for the low-level CCC) for a method analyte, and field sample extracts show no concentrations above the MRL for that analyte, non-detects may be reported without re-analysis.

### 10.5 Corrective Action

Failure to meet the CCC QC performance criteria requires corrective action. Following a minor remedial action, such as servicing the autosampler or flushing the column, check the calibration with a mid-level CCC and a CCC at the MRL, or recalibrate according to [Section 10.3](#). If isotope performance standard and calibration failures persist, maintenance may be required, such as servicing the LC-MS/MS system or replacing the LC column. These latter measures constitute major maintenance and the analyst must return to the initial calibration step ([Sect. 10.3](#)).

## 11 Procedure

This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. The data published in this method ([Sect. 17](#)) demonstrate acceptable performance using manual extraction. The authors did not evaluate automated extraction systems. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the LRBs should be rotated among the ports to ensure that all the valves and tubing meet the LRB requirements ([Sect. 9.2.1](#)).

### 11.1 Sample Bottle Rinse

Some of the PFAS adsorb to surfaces, including polypropylene. During the elution step of the procedure, sample bottles must be rinsed with the elution solvent whether extractions are performed manually or by automation.

### 11.2 Reuse of Extraction Cartridges

The SPE cartridges described in this section are designed for a single use. They may not be reconditioned for subsequent analyses.

### 11.3 Sample Preparation

#### 11.3.1 Sample Volume

Determine sample volume. An indirect measurement may be done in one of two ways: by marking the level of the sample on the bottle or by weighing the sample and bottle to the nearest 1 gram. After

extraction, proceed to [Section 11.5](#) to complete the volume measurement. Some of the PFAS adsorb to surfaces, thus the sample may not be transferred to a graduated cylinder for volume measurement. The LRB, LFB and FRB must have the same volume as that of the field samples and may be prepared by measuring reagent water with a graduated cylinder.

### 11.3.2 Verifying Sample pH

Verify that the sample containing 1 g/L ammonium acetate has a pH between 6.0 and 8.0. Acetic acid may be added as needed to reduce the pH

### 11.3.3 Fortify QC Samples

Fortify LFBs, LFSMs, and LFSMDs, with an appropriate volume of Analyte PDS ([Sect. 7.17.4](#)). Cap and invert each sample several times to mix.

### 11.3.4 Addition of Isotope Dilution Analogues

Add an aliquot of the isotope dilution analogue PDS ([Sect. 7.16.1](#)) to each sample, then cap and invert to mix. During method development, a 20  $\mu\text{L}$  aliquot of the PDS (0.50–2.0  $\text{ng}/\mu\text{L}$ ) was added to achieve a final concentration of 40  $\text{ng}/\text{L}$  of the isotopically labeled carboxylates and perfluorinated sulfonates, and 160  $\text{ng}/\text{L}$  of the telomer sulfonates.

## 11.4 Extraction Procedure

### 11.4.1 Cartridge Cleaning and Conditioning

Do not allow cartridge packing material to go dry during any of the conditioning steps. If the cartridge goes dry during the conditioning phase, the conditioning must be repeated. Rinse each cartridge with 10 mL of methanol. Next, rinse each cartridge with 10 mL of aqueous 0.1 M phosphate buffer ([Sect. 7.8](#)) without allowing the water to drop below the top edge of the packing. Close the valve and add 2–3 mL of phosphate buffer to the cartridge reservoir and fill the remaining volume with reagent water.

### 11.4.2 Cartridge Loading

Attach the sample transfer tubes ([Sect. 6.8.3](#)) and adjust the vacuum to approximately 5 inches Hg. Begin adding sample to the cartridge. Adjust the vacuum and control valves so that the approximate flow rate is 5 mL/min. Do not allow the cartridge to go dry before all the sample has passed through. Flow rates above 5 mL/min during loading may cause low analyte recovery.

### 11.4.3 Sample Bottle Rinse and Cartridge Drying

After the entire sample has passed through the cartridge, rinse the sample bottle with a 10 mL aliquot of 1 g/L ammonium acetate in reagent water. Draw the rinsate through the sample transfer tubes and the cartridges. Add 1 mL of methanol to the sample bottle and draw through the transfer tube and SPE cartridge. This step is designed to remove most of the water from the transfer line and cartridge resulting in the reduction of the salt and water present in the eluate. The methanol rinse may also reduce interferences by removing weakly retained organic material prior to elution. If plastic reservoirs are used instead of transfer lines, the reservoirs must be rinsed with the ammonium acetate solution and the 1 mL aliquot of methanol.

#### 11.4.4 Cartridge Drying

Draw air or nitrogen through the cartridge for 5 min at high vacuum (15–20 in. Hg).

#### 11.4.5 Sample Bottle and Cartridge Elution

After the drying step, release the vacuum on the extraction manifold and place a collection tube under each sample position. Rinse the sample bottles with 5 mL of the elution solvent, methanol with 2% ammonium hydroxide (v/v), then elute the analytes from the cartridges by pulling the elution solvent through the sample transfer tubes and the cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion. Repeat sample bottle rinse and cartridge elution with a second 5 mL aliquot of elution solvent. If plastic reservoirs are used instead of transfer lines, attempt to rinse the entire inner surface of the reservoir with the elution solvent.

#### 11.4.6 Extract Concentration

Concentrate the extract to dryness under a gentle stream of nitrogen in a heated water bath (55–60 °C). Reconstitute the extract with 1.0 mL of 20% reagent water in methanol (v/v). Add the isotope performance standards to the extract and vortex.

#### 11.4.7 Extract Transfer and Storage

Transfer the final extract to a polypropylene autosampler vial. Store extracts at room temperature. Recap vials as soon as possible after injection to prevent evaporation losses; the polypropylene caps do not reseal after puncture. Alternatively, extracts can be stored in the 15 mL collection tubes after extraction. A small aliquot can be removed for analysis if the autosampler vial and injection system accommodate small volumes.

### 11.5 Sample Volume Determination

Use a graduated cylinder to measure the volume of water required to fill the original sample bottle to the mark made prior to extraction. If using weight to determine the volume, weigh the empty bottle to the nearest 1 gram and subtract this value from the weight recorded prior to extraction. Assume a sample density of 1.0 g/mL. Record the sample volumes for use in the final calculations of analyte concentrations.

### 11.6 Sample Analysis

#### 11.6.1 Establish LC-MS/MS Operating Conditions

Establish MS/MS operating conditions per the procedures in [Section 10.1](#) and chromatographic conditions per [Section 10.2](#). Establish a valid initial calibration following the procedures in [Section 10.3](#) or confirm that the existing calibration is still valid by analyzing a low-level CCC. If establishing an initial calibration for the first time, complete the IDC prior to analyzing field samples. Analyze field and QC samples in a properly sequenced Analysis Batch as described in [Section 11.7](#).

#### 11.6.2 Verify Retention Time Windows

The analyst must ensure that each method analyte elutes entirely within the assigned window during each Analysis Batch. Make this observation by viewing the quantitation ion for each analyte in the CCCs analyzed during an Analysis Batch. If an analyte peak drifts out of the assigned window, then data for

that analyte is invalid in all injections acquired since the last valid CCC. In addition, all peaks representing multiple isomers of an analyte must elute entirely within the same MRM window.

## 11.7 Analysis Batch Sequence

An Analysis Batch is a sequence of samples, analyzed within a 24-hour period, of no more than 20 field samples and includes all required QC samples (LRB, CCCs, the LFSM and LFSMD (or FD)). The required QC samples are not included in counting the maximum field sample total of 20. LC-MS/MS conditions for the Analysis Batch must be the same as those used during calibration.

### 11.7.1 Analyze Initial CCC

After a valid calibration is established, begin every Analysis Batch by analyzing an initial low-level CCC at or below the MRL. This initial CCC must be within 50–150% of the true value for each method analyte and must pass both the isotope performance standard area response criterion ([Sect. 10.4.1](#)) and the isotope dilution analogue recovery criterion ([Sect. 10.4.2](#)). The initial CCC confirms that the calibration is still valid. Failure to meet the QC criteria may indicate that recalibration is required prior to analyzing samples.

### 11.7.2 Analyze Field and QC Samples

After the initial CCC, continue the Analysis Batch by analyzing an LRB, followed by the field samples and QC samples. Analyze a mid- or high-level CCC after every ten field samples and at the end each Analysis Batch. Do not count QC samples (LRBs, FDs, LFSMs, LFSMDs) when calculating the required frequency of CCCs.

### 11.7.3 Analyze Final CCC

The last injection of the Analysis Batch must be a mid- or high-level CCC. The acquisition start time of the final CCC must be within 24 hours of the acquisition start time of the low-level CCC at the beginning of the Analysis Batch. More than one Analysis Batch within a 24-hour period is permitted. An Analysis Batch may contain field and QC samples from multiple extraction batches.

### 11.7.4 Initial Calibration Frequency

A full calibration curve is not required before starting a new Analysis Batch. A previous calibration can be confirmed by running an initial, low-level CCC followed by an LRB. If a new calibration curve is analyzed, an Analysis Batch run immediately thereafter must begin with a low-level CCC and an LRB.

## 12 Data Analysis and Calculations

Because environmental samples may contain both branched and linear isomers of the method analytes, but quantitative standards that contain branched isomers do not exist for all method analytes, integration and quantitation of the PFAS is dependent on the type of standard materials available.

### 12.1 Identify Peaks by Retention Times

At the conclusion of data acquisition, use the same software settings established during the calibration procedure to identify analyte peaks in the predetermined retention time windows. Confirm the identity of each analyte by comparison of its retention time with that of the corresponding analyte peak in an

initial calibration standard or CCC. Proceed with quantitation based on the type of standard available for each method analyte.

#### 12.1.1 Method Analytes without Technical-Grade Standards

If standards containing the branched and linear isomers cannot be purchased (i.e., only the linear isomer is available), only the linear isomer can be identified and quantitated in field samples and QC samples because the retention time of the branched isomers cannot be confirmed.

#### 12.1.2 PFHxS, PFOS, and other Analytes with Technical-Grade Standards

During method development, multiple chromatographic peaks, representing branched and linear isomers, were observed for standards of PFHxS and PFOS using the LC conditions in **Table 1**. For PFHxS and PFOS, all the chromatographic peaks observed in the standard must be integrated and the areas summed. Chromatographic peaks in all field samples and QC samples must be integrated in the same way as the calibration standard for analytes with quantitative standards containing the branched and linear isomers.

#### 12.1.3 PFOA

For PFOA, identify the branched and linear isomers by analyzing a technical-grade standard that includes both linear and branched isomers as directed in [Section 10.2.2](#) and ensure that all isomers elute within the same acquisition segment. Quantitate field samples and fortified matrix samples by integrating the total response, accounting for peaks that are identified as linear and branched isomers. Quantitate based on the initial calibration with the quantitative PFOA standard containing just the linear isomer.

### 12.2 Calculate Analyte Concentrations

Calculate analyte concentrations using the multipoint calibration and the measured sample volume. Report only those values that fall between the MRL and the highest calibration standard.

### 12.3 Calculate Isotope Dilution Analogue Recovery

Calculate the concentration of each isotope dilution analogue using the multipoint calibration and the measured sample volume. Verify that the percent recovery is within 50–200% of the true value.

### 12.4 Significant Figures

Calculations must use all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

### 12.5 Exceeding the Calibration Range

The analyst must not extrapolate beyond the established calibration range. If an analyte result exceeds the range of the initial calibration curve, a field duplicate of the sample must be extracted, if available. Dilute an aliquot of the field duplicate with reagent water to a final volume equal to that used for the IDC. Add ammonium acetate to a final concentration of 1 g/L and process the diluted sample. Report all concentrations measured in the original sample that do not exceed the calibration range. Report concentrations of analytes that exceeded the calibration range in the original sample based on measurement in a diluted sample. Incorporate the dilution factor into final concentration calculations

and the resulting data must be annotated as a dilution. This is the only circumstance when subsampling is permitted.

## 13 Method Performance

### 13.1 Precision, Accuracy, and LCMRL Results

Tables for these data are presented in Section 17. LCMRLs are presented in **Table 7**. Single-laboratory precision and accuracy data are presented for three water matrices: reagent water (**Table 8**), finished ground water (**Table 10**), and a drinking water matrix from a surface water source (**Table 12**). The mean isotope dilution analogue recoveries measured in the replicate samples used in these studies are presented in **Table 9** for reagent water, **Table 11** for finished groundwater, and **Table 13** for the surface water matrix.

### 13.2 Analyte Stability Study

Chlorinated (finished) surface water samples were inoculated with microbial-rich water from an impacted surface source and fortified with 40 ng/L of the PFAS method analytes. These samples were stored as required in this method. The percent change from the initial analyzed concentration observed after 7, 14, 21, and 28 days is presented in Section 17, **Table 14**.

### 13.3 Extract Storage Stability

Extract storage stability studies were conducted on extracts obtained from the analyte stability study ([Sect. 13.2](#)). The percent change from the initial analyzed concentration observed after 14, 21, and 27 days storage is presented in Section 17, **Table 15**.

## 14 Pollution Prevention

For information about pollution prevention applicable to laboratory operations described in this method, consult: *Less is Better, Guide to Minimizing Waste in Laboratories*, a publication available from the [American Chemical Society](http://www.acs.org) (accessed April 2019) at [www.acs.org](http://www.acs.org).

## 15 Waste Management

Laboratory waste management practices should be consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. In addition, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

## 16 References

1. US EPA. *Statistical Protocol for the Determination of the Single-Laboratory Lowest Concentration Minimum Reporting Level (LCMRL) and Validation of Laboratory Performance at or Below the Minimum Reporting Level (MRL)*; EPA 815-R-05-006; Office of Water: Cincinnati, OH, November 2004.
2. US EPA. *Technical Basis for the Lowest Concentration Minimum Reporting Level (LCMRL) Calculator*; EPA 815-R-11-001; Office of Water: Cincinnati, OH, December 2010.

3. Martin, J.W., et al. Analytical Challenges Hamper Perfluoroalkyl Research. *Environ. Sci. Technol.* 2004, Vol. 38, 248A–255A.
4. Cahill, J.D., et al. Determination of Pharmaceutical Compounds in Surface- and Ground-Water Samples by Solid-Phase Extraction and High-Performance Liquid Chromatography Electrospray Ionization Mass Spectrometry. *J. Chromatography A*, 2004, 1041, 171–180.
5. Langlois, I. and Oehme, M. Structural Identification of Isomers Present in Technical Perfluorooctane Sulfonate by Tandem Mass Spectrometry. *Rapid Communication Mass Spectrometry*. 2006, Vol. 20, 844–850.

## 17 Tables, Figures and Method Performance Data

Table 1. HPLC Method Conditions<sup>a</sup>

Time (min)	% 20 mM ammonium acetate	% Methanol
Initial	95.0	5.0
0.5	95.0	5.0
3.0	60.0	40.0
16.0	20.0	80.0
18.0	20.0	80.0
20.0	5.0	95.0
22.0	5.0	95.0
25.0	95.0	5.0
35.0	95.0	5.0

- <sup>a</sup>. Phenomenex Gemini<sup>®</sup> C18, 2 x 50 mm, 3.0 μm silica with TMS end-capping. Flow rate of 0.25 mL/min; run time 35 minutes; 10 μL injection into a 50 μL loop. The chromatogram in **Figure 1** was obtained under these conditions.

Table 2. ESI-MS Method Conditions

ESI Conditions for Waters (Milford, MA) Xevo TQD	
Polarity	Negative ion
Capillary needle voltage	-2.7 kV
Cone gas flow	40 L/hour
Nitrogen desolvation gas	800 L/hour
Desolvation gas temperature	300 °C

Table 3. *Isotopically Labeled Isotope Performance Standards and Retention Times*

Isotope Performance Standard	Peak # (Figure 1)	RT (min)
<sup>13</sup> C <sub>3</sub> -PFBA	1	4.14
<sup>13</sup> C <sub>2</sub> -PFOA	26	12.19
<sup>13</sup> C <sub>4</sub> -PFOS	32	13.73

Table 4. *Isotope Dilution Analogues: RTs and Suggested Isotope Performance Standard References*

Isotopically Labeled Analyte	Peak # (Fig. 1)	RT (min)	Suggested Isotope Performance Standard
<sup>13</sup> C <sub>4</sub> -PFBA	2	4.14	<sup>13</sup> C <sub>3</sub> -PFBA
<sup>13</sup> C <sub>5</sub> -PFPeA	5	6.13	<sup>13</sup> C <sub>3</sub> -PFBA
<sup>13</sup> C <sub>3</sub> -PFBS	7	6.62	<sup>13</sup> C <sub>4</sub> -PFOS
<sup>13</sup> C <sub>2</sub> -4:2FTS	12	8.12	<sup>13</sup> C <sub>4</sub> -PFOS
<sup>13</sup> C <sub>5</sub> -PFHxA	14	8.35	<sup>13</sup> C <sub>2</sub> -PFOA
<sup>13</sup> C <sub>3</sub> -HFPO-DA	17	9.06	<sup>13</sup> C <sub>2</sub> -PFOA
<sup>13</sup> C <sub>4</sub> -PFHpA	19	10.34	<sup>13</sup> C <sub>2</sub> -PFOA
<sup>13</sup> C <sub>3</sub> -PFHxS	21	10.61	<sup>13</sup> C <sub>4</sub> -PFOS
<sup>13</sup> C <sub>2</sub> -6:2FTS	24	12.05	<sup>13</sup> C <sub>4</sub> -PFOS
<sup>13</sup> C <sub>8</sub> -PFOA	27	12.19	<sup>13</sup> C <sub>2</sub> -PFOA
<sup>13</sup> C <sub>9</sub> -PFNA	30	13.70	<sup>13</sup> C <sub>2</sub> -PFOA
<sup>13</sup> C <sub>8</sub> -PFOS	33	13.73	<sup>13</sup> C <sub>4</sub> -PFOS
<sup>13</sup> C <sub>2</sub> -8:2FTS	36	14.94	<sup>13</sup> C <sub>4</sub> -PFOS
<sup>13</sup> C <sub>6</sub> -PFDA	38	15.00	<sup>13</sup> C <sub>2</sub> -PFOA
<sup>13</sup> C <sub>7</sub> -PFUnA	40	16.14	<sup>13</sup> C <sub>2</sub> -PFOA
<sup>13</sup> C <sub>2</sub> -PFDoA	43	17.13	<sup>13</sup> C <sub>2</sub> -PFOA

Table 5. Method Analytes, Retention Times and Suggested Isotope Dilution Analogue References

Analyte	Peak # (Figure 1)	RT (min)	Isotope Dilution Analogue
PFBA	3	4.15	$^{13}\text{C}_4$ -PFBA
PFMPA	4	4.84	$^{13}\text{C}_4$ -PFBA
PFPeA	6	6.13	$^{13}\text{C}_5$ -PFPeA
PFBS	8	6.62	$^{13}\text{C}_3$ -PFBS
PFMBA	9	6.81	$^{13}\text{C}_5$ -PFPeA
PFEESA	10	7.53	$^{13}\text{C}_3$ -PFBS
NFDHA	11	8.01	$^{13}\text{C}_5$ -PFHxA
4:2FTS	13	8.12	$^{13}\text{C}_2$ -4:2FTS
PFHxA	15	8.36	$^{13}\text{C}_5$ -PFHxA
PFPeS	16	8.69	$^{13}\text{C}_3$ -PFHxS
HFPO-DA	18	9.06	$^{13}\text{C}_3$ -HFPO-DA
PFHpA	20	10.42	$^{13}\text{C}_4$ -PFHpA
PFHxS	22	10.62	$^{13}\text{C}_3$ -PFHxS
ADONA	23	10.73	$^{13}\text{C}_4$ -PFHpA
6:2FTS	25	12.04	$^{13}\text{C}_2$ -6:2FTS
PFOA	28	12.19	$^{13}\text{C}_8$ -PFOA
PFHpS	29	12.28	$^{13}\text{C}_8$ -PFOS
PFNA	31	13.70	$^{13}\text{C}_9$ -PFNA
PFOS	34	13.74	$^{13}\text{C}_8$ -PFOS
9Cl-PF3ONS	35	14.53	$^{13}\text{C}_8$ -PFOS
8:2 FTS	37	14.94	$^{13}\text{C}_2$ -8:2FTS
PFDA	39	15.00	$^{13}\text{C}_6$ -PFDA
PFUnA	41	16.14	$^{13}\text{C}_7$ -PFUnA
11Cl-PF3OUdS	42	16.70	$^{13}\text{C}_8$ -PFOS
PFDoA	44	17.13	$^{13}\text{C}_2$ -PFDoA

Table 6. MS/MS Method Conditions<sup>a</sup>

Segment <sup>b</sup>	Analyte	Precursor Ion <sup>c</sup> (m/z)	Product Ion <sup>c,d</sup> (m/z)	Cone Voltage (v)	Collision Energy <sup>e</sup> (v)
1	PFBA	213	169	22	10
1	<sup>13</sup> C <sub>3</sub> -PFBA	216	172	22	10
1	<sup>13</sup> C <sub>4</sub> -PFBA	217	172	22	10
1	PFMPA	229	85	23	10
2	PFPeA	263	219	20	8
2	<sup>13</sup> C <sub>5</sub> -PFPeA	268	223	20	8
2	<sup>13</sup> C <sub>3</sub> -PFBS	302	80	45	30
2	PFBS	299	80	45	30
2	PFMBA	279	85	22	10
3	PFEESA	315	135	44	20
3	NFDHA	295	201	14	8
3	<sup>13</sup> C <sub>2</sub> -4:2FTS	329	309	40	18
3	4:2FTS	327	307	40	18
3	<sup>13</sup> C <sub>5</sub> -PFHxA	318	273	20	8
3	PFHxA	313	269	20	8
3	PFPeS	349	80	45	35
3	<sup>13</sup> C <sub>3</sub> -HFPO-DA	287 <sup>f</sup>	169	15	5
3	HFPO-DA	285 <sup>f</sup>	169	15	5
4	<sup>13</sup> C <sub>4</sub> -PFHpA	367	322	15	8
4	PFHpA	363	319	15	8
4	<sup>13</sup> C <sub>3</sub> -PFHxS <sup>g</sup>	402	80	45	40
4	PFHxS <sup>h</sup>	399	80	45	40
4	ADONA	377	251	15	10
5	<sup>13</sup> C <sub>2</sub> -6:2FTS	429	409	47	22
5	6:2FTS	427	407	47	22
5	<sup>13</sup> C <sub>2</sub> -PFOA	415	370	18	10
5	<sup>13</sup> C <sub>8</sub> -PFOA	421	376	18	10
5	PFOA	413	369	18	10
5	PFHpS	449	80	45	40
6	<sup>13</sup> C <sub>9</sub> -PFNA	472	427	17	10
6	PFNA	463	419	17	10
6	<sup>13</sup> C <sub>4</sub> -PFOS <sup>g</sup>	503	80	45	45
6	<sup>13</sup> C <sub>8</sub> -PFOS <sup>g</sup>	507	80	45	45
6	PFOS <sup>h</sup>	499	80	45	45
7	9Cl-PF3ONS	531	351	55	25
7	<sup>13</sup> C <sub>2</sub> -8:2FTS	529	509	53	28
7	8:2FTS	527	507	53	28
7	<sup>13</sup> C <sub>6</sub> -PFDA	519	474	22	10
7	PFDA	513	469	22	10

Segment <sup>b</sup>	Analyte	Precursor Ion <sup>c</sup> ( <i>m/z</i> )	Product Ion <sup>c,d</sup> ( <i>m/z</i> )	Cone Voltage (v)	Collision Energy <sup>e</sup> (v)
8	<sup>13</sup> C <sub>7</sub> -PFUnA	570	525	24	10
8	PFUnA	563	519	24	10
8	11Cl- PF3OUdS	631	451	60	30
8	<sup>13</sup> C <sub>2</sub> -PFDoA	615	570	22	10
8	PFDoA	613	569	22	10

- a. An LC-MS/MS chromatogram of the analytes obtained using these parameters is shown in **Figure 1**.
- b. Segments are time durations in which single or multiple scan events occur.
- c. Precursor and product ions listed in this table are nominal masses. During MS and MS/MS optimization, the analyst should determine precursor and product ion masses to one decimal place by locating the apex of the mass spectral peak (e.g., *m/z* 498.9→79.9 for PFOS). These precursor and product ion masses (with at least one decimal place) should be used in the MS/MS method for all analyses.
- d. Ions used for quantitation purposes.
- e. Argon used as collision gas.
- f. HFPO-DA is not stable in the ESI source and the [M – H]<sup>–</sup> yields a weak signal under typical ESI conditions. The precursor ion used during method development was [M – CO<sub>2</sub> – H]<sup>–</sup>.
- g. The isotope dilution analogue used during method development was composed of the linear isomer exclusively.
- h. Analyte has multiple resolved chromatographic peaks due to linear and branched isomers. All peaks summed for quantitation purposes. To reduce bias regarding detection of branched and linear isomers, the *m/z* 80 product ion must be used for this analyte.

Table 7. LCMRL Results

Analyte	LCMRL Fortification Levels (ng/L)	Calculated LCMRL (ng/L)
PFBA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	13
PFMPA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	3.8
PFPeA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	3.9
PFBS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	3.5
PFMBA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	3.7
PFEESA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	2.6
NFDHA	4.0, 6.0, 10, 14, 20, 41, 82	16
4:2FTS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	4.7
PFHxA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	5.3
PFPeS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	6.3
HFPO-DA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	3.7
PFHpA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	2.6
PFHxS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	3.7
ADONA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	3.4
6:2FTS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	14
PFOA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	3.4
PFHpS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	5.1
PFNA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	4.8
PFOS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	4.4
9Cl-PF3ONS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	1.4
8:2FTS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	9.1
PFDA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	2.3
PFUnA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	2.7
11Cl-PF3OUdS	1.0, 2.0, 4.0, 6.0, 10, 14, 20	1.6
PFDoA	1.0, 2.0, 4.0, 6.0, 10, 14, 20	2.2

Table 8. Precision and Accuracy Data for Reagent Water

Analyte	Low Fortification (ng/L)	Mean %R <sup>a</sup> (n=7)	%RSD <sup>a</sup>	High Fortification (ng/L)	Mean %R (n=5)	%RSD
PFBA	10	128	8.6	80	98.4	2.4
PFMPA	10	108	4.5	80	98.1	2.2
PFPeA	10	107	4.9	80	99.6	3.6
PFBS	10	102	9.1	80	96.2	2.9
PFMBA	10	111	6.8	80	101	3.4
PFEESA	10	107	10	80	98.8	4.0
NFDHA	10	110	15	80	98.5	5.4
4:2FTS	10	94.4	14	80	100	5.7
PFHxA	10	102	8.0	80	97	7.7
PFPeS	10	99.5	19	80	101	7.8
HFPO-DA	10	102	9.7	80	102	4.7
PFHpA	10	108	7.0	80	104	4.1
PFHxS	10	103	9.0	80	97.7	5.5
ADONA	10	96.3	3.1	80	96.8	5.6
6:2FTS	10	109	15	80	111	11
PFOA	10	108	7.4	80	98.5	6.9
PFHpS	10	98.8	8.9	80	102	7.0
PFNA	10	109	6.2	80	99.6	5.6
PFOS	10	104	8.7	80	98.0	4.3
9Cl-PF3ONS	10	99.7	4.6	80	103	6.8
8:2FTS	10	100	17	80	100	13
PFDA	10	100	4.2	80	100	1.8
PFUnA	10	102	10	80	97.3	8.1
11Cl-PF3OUdS	10	106	5.3	80	102	6.1
PFDoA	10	101	6.2	80	96.3	5.1

<sup>a</sup> %R = percent recovery; %RSD = percent relative standard deviation

Table 9. P&A in Reagent Water: Isotope Dilution Analogue Recovery Data<sup>a</sup>

Analyte	Analogue Fortification (ng/L)	Mean %R <sup>b,c</sup> (n=7) P&A Low	%RSD <sup>b,c</sup>	Mean %R (n=5) P&A High	%RSD
<sup>13</sup> C <sub>4</sub> -PFBA	40	95.6	11	92.5	3.4
<sup>13</sup> C <sub>5</sub> -PFPeA	40	93.4	9.3	91.7	4.6
<sup>13</sup> C <sub>3</sub> -PFBS	40	98.6	9.6	107	6.6
<sup>13</sup> C <sub>2</sub> -4:2FTS	160	102	6.7	108	3.5
<sup>13</sup> C <sub>5</sub> -PFHxA	40	92.5	6.4	92.8	11
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40	88.6	6.5	88.8	7.4
<sup>13</sup> C <sub>4</sub> -PFHpA	40	98.0	4.0	94.0	8.3
<sup>13</sup> C <sub>3</sub> -PFHxS	40	101	11	106	8.2
<sup>13</sup> C <sub>2</sub> -6:2FTS	160	109	9.5	99.8	4.7
<sup>13</sup> C <sub>8</sub> -PFOA	40	98.0	4.1	91.5	8.7
<sup>13</sup> C <sub>9</sub> -PFNA	40	97.1	4.9	92.1	8.4
<sup>13</sup> C <sub>8</sub> -PFOS	40	98.8	6.5	96.5	5.0
<sup>13</sup> C <sub>2</sub> -8:2FTS	160	106	13.9	108	8.7
<sup>13</sup> C <sub>6</sub> -PFDA	40	104	7.7	104	6.1
<sup>13</sup> C <sub>7</sub> -PFUnA	40	107	6.0	98.8	7.5
<sup>13</sup> C <sub>2</sub> -PFDoA	40	100	5.7	94.0	6.7

a. P&A = “precision and accuracy”.

b. %R = percent recovery; %RSD = percent relative standard deviation.

c. Mean and %RSD of the isotope dilution analogue results for the fortified samples in the P&A study; number of replicates given in the header row of the table.

Table 10. Precision and Accuracy Data for Finished Ground Water<sup>a</sup>

Analyte	Low Fortification (ng/L)	Mean %R <sup>b</sup> (n=5)	%RSD <sup>b</sup>	High Fortification (ng/L)	Mean %R (n=5)	%RSD
PFBA	10	127	15	80	98.0	4.0
PFMPA	10	100	8.3	80	103	9.8
PFPeA	10	105	11	80	105	5.1
PFBS	10	111	12	80	101	10
PFMBA	10	99.0	4.6	80	100	2.3
PFEESA	10	101	3.5	80	107	8.8
NFDHA	10	95.1	17	80	98.5	18
4:2FTS	10	70.5	20	80	116	9.2
PFHxA	10	104	18	80	111	17
PFPeS	10	87.5	5.0	80	106	6.2
HFPO-DA	10	105	7.4	80	103	7.5
PFHpA	10	102	6.8	80	101	6.4
PFHxS	10	86.6	18	80	108	6.8
ADONA	10	97.6	8.1	80	94.2	6.9
6:2FTS	10	99.9	15	80	100	12
PFOA	10	95.8	8.1	80	104	9.8
PFHpS	10	94.0	6.3	80	113	6.0
PFNA	10	95.1	7.2	80	108	3.3
PFOS	10	c	c	80	109	5.8
9Cl-PF3ONS	10	92.7	7.2	80	111	7.9
8:2FTS	10	108	19	80	102	3.2
PFDA	10	90.8	9.8	80	104	7.1
PFUnA	10	98.3	8.8	80	105	3.0
11Cl-PF3OUdS	10	94.6	8.3	80	110	9.3
PFDoA	10	92.7	7.8	80	102	6.3

a. Finished water from a ground water source. Hardness = 320 mg/L as CaCO<sub>3</sub>. pH = 7.88 at 17 °C. Free Cl<sub>2</sub> = 0.64 mg/L. Total Cl<sub>2</sub> = 0.74 mg/L.

b. %R = percent recovery, corrected for native concentration; %RSD = percent relative standard deviation.

c. The spike level was below the ambient PFOS concentration of 25 ng/L.

Table 11. P&A in Finished Ground Water: Isotope Dilution Analogue Recovery Data<sup>a</sup>

Analyte	Analogue Fortification (ng/L)	Mean %R <sup>b,c</sup> (n=6) P&A Low	%RSD <sup>b,c</sup>	Mean %R (n=6) P&A High	%RSD
<sup>13</sup> C <sub>4</sub> -PFBA	40	89.5	4.4	81.3	7.8
<sup>13</sup> C <sub>5</sub> -PFPeA	40	94.0	4.2	84.6	7.7
<sup>13</sup> C <sub>3</sub> -PFBS	40	103	1.7	93.6	8.5
<sup>13</sup> C <sub>2</sub> -4:2FTS	160	107	6.1	105	2.6
<sup>13</sup> C <sub>5</sub> -PFHxA	40	93.8	9.8	75.8	16
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40	77.8	8.5	72.0	9.8
<sup>13</sup> C <sub>4</sub> -PFHpA	40	90.5	8.4	83.3	10
<sup>13</sup> C <sub>3</sub> -PFHxS	40	101	7.8	94.7	6.4
<sup>13</sup> C <sub>2</sub> -6:2FTS	160	101	5.2	101	4.5
<sup>13</sup> C <sub>8</sub> -PFOA	40	89.5	5.7	82.8	10
<sup>13</sup> C <sub>9</sub> -PFNA	40	103	6.6	78.0	11
<sup>13</sup> C <sub>8</sub> -PFOS	40	101	7.6	89.7	4.5
<sup>13</sup> C <sub>2</sub> -8:2FTS	160	97.2	7.4	94.0	8.0
<sup>13</sup> C <sub>6</sub> -PFDA	40	98.7	6.3	82.3	15
<sup>13</sup> C <sub>7</sub> -PFUnA	40	102	4.3	82.6	8.0
<sup>13</sup> C <sub>2</sub> -PFDoA	40	98.8	4.6	81.2	10

a. P&A = "precision and accuracy".

b. %R = percent recovery; %RSD = percent relative standard deviation.

c. Mean and %RSD of the isotope dilution analogue results for the unfortified matrix sample and the fortified samples in the P&A study; number of replicates given in the header row of the table.

Table 12. Precision and Accuracy Data for a Surface Water Matrix<sup>a</sup>

Analyte	Low Fortification (ng/L)	Mean %R <sup>b,c</sup> (n=5)	%RSD <sup>b</sup>	High Fortification (ng/L)	Mean %R (n=5)	%RSD
PFBA	10	95.4	19	80	106	4.8
PFMPA	10	108	16	80	102	5.9
PFPeA	10	93	13	80	101	6.0
PFBS	10	111	17	80	98.3	2.7
PFMBA	10	93.0	12	80	103	3.0
PFEESA	10	95.6	15	80	99.1	2.4
NFDHA	10	102	14	80	101	2.5
4:2FTS	10	70.9	17	80	91.1	7.8
PFHxA	10	96.9	19	80	103	4.2
PFPeS	10	87.5	14	80	104	4.9
HFPO-DA	10	109	8.7	80	105	7.0
PFHpA	10	95.9	11	80	105	4.8
PFHxS	10	78.5	8.2	80	97.1	5.3
ADONA	10	94.3	7.9	80	95.8	6.0
6:2FTS	10	86.5	6.3	80	101	9.7
PFOA	10	91.9	9.8	80	98.7	4.9
PFHpS	10	88.4	14	80	106	3.4
PFNA	10	89.7	9.5	80	95.9	2.8
PFOS	10	95.1	11	80	105	8.0
9Cl-PF3ONS	10	82.4	5.0	80	94.1	3.9
8:2FTS	10	102	7.6	80	101	4.0
PFDA	10	87.3	12	80	98.5	8.0
PFUnA	10	96.9	5.4	80	95.2	2.7
11Cl-PF3OUdS	10	82.4	8.9	80	93.0	4.4
PFDoA	10	94.6	2.3	80	98.4	4.1

- <sup>a</sup>. Surface water matrix was sampled after the clarifier and prior to granular activated carbon within the drinking water treatment plant and chlorinated in our laboratory. pH = 8.1 at 20 °C. Free Cl<sub>2</sub> = 0.98 mg/L. Total Cl<sub>2</sub> = 1.31 mg/L. Total Organic Carbon (TOC) = 3.8 mg/L C.
- <sup>b</sup>. %R = percent recovery; %RSD = percent relative standard deviation.
- <sup>c</sup>. Corrected for native concentration.

Table 13. P&A in Surface Water Matrix: Isotope Dilution Analogue Recovery Data<sup>a</sup>

Analyte	Analogue Fortification (ng/L)	Mean %R <sup>b,c</sup> (n=6) P&A Low	%RSD <sup>b,c</sup>	Mean %R (n=6) P&A High	%RSD
<sup>13</sup> C <sub>4</sub> -PFBA	40	86.9	18	86.3	6.5
<sup>13</sup> C <sub>5</sub> -PFPeA	40	105	15	102	5.7
<sup>13</sup> C <sub>3</sub> -PFBS	40	98.6	11	99.8	4.5
<sup>13</sup> C <sub>2</sub> -4:2FTS	160	136	13	138	6.3
<sup>13</sup> C <sub>5</sub> -PFHxA	40	88.8	16	84.8	4.5
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40	78.4	14	75.4	13
<sup>13</sup> C <sub>4</sub> -PFHpA	40	91.6	12	89.3	6.0
<sup>13</sup> C <sub>3</sub> -PFHxS	40	98.2	6.5	96.0	9.6
<sup>13</sup> C <sub>2</sub> -6:2FTS	160	110	9.7	109	8.4
<sup>13</sup> C <sub>8</sub> -PFOA	40	90.1	14	86.6	4.5
<sup>13</sup> C <sub>9</sub> -PFNA	40	91.0	14	87.2	6.0
<sup>13</sup> C <sub>8</sub> -PFOS	40	98.8	15	95.6	5.0
<sup>13</sup> C <sub>2</sub> -8:2FTS	160	101	9.8	97.3	11
<sup>13</sup> C <sub>6</sub> -PFDA	40	92.0	16	86.6	10
<sup>13</sup> C <sub>7</sub> -PFUnA	40	92.2	16	90.0	5.6
<sup>13</sup> C <sub>2</sub> -PFDoA	40	91.2	14	90.8	10

a. P&A = "precision and accuracy".

b. %R = percent recovery; %RSD = percent relative standard deviation.

c. Mean and %RSD of the isotope dilution analogue results for the unfortified matrix sample and the fortified samples in the P&A study; number of replicates given in the header row of the table.

Table 14. Aqueous Sample Holding Time Data<sup>a</sup>

Analyte	Fortified Conc. (ng/L)	Day Zero Mean (ng/L)	Day Zero %RSD	Day 7 %Change <sup>b</sup>	Day 7 %RSD	Day 14 %Change	Day 14 %RSD	Day 21 %Change	Day 21 %RSD	Day 28 %Change	Day 28 %RSD
PFBA	40	42	4.6	9.1	2.3	3.1	7.2	5.1	5.4	4.2	5.0
PFMPA	40	41	5.2	5.5	2.2	-7.8	5.1	1.0	6.3	-10	3.1
PFPeA	40	43	4.1	1.2	1.9	-2.2	6.5	-0.29	2.5	-6.5	5.8
PFBS	40	43	9.7	-1.9	3.6	-6.1	1.8	-4.0	2.5	-7.6	8.9
PFMBA	40	40	3.0	-2.5	3.7	-5.7	4.3	0.20	5.0	-6.6	6.3
PFEESA	40	39	3.2	2.6	5.7	-1.8	6.7	-2.4	4.5	-1.7	2.6
NFDHA	40	39	6.5	-4.0	7.2	-11	6.9	-3.8	5.2	-2.9	8.0
4:2FTS	40	43	9.7	-1.7	3.8	-2.6	9.6	-2.0	6.1	-0.34	5.3
PFHxA	40	42	5.2	-0.37	4.6	-2.61	5.6	-1.7	5.8	-2.3	7.6
PFPeS	40	41	3.2	5.6	7.5	-3.1	2.6	6.0	9.2	-11	9.4
HFPO-DA	40	42	5.1	6.2	4.8	3.2	9.2	2.1	2.1	-3.5	4.2
PFHpA	40	41	4.6	-0.042	2.4	-4.7	1.7	-2.9	3.6	-3.0	5.4
PFHxS	40	41	4.3	1.8	3.0	-1.8	1.8	-1.8	9.0	-0.99	6.8
ADONA	40	39	4.2	-4.3	3.1	-12	5.7	-6.2	5.9	-2.3	3.1
6:2FTS	40	41	7.5	-4.3	4.4	-0.74	9.4	2.5	6.0	-1.5	6.0
PFOA	40	41	5.4	-1.5	6.7	1.6	5.1	-2.0	4.9	-6.5	7.2
PFHpS	40	41	4.7	-2.4	5.4	1.2	3.1	0.30	3.2	2.9	7.2
PFNA	40	42	4.1	2.05	0.57	-6.0	4.9	-6.1	3.4	-9.5	3.4
PFOS	40	41	7.0	-2.1	4.7	-1.8	5.2	1.0	5.8	-1.6	5.3
9Cl-PF3ONS	40	40	3.5	1.6	4.8	-0.34	1.8	4.0	4.8	-2.6	10
8:2FTS	40	44	7.9	-0.36	2.5	-1.4	6.7	0.026	3.8	-3.6	6.9
PFDA	40	41	5.0	0.12	3.1	-2.7	3.8	-1.4	3.8	-2.4	7.0
PFUnA	40	39	3.9	-1.3	4.7	-12	1.2	3.7	3.1	-6.7	3.5
11Cl-PF3OUdS	40	40	4.9	-1.1	4.5	-9.4	5.1	-11.0	4.7	-12	7.3
PFDoA	40	39	4.4	9.5	6.5	-4.8	6.0	-3.4	5.8	-16	6.1

<sup>a</sup> Finished water from a surface water source. pH = 8.84 at 18 °C; total organic carbon (TOC) = 0.75 mg/L C (mean of 2019 first quarter plant records); free chlorine = 0.87 mg/L, total chlorine = 1.04 mg/L. Day Zero: *n*=7. All other events: *n*=5.

<sup>b</sup> %Change = percent change from Day Zero calculated as follows: (Day X mean concentration – Day Zero mean concentration) / Day Zero mean concentration \* 100%, where X is the analysis day.

Table 15. Extract Holding Time Data<sup>a</sup>

Analyte	Fortified Conc. (ng/L)	Day Zero Mean (ng/L)	Day Zero %RSD	Day 14 %Change <sup>b</sup>	Day 14 %RSD	Day 21 %Change	Day 21 %RSD	Day 27 %Change	Day 27 %RSD
PFBA	40	42	4.6	-8.0	4.2	-4.4	0.89	-12	6.4
PFMPA	40	41	5.2	-3.9	4.5	-0.10	5.1	-3.9	12
PFPeA	40	43	4.1	-6.0	6.0	-0.55	4.8	-5.4	1.1
PFBS	40	43	9.7	2.6	2.0	6.6	2.3	2.9	3.6
PFMBA	40	40	3.0	-10	7.1	-4.8	5.3	-8.8	2.7
PFEESA	40	39	3.2	1.3	8.9	-3.6	2.1	-4.9	3.6
NFDHA	40	39	6.5	-10	3.9	-13	6.8	-11	3.1
4:2FTS	40	43	9.7	-4.7	8.5	-6.2	8.8	-7.3	8.5
PFHxA	40	42	5.2	-4.6	6.3	-20	3.0	-14	4.7
PFPeS	40	41	3.2	-6.7	8.6	-11	5.2	-10	4.5
HFPO-DA	40	42	5.1	-4.9	4.9	-4.7	5.1	-4.4	7.7
PFHpA	40	41	4.6	-1.9	1.9	-6.1	4.8	-8.7	7.8
PFHxS	40	41	4.3	-19	9.9	-21	8.4	-22	11
ADONA	40	39	4.2	-1.2	1.9	-7.8	6.4	-7.5	5.0
6:2FTS	40	41	7.5	-5.3	13	-7.6	5.8	-8.4	14
PFOA	40	41	5.4	-5.7	6.3	-2.2	4.2	-2.4	3.3
PFHpS	40	41	4.7	-8.7	7.3	-6.0	5.2	-3.2	4.2
PFNA	40	42	4.1	-5.8	5.6	0.17	3.2	-2.0	6.0
PFOS	40	41	7.0	-3.8	10	-4.2	2.5	-3.7	4.4
9Cl-PF3ONS	40	40	3.5	-5.8	7.7	-9.3	4.0	-8.6	4.7
8:2FTS	40	44	7.9	-4.7	6.3	-1.3	5.8	-6.4	2.9
PFDA	40	41	5.0	-3.7	5.3	-1.8	5.6	-4.8	3.1
PFUnA	40	39	3.9	6.2	4.0	0.63	7.5	-2.8	5.2
11Cl-PF3OUdS	40	40	4.9	-12	5.9	-18	4.6	-10	6.3
PFDoA	40	39	4.4	1.9	5.5	1.0	6.4	-2.6	3.3

<sup>a</sup>. Finished water from a surface water source. pH = 8.84 at 18 °C; total organic carbon (TOC) = approximately 0.75 mg/L C (2019 first quarter plant records); free chlorine = 0.87 mg/L, total chlorine = 1.04 mg/L. Day Zero: *n*=7. All other events: *n*=7.

<sup>b</sup>. %Change = percent change from Day Zero calculated as follows: (Day X mean concentration – Day Zero mean concentration) / Day Zero mean concentration \* 100%, where X is the analysis day.

Table 16. Initial Demonstration of Capability (IDC) Quality Control Requirements

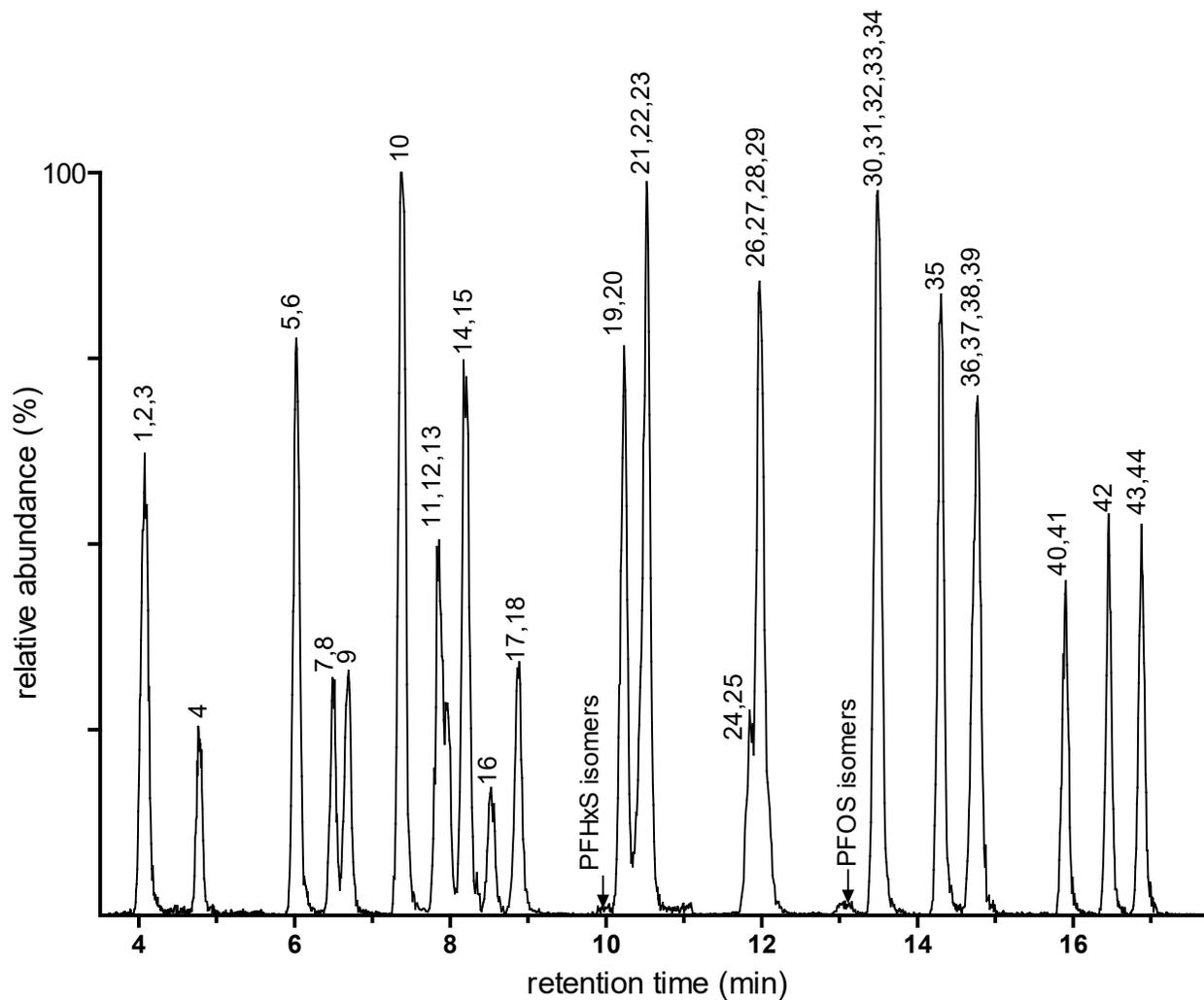
Method Reference	Requirement	Specification and Frequency	Acceptance Criteria
<a href="#">Section 10.2.2</a>	Establish retention times for branched isomers	Each time chromatographic conditions change	All isomers of each analyte must elute within the same MRM window.
<a href="#">Section 9.1.1</a>	Demonstration of low system background	Analyze a Laboratory Reagent Blank (LRB) after the highest standard in the calibration range.	Demonstrate that the method analytes are less than one-third of the Minimum Reporting Level (MRL).
<a href="#">Section 9.1.2</a>	Demonstration of precision	Extract and analyze 7 replicate Laboratory Fortified Blanks (LFBs) near the mid-range concentration.	Percent relative standard deviation must be $\leq 20\%$ .
<a href="#">Section 9.1.3</a>	Demonstration of accuracy	Calculate mean recovery for replicates used in <a href="#">Section 9.1.2</a> .	Mean recovery within 70–130% of the true value.
<a href="#">Section 9.1.4</a>	MRL confirmation	Fortify and analyze 7 replicate LFBs at the proposed MRL concentration. Confirm that the Upper Prediction Interval of Results (PIR) and Lower PIR meet the recovery criteria.	Upper PIR $\leq 150\%$ Lower PIR $\geq 50\%$
<a href="#">Section 9.1.5</a>	Calibration Verification	Analyze mid-level QCS.	Results must be within 70–130% of the true value.

Table 17. Ongoing Quality Control Requirements

Method Reference	Requirement	Specification and Frequency	Acceptance Criteria
<a href="#">Section 10.3</a>	Initial calibration	Use the isotope dilution calibration technique to generate a linear or quadratic calibration curve. Use at least 5 standard concentrations. Evaluate the calibration curve as described in <a href="#">Section 10.3.5</a> .	When each calibration standard is calculated as an unknown using the calibration curve, analytes fortified at or below the MRL should be within 50–150% of the true value. Analytes fortified at all other levels should be within 70–130% of the true value.
<a href="#">Section 9.2.1</a>	Laboratory Reagent Blank (LRB)	Include one LRB with each Extraction Batch. Analyze one LRB with each Analysis Batch.	Demonstrate that all method analytes are below one-third the Minimum Reporting Level (MRL), and that possible interference from reagents and glassware do not prevent identification and quantitation of method analytes.

Method Reference	Requirement	Specification and Frequency	Acceptance Criteria
<a href="#">Section 9.2.3</a>	Laboratory Fortified Blank	Include one LFB with each Extraction Batch.	For analytes fortified at concentrations $\leq 2$ x the MRL, the result must be within 50–150% of the true value; 70–130% of the true value if fortified at concentrations greater than 2 x the MRL.
<a href="#">Section 10.4</a>	Continuing Calibration Check (CCC)	Verify initial calibration by analyzing a low-level CCC (concentrations at or below the MRL for each analyte) at the beginning of each Analysis Batch. Subsequent CCCs are required after every tenth field sample and to complete the batch.	The lowest level CCC must be within 50–150% of the true value. All other levels must be within 70–130% of the true value.
<a href="#">Section 9.2.4</a>	Isotope performance standards	Isotope performance standards are added to all standards and sample extracts.	Peak area counts for each isotope performance standard must be within 50–150% of the average peak area in the initial calibration.
<a href="#">Section 9.2.5</a>	Isotope dilution analogues	Isotope dilution analogues are added to all samples prior to extraction.	50%–200% recovery for each analogue
<a href="#">Section 9.2.6</a>	Laboratory Fortified Sample Matrix (LFSM)	Include one LFSM per Extraction Batch. Fortify the LFSM with method analytes at a concentration close to but greater than the native concentrations (if known).	For analytes fortified at concentrations $\leq 2$ x the MRL, the result must be within 50–150% of the true value; 70–130% of the true value if fortified at concentrations greater than 2 x the MRL.
<a href="#">Section 9.2.7</a>	Laboratory Fortified Sample Matrix Duplicate (LFSMD) or Field Duplicate (FD)	Include at least one LFSMD or FD with each Extraction Batch.	For LFSMDs or FDs, relative percent differences must be $\leq 30\%$ ( $\leq 50\%$ if analyte concentration $\leq 2$ x the MRL).
<a href="#">Section 9.2.8</a>	Field Reagent Blank (FRB)	Analyze the FRB if any analyte is detected in the associated field samples.	If an analyte detected in the field sample is present in the associated FRB at greater than one-third the MRL, the results for that analyte are invalid.
<a href="#">Section 9.2.9</a>	Calibration Verification using QCS	Perform a Calibration Verification at least quarterly.	Results must be within 70–130% of the true value.

Figure 1. Example Chromatogram for Reagent Water Fortified with Method Analytes at 80 ng/L<sup>a</sup>



<sup>a</sup> Numbered peaks are identified in [Table 3](#), [Table 4](#), and [Table 5](#).

**METHOD 537.1 DETERMINATION OF SELECTED PER- AND  
POLYFLUORINATED ALKYL SUBSTANCES IN DRINKING  
WATER BY SOLID PHASE EXTRACTION AND LIQUID  
CHROMATOGRAPHY/TANDEM MASS SPECTROMETRY  
(LC/MS/MS)**

**Version 2.0  
March 2020**

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**J.A. Shoemaker and D.R. Tettehorst, Office of Research and Development, Method 537.1,  
Rev 1.0 (2018)**

**J.A. Shoemaker (Office of Research and Development), P.E. Grimmett (Office of Research  
and Development), B.K. Boutin (National Council on Aging), Method 537, Rev 1.1 (2009)**

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## METHOD 537.1

### DETERMINATION OF SELECTED PER- AND POLYFLUORINATED ALKYL SUBSTANCES IN DRINKING WATER BY SOLID PHASE EXTRACTION AND LIQUID CHROMATOGRAPHY/TANDEM MASS SPECTROMETRY (LC/MS/MS)

#### 1. SCOPE AND APPLICATION

- 1.1. This is a solid phase extraction (SPE) liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected per- and polyfluorinated alkyl substances (PFAS) in drinking water. Accuracy and precision data have been generated in reagent water and drinking water for the compounds listed in the table below.

<u>Analyte<sup>a</sup></u>	<u>Acronym</u>	<u>Chemical Abstract Services Registry Number (CASRN)</u>
Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6 <sup>b</sup>
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
Perfluorobutanesulfonic acid	PFBS	375-73-5
Perfluorodecanoic acid	PFDA	335-76-2
Perfluorododecanoic acid	PFDoA	307-55-1
Perfluoroheptanoic acid	PFHpA	375-85-9
Perfluorohexanesulfonic acid	PFHxS	355-46-4
Perfluorohexanoic acid	PFHxA	307-24-4
Perfluorononanoic acid	PFNA	375-95-1
Perfluorooctanesulfonic acid	PFOS	1763-23-1
Perfluorooctanoic acid	PFOA	335-67-1
Perfluorotetradecanoic acid	PFTA	376-06-7
Perfluorotridecanoic acid	PFTTrDA	72629-94-8
Perfluoroundecanoic acid	PFUnA	2058-94-8
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9 <sup>c</sup>
9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1 <sup>d</sup>
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4 <sup>e</sup>

<sup>a</sup> Some PFAS are commercially available as ammonium, sodium and potassium salts. This method measures all forms of the analytes as anions while the counterion is inconsequential. Analytes may be purchased as acids or as any of the corresponding salts (see Section 7.2.3 regarding correcting the analyte concentration for the salt content).

<sup>b</sup> HFPO-DA and the ammonium salt of HFPO-DA are components of the GenX processing aid technology and both are measured as the anion of HFPO-DA by this method.

<sup>c</sup> 11Cl-PF3OUdS is available in salt form (e.g. CASRN of potassium salt is 83329-89-9).

<sup>d</sup> 9Cl-PF3ONS analyte is available in salt form (e.g. CASRN of potassium salt is 73606-19-6)

<sup>e</sup> ADONA is available as the sodium salt (no CASRN) and the ammonium salt (CASRN is 958445-44-8).

- 1.2. Minimum Reporting Level (MRL) is the lowest analyte concentration that meets Data Quality Objectives (DQOs) that are developed based on the intended use of this method. The single laboratory lowest concentration MRL (LCMRL) is the lowest true concentration for which the future recovery is predicted to fall, with high confidence (99%), between 50 and 150% recovery. Single laboratory LCMRLs for analytes in this method range from 0.53-6.3 ng/L and are listed in [Table 5](#). The procedure used to determine the LCMRL is described elsewhere.<sup>1</sup>
- 1.3. Laboratories using this method will not be required to determine the LCMRL for this method, but will need to demonstrate that their laboratory MRL for this method meets requirements described in Section [9.2.6](#).
- 1.4. Determining the Detection Limit (DL) for analytes in this method is optional (Sect. [9.2.8](#)). Detection limit is defined as the statistically calculated minimum concentration that can be measured with 99% confidence that the reported value is greater than zero.<sup>2</sup> The DL is compound dependent and is dependent on extraction efficiency, sample matrix, fortification concentration, and instrument performance.
- 1.5. This method is intended for use by analysts skilled in solid phase extractions, the operation of LC/MS/MS instruments, and the interpretation of the associated data.
- 1.6. METHOD FLEXIBILITY – In recognition of technological advances in analytical systems and techniques, the laboratory is permitted to modify the evaporation technique, separation technique, LC column, mobile phase composition, LC conditions and MS and MS/MS conditions (Sect. [6.12](#), [9.1.1](#), [10.2](#), and [12.1](#)). **Changes may not be made to sample collection and preservation (Sect. [8](#)), the sample extraction steps (Sect. [11.4](#)), or to the quality control requirements (Sect. [9](#)).** Method modifications should be considered only to improve method performance. Modifications that are introduced in the interest of reducing cost or sample processing time, but result in poorer method performance, should not be used. Analytes must be adequately resolved chromatographically to permit the mass spectrometer to dwell on a minimum number of compounds eluting within a retention time window. Instrumental sensitivity (or signal-to-noise) will decrease if too many compounds are permitted to elute within a retention time window. In all cases where method modifications are proposed, the analyst must perform the procedures outlined in the initial demonstration of capability (IDC, Sect. [9.2](#)), verify that all Quality Control (QC) acceptance criteria in this method (Sect. [9](#)) are met, and that acceptable method performance can be verified in a real sample matrix (Sect. [9.3.6](#)).

**NOTE:** The above method flexibility Section is intended as an abbreviated summation of method flexibility. Sections 4-12 provide detailed information of specific portions of the method that may be modified. If there is any perceived conflict between the general method flexibility statement in Section [1.6](#) and specific information in Sections 4-12, Sections 4-12 supersede Section [1.6](#).

## 2. SUMMARY OF METHOD

A 250-mL water sample is fortified with surrogates and passed through an SPE cartridge containing polystyrenedivinylbenzene (SDVB) to extract the method analytes and surrogates. The compounds are eluted from the solid phase sorbent with a small amount of methanol. The extract is concentrated to dryness with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 96:4% (vol/vol) methanol:water and addition of the internal standards. A 10- $\mu$ L injection is made into an LC equipped with a C18 column that is interfaced to an MS/MS. The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the internal standard technique. Surrogate analytes are added to all Field and QC Samples to monitor the extraction efficiency of the method analytes.

## 3. DEFINITIONS

- 3.1. ANALYSIS BATCH – A set of samples that is analyzed on the same instrument during a 24-hour period, including no more than 20 Field Samples, that begins and ends with the analysis of the appropriate Continuing Calibration Check (CCC) standards. Additional CCCs may be required depending on the length of the analysis batch and/or the number of Field Samples.
- 3.2. CALIBRATION STANDARD (CAL) – A solution prepared from the primary dilution standard solution and/or stock standard solution, internal standard(s), and the surrogate(s). The CAL solutions are used to calibrate the instrument response with respect to analyte concentration.
- 3.3. COLLISIONALLY ACTIVATED DISSOCIATION (CAD) – The process of converting the precursor ion's translational energy into internal energy by collisions with neutral gas molecules to bring about dissociation into product ions.
- 3.4. CONTINUING CALIBRATION CHECK (CCC) – A calibration standard containing the method analytes, internal standard(s) and surrogate(s). The CCC is analyzed periodically to verify the accuracy of the existing calibration for those analytes.
- 3.5. DETECTION LIMIT (DL) – The minimum concentration of an analyte that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero. This is a statistical determination of precision (Sect. [9.2.8](#)), and accurate quantitation is not expected at this level.<sup>2</sup>
- 3.6. EXTRACTION BATCH – A set of up to 20 Field Samples (not including QC samples) extracted together by the same person(s) during a work day using the same lot of SPE devices, solvents, surrogate, internal standard and fortifying solutions. Required QC samples include Laboratory Reagent Blank, Laboratory Fortified Blank, Laboratory Fortified Sample Matrix, and either a Field Duplicate or Laboratory Fortified Sample Matrix Duplicate.

- 3.7. FIELD DUPLICATES (FD1 and FD2) – Two separate samples collected at the same time and place under identical circumstances and treated exactly the same throughout field and laboratory procedures. Analyses of FD1 and FD2 give a measure of the precision associated with sample collection, preservation, and storage, as well as laboratory procedures.
- 3.8. FIELD REAGENT BLANK (FRB) – An aliquot of reagent water that is placed in a sample container in the laboratory and treated as a sample in all respects, including shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the FRB is to determine if method analytes or other interferences are present in the field environment.
- 3.9. INTERNAL STANDARD (IS) – A pure chemical added to an extract or standard solution in a known amount(s) and used to measure the relative response of other method analytes and surrogates that are components of the same solution. The internal standard must be a chemical that is structurally similar to the method analytes, has no potential to be present in water samples, and is not a method analyte.
- 3.10. LABORATORY FORTIFIED BLANK (LFB) – A volume of reagent water or other blank matrix to which known quantities of the method analytes and all the preservation compounds are added in the laboratory. The LFB is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.
- 3.11. LABORATORY FORTIFIED SAMPLE MATRIX (LFSM) – A preserved field sample to which known quantities of the method analytes are added in the laboratory. The LFSM is processed and analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate sample extraction and the measured values in the LFSM corrected for background concentrations.
- 3.12. LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (LFSMD) – A duplicate of the Field Sample used to prepare the LFSM. The LFSMD is fortified, extracted, and analyzed identically to the LFSM. The LFSMD is used instead of the Field Duplicate to assess method precision when the occurrence of method analytes is low.
- 3.13. LABORATORY REAGENT BLANK (LRB) – An aliquot of reagent water or other blank matrix that is treated exactly as a sample including exposure to all glassware, equipment, solvents and reagents, sample preservatives, internal standard, and surrogates that are used in the analysis batch. The LRB is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.

- 3.14. **LOWEST CONCENTRATION MINIMUM REPORTING LEVEL (LCMRL)** – The single laboratory LCMRL is the lowest true concentration for which a future recovery is expected, with 99% confidence, to be between 50 and 150% recovery.1
- 3.15. **MINIMUM REPORTING LEVEL (MRL)** – The minimum concentration that can be reported as a quantitated value for a method analyte in a sample following analysis. This defined concentration can be no lower than the concentration of the lowest calibration standard for that analyte and can only be used if acceptable QC criteria for this standard are met. A procedure for verifying a laboratory’s MRL is provided in Section [9.2.6](#).
- 3.16. **PRECURSOR ION** – For the purpose of this method, the precursor ion is the deprotonated molecule ( $[M-H]^-$ ) of the method analyte. In MS/MS, the precursor ion is mass selected and fragmented by collisionally activated dissociation to produce distinctive product ions of smaller  $m/z$ .
- 3.17. **PRIMARY DILUTION STANDARD (PDS) SOLUTION** – A solution containing the analytes prepared in the laboratory from stock standard solutions and diluted as needed to prepare calibration solutions and other needed analyte solutions.
- 3.18. **PRODUCT ION** – For the purpose of this method, a product ion is one of the fragment ions produced in MS/MS by collisionally activated dissociation of the precursor ion.
- 3.19. **QUALITATIVE STANDARD** – A qualitative standard is a standard for which either the concentration is estimated or method analyte impurities exist at a concentration  $>1/3$  of the MRL in the highest concentration calibration standard. For the purposes of this method, qualitative standards are used to identify retention times of branched isomers of method analytes and are not used for quantitation purposes.
- 3.20. **QUALITY CONTROL SAMPLE (QCS)** – A solution of method analytes of known concentrations that is obtained from a source external to the laboratory and different from the source of calibration standards. The second source SSS is used to fortify the QCS at a known concentration. The QCS is used to check calibration standard integrity.
- 3.21. **QUANTITATIVE STANDARD** – A quantitative standard is a standard of known concentration and purity. The quantitative standard must not contain any of the method analytes as impurities at concentrations  $>1/3$  of the MRL in the highest concentration calibration standard.
- 3.22. **SAFETY DATA SHEET (SDS)** – Written information provided by vendors concerning a chemical’s toxicity, health hazards, physical properties, fire, and reactivity data including storage, spill, and handling precautions.

- 3.23. STOCK STANDARD SOLUTION (SSS) – A concentrated solution containing one or more method analytes prepared in the laboratory using assayed reference materials or purchased from a reputable commercial source.
- 3.24. SURROGATE ANALYTE (SUR) – A pure chemical which chemically resembles method analytes and is extremely unlikely to be found in any sample. This chemical is added to a sample aliquot in known amount(s) before processing and is measured with the same procedures used to measure other method analytes. The purpose of the SUR is to monitor method performance with each sample.

#### 4. INTERFERENCES

- 4.1. All glassware must be meticulously cleaned. Wash glassware with detergent and tap water, rinse with tap water, followed by a reagent water rinse. Non-volumetric glassware can be heated in a muffle furnace at 400 °C for 2 h or solvent rinsed. Volumetric glassware should be solvent rinsed and not be heated in an oven above 120 °C. Store clean glassware inverted or capped. **Do not cover with aluminum foil because PFAS can be potentially transferred from the aluminum foil to the glassware.**

**NOTE:** Samples and extracts should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte, IS and SUR standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.

- 4.2. Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc.<sup>3</sup> All items such as these must be routinely demonstrated to be free from interferences (less than 1/3 the MRL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section [9.3.1](#). **Subtracting blank values from sample results is not permitted.**
- 4.3. Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent.<sup>4-5</sup> Total organic carbon (TOC) is a good indicator of humic content of the sample. Under the LC conditions used during method development, matrix effects due to total organic carbon (TOC) were not observed.

- 4.4. Relatively large quantities of the preservative (Sect. [8.1.2](#)) are added to sample bottles. The potential exists for trace-level organic contaminants in these reagents. Interferences from these sources should be monitored by analysis of laboratory reagent blanks (Sect. [9.3.1](#)), particularly when new lots of reagents are acquired.
- 4.5. SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

## 5. **SAFETY**

- 5.1. The toxicity or carcinogenicity of each reagent used in this method has not been precisely defined. Each chemical should be treated as a potential health hazard, and exposure to these chemicals should be minimized. Each laboratory is responsible for maintaining an awareness of OSHA regulations regarding safe handling of chemicals used in this method. A reference file of SDSs should be made available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available.<sup>6-8</sup>
- 5.2. PFOA has been described as likely to be carcinogenic to humans.<sup>9</sup> Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

## 6. **EQUIPMENT AND SUPPLIES**

(Brand names and/or catalog numbers are included for illustration only, and do not imply endorsement of the product.) Due to potential adsorption of analytes onto glass, polypropylene containers were used for all standard, sample and extraction preparations. Other plastic materials (e.g., polyethylene) which meet the QC requirements of Section [9](#) may be substituted.

- 6.1. SAMPLE CONTAINERS – 250-mL polypropylene bottles fitted with polypropylene screw caps.
- 6.2. POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles (VWR Cat. No.: 16066-960 or equivalent).
- 6.3. CENTRIFUGE TUBES – 15-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts (Thomas Scientific Cat. No.: 2602A10 or equivalent).
- 6.4. AUTOSAMPLER VIALS – Polypropylene 0.4-mL autosampler vials (ThermoFisher Cat. No.: C4000-11) with polypropylene caps (ThermoFisher Cat. No.: C5000-50 or equivalent).

**NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.**

- 6.5. POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.
- 6.6. MICRO SYRINGES – Suggested sizes include 5, 10, 25, 50, 100, 250, 500 and 1000- $\mu$ L syringes.
- 6.7. PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets (Fisher Cat. No.: 13-711-7 or equivalent).
- 6.8. ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.
- 6.9. SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES
  - 6.9.1. SPE CARTRIDGES – 0.5 g, 6-mL SPE cartridges containing styrenedivinylbenzene (SDVB) polymeric sorbent phase (Agilent Cat. No.: 1225-5021 or equivalent). The sorbent may not be modified with monomers other than SDVB.
  - 6.9.2. VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with Visiprep™ large volume sampler (Supelco Cat. No. 57030 and 57275 or equivalent) for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the LRB (Sect. 9.3.1).
  - 6.9.3. SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8” O.D. x 1/16” I.D. polypropylene or polyethylene tubing (Hudson Extrusions LLDPE or equivalent) cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the LRB (Sect. 9.3.1) and LFB (Sect. 9.3.3) QC requirements. The PTFE transfer tubes may be used, but an LRB must be run on each PTFE transfer tube and the QC requirements in Section 9.3.1 must be met. In the case of automated SPE, the removal of PTFE lines may not be feasible; therefore, LRBs will need to be rotated among the ports and must meet the QC requirements of Sections 9.2.2 and 9.3.1.

- 6.10. EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 65 °C (Meyer N-Evap, Model 111, Organomation Associates, Inc. or equivalent).
- 6.11. LABORATORY OR ASPIRATOR VACUUM SYSTEM – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.
- 6.12. LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM

6.12.1. LC SYSTEM – Instrument capable of reproducibly injecting up to 10- $\mu$ L aliquots and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.3 mL/min). The usage of a column heater is optional.

**NOTE: During the course of method development, it was discovered that while idle for more than one day, PFAS built up in the PTFE solvent transfer lines. To prevent long delays in purging high levels of PFAS from the LC solvent lines, they were replaced with PEEK™ tubing and the PTFE solvent frits were replaced with stainless steel frits. It is not possible to remove all PFAS background contamination, but these measures help to minimize their background levels.**

6.12.2. LC/TANDEM MASS SPECTROMETER – The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.3 mL/min. The system must be capable of performing MS/MS to produce unique product ions (Sect. 3.18) for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision. Data are demonstrated in Tables 5-9 using a triple quadrupole mass spectrometer (Waters XEVO TQMS). See the Note in Sect. 10.2.3 pertaining to potential limitations of some MS/MS instrumentation in achieving the required MS/MS transitions.

6.12.3. DATA SYSTEM – An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.

6.12.4. ANALYTICAL COLUMN – An LC C18 column (2.1 x 150 mm) packed with 5  $\mu$ m dp C18 solid phase particles (Waters #: 186001301 or equivalent) was used. Any column that provides adequate resolution, peak shape, capacity, accuracy, and precision (Sect. 9) may be used.

## 7. REAGENTS AND STANDARDS

- 7.1. GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals should be used. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first determined that the reagent is of sufficiently high purity to permit its use without lessening the quality of the determination.
- 7.1.1. REAGENT WATER – Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/3 the MRL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system's tubing.
- 7.1.2. METHANOL (CH<sub>3</sub>OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences (Fisher LC/MS grade or equivalent).
- 7.1.3. AMMONIUM ACETATE (NH<sub>4</sub>C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences (Sigma-Aldrich ACS grade or equivalent).
- 7.1.4. 20 mM AMMONIUM ACETATE/REAGENT WATER – To prepare 1 L, add 1.54 g ammonium acetate to 1 L of reagent water. This solution is volatile and must be replaced at least once a week. More frequent replacement may be necessary if unexplained loss in sensitivity or retention time shifts are encountered and attributed to loss of the ammonium acetate.
- 7.1.5. TRIZMA® PRESET CRYSTALS, pH 7.0 (Sigma cat# T-7193 or equivalent) – Reagent grade. A premixed blend of Tris [Tris(hydroxymethyl)aminomethane] and Tris HCL [Tris(hydroxymethyl)aminomethane hydrochloride]. Alternatively, a mix of the two components with a weight ratio of 15.5/1 Tris HCL/Tris may be used. This blend is targeted to produce a pH near 7.0 at 25 °C in reagent water. Trizma® functions as a buffer and removes free chlorine in chlorinated finished waters (Sect. [8.1.2](#)).
- 7.1.6. NITROGEN – Used for the following purposes:
- 7.1.6.1. Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications.
- 7.1.6.2. Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).

7.1.7. ARGON – Used as collision gas in MS/MS instruments. Argon should meet or exceed instrument manufacturer’s specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.

7.2. STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte, IS and SUR standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers. Solution concentrations listed in this Section were used to develop this method and are included as an example. Alternate concentrations may be used as necessary depending on instrument sensitivity and the calibration range used. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples. PDS and calibration standards were found to be stable for, at least, one month during method development. Laboratories should use standard QC practices to determine when standards need to be replaced. The target analyte manufacturer’s guidelines may be helpful when making the determination.

**NOTE:** Stock standards (Sect. [7.2.1.1](#), [7.2.2.1](#) and [7.2.3.1](#)) were stored at  $\leq 4$  °C. Primary dilution standards (Sect. [7.2.1.2](#), [7.2.2.2](#) and [7.2.3.2](#)) were stored at room temperature to prevent adsorption of the method analytes onto the container surfaces that may occur when refrigerated. Storing the standards at room temperature will also minimize daily imprecision due to the potential of inadequate room temperature stabilization. However, standards may be stored cold provided the standards are allowed to come to room temperature and vortexed well prior to use.

7.2.1. INTERNAL (IS) STOCK STANDARD SOLUTIONS – This method uses three IS compounds listed in the table below. These isotopically labeled IS(s) were carefully chosen during method development because they encompass all the functional groups of the method analytes. Although alternate IS standards may be used provided they are isotopically labeled compounds with similar functional groups as the method analytes, the analyst must have documented reasons for using alternate IS(s). Alternate IS(s) must meet the QC requirements in Section [9.3.4](#). Note that different isotopic labels of the same IS(s) are acceptable (e.g.,  $^{13}\text{C}_2$ -PFOA and  $^{13}\text{C}_4$ -PFOA) but will require modification of the MS/MS precursor and product ions.

Internal Standards	Acronym
Perfluoro-[1,2- $^{13}\text{C}_2$ ]octanoic acid	$^{13}\text{C}_2$ -PFOA
Sodium perfluoro-1-[1,2,3,4- $^{13}\text{C}_4$ ]octanesulfonate	$^{13}\text{C}_4$ -PFOS
N-deuteriomethylperfluoro-1-octanesulfonamidoacetic acid	$\text{d}_3$ -NMeFOSAA

7.2.1.1. IS STOCK STANDARD SOLUTIONS (IS SSS) – These IS stocks can be obtained as individual certified stock standard solutions. The ISs can also be purchased as PDSs, making the preparation of individual SSSs unnecessary. Analysis of the IS(s) is less complicated if the IS(s) purchased contains only the linear isomer.

7.2.1.2. INTERNAL STANDARD PRIMARY DILUTION (IS PDS) STANDARD (1-4 ng/μL) – Prepare, or purchase commercially, the IS PDS at a suggested concentration of 1-4 ng/μL. The IS PDS (in methanol with 4 molar equivalents of sodium hydroxide) was purchased from Wellington Labs. Alternatively, the IS PDS can be prepared in methanol containing 4% reagent water. Use 10 μL of this 1-4 ng/μL solution to fortify the final 1-mL extracts (Sect. [11.5](#)). This will yield a concentration of 10-40 ng/mL of each IS in the 1-mL extracts.

IS	Final Conc. of IS PDS (ng/μL)
<sup>13</sup> C <sub>2</sub> -PFOA	1.0
<sup>13</sup> C <sub>4</sub> -PFOS	3.0
d <sub>3</sub> -NMeFOSAA	4.0

7.2.2. SURROGATE (SUR) STANDARD SOLUTIONS – The four SUR(s) listed in the table below were purchased from Wellington Labs as linear only isomers. These isotopically labeled SUR standards were carefully chosen during method development because they encompass most of the functional groups, as well as the water solubility range of the method analytes. Although alternate SUR standards may be used provided they are isotopically labeled compounds with similar functional groups as the method analytes, the analyst must have documented reasons for using alternate SUR standards. The alternate SUR standards chosen must still span the water solubility range of the method analytes. In addition, alternate SUR standards must meet the QC requirements in Section [9.3.5](#).

Surrogates	Acronym
Perfluoro-n-[1,2- <sup>13</sup> C <sub>2</sub> ]hexanoic acid	<sup>13</sup> C <sub>2</sub> -PFHxA
Perfluoro-n-[1,2- <sup>13</sup> C <sub>2</sub> ]decanoic acid	<sup>13</sup> C <sub>2</sub> -PFDA
N-deuterioethylperfluoro-1-octanesulfonamidoacetic acid	d <sub>5</sub> -NEtFOSAA
Tetrafluoro-2-heptafluoropropoxy- <sup>13</sup> C <sub>3</sub> -propanoic acid	<sup>13</sup> C <sub>3</sub> -HFPO-DA

7.2.2.1. SUR STOCK STANDARD SOLUTIONS (SUR SSS) – These SUR stocks can be obtained as individual certified stock standard solutions. The SURs can also be purchased as PDSs, making the preparation of individual SSSs

unnecessary. Analysis of the SUR(s) is less complicated if the SUR(s) purchased contains only the linear isomer.

- 7.2.2.2. SURROGATE PRIMARY DILUTION STANDARD (SUR PDS) (1-4 ng/ $\mu$ L) – Prepare, or purchase commercially, the SUR PDS at a suggested concentration of 1-4 ng/ $\mu$ L. The SUR PDS (in methanol with 4 molar equivalents of sodium hydroxide) was purchased from Wellington Labs. Alternatively, the SUR PDS can be prepared in methanol containing 4% reagent water. Use 10  $\mu$ L of this 1-4 ng/ $\mu$ L solution to fortify all QC and Field Samples. (Sect. [11.5](#)). This will yield SUR concentrations of 40-160 ng/L in the 250 mL aqueous samples.

SUR	Final Conc. of SUR PDS (ng/ $\mu$ L)
$^{13}\text{C}_2$ -PFHxA	1.0
$^{13}\text{C}_2$ -PFDA	1.0
d <sub>5</sub> -NEtFOSAA	4.0
$^{13}\text{C}_3$ -HFPO-DA	1.0

- 7.2.3. ANALYTE STANDARD SOLUTIONS – Analyte standards may be purchased commercially as ampouled solutions or prepared from neat materials. If commercially available, the method analytes must be purchased as technical grade (linear and branched isomers) standards or neat materials. Standards or neat materials that contain only the linear isomer can be substituted only if technical grade (linear and branched isomers) standards or neat material cannot be purchased as quantitative standards (see note below regarding PFOA). At the time of this method development, PFHxS, PFOS, NEtFOSAA and NMeFOSAA are available as technical grade (containing branched and linear isomers) and therefore must be purchased as technical grade.

**A qualitative standard (Sect. [3.19](#)) is available for PFOA that contains the linear and branched isomers (Wellington Labs, Cat. No. T-PFOA, or equivalent). This qualitative PFOA standard must be purchased and used to identify the retention times of the branched PFOA isomers, but the linear only PFOA standard must be used for quantitation (Sect. [12.2](#)) until a quantitative PFOA standard containing the branched and linear isomers becomes commercially available.**

PFHxS, PFOS, ADONA, 9Cl-PF3ONS and 11Cl-PF3OUdS may not be available as the acids listed in Section [1.1](#), but rather as their corresponding salts, such as  $\text{NH}_4^+$ ,  $\text{Na}^+$  and  $\text{K}^+$ . These salts are acceptable starting materials for the stock standards provided the measured mass is corrected for the salt content according to the equation below. Prepare the Analyte Stock and Primary Dilutions Standards as described below.

$$Mass_{acid} = MeasuredMass_{salt} \times \frac{MW_{acid}}{MW_{salt}}$$

where:

$MW_{acid}$  = the molecular weight of PFAS

$MW_{salt}$  = the molecular weight of purchased salt

- 7.2.3.1. ANALYTE STOCK STANDARD SOLUTION (SSS) – Analyte standards may be purchased commercially as ampouled solutions prepared from neat materials. Commercially prepared SSSs are available for all method analytes. During method development, mixes or individual stocks were obtained from Accustandard, Absolute, Wellington Labs and Synquest. When using these stock standards to prepare a PDS, care must be taken to ensure that these standards are at room temperature and adequately vortexed.
- 7.2.3.2. ANALYTE PRIMARY DILUTION STANDARD (PDS) SOLUTION (0.5-2.5 ng/μL) – The analyte PDS contains all the method analytes of interest at various concentrations in methanol containing 4% water (or in methanol containing 4 molar equivalents of sodium hydroxide). The ESI and MS/MS response varies by compound; therefore, a mix of concentrations may be needed in the analyte PDS. See Tables 5-9 in Section 17 for suggested concentrations for each analyte. During method development, the analyte PDS was prepared such that approximately the same instrument response was obtained for all the analytes. The analyte PDS is prepared by dilution of the combined Analyte Stock Standard Solutions and is used to prepare the CAL standards, and fortify the LFBs, LFSMs, and LFSMDs with the method analytes. If the PDS is stored cold, care must be taken to ensure that these standards are at room temperature and adequately vortexed before usage.
- 7.2.4. CALIBRATION STANDARDS (CAL) – At least five calibration concentrations are required to prepare the initial calibration curve spanning a 20-fold concentration range (Sect. 10.2). Larger concentration ranges will require more calibration points. Prepare the CAL standards over the concentration range of interest from dilutions of the analyte PDS in methanol containing 4% reagent water. The suggested analyte concentrations found in Tables 5-9 can be used as a starting point for determining the calibration range. The IS and SUR are added to the CAL standards at a constant concentration. During method development, the concentrations of the SUR(s) were 10-40 pg/μL in the standard (40-160 ng/L in the sample) and the IS(s) were 10-40 ng/mL. The lowest concentration CAL standard must be at or below the MRL, which may depend on system sensitivity. The CAL standards may also be used as CCCs (Sect. 9.3.2).

## 8. SAMPLE COLLECTION, PRESERVATION, AND STORAGE

### 8.1. SAMPLE BOTTLE PREPARATION

- 8.1.1. Samples must be collected in a 250-mL polypropylene bottle fitted with a polypropylene screw-cap.
- 8.1.2. The preservation reagent, listed in the table below, is added to each sample bottle as a solid prior to shipment to the field (or prior to sample collection).

Compound	Amount	Purpose
Trizma® (Sect. <a href="#">7.1.5</a> )	5.0 g/L	buffering reagent and removes free chlorine

### 8.2. SAMPLE COLLECTION

- 8.2.1. The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.
- 8.2.1. Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.
- 8.2.2. Fill sample bottles, taking care not to flush out the sample preservation reagent. Samples do not need to be collected headspace free.
- 8.2.3. After collecting the sample, cap the bottle and agitate by hand until preservative is dissolved. Keep the sample sealed from time of collection until extraction.

### 8.3. FIELD REAGENT BLANKS (FRB)

- 8.3.1. An FRB must be handled along with each sample set. The sample set is composed of samples collected from the same sample site and at the same time. At the laboratory, fill the field blank sample bottle with reagent water, then seal, and ship to the sampling site along with the sample bottles. For each FRB shipped, a second FRB bottle containing only the preservative must also be shipped. At the sampling site, the sampler must open the shipped FRB and pour the preserved reagent water into the empty shipped sample bottle, seal and label this bottle as the FRB. The FRB is shipped back to the laboratory along with the samples and analyzed to ensure that PFAS were not introduced into the sample during sample collection/handling.
- 8.3.2. The same batch of preservative must be used for the FRBs as for the field samples.

8.3.3. The reagent water used for the FRBs must be initially analyzed for method analytes as a LRB (using the same lot of sample bottles as the field samples) and must meet the LRB criteria in Section [9.3.1](#) prior to use. This requirement will ensure samples are not being discarded due to contaminated reagent water or sample bottles rather than contamination during sampling.

8.4. **SAMPLE SHIPMENT AND STORAGE** – Samples must be chilled during shipment and must not exceed 10 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 10 °C when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 °C until extraction but must not be frozen.

**NOTE:** Samples that are significantly above 10° C, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

8.5. **SAMPLE AND EXTRACT HOLDING TIMES** – Results of the sample storage stability study ([Table 10](#)) indicated that all compounds listed in this method have adequate stability for 14 days when collected, preserved, shipped and stored as described in Sections [8.1](#), [8.2](#), and [8.4](#). Therefore, water samples should be extracted as soon as possible but must be extracted within 14 days. Extracts must be stored at room temperature and analyzed within 28 days after extraction. The extract storage stability study data are presented in [Table 11](#).

## 9. QUALITY CONTROL

9.1. QC requirements include the Initial Demonstration of Capability (IDC) and ongoing QC requirements that must be met when preparing and analyzing Field Samples. This Section describes the QC parameters, their required frequencies, and the performance criteria that must be met in order to meet EPA quality objectives. The QC criteria discussed in the following sections are summarized in [Table 12](#) and [Table 13](#). These QC requirements are considered the minimum acceptable QC criteria. Laboratories are encouraged to institute additional QC practices to meet their specific needs.

9.1.1. **METHOD MODIFICATIONS** – The analyst is permitted to modify LC columns, LC conditions, evaporation techniques, internal standards or surrogate standards, and MS and MS/MS conditions. Each time such method modifications are made, the analyst must repeat the procedures of the IDC. **Modifications to LC conditions should still produce conditions such that co-elution of the method analytes is minimized to reduce the probability of suppression/enhancement effects.**

9.2. **INITIAL DEMONSTRATION OF CAPABILITY** – The IDC must be successfully performed prior to analyzing any Field Samples. Prior to conducting the IDC, the

analyst must first generate an acceptable Initial Calibration following the procedure outlined in Section [10.2](#).

- 9.2.1. INITIAL DEMONSTRATION OF BRANCHED vs LINEAR ISOMER PROFILE for PFOA IN A QUALITATIVE STANDARD – Prepare and analyze a qualitative standard used for identifying retention times of branch isomers of PFOA. Identify the retention times of branched isomers of PFOA in the purchased technical grade PFOA standard. This qualitative PFOA standard is not used for quantitation (see Section [12.2](#)). This branched isomer identification check must be repeated any time changes occur that affect the analyte retention times.
- 9.2.2. INITIAL DEMONSTRATION OF LOW SYSTEM BACKGROUND – Any time a new lot of SPE cartridges, solvents, centrifuge tubes, disposable pipets, and autosampler vials are used, it must be demonstrated that an LRB is reasonably free of contamination and that the criteria in Section [9.3.1](#) are met. If an automated extraction system is used, an LRB should be extracted on each port to ensure that all the valves and tubing are free from potential PFAS contamination.
- 9.2.3. INITIAL DEMONSTRATION OF PRECISION (IDP) – Prepare, extract, and analyze four to seven replicate LFBs fortified near the midrange of the initial calibration curve according to the procedure described in Section [11.4](#). Sample preservatives as described in Section [8.1.2](#) must be added to these samples. The relative standard deviation (RSD) of the results of the replicate analyses must be less than 20%.
- 9.2.4. INITIAL DEMONSTRATION OF ACCURACY (IDA) – Using the same set of replicate data generated for Section [9.2.3](#), calculate average recovery. The average recovery of the replicate values must be within  $\pm 30\%$  of the true value.
- 9.2.5. INITIAL DEMONSTRATION OF PEAK ASYMMETRY FACTOR – Peak asymmetry factors must be calculated using the equation in Section [9.3.9](#) for the first two eluting peaks (if only two analytes are being analyzed, both must be evaluated) in a mid-level CAL standard. The peak asymmetry factors must fall in the range of 0.8 to 1.5. See guidance in Section [10.2.4.1](#) if the calculated peak asymmetry factors do not meet the criteria.
- 9.2.6. MINIMUM REPORTING LEVEL (MRL) CONFIRMATION – Establish a target concentration for the MRL based on the intended use of the method. The MRL may be established by a laboratory for their specific purpose or may be set by a regulatory agency. Establish an Initial Calibration following the procedure outlined in Section [10.2](#). The lowest CAL standard used to establish the Initial Calibration (as well as the low-level CCC, Section [10.3](#)) must be at or below the concentration of the MRL. Establishing the MRL concentration too low may cause repeated failure of ongoing QC requirements. Confirm the MRL following the procedure outlined below.

- 9.2.6.1. Fortify, extract, and analyze seven replicate LFBs at the proposed MRL concentration. These LFBs must contain all method preservatives described in Section [8.1.2](#). Calculate the mean measured concentration (*Mean*) and standard deviation for these replicates. Determine the Half Range for the prediction interval of results ( $HR_{PIR}$ ) using the equation below

$$HR_{PIR} = 3.963s$$

where

$$\begin{array}{ll} s & = \text{the standard deviation} \\ 3.963 & = \text{a constant value for seven replicates.}^1 \end{array}$$

- 9.2.6.2. Confirm that the upper and lower limits for the Prediction Interval of Result ( $PIR = Mean \pm HR_{PIR}$ ) meet the upper and lower recovery limits as shown below

The Upper PIR Limit must be  $\leq 150\%$  recovery.

$$\frac{Mean + HR_{PIR}}{Fortified\ Concentration} \times 100\% \leq 150\%$$

The Lower PIR Limit must be  $\geq 50\%$  recovery.

$$\frac{Mean - HR_{PIR}}{Fortified\ Concentration} \times 100\% \geq 50\%$$

- 9.2.6.3. The MRL is validated if both the Upper and Lower PIR Limits meet the criteria described above (Sect. [9.2.6.2](#)). If these criteria are not met, the MRL has been set too low and must be determined again at a higher concentration.
- 9.2.7. CALIBRATION CONFIRMATION – Analyze a QCS as described in Section [9.3.10](#) to confirm the accuracy of the standards/calibration curve.
- 9.2.8. DETECTION LIMIT DETERMINATION (*optional*) – *While DL determination is not a specific requirement of this method, it may be required by various regulatory bodies associated with compliance monitoring. It is the responsibility of the laboratory to determine if DL determination is required based upon the intended use of the data.*
- 9.2.8.1. Replicate analyses for this procedure should be done over at least three days (i.e., both the sample extraction and the LC/MS/MS analyses should be done over at least three days). Prepare at least seven replicate LFBs at a concentration estimated to be near the DL. This concentration may be estimated by selecting a concentration at 2-5 times the noise level. The DLs in [Table 5](#) were calculated from LFBs fortified at various concentrations as

indicated in the table. The appropriate fortification concentrations will be dependent upon the sensitivity of the LC/MS/MS system used. All preservation reagents listed in Section [8.1.2](#) must also be added to these samples. Analyze the seven replicates through all steps of Section [11](#).

**NOTE:** If an MRL confirmation data set meets these requirements, a DL may be calculated from the MRL confirmation data, and no additional analyses are necessary.

Calculate the *DL* using the following equation

$$DL = s \times t_{(n-1, 1-\alpha=0.99)}$$

where

*s* = standard deviation of replicate analyses

$t_{(n-1, 1-\alpha=0.99)}$  = Student's t value for the 99% confidence level with *n*-1 degrees of freedom

*n* = number of replicates.

**NOTE:** Do not subtract blank values when performing DL calculations. The DL is a statistical determination of precision only.<sup>2</sup> If the DL replicates are fortified at a low enough concentration, it is likely that they will not meet the precision and accuracy criteria for CCCs. Therefore, no precision and accuracy criteria are specified.

9.2.8.2. If a laboratory is establishing their own MRL, the calculated DLs should not be used as the MRL for analytes that commonly occur as background contaminants. Method analytes that are seen in the background should be reported as present in Field Samples, only after careful evaluation of the background levels. It is recommended that a MRL be established at the mean LRB concentrations + 3σ or 3 times the mean LRB concentration, whichever is greater. This value should be calculated over a period of time, to reflect variability in the blank measurements. It is recommended that this value be used as an MRL in order to avoid reporting false positive results.

9.3. ONGOING QC REQUIREMENTS – This Section summarizes the ongoing QC criteria that must be followed when processing and analyzing Field Samples.

9.3.1. LABORATORY REAGENT BLANK (LRB) – An LRB is required with each extraction batch (Sect. [3.6](#)) to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. If more than 20 Field Samples are included in a batch, analyze an LRB for every 20 samples. If the LRB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before

proceeding. Background from method analytes or other contaminants that interfere with the measurement of method analytes must be below 1/3 of the MRL. Blank contamination is estimated by extrapolation, if the concentration is below the lowest CAL standard. This extrapolation procedure is not allowed for sample results as it may not meet data quality objectives. If the method analytes are detected in the LRB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch. Because background contamination is a significant problem for several method analytes, maintaining a historical record of LRB data is highly recommended.

- 9.3.2. CONTINUING CALIBRATION CHECK (CCC) – CCC Standards are analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch. See Section [10.3](#) for concentration requirements and acceptance criteria.
- 9.3.3. LABORATORY FORTIFIED BLANK (LFB) – An LFB is required with each extraction batch (Sect. [3.6](#)). The fortified concentration of the LFB must be rotated between low, medium, and high concentrations from batch to batch. The low concentration LFB must be as near as practical to, but no more than two times, the MRL. Similarly, the high concentration LFB should be near the high end of the calibration range established during the initial calibration (Sect. [10.2](#)). Results of the low-level LFB analyses must be 50-150% of the true value. Results of the medium and high-level LFB analyses must be 70-130% of the true value. If the LFB results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.
- 9.3.4. INTERNAL STANDARDS (IS) – The analyst must monitor the peak areas of the IS(s) in all injections during each analysis day. The IS responses (peak areas) in any chromatographic run must be within 70-140% of the response in the most recent CCC and must not deviate by more than 50% from the average area measured during initial analyte calibration. If the IS areas in a chromatographic run do not meet these criteria, inject a second aliquot of that extract aliquotted into a new capped autosampler vial. Random evaporation losses have been observed with the polypropylene caps causing high IS(s) areas.
  - 9.3.4.1. If the reinjected aliquot produces an acceptable IS response, report results for that aliquot.
  - 9.3.4.2. If the reinjected extract fails again, the analyst should check the calibration by reanalyzing the most recently acceptable CAL standard. If the CAL standard fails the criteria of Section [10.3](#), recalibration is in order per Section [10.2](#). If the CAL standard is acceptable, extraction of the sample may need to be repeated provided the sample is still within the holding time.

Otherwise, report results obtained from the reinjected extract, but annotate as suspect. Alternatively, collect a new sample and re-analyze.

- 9.3.5. SURROGATE RECOVERY – The SUR standard is fortified into all samples, CCCs, LRBs, LFBs, LFSMs, LFSMDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The SUR is a means of assessing method performance from extraction to final chromatographic measurement. Calculate the recovery (%R) for the SUR using the following equation

$$\%R = \left( \frac{A}{B} \right) \times 100$$

where

*A* = calculated SUR concentration for the QC or Field Sample

*B* = fortified concentration of the SUR.

- 9.3.5.1. SUR recovery must be in the range of 70-130%. When SUR recovery from a sample, blank, or CCC is less than 70% or greater than 130%, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4) instrument performance. Correct the problem and reanalyze the extract.
- 9.3.5.2. If the extract reanalysis meets the SUR recovery criterion, report only data for the reanalyzed extract.
- 9.3.5.3. If the extract reanalysis fails the 70-130% recovery criterion, the analyst should check the calibration by injecting the last CAL standard that passed. If the CAL standard fails the criteria of Section [10.3](#), recalibration is in order per Section [10.2](#). If the CAL standard is acceptable, extraction of the sample should be repeated provided the sample is still within the holding time. If the re-extracted sample also fails the recovery criterion, report all data for that sample as suspect/SUR recovery to inform the data user that the results are suspect due to SUR recovery. Alternatively, collect a new sample and re-analyze.
- 9.3.6. LABORATORY FORTIFIED SAMPLE MATRIX (LFSM) – Analysis of an LFSM is required in each extraction batch and is used to determine that the sample matrix does not adversely affect method accuracy. Assessment of method precision is accomplished by analysis of a Field Duplicate (FD) (Sect. [9.3.7](#)); however, infrequent occurrence of method analytes would hinder this assessment. If the occurrence of method analytes in the samples is infrequent, or if historical trends are unavailable, a second LFSM, or LFSMD, must be prepared, extracted, and analyzed from a duplicate of the Field Sample. Extraction batches that contain LFSMDs will not require the extraction of a FD. If a variety of different sample matrices are analyzed regularly, for example, drinking water from groundwater and surface water sources, method performance should be

established for each. Over time, LFSM data should be documented by the laboratory for all routine sample sources.

9.3.6.1. Within each extraction batch (Sect. 3.6), a minimum of one Field Sample is fortified as an LFSM for every 20 Field Samples analyzed. The LFSM is prepared by spiking a sample with an appropriate amount of the Analyte PDS (Sect. 7.2.3.2). Select a spiking concentration that is greater than or equal to the matrix background concentration, if known. Use historical data and rotate through the low, mid and high concentrations when selecting a fortifying concentration.

9.3.6.2. Calculate the percent recovery (%*R*) for each analyte using the equation

$$\%R = \frac{(A - B)}{C} \times 100$$

where

- A = measured concentration in the fortified sample
- B = measured concentration in the unfortified sample
- C = fortification concentration.

9.3.6.3. Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 70-130%, except for low-level fortification near or at the MRL (within a factor of 2-times the MRL concentration) where 50-150% recoveries are acceptable. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCCs, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.3.7. FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or LFSMD) – Within each extraction batch (not to exceed 20 Field Samples, Sect. 3.6), a minimum of one FD or LFSMD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an LFSMD should be analyzed rather than an FD.

9.3.7.1. Calculate the relative percent difference (*RPD*) for duplicate measurements (*FD1* and *FD2*) using the equation

$$RPD = \frac{|FD1 - FD2|}{(FD1 + FD2)/2} \times 100$$

9.3.7.2. RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the MRL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of

any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCC, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

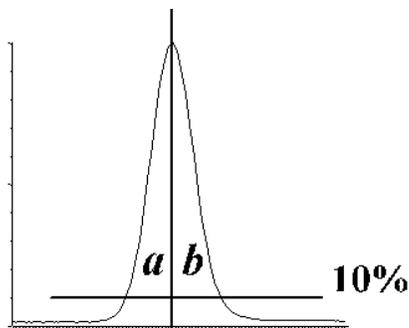
- 9.3.7.3. If an LFSMD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate LFSMs (LFSM and LFSMD) using the equation

$$RPD = \frac{|LFSM - LFSMD|}{(LFSM + LFSMD)/2} \times 100$$

- 9.3.7.4. RPDs for duplicate LFSMs must be  $\leq 30\%$  for samples fortified at or above their native concentration. Greater variability may be observed when LFSMs are fortified at analyte concentrations that are within a factor of 2 of the MRL. LFSMs fortified at these concentrations must have RPDs that are  $\leq 50\%$  for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCC, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

- 9.3.8. FIELD REAGENT BLANK (FRB) – The purpose of the FRB is to ensure that PFAS measured in the Field Samples were not inadvertently introduced into the sample during sample collection/handling. Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the MRL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample. If the method analyte(s) found in the Field Sample is present in the FRB at a concentration greater than 1/3 the MRL, then all samples collected with that FRB are invalid and must be recollected and reanalyzed.
- 9.3.9. PEAK ASYMMETRY FACTOR – A peak asymmetry factor must be calculated using the equation below during the IDC and every time chromatographic changes are made that may affect peak shape. The peak asymmetry factor for the first two eluting peaks in a mid-level CAL standard (if only two analytes are being analyzed, both must be evaluated) must fall in the range of 0.8 to 1.5. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted. See guidance in Section [10.2.4.1](#) if the calculated peak asymmetry factors do not meet the criteria.

$$A_s = \frac{b}{a}$$



where:

$A_s$  = peak asymmetry factor

$B$  = width of the back half of the peak measured (at 10% peak height) from the trailing edge of the peak to a line dropped perpendicularly from the peak apex

$a$  = the width of the front half of the peak measured (at 10% peak height) from the leading edge of the peak to a line dropped perpendicularly from the apex.

9.3.10. QUALITY CONTROL SAMPLES (QCS) – As part of the IDC (Sect. 9.2), each time a new Analyte PDS (Sect. 7.2.3.2) is prepared, and at least quarterly, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared at a mid-level concentration and analyzed just like a CCC. Acceptance criteria for the QCS are identical to the CCCs; the calculated amount for each analyte must be  $\pm 30\%$  of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedure to locate and correct the problem.

## **10. CALIBRATION AND STANDARDIZATION**

10.1. Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCC is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.

### 10.2. INITIAL CALIBRATION

#### 10.2.1. ESI-MS/MS TUNE

10.2.1.1. Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.

10.2.1.2. Optimize the  $[M-H]^-$  or  $[M-CO_2]^-$  for each method analyte by infusing approximately 0.5-1.0  $\mu\text{g/mL}$  of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow

rate (approximately 0.3 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima. See [Table 2](#) for ESI-MS conditions used in method development.

10.2.1.3. Optimize the product ion (Sect. [3.18](#)) for each analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.3 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions and the sulfonic acids have similar MS/MS conditions. See [Table 4](#) for MS/MS conditions used in method development.

10.2.2. Establish LC operating parameters that optimize resolution and peak shape. Suggested LC conditions can be found in [Table 1](#). The LC conditions listed in [Table 1](#) may not be optimum for all LC systems and may need to be optimized by the analyst (See Sect. [10.2.4.1](#)). Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

**Cautions: LC system components, as well as the mobile phase constituents, contain many of the analytes in this method. Thus, these PFAS will build up on the head of the LC column during mobile phase equilibration. To minimize the background PFAS peaks and to keep background levels constant, the time the LC column sits at initial conditions must be kept constant and as short as possible (while ensuring reproducible retention times). In addition, prior to daily use, flush the column with 100% methanol for at least 20 min before initiating a sequence. It may be necessary on some systems to flush other LC components such as wash syringes, sample needles or any other system components before daily use.**

**Mobile phase modifiers other than 20 mM ammonium acetate may be used at the discretion of the analyst, provided that the retention time stability criteria in Sect. [11.7.2](#) can be met over a period of two weeks. During method development, retention times shifted to shorter and shorter times as days progressed when mobile phases with less than 20 mM ammonium acetate were used.**

10.2.3. Inject a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ( $[M-H]^-$ ; Sect. [3.16](#)) for the analytes in each window and choose the most abundant product

ion. The product ions (also the quantitation ions) chosen during method development are in [Table 4](#), although these will be instrument dependent. For maximum sensitivity, small mass windows of  $\pm 0.5$  daltons around the product ion mass were used for quantitation.

**NOTE: There have been reports<sup>10</sup> that not all product ions in the linear PFOS are produced in all branched PFOS isomers. (This phenomenon may exist for many of the PFAS.) Thus, to reduce PFOS, PFBS and PFHxS bias, it is required that the precursor  $m/z \rightarrow m/z$  80 transition be used as the quantitation transition. Some MS/MS instruments, may not be able to scan a product ion with such a wide mass difference from the precursor ion; therefore, if the MS/MS cannot measure the precursor  $m/z \rightarrow m/z$  80 transition they may not be used for this method if PFOS, PFBS, or PFHxS analysis is to be conducted.**

10.2.4. Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.

**NOTE: Ensure that the retention time window used to collect data for each analyte is sufficient to detect earlier eluting branched isomers.**

10.2.4.1. If broad, split or fronting peaks are observed for the first two eluting chromatographic peaks (if only two analytes are being analyzed, both must be evaluated), change the initial mobile phase conditions to higher aqueous content until the peak asymmetry ratio for each peak is 0.8 – 1.5. The peak asymmetry factor is calculated as described in Section [9.3.9](#) on a mid-level CAL standard. The peak asymmetry factor must meet the above criteria for the first two eluting peaks during the IDC and every time a new calibration curve is generated. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

10.2.4.2. Most PFAS are produced by two different processes. One process gives rise to linear PFAS only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS can potentially be found in the environment. Refer to Section [12.2](#) for guidance on integration and quantitation of PFAS.

10.2.5. Prepare a set of at least five CAL standards as described in Section [7.2.4](#). The lowest concentration CAL standard must be at or below the MRL, which may depend on system sensitivity. It is recommended that at least four of the CAL standards are at a concentration greater than or equal to the MRL.

10.2.6. The LC/MS/MS system is calibrated using the IS technique. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve

for each of the analytes. This curve **must always** be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes.

10.2.7. CALIBRATION ACCEPTANCE CRITERIA – Validate the initial calibration by calculating the concentration of each analyte as an unknown against its regression equation. For calibration levels that are  $\leq$  MRL, the result for each analyte must be within  $\pm 50\%$  of the true value. All other calibration points must calculate to be within  $\pm 30\%$  of their true value. If these criteria cannot be met, the analyst will have difficulty meeting ongoing QC criteria. It is recommended that corrective action is taken to reanalyze the CAL standards, restrict the range of calibration, or select an alternate method of calibration (forcing the curve through zero is still required).

**CAUTION:** When acquiring MS/MS data, LC operating conditions must be carefully reproduced for each analysis to provide reproducible retention times. If this is not done, the correct ions will not be monitored at the appropriate times. As a precautionary measure, the chromatographic peaks in each window must not elute too close to the edge of the segment time window.

10.3. CONTINUING CALIBRATION CHECK (CCC) – Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a “sample” is considered to be a Field Sample. LRBs, CCCs, LFBs, LFSMs, FDs FRBs and LFSMDs are not counted as samples. The beginning CCC of each analysis batch must be at or below the MRL to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCCs should alternate between a medium and high concentration CAL standard.

10.3.1. Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.

10.3.2. Determine that the absolute areas of the quantitation ions of the IS(s) are within 70-140% of the areas measured in the most recent continuing calibration check, and within 50-150% from the average areas measured during initial calibration. If any of the IS areas has changed by more than these amounts, adjustments must be made to restore system sensitivity. These adjustments may include cleaning of the MS ion source, or other maintenance as indicated in Section [10.3.4](#). Major instrument maintenance requires recalibration (Sect. [10.2](#)) and verification of sensitivity by analyzing a CCC at or below the MRL (Sect. [10.3](#)). Control charts are useful aids in documenting system sensitivity changes.

10.3.3. Calculate the concentration of each analyte and SUR in the CCC. The calculated amount for each analyte and SUR for medium and high level CCCs must be within  $\pm 30\%$  of the true value. The calculated amount for the lowest calibration point for each analyte must be within  $\pm 50\%$  and the SUR must be within  $\pm 30\%$  of the true value. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken (Sect. [10.3.4](#)) which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification that are still within holding time must be reanalyzed after adequate calibration has been restored, with the following exception. **If the CCC fails because the calculated concentration is greater than 130% (150% for the low-level CCC) for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.**

10.3.4. REMEDIAL ACTION – Failure to meet CCC QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration (Sect. [10.2](#)) and verification of sensitivity by analyzing a CCC at or below the MRL (Sect. [10.3](#))

## 11. PROCEDURE

11.1. This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. The data presented in Tables 5-11 demonstrate data collected by manual extraction. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the LRBs should be rotated among the ports to ensure that all the valves and tubing meet the LRB requirements (Sect. [9.3.1](#)).

11.2. Some of the PFAS adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent (Sect. [11.4.4](#)) whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected (Sect. [11.4.4](#)).

**NOTE:** The SPE cartridges and sample bottles described in this Section are designed as single use items and must be discarded after use. They may not be refurbished for reuse in subsequent analyses.

### 11.3. SAMPLE PREPARATION

11.3.1. Samples are preserved, collected and stored as presented in Section [8](#). All Field and QC Samples, including the LRB, LFB and FRB, must contain the dechlorinating agent listed in Section [8.1.2](#). Before extraction, verify that the sample pH is  $7 \pm 0.5$ . Determine sample volume. An indirect measurement may

be done in one of two ways: by marking the level of the sample on the bottle or by weighing the sample and bottle to the nearest 1 g. After extraction, proceed to Section [11.6](#) for final volume determination. Some of the PFAS adsorb to surfaces, thus the sample volume may **NOT** be transferred to a graduated cylinder for volume measurement. The LRB, LFB and FRB may be prepared by measuring 250 mL of reagent water with a polypropylene graduated cylinder or filling a 250-mL sample bottle to near the top.

11.3.2. Add an aliquot of the SUR PDS (Sect. [7.2.2.2](#)) to each sample, cap and invert to mix. During method development, a 10- $\mu$ L aliquot of the 1-4 ng/ $\mu$ L SUR PDS (Sect. [7.2.2.2](#)) was added to 250 mL of sample for a final concentration of 40 ng/L for  $^{13}\text{C}_2$ -PFHxA,  $^{13}\text{C}_3$ -HFPO-DA, and  $^{13}\text{C}_2$ -PFDA and 160 ng/L for d<sub>5</sub>-NEtFOSAA.

11.3.3. In addition to the SUR(s) and dechlorination agent, if the sample is an LFB, LFSM, or LFSMD, add the necessary amount of analyte PDS (Sect. [7.2.3.2](#)). Cap and invert each sample to mix.

#### 11.4. CARTRIDGE SPE PROCEDURE

11.4.1. CARTRIDGE CLEAN-UP AND CONDITIONING – DO NOT allow cartridge packing material to go dry during any of the conditioning steps. Rinse each cartridge with 15 mL of methanol. Next, rinse each cartridge with 18 mL of reagent water, without allowing the water to drop below the top edge of the packing. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Add 2-3 mL of reagent water to each cartridge, attach the sample transfer tubes (Sect. [6.9.3](#)), turn on the vacuum, and begin adding sample to the cartridge.

NOTE: If low recoveries are observed for PFBS and PFHxA during the IDC, recoveries may be improved by allowing a one- or two-minute soak time after each addition of the methanol and water used in the clean-up and conditioning step.

11.4.2. SAMPLE EXTRACTON – Adjust the vacuum so that the approximate flow rate is 10-15 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

11.4.3. SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample bottles with two 7.5-mL aliquots of reagent water and draw each aliquot through the sample transfer tubes and the cartridges. Draw air or nitrogen through the cartridge for 5 min at high vacuum (10-15 in. Hg).

**NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs**

**must be treated like the transfer tubes. After the entire sample has passed through the cartridge, the reservoirs must be rinsed to waste with reagent water.**

11.4.4. SAMPLE BOTTLE AND CARTRIDGE ELUTION – Turn off and release the vacuum. Lift the extraction manifold top and insert a rack with collection tubes into the extraction tank to collect the extracts as they are eluted from the cartridges. Rinse the sample bottles with 4 mL of methanol and elute the analytes from the cartridges by pulling the 4 mL of methanol through the sample transfer tubes and the cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion. Repeat sample bottle rinse and cartridge elution with a second 4-mL aliquot of methanol.

NOTE: If low recoveries are observed for PFBS and PFHxA during the IDC, recoveries may be improved by allowing a one or two-minute soak time after each four mL addition of the methanol and water used in the clean-up and conditioning step.

**NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the reservoirs have been rinsed in Section [11.4.3](#), the elution solvent used to rinse the sample bottles must be swirled down the sides of the reservoirs while eluting the cartridge to ensure that any method analytes on the surface of the reservoirs are transferred to the extract.**

11.5. EXTRACT CONCENTRATION – Concentrate the extract to dryness under a gentle stream of nitrogen in a heated water bath (60-65 °C) to remove all the water/methanol mix. Add the appropriate amount of 96:4% (vol/vol) methanol:water solution and the IS PDS (Sect. [7.2.1.2](#)) to the collection vial to bring the volume to 1 mL and vortex. (10 µL of the 1-4 ng/µL IS PDS for extract concentrations of 10-40 ng/mL were used for method development). Transfer a small aliquot with a plastic pipet (Sect. [6.7](#)) to a polypropylene autosampler vial.

**NOTE: It is recommended that the entire 1-mL aliquot not be transferred to the autosampler vial because the polypropylene autosampler caps do not reseal after injection. Therefore, do not store the extracts in the autosampler vials as evaporation losses occur in these autosampler vials. Extracts can be stored in 15-mL centrifuge tubes (Sect. [6.3](#)).**

11.6. SAMPLE VOLUME DETERMINATION – If the level of the sample was marked on the sample bottle, use a graduated cylinder to measure the volume of water required to fill the original sample bottle to the mark made prior to extraction. Determine to the nearest 2 mL. If using weight to determine volume, weigh the empty bottle to the nearest 1 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight (Sect. [11.3.1](#)). Assume a sample density of 1.0 g/mL.

In either case, the sample volume will be used in the final calculations of the analyte concentration (Sect. [12.3](#)).

## 11.7. EXTRACT ANALYSIS

- 11.7.1. Establish operating conditions equivalent to those summarized in Tables 1-4 of Section [17](#). Instrument conditions and columns should be optimized prior to the initiation of the IDC.
- 11.7.2. Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration and completing the IDC can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.
- 11.7.3. Calibrate the system by either the analysis of a calibration curve (Sect. [10.2](#)) or by confirming the initial calibration is still valid by analyzing a CCC as described in Section [10.3](#). If establishing an initial calibration for the first time, complete the IDC as described in Section [9.2](#).
- 11.7.4. Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots (10  $\mu$ L was used in method development), under the same conditions used to analyze the CAL standards.
- 11.7.5. At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard. Comparison of the MS/MS mass spectra is not particularly useful given the limited  $\pm 0.5$  dalton mass range around a single product ion for each method analyte.
- 11.7.6. The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the extract may be diluted with 96%:4% (vol/vol) methanol:water solution and the appropriate amount of IS added to match the original concentration. Re-inject the diluted extract. Incorporate the dilution factor into the final concentration calculations. Acceptable SUR performance (Sect. [9.3.5.1](#)) should be determined from the undiluted sample extract. The resulting data must be documented as a dilution and MRLs adjusted accordingly.

## **12. DATA ANALYSIS AND CALCULATION**

- 12.1. Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in [Table 4](#). Other ions may be selected at the discretion of the analyst.
- 12.2. Because environmental samples may contain both branched and linear isomers for method analytes, but quantitative standards that contain the linear and branched isomers do not exist for all method analytes, integration and quantitation of the PFAS is dependent on type of standard available for each PFAS. It is recognized that some of the procedures described below for integration of standards, QC samples and Field Samples may cause a small amount of unavoidable bias in the quantitation of the method analytes due to the current state of the commercially available standards.
  - 12.2.1. During method development, multiple chromatographic peaks were observed for standards of PFHxS, PFOS, NMeFOSAA, and NEtFOSAA using the LC conditions in [Table 1](#) due to chromatographic resolution of the linear and branched isomers of these compounds. For PFHxS, PFOS, NMeFOSAA and NEtFOSAA, all the chromatographic peaks observed in the standard must be integrated and the areas summed. Chromatographic peaks in all Field Samples and QC samples must be integrated in the same way as the CAL standard for analytes with quantitative standards containing the branched and linear isomers.
  - 12.2.2. For PFOA, identify the branched isomers by analyzing a qualitative standard that includes both linear and branched isomers and compare retention times and tandem mass spectrometry transitions. Quantitate Field Samples and QC samples by integrating the total response (i.e., accounting for peaks that are identified as linear and branched isomers) and relying on the initial calibration with a linear-isomer quantitative PFOA standard.
  - 12.2.3. If standards containing the branched and linear isomers cannot be purchased (i.e., only linear isomer is available), only the linear isomer can be identified and quantitated in Field Samples and QC samples using the linear standard because the retention time of the branched isomers cannot be confirmed.
- 12.3. Calculate analyte and SUR concentrations using the multipoint calibration as described in Section [10.2](#). Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section [11.6](#).
- 12.4. Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.

- 12.5. Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

**NOTE:** Some data in Section [17](#) of this method are reported with more than two significant figures. This is done to better illustrate the method performance.

### **13. METHOD PERFORMANCE**

- 13.1. PRECISION, ACCURACY, AND MINIMUM REPORTING LEVELS – Tables for these data are presented in Section [17](#). LCMRLs and DLs for each method analyte are presented in [Table 5](#). Precision and accuracy are presented for four water matrices: reagent water ([Table 6](#)); chlorinated (finished) ground water ([Table 7](#)); chlorinated (finished) surface water ([Table 8](#)); and private well water ([Table 9](#)).
- 13.2. SAMPLE STORAGE STABILITY STUDIES – An analyte storage stability study was conducted by fortifying the analytes into chlorinated surface water samples that were collected, preserved, and stored as described in Section [8](#). The precision and mean recovery (n=4) of analyses, conducted on Days 0, 8, and 14 are presented in [Table 10](#).
- 13.3. EXTRACT STORAGE STABILITY STUDIES – Extract storage stability studies were conducted on extracts obtained from a chlorinated surface water fortified with the method analytes. The precision and mean recovery (n=4) of injections conducted on Days 0, 8, 14, 22, and 28 are reported in [Table 11](#).
- 13.4. MULTI-LABORATORY DEMONSTRATION – The performance of this method was demonstrated by multiple laboratories, with results similar to those reported in Section [17](#). The authors wish to acknowledge the work of 1) EPA Region 2 in Edison, NJ., 2) Eurofins Eaton Analytical, LLC in Monrovia, CA, and 3) New Jersey Department of Health in Ewing, NJ.

### **14. POLLUTION PREVENTION**

- 14.1. This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.
- 14.2. For information about pollution prevention that may be applicable to laboratory operations, consult “Less is Better: Laboratory Chemical Management for Waste Reduction” available from the American Chemical Society’s Department of Government Relations and Science Policy, 1155 16<sup>th</sup> Street N.W., Washington, D.C., 20036 or on-line at [http://membership.acs.org/c/ccs/pub\\_9.htm](http://membership.acs.org/c/ccs/pub_9.htm) (accessed August 2008).

## 15. WASTE MANAGEMENT

The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

## 16. REFERENCES

1. Winslow, S.D., Pepich, B.V., Martin, J.J., Hallberg, G.R., Munch, D.J., Frebis, C.P., Hedrick, E.J., Krop, R.A. "Statistical Procedures for Determination and Verification of Minimum Reporting Levels for Drinking water Methods." *Environ. Sci. Technol.* 2004, 40, 281-288.
2. Glaser, J.A., D.L. Foerst, G.D. McKee, S.A. Quave, W.L. Budde, "Trace Analyses for Wastewaters." *Environ. Sci. Technol.* 1981, 15, 1426-1435.
3. Martin, J.W., Kannan, K., Berger, U., De Voogt, P., Field, J., Franklin, J., Giesy, J.P., Harner, T., Muir, D.C., Scott, B., Kaiser, M., Järnberg, U., Jones, K.C., Mabury, S.A., Schroeder, H., Simcik, M., Sottani, C., van Bavel, B., Kärrman, A., Lindström, G., van Leeuwen, S. "Analytical Challenges Hamper Perfluoroalkyl Research." *Environ. Sci. Technol.* 2004, 38, 248A-255A.
4. Leenheer, J.A., Rostad, C.E., Gates, P.M., Furlong, E.T., Ferrer, I. "Molecular Resolution and Fragmentation of Fulvic Acid by Electrospray Ionization/Multistage Tandem Mass Spectrometry." *Anal. Chem.* 2001, 73, 1461-1471.
5. Cahill, J.D., Furlong E.T., Burkhardt, M.R., Kolpin, D., Anderson, L.G. "Determination of Pharmaceutical Compounds in Surface- and Ground-Water Samples by Solid-Phase Extraction and High-Performance Liquid Chromatography Electrospray Ionization Mass Spectrometry." *J. Chromatogr. A* 2004, 1041, 171-180.
6. "OSHA Safety and Health Standards, General Industry," (29CFR1910). Occupational Safety and Health Administration, OSHA 2206, (Revised, July 1, 2001).
7. "Carcinogens-Working with Carcinogens," Publication No. 77-206, Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control, National Institute of Occupational Safety and Health, Atlanta, Georgia, August 1977.
8. "Safety in Academic Chemistry Laboratories," American Chemical Society Publication, Committee on Chemical Safety, 8th Edition. Information on obtaining a copy is available at

<https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/safety-in-academic-chemistry-laboratories-students.pdf> (accessed October 2018).

9. “SAB Review of EPA’s Draft Risk Assessment of Potential Human Health Effects Associated with PFOA and Its Salts.” Document available at [http://yosemite.epa.gov/sab/SABPRODUCT.NSF/A3C83648E77252828525717F004B9099/\\$File/sab\\_06\\_006.pdf](http://yosemite.epa.gov/sab/SABPRODUCT.NSF/A3C83648E77252828525717F004B9099/$File/sab_06_006.pdf) (accessed October 2018).
10. Langlois, I. and Oehme, M. “Structural Identification of Isomers Present In Technical Perfluorooctane Sulfonate By Tandem Mass Spectrometry.” Rapid Commun. Mass Spectrom. 2006, 20, 844-850.

## 17. TABLES, DIAGRAMS, FLOWCHARTS AND VALIDATION DATA

**Table 1. LC Method Conditions**

Time (min)	% 20 mM ammonium acetate	% Methanol
Initial	60.0	40.0
1.0	60.0	40.0
25.0	10.0	90.0
32.0	10.0	90.0
32.1	60.0	40.0
37.0	60.0	40.0

Waters Atlantis® dC<sub>18</sub> 2.1 x 150 mm packed with 5.0 µm C<sub>18</sub> stationary phase  
Flow rate of 0.3 mL/min  
10 µL injection into a 50 µL loop

**Table 2. ESI-MS Method Conditions**

ESI Conditions	
Polarity	Negative ion
Capillary needle voltage	-3 kV
Cone gas flow	50 L/hr
Nitrogen desolvation gas	800 L/hr
Desolvation gas temp.	350°C

**Table 3. Method Analytes, Retention Times (RT) and Suggested IS References**

Analyte	Peak # (Fig. 1)	RT (min)	IS# Ref
PFBS	1	7.62	2
PFHxA	2	10.42	1
HFPO-DA	4	11.38	1
PFHpA	6	13.40	1
PFHxS	7	13.58	2
ADONA	8	13.73	1
PFOA	9	15.85	1
PFOS	11	17.91	2
PFNA	13	17.92	1
9Cl-PF3ONS	14	18.91	2
PFDA	15	19.69	1
NMeFOSAA	17	20.50	3
PFUnA	19	21.21	1
NEtFOSAA	20	21.26	3
11Cl-PF3OUdS	22	21.84	2
PFDoA	23	22.52	1
PFTTrDA	24	23.66	1
PFTA	25	24.64	1
<sup>13</sup> C <sub>2</sub> -PFHxA	3	10.42	1
<sup>13</sup> C <sub>3</sub> -HFPO-DA	5	11.40	1
<sup>13</sup> C <sub>2</sub> -PFDA	16	19.69	1
d <sub>5</sub> -NEtFOSAA	21	21.24	3
<sup>13</sup> C <sub>2</sub> -PFOA– IS#1	10	15.85	-
<sup>13</sup> C <sub>4</sub> -PFOS– IS#2	12	17.91	-
d <sub>3</sub> -NMeFOSAA–IS#3	18	20.49	-

**Table 4. MS/MS Method Conditions<sup>a</sup>**

Segment <sup>b</sup>	Analyte	Precursor Ion <sup>c</sup> ( <i>m/z</i> )	Product Ion <sup>c,d</sup> ( <i>m/z</i> )	Cone Voltage (v)	Collision Energy <sup>e</sup> (v)
1	PFBS <sup>g</sup>	299	80	42	30
1	PFH <sub>x</sub> A	313	269	14	10
1	HFPO-DA	285 <sup>f</sup>	169	12	8
2	PFHpA	363	319	12	10
2	PFH <sub>x</sub> S <sup>g,h</sup>	399	80	46	32
2	ADONA	377	251	14	12
3	PFOA	413	369	14	10
3	PFOS <sup>g,h</sup>	499	80	52	42
3	PFNA	463	419	16	12
4	9Cl-PF3ONS	531	351	34	24
4	PFDA	513	469	14	10
4	NMeFOSAA <sup>g</sup>	570	419	30	20
4	PFUnA	563	519	12	10
4	NEtFOSAA <sup>g</sup>	584	419	30	20
4	11Cl-PF3OUdS	631	451	40	24
4	PFDoA	613	569	18	10
5	PFTTrDA	663	619	14	14
5	PFTA	713	669	14	12
1	<sup>13</sup> C <sub>2</sub> -PFH <sub>x</sub> A	315	270	16	10
1	<sup>13</sup> C <sub>3</sub> -HFPO-DA	287	169	10	6
4	<sup>13</sup> C <sub>2</sub> -PFDA	515	470	18	10
4	d <sub>5</sub> -NEtFOSAA	589	419	28	22
3	<sup>13</sup> C <sub>2</sub> -PFOA	415	370	16	10
3	<sup>13</sup> C <sub>4</sub> -PFOS	503	80	58	42
4	d <sub>3</sub> -NMeFOSAA	573	419	28	14

<sup>a</sup> An LC/MS/MS chromatogram of the analytes is shown in [Figure 1](#).

<sup>b</sup> Segments are time durations in which single or multiple scan events occur.

<sup>c</sup> Precursor and product ions listed in this table are nominal masses. During MS and MS/MS optimization, the analyst should determine precursor and product ion masses to one decimal place by locating the apex of the mass spectral peak place (e.g., *m/z* 498.9→79.9 for PFOS). These precursor and product ion masses (with at least one decimal place) should be used in the MS/MS method for all analyses.

<sup>d</sup> Ions used for quantitation purposes.

<sup>e</sup> Argon used as collision gas at a flow rate of 0.15 mL/min.

<sup>f</sup> HFPO-DA is not stable in the ESI source and the [M-H]<sup>-</sup> is not observed under typical ESI conditions. The precursor ion used during method development was [M-CO<sub>2</sub>]<sup>-</sup>.

<sup>g</sup> Analyte has multiple resolved chromatographic peaks due to linear and branched isomers. All peaks summed for quantitation purposes.

<sup>h</sup> To reduce bias regarding detection of branch and linear isomers, the *m/z* 80 product ion must be used for this analyte.

**Table 5. DLs and LCMRLs in Reagent Water**

Analyte	Fortified Conc. (ng/L) <sup>a</sup>	DL <sup>b</sup> (ng/L)	LCMRL <sup>c</sup> (ng/L)
PFBS	4.0	1.8	6.3
PFHxA	4.0	1.0	1.7
HFPO-DA	4.0	1.9	4.3
PFHpA	4.0	0.71	0.63
PFHxS	4.0	1.4	2.4
ADONA	4.0	0.88	0.55
PFOA	4.0	0.53	0.82
PFOS	4.0	1.1	2.7
PFNA	4.0	0.70	0.83
9Cl-PF3ONS	4.0	1.4	1.8
PFDA	4.0	1.6	3.3
NMeFOSAA	4.0	2.4	4.3
PFUnA	4.0	1.6	5.2
NEtFOSAA	4.0	2.8	4.8
11Cl-PF3OUdS	4.0	1.5	1.5
PFDoA	4.0	1.2	1.3
PFTTrDA	4.0	0.72	0.53
PFTA	4.0	1.1	1.2

<sup>a</sup> Spiking concentration used to determine DL.

<sup>b</sup> Detection limits were determined by analyzing seven replicates over three days according to Section [9.2.8](#).

<sup>c</sup> LCMRLs were calculated according to the procedure in reference 1.

**Table 6. Precision and Accuracy (n=8) of PFAS in Fortified Reagent Water**

<b>18. Analyte</b>	<b>Fortified Conc. (ng/L)</b>	<b>Mean % Recovery</b>	<b>% RSD</b>	<b>Fortified Conc. (ng/L)</b>	<b>Mean % Recovery</b>	<b>% RSD</b>
PFBS	16.0	90.8	6.8	80.0	85.1	6.7
PFHxA	16.0	101	8.0	80.0	96.5	4.6
HFPO-DA	16.0	97.8	1.8	80.0	96.8	5.1
PFHpA	16.0	105	3.3	80.0	104	2.7
PFHxS	16.0	109	6.7	80.0	107	4.4
ADONA	16.0	108	1.3	80.0	106	3.6
PFOA	16.0	106	1.8	80.0	104	3.1
PFOS	16.0	111	4.7	80.0	107	4.8
PFNA	16.0	110	2.6	80.0	104	3.6
9Cl-PF3ONS	16.0	108	8.8	80.0	101	3.8
PFDA	16.0	111	2.4	80.0	107	3.6
NMeFOSAA	16.0	104	5.2	80.0	102	5.4
PFUnA	16.0	107	2.8	80.0	101	1.3
NEtFOSAA	16.0	97.7	6.8	80.0	101	2.5
11Cl-PF3OUdS	16.0	109	3.4	80.0	103	6.1
PFDoA	16.0	101	7.2	80.0	107	3.7
PFTTrDA	16.0	108	2.6	80.0	99.1	3.6
PFTA	16.0	110	0.9	80.0	97.2	3.6
<sup>13</sup> C <sub>2</sub> -PFHxA	40.0	88.5	6.4	40.0	97.0	4.9
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40.0	94.5	3.2	40.0	101	9.9
<sup>13</sup> C <sub>2</sub> -PFDA	40.0	99.1	3.4	40.0	106	2.7
d <sub>5</sub> -NEtFOSAA	160	90.0	2.6	160	99.5	4.8

**Table 7. Precision and Accuracy (n=4) of PFAS in Tap Water<sup>a</sup> from a Ground Water Source**

<b>19. Analyte</b>	<b>Fortified Conc. (ng/L)</b>	<b>Mean % Recovery</b>	<b>% RSD</b>	<b>Fortified Conc. (ng/L)</b>	<b>Mean % Recovery</b>	<b>% RSD</b>
PFBS	16.0	104	3.1	80.0	90.2	2.1
PFHxA	16.0	105	3.5	80.0	91.6	3.9
HFPO-DA	16.0	99.6	4.0	80.0	90.6	2.9
PFHpA	16.0	101	3.4	80.0	91.2	4.2
PFHxS	16.0	110.0	3.3	80.0	93.5	4.8
ADONA	16.0	104	3.9	80.0	92.2	4.7
PFOA	16.0	105	2.7	80.0	91.1	4.8
PFOS	16.0	108	3.3	80.0	93.9	3.8
PFNA	16.0	105	2.4	80.0	92.4	6.9
9Cl-PF3ONS	16.0	101	8.1	80.0	92.4	4.9
PFDA	16.0	102	4.5	80.0	92.5	7.7
NMeFOSAA	16.0	92.6	7.4	80.0	87.1	9.4
PFUnA	16.0	104	4.8	80.0	92.8	5.6
NEtFOSAA	16.0	108	18.4	80.0	94.1	6.7
11Cl-PF3OUdS	16.0	103	3.4	80.0	95.4	5.4
PFDoA	16.0	99.4	4.6	80.0	92.0	5.0
PFTTrDA	16.0	98.8	4.1	80.0	93.1	5.9
PFTA	16.0	102	3.7	80.0	93.9	5.0
<sup>13</sup> C <sub>2</sub> -PFHxA	40.0	97.7	3.4	40.0	87.0	6.2
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40.0	97.2	3.9	40.0	88.8	6.2
<sup>13</sup> C <sub>2</sub> -PFDA	40.0	97.5	5.3	40.0	86.0	10
d <sub>5</sub> -NEtFOSAA	160	94.7	8.8	160	80.8	10

<sup>a</sup> TOC = 0.53 mg/L and hardness = 377 mg/L measured as calcium carbonate.

**Table 8. Precision and Accuracy (n=4) Of PFAS in Tap Water<sup>a</sup> from a Surface Water Source**

<b>20. Analyte</b>	<b>Fortified Conc. (ng/L)</b>	<b>Mean % Recovery</b>	<b>% RSD</b>	<b>Fortified Conc. (ng/L)</b>	<b>Mean % Recovery</b>	<b>% RSD</b>
PFBS	16.0	91.6	3.8	80.0	91.9	7.1
PFHxA	16.0	92.0	5.5	80.0	99.3	4.0
HFPO-DA	16.0	88.6	1.3	80.0	102	2.2
PFHpA	16.0	95.5	3.6	80.0	101	3.3
PFHxS	16.0	99.1	2.5	80.0	102	0.9
ADONA	16.0	95.5	2.9	80.0	102	3.5
PFOA	16.0	97.9	5.2	80.0	98.8	3.9
PFOS	16.0	93.5	5.9	80.0	101	2.4
PFNA	16.0	96.4	3.4	80.0	101	2.8
9Cl-PF3ONS	16.0	93.1	4.6	80.0	102	3.3
PFDA	16.0	95.3	1.7	80.0	99.2	3.3
NMeFOSAA	16.0	99.3	7.2	80.0	94.9	4.5
PFUnA	16.0	99.8	1.7	80.0	100	4.1
NEtFOSAA	16.0	93.3	8.0	80.0	90.5	3.9
11Cl-PF3OUdS	16.0	97.6	6.7	80.0	97.5	3.1
PFDoA	16.0	88.0	1.8	80.0	97.0	2.7
PFTTrDA	16.0	94.7	2.5	80.0	95.5	1.8
PFTA	16.0	94.1	5.9	80.0	97.8	3.3
<sup>13</sup> C <sub>2</sub> -PFHxA	40.0	86.3	2.8	40.0	90.6	4.1
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40.0	92.9	2.4	40.0	101	1.8
<sup>13</sup> C <sub>2</sub> -PFDA	40.0	89.3	4.3	40.0	95.8	2.2
d <sub>5</sub> -NEtFOSAA	160	86.5	5.4	160	83.1	4.4

<sup>a</sup> TOC = 2.4 mg/L and hardness = 103 mg/L measured as calcium carbonate.

**Table 9. Precision and Accuracy (n=4) Of PFAS in Tap Water<sup>a</sup> from a Private Well**

<b>21. Analyte</b>	<b>Fortified Conc. (ng/L)</b>	<b>Mean % Recovery</b>	<b>% RSD</b>
PFBS	80.0	99.7	3.1
PFHxA	80.0	96.3	2.7
HFPO-DA	80.0	94.2	4.3
PFHpA	80.0	97.4	1.9
PFHxS	80.0	99.4	4.0
ADONA	80.0	98.7	2.8
PFOA	80.0	97.2	1.5
PFOS	80.0	100	1.9
PFNA	80.0	99.4	1.3
9Cl-PF3ONS	80.0	101	2.2
PFDA	80.0	98.7	2.3
NMeFOSAA	80.0	93.2	4.6
PFUnA	80.0	98.8	1.7
NEtFOSAA	80.0	94.4	0.6
11Cl-PF3OUdS	80.0	99.8	2.5
PFD <sub>o</sub> A	80.0	99.3	1.9
PFT <sub>r</sub> DA	80.0	96.2	1.3
PFTA	80.0	97.9	1.2
<sup>13</sup> C <sub>2</sub> -PFHxA	40.0	89.9	2.7
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40.0	95.7	5.3
<sup>13</sup> C <sub>2</sub> -PFDA	40.0	92.3	1.8
d <sub>5</sub> -NEtFOSAA	160	86.3	4.5

<sup>a</sup> TOC = 0.56 mg/L and hardness = 394 mg/L measured as calcium carbonate.

**Table 10. Aqueous Sample Holding Time Data for Tap Water Samples from a Surface Water Source<sup>a</sup>, Fortified with Method Analytes and Preserved and Stored According to Section 8 (n=4)**

Analyte	Fortified Conc. (ng/L)	Day 0 Mean % Recovery	Day 0 % RSD	Day 8 Mean % Recovery	Day 8 % RSD	Day 14 Mean % Recovery	Day 14 % RSD
PFBS	80.0	91.9	7.1	99.4	4.2	93.4	11
PFHxA	80.0	99.3	4.0	101	5.4	93.4	7.9
HFPO-DA	80.0	102	2.2	101	5.3	100	11
PFHpA	80.0	101	3.3	99.2	2.2	101	3.6
PFHxS	80.0	102	0.9	103	4.0	107	4.5
ADONA	80.0	102	3.5	102	4.7	101	4.4
PFOA	80.0	98.8	3.9	99.8	0.63	100	3.5
PFOS	80.0	101	2.4	101	3.6	106	6.8
PFNA	80.0	101	2.8	101	0.87	105	4.8
9Cl-PF3ONS	80.0	102	3.3	100	2.2	102	4.4
PFDA	80.0	99.2	3.3	99.6	1.6	102	5.5
NMeFOSAA	80.0	94.9	4.5	98.0	3.5	95.4	7.3
PFUnA	80.0	100	4.1	101	4.4	100	6.2
NEtFOSAA	80.0	90.5	3.9	102	5.3	96.5	7.7
11Cl-PF3OUdS	80.0	97.5	3.1	101	4.5	102	5.5
PFDoA	80.0	97.0	2.7	98.4	3.5	103	3.8
PFTTrDA	80.0	95.5	1.8	99.5	3.2	99.4	3.8
PFTA	80.0	97.8	3.3	102	3.2	96.2	2.1
<sup>13</sup> C <sub>2</sub> -PFHxA	40.0	90.6	4.1	93.6	5.5	93.0	8.8
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40.0	101	1.8	101	3.1	91.5	12
<sup>13</sup> C <sub>2</sub> -PFDA	40.0	95.8	2.2	92.6	6.8	104	2.8
d <sub>5</sub> -NEtFOSAA	160	83.1	4.4	87.6	2.6	95.2	4.3

<sup>a</sup> TOC = 2.4 mg/L and hardness = 103 mg/L measured as calcium carbonate.

**Table 11. Extract Holding Time Data for Tap Water Samples from a Surface Water Source, Fortified with Method Analytes and Preserved and Stored According to Section 8 (n=4)**

Analyte	Fortified Conc. (ng/L)	Day 0 Mean % Recovery	Day 0 % RSD	Day 8 Mean % Recovery	Day 8 % RSD	Day 14 Mean % Recovery	Day 14 % RSD	Day 28 Mean % Recovery	Day 28 % RSD
PFBS	80.0	91.9	7.1	96.9	5.1	90.6	10	99.4	5.3
PFHxA	80.0	99.3	4.0	10	1.3	94.1	2.9	105	2.6
HFPO-DA	80.0	102	2.2	103	1.4	98.7	2.6	103	1.1
PFHpA	80.0	101	3.3	102	2.9	98.3	1.0	104	3.5
PFHxS	80.0	102	0.9	105	2.9	99.7	1.8	107	2.5
ADONA	80.0	102	3.5	104	3.7	98.6	2.5	106	2.5
PFOA	80.0	98.8	3.9	106	3.7	101	1.8	106	2.8
PFOS	80.0	101	2.4	102	1.1	103	1.8	109	2.2
PFNA	80.0	101	2.8	105	1.8	103	2.3	107	2.4
9Cl-PF3ONS	80.0	102	3.3	99.4	3.1	97.6	2.9	107	2.2
PFDA	80.0	99.2	3.3	104	1.9	101.2	0.9	107	3.4
NMeFOSAA	80.0	94.9	4.5	101	3.9	90.5	5.2	105	6.8
PFUnA	80.0	100	4.1	104	5.5	102	4.2	106	3.0
NEtFOSAA	80.0	90.5	3.9	104	3.1	93.6	7.7	102	2.9
11Cl-PF3OUdS	80.0	97.5	3.1	103	1.9	97.3	1.6	108	2.7
PFDoA	80.0	97.0	2.7	102	3.7	99.8	3.3	106	2.6
PFTTrDA	80.0	95.5	1.8	102	3.0	97.2	1.6	104	3.1
PFTA	80.0	97.8	3.3	105	4.2	98.8	2.1	108	2.5
<sup>13</sup> C <sub>2</sub> -PFHxA	40.0	90.6	4.1	101	1.2	101	2.6	114	2.1
<sup>13</sup> C <sub>3</sub> -HFPO-DA	40.0	101	1.8	95.5	3.2	96.5	2.7	111	2.5
<sup>13</sup> C <sub>2</sub> -PFDA	40.0	95.8	2.2	100	2.7	109	1.9	124	4.4
d <sub>5</sub> -NEtFOSAA	160	83.1	4.4	94.7	1.6	91.4	4.8	113	9.1

**Table 12. Initial Demonstration of Capability Quality Control Requirements**

Method Reference	Requirement	Specification and Frequency	Acceptance Criteria
Sect. <a href="#">9.2.2</a>	Initial Demonstration of Low System Background	Analyze LRB prior to any other IDC steps.	Demonstrate that all method analytes are below 1/3 the MRL and that possible interferences from extraction media do not prevent the identification and quantification of method analytes.
Sect. <a href="#">9.2.3</a>	Initial Demonstration of Precision (IDP)	Analyze four to seven replicate LFBs fortified near the midrange calibration concentration.	%RSD must be <20%
Sect. <a href="#">9.2.4</a>	Initial Demonstration of Accuracy (IDA)	Calculate average recovery for replicates used in IDP.	Mean recovery $\pm$ 30% of true value
Sect. <a href="#">9.2.5</a>	Initial Demonstration of Peak Asymmetry Factor	Calculate the peak asymmetry factor using the equation in Section <a href="#">9.3.9</a> for the first two eluting chromatographic peaks in a mid-level CAL standard.	Peak asymmetry factor of 0.8 - 1.5
Sect. <a href="#">9.2.6</a>	Minimum Reporting Limit (MRL) Confirmation	Fortify, extract and analyze seven replicate LFBs at the proposed MRL concentration. Calculate the Mean and the Half Range (HR). Confirm that the upper and lower limits for the Prediction Interval of Result (Upper PIR, and Lower PIR, Sect. <a href="#">9.2.6.2</a> ) meet the recovery criteria.	Upper PIR $\leq$ 150% Lower PIR $\geq$ 50%
Sect. <a href="#">9.2.7</a> and <a href="#">9.3.10</a>	Quality Control Sample (QCS)	Analyze a standard from a second source, as part of IDC.	Results must be within 70-130% of true value.
Sect. <a href="#">9.2.8</a>	Detection Limit (DL) Determination (optional)	Over a period of three days, prepare a minimum of seven replicate LFBs fortified at a concentration estimated to be near the DL. Analyze the replicates through all steps of the analysis. Calculate the DL using the equation in Sect. <a href="#">9.2.8.1</a> .	Data from DL replicates are <u>not required</u> to meet method precision and accuracy criteria. If the DL replicates are fortified at a low enough concentration, it is likely that they will not meet precision and accuracy criteria.

**NOTE:** Table 12 is intended as an abbreviated summary of QC requirements provided as a convenience to the method user. Because the information has been abbreviated to fit the table format, there may be issues that need additional clarification, or areas where important additional information from the method text is needed. In all cases, the full text of the QC in Section [9](#) supersedes any missing or conflicting information in this table.

**Table 13. Ongoing Quality Control Requirements (Summary)**

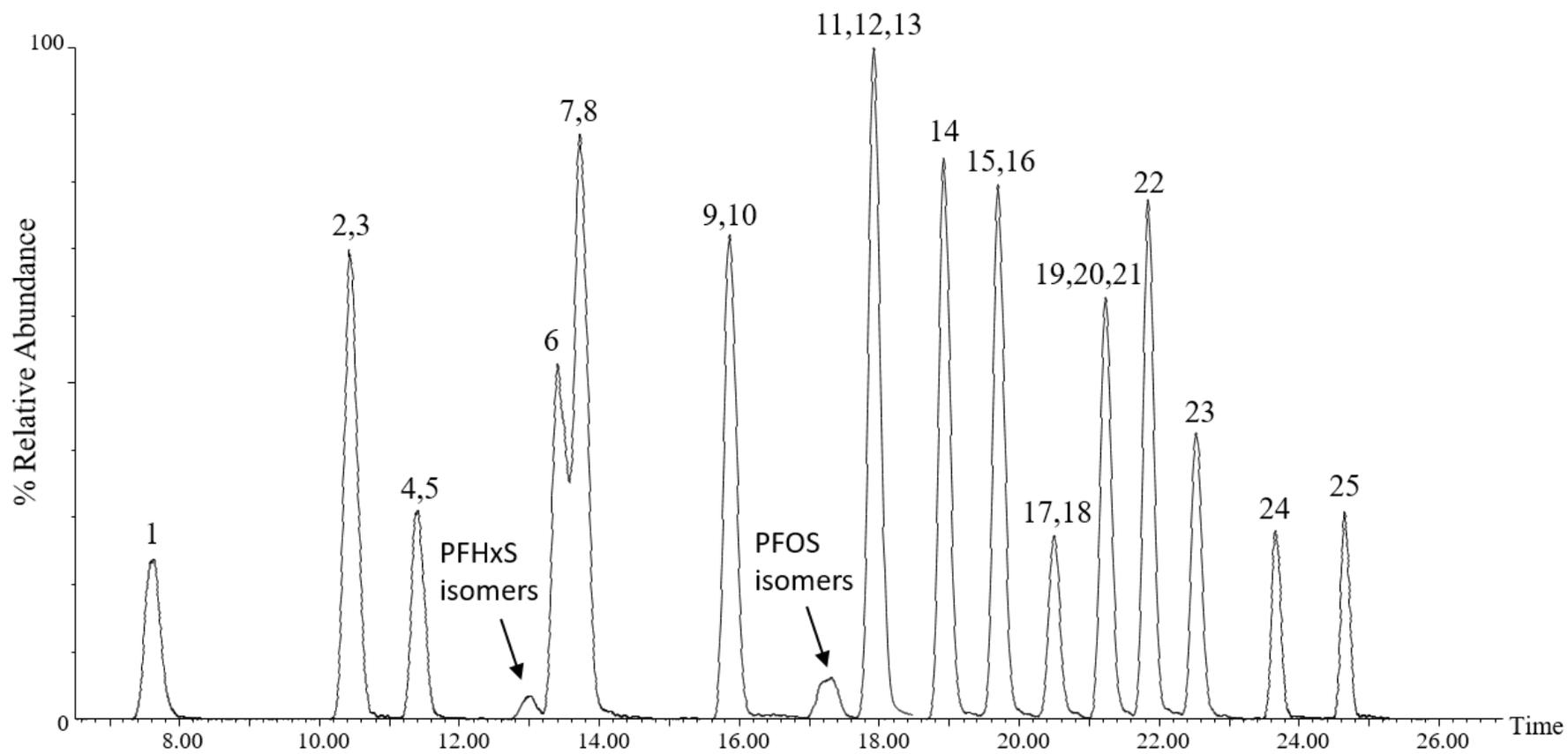
<b>Method Reference</b>	<b>Requirement</b>	<b>Specification and Frequency</b>	<b>Acceptance Criteria</b>
Sect. <a href="#">8.1</a> - Sect. <a href="#">8.5</a>	Sample Holding Time	14 days with appropriate preservation and storage as described in Sections <a href="#">8.1-8.5</a> .	Sample results are valid only if samples are extracted within the sample holding time.
Sect. <a href="#">8.5</a>	Extract Holding Time	28 days when stored at room temperature in polypropylene centrifuge tubes.	Extract results are valid only if extracts are analyzed within the extract holding time.
Sect. <a href="#">9.3.1</a>	Laboratory Reagent Blank (LRB)	One LRB with each extraction batch of up to 20 samples.	Demonstrate that all method analytes are below 1/3 the MRL and confirm that possible interferences do not prevent quantification of method analytes. If targets exceed 1/3 the MRL or if interferences are present, results for these subject analytes in the extraction batch are invalid.
Sect. <a href="#">9.3.3</a>	Laboratory Fortified Blank (LFB)	One LFB is required for each extraction batch of up to 20 Field Samples. Rotate the fortified concentrations between low, medium and high amounts.	Results of LFB analyses must be 70-130% of the true value for each method analyte for all fortified concentrations except the lowest CAL point. Results of the LFBs corresponding to the lowest CAL point for each method analyte must be 50-150% of the true value.
Sect. <a href="#">9.3.4</a>	Internal Standard (IS)	Internal standards, <sup>13</sup> C <sub>2</sub> -PFOA (IS#1), <sup>13</sup> C <sub>4</sub> -PFOS (IS#2), and d <sub>3</sub> -NMeFOSAA (IS#3), are added to all standards and sample extracts, including QC samples. Compare IS areas to the average IS area in the initial calibration and to the most recent CCC.	Peak area counts for all ISs in all injections must be within ± 50% of the average peak area calculated during the initial calibration and 70-140% from the most recent CCC. If ISs do not meet this criterion, corresponding target results are invalid.
Sect. <a href="#">9.3.5</a>	Surrogate Standards (SUR)	Surrogate standards, <sup>13</sup> C <sub>2</sub> -PFHxA, <sup>13</sup> C <sub>3</sub> -HFPO-DA, <sup>13</sup> C <sub>2</sub> -PFDA, and d <sub>5</sub> -NEtFOSAA, are added to all CAL standards and samples, including QC samples. Calculate SUR recoveries.	SUR recoveries must be 70-130% of the true value. If a SUR fails this criterion, report all results for sample as suspect/SUR recovery.

**Table 13. (Continued)**

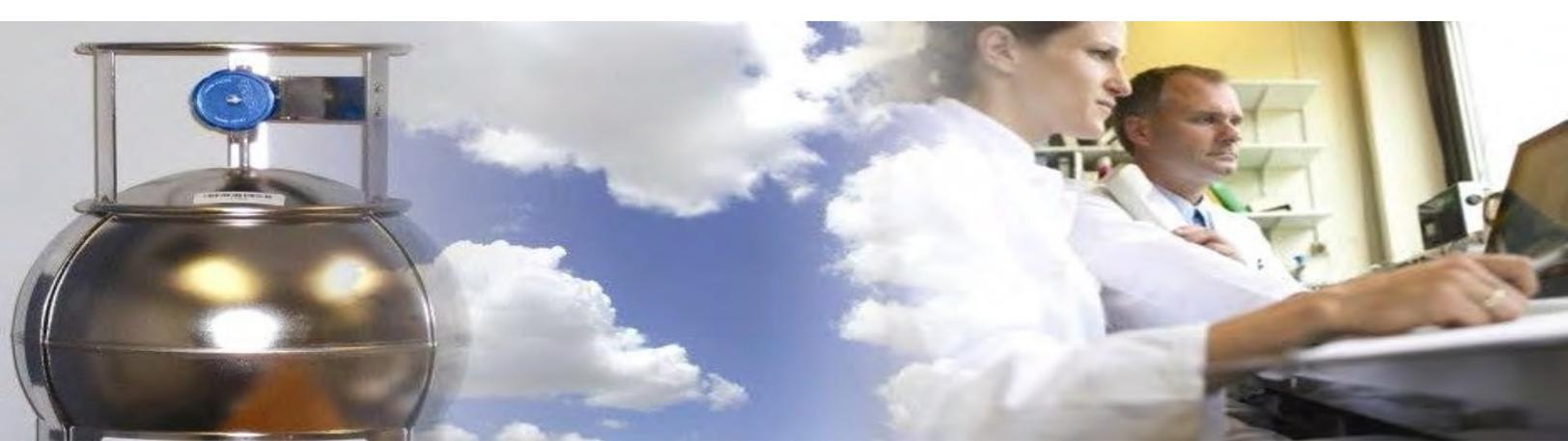
Method Reference	Requirement	Specification and Frequency	Acceptance Criteria
Sect. <a href="#">9.3.6</a>	Laboratory Fortified Sample Matrix (LFSM)	Analyze one LFSM per extraction batch (20 samples or less) fortified with method analytes at a concentration close to but greater than the native concentration, if known. Calculate LFSM recoveries.	Recoveries at mid and high levels must be within 70-130% and within 50-150% at the low-level fortified amount (near the MRL). If these criteria are not met, results are labeled suspect due to matrix effects.
Sect. <a href="#">9.3.7</a>	Laboratory Fortified Sample Matrix Duplicate (LFSMD) or Field Duplicates (FD)	Extract and analyze at least one FD or LFSMD with each extraction batch (20 samples or less). A LFSMD may be substituted for a FD when the frequency of detects are low. Calculate RPDs.	Method analyte RPDs for the LFMD or FD must be $\leq 30\%$ at mid and high levels of fortification and $\leq 50\%$ near the MRL. If these criteria are not met, results are labeled suspect due to matrix effects.
Sect. <a href="#">9.3.8</a>	Field Reagent Blank (FRB)	Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the MRL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample.	If the method analyte(s) found in the Field Sample is present in the FRB at a concentration greater than 1/3 the MRL, then all samples collected with that FRB are invalid and must be recollected and reanalyzed.
Sect. <a href="#">9.3.9</a>	Peak Asymmetry Factor	Calculate the peak asymmetry factor for the first two eluting chromatographic peaks in a mid-level CAL standard during IDC and when chromatographic changes are made that affect peak shape.	Peak asymmetry factor of 0.8 - 1.5
Sect. <a href="#">9.3.10</a>	Quality Control Sample (QCS)	Analyze at least quarterly or when preparing new standards, as well as during the IDC.	Results must be within 70-130% of true value.
Sect. <a href="#">10.2</a> and Sect. <a href="#">9.3.2</a>	Initial Calibration	Use IS calibration technique to generate a first or second order calibration curve forced through zero. Use at least five standard concentrations. Check the calibration curve as described in Sect. <a href="#">10.2.4.4</a> .	When each CAL standard is calculated as an unknown using the calibration curve, the analyte and SUR results must be 70-130% of the true value for all except the lowest standard, which must be 50-150% of the true value. Recalibration is recommended if these criteria are not met.
Sect. <a href="#">9.3.2</a> and Sect. <a href="#">10.3</a>	Continuing Calibration Check (CCC)	Verify initial calibration by analyzing a low level (at the MRL or below) CCC prior to analyzing samples. CCCs are then injected after every 10 samples and after the last sample, rotating concentrations to cover the calibrated range of the instrument.	Recovery for each analyte and SUR must be within 70-130% of the true value for all but the lowest level of calibration. Recovery for each analyte in the lowest CAL level CCC must be within 50-150% of the true value and the SUR must be within 70-130% of the true value.

**NOTE:** Table 13 is intended as an abbreviated summary of QC requirements provided as a convenience to the method user. Because the information has been abbreviated to fit the table format, there may be issues that need additional clarification, or areas where important additional information from the method text is needed. In all cases, the full text of the QC in Sections 8-10 supersedes any missing or conflicting information in this table.

Figure 1. Example Chromatogram for Reagent Water Fortified with Method 537.1 Analytes at 80 ng/L. Numbered Peaks are Identified in [Table 3](#)



## **Appendix D – Laboratory Guidance and Standard Operating Procedures**



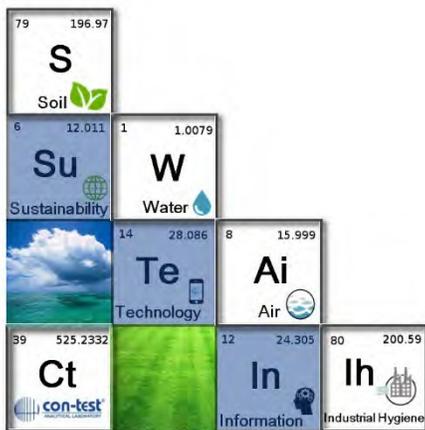
# CON-TEST

## ANALYTICAL LABORATORY

SC Department of Health and Environmental Control

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### 2020 USER GUIDE



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ANALYTICAL LABORATORY

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# Con-Test Overview

CON-TEST Analytical Laboratory, located at 39 Spruce Street, East Longmeadow, MA is a full service environmental testing laboratory with capabilities in nearly all soil, air and water analyses. Con-Test has experienced staff and state of the art instrumentation to provide quality analytical services, balancing response and prompt turnaround with precise and reliable analyses, ensuring data integrity. Our value –added service includes expertise in technical and customer service which is reflected in a diverse customer base.

In business since 1984 and privately owned since 1996, Con-Test is staffed with highly experienced core management individuals and technically competent and experienced laboratory personnel. Our management team has collectively over 105 years of experience in the environmental laboratory industry and have a strong client services orientation. Our department supervisors and lead analysts have over ten years of environmental laboratory experience. Clients rely on Con-Test for defensible data, top-notch customer service, clarity in reporting and interpretation and a stringent quality assurance program. Continual expansions to the laboratory add state of the art instrumentation and staff (currently over 124 professionals, 94 FTE) with significant gains in capacity, efficiency and capabilities.

Con-Test holds certifications in Massachusetts, Connecticut, Rhode Island, New Hampshire, New York, New Jersey, Maine, Vermont, North Carolina, Virginia, Florida (air) as well as NELAC and American Industrial Hygiene Association (AIHA-LAP, LLC, ISO 17025) accreditation. NY is also our primary NELAC certification.

## Our Analytical Programs are Comprehensive & Client Orientated

**QUALITY \* SERVICE \* DATA MANAGEMENT, WEBSITE, MOBILE DEVICE APP & EDDs \* QUALIFICATIONS OF LAB STAFF & TRAINING \* PERFORMANCE HISTORY \* SAFETY ASSURANCE \* SUSTAINABILITY & GREEN PROGRAM \* DATA PROTECTION & DATA INTEGRITY \* MORALS & ETHICS \* ENVIRONMENTAL INDICES \* CERTIFICATIONS \* LEADING EDGE INSTRUMENTATION \* QA/QC & SAMPLE MANAGEMENT \* RELIABLE TURNAROUND \* AUDIT RECORD \* DIVERSITY PROGRAMS \* TRIEY/LAB PARTICIPATION**





## **Sales**

**Adam Phillips**  
*Account Executive*

Tel: 919 451 3370  
Email: [Adam.Phillips@contestlabs.com](mailto:Adam.Phillips@contestlabs.com)

## **Client Services**

**Michelle Koch**  
*Project Manager*

Tel: 413 525 2332  
Email: [Michelle.Koch@contestlabs.com](mailto:Michelle.Koch@contestlabs.com)

## **Sample Shipments**

- Please follow sample packing instructions on pages 8 of this user guide
- For Saturday or Sunday delivery please contact your project manager in advance
- Email Adam Phillips ([adam.phillips@contestlabs.com](mailto:adam.phillips@contestlabs.com)) for custom return Fedex shipping labels, he will email them individually.

## **Shipping Details**

**Con-Test Analytical Laboratory**  
Sample Receiving/Bldg 1  
39 Spruce St., East Longmeadow, MA. 01028  
413-525-2332

**[WWW.Contestlabs.com](http://WWW.Contestlabs.com)**

# EPA 537.1

## Determination of Selected Per-and Poly-Fluorinated Alkyl Acids (PFAS) by Solid Phase Extraction & Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)

**Matrix:** Drinking water

**Media:** 2-250mL Plastic Containers per sample, 1-250mL empty plastic container and 1-250mL plastic container filled with DI per sampling event

**Holding Time:** 14 days until extraction; 28 days after extraction

**Preservation:** Trizma©. Cool to at or below 10°C

**Analytical Method:** Liquid Chromatography in tandem with Triple Quad Mass Spectrometry (LC/MS/MS)

**Standard Reporting Limit:** 2.0 ng/L

**Code:** PFAS 537.1

**Scope of Method:** This method includes the qualitative and quantitative analysis of a select PFAS compounds in drinking water specifically by utilizing SPE Extraction followed by analysis using LC/MS/MS and an internal standard technique.

### Compound List

*The following compounds can be analyzed for:*

ANALYTE(S)	ACRONYM	RL(NG/L)
Hexafluoropropylene oxide dimer acid (GenX)	HFPO-DA	2.0
N-ethylperfluorooctanesulfonamidoacetic acid	NETfOSAA	2.0
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2.0
Perfluorobutanesulfonic acid	PFBS	2.0
Perfluorodecanoic acid	PFDA	2.0
Perfluorododecanoic acid	PFDOA	2.0
Perfluoroheptanoic acid	PFHpA	2.0
Perfluorohexanesulfonic acid	PFHxS	2.0
Perfluorohexanoic acid	PFHxA	2.0
Perfluorononanoic acid	PFNA	2.0
Perfluorooctanesulfonic acid	PFOS	2.0
Perfluorooctanoic acid	PFOA	2.0
Perfluorotetradecanoic acid	PFTA	2.0
Perfluorotridecanoic acid	PFTTrDA	2.0
Perfluoroundecanoic acid	PFUnA	2.0
11Cl-PF3OUdS	F53B Major	2.0
9Cl-PF3ONS	F53B Minor	2.0
4,8-dioxa-3H-perfluorononanoic acid	ADONA	2.0



# PFAS – Sampling Containers/kits (water)



# PFAS SAMPLING INSTRUCTIONS

## for Drinking Water

All sampling events will receive multiple 250mL polypropylene(PP) containers with wide screw caps, nitrile gloves, and a Chain of Custody form. There will also be a container filled with DI water to act as a Field Blank for each sampling event. When Drinking water is to be tested, each sample container will contain ~1.25 grams of the preservative Trizma®. After collection (see below), the samples should be cooled down to below 10°C prior to packing and shipment to the laboratory.

### NOTES:

- When sampling, be sure to keep the area free of aluminum foil, Teflon, permanent marker, and scotch guard; as these can contaminate the samples with the target analytes
- Sample holding times are **14 days** from the time of collection, please be aware of this when sampling, in order to make sure shipment and testing are able to happen within that time frame.

### SAMPLE COLLECTION FOR DRINKING WATER:

- Remove any aeration or purification device from the collection area (if present)
- Turn water on to full flow for 5 minutes, this allows the system to be flushed
  - During this time is a good chance to label the sample containers. Two containers are to be collected at each sample site. One acts as a backup and **both should be labeled with the exact same information.**
- After 5 minutes, turn the water pressure down to avoid splashing during collection
- Put on the gloves included with the sampling kit.
- Without touching the rim, carefully open the container containing the DI water and pour into one of the sample containers (to be labeled "Field Blank"). Discard the now empty container.
  - There should be no containers returning with the label "DI Water for Field Reagent Blank".
- Without touching the rim, open a sample container and hold under the water flow until almost full (there is a seam line at the top of the container, the water should reach just over that level). Do not overfill, as this will cause loss of the preservative and potentially affect the results.
- Without touching the rim of the container, carefully screw the top back on tightly and agitate the container to dissolve the Trizma®.
- Repeat with the second sampling container
- Make sure each sample label has the sample name, source, date and time clearly written.
- The Chain of Custody form should have the same information as the labels
- Refrigerate down to 10°C, then pack into ice cooler for shipment
- **All bottles to be returned should be repackaged in the same bag they were recieved in or the smaller bags, if provided.**

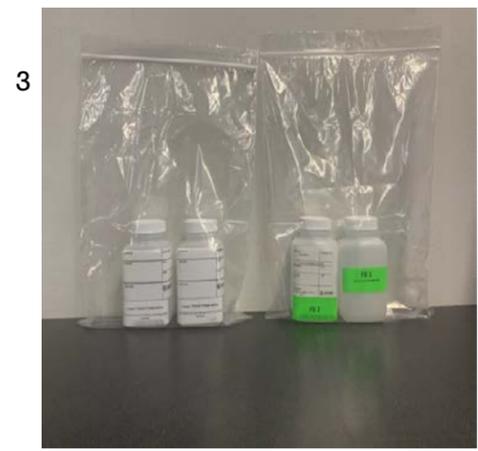
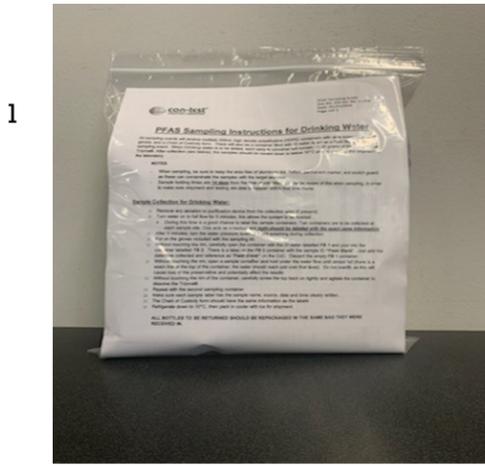
# DO

- Confirm that a PFAS-free water source is used for decontamination and drilling fluids. This is particularly important when working in a municipality where the public water supply may be affected.
- Utilize field blanks, equipment rinsate blanks and trip blanks to assess data quality and notify project staff of potential cross-contamination or false positives.
- Triple-rinse sampling tools and sampling equipment with distilled water following decontamination procedures.
- Use only PFAS-free materials when working on a PFAS site, such as high density polyethylene (HDPE) or polypropylene. When necessary, contact vendors for certification that materials are PFAS-free.
- Wash hands frequently and don a new pair of nitrile gloves between samples, after coming in contact with suspected PFAS-containing materials, between sample locations and immediately before collecting samples for PFAS analysis.
- Utilize written Standard Operating Procedures or project work plans to clearly identify precautions to be taken by field personnel when sampling for PFAS.
- Use HDPE sample containers unless specifically instructed otherwise by the project laboratory.

**The following activities may impact sample integrity and could potentially result in sample contamination and the occurrence of false-positives:**

- Do not use any materials that contain Teflon™ — a material known to contain PFAS.
- Do not allow food on site. Many common food packaging items could potentially contain or have been treated with PFAS or similar compounds.
- Do not wear clothing or boots that have been treated to be water-resistant. If sampling in the rain, PVC rain gear may be used.
- Do not use water-resistant paper, labels, self-sticking notes, aluminum foil, or blue-gel ice packs as these products have the potential to contain or be coated with PFAS or similar compounds.
- Do not use Tyvek.

# DON'T



## COOLER PACKING & SAMPLE RETURN INSTRUCTIONS

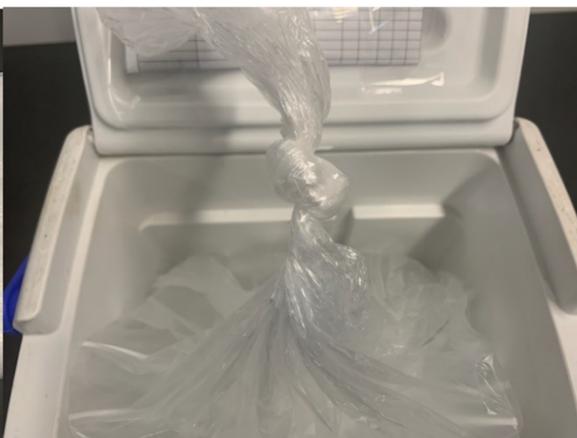


Picture 4

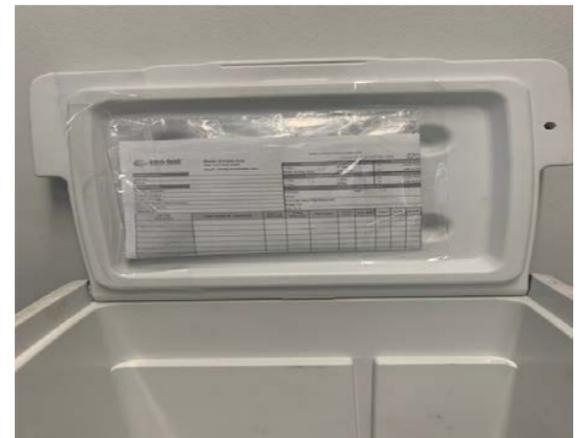
- Each PFAS sampling kit will arrive in a sealed ziplock bag. The bag will contain instructions on how to collect your sample, a chain of custody, two containers with trizma preservative (one container marked FB1, filled with DI water to act as a Field Blank, and an additional trizma preserved container marked FB2). There will also be 2 sets of protective gloves, and an additional ziplock bag to place your field blank in after collection. Please see pictures 1 and 2 for reference.
- Follow the sampling instructions to collect your sample. Package your samples as shown in picture 3 when preparing for return shipment.
- To return samples to Con-Test, please use the cooler(s) provided.
- 1) Place the provided large and heavy plastic bag in the cooler, referred to as cooler liner (as shown in picture 4).
- 2) Place containers upright in the individually bagged kits (in sealed ziplock bag provided) as shown in picture 5, making sure the ziplock bags are closed to prevent water from getting in the bag.
- When liner is loaded, please fill the remainder of cooler space with loose ice. Squeeze out any excess air from the liner and tie or secure the bag shut, as shown in picture 6.
- Place the completed and relinquished COC in a sealed ziplock bag and tape it to the lid of the cooler to keep it dry during transit (as shown in picture 7).
- Using packing tape, wrap completely around each end of the cooler to keep lid shut during shipment, then place Fedex return shipping label on top of cooler.



Picture 5



Picture 6



Picture 7



**1. WHEN SAMPLING, BRING ICE IN SEALED BAGS TO CHILL SAMPLES DURING SAMPLE COLLECTION.**

2. The sampler will receive the following sample kit from our lab:

Bottle Label	# of Bottles	Size	Bottle	Preservative
@537	3	275mL	Polypropylene (PP) bottles with PP screw-caps ( <b>no round label on bottle</b> )	1.4g of Trizma
@537 TB	1	275mL	PP bottles with PP screw-caps ( <b>white round label on bottle</b> )	1.4g of Trizma
@537 FB	1	275mL	PP bottles with PP screw-caps ( <b>blue round label on bottle</b> )	None



\* The sampler will receive the Trip Blank (TB) filled with water and preservative. It is colored in the picture to indicate the bottle is filled (not empty) for picture purposes only. \*\*The sampler will also receive an empty bottle labeled @537 FB (Field Blank) and 3 sets of preserved bottles.

3. Put on nitrile gloves. While at the site, before collecting samples, open the @537 TB labeled bottle containing the preserved reagent water.



4. Pour the preserved reagent water into the empty bottle labeled (@537 FB)

Cap both the filled @537 FB and the now empty TB bottle. Ship the filled FB and the now empty @537 TB bottle back to the lab along with the samples.



5. If sampling from faucet, remove the aerator and screen.

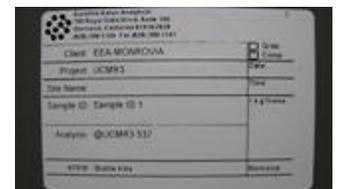


6. Open the tap and let the water of the sample source run at fast flow for approximately 5 minutes.



7. Use indelible ink (pen included in kit) to clearly identify the sample bottles with the information listed below.

- Sample ID
- Source of sample, if not already on label
- Analysis required, if not already on label
- Date and Time of collection
- Preservative used, if not already on label



8. Slow water flow to thickness of a pencil (to minimize splashing) and fill bottle.



9. Fill sample bottle up to **bottom of neck**, taking care not to flush out preservatives and making sure the mouth of the bottle does not come in contact with anything other than sample water.



10. Cap and invert the bottles at least 5 times to mix the sample with the preservative.



11. Collect sample for the other 2 sample bottles by repeating steps 8 to 10.

### **SHIPPING SAMPLES AND STORAGE**

- If shipping samples on the same day of sampling, chill samples until at or below 10°C by exchanging the ice used during sampling with sealed bags of fresh ice.
- Pack chilled samples** in a cooler and add enough **FRESH** wet ice to take up 30-50% of the cooler (e.g. most of the remaining space) as recommended in our "**Wet Ice Packing Instructions.**"
- Complete the Chain of Custody during sample collection. Place completed Kit Order and completed Chain of Custody in a ziplock bag in the cooler on top of packing material. The following information is required on the completed Chain of Custody.
  - Collector's name
  - Date and time of collection
  - Unique field sample ID
  - Comments about the sample, if applicable
  - Sample type (Sample, TB, or FB)
- Ship via overnight service such as FEDEX, UPS, or DHL, etc.** Sample must not exceed 10°C during transit.
- Samples **MUST** arrive at lab within 48 hours of sampling at or less than 10°C, greater than 0°C (not frozen).
- If samples are received more than 48 hours after sampling they must be at or less than 6°C, greater than 0°C (not frozen).**
- If samples are received on the same day as collection, temperature may be greater than 10°C with evidence of cooling such as ice.
- Maximum **HOLDING TIME FOR SAMPLES IS 14 DAYS** from time of collection. Sample extracts can be held for a maximum of 28 days.
- Alternatively, cool the samples down by placing them **overnight** in a cooler with ice, or in a refrigerator (store chilled for at least 12 hours before packing for shipment). Maintain the samples cold until repacked in the cooler for shipment to the lab.

### **ADDITIONAL NOTES**

- Do not composite (i.e., combine, mix or blend) samples.
- Avoid handling potential contamination such as food packaging and certain foods and beverages before sample collection. Wash hands before sampling and wear powderless nitrile gloves (included in kit) while filling and sealing the sample bottles.
- Collect samples early enough in the day to allow adequate time to cool and to send those samples for overnight delivery to the laboratory, if not refrigerated and stored overnight before shipping.
- Try to collect only on a Monday, Tuesday or Wednesday and ship no later than Thursday of each week, and try to **NOT** collect samples on Friday, Saturday, or Sunday unless special arrangements have been made for the receipt of samples at the laboratory within 48-hours of collection.
- If shipping to the laboratory with **frozen gel packs** rather than wet ice, please be sure that the gel packs have **been frozen for at least 48 hours** prior to the shipment time.
- If in doubt, please review our YouTube sampling video at <http://www.youtube.com/user/EurofinsEaton>.

## **Appendix E – Laboratory Qualification Information**

# State of South Carolina

**Solicitation # 5400019308**

**Opening Date March 17, 2020/ 2:30 pm ET**

**South Carolina Department of Health and Environmental Control**

Prepared by:

Con-Test Analytical Laboratory

39 Spruce Street

East Longmeadow, MA 01028

413-525-2332

Fax 413-525-6405

Karly Monette – Inside Sales Representative

[karly.monette@contestlabs.com](mailto:karly.monette@contestlabs.com)

[www.ContestLabs.com](http://www.ContestLabs.com)

March 17, 2020



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ANALYTICAL LABORATORY

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  - B. Professional Staff and Org Chart
  - C. PFAS SOP
  - D. PFAS Experience
  - E. Insurance Certificates
  - F. QA Manual

## **Section I. – Cover Letter**



Date: March 11th, 2020

To: E. Madison Winslow  
SC DHEC- Division of Procurement Services  
2600 Bull Street, Columbia SC 29201

RE: Solicitation# 5400019308- Per-and Polyfluroalkyl Substance Analysis

I want to start by saying Con-Test is excited to be bidding on this project. We have a rich history of success as a strategic analytical partner for state agencies and their consultants. Con-Test Analytical Laboratory believes that our core company values surrounding quality, service, and client satisfaction are a great foundation. Making sure you and your team are successful is central to how we have built our client services. We do not just consider ourselves a partner with everyone we work with, but more so as an extension of your team. With the scope of work you have outlined in the RFP, we will customize our services to meet the many moving demands. We have successfully built and executed these services for similar portfolios and scopes of work. These will include but not be limited to:

**\*Project Coordination/Schedule:** We will work with all DHEC contacts, as well as their environmental consultants and contractors involved in these projects to ensure media sampling kits, chains of custody, and any other project demands are met. Con-Test will set-up a schedule prior to the project starting with all the details outlined. All projects begin with an internal checklist to ensure all information is obtained.

**\*Project Management Team/Customer Service:** The Project Manager will carry your project from the initiation to final reporting, and all other aspects such as reviewing the scope of work, reviewing the chain of custody, placing the bottle order, and helping to coordinate sample delivery. As part of our customer service, you will also have access to ownership and laboratory director to answer any questions you may have.

**\*Customized Sampling Kits:** Bagged and sorted to make sampling as efficient and straight forward as possible. There will be a prepaid label sent for you to send the samples back to Con-Test.



\*Pre-made Projects in our LIMS: Reviewed by the laboratory project manager before sampling begins, this allows for little opportunity for transcription errors on the chain of custody. This will also help aid in catching any potential oversights that may occur in between the initial scope of work, and sample receipt to the laboratory.

\*Pre-labeled Sampling Containers: The more info we have the more we can populate (minus sampling time of course).

\*Data Deliverables: PDF report and Microsoft® Excel format to be emailed at time of reporting to the contact on the chain of custody as identified by DHEC PFAS results will be uploaded thereafter electronically by the laboratory into the DHEC reporting system (see attached QA manual for more on reporting).

\*Data Storage: All raw data stored for 10 years.

\*Turnaround Time: PFAS standard TAT 10 business days, or 14 calendar days. This can be expedited to 3-5 day with prior approval.

\*Client website for access to data, data status, pick-up scheduling, sampling kit orders, historical data, RL's, MDL's, compound lists, sampling guides, etc.

\*Technical training: We welcome your team to tour the lab, have technical training on-site, or at your location or over a webinar. This includes outside technical trainings for consultants, ranging from sample collection techniques to quality assurance and data validation training.

\*24/7 capabilities: We currently hold multiple utility Emergency Response contracts, these require us to be able to accept and produce results 24 hours a day, 365 days a year. Now the need is not always there, but we have delivered in all areas to include major holidays and during major storms.

\*Investment in technologies: Con-Test consistently re-invests in their company, more than \$500,000 annually in the latest instruments to keep up with the ever-changing industry.

In summary, we feel our structured/planned approach to make your teams sampling jobs as efficient and accurate as possible, our quality focus for numbers you can trust. Our industry leading client service has served as a successful partnership with other state agencies, as well as consultants throughout many states. Our attention to detail from ownership, to dedicated project managers, provides a unique mix for an analytical partner that can not only help your team succeed, but excel.

Thank you for the opportunity and I look forward to any questions I can help answer by phone, e-mail, or even better in person.

Best Regards,

Thomas Veratti

President

Con-Test Analytical Laboratory



## Section II. – Amendment I



# State of South Carolina

Invitation For Bid  
Amendment - I

Solicitation: 5400019308  
Date Issued: March 5, 2020  
Procurement Officer: E. Madison Winslow *E. Madison Winslow*  
Phone: 803-898-3487  
E-Mail Address: winsloem@dhec.sc.gov

DESCRIPTION: Per-and Polyfluoroalkyl Substances (PFAS) Analysis

USING GOVERNMENTAL UNIT: South Carolina Department of Health and Environmental Control

*The Term "Offer" Means Your "Bid" or "Proposal". Unless submitted on-line, your offer must be submitted in a sealed package. Solicitation Number and Opening Date must appear on package exterior. See "Submitting Your Paper Offer or Modification" provision.*

**SUBMIT YOUR OFFER ON-LINE AT THE FOLLOWING URL: <http://www.procurement.sc.gov>**  
(see page 3 and 4 for instructions)

SUBMIT OFFER BY (Opening Date/Time): **March 17, 2020/2:30 pm ET** (See "Deadline For Submission Of Offer" provision)

QUESTIONS MUST BE RECEIVED BY: ~~March 4, 2020/2:30 pm ET~~ (See "Questions From Offerors" provision)

NUMBER OF COPIES TO BE SUBMITTED: 1

CONFERENCE TYPE: <b>Not Applicable</b> DATE & TIME:  (As appropriate, see "Conferences - Pre-Bid/Proposal" & "Site Visit" provisions)	LOCATION: <b>Not Applicable</b>
--	---------------------------------

AWARD & AMENDMENTS	Award will be posted on <b>March 23, 2020</b> . The award, this solicitation, any amendments, and any related notices will be posted at the following web address: <a href="http://www.procurement.sc.gov">http://www.procurement.sc.gov</a>
--------------------	--

You must submit a signed copy of this form with Your Offer. By signing, You agree to be bound by the terms of the Solicitation. You agree to hold Your Offer open for a minimum of thirty (30) calendar days after the Opening Date. (See "Signing Your Offer" provision.)

NAME OF OFFEROR Filli LLC dba Con-Test Analytical Laboratory  (full legal name of business submitting the offer)	Any award issued will be issued to, and the contract will be formed with, the entity identified as the Offeror. The entity named as the offeror must be a single and distinct legal entity. Do not use the name of a branch office or a division of a larger entity if the branch or division is not a separate legal entity, i.e., a separate corporation, partnership, sole proprietorship, etc.
---	--

AUTHORIZED SIGNATURE <i>Lauren Tirrell</i> (Person must be authorized to submit binding offer to contract on behalf of Offeror.)	DATE SIGNED 03-11-2020
--	---------------------------

TITLE Marketing Supervisor (business title of person signing above)	STATE VENDOR NO. 7000280649 (Register to Obtain S.C. Vendor No. at <a href="http://www.procurement.sc.gov">www.procurement.sc.gov</a> )
---	---

PRINTED NAME Lauren Tirrell (printed name of person signing above)	STATE OF INCORPORATION Massachusetts (If you are a corporation, identify the state of incorporation.)
--	---

OFFEROR'S TYPE OF ENTITY: (Check one) (See "Signing Your Offer" provision.)

Sole Proprietorship  Partnership  Other LLC

Corporate entity (not tax-exempt)  Corporation (tax-exempt)  Government entity (federal, state, or local)

*LT*

**PAGE TWO**

(Return Page Two with Your Offer)

<p><b>HOME OFFICE ADDRESS</b> (Address for offeror's home office / principal place of business)</p> <p>39 Spruce Street East Longmeadow, MA 01028</p>	<p><b>NOTICE ADDRESS</b> (Address to which all procurement and contract related notices should be sent.) (See "Notice" clause)</p> <p>39 Spruce Street East Longmeadow, MA 01028</p> <p>413-525-2332</p> <p>Area Code - Number - Extension Facsimile</p> <p>lauren.tirrell@contestlabs.com</p> <p>E-mail Address</p>
---	--

<p><b>PAYMENT ADDRESS</b> (Address to which payments will be sent.) (See "Payment" clause)</p> <p><input checked="" type="checkbox"/> Payment Address same as Home Office Address <input type="checkbox"/> Payment Address same as Notice Address (check only one)</p>	<p><b>ORDER ADDRESS</b> (Address to which purchase orders will be sent) (See "Purchase Orders and "Contract Documents" clauses)</p> <p><input checked="" type="checkbox"/> Order Address same as Home Office Address <input type="checkbox"/> Order Address same as Notice Address (check only one)</p>
--	---

**ACKNOWLEDGMENT OF AMENDMENTS**  
Offerors acknowledges receipt of amendments by indicating amendment number and its date of issue. (See "Amendments to Solicitation" Provision)

Amendment No.	Amendment Issue Date						
1	3/5/2020						

<b>DISCOUNT FOR PROMPT PAYMENT</b> (See "Discount for Prompt Payment" clause)	10 Calendar Days (%) 1%	20 Calendar Days (%) 0	30 Calendar Days (%) 0	____ Calendar Days (%) 0
--	----------------------------	---------------------------	---------------------------	-----------------------------

**PREFERENCES - A NOTICE TO VENDORS (SEP. 2009):** On June 16, 2009, the South Carolina General Assembly rewrote the law governing preferences available to in-state vendors, vendors using in-state subcontractors, and vendors selling in-state or US end products. This law appears in Section 11-35-1524 of the South Carolina Code of Laws. A summary of the new preferences is available at [www.procurement.sc.gov/preferences](http://www.procurement.sc.gov/preferences). **ALL THE PREFERENCES MUST BE CLAIMED AND ARE APPLIED BY LINE ITEM, REGARDLESS OF WHETHER AWARD IS MADE BY ITEM OR LOT. VENDORS ARE CAUTIONED TO CAREFULLY REVIEW THE STATUTE BEFORE CLAIMING ANY PREFERENCES. THE REQUIREMENTS TO QUALIFY HAVE CHANGED. IF YOU REQUEST A PREFERENCE, YOU ARE CERTIFYING THAT YOUR OFFER QUALIFIES FOR THE PREFERENCE YOU'VE CLAIMED. IMPROPERLY REQUESTING A PREFERENCE CAN HAVE SERIOUS CONSEQUENCES. [11-35-1524(E)(4)&(6)]**

**PREFERENCES - ADDRESS AND PHONE OF IN-STATE OFFICE:** Please provide the address and phone number for your in-state office in the space provided below. An in-state office is necessary to claim either the Resident Vendor Preference (11-35-1524(C)(1)(i)&(ii)) or the Resident Contractor Preference (11-35-1524(C)(1)(iii)). Accordingly, you must provide this information to qualify for the preference. An in-state office is not required, but can be beneficial, if you are claiming the Resident Subcontractor Preference (11-35-1524(D)).

In-State Office Address same as Home Office Address  In-State Office Address same as Notice Address (check only one)

LT

## INSTRUCTIONS FOR OFFERORS SUBMITTING BIDS ON LINE

All Offerors desiring to respond to this solicitation should register and submit your response online. To respond online, Offeror must follow the new South Carolina Enterprise Information System (SCEIS) vendor registration instructions found at the South Carolina Procurement Information Center website address of: <http://www.procurement.sc.gov/>. If Offeror is registered in the old procurement system, Offerors must register or update their information in the new SCEIS system. Once the registration process is complete, the system will generate a SCEIS vendor user ID and password. The Offeror must keep this information current or the Offeror will not be able to submit future bids.

**Offerors will need to follow these instructions carefully when responding to the solicitation online.**

1. The original solicitation response should be submitted online and it will be the official response.
2. All Offerors must attach all additional requested documents to their response in the online system. These documents can be attached under the “Notes and Attachments” tab of the online solicitation either on the main page or under the necessary line item.

### OFFERORS ENCOUNTERING REGISTRATION OR BIDDING PROBLEMS SHOULD CONTACT:

DSIT Help Desk (803) 896-0001 Select Option 1 then Option 2

Monday – Friday 8:00 AM – 4:30 PM

Offeror instructions can be found at:

<http://procurement.sc.gov/vendor/submitting-offers>

### **NOTICE**

- To submit bids vendors must use Internet Explorer 8, 9 or 10, which is compatible with SAP. Other browsers such as Internet Explorer 11, Google Chrome, or Mozilla Firefox will not function properly and may prohibit bid submissions.
- **It will be the responsibility of each bidder to ensure that their response was submitted properly. The Response Status must indicate 'Submitted'. If the response is in a 'HELD' or 'SAVED' status, you MUST go back in the system and submit the response before it can be 'ACCEPTED' by the State.**
- Bidders are encouraged to review the 'Simulation for Bid Creation' before trying to submit their response.
- Electronic bid submission (SRM Login) – <https://vendorportal.sc.gov/irj/portal>
- Submitting Confidential Data - <https://procurement.sc.gov/legal/general-info>

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## INSTRUCTIONS FOR OFFERORS SUBMITTING HARD COPY BIDS

### Mailing Address:

SC DHEC – Division of Procurement Services  
Bureau of Business Management  
Columbia Mills Building  
2600 Bull Street  
Columbia, S.C. 29201

### Opening/Physical Address:

SCDHEC – Division of Procurement Services  
Bureau of Business Management  
Columbia Mills Building – 4<sup>th</sup> Floor  
301 Gervais Street  
Columbia, S.C. 29201

**See Section II.A. – Public Opening Information – DHEC Clause**

1. Offerors shall submit their bid in a sealed package.
2. The solicitation number and opening date must appear on the package exterior
3. Offerors shall submit one (1) copy.

**PLEASE NOTE THAT IF TERMS AND CONDITIONS ARE OBJECTED OR QUALIFIED OR OFFEROR INCLUDES ADDITIONAL TERMS AND CONDITIONS TO BE CONSIDERED, THE OFFER WILL BE DEEMED NON-RESPONSIVE AND WILL BE ELIMINATED FROM FURTHER CONSIDERATION.**

**IF YOU QUALIFY YOUR OFFER WITH A STATEMENT SUCH AS, “THIS IS NOT AN OFFER”, THE OFFER WILL BE DEEMED “NON-RESPONSIVE” AND REMOVED FROM FURTHER CONSIDERATION.**

## OFFEROR BID SUBMISSION VALIDATION

After submitting an online response to a solicitation, Offerors may validate their submission with the following steps:

**STEP 1:** Go back to the initial 'RFx and Auctions' screen

Event Number	Event Description	Event Type	Event Status	Start Date	End Date	Response Number	Response Status	Event Version	Response Version	Q&A	Start Time	End Time
5400005986	Computer Replacement for SCODV	Request for Proposal	Published	11/06/2013			No Bid Created	2		0	02:00:00	14:00:00
5400005985	Computer Room Upgrade Project	Request for Proposal	Published	11/06/2013			No Bid Created	2		0	02:00:00	15:00:00
5400005983	RAY44228 110442013 08:46:48	Invitation For Bid	Published	11/06/2013			No Bid Created	1		0	06:00:00	11:00:00
5400005987	Whiteboard Stand	Invitation For Bid	Published	11/15/2013			No Bid Created			0	06:00:00	10:30:00
5400006796	Computer Room Upgrade Project	Invitation For Bid	Published	11/05/2013		5500029632	Submitted			0	02:00:00	17:30:00
5400006771	Workcenter Services	Request for Proposal	Published	01/25/2014			No Bid Created	3		0	00:00:00	14:00:00
5400006687	Web Site Design Project	Request for Proposal	Published	11/06/2013			No Bid Created	7		0	00:00:00	17:30:00
5400006128	DSS FPS Technical Assistance & Support	Fixed Price Bid	Published	06/30/2014			No Bid Created	5		0	06:00:00	11:00:00
5400006248	FPB TO PROVIDE MULTI-AGENCY COMMUNITY EA	Fixed Price Bid	Published	05/21/2014			No Bid Created	3		0	08:00:00	11:30:00
5400005980	Xerox Network Products & Services	Fixed Price Bid	Published	08/19/2013			No Bid Created	3		0	00:00:00	14:30:00

**STEP 2:** Select the 'Refresh' button to update the screen.

**STEP 3:** Make sure the RFx you responded to, has your specific bid response number '55XXXXXXXX' displayed in the Response Number column and the Response Status column has a status of 'Submitted' before you log off.

**NOTE:** You also have the ability to print out a copy of your submission by selecting the 'Print Preview' button after your offer has been submitted.

**Display RFx Response:**

[Edit](#) | [Print Preview](#) | [Close](#) | [Withdraw](#) | [Export Questions and Answers \(0\)](#)

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**RFx Response Number** 5500029632      **RFx Number** 5400006796      **Status** Submitted  
**RFx Response Version Number** Active Version      **RFx Version Number** 8

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## **I. SCOPE OF SOLICITATION**

It is the intent of the State of South Carolina, SC Department of Health and Environmental Control (DHEC), to solicit bids for a contract to provide Per- and Polyfluoroalkyl Substances (PFAS) Analysis, in accordance with the requirements stated herein.

### **Performance Time-Frame:**

Due to the source of funds allocated for this project, loss of funds may result after June 1, 2020. All services must be completed to the satisfactions of the DHEC end-user, and the invoice received prior to this date. The ability to meet this requirement may be a factor in the award process.

### **ACQUIRE SERVICES (JAN 2006)**

The purpose of this solicitation is to acquire services complying with the enclosed description and/or specifications and conditions. [01-1010-1]

## II. INSTRUCTIONS TO OFFERORS - A. GENERAL INSTRUCTIONS

### DEFINITIONS, CAPITALIZATION, AND HEADINGS (DEC 2015)

CLAUSE HEADINGS USED IN THIS SOLICITATION ARE FOR CONVENIENCE ONLY AND SHALL NOT BE USED TO CONSTRUE MEANING OR INTENT. EVEN IF NOT CAPITALIZED, THE FOLLOWING DEFINITIONS ARE APPLICABLE TO ALL PARTS OF THE SOLICITATION, UNLESS EXPRESSLY PROVIDED OTHERWISE.

AMENDMENT means a document issued to supplement the original solicitation document.

AUTHORITY means the State Fiscal Accountability Authority or its successor in interest.

BUSINESS means any corporation, partnership, individual, sole proprietorship, joint stock company, joint venture, or any other legal entity. [11-35-310(3)]

CHANGE ORDER means any written alteration in specifications, delivery point, rate of delivery, period of performance, price, quantity, or other provisions of any contract accomplished by mutual agreement of the parties to the contract. [11-35-310(4)]

CONTRACT See clause entitled Contract Documents & Order of Precedence.

CONTRACT MODIFICATION means a written order signed by the procurement officer, directing the contractor to make changes which the clause of the contract titled "Changes," if included herein, authorizes the Procurement Officer to order without the consent of the contractor. [11-35-310(9)]

CONTRACTOR means the Offeror receiving an award as a result of this solicitation.

COVER PAGE means the top page of the original solicitation on which the solicitation is identified by number. Offerors are cautioned that Amendments may modify information provided on the Cover Page.

OFFER means the bid or proposal submitted in response this solicitation. The terms Bid and Proposal are used interchangeably with the term Offer.

OFFEROR means the single legal entity submitting the offer. The term Bidder is used interchangeably with the term Offeror. See bidding provisions entitled Signing Your Offer and Bid/Proposal As Offer To Contract.

PAGE TWO means the second page of the original solicitation, which is labeled Page Two.

PROCUREMENT OFFICER means the person, or his successor, identified as such on either the Cover Page, an amendment, or an award notice.

YOU and YOUR means Offeror.

SOLICITATION means this document, including all its parts, attachments, and any Amendments.

STATE means the Using Governmental Unit(s) identified on the Cover Page.

SUBCONTRACTOR means any person you contract with to perform or provide any part of the work.

US or WE means the using governmental unit.

USING GOVERNMENTAL UNIT means the unit(s) of government identified as such on the Cover Page. If the Cover Page identifies the Using Governmental Unit as "Statewide Term Contract," the phrase "Using Governmental Unit" means any South Carolina Public Procurement Unit [11-35-4610(5)] that has submitted a Purchase Order to you pursuant to the contract resulting from this solicitation. Reference the clauses titled "Purchase Orders" and "Statewide Term Contract."

WORK means all labor, materials, equipment, services, or property of any type, provided or to be provided by the Contractor to fulfill the Contractor's obligations under the Contract.

[02-2A003-3]

### AMENDMENTS TO SOLICITATION (JAN 2004)

(a) The Solicitation may be amended at any time prior to opening. All actual and prospective Offerors should monitor the following web site for the issuance of Amendments: [www.procurement.sc.gov](http://www.procurement.sc.gov) (b) Offerors shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on Page Two, (3) by letter, or (4) by submitting a bid that indicates in some way that the bidder received the amendment. (c) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged. [02-2A005-1]

### AUTHORIZED AGENT (FEB 2015)

All authority regarding this procurement is vested solely with the responsible Procurement Officer. Unless specifically delegated in writing, the Procurement Officer is the only government official authorized to bind the government with regard to this procurement or the resulting contract. [02-2A007-1]

## **AWARD NOTIFICATION (FEB 2015)**

Notice regarding any award, cancellation of award, or extension of award will be posted at the location and on the date specified on the Cover Page or, if applicable, any notice of extension of award. Should the contract resulting from this Solicitation have a total or potential value of one hundred thousand dollars or more, such notice will be sent to all Offerors responding to the Solicitation and any award will not be effective until the eleventh day after such notice is given. [02-2A010-2]

## **BID/PROPOSAL AS OFFER TO CONTRACT (JAN 2004)**

By submitting Your Bid or Proposal, You are offering to enter into a contract with the Using Governmental Unit(s). Without further action by either party, a binding contract shall result upon final award. Any award issued will be issued to, and the contract will be formed with, the entity identified as the Offeror on the Cover Page. An Offer may be submitted by only one legal entity; "joint bids" are not allowed. [02-2A015-1]

## **BID ACCEPTANCE PERIOD (JAN 2004)**

In order to withdraw Your Offer after the minimum period specified on the Cover Page, You must notify the Procurement Officer in writing. [02-2A020-1]

## **BID IN ENGLISH and DOLLARS (JAN 2004)**

Offers submitted in response to this solicitation shall be in the English language and in US dollars, unless otherwise permitted by the Solicitation. [02-2A025-1]

## **CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (MAY 2008)**

**GIVING FALSE, MISLEADING, OR INCOMPLETE INFORMATION ON THIS CERTIFICATION MAY RENDER YOU SUBJECT TO PROSECUTION UNDER SECTION 16-9-10 OF THE SOUTH CAROLINA CODE OF LAWS AND OTHER APPLICABLE LAWS.**

(a) By submitting an offer, the offeror certifies that-

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to-

(i) Those prices;

(ii) The intention to submit an offer; or

(iii) The methods or factors used to calculate the prices offered.

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory-

(1) Is the person in the offeror's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this certification; or

(2)(i) Has been authorized, in writing, to act as agent for the offeror's principals in certifying that those principals have not participated, and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this certification [As used in this subdivision (b)(2)(i), the term "principals" means the person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal];

(ii) As an authorized agent, does certify that the principals referenced in subdivision (b)(2)(i) of this certification have not participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this certification; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this certification.

(c) If the offeror deletes or modifies paragraph (a)(2) of this certification, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure. [02-2A032-1]

## **CERTIFICATION REGARDING DEBARMENT AND OTHER RESPONSIBILITY MATTERS (JAN 2004)**

(a) (1) By submitting an Offer, Offeror certifies, to the best of its knowledge and belief, that-

(i) Offeror and/or any of its Principals-

(A) Are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any state or federal agency; (B) Have not, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and (C) Are not presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision. (ii) Offeror has not, within a three-year period preceding this offer, had one or more contracts terminated for default by any public (Federal, state, or local) entity.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

(b) Offeror shall provide immediate written notice to the Procurement Officer if, at any time prior to contract award, Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) If Offeror is unable to certify the representations stated in paragraphs (a)(1), Offer must submit a written explanation regarding its inability to make the certification. The certification will be considered in connection with a review of the Offeror's responsibility. Failure of the Offeror to furnish additional information as requested by the Procurement Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly or in bad faith rendered an erroneous certification, in addition to other remedies available to the State, the Procurement Officer may terminate the contract resulting from this solicitation for default. [02-2A035-1]

## **CODE OF LAWS AVAILABLE (JAN 2006)**

The South Carolina Code of Laws, including the Consolidated Procurement Code, is available at:  
<http://www.scstatehouse.gov/code/statmast.php>

The South Carolina Regulations are available at: <http://www.scstatehouse.gov/coderegs/statmast.php>  
[02-2A040-2]

## **DISCLOSURE OF CONFLICTS OF INTEREST OR UNFAIR COMPETITIVE ADVANTAGE (FEB 2015)**

You warrant and represent that your offer identifies and explains any unfair competitive advantage you may have in competing for the proposed contract and any actual or potential conflicts of interest that may arise from your participation in this competition or your receipt of an award. The two underlying principles are (a) preventing the existence of conflicting roles that might bias a contractor's judgment, and (b) preventing an unfair competitive advantage. If you have an unfair competitive advantage or a conflict of interest, the state may withhold award. Before withholding award on these grounds, an offeror will be notified of the concerns and provided a reasonable opportunity to respond. Efforts to avoid or mitigate such concerns, including restrictions on future activities, may be considered. Without limiting the foregoing, you represent that your offer identifies any services that relate to either this solicitation or the work and that has already been performed by you, a proposed subcontractor, or an affiliated business of either. [02-2A047-2]

## **DEADLINE FOR SUBMISSION OF OFFER (JAN 2004)**

Any offer received after the Procurement Officer of the governmental body or his designee has declared that the time set for opening has arrived, shall be rejected unless the offer has been delivered to the designated purchasing office or the governmental body's mail room which services that purchasing office prior to the opening. [R.19-445.2070(G)] [02-2A050-1]

### **DRUG FREE WORK PLACE CERTIFICATION (JAN 2004)**

By submitting an Offer, Contractor certifies that, if awarded a contract, Contractor will comply with all applicable provisions of The Drug-free Workplace Act, Title 44, Chapter 107 of the South Carolina Code of Laws, as amended. [02-2A065-1]

### **DUTY TO INQUIRE (FEB 2015)**

Offeror, by submitting an Offer, represents that it has read and understands the Solicitation and that its Offer is made in compliance with the Solicitation. Offerors are expected to examine the Solicitation thoroughly and should request an explanation of any ambiguities, discrepancies, errors, omissions, or conflicting statements in the Solicitation. Failure to do so will be at the Offeror's risk. All ambiguities, discrepancies, errors, omissions, or conflicting statements in the Solicitation shall be interpreted to require the better quality or greater quantity of work and/or materials, unless otherwise directed by amendment. Offeror assumes responsibility for any patent ambiguity in the Solicitation that Offeror does not bring to the State's attention. See clause entitled "Questions from Offerors." [02-2A070-2]

### **ETHICS CERTIFICATE (MAY 2008)**

By submitting an offer, the offeror certifies that the offeror has and will comply with, and has not, and will not, induce a person to violate Title 8, Chapter 13 of the South Carolina Code of Laws, as amended (ethics act). The following statutes require special attention: Section 8-13-700, regarding use of official position for financial gain; Section 8-13-705, regarding gifts to influence action of public official; Section 8-13-720, regarding offering money for advice or assistance of public official; Sections 8-13-755 and 8-13-760, regarding restrictions on employment by former public official; Section 8-13-775, prohibiting public official with economic interests from acting on contracts; Section 8-13-790, regarding recovery of kickbacks; Section 8-13-1150, regarding statements to be filed by consultants; and Section 8-13-1342, regarding restrictions on contributions by contractor to candidate who participated in awarding of contract. The state may rescind any contract and recover all amounts expended as a result of any action taken in violation of this provision. If contractor participates, directly or indirectly, in the evaluation or award of public contracts, including without limitation, change orders or task orders regarding a public contract, contractor shall, if required by law to file such a statement, provide the statement required by Section 8-13-1150 to the procurement officer at the same time the law requires the statement to be filed. [02-2A075-2]

### **OMIT TAXES FROM PRICE (JAN 2004)**

Do not include any sales or use taxes in Your price that the State may be required to pay. [02-2A080-1]

### **OPEN TRADE REPRESENTATION (JUN 2015)**

By submitting an Offer, Offeror represents that Offeror is not currently engaged in the boycott of a person or an entity based in or doing business with a jurisdiction with whom South Carolina can enjoy open trade, as defined in SC Code Section 11-35-5300. [02-2A083-1]

### **PROTESTS (MAY 2019)**

If you are aggrieved in connection with the solicitation or award of the contract, you may be entitled to protest, but only as provided in Section 11-35-4210. To protest a solicitation, you must submit a protest within fifteen days of the date the applicable solicitation document is issued. To protest an award, you must (i) submit notice of your intent to protest within seven business days of the date the award notice is posted, and (ii) submit your actual protest within fifteen days of the date the award notice is posted. Days are calculated as provided in Section 11-35-310(13). Both protests and notices of intent to protest must be in writing and must be received by the appropriate Chief Procurement Officer within the time provided. See clause entitled "Protest-CPO". The grounds of the protest and the relief requested must be set forth with enough particularity to give notice of the issues to be decided. [02-2A085-2]

## PROHIBITED COMMUNICATIONS AND DONATIONS (FEB 2015)

Violation of these restrictions may result in disqualification of your offer, suspension or debarment, and may constitute a violation of law.

(a) During the period between publication of the solicitation and final award, *you must not communicate, directly or indirectly, with the Using Governmental Unit or its employees, agents or officials regarding any aspect of this procurement activity*, unless otherwise approved in writing by the Procurement Officer. All communications must be solely with the Procurement Officer. [R. 19-445.2010]

(b) You are advised to familiarize yourself with Regulation 19-445.2165, which restricts donations to a governmental entity with whom you have or seek to have a contract. *You represent that your offer discloses any gifts made, directly or through an intermediary, by you or your named subcontractors to or for the benefit of the Using Governmental Unit during the period beginning eighteen months prior to the Opening Date.* [R. 19-445.2165] [02-2A087-1]

## PUBLIC OPENING (JAN 2004)

Offers will be publicly opened at the date/time and at the location identified on the Cover Page, or last Amendment, whichever is applicable. [02-2A090-1]

## PUBLIC OPENING INFORMATION (DHEC - AUG 2014)

Vendors arriving at 301 Gervais Street will notice that this is also the location of the State Museum. Do not enter using the main museum entrance. To enter SC DHEC, vendors are to proceed from the front of the building to the left side (canal side). Park in either the lower or upper deck of the two-level parking garage.

Adjacent to the first floor parking garage is a glass door with a SC DHEC logo. This entrance is locked at all times. Press the intercom button in order to request entrance to the building. The door will be opened by the Agency receptionist. When you enter the building you will be required to sign in. You will be escorted to the 4th floor receptionist for your offer to be date/time stamped and then, if desired, escorted to the conference room where the public opening will take place. If you have issues with building access, please call DHEC's procurement receptionist at (803) 898-3501.

It will take several minutes to obtain building access and have offers date/time stamped. The public opening date/time is identified on the Cover Page, or the last Amendment, if applicable. Please plan accordingly. Opening times will not be adjusted.

## QUESTIONS FROM OFFERORS (FEB 2015)

(a) Any prospective offeror desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing. Questions regarding the original solicitation or any amendment must be received by the Procurement Officer no later than five (5) days prior to opening unless an earlier date is stated on the Cover Page. Label any communication regarding your questions with the name of the procurement officer, and the solicitation's title and number. Oral explanations or instructions will not be binding. [See R. 19-445.2042(B)] Any information given a prospective offeror concerning a solicitation will be furnished promptly to all other prospective offerors as an Amendment to the solicitation, if that information is necessary for submitting offers or if the lack of it would be prejudicial to other prospective offerors. See clause entitled "Duty to Inquire." **We will not identify you in our answer to your question.** (b) The State seeks to permit maximum practicable competition. Offerors are urged to advise the Procurement Officer -- as soon as possible -- regarding any aspect of this procurement, including any aspect of the Solicitation that unnecessarily or inappropriately limits full and open competition. [See R. 19-445.2140] [02-2A095-2]

## REJECTION/CANCELLATION (JAN 2004)

The State may cancel this solicitation in whole or in part. The State may reject any or all proposals in whole or in part. [SC Code Section 11-35-1710 & R.19-445.2065] [02-2A100-1]

## RESPONSIVENESS/IMPROPER OFFERS (JUN 2015)

(a) Bid as Specified. Offers for supplies or services other than those specified will not be considered unless authorized by the Solicitation. (b) Multiple Offers. Offerors may submit more than one Offer, provided that each Offer has significant differences other than price. Each separate Offer must satisfy all Solicitation requirements. If this solicitation is an Invitation for Bids, each separate offer must be submitted as a separate document. If this solicitation is a Request for Proposals, multiple offers may be submitted as one document, provided that you clearly differentiate between each offer and you submit a separate cost proposal for each offer, if applicable. (c) Responsiveness. Any Offer which fails to conform to the material requirements of the Solicitation may be rejected as nonresponsive. Offers which impose conditions that modify material requirements of the Solicitation may be rejected. If a fixed price is required, an Offer will be rejected if the total possible cost to the State cannot be determined. Offerors will not be given an opportunity to correct any material nonconformity. Any deficiency resulting from a minor informality may be cured or waived at the sole discretion of the Procurement Officer. [R.19-445.2070 and Section 11-35-1520(13)] (d) Price Reasonableness: Any offer may be rejected if the Procurement Officer determines in writing that it is unreasonable as to price. [R. 19-445.2070]. (e) Unbalanced Bidding. The State may reject an Offer as nonresponsive if the prices bid are materially unbalanced between line items or subline items. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated in relation to cost for other work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to the State even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment. (f) **Do not submit bid samples or descriptive literature unless expressly requested.** Unsolicited bid samples or descriptive literature will not be examined or tested, will not be used to determine responsiveness, and will not be deemed to vary any of the provisions of the solicitation. S.C. Code Ann. Reg. 19-445.2077(D). [02-2A105-2]

## SIGNING YOUR OFFER (JAN 2004)

Every Offer must be signed by an individual with actual authority to bind the Offeror. (a) If the Offeror is an individual, the Offer must be signed by that individual. If the Offeror is an individual doing business as a firm, the Offer must be submitted in the firm name, signed by the individual, and state that the individual is doing business as a firm. (b) If the Offeror is a partnership, the Offer must be submitted in the partnership name, followed by the words by its Partner, and signed by a general partner. (c) If the Offeror is a corporation, the Offer must be submitted in the corporate name, followed by the signature and title of the person authorized to sign. (d) An Offer may be submitted by a joint venturer involving any combination of individuals, partnerships, or corporations. If the Offeror is a joint venture, the Offer must be submitted in the name of the Joint Venture and signed by every participant in the joint venture in the manner prescribed in paragraphs (a) through (c) above for each type of participant. (e) If an Offer is signed by an agent, other than as stated in subparagraphs (a) through (d) above, the Offer must state that it has been signed by an Agent. Upon request, Offeror must provide proof of the agent's authorization to bind the principal. [02-2A115-1]

## STATE OFFICE CLOSINGS (JAN 2004)

If an emergency or unanticipated event interrupts normal government processes so that offers cannot be received at the government office designated for receipt of bids by the exact time specified in the solicitation, the time specified for receipt of offers will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal government processes resume. In lieu of an automatic extension, an Amendment may be issued to reschedule bid opening. If state offices are closed at the time a pre-bid or pre-proposal conference is scheduled, an Amendment will be issued to reschedule the conference. Useful information may be available at:  
<http://sccmd.org/planandpreparc/disasters/index.pho/department/response/severe-winter-weather> [02-2A120-3]

## SUBMITTING CONFIDENTIAL INFORMATION (FEB 2015)

(An overview is available at [www.procurement.sc.gov](http://www.procurement.sc.gov)) For every document Offeror submits in response to or with regard to this solicitation or request, Offeror must separately mark with the word "CONFIDENTIAL" every page, or portion thereof, that Offeror contends contains information that is exempt from public disclosure because it is either (a) a trade secret as defined in Section 30-4-40(a)(1), or (b) privileged and confidential, as that phrase is used in Section 11-35-410. For every document Offeror submits in response to or with regard to this solicitation or request, Offeror must separately mark with the words "TRADE SECRET" every page, or portion thereof, that Offeror contends contains a trade secret as that term is defined by Section 39-8-20 of the Trade Secrets Act. For every document Offeror submits in response to or with regard to this solicitation or request, Offeror must separately mark with the word "PROTECTED" every page, or portion thereof, that Offeror contends is protected by Section 11-35-1810. All markings must be conspicuous; use color,

bold, underlining, or some other method in order to conspicuously distinguish the mark from the other text. Do not mark your entire response (bid, proposal, quote, etc.) as confidential, trade secret, or protected. If your response, or any part thereof, is improperly marked as confidential or trade secret or protected, the State may, in its sole discretion, determine it nonresponsive. If only portions of a page are subject to some protection, do not mark the entire page. By submitting a response to this solicitation or request, Offeror (1) agrees to the public disclosure of every page of every document regarding this solicitation or request that was submitted at any time prior to entering into a contract (including, but not limited to, documents contained in a response, documents submitted to clarify a response, and documents submitted during negotiations), unless the page is conspicuously marked "TRADE SECRET" or "CONFIDENTIAL" or "PROTECTED", (2) agrees that any information not marked, as required by these bidding instructions, as a "Trade Secret" is not a trade secret as defined by the Trade Secrets Act, and (3) agrees that, notwithstanding any claims or markings otherwise, any prices, commissions, discounts, or other financial figures used to determine the award, as well as the final contract amount, are subject to public disclosure. In determining whether to release documents, the State will detrimentally rely on Offeror's marking of documents, as required by these bidding instructions, as being either "Confidential" or "Trade Secret" or "PROTECTED". By submitting a response, Offeror agrees to defend, indemnify and hold harmless the State of South Carolina, its agencies, officers and employees, from every claim, demand, loss, expense, cost, damage or injury, including attorney's fees, arising out of or resulting from withholding information by the State of South Carolina or any of its agencies, that Offeror marked as "confidential" or "trade secret" or "PROTECTED". (All references to S.C. Code of Laws.) [02-2A125-2]

### **SUBMITTING A PAPER OFFER OR MODIFICATION (MAR 2015)**

Unless specifically instructed otherwise in the solicitation, you should submit your offer or modification in accordance with the clause titled "ON-LINE BIDDING INSTRUCTIONS." Paper offers are discouraged. If you must submit a paper offer or modification the following instructions apply. (a) All prices and notations should be printed in ink or typewritten. Errors should be crossed out, corrections entered and initialed by the person signing the bid. Do not modify the solicitation document itself (including bid schedule). (b) (1) All copies of the offer or modification, and any other documents required to be submitted with the offer shall be enclosed in a sealed, opaque envelope or package. (2) Submit your offer or modification to the address on the Cover Page. (3) The envelope or package must show the time and date specified for opening, the solicitation number, and the name and address of the bidder. If the offer or modification is sent by mail or special delivery service (UPS, Federal Express, etc.), the outermost envelope or wrapper must be labeled "OFFER ENCLOSED" on the face thereof. (c) If you are responding to more than one solicitation, submit each offer in a separate envelope or package. (d) Submit the number of copies indicated on the Cover Page. (e) Facsimile or e-mail offers, modifications, or withdrawals, will not be considered unless authorized by the Solicitation. [02-2A130-2]

### **TAX CREDIT FOR SUBCONTRACTING WITH DISADVANTAGED SMALL BUSINESSES (JAN 2008)**

Pursuant to Section 12-6-3350, a taxpayer having a contract with this State who subcontracts with a socially and economically disadvantaged small business is eligible for an income tax credit equal to four percent of the payments to that subcontractor for work pursuant to the contract. The subcontractor must be certified as a socially and economically disadvantaged small business as defined in Section 11-35-5010 and regulations pursuant to it. The credit is limited to a maximum of fifty thousand dollars annually. A taxpayer is eligible to claim the credit for ten consecutive taxable years beginning with the taxable year in which the first payment is made to the subcontractor that qualifies for the credit. After the above ten consecutive taxable years, the taxpayer is no longer eligible for the credit. A taxpayer claiming the credit shall maintain evidence of work performed for the contract by the subcontractor. The credit may be claimed on Form TC-2, "Minority Business Credit." A copy of the subcontractor's certificate from the Governor's Office of Small and Minority Business (OSMBA) is to be attached to the contractor's income tax return. Questions regarding the tax credit and how to file are to be referred to: SC Department of Revenue, Research and Review, Phone: (803) 898-5786, Fax: (803) 898-5888. Questions regarding subcontractor certification are to be referred to: Governor's Office of Small and Minority Business Assistance, Phone: (803) 734-0657, Fax: (803) 734-2498. [02-2A135-1]

### **VENDOR REGISTRATION MANDATORY (JAN 2006)**

You must have a state vendor number to be eligible to submit an offer. To obtain a state vendor number, visit [www.procurement.sc.gov](http://www.procurement.sc.gov) and select New Vendor Registration. (To determine if your business is already registered, go to "Vendor Search"). Upon registration, you will be assigned a state vendor number. Vendors must keep their vendor information current. If you are already registered, you can update your information by selecting Change Vendor Registration. (Please note that vendor registration does not substitute for any obligation to register with the S.C. Secretary of State or S.C. Department of Revenue. You can register with the agencies at <http://www.scbos.com/default.htm>) [02-2A145-1]

## **WITHDRAWAL OR CORRECTION OF OFFER (JAN 2004)**

Offers may be withdrawn by written notice received at any time before the exact time set for opening. If the Solicitation authorizes facsimile offers, offers may be withdrawn via facsimile received at any time before the exact time set for opening. A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for opening, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid. The withdrawal and correction of Offers is governed by S.C. Code Section 11-35-1520 and Regulation 19-445.2085. [02-2A150-1]

## II. INSTRUCTIONS TO OFFERORS -- B. SPECIAL INSTRUCTIONS

### CLARIFICATION (NOV 2007)

Pursuant to Section 11-35-1520(8), the Procurement Officer may elect to communicate with you after opening for the purpose of clarifying either your offer or the requirements of the solicitation. Such communications may be conducted only with offerors who have submitted an offer which obviously conforms in all material aspects to the solicitation. Clarification of an offer must be documented in writing and included with the offer. Clarifications may not be used to revise an offer or the solicitation. [Section 11-35-1520(8); R.19-445.2080] [02-2B055-1]

### ON-LINE BIDDING INSTRUCTIONS (MAR 2015)

(a) Mandatory Registration. You must register before you can submit an offer on line! See clause entitled "VENDOR REGISTRATION MANDATORY."

(b) Steps for On-Line Bidding

1 The link provided on the solicitation's Cover Page will take you to our web based on-line bidding system, where you will enter and/or upload your offer.

2 Follow the general user instructions posted at [www.procurement.sc.gov](http://www.procurement.sc.gov) under the heading "Submitting Offers."

3 Confirm your offer has a status of "submitted" by refreshing the "RFx and Auctions" screen.

**Only offers with a status of "submitted" have been received by the State.**

**Offers with a status of "saved" have not been received.**

4 Save or print a copy of your offer using the "Print Preview" button after your offer has been submitted.

[02-2B105-2]

### PROTEST - CPO - MMO ADDRESS (JUN 2006)

Any protest must be addressed to the Chief Procurement Officer, Materials Management Office, and submitted in writing

(a) by email to [protest-mmo@mmo.state.sc.us](mailto:protest-mmo@mmo.state.sc.us),

(b) by facsimile at 803-737-0639, or

(c) by post or delivery to 1201 Main Street, Suite 600, Columbia, SC 29201. [02-2B122-1]

### UNIT PRICES REQUIRED (JAN 2006)

Unit price to be shown for each item. [02-2B170-1]

### III. SCOPE OF WORK/SPECIFICATIONS

#### Background

Per- and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals that includes PFOA, PFOS, GenX, and many other chemicals. PFAS have been manufactured and used in a variety of industries around the globe, including in the United States since the 1940s. PFOA and PFOS have been the most extensively produced and studied of these chemicals. Both chemicals are very persistent in the environment and in the human body – meaning they don't break down and they can accumulate over time. There is evidence that exposure to PFAS can lead to adverse human health effects.

PFAS can be found in:

- Food packaged in PFAS-containing materials, processed with equipment that used PFAS, or grown in PFAS-contaminated soil or water.
- Commercial household products, including stain- and water-repellent fabrics, nonstick products (e.g., Teflon), polishes, waxes, paints, cleaning products, and fire-fighting foams (a major source of groundwater contamination at airports and military bases where firefighting training occurs).
- Workplace, including production facilities or industries (e.g., chrome plating, electronics manufacturing or oil recovery) that use PFAS.
- Drinking water, typically localized and associated with a specific facility (e.g., manufacturer, landfill, wastewater treatment plant, firefighter training facility).
- Living organisms, including fish, animals and humans, where PFAS have the ability to build up and persist over time.

Although PFOA and PFOS are no longer manufactured in the United States, they are still produced internationally and can be imported into the United States in consumer goods such as carpet, leather and apparel, textiles, paper and packaging, coatings, rubber and plastics.

There is evidence that exposure to PFAS can lead to adverse health outcomes in humans. If humans, or animals, ingest PFAS (by eating or drinking food or water than contain PFAS), the PFAS are absorbed, and can accumulate in the body. PFAS stay in the human body for long periods of time. As a result, as people get exposed to PFAS from different sources over time, the level of PFAS in their bodies may increase to the point where they suffer from adverse health effects.

The use of Bidder, Offeror or Contract Laboratory are used interchangeably in the solicitation.

#### **3.1. SCOPE OF WORK**

- 3.1.1. Services to include all necessary documentation work, and equipment to perform Per-and polyfluoroalkyl substances (PFAS) sample analysis.

#### **3.2. CERTIFICATION / QUALITY ASSURANCE:**

- 3.2.1. Bidders must be able to perform and report for Per- and polyfluoroalkyl substances (PFAS) analysis.
- 3.2.2. EPA Method 537.1 will be used for the analysis.
- 3.2.2.1. Bidders must be certified for this method.
- 3.2.2.1.1. A .pdf attachment from the Environmental Protection Agency (EPA) for this method has been provided for this solicitation.
- 3.2.2.1.2. Certification must be in effect at the time of submission of the offer, and maintained until completion of required analysis.
- 3.2.3. At the discretion of DHEC and/or DHEC Office of Environmental Laboratory Certification, the contract laboratory will submit to an inspection and evaluation prior to the contract being awarded.
- 3.2.4. The contract laboratory will also be subject to inspection and evaluation by the U.S. Environmental Protection Agency and the DHEC Office of Environmental Laboratory Certification, if necessary.
- 3.2.5. An on-site evaluation may be required of those laboratories that have not had an on-site visit performed by the DHEC Office of Environmental Laboratory Certification or a certifying authority recognized by the DHEC program. Any out of state vendors will incur all expenses of the DHEC staff performing the on-site evaluation.

#### **3.3. NUMBER OF SAMPLES:**

- 3.3.1. Bidders shall provide an estimated analysis of 150-450 PFAS samples.
- 3.3.2. There is no guarantee of the number of samples that will be submitted for analysis.

- 3.4. **PERFORMANCE TIMEFRAME:**  
3.4.1. Analysis must be completed by June 1, 2020.  
3.4.2. The ability to meet this requirement may be a factor in the award process.
- 3.5. **LABORATORY PROCEDURES:**  
3.5.1. Proper laboratory procedures such as sample preservation, analysis of quality control samples, quality control procedures, and record keeping are included in the contract.
- 3.6. **SUBCONTRACTING**  
Any subcontract laboratory would be subject to the same contract specifications, certification and inspection requirements as stated under Section III. Scope of Work/Specifications.
- 3.7. **DELIVERY OF BOTTLES AND CHAIN OF CUSTODY:**  
3.7.1. Sample kits including sample collection documentation, instructions, and bottles are to be delivered to DHEC Bureau of Water as part of the contract.  
3.7.1.1. The contractual obligations include delivery of the proper number and type of sample bottles by courier, parcel post, or common carrier.  
3.7.1.2. Return shipment of samples is to be done as a part of the contract cost.  
3.7.2. Samples can be shipped in any of the following manners: USPS; Fed Ex, UPS, pick-up by the laboratory.  
3.7.3. A prepaid label must be provided for all return shipments.  
3.7.4. Written instructions are to be provided concerning collection, preservation, and return shipping procedures.  
3.7.5. Relevant addresses will be provided to the contracted laboratory(ies).  
3.7.6. "Chain-of-custody" forms are to be provided for each shipment.  
3.7.7. At DHEC's discretion, kits may be directly delivered and contractor's courier service may not be used.
- 3.8. **COLLECTION BOTTLE CONFIGURATION:**  
EPA recommends the following configurations:  
3.8.1. Sample containers: 250-mL polypropylene bottles fitted with polypropylene screw caps  
3.8.2. Polypropylene bottles: 4-mL narrow-mouth
- 3.9. **LOST OR DAMAGED SAMPLES**  
3.9.1. Samples lost or damaged while in transit or in the custody of the contract laboratory will be repeated at no additional cost to DHEC Bureau of Water.  
3.9.2. Invalidated samples are to be repeated and may be billed as additional samples if not due to laboratory error.  
3.9.3. Samples with no "chain-of-custody" form will be considered exceeding the appropriate holding time and may be billed as additional samples.
- 3.10. **CONFIDENTIALITY OF DATA:**  
All data including sampling site location and analytical results are the property of DHEC Bureau of Water and are not to be released to anyone including the water system from which they were collected without written permission from DHEC. Any request for data must be addressed to DHEC Freedom of Information Office.
- 3.11. **REPORTING RESULTS:**  
3.11.1. The analytical results are to be reported to the DHEC Bureau of Water in electronic format within twenty-one (21) days of analysis.  
3.11.1.1. The final report must include the results and a copy of the chain-of-custody form.  
3.11.1.2. Analytical results must be reported using the proper format.  
3.11.2. The laboratory must submit updates monthly. These updates should include documentation of bottle deliveries, and any complications should they arise.
- 3.12. **PROJECT STAFFING:**  
3.12.1 The Contractor is expected to propose sufficient staff with the requisite skills and abilities to meet all requirements of this bid.  
3.12.2. The Contractor must identify the personnel and provide their assigned roles and resumes demonstrating their qualifications and experience for the identified staff. The personnel identified must be employed by the Contractor at the time the offer is submitted.  
3.12.3. The Contractor's offer must describe policies, plans, and intentions about maintaining continuity of key staff assigned to the project and avoiding and minimizing the impact of necessary staff changes.

**3.13. INVOICING:**

The actual data results must accompany all invoices (hard copy and email) for those samples included in the invoice.

**3.14. PRICING:**

3.14.1. Provide an individual price for analysis of Method 537.1.

3.14.1.1. The costs must be all-inclusive, including collection supplies, freight, and shipping charges.

3.14.1.2. Bidders shall provide pricing for both five-day and three-day expedited analysis (the pricing for expedited analyses will not be part of the award criteria).

**DELIVERY/PERFORMANCE LOCATION -- SPECIFIED (JAN 2006)**

After award, all deliveries shall be made and all services provided to the following address, unless otherwise specified:  
South Carolina Department of Health and Environmental Control  
Bureau of Water  
2600 Bull Street  
Columbia, SC 29201

[03-3030-1]

**IV. INFORMATION FOR OFFERORS TO SUBMIT**

**INFORMATION FOR OFFERORS TO SUBMIT – EVALUATION (JAN 2006)**

In addition to information requested elsewhere in this solicitation, offerors should submit the following information for purposes of evaluation: [04-4005-1]

- 4.1 Provide a detailed report of the lab's sample handling capabilities, analytical report generation, data transfer, and ability to successfully report by electronic transfer and hard copy, monitoring data using the format and essential reporting characteristics supplied by DHEC and level of technological capabilities (i.e., existence of a laboratory information management system portal accessible by DHEC).
- 4.2 Pricing
- 4.3 Certification – Provide proof of certification to conduct Per- and polyfluoroalkyl substances (PFAS) using Method 537.1.

**INFORMATION FOR OFFERORS TO SUBMIT -- GENERAL (MAR 2015)**

You shall submit a signed Cover Page and Page Two. If you submit your offer electronically, you must upload an image of a signed Cover Page and Page Two. Your offer should include all other information and documents requested in this part and in parts II.B. Special Instructions; III. Scope of Work; V. Qualifications; VIII. Bidding Schedule/Price Proposal; and any appropriate attachments addressed in Part IX. Attachments to Solicitations. You should submit a summary of all insurance policies you have or plan to acquire to comply with the insurance requirements stated herein, if any, including policy types; coverage types; limits, sub-limits, and deductibles for each policy and coverage type; the carrier's A.M. Best rating; and whether the policy is written on an occurrence or claims-made basis. [04-4010-2]

**MINORITY PARTICIPATION (DEC 2015)**

Is the bidder a South Carolina Certified Minority Business? [ ] Yes [  ] No

Is the bidder a Minority Business certified by another governmental entity? [ ] Yes [  ] No

If so, please list the certifying governmental entity: \_\_\_\_\_

Will any of the work under this contract be performed by a SC certified Minority Business as a subcontractor? [ ] Yes [  ] No

If so, what percentage of the total value of the contract will be performed by a SC certified Minority Business as a subcontractor? \_\_\_\_\_

Will any of the work under this contract be performed by a minority business certified by another governmental entity as a subcontractor? [ ] Yes [  ] No

If so, what percentage of the total value of the contract will be performed by a minority business certified by another governmental entity as a subcontractor? \_\_\_\_\_

If a certified Minority Business is participating in this contract, please indicate all categories for which the Business is certified:

- [ ] Traditional minority
- [ ] Traditional minority, but female
- [ ] Women (Caucasian females)
- [ ] Hispanic minorities
- [ ] DOT referral (Traditional minority)
- [ ] DOT referral (Caucasian female)
- [ ] Temporary certification
- [ ] SBA 8 (a) certification referral
- [ ] Other minorities (Native American, Asian, etc.)

(If more than one minority contractor will be utilized in the performance of this contract, please provide the information above for each minority business.)

The Department of Administration, Division of Small and Minority Business Contracting and Certification, publishes a list of certified minority firms. The Minority Business Directory is available at the following URL:  
<http://osmba.sc.gov/directory.html> [04-4015-3]

## V. QUALIFICATIONS

### QUALIFICATIONS OF OFFEROR (MAR 2015)

(1) To be eligible for award, you must have the capability in all respects to perform fully the contract requirements and the integrity and reliability which will assure good faith performance. We may also consider a documented commitment from a satisfactory source that will provide you with a capability. We may consider information from any source at any time prior to award. We may elect to consider (i) key personnel, any predecessor business, and any key personnel of any predecessor business, including any facts arising prior to the date a business was established, and/or (ii) any subcontractor you identify. (2) You must promptly furnish satisfactory evidence of responsibility upon request. Unreasonable failure to supply requested information is grounds for rejection. (3) **Corporate subsidiaries are cautioned that the financial capability of an affiliated or parent company will not be considered in determining financial capability;** however, we may elect to consider any security, e.g., letter of credit, performance bond, parent-company corporate guaranty, that you offer to provide. Instructions and forms to help assure acceptability are posted on [procurement.sc.gov](http://procurement.sc.gov), link to "Standard Clauses & Provisions." [05-5005-2]

### SUBCONTRACTOR – IDENTIFICATION (FEB 2015)

If you intend to subcontract, at any tier level, with another business for any portion of the work and that portion either (1) exceeds 10% of your cost, (2) involves access to any "government information," as defined in the clause entitled "Information Security - Definitions," if included, or (3) otherwise involves services critical to your performance of the work (err on the side of inclusion), your offer must identify that business and the work which they are to perform. Identify potential subcontractors by providing the business name, address, phone, taxpayer identification number, and point of contact. In determining your responsibility, the state may contact and evaluate your proposed subcontractors. [05- 5030-2]

## VI. AWARD CRITERIA

### AWARD CRITERIA -- BIDS (JAN 2006)

Award will be made to the lowest responsible and responsive bidder(s). [06-6020-1]

### AWARD TO ONE OFFEROR (JAN 2006)

Award will be made to one Offeror. [06-6040-1]

### COMPETITION FROM PUBLIC ENTITIES (JAN 2006)

If a South Carolina governmental entity submits an offer, the Procurement Officer will, when determining the lowest offer, add to the price provided in any offers submitted by non-governmental entities a percentage equivalent to any applicable sales or use tax. S.C. Code Ann. Regs 117-304.1 (Supp. 2004). [06-6057-1]

### UNIT PRICE GOVERNS (JAN 2006)

In determining award, unit prices will govern over extended prices unless otherwise stated. [06-6075-1]

## **VII. TERMS AND CONDITIONS -- A. GENERAL**

### **ASSIGNMENT, NOVATION, AND CHANGE OF NAME, IDENTITY, OR STRUCTURE (FEB 2015)**

(a) Contractor shall not assign this contract, or its rights, obligations, or any other interest arising from this contract, or delegate any of its performance obligations, without the express written consent of the responsible procurement officer. The foregoing restriction does not apply to a transfer that occurs by operation of law (e.g., bankruptcy; corporate reorganizations and consolidations, but not including partial asset sales). Notwithstanding the foregoing, contractor may assign monies receivable under the contract provided that the state shall have no obligation to make payment to an assignee until thirty days after contractor (not the assignee) has provided the responsible procurement officer with (i) proof of the assignment, (ii) the identity (by contract number) of the specific state contract to which the assignment applies, and (iii) the name of the assignee and the exact address or account information to which assigned payments should be made. (b) If contractor amends, modifies, or otherwise changes its name, its identity (including its trade name), or its corporate, partnership or other structure, or its FEIN, contractor shall provide the procurement officer prompt written notice of such change. (c) Any name change, transfer, assignment, or novation is subject to the conditions and approval required by Regulation 19-445.2180, which does not restrict transfers by operation of law. [07-7A004-2]

### **BANKRUPTCY - GENERAL (FEB 2015)**

(a) Notice. In the event the Contractor enters into proceedings relating to bankruptcy, whether voluntary or involuntary, the Contractor agrees to furnish written notification of the bankruptcy to the Using Governmental Unit. This notification shall be furnished within two (2) days of the initiation of the proceedings relating to the bankruptcy filing. This notification shall include the date on which the bankruptcy petition was filed, the identity of the court in which the bankruptcy petition was filed, and a listing of all State contracts against which final payment has not been made. This obligation remains in effect until final payment under this Contract. (b) Termination. This contract is voidable and subject to immediate termination by the State upon the contractor's insolvency, including the filing of proceedings in bankruptcy. [07-7A005-2]

### **CHOICE-OF-LAW (JAN 2006)**

The Agreement, any dispute, claim, or controversy relating to the Agreement, and all the rights and obligations of the parties shall, in all respects, be interpreted, construed, enforced and governed by and under the laws of the State of South Carolina, except its choice of law rules. As used in this paragraph, the term "Agreement" means any transaction or agreement arising out of, relating to, or contemplated by the solicitation. [07-7A010-1]

### **CONTRACT DOCUMENTS and ORDER OF PRECEDENCE (FEB 2015)**

(a) Any contract resulting from this solicitation shall consist of the following documents: (1) a Record of Negotiations, if any, executed by you and the Procurement Officer, (2) the solicitation, as amended, (3) documentation of clarifications [11-35-1520(8)] or discussions [11-35-1530(6)] of an offer, if applicable, (4) your offer, (5) any statement reflecting the State's final acceptance (a/k/a "award"), and (6) purchase orders. These documents shall be read to be consistent and complimentary. Any conflict among these documents shall be resolved by giving priority to these documents in the order listed above. (b) The terms and conditions of documents (1) through (5) above shall apply notwithstanding any additional or different terms and conditions in any other document, including without limitation, (i) a purchase order or other instrument submitted by the State, (ii) any invoice or other document submitted by Contractor, or (iii) any privacy policy, terms of use, or end user agreement. Except as otherwise allowed herein, the terms and conditions of all such documents shall be void and of no effect. (c) No contract, license, or other agreement containing contractual terms and conditions will be signed by any Using Governmental Unit. Any document signed or otherwise agreed to by persons other than the Procurement Officer shall be void and of no effect. [07-7A015-2]

### **DISCOUNT FOR PROMPT PAYMENT (JAN 2006)**

(a) Discounts for prompt payment will not be considered in the evaluation of offers. However, any offered discount will form a part of the award, and will be taken if payment is made within the discount period indicated in the offer by the offeror. As an alternative to offering a discount for prompt payment in conjunction with the offer, offerors awarded contracts may include discounts for prompt payment on individual invoices.

(b) In connection with any discount offered for prompt payment, time shall be computed from the date of the invoice. If the Contractor has not placed a date on the invoice, the due date shall be calculated from the date the designated billing office receives a proper invoice, provided the state annotates such invoice with the date of receipt at the time of receipt. For the purpose of computing the discount earned, payment shall be considered to have been made on the date that appears on the payment check or, for an electronic funds transfer, the specified payment date. When the discount date falls on a Saturday, Sunday, or legal holiday when Federal Government offices are closed and Government business is not expected to be conducted, payment may be made on the following business day. [07-7A020-1]

#### **DISPUTES (JAN 2006)**

(1) Choice-of-Forum. All disputes, claims, or controversies relating to the Agreement shall be resolved exclusively by the appropriate Chief Procurement Officer in accordance with Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws, or in the absence of jurisdiction, only in the Court of Common Pleas for, or a federal court located in, Richland County, State of South Carolina. Contractor agrees that any act by the government regarding the Agreement is not a waiver of either the government's sovereign immunity or the government's immunity under the Eleventh Amendment of the United States Constitution. As used in this paragraph, the term "Agreement" means any transaction or agreement arising out of, relating to, or contemplated by the solicitation. (2) Service of Process. Contractor consents that any papers, notices, or process necessary or proper for the initiation or continuation of any disputes, claims, or controversies relating to the Agreement; for any court action in connection therewith; or for the entry of judgment on any award made, may be served on Contractor by certified mail (return receipt requested) addressed to Contractor at the address provided as the Notice Address on Page Two or by personal service or by any other manner that is permitted by law, in or outside South Carolina. Notice by certified mail is deemed duly given upon deposit in the United States mail. [07-7A025-1]

#### **EQUAL OPPORTUNITY (JAN 2006)**

Contractor is referred to and shall comply with all applicable provisions, if any, of Title 41, Part 60 of the Code of Federal Regulations, including but not limited to Sections 60-1.4, 60-4.2, 60-4.3, 60-250.5(a), and 60-741.5(a), which are hereby incorporated by reference. [07-7A030-1]

#### **FALSE CLAIMS (JAN 2006)**

According to the S.C. Code of Laws Section 16-13-240, "a person who by false pretense or representation obtains the signature of a person to a written instrument or obtains from another person any chattel, money, valuable security, or other property, real or personal, with intent to cheat and defraud a person of that property is guilty" of a crime. [07-7A035-1]

#### **FIXED PRICING REQUIRED (JAN 2006)**

Any pricing provided by contractor shall include all costs for performing the work associated with that price. Except as otherwise provided in this solicitation, contractor's price shall be fixed for the duration of this contract, including option terms. This clause does not prohibit contractor from offering lower pricing after award. [07-7A040-1]

#### **NO INDEMNITY OR DEFENSE (FEB 2015)**

Any term or condition is void to the extent it requires the State to indemnify, defend, or pay attorney's fees to anyone for any reason. [07-7A045-2]

#### **NOTICE (JAN 2006)**

(A) After award, any notices shall be in writing and shall be deemed duly given (1) upon actual delivery, if delivery is by hand, (2) upon receipt by the transmitting party of automated confirmation or answer back from the recipient's device if delivery is by telex, telegram, facsimile, or electronic mail, or (3) upon deposit into the United States mail, if postage is prepaid, a return receipt is requested, and either registered or certified mail is used. (B) Notice to contractor shall be to the address identified as the Notice Address on Page Two. Notice to the state shall be to the Procurement Officer's address on the Cover Page. Either party may designate a different address for notice by giving notice in accordance with this paragraph. [07-7A050-1]

## **OPEN TRADE (JUN 2015)**

During the contract term, including any renewals or extensions, Contractor will not engage in the boycott of a person or an entity based in or doing business with a jurisdiction with whom South Carolina can enjoy open trade, as defined in SC Code Section 11-35-5300. [07-7A053-1]

## **PAYMENT and INTEREST (FEB 2015)**

(a) The State shall pay the Contractor, after the submission of proper invoices or vouchers, the prices stipulated in this contract for supplies delivered and accepted or services rendered and accepted, less any deductions provided in this contract. Unless otherwise specified herein, including the purchase order, payment shall not be made on partial deliveries accepted by the Government. (b) Unless otherwise provided herein, including the purchase order, payment will be made by check mailed to the payment address on "Page Two." (c) Notwithstanding any other provision, payment shall be made in accordance with S.C. Code Section 11-35-45, or Chapter 6 of Title 29 (real property improvements) when applicable, which provides the Contractor's exclusive means of recovering any type of interest from the Owner. Contractor waives imposition of an interest penalty unless the invoice submitted specifies that the late penalty is applicable. Except as set forth in this paragraph, the State shall not be liable for the payment of interest on any debt or claim arising out of or related to this contract for any reason. (d) Amounts due to the State shall bear interest at the rate of interest established by the South Carolina Comptroller General pursuant to Section 11-35-45 ("an amount not to exceed fifteen percent each year"), as amended, unless otherwise required by Section 29-6-30. (e) Any other basis for interest, including but not limited to general (pre- and post-judgment) or specific interest statutes, including S.C. Code Ann. Section 34-31-20, are expressly waived by both parties. If a court, despite this agreement and waiver, requires that interest be paid on any debt by either party other than as provided by items (c) and (d) above, the parties further agree that the applicable interest rate for any given calendar year shall be the lowest prime rate as listed in the first edition of the Wall Street Journal published for each year, applied as simple interest without compounding. (f) The State shall have all of its common law, equitable and statutory rights of set-off. [07-7A055-3]

## **PUBLICITY (JAN 2006)**

Contractor shall not publish any comments or quotes by State employees, or include the State in either news releases or a published list of customers, without the prior written approval of the Procurement Officer. [07-7A060-1]

## **PURCHASE ORDERS (JAN 2006)**

Contractor shall not perform any work prior to the receipt of a purchase order from the using governmental unit. The using governmental unit shall order any supplies or services to be furnished under this contract by issuing a purchase order. Purchase orders may be used to elect any options available under this contract, e.g., quantity, item, delivery date, payment method, but are subject to all terms and conditions of this contract. Purchase orders may be electronic. No particular form is required. An order placed pursuant to the purchasing card provision qualifies as a purchase order. [07-7A065-1]

## **SURVIVAL OF OBLIGATIONS (JAN 2006)**

The Parties' rights and obligations which, by their nature, would continue beyond the termination, cancellation, rejection, or expiration of this contract shall survive such termination, cancellation, rejection, or expiration, including, but not limited to, the rights and obligations created by the following clauses: Indemnification - Third Party Claims, Intellectual Property Indemnification, and any provisions regarding warranty or audit. [07-7A075-1]

## **TAXES (JAN 2006)**

Any tax the contractor may be required to collect or pay upon the sale, use or delivery of the products shall be paid by the State, and such sums shall be due and payable to the contractor upon acceptance. Any personal property taxes levied after delivery shall be paid by the State. It shall be solely the State's obligation, after payment to contractor, to challenge the applicability of any tax by negotiation with, or action against, the taxing authority. Contractor agrees to refund any tax collected, which is subsequently determined not to be proper and for which a refund has been paid to contractor by the taxing authority. In the event that the contractor fails to pay, or delays in paying, to any taxing authorities, sums paid by the State to contractor, contractor shall be liable to the State for any loss (such as the assessment of additional interest) caused by virtue of this failure or delay. Taxes based on Contractor's net income or assets shall be the sole responsibility of the contractor. [07-7A080-1]

#### **TERMINATION DUE TO UNAVAILABILITY OF FUNDS (JAN 2006)**

Payment and performance obligations for succeeding fiscal periods shall be subject to the availability and appropriation of funds therefor. When funds are not appropriated or otherwise made available to support continuation of performance in a subsequent fiscal period, the contract shall be canceled. In the event of a cancellation pursuant to this paragraph, contractor will be reimbursed the resulting unamortized, reasonably incurred, nonrecurring costs. Contractor will not be reimbursed any costs amortized beyond the initial contract term. [07-7A085-1]

#### **THIRD PARTY BENEFICIARY (JAN 2006)**

This Contract is made solely and specifically among and for the benefit of the parties hereto, and their respective successors and assigns, and no other person will have any rights, interest, or claims hereunder or be entitled to any benefits under or on account of this Contract as a third party beneficiary or otherwise. [07-7A090-1]

#### **WAIVER (JAN 2006)**

The State does not waive any prior or subsequent breach of the terms of the Contract by making payments on the Contract, by failing to terminate the Contract for lack of performance, or by failing to strictly or promptly insist upon any term of the Contract. Only the Procurement Officer has actual authority to waive any of the State's rights under this Contract. Any waiver must be in writing. [07-7A095-1]

## **VII. TERMS AND CONDITIONS -- B. SPECIAL**

### **CHANGES (JAN 2006)**

(1) Contract Modification. By a written order, at any time, and without notice to any surety, the Procurement Officer may, subject to all appropriate adjustments, make changes within the general scope of this contract in any one or more of the following:

(a) drawings, designs, or specifications, if the supplies to be furnished are to be specially manufactured for the [State] in accordance therewith;

(b) method of shipment or packing;

(c) place of delivery;

(d) description of services to be performed;

(e) time of performance (i.e., hours of the day, days of the week, etc.); or,

(f) place of performance of the services. Subparagraphs (a) to (c) apply only if supplies are furnished under this contract.

Subparagraphs (d) to (f) apply only if services are performed under this contract.

(2) Adjustments of Price or Time for Performance. If any such change increases or decreases the contractor's cost of, or the time required for, performance of any part of the work under this contract, whether or not changed by the order, an adjustment shall be made in the contract price, the delivery schedule, or both, and the contract modified in writing accordingly. Any adjustment in contract price made pursuant to this clause shall be determined in accordance with the Price Adjustment Clause of this contract. Failure of the parties to agree to an adjustment shall not excuse the contractor from proceeding with the contract as changed, provided that the State promptly and duly make such provisional adjustments in payment or time for performance as may be reasonable. By proceeding with the work, the contractor shall not be deemed to have prejudiced any claim for additional compensation, or an extension of time for completion.

(3) Time Period for Claim. Within 30 days after receipt of a written contract modification under Paragraph (1) of this clause, unless such period is extended by the Procurement Officer in writing, the contractor shall file notice of intent to assert a claim for an adjustment. Later notification shall not bar the contractor's claim unless the State is prejudiced by the delay in notification.

(4) Claim Barred After Final Payment. No claim by the contractor for an adjustment hereunder shall be allowed if notice is not given prior to final payment under this contract. [07-7B025-1]

### **CISG (JAN 2006)**

The parties expressly agree that the UN Convention on the International Sale of Goods shall not apply to this agreement. [07-7B030-1]

### **COMPLIANCE WITH LAWS (JAN 2006)**

During the term of the contract, contractor shall comply with all applicable provisions of laws, codes, ordinances, rules, regulations, and tariffs. [07-7B035-1]

### **CONTRACTOR PERSONNEL (JAN 2006)**

The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them. [07-7B060-1]

### **DEFAULT (JAN 2006)**

(a) (1) The State may, subject to paragraphs (c) and (d) of this clause, by written notice of default to the Contractor, terminate this contract in whole or in part if the Contractor fails to:

(i) Deliver the supplies or to perform the services within the time specified in this contract or any extension;

(ii) Make progress, so as to endanger performance of this contract (but see paragraph (a)(2) of this clause); or

(iii) Perform any of the other material provisions of this contract (but see paragraph (a)(2) of this clause).

(2) The State's right to terminate this contract under subdivisions (a)(1)(ii) and (1)(iii) of this clause, may be exercised if the

Contractor does not cure such failure within 10 days (or more if authorized in writing by the Procurement Officer) after receipt of the notice from the Procurement Officer specifying the failure.

(b) If the State terminates this contract in whole or in part, it may acquire, under the terms and in the manner the Procurement Officer considers appropriate, supplies or services similar to those terminated, and the Contractor will be liable to the State for any excess costs for those supplies or services. However, the Contractor shall continue the work not terminated.

(c) Except for defaults of subcontractors at any tier, the Contractor shall not be liable for any excess costs if the failure to perform the contract arises from causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (1) acts of God or of the public enemy, (2) acts of the State in either its sovereign or contractual capacity, (3) fires, (4) floods, (5) epidemics, (6) quarantine restrictions, (7) strikes, (8) freight embargoes, and (9) unusually severe weather. In each instance the failure to perform must be beyond the control and without the fault or negligence of the Contractor.

(d) If the failure to perform is caused by the default of a subcontractor at any tier, and if the cause of the default is beyond the control of both the Contractor and subcontractor, and without the fault or negligence of either, the Contractor shall not be liable for any excess costs for failure to perform, unless the subcontracted supplies or services were obtainable from other sources in sufficient time for the Contractor to meet the required delivery schedule.

(e) If this contract is terminated for default, the State may require the Contractor to transfer title and deliver to the State, as directed by the Procurement Officer, any (1) completed supplies, and (2) partially completed supplies and materials, parts, tools, dies, jigs, fixtures, plans, drawings, information, and contract rights (collectively referred to as "manufacturing materials" in this clause) that the Contractor has specifically produced or acquired for the terminated portion of this contract. Upon direction of the Procurement Officer, the Contractor shall also protect and preserve property in its possession in which the State has an interest.

(f) The State shall pay contract price for completed supplies delivered and accepted. The Contractor and Procurement Officer shall agree on the amount of payment for manufacturing materials delivered and accepted and for the protection and preservation of the property; if the parties fail to agree, the Procurement Officer shall set an amount subject to the Contractor's rights under the Disputes clause. Failure to agree will be a dispute under the Disputes clause. The State may withhold from these amounts any sum the Procurement Officer determines to be necessary to protect the State against loss because of outstanding liens or claims of former lien holders.

(g) If, after termination, it is determined that the Contractor was not in default, or that the default was excusable, the rights and obligations of the parties shall, if the contract contains a clause providing for termination for convenience of the State, be the same as if the termination had been issued for the convenience of the State. If, in the foregoing circumstances, this contract does not contain a clause providing for termination for convenience of the State, the contract shall be adjusted to compensate for such termination and the contract modified accordingly subject to the contractor's rights under the Disputes clause.

(h) The rights and remedies of the State in this clause are in addition to any other rights and remedies provided by law or under this contract. [07-7B075-1]

#### **ESTIMATED QUANTITY -- UNKNOWN (JAN 2006)**

The total quantity of purchases of any individual item on the contract is not known. The State does not guarantee that the State will buy any specified item or total amount. The omission of an estimated purchase quantity does not indicate a lack of need but rather a lack of historical information. [07-7B095-1]

#### **ILLEGAL IMMIGRATION (NOV 2008)**

(An overview is available at [www.procurement.sc.gov](http://www.procurement.sc.gov)) By signing your offer, you certify that you will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina Code of Laws and agree to provide to the State upon request any documentation required to establish either: (a) that Title 8, Chapter 14 is inapplicable to you and your subcontractors or sub-subcontractors; or (b) that you and your subcontractors or sub-subcontractors are in compliance with Title 8, Chapter 14. Pursuant to Section 8-14- 60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony, and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." You agree to include in any contracts with your subcontractors language requiring your subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in their contracts with the sub-subcontractors language requiring the sub-subcontractors to comply with the applicable requirements of Title 8, Chapter 14. [07-7B097-1]

## **INDEMNIFICATION-THIRD PARTY CLAIMS – GENERAL (NOV 2011)**

Notwithstanding any limitation in this agreement, and to the fullest extent permitted by law, Contractor shall defend and hold harmless Indemnitees for and against any and all suits or claims of any character (and all related damages, settlement payments, attorneys' fees, costs, expenses, losses or liabilities) by a third party which are attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property arising out of or in connection with the goods or services acquired hereunder or caused in whole or in part by any act or omission of contractor, its subcontractors, their employees, workmen, servants, agents, or anyone directly or indirectly employed by them or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by an Indemnitee, and whether or not such claims are made by a third party or an Indemnitee; however, if an Indemnitee's negligent act or omission is subsequently determined to be the sole proximate cause of a suit or claim, the Indemnitee shall not be entitled to indemnification hereunder. Contractor shall be given timely written notice of any suit or claim. Contractor's obligations hereunder are in no way limited by any protection afforded under workers' compensation acts, disability benefits acts, or other employee benefit acts. This clause shall not negate, abridge, or reduce any other rights or obligations of indemnity which would otherwise exist. The obligations of this paragraph shall survive termination, cancelation, or expiration of the parties' agreement. This provision shall be construed fairly and reasonably, neither strongly for nor against either party, and without regard to any clause regarding insurance. As used in this clause, "Indemnitees" means the State of South Carolina, its instrumentalities, agencies, departments, boards, political subdivisions and all their respective officers, agents and employees. [07-7B100-2]

## **INDEMNIFICATION – INTELLECTUAL PROPERTY (JAN 2006)**

(a) Without limitation and notwithstanding any provision in this agreement, Contractor shall, upon receipt of notification, defend and indemnify the State, its instrumentalities, agencies, departments, boards, political subdivisions and all their respective officers, agents and employees against all actions, proceedings or claims of any nature (and all damages, settlement payments, attorneys' fees (including inside counsel), costs, expenses, losses or liabilities attributable thereto) by any third party asserting or involving an IP right related to an acquired item. State shall allow Contractor to defend such claim so long as the defense is diligently and capably prosecuted. State shall allow Contractor to settle such claim so long as (i) all settlement payments are made by Contractor, and (ii) the settlement imposes no non-monetary obligation upon State. State shall reasonably cooperate with Contractor's defense of such claim. (b) In the event an injunction or order shall be obtained against State's use of any acquired item, or if in Contractor's opinion, the acquired item is likely to become the subject of a claim of infringement or violation of an IP right, Contractor shall, without in any way limiting the foregoing, and at its expense, either: (1) procure for State the right to continue to use, or have used, the acquired item, or (2) replace or modify the acquired item so that it becomes non-infringing but only if the modification or replacement does not adversely affect the specifications for the acquired item or its use by State. If neither (1) nor (2), above, is practical, State may require that Contractor remove the acquired item from State, refund to State any charges paid by State therefor, and take all steps necessary to have State released from any further liability. (c) Contractor's obligations under this paragraph do not apply to a claim to the extent (i) that the claim is caused by Contractor's compliance with specifications furnished by the State unless Contractor knew its compliance with the State's specifications would infringe an IP right, or (ii) that the claim is caused by Contractor's compliance with specifications furnished by the State if the State knowingly relied on a third party's IP right to develop the specifications provided to Contractor and failed to identify such product to Contractor. (d) As used in this paragraph, these terms are defined as follows: "IP right(s)" means a patent, copyright, trademark, trade secret, or any other proprietary right. "Acquired item(s)" means the rights, goods, or services furnished under this agreement. "Specification(s)" means a detailed, exact statement of particulars such as a statement prescribing materials, dimensions, and quality of work. (e) Contractor's obligations under this clause shall survive the termination, cancellation, rejection, or expiration of this Agreement. [07-7B103-1]

## **LICENSES AND PERMITS (JAN 2006)**

During the term of the contract, the Contractor shall be responsible for obtaining, and maintaining in good standing, all licenses (including professional licenses, if any), permits, inspections and related fees for each or any such licenses, permits and /or inspections required by the State, county, city or other government entity or unit to accomplish the work specified in this solicitation and the contract. [07-7B115-1]

## **MATERIAL AND WORKMANSHIP (JAN 2006)**

Unless otherwise specifically provided in this contract, all equipment, material, and articles incorporated in the work covered by this contract are to be new and of the most suitable grade for the purpose intended. [07-7B120-1]

## **PRICE ADJUSTMENTS (JAN 2006)**

(1) Method of Adjustment. Any adjustment in the contract price made pursuant to a clause in this contract shall be consistent with this Contract and shall be arrived at through whichever one of the following ways is the most valid approximation of the actual cost to the Contractor (including profit, if otherwise allowed): (a) by agreement on a fixed price adjustment before commencement of the pertinent performance or as soon thereafter as practicable; (b) by unit prices specified in the Contract or subsequently agreed upon; (c) by the costs attributable to the event or situation covered by the relevant clause, including profit if otherwise allowed, all as specified in the Contract; or subsequently agreed upon; (d) in such other manner as the parties may mutually agree; or, (e) in the absence of agreement by the parties, through a unilateral initial written determination by the Procurement Officer of the costs attributable to the event or situation covered by the clause, including profit if otherwise allowed, all as computed by the Procurement Officer in accordance with generally accepted accounting principles, subject to the provisions of Title 11, Chapter 35, Article 17 of the S.C. Code of Laws.

(2) Submission of Price or Cost Data. Upon request of the Procurement Officer, the contractor shall provide reasonably available factual information to substantiate that the price or cost offered, for any price adjustments is reasonable, consistent with the provisions of Section 11-35-1830. [07-7B160-1]

## **PRICING DATA -- AUDIT -- INSPECTION (JAN 2006)**

[Clause Included Pursuant to Section 11-35-1830, - 2210, & -2220] (a) Cost or Pricing Data. Upon Procurement Officer's request, you shall submit cost or pricing data, as defined by 48 C.F.R. Section 2.101 (2004), prior to either (1) any award to contractor pursuant to 11-35-1530 or 11-35-1560, if the total contract price exceeds \$500,000, or (2) execution of a change order or contract modification with contractor which exceeds \$100,000. Your price, including profit or fee, shall be adjusted to exclude any significant sums by which the state finds that such price was increased because you furnished cost or pricing data that was inaccurate, incomplete, or not current as of the date agreed upon between parties. (b) Records Retention. You shall maintain your records for three years from the date of final payment, or longer if requested by the chief Procurement Officer. The state may audit your records at reasonable times and places. As used in this subparagraph (b), the term "records" means any books or records that relate to cost or pricing data submitted pursuant to this clause. In addition to the obligation stated in this subparagraph (b), you shall retain all records and allow any audits provided for by 11-35-2220(2). (c) Inspection. At reasonable times, the state may inspect any part of your place of business which is related to performance of the work. (d) Instructions Certification. When you submit data pursuant to subparagraph (a), you shall (1) do so in accordance with the instructions appearing in Table 15-2 of 48 C.F.R. Section 15.408 (2004) (adapted as necessary for the state context), and (2) submit a Certificate of Current Cost or Pricing Data, as prescribed by 48 CFR Section 15.406-2(a) (adapted as necessary for the state context). (e) Subcontracts. You shall include the above text of this clause in all of your subcontracts. (f) Nothing in this clause limits any other rights of the state. [07-7B185-1]

## **RESTRICTIONS ON PRESENTING TERMS OF USE OR OFFERING ADDITIONAL SERVICES (FEB 2015)**

(a) Citizens, as well as public employees (acting in their individual capacity), should not be unnecessarily required to agree to or provide consent to policies or contractual terms in order to access services acquired by the government pursuant to this contract (hereinafter "applicable services") or, in the case of public employees, to perform their job duties; accordingly, in performing the work, contractor shall not require or invite any citizen or public employee to agree to or provide consent to any end user contract, privacy policy, or other terms of use (hereinafter "terms of use") not previously approved in writing by the procurement officer. Contractor agrees that any terms of use regarding applicable services are void and of no effect. (b) Unless expressly provided in the solicitation, public contracts are not intended to provide contractors an opportunity to market additional products and services; accordingly, in performing the work, contractor shall not – for itself or on behalf of any third party – offer citizens or public employees (other than the procurement officer) any additional products or services not required by the contract. (c) Any reference to contractor in items (a) or (b) also includes any subcontractor at any tier. Contractor is responsible for compliance with these obligations by any person or entity that contractor authorizes to take any action related to the work. (d) Any violation of this clause is a material breach of contract. The parties acknowledge the difficulties inherent in determining the damage from any breach of these restrictions. Contractor shall pay the state liquidated damages of \$1,000 for each contact with a citizen or end user that violates this restriction. [07-7B212-1]

## **SHIPPING / RISK OF LOSS (JAN 2006)**

F.O.B. Destination. Destination is the shipping dock of the Using Governmental Units' designated receiving site, or other location, as specified herein. (See Delivery clause) [07-7B220-1]

## **SUBSTITUTIONS PROHIBITED - END PRODUCT PREFERENCES (SEP 2009)**

If you receive the award as a result of the South Carolina end product or United States end product preference, you may not substitute a nonqualifying end product for a qualified end product. If you violate this provision, the State may terminate your contract for cause and you may be debarred. In addition, you shall pay to the State an amount equal to twice the difference between the price paid by the State and your evaluated price for the item for which you delivered a substitute. [11-35-1534(B)(4)] [07-7B236-1]

## **TERMINATION FOR CONVENIENCE (JAN 2006)**

(1) Termination. The Procurement Officer may terminate this contract in whole or in part, for the convenience of the State. The Procurement Officer shall give written notice of the termination to the contractor specifying the part of the contract terminated and when termination becomes effective.

(2) Contractor's Obligations. The contractor shall incur no further obligations in connection with the terminated work and on the date set in the notice of termination the contractor will stop work to the extent specified. The contractor shall also terminate outstanding orders and subcontracts as they relate to the terminated work. The contractor shall settle the liabilities and claims arising out of the termination of subcontracts and orders connected with the terminated work. The Procurement Officer may direct the contractor to assign the contractor's right, title, and interest under terminated orders or subcontracts to the State. The contractor must still complete the work not terminated by the notice of termination and may incur obligations as are necessary to do so.

(3) Right to Supplies. The Procurement Officer may require the contractor to transfer title and deliver to the State in the manner and to the extent directed by the Procurement Officer: (a) any completed supplies; and (b) such partially completed supplies and materials, parts, tools, dies, jigs, fixtures, plans, drawings, information, and contract rights (hereinafter called "manufacturing material") as the contractor has specifically produced or specially acquired for the performance of the terminated part of this contract. The contractor shall, upon direction of the Procurement Officer, protect and preserve property in the possession of the contractor in which the State has an interest. If the Procurement Officer does not exercise this right, the contractor shall use best efforts to sell such supplies and manufacturing materials in accordance with the standards of Uniform Commercial Code Section 2-706. Utilization of this Section in no way implies that the State has breached the contract by exercise of the Termination for Convenience Clause.

(4) Compensation. (a) The contractor shall submit a termination claim specifying the amounts due because of the termination for convenience together with cost or pricing data required by Section 11-35-1830 bearing on such claim. If the contractor fails to file a termination claim within one year from the effective date of termination, the Procurement Officer may pay the contractor, if at all, an amount set in accordance with Subparagraph (c) of this Paragraph.

(b) The Procurement Officer and the contractor may agree to a settlement and that the settlement does not exceed the total contract price plus settlement costs reduced by payments previously made by the State, the proceeds of any sales of supplies and manufacturing materials under Paragraph (3) of this clause, and the contract price of the work not terminated;

(c) Absent complete agreement under Subparagraph (b) of this Paragraph, the Procurement Officer shall pay the contractor the following amounts, provided payments agreed to under Subparagraph (b) shall not duplicate payments under this Subparagraph: (i) contract prices for supplies or services accepted under the contract; (ii) costs reasonably incurred in performing the terminated portion of the work less amounts paid or to be paid for accepted supplies or services; (iii) reasonable costs of settling and paying claims arising out of the termination of subcontracts or orders pursuant to Paragraph (2) of this clause. These costs must not include costs paid in accordance with Subparagraph (c)(ii) of this paragraph; (iv) any other reasonable costs that have resulted from the termination. The total sum to be paid the contractor under this Subparagraph shall not exceed the total contract price plus the reasonable settlement costs of the contractor reduced by the amount of payments otherwise made, the proceeds of any sales of supplies and manufacturing materials under Subparagraph (b) of this Paragraph, and the contract price of work not terminated.

(d) Contractor must demonstrate any costs claimed, agreed to, or established under Subparagraphs (b) and (c) of this Paragraph using its standard record keeping system, provided such system is consistent with any applicable Generally Accepted Accounting Principles.

(5) Contractor's failure to include an appropriate termination for convenience clause in any subcontract shall not (i) affect the State's right to require the termination of a subcontract, or (ii) increase the obligation of the State beyond what it would have been if the subcontract had contained an appropriate clause. [07-7B265-1]

## **VII. TERMS AND CONDITIONS – C. DHEC'S SPECIAL CLAUSES**

### **PREVENTING AND REPORTING FRAUD, WASTE AND ABUSE (DHEC MAR-2014)**

DHEC has procedures and policies concerning the prevention and reporting of fraud, waste and abuse (FWA) in agency-funded programs, including but not limited to those funded by federal grants such as Medicaid. No agency employee, agent, or contractor shall direct, participate in, approve, or tolerate any violation of federal or State laws regarding FWA in government programs. Federal law prohibits any person or company from knowingly submitting false or fraudulent claims or statements to a federally funded program, including false claims for payment or conspiracy to get such a claim approved or paid. The False Claims Act, 31 U.S.C. §3729-3733, and other "whistleblower" statutes include remedies for employees who are retaliated against in their employment for reporting violations of the Act or for reporting fraud, waste, abuse, or violations of law in connection with federal contracts or grants, or danger to public health or safety. Under State law, persons may be criminally prosecuted for false claims made for health care benefits, for Medicaid fraud, for insurance fraud, or for using a computer in a fraud scheme or to obtain money or services by false representations. Additional information regarding the federal and State laws prohibiting false claims and SCDHEC's policies and procedures regarding false claims may be obtained from the agency's Contracts Manager or Bureau of Business Management.

Any employee, agent, or contractor of SCDHEC who submits a false claim in violation of federal or State laws will be reported to appropriate authorities. If Contractor, Contractor's agents or employees have reason to suspect FWA in agency programs, this information should be reported in confidence to the agency. A report may be made by writing to the Office of Internal Audits, DHEC, 2600 Bull Street, Columbia, SC 29201; or by calling the Agency Fraud, Waste and Abuse Hotline at 803-896-0650 or toll-free at 1-866-206-5202. Contractor is required to inform Contractor's employees of the existence of DHEC's policy prohibiting FWA and the procedures for reporting FWA to the agency. Contractor must also inform Contractor's employees, in writing, of their rights and remedies under 41 U.S.C. §4712 concerning reporting FWA or violations of law in connection with federal contracts or grants, or danger to public health or safety, in the predominant native language of the workforce. [Reference: False Claims Act, 31 U.S.C. §3729-3733; 41 U.S.C. §4712]

### **DHEC's CONFIDENTIALITY POLICY (DHEC – MAR 2014)**

Confidential information includes information known or maintained in any form, whether recorded or not, consisting of protected health information, other health information, personal information, personal identifying information, confidential business information, and any other information required by law to be treated as confidential, designated as confidential by DHEC, or known or believed by contractor or contractor's employee or agent to be claimed as confidential or entitled to confidential treatment. (a) Contractor will not: (i) access, view, use, or disclose confidential information without written authorization from DHEC, unless required to perform its responsibilities under this contract or required by law (as determined by a court or other governmental body with authority); (ii) discuss confidential information obtained in the course of its relationship with DHEC with any other person or in any location outside of its area of responsibility in DHEC; or (iii) make any unauthorized copy of confidential information, or remove or transfer this information to any unauthorized location or media. (b) If contractor discloses confidential information pursuant to a properly completed authorization or legal process, order, or requirement, contractor must document the disclosure and make the documentation and authorization available for DHEC inspection and audit. Contractor will direct any request it receives for confidential information obtained through performance of services under this contract, including a subpoena, litigation discovery request, court order, or Freedom of Information Act request, to the DHEC Contracts Manager and DHEC Office of General Counsel as soon as possible, and in every case within one business day of receipt. (c) Contractor must ensure that its employees, agents, and subcontractors who may have access to DHEC confidential information are aware of and comply with these confidentiality requirements. Contractor must ensure that any release of confidential information is limited to the minimum necessary to meet its obligations under this agreement and applicable law. If contractor will or may have access to any Protected Health Information (PHI) under the Health Insurance Portability and Accountability Act (HIPAA), Public Law 104-92, as amended, and regulations (45 CFR Parts 160 and 164), DHEC may require the contractor to sign and comply with DHEC's Business Associate Agreement (DHEC Form 0854, attached) and protect PHI in compliance with the referenced HIPAA laws. (d) Unauthorized use or disclosure of confidential information may result in termination of this agreement and may be grounds for fines, penalties, imprisonment, injunctive action, damages, civil suit, or debarment from doing business with the State. The contractor must immediately notify the DHEC Compliance Officer and the DHEC Contracts Manager of any unauthorized use or disclosure of confidential information received under this contract. (e) The obligations of this provision shall survive termination, cancellation, or expiration of the contract.

### **TOBACCO-FREE CAMPUS POLICY (DHEC - FEB 2016)**

Use of all tobacco products, including smokeless tobacco and electronic cigarettes, is prohibited in any facility or on any property owned or controlled by DHEC (including parking lots, parking garages sidewalks, and breezeways).

**VIII. BIDDING SCHEDULE / PRICE-BUSINESS PROPOSAL**

**BIDDING SCHEDULE (NOV 2007)**

Line Number	Quantity	Unit of Measure	Unit Price	Extended Price
0001	1.000	each	\$190.00	\$190.00
<b>Product Category:</b> 98991 - Water Sampling and Analysis Services				
<b>Item Description:</b> Sample analysis – Method 537.1				
<b>Tendering Text:</b> See specifications in Section III.				
<b>Internal Item Number:</b> 1				
Question	Mandatory / Optional	Multiple Responses Accepted?	Response	
The bidder has read and understands all Amendments.	Mandatory	No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
1. The Submitter has read and understands the terms and conditions of this solicitation.	Mandatory	No	<input checked="" type="checkbox"/> Yes. I have read and understand the terms and conditions.	
2. The offer is in accordance with the terms and conditions of this solicitation.	Mandatory	No	<input checked="" type="checkbox"/> Yes. I have read and understand the terms and conditions.	
Can bidder meet the June 1, 2020 Performance Time-Frame?	Mandatory	No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Line Number	Quantity	Unit of Measure	Unit Price	Extended Price
0002	1.000	each	\$285.00	\$285.00
<b>Product Category:</b> 98991 - Water Sampling and Analysis Services				
<b>Item Description:</b> Sample analysis – Method 537.1 – 5-day expedited analysis				
<b>Tendering Text:</b> See specifications in Section III. <b>NOTE: This line item will not be part of the award criteria.</b>				
<b>Internal Item Number:</b> 2				
Question	Mandatory / Optional	Multiple Responses Accepted?	Response	
The bidder has read and understands all Amendments.	Mandatory	No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
1. The Submitter has read and understands the terms and conditions of this solicitation.	Mandatory	No	<input checked="" type="checkbox"/> Yes. I have read and understand the terms and conditions.	
2. The offer is in accordance with the terms and conditions of this solicitation.	Mandatory	No	<input checked="" type="checkbox"/> Yes. I have read and understand the terms and conditions.	

Line Number	Quantity	Unit of Measure	Unit Price	Extended Price
0003	1.000	each	\$332.50	\$332.50
<b>Product Category:</b> 98991 - Water Sampling and Analysis Services				
<b>Item Description:</b> Sample analysis – Method 537.1 – 3-day expedited analysis				
<b>Tendering Text:</b> See specifications in Section III. <b>NOTE: This line item will not be part of the award criteria.</b>				
<b>Internal Item Number:</b> 3				
Question	Mandatory / Optional	Multiple Responses Accepted?	Response	
The bidder has read and understands all Amendments.	Mandatory	No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
1. The Submitter has read and understands the terms and conditions of this solicitation.	Mandatory	No	<input checked="" type="checkbox"/> Yes. I have read and understand the terms and conditions.	
2. The offer is in accordance with the terms and conditions of this solicitation.	Mandatory	No	<input checked="" type="checkbox"/> Yes. I have read and understand the terms and conditions.	

## IX. ATTACHMENTS TO SOLICITATION

- A. Nonresident Taxpayer Registration Affidavit Income Tax Withholding
- B. Offeror's Checklist
- C. EPA Method 537.1 (separate attachment)

### NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING

#### IMPORTANT TAX NOTICE - NONRESIDENTS ONLY

Withholding Requirements for Payments to Nonresidents: Section 12-8-550 of the South Carolina Code of Laws requires persons hiring or contracting with a nonresident conducting a business or performing personal services of a temporary nature within South Carolina to withhold 2% of each payment made to the nonresident. The withholding requirement does not apply to (1) payments on purchase orders for tangible personal property when the payments are not accompanied by services to be performed in South Carolina, (2) nonresidents who are not conducting business in South Carolina, (3) nonresidents for contracts that do not exceed \$10,000 in a calendar year, or (4) payments to a nonresident who (a) registers with either the S.C. Department of Revenue or the S.C. Secretary of State and (b) submits a Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to the person letting the contract.

The withholding requirement applies to every governmental entity that uses a contract ("Using Entity"). Nonresidents should submit a separate copy of the Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to every Using Entity that makes payment to the nonresident pursuant to this solicitation. Once submitted, an affidavit is valid for all contracts between the nonresident and the Using Entity, unless the Using Entity receives notice from the Department of Revenue that the exemption from withholding has been revoked.

Section 12-8-540 requires persons making payment to a nonresident taxpayer of rentals or royalties at a rate of \$1,200.00 or more a year for the use of or for the privilege of using property in South Carolina to withhold 7% of the total of each payment made to a nonresident taxpayer who is not a corporation and 5% if the payment is made to a corporation. Contact the Department of Revenue for any applicable exceptions.

For information about other withholding requirements (e.g., employee withholding), contact the Withholding Section at the South Carolina Department of Revenue at 803-898-5383 or visit the Department's website at: [www.sctax.org](http://www.sctax.org)

This notice is for informational purposes only. This agency does not administer and has no authority over tax issues. All registration questions should be directed to the License and Registration Section at 803-898-5872 or to the South Carolina Department of Revenue, Registration Unit, Columbia, S.C. 29214-0140. All withholding questions should be directed to the Withholding Section at 803-896-1420.

PLEASE SEE THE "NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING" FORM (FORM NUMBER I-312) LOCATED AT:

<http://www.sctax.org/Forms+and+Instructions/withholding/default.htm>

[09-9005-4]

## OFFEROR'S CHECKLIST (JUN 2007)

### OFFEROR'S CHECKLIST -- AVOID COMMON BID/PROPOSAL MISTAKES

Review this checklist prior to submitting your bid/proposal.

If you fail to follow this checklist, you risk having your bid/proposal rejected.

- Do not include any of your standard contract forms!
- Unless expressly required, do not include any additional boilerplate contract clauses.
- Reread your entire bid/proposal to make sure your bid/proposal does not take exception to any of the state's mandatory requirements.
- Make sure you have properly marked all protected, confidential, or trade secret information in accordance with the instructions entitled: SUBMITTING CONFIDENTIAL INFORMATION. **DO NOT** mark your entire bid/proposal as confidential, trade secret, or protected! **Do not include a legend on the cover stating that your entire response is not to be released!**
- Have you properly acknowledged all amendments? Instructions regarding how to acknowledge an amendment should appear in all amendments issued.
- Make sure your bid/proposal includes a copy of the solicitation cover page. Make sure the cover page is signed by a person that is authorized to contractually bind your business.
- Make sure your Bid/proposal includes the number of copies requested.
- Check to ensure your Bid/proposal includes everything requested!
- If you have concerns about the solicitation, do not raise those concerns in your response! **After opening, it is too late! If this solicitation includes a pre-bid/proposal conference or a question & answer period, raise your questions as a part of that process!** Please see instructions under the heading "submission of questions" and any provisions regarding pre-bid/proposal conferences.

[09-9010-1]

## Section IV. – Attachments

## **Attachment A– Certifications**

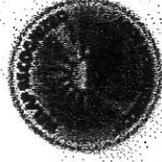


*State of New Hampshire*  
*Environmental Laboratory Accreditation Program*  
*Awards*  
**PRIMARY NH ELAP ACCREDITATION**

*to*  
**CON-TEST ANALYTICAL LABORATORY (#2557)**  
*of*  
**EAST LONGMEADOW, MA**

For the matrix, method and analytes listed on the latest Analyte List in accordance with the provisions on the 2009 TNI Standards and Env-C 300.

**Certificate Number: 255719**  
**Effective Date: 9/7/2019**  
**Expiration Date: 9/6/2020**  
**Laboratory ID: 2557**



*Bill Hall*

Bill Hall  
 NH ELAP Program Manager

Method accreditation does not imply acceptance for NHDES compliance testing. Laboratory is required to use EPA-approved methods required by regulation. Continuing accreditation status is dependent on successful ongoing participation in the program. Customers may verify the laboratory's current accreditation status by calling (603) 271-2998 or by visiting the NH ELAP website (<https://www.dcs.nh.gov/organization/divisions/awater/awater/elap/index.html>)

**NEW HAMPSHIRE ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM**

29 Hazen Drive, PO Box 95, Concord, NH 03302 (603) 271-2998

**PRIMARY ACCREDITATION ANALYTE LIST**

ANALYTE LIST NUMBER: 255719-A



**CON-TEST ANALYTICAL LABORATORY (#2557)**  
39 SPRUCE STREET

**EAST LONGMEADOW MA 01028**  
413-525-2332

Lab ID: 2557



Analyte Code	Analyte Name	Effective Date	Expiration Date	Matrix	Category	Accr. Type
<b>Method Code: 10091675 Method Ref: EPA 537</b>						
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	04/26/2017	09/06/2020	D	SBN	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	04/26/2017	09/06/2020	D	SBN	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	04/26/2017	09/06/2020	D	SBN	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	04/26/2017	09/06/2020	D	SBN	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	04/26/2017	09/06/2020	D	SBN	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	04/26/2017	09/06/2020	D	SBN	NE
6904	PERFLUOROUNDECANOIC ACID (PFUDA) 2058-94-8	04/26/2017	09/06/2020	D	SBN	NE
<b>Method Code: NH0278 Method Ref: SOP 454-PFAAS-ISOTOPE DILUTION</b>						
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	12/11/2017	09/06/2020	D	SBN	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	12/11/2017	09/06/2020	D	SBN	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	12/11/2017	09/06/2020	D	SBN	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	12/11/2017	09/06/2020	D	SBN	NE
6912	PERFLUOROCTANOIC ACID (PFOA) 335-67-1	12/11/2017	09/06/2020	D	SBN	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	12/11/2017	09/06/2020	D	SBN	NE
<b>Method Code: 10091642 Method Ref: EPA 537.1</b>						
4847	N-METHYLPERFLUOROCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA)	06/27/2019	09/06/2020	D	SNO	NE
<b>Method Code: 10091675 Method Ref: EPA 537</b>						
4846	N-ETHYLPERFLUOROCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	04/26/2017	09/06/2020	D	SNO	NE
4847	N-METHYLPERFLUOROCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA)	04/26/2017	09/06/2020	D	SNO	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	04/26/2017	09/06/2020	D	SNO	NE
<b>Method Code: 10091642 Method Ref: EPA 537.1</b>						
9490	11-CHLOROICOSAFLUORO-3-OXAUNDECANE-1-SULFONIC ACID (11-CL-PF30UDS)	06/27/2019	09/06/2020	D	PFC	NE
6951	4,8-DIOXA-3H-PERFLUORONONANOIC ACID (ADONA) 919005-14-4	06/27/2019	09/06/2020	D	PFC	NE
6952	9-CHLOROHEXADECAFLUORO-3-OXANONANE-1-SULFONIC ACID (9-CL-PF30NS)	06/27/2019	09/06/2020	D	PFC	NE
9460	HEXAFLUOROPROPYLENEOXIDE DIMER ACID (HFPO-DA)	06/27/2019	09/06/2020	D	PFC	NE
4846	N-ETHYLPERFLUOROCTANE SULFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	06/27/2019	09/06/2020	D	PFC	NE
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	06/27/2019	09/06/2020	D	PFC	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	06/27/2019	09/06/2020	D	PFC	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	06/27/2019	09/06/2020	D	PFC	NE

This analyte list supersedes all previously issued analyte lists. Method accreditation does not imply acceptance for NHDES compliance testing. Laboratory is required to use EPA-approved methods required by regulation. Continuing accreditation status is dependent on successful ongoing participation in the program. Customers may verify the laboratory's current accreditation status by calling (603) 271-2998 or by visiting the NH ELAP website (<https://www.des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm>)

# NEW HAMPSHIRE ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

29 Hazen Drive, PO Box 95, Concord, NH 03302 (603) 271-2998

## PRIMARY ACCREDITATION ANALYTE LIST

ANALYTE LIST NUMBER: 255719-A



**CON-TEST ANALYTICAL LABORATORY (#2557)**  
39 SPRUCE STREET

EAST LONGMEADOW MA 01028  
413-525-2332  
Lab ID: 2557



6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	06/27/2019	09/06/2020	D	PFC	NE
6927	PERFLUOROHXANE SULFONIC ACID (PFHXS) 355-46-4	06/27/2019	09/06/2020	D	PFC	NE
6913	PERFLUOROHXANOIC ACID (PFHXA) 307-24-4	06/27/2019	09/06/2020	D	PFC	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	06/27/2019	09/06/2020	D	PFC	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	06/27/2019	09/06/2020	D	PFC	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	06/27/2019	09/06/2020	D	PFC	NE
6904	PERFLUOROUNDECANOIC ACID (PFUDA) 2058-94-8	06/27/2019	09/06/2020	D	PFC	NE
<b>Method Code: 10091675 Method Ref: EPA 537</b>			<b>Revision: 1.1</b>		<b>Date: 2009</b>	
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	03/28/2019	09/06/2020	D	PFC	NE
6927	PERFLUOROHXANE SULFONIC ACID (PFHXS) 355-46-4	03/28/2019	09/06/2020	D	PFC	NE
<b>Method Code: NH0278 Method Ref: SOP 454-PFAAS-ISOTOPE DILUTION</b>			<b>Revision:</b>		<b>Date:</b>	
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	03/28/2019	09/06/2020	D	PFC	NE
6927	PERFLUOROHXANE SULFONIC ACID (PFHXS) 355-46-4	03/28/2019	09/06/2020	D	PFC	NE
6931	PERFLUOROCTANE SULFONIC ACID (PFOS) 1763-23-1	03/28/2019	09/06/2020	D	PFC	NE
<b>Method Code: 90017202 Method Ref: MADEP EPH</b>			<b>Revision: 1.1</b>		<b>Date: 2004</b>	
5005	NAPHTHALENE	11/07/2012	09/06/2020	N	VOC	NE
<b>Method Code: 90017451 Method Ref: MADEP VPH</b>			<b>Revision: 2.1</b>		<b>Date: 2018</b>	
4375	BENZENE	09/10/2018	09/06/2020	N	VOC	NE
4765	ETHYLBENZENE	09/10/2018	09/06/2020	N	VOC	NE
5000	METHYL TERT-BUTYL ETHER (MTBE)	09/10/2018	09/06/2020	N	VOC	NE
5005	NAPHTHALENE	09/10/2018	09/06/2020	N	VOC	NE
5140	TOLUENE	09/10/2018	09/06/2020	N	VOC	NE
5304	VPH ALIPHATIC C5-C8	09/10/2018	09/06/2020	N	VOC	NE
5306	VPH ALIPHATIC C9-C12	09/10/2018	09/06/2020	N	VOC	NE
5311	VPH AROMATIC C9-C10	09/10/2018	09/06/2020	N	VOC	NE
5260	XYLENE (TOTAL)	09/10/2018	09/06/2020	N	VOC	NE
<b>Method Code: 90017202 Method Ref: MADEP EPH</b>			<b>Revision: 1.1</b>		<b>Date: 2004</b>	
5500	ACENAPHTHENE	11/07/2012	09/06/2020	N	SBN	NE
5505	ACENAPHTHYLENE	11/07/2012	09/06/2020	N	SBN	NE
5555	ANTHRACENE	11/07/2012	09/06/2020	N	SBN	NE
5575	BENZO(A)ANTHRACENE	11/07/2012	09/06/2020	N	SBN	NE
5580	BENZO(A)PYRENE	11/07/2012	09/06/2020	N	SBN	NE
5585	BENZO(B)FLUORANTHENE	11/07/2012	09/06/2020	N	SBN	NE
5590	BENZO(G,H,I)PERYLENE	11/07/2012	09/06/2020	N	SBN	NE
5600	BENZO(K)FLUORANTHENE	11/07/2012	09/06/2020	N	SBN	NE
5855	CHRYSENE	11/07/2012	09/06/2020	N	SBN	NE
5895	DIBENZO(A,H)ANTHRACENE	11/07/2012	09/06/2020	N	SBN	NE

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29 Hazen Drive, PO Box 95, Concord, NH 03302 (603) 271-2998

**PRIMARY ACCREDITATION ANALYTE LIST**

ANALYTE LIST NUMBER: 255719-A



**CON-TEST ANALYTICAL LABORATORY (#2557)**  
39 SPRUCE STREET

**EAST LONGMEADOW MA 01028**  
413-525-2332

Lab ID: 2557



6218	EPH ALIPHATIC C19-C36	11/07/2012	09/06/2020	N	SBN	NE
6222	EPH ALIPHATIC C9-C18	11/07/2012	09/06/2020	N	SBN	NE
6232	EPH AROMATIC C11-C22	11/07/2012	09/06/2020	N	SBN	NE
6265	FLUORANTHENE	11/07/2012	09/06/2020	N	SBN	NE
6315	INDENO(1,2,3-CD)PYRENE	11/07/2012	09/06/2020	N	SBN	NE
6615	PHENANTHRENE	11/07/2012	09/06/2020	N	SBN	NE
6665	PYRENE	11/07/2012	09/06/2020	N	SBN	NE
<b>Method Code: NH0256      Method Ref: SOP 434-PFAAS</b>						
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	05/12/2017	09/06/2020	N	SBN	NE
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	05/12/2017	09/06/2020	N	SBN	NE
6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	05/12/2017	09/06/2020	N	SBN	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	05/12/2017	09/06/2020	N	SBN	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	05/12/2017	09/06/2020	N	SBN	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	05/12/2017	09/06/2020	N	SBN	NE
6912	PERFLUOROOCCTANOIC ACID (PFOA) 335-67-1	05/12/2017	09/06/2020	N	SBN	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	05/12/2017	09/06/2020	N	SBN	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	05/12/2017	09/06/2020	N	SBN	NE
6904	PERFLUOROUNDACANOIC ACID (PFUDA) 2058-94-8	05/12/2017	09/06/2020	N	SBN	NE
<b>Method Code: NH0278      Method Ref: SOP 454-PFAAS-ISOTOPE DILUTION</b>						
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	12/11/2017	09/06/2020	N	SBN	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	12/11/2017	09/06/2020	N	SBN	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	12/11/2017	09/06/2020	N	SBN	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	12/11/2017	09/06/2020	N	SBN	NE
6912	PERFLUOROOCCTANOIC ACID (PFOA) 335-67-1	12/11/2017	09/06/2020	N	SBN	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	12/11/2017	09/06/2020	N	SBN	NE
<b>Method Code: NH0256      Method Ref: SOP 434-PFAAS</b>						
6457	6:2 FLUOROTELOMER SULFONATE (6:2FTS)	05/12/2017	09/06/2020	N	SNO	NE
4846	N-ETHYLPERFLUOROOCCTANE SUFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	05/12/2017	09/06/2020	N	SNO	NE
4847	N-METHYLPERFLUOROOCCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA)	05/12/2017	09/06/2020	N	SNO	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	05/12/2017	09/06/2020	N	SNO	NE
<b>Method Code: NH0256      Method Ref: SOP 434-PFAAS</b>						
6461	8:2 FLUOROTELOMER SULFONATE (8:2 FTS)	05/12/2017	09/06/2020	N	OTH	NE
<b>Method Code: NH0256      Method Ref: SOP 434-PFAAS</b>						
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	03/28/2019	09/06/2020	N	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	03/28/2019	09/06/2020	N	PFC	NE

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ANALYTE LIST NUMBER: 255719-A



**CON-TEST ANALYTICAL LABORATORY (#2557)**  
39 SPRUCE STREET

**EAST LONGMEADOW MA 01028**  
413-525-2332

Lab ID: 2557



Method Code	Method Ref	Analyte	Original Date	Revision	Category	Parameter	Notes
6931	SOP 454-PFAAS-ISOTOPE DILUTION	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	03/28/2019	09/06/2020	N	PFC	NE
Method Code: NH0278				Revision:		Date:	
6918		PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	06/28/2019	09/06/2020	N	PFC	NE
6927		PERFLUOROHXANE SULFONIC ACID (PFHXS) 355-46-4	06/28/2019	09/06/2020	N	PFC	NE
6931	MADEP EPH	PERFLUOROOCTANE SULFONIC ACID (PFOS) 1763-23-1	06/28/2019	09/06/2020	N	PFC	NE
Method Code: 90017202				Revision: 1.1		Date: 2004	
5005		NAPHTHALENE	11/07/2012	09/06/2020	SC	VOC	NE
Method Code: 90017451		Method Ref: MADEP VPH		Revision: 2.1		Date: 2018	
4375	MADEP EPH	BENZENE	09/10/2018	09/06/2020	SC	VOC	NE
4765		ETHYLBENZENE	09/10/2018	09/06/2020	SC	VOC	NE
5000		METHYL TERT-BUTYL ETHER (MTBE)	09/10/2018	09/06/2020	SC	VOC	NE
5005		NAPHTHALENE	09/10/2018	09/06/2020	SC	VOC	NE
5140		TOLUENE	09/10/2018	09/06/2020	SC	VOC	NE
5304		VPH ALIPHATIC C5-C8	09/10/2018	09/06/2020	SC	VOC	NE
5306		VPH ALIPHATIC C9-C12	09/10/2018	09/06/2020	SC	VOC	NE
5311		VPH AROMATIC C9-C10	09/10/2018	09/06/2020	SC	VOC	NE
5260		XYLENE (TOTAL)	09/10/2018	09/06/2020	SC	VOC	NE
Method Code: 90017202		Method Ref: MADEP EPH		Revision: 1.1		Date: 2004	
5500		ACENAPHTHENE	11/07/2012	09/06/2020	SC	SBN	NE
5505		ACENAPHTHYLENE	11/07/2012	09/06/2020	SC	SBN	NE
5555		ANTHRACENE	11/07/2012	09/06/2020	SC	SBN	NE
5575		BENZO(A)ANTHRACENE	11/07/2012	09/06/2020	SC	SBN	NE
5580		BENZO(A)PYRENE	11/07/2012	09/06/2020	SC	SBN	NE
5585		BENZO(B)FLUORANTHENE	11/07/2012	09/06/2020	SC	SBN	NE
5590	BENZO(G,H,I)PERYLENE	11/07/2012	09/06/2020	SC	SBN	NE	
5600	BENZO(K)FLUORANTHENE	11/07/2012	09/06/2020	SC	SBN	NE	
5855	CHRYSENE	11/07/2012	09/06/2020	SC	SBN	NE	
5895	DIBENZO(A,H)ANTHRACENE	11/07/2012	09/06/2020	SC	SBN	NE	
6218	EPH ALIPHATIC C19-C36	11/07/2012	09/06/2020	SC	SBN	NE	
6222	EPH ALIPHATIC C9-C18	11/07/2012	09/06/2020	SC	SBN	NE	
6232	EPH AROMATIC C11-C22	11/07/2012	09/06/2020	SC	SBN	NE	
6265	FLUORANTHENE	11/07/2012	09/06/2020	SC	SBN	NE	
6315	INDENO(1,2,3-CD)PYRENE	11/07/2012	09/06/2020	SC	SBN	NE	
6615	PHENANTHRENE	11/07/2012	09/06/2020	SC	SBN	NE	
6665	PYRENE	11/07/2012	09/06/2020	SC	SBN	NE	
Method Code: NH0286	Method Ref: SOP 465-PFAAS-SOIL/SOLID		Revision:		Date:		
6905	PERFLUORODECANOIC ACID (PFDA) 335-76-2	09/10/2018	09/06/2020	SC	SBN	NE	

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39 SPRUCE STREET**

**EAST LONGMEADOW MA 01028  
413-525-2332  
Lab ID: 2557**



6903	PERFLUORODODECANOIC ACID (PFDOA) 307-55-1	09/10/2018	09/06/2020	SC	SBN	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	09/10/2018	09/06/2020	SC	SBN	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	09/10/2018	09/06/2020	SC	SBN	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	09/10/2018	09/06/2020	SC	SBN	NE
6912	PERFLUOROOCCTANOIC ACID (PFOA) 335-67-1	09/10/2018	09/06/2020	SC	SBN	NE
6902	PERFLUOROTETRADECANOIC ACID (PFTDA) 376-06-7	09/10/2018	09/06/2020	SC	SBN	NE
6904	PERFLUOROUNDECANOIC ACID (PFUDA) 2058-94-8	09/10/2018	09/06/2020	SC	SBN	NE
<b>Method Code: NH0287</b>		<b>Method Ref: SOP 466-PFAAS-SOIL/SOLID - ISOTOPE DILUTION</b>		<b>Revision:</b>	<b>Date:</b>	
6915	PERFLUOROBUTANOIC ACID (PFBA) 375-22-4	09/10/2018	09/06/2020	SC	SBN	NE
6908	PERFLUOROHEPTANOIC ACID (PFHPA) 375-85-9	09/10/2018	09/06/2020	SC	SBN	NE
6913	PERFLUOROHEXANOIC ACID (PFHXA) 307-24-4	09/10/2018	09/06/2020	SC	SBN	NE
6906	PERFLUORONONANOIC ACID (PFNA) 375-95-1	09/10/2018	09/06/2020	SC	SBN	NE
6912	PERFLUOROOCCTANOIC ACID (PFOA) 335-67-1	09/10/2018	09/06/2020	SC	SBN	NE
6914	PERFLUOROPENTANOIC ACID (PFPEA) 2706-90-3	09/10/2018	09/06/2020	SC	SBN	NE
<b>Method Code: NH0286</b>		<b>Method Ref: SOP 465-PFAAS-SOIL/SOLID</b>		<b>Revision:</b>	<b>Date:</b>	
4846	N-ETHYLPERFLUOROOCCTANE SUFONAMIDO ACETIC ACID (NETFOSAA) 2991-50-6	09/10/2018	09/06/2020	SC	SNO	NE
4847	N-METHYLPERFLUOROOCCTANE SULFONAMIDO ACETIC ACID (NMEFOSAA)	09/10/2018	09/06/2020	SC	SNO	NE
9563	PERFLUOROTRIDECANOIC ACID (PFTRDA) 72629-94-8	09/10/2018	09/06/2020	SC	SNO	NE
<b>Method Code: NH0286</b>		<b>Method Ref: SOP 465-PFAAS-SOIL/SOLID</b>		<b>Revision:</b>	<b>Date:</b>	
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	03/28/2019	09/06/2020	SC	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	03/28/2019	09/06/2020	SC	PFC	NE
6931	PERFLUOROOCCTANE SULFONIC ACID (PFOS) 1763-23-1	03/28/2019	09/06/2020	SC	PFC	NE
<b>Method Code: NH0287</b>		<b>Method Ref: SOP 466-PFAAS-SOIL/SOLID - ISOTOPE DILUTION</b>		<b>Revision:</b>	<b>Date:</b>	
6918	PERFLUOROBUTANE SULFONIC ACID (PFBS) 375-73-5	03/28/2019	09/06/2020	SC	PFC	NE
6927	PERFLUOROHEXANE SULFONIC ACID (PFHXS) 355-46-4	03/28/2019	09/06/2020	SC	PFC	NE
6931	PERFLUOROOCCTANE SULFONIC ACID (PFOS) 1763-23-1	03/28/2019	09/06/2020	SC	PFC	NE

*Bill Hall*  
CON-TEST 9/3/2019

Bill Hall  
NH ELAP Program Manager  
Issue Date: 09/03/2019

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39 SPRUCE STREET**

**EAST LONGMEADOW MA 01028  
413-525-2332  
Lab ID: 2557**



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Matrix Legend: AE=Air; BT=Tissue; D=Drinking Water; N=Non-Potable Water; SC=Solid and Chemical Materials

Category Legend: MIC=Microbiology; MET=Metals; NMI=Non-Metal Inorganics; PRE=Preparation; VOC=Volatile Organic Compounds; SBN=SVOC-BNA; SHE=SVOC-Herbicides; SNO=SVOC-NOS; SPC=SVOC-PCB; SPE=SVOC-Pesticides; RAD=Radiochemistry; WET=Wet

Accreditation Legend: NE=NELAP; NH=NH State Certification; CE=State Certification; IN=Interim (NELAP); WI=Withdrawn; AP=Applied; RE=Revoked; SU=Suspended

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# **Attachment B— Professional Staff and Organization Chart**

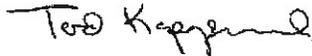




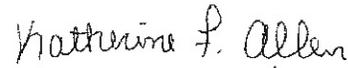
## **Attachment C– PFAS SOP**

**Determination of Selected Perfluorinated Alkyl Acids (PFAS)**  
**by Solid Phase Extraction & Liquid Chromatography/Tandem**  
**Mass Spectrometry (LC/MS/MS)**  
Method 537.1, EPA 537 and ISO 25101

Approved:



Tod Kopyscinski  
Laboratory Director



Katherine Allen  
QA Officer

Revision Number: 8

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## Change Record

Revision	Date	Responsible Person	Description of Change
0	12/07/2016	Brianna McLaughlin	Original
1	01/20/2017	Brianna McLaughlin	Update from additional method development: removal of required LCSD, Sec 1.1 (addition of revised reporting limits for compounds certified by NY), Sec 7.3.2 and 8.2.9 (addition of requirement for a 6 point curve when using a quadratic calibration curve), and Sec 7.2.5.7 (mention of exception for second source verification), and Sec 7.3.3 (revision of language used in calibration section).
2	03/15/2017	BM/KFA	Update to include Appendix E (Surface and Ground Water modifications added) and Sec 5.7 and 5.8 added (5mM solutions not 2Mm), Sec 7.7.3 and 8.2.12 (addition of Response QC check), and Sec 7.2 (changed standard storage parameters).
3	03/21/2017	BM	Update to Section 1.0 (new RL table)
4	04/14/2017	BM	Update to Sec 7.3.3 (table 2+4 replaced with section referrals) and Section 7.6.2 (additional detail on how PFOA is quantitated) and Sec 17.13 (TNI 2009 standard added)
5	1/18/2018	BM	Updates from NY 2017 Audit: Sec 3.3 (add to test before extraction), Section 7.2.5.5 (addition of another calibration point to meet method 20-fold range requirement), and additional mention of ending CCC in sections 7.4.2 and 8.2.10
6	11/13/2018	KFA/KAF	Updates from Sept 2018 NH Audit: Title change from 537.1 to 537, Sec 3.4 (should replaced with must), Sec 7.3.4 (Surrogates should be changed to must be and removed reference to calculation #2), Sec 7.5.2 (Blank Spike duplicate deleted), Sec 7.5.3 (addition of DI water rinse after methanol), Sec 7.6.1.1 (blank extraction replaced with blank subtraction), Sec 7.7.3 (deleted to prove system is contamination free), Sec 8.2.7 (removed reference of calculation 4), and Sec 8.2.12 (deleted section for Response QC check), Sec 5.7(updated volumes), Sec 5.8 (changed water to methanol), Appendix E(added pH adjustment method)
7	5/23/2019	BLM	Update from annual internal audit: Sec 3.2.2 (bottles orders use same lot of pres.), Sec. 3.3 (document Cl <sub>2</sub> check on bench sheet), Sec 4.13.3.1 (save lot check), Sec 5.7 (added prepared weekly), Sec 7.2.5.4 (new Cal standard mix used), Sec 7.2.5.7 (add ICV limits), Sec 7.5.1 (check chlorine and pH and document), Sec 7.5.5 (deleted 10ul and added 5, 25, or 50ul), Sec 7.2.5.3 (added in volumes and container type), Sec 7.2.5.4 (updated PFAS stock solution chart to reflect new compound sources); Sec 7.2.5.5 (removed original information); Sec 1.1 (added in new compounds per Method 537.1), Sec 7.2.3.3 (updated volume needed), Sec 7.5 (new info added), Sec 7.2.3.4 (Updated table to reflect new surrogate compound), Sec 7.5.15 (Updated volume from 10mL to 2mL), additions to Sec 8.0 (additional method performance criteria added), Addition of Sec 13.18 (added EPA 537.1 reference), Appendix A (fixed container type) Removal of Appendix E
8	11/20/2019	BLM	Updates from Addition of Cert in PA and NH request: Sec 1.0 (RLs updated to be all 2ng/L), Sec 4.2.1 and 4.3.1 (new columns added), Sec 4.13.3 (new cartridges added), Sec 4.17 (pH paper added), Sec 5.7 (20mM added), Sec 7.2.3.4 (final conc. Changed for 5-NEtFOSAA), Sec 7.2.4.2 (6 month exp date added), Sec 7.3 (deleted sections not needed), Sec 7.4.1 (addition of surr. % recoveries), sec. 7.4.2 (addition to note about non-conformance), sec 7.5.1 (addition of pH range), sec 7.7.2 (new parameters added for 20mM), Sec 8.2.4 (added if enough sample provided), and Sec 8.2.5 (MD and MSD added).

### Distribution/Training List

See Employee Training Record File for signed training statements for trained users.

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## 1.0 SUMMARY, SCOPE, AND APPLICATION

- 1.1 This method is used to analyze drinking water samples for selected perfluorinated alkyl acids (PFAS). A sample of approximately 250mLs of de-chlorinated drinking water is fortified with spikes and surrogates and extracted via Solid Phase Extraction (SPE). The sample is then concentrated to dryness and subsequently brought up to a final volume of 1 mL with 96:4 methanol:water and internal standard. All samples are analyzed using an Agilent 6460 Triple Quad LC/MS (LC/MS/MS) system. Target analytes are identified by comparing mass spectra and retention times to reference spectra and retention times of calibration standards. Analytes are quantitated using the internal standard technique. The following compounds can be identified by this method:

Analyte	Acronym	RL(ng/L)
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2.0
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2.0
Perfluorobutanesulfonic acid	PFBS	2.0
Perfluorodecanoic acid	PFDA	2.0
Perfluorododecanoic acid	PFDoA	2.0
Perfluoroheptanoic acid	PFHpA	2.0
Perfluorohexanesulfonic acid***	PFHxS	2.0
Perfluorohexanoic acid	PFHxA	2.0
Perfluorononanoic acid	PFNA	2.0
Perfluorooctanesulfonic acid***	PFOS	2.0
Perfluorooctanoic acid**	PFOA	2.0
Perfluorotetradecanoic acid	PFTA	2.0
Perfluorotridecanoic acid	PFTrDA	2.0
Perfluoroundecanoic acid	PFUnA	2.0
Hexafluoropropylene oxide dimer acid§	HFPO-DA	2.0
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid§	11Cl-PF3OUdS	2.0
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid§	9Cl-PF3ONS	2.0
4,8-dioxa-3H-perfluorononanoic acid§	ADONA	2.0

§ Newly added compounds for Method 537.1

\*\* Denotes compounds that are identified Qualitative/Semi-quantitative per EPA Technical Advisory 815-B-16-021

\*\*\* Denotes compounds that are quantitated using both linear and branched isomers.

## 2.0 INTERFERENCES

2.1 Standards and samples should not come into contact with glass other than standards purchased in glass ampoules. PFAS commonly adsorb to the surface and could result in recovery discrepancies.

2.2 Matrix interferences may be caused by co-extracted contaminants present in the sample.

2.3 Method interferences may be caused by contaminants in solvents, reagents, and other sample processing hardware.

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- 2.3.1 Other common lab supplies that are associated with PFAS and should be avoided where possible: aluminum foil, permanent marker, and PTFE.
  - 2.3.1.1 Due to PTFE present in solvent lines in Agilent LC, an inline filter column has been installed to reduce any background contamination prior to sample introduction into the system. See Equipment and Supplies Section 4.0.
- 2.3.2 Organic contaminants can pose a threat of interference due to the high quantities of de-chlorinating agent added to samples.
- 2.3.3 Contamination levels should be monitored and all blanks should be free from interferences (less than 1/3 the MRL) in all Laboratory Reagent Blanks (LRB). If outside of this criterion, there will be a note on the report.
- 2.3.4 Blank subtraction is not permitted in this method.

### 3.0 SAMPLE PRESERVATION/STORAGE/HOLDING TIME

- 3.1 Samples must be collected in a wide mouth 250-mL polypropylene bottle fitted with a polypropylene screw cap.
- 3.2 Prior to shipment to the field for sampling, 1.25g of buffering reagent Trizma® (5.0g/L) will be added to each bottle.
  - 3.2.1 It is important that no amount of preservative is spilled from the container or overflowed during sampling. Trizma® reduces free chlorine in the samples.
  - 3.2.2 For all sampling procedures See Appendix A. It is important to note that all bottle orders will be made using the same lot of preservative and sample containers.
- 3.3 All samples must be checked for free chlorine levels upon receipt using SenSafe free chlorine strips and show to be <0.1 ppm free chlorine before extraction. All samples above this limit should be rejected. This will be documented on the bench sheet.
- 3.4 Samples cannot exceed 10°C during the first 48 hours following sample collection. Samples must be received at or below 10°C.
- 3.5 Prior to extraction, samples must be stored at or below 6°C and cannot be frozen.
- 3.6 Samples collected must be extracted within 14 days. Extracted samples must be run within 28 days of extraction and remain stored at room temperature.

### 4.0 EQUIPMENT & SUPPLIES

- 4.1 Triple Quad LC/MS System
- 4.2 Inline pre-filter column
- 4.3 Analytical Column
- 4.4 Auto-pipettors: 0-10uL, 10-100uL, 100-1000uL
- 4.5 Polypropylene pipet tip: 0-10uL, 10-100uL, 100-1000uL
- 4.6 Polypropylene transfer pipets
- 4.7 Polypropylene graduated cylinder: 10mL, 50mL, 100mL, 1000mL
- 4.8 Vials: 2ml polypropylene vials

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- 4.9 Caps: 11mm polypropylene snap caps
- 4.10 Sample containers: 250ml wide mouth polypropylene containers
- 4.11 Polypropylene centrifuge tubes
- 4.12 SenSafe free chlorine test strips
- 4.13 SPE system or manual SPE Set-up (Parts listed below)
  - 4.13.1 Vacuum pump capable of reaching up to 20" Hg
  - 4.13.2 13L Safety coated Pyrex waste collection container
  - 4.13.3 Polypropylene tubing for vacuum pump and manifold
- 4.14 N-Evap concentrator system
- 4.15 Balance: Analytical, capable of accurately weighing 0.0001g
- 4.16 Vortex
- 4.17 Narrow Range and full Range pH Paper

## 5.0 REAGENTS & STANDARDS

- 5.1 Reagent Water : interferent free
- 5.2 Methanol : LC/MS Grade
- 5.3 Nitrogen : Ultra high purity
- 5.4 Ammonium Acetate : LC/MS Grade
- 5.5 Stock Standard Solutions: Purchased as either certified solutions or neat standards.
- 5.6 Surrogate, Internal Standard, and ESI-L Low concentration tuning mix purchased as certified solutions
- 5.7 20 mM Ammonium Acetate reagent water: Prepared by adding 1.5400 grams of Ammonium Acetate to 1000mL of reagent water and mixing until solids are into solution. This solution must be replaced weekly.
- 5.8 96:4 Methanol:water- Stable for 1 year
- 5.9 Trizma® De-chlorinating agent
- 5.10 Tuning Mix

## 6.0 SAFETY

See Material Safety Data Sheets (MSDS) and Con-Test Chemical Hygiene Plan.

## 7.0 PROCEDURE

- 7.1 Sampling
  - 7.1.1 See Appendix A
- 7.2 Surrogate/Spike/Internal Standard Preparation

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- 7.2.1** All standards must be documented in Element and have Certificate of Analysis forms attached electronically. All information should be documented and each standard should be given an Element Standard ID#.
- 7.2.2** Standards may be received in purchased glass ampoules but any transfer or dilution must be stored in polypropylene vials with Non-PTFE caps.
- 7.2.3 PFAS Surrogate Preparation – If pre-mixed solution is unavailable**
- 7.2.3.1** All purchased surrogate stock standards are to be stored until expiration date provided by manufacturer at 4°C.
- 7.2.3.2** Prepared surrogate solutions should be stored at 4°C and vortexed prior to usage. This standard will expire 2 months after preparation date or manufacturer's expiration date, whichever comes first.
- 7.2.3.3** Add 4300 uL of prepared 96:4 methanol:water to a clean 15mL centrifuge tube.
- 7.2.3.4** Add desired amount of stock solution found in table below to equate to final volume of 5000uL.

Compound	Volume (µL)	Final Volume (µL)	Final Concentration (ng/mL)
<sup>13</sup> C <sub>2</sub> -PFHxA 50ug/mL	100	5000	1000
<sup>13</sup> C <sub>2</sub> -PFDA 50ug/mL	100	5000	1000
d <sub>5</sub> -NEtFOSAA 50ug/mL	400	5000	4000
<sup>13</sup> C <sub>3</sub> -HFPO-DA 50ug/mL	100	5000	1000

**7.2.4 PFAS Internal Standard Preparation**

- 7.2.4.1** All purchased internal standard stock standards are to be stored until expiration date provided by manufacturer at 4°C.
- 7.2.4.2** Prepared internal standard solutions should be stored at 4°C and vortexed prior to usage. This standard will expire 6 months after preparation date or manufacturer's expiration date, whichever comes first.
- 7.2.4.3** Add 4200uL of prepared 96:4 methanol:water to a clean 15mL centrifuge tube.
- 7.2.4.4** Add desired amount of stock solution found in table below to equate to final volume of 5000uL.

Compound	Volume (µL)	Final Volume (µL)	Final Concentration (ng/mL)
<sup>13</sup> C <sub>2</sub> -PFOA 50ug/mL	100	5000	1000
<sup>13</sup> C <sub>4</sub> -PFOS 50ug/mL	300	5000	3000
d <sub>3</sub> -NMeFOSAA 50ug/mL	400	5000	4000

**7.2.5.1 PFAS Stock Solution Preparation**

- 7.2.5.1** All purchased PFAS spike standard stock standards are to be stored until expiration date provided by manufacturer at 4°C.

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7.2.5.2 Prepared PFAS stock standard solutions should be stored at 4°C and vortexed prior to usage. These standards will expire 2 months after preparation date or manufacturer's expiration date, whichever comes first.

7.1.5.3 Add 840µL of 96:4 methanol:water to a clean 2mL polypropylene vial

7.1.5.4 Add 40µL of each compound listed in the table below.

This mixture will be added to the PFAC 24PAR mix to create the new stock solutions

Compound	Concentration of Standard (ng/ mL)	Volume (µL)	Final Volume (µL)	Final Concentration (ng/ mL)
NaDONA (ADONA)	50000	40	1000	2000
HFPO-DA	50000	40	1000	2000
9Cl-PF3ONS	50000	40	1000	2000
11Cl-PF3OUdS	50000	40	1000	2000

7.2.5.5 Add desired amount 96:4 methanol:water to a clean 2mL polypropylene vial.

7.2.5.6 Add desired amount of stock solution found in tables below to equate to final volume of 1000µL.

Compound	Concentration of Standard (ng/ mL)	Volume (µL)	Final Volume (µL)	Final Concentration (ng/ mL)
PFAC 24PAR	2000	500	1000	1000
Add. compounds	2000	500		
PFAC 24PAR	2000	50	1000	100
Add. compounds	2000	50		

\*Individual analyte concentration may vary due to amount of anion present in solution. All calculations must use the anion concentration, not the salt concentration. See Calculation 1

7.2.5.7 Subsequent dilutions of this stock should be stored at 4°C for up to two weeks. The stock solution will be used for the following spikes:

-Initial Calibration

Volume Stock Standard (µL)	Concentration of Stock (ng/ mL)	Volume of Surrogate Stock (µL)	Volume of Internal Standard (µL)	Volume of 96:4 Methanol:Water (µL)	Final Volume (µL)	Final Concentration (ng/mL)
2.5	100	2	10	985.5	1000	0.25*
5.0	100	4	10	981	1000	0.5*
10.0	100	6	10	974	1000	1.0*
25.0	100	8	10	957	1000	2.5*
50.0	100	10	10	930	1000	5.0*
10.0	1000	15	10	965	1000	10.0*
25.0	1000	20	10	945	1000	25.0*
50.0	1000	25	10	915	1000	50.0*

\* Individual analyte concentration may vary due to amount of anion present in solution. All calculations must use the anion concentration, not the salt concentration. See Calculation 1

-Continuing Calibration Standards: low, mid, and high levels

Volume Stock Standard (µL)	Concentration of Stock (ng/ mL)	Volume of Surrogate Stock (µL)	Volume of Internal Standard (µL)	Volume of 96:4 Methanol:Water (µL)	Final Volume (µL)	Final Concentration (ng/mL)
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5	100	10	10	975	1000	5.0
5	1000	10	10	975	1000	50.0
50	1000	10	10	930	1000	500.0

-Lab Control Spike Standards: low, mid- high levels Using a Second Source

Volume Stock Standard (µL)	Concentration of Stock (ng/mL)	Volume of 96:4 Methanol:Water (µL)	Final Volume (µL)	Final Concentration (ng/mL)
50	2000	10	940	1000

-Quality Control Sample Standard: Using a second source

Volume Stock Standard (µL)	Concentration of Stock (ng/mL)	Volume of Surrogate Stock (µL)	Volume of Internal Standard (µL)	Volume of 96:4 Methanol:Water (µL)	Final Volume (µL)	Final Concentration (ng/mL)
5	2000	10	10	985	1000	10

7.2.5.8 A quality control standard (QCS) will serve as an initial calibration verification (ICV) and be run following initial calibration and all subsequent calibrations. This QCS/ICV will be made from a second source for as many compounds as commercially available. If a second source is not available, a different lot number should be used. This sample must be run following a calibration or quarterly, whichever comes first. Limits for ICV = 70-130%.

7.2.5.9 All attempts were made to find second source vendors for the standards, but at a minimum, a different lot from the same manufacturer can be used in the event that a second vendor is not an option.

### 7.3 Initial Calibration Criteria

- 7.3.1 All analytes must first be [M-H]<sup>+</sup> and product ion optimized with the LC/MS/MS system using the MassHunter Optimizer program. This optimization should be done using a high-level standard for each analyte and using all of the LC parameters used in the analytical method. A mid-level standard must then be run to identify all retention time windows for all compounds of interest (See Section 7.7.2).
- 7.3.2 A calibration is to be run when continuing calibration checks, surrogates, or internal standards do not pass QC criteria. A calibration should also be performed when any hardware is changed or major instrument maintenance is performed.
- 7.3.2 The initial calibration must contain a minimum of five points spanning a twenty-fold range for all target analytes and surrogates for linear regression. A minimum of six points is required for a quadratic calibration. Target analytes detected in a sample at concentrations below the concentration of the lowest

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initial calibration standard should not be reported as quantitative results. If reported, they must be qualified as estimates, or "J" flags.

- 7.3.3 The LC/MS/MS system is to be calibrated using the internal standard technique. Therefore, IS is added at a constant concentration in all standards. The linear regression must always be forced through zero and can be concentration weighted. Forcing through zero allows for more sensitivity to detect background contamination within the system. The calibration should be done using the same LC conditions as the samples (See Section 7.7.2).
- 7.3.4 The calibration points at or below the MRL within the calibration must be within 50-150% of the true value. All other points must be within 70-130% of the true value. All surrogate values must be within 70-130% of the true value.
- 7.3.5 The first two eluting peaks in the compound list for 537 must have a peak asymmetry factor between 0.8-1.5. See Calculation 3.
- 7.3.6 After the initial calibration is run, a second source quality control sample must be run containing all analytes commercially available. If one is not available, a different lot number from the same vendor is acceptable. The recoveries must be within 70-130% of the true value.

#### 7.4 Continuing Calibration

- 7.4.1 At the beginning of a run a low-level continuing calibration check (CCC) must be run at the MRL. The results must be between 50-150% of the true value for all target analytes. All surrogate recoveries must be between 70-130%
- 7.4.2 After every ten field samples a subsequent CCC must be run alternating between a mid-level CCC and a high level CCC. The requirements for the mid and high level CCCs are 70-130% of the true value. All surrogates must fall within 70-130% of the true value. At the end of a run containing field samples, an ending CCC must be run.

**Note: If the CCC fails high (over 130% or over 150% and the analytes are not detected in any field samples, the data can be reported without re-analysis. The report must contain a note specifying any non-conformance of the CCC.**

- 7.4.3 All IS absolute areas must be within 70-140% of the previous CCC and 50-150% of the average areas from initial calibration.
- 7.4.4 CCC failure may result in required maintenance or re-calibration. If samples are re-run to have similar CCC failures, the suspected matrix interference should be noted on the report.
- 7.4.5 A checktune will be run once weekly to verify MS operating criteria. This is run through the MassHunter program using Agilent ESI-L Low Concentration Tuning Mix. If criteria are out of spec, the parameters set forth in the Agilent 6400 Series Triple Quadrupole LC/MS System Quick Start Guide must be followed to adjust values. If re-run of checktune does not pass, an autotune must be run and the instrument must be recalibrated.

#### 7.5 Sample Extraction Procedure

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- 7.5.1 To measure sample initial volume mark a line at the meniscus present in the container. For each lab QC sample required, a clean sample bottle with Trizma® preservative should be filled to the near top and marked for initial volume measurement. Check each sample for chlorine and verify pH is  $7.0 \pm 0.5$  pH units with pH paper (See Section 3.3 for further information on free chlorine readings). If sample pH is not  $7.0 \pm 0.5$  pH units, adjust pH with Trizma. This will all be documented on the bench sheet.
- 7.5.2 For every 20 field samples, a blank and a blank spike must be extracted. (Field blanks are considered field samples in this consideration as they are treated as such) Ideally, if adequate sample volume is available, a duplicate and a matrix spike should be included on every batch.
- 7.5.3 All polypropylene equipment including graduated cylinders and sample transfer lines/reservoirs should be washed prior to using with extraction solvent (96:4 Methanol:water), followed by a DI water rinse.
- 7.5.4 Add 10uL of surrogate to each sample, recap and invert to mix well.
- 7.5.5 Add either 5uL, 25ul, or 50ul, depending on spike-level (low, mid, or high) of spike to all BS and MS samples included on the extraction batch.
- 7.5.6 After SPE system is set up, condition the cartridges first with 15mL methanol, followed by 18mL of reagent water.
- \*Note: The sample cartridges must not be allowed to run dry at any point during conditioning. If they become dry, the conditioning must be started over.**
- 7.5.7 Next add 4-5 mL of reagent water and attach either sample transfer tube or reservoir to the cartridge and begin transferring sample. The samples should be passed through the cartridge at approximately 10mL/min. This equates to a quick drop wise fashion eluting from the cartridge.
- 7.5.8 Rinse sample bottle with 7.5mL of reagent water and pass through tubing and cartridge. Repeat once more.
- 7.5.9 Remove sample transfer tubes/reservoirs and allow air to pass through the cartridges for 5 minutes at approximately 10-15" Hg.
- 7.5.10 Turn off vacuum and add tray of labeled collection vials to manifold.
- 7.5.11 Rinse sample bottles with 4mL of methanol and allow to elute through the cartridge at a low vacuum. Collection should occur in a dropwise fashion. Repeat once.
- 7.5.12 Samples can then be concentrated to dryness in N-Evap concentrator heated between 60-65°C
- 7.5.13 Add 990uL of 96:4 methanol:water taking care to rinse the side of the container.
- 7.5.14 Add 10uL of internal standard to every extract and vortex to thoroughly mix extract.
- 7.5.15 Determine initial volume in container to the nearest 2mL using a graduated cylinder and the marking made on the outside of each container and record.

7.6 Data Analysis

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7.6.1 The analyst cannot extrapolate beyond the range of the calibration. If an analyte is outside of the determined range, the sample must be diluted with be within range and re-run.

7.6.1.1 There is extrapolation allowed only to determine if there is blank contamination. Since there is no blank subtraction, any contamination present must be below 1/3 of the MRL for specific analyte.

7.6.2 Compounds that have both branched and linear isomers will be reported as total. They will be quantitated as two separate peaks and then summed together for the final concentration.

7.6.2.1 PFOA will be quantitated by using a qualitative/semi-quantitative approach per EPA guidance. Since there is no standard available, the calibration will be done using the linear isomer only. A technical grade standard will be run to identify the retention time of the branched isomer. All samples will be quantitated using the area of both the linear and branched isomers of PFOA that may be present within the sample.

7.6.3 All analytes and surrogates will be calculated based off the initial calibration criteria.

## 7.7 Instrumentation Procedure

7.7.1 Before any QC or samples can be run, the HPLC must be allowed to purge for at least thirty minutes. This purge can be done using any combination of the mobile phases, but prior to samples running, the initial mobile phase conditions used in the method must be allowed to run for 15 minutes or until pressure has stabilized.

7.7.2 The instrument must be stable in all parameters before a run is started. The following are the HPLC and ESI-MS Method Conditions. Also, See Appendix B for MS/MS Method Conditions.

7.7.3 An instrument sequence will be made. It will begin with two double blanks. Those will be followed by the opening Low level CCC. Then, the batch can start running. Every 10 field samples (excluding QC and FRBs) a subsequent CCC must be run, alternating from medium to high and back to low. The sequence must end with a CCC.

7.7.4 The run can end with a script to put the instrument into standby mode.

7.7.5 See Appendix C for an example.

## 8.0 QUALITY CONTROL & METHOD PERFORMANCE

### 8.1 Definitions

For definitions and explanations of quality control measures (blanks, LCS/QC Reference, LFB, Duplicates, MS/MSD, etc.) refer to the Con-Test Analytical Quality Assurance Manual.

### 8.2 Quality Control Measures & Acceptance Criteria

#### 8.2.1 Method Blank

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## **Attachment D– Laboratory Experience**



## Con-Test Analytical Laboratory PFAS Experience

Con-Test has been a leader in emerging contaminants throughout our 23 years. We recognize that the State of Massachusetts is at the forefront of the PFAS crisis in our country. As this emerging contaminant and the ways to monitor and remediate evolve; Con-Test is committed and invested to adapting to these changes.

We are currently NELAC certified through our primary states of New York as well as New Hampshire for PFAS in drinking water by method 537, 537.1, and isotope dilution and are an approved laboratory for the state of Massachusetts by this method.

### **Project Experience:**

Con-Test was the first environmental laboratory in New England with the capabilities to analyze for PFAS. We have been active educators in the environmental industry through association training, webinars, and assisting organization of the first emerging contaminants conference in North Carolina.

Con-Test began running PFAS in drinking water by method 537.1 for over 300 Public Water Suppliers and their consultants. During this time period we have analyzed and reported over 1000 samples in Massachusetts, New Hampshire, and Vermont.

#### 1. Vermont Statewide Sampling for PFAS in Drinking Water Program

Beginning in October 2019, Con-Test began to analyze samples for Public Water Suppliers and their consultants in Vermont for public Community (CWS) and Non-Transient Non-Community (NTNC) Water Systems, along with wells for private home owners. We have analyzed for over 200 samples in Vermont by method 537.1 during this time period.

#### 2. New Hampshire Sampling for PFAS in Drinking Water Program

Beginning in October 2019, Con-Test began to analyze samples for Public Water Suppliers and their consultants in the State of New Hampshire for public Community (CWS) and Non-Transient Non-Community (NTNC) Water Systems, along with wells for private home owners. We have analyzed for over 350 samples in New Hampshire by method 537.1 during this time period.

#### 3. City of Westfield - Westfield Water Dept., Westfield DEW Water Division

Since March of 2018, Con-Test has worked the City of Westfield, MA on PFAS analysis. Prior to running by method 537.1, method 537 modified was used. Since beginning to support the City of Westfield on the testing, we have analyzed almost 200 samples.

\*Other pertinent projects: City of Greensboro, NC; Israel Department of Environment



**Laboratory Staff Experience:**

The Laboratory Supervisor began the development of the laboratory's PFAS Department at Con-Test in 2016. She is now in charge of all research and development to further the laboratory's capabilities of this ever-changing market. The Laboratory Supervisor has done presentations for the Environmental Business Council (EBC), and is currently working with other state agencies, PFAS work groups, and the ITRC PFAS work group.

Representatives from Con-Test Analytical frequently attends conferences regarding updates to PFAS throughout the state of New England to obtain all pertinent information and relay back to laboratory staff. We have exhibited at multiple conferences within the past year, including the American Groundwater Trust New England PFAS Workshop, and the AEHS East Coast Conference.

**Instrumentation:** Con-Test has two instruments committed to running PFAS full time.

1. Agilent LC/MS Triple Quad – G6460C with 1260 Infinity I HPLC
2. Agilent LC/MS Triple Quad – G6470A with 1290 Infinity II HPLC

## **Attachment E– Insurance Certificates**



# Attachment F– QA Manual



# CON-TEST ANALYTICAL LABORATORY

## QUALITY ASSURANCE MANUAL

39 Spruce Street  
East Longmeadow, Massachusetts  
(413) 525-2332

*Tod Kopycinski*

04/30/2019

\_\_\_\_\_  
Tod Kopycinski  
Laboratory Technical Director

\_\_\_\_\_  
Effective Date

*Katherine F. Allen*

04/30/2019

\_\_\_\_\_  
Katherine F. Allen  
Quality Assurance Officer

\_\_\_\_\_  
Effective Date

Revision Number: 28

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**Revision Record**

Revision	Date	Responsible Person	Description of Change
1	1/1/2000	Sondra S. Kocot	Initial Version
2	7/16/2000	Sondra S. Kocot	Update App. A, delete distribution table and replace with distribution statement only; Update Equipment List: General Release
3	3/22/2002	Sondra S. Kocot	Update Method List, Equipment List, and Organizational Chart (Appendix A)
3A	11/21/2002	Sondra S. Kocot	Update Method List and Organizational Chart (Appendix A)
4	10/02/2003	Sondra S. Kocot	Update Organizational Chart (Appendix A); Statement for "Lab Ethics in Data Manipulation"; Statement for "Samples/Reports Involved in Litigation", change in storage-time for non-metal waters; update Equipment List
5	04/14/2004	Sondra S. Kocot	Update accreditation (section 3.3.4.1); add AZ office address (Intro. Section)
6	05/10/2004	Sondra S. Kocot	Updates for compliance with MA DEP Microbiology Audit and AZ Audit; additions affect primarily sections 4.0 & 7.0, with the addition of the Chem. Hygiene Plan as an Appendix, Org. chart also updated.
7	10/08/2004	Sondra S. Kocot	Updates include: Organizational chart, Equipment List, Metals Training, Uncertainty Statement (section 3)
8	02/21/2005	Sondra S. Kocot	Updates include: Organizational chart, EPA reference (200.7, 40 CFR Part 136 App C) added for non-potable ICP water samples
9	03/22/2005	Sondra S. Kocot	Edit MDL study paragraph to include discussion of outliers; update equipment list
10	07/19/2005	Sondra S. Kocot	Updates for compliance with June 2005 AIHA-LAP, LLC Audit: Organizational chart (App A), sections 3.2.1, 3.3.4.4, 9.2.4, and 13.0.
11	05/24/2007	Edward J. Denson/ Sondra Slesinski	Annual Updates
12	10/22/2007 , 12/05/2007	Edward J. Denson/ Sondra Slesinski	Updates per Oct 2007 AIHA-LAP, LLC audit and Nov 2007 client audit: See next page for detailed change record
13	07/14/2008	Katherine F. Delisle	Updates per recommendation of Massachusetts, to include new methods. See detailed change record.
14	03/25/2009	Katherine F. Delisle	Updates per changes in policy for Eppendorf's and MDLs. See detailed change record.
15	01/11/2010	Katherine F. Allen	Updates from July 2009 AIHA-LAP, LLC audit and MA June 2009 audit. See detailed change record.
16	06/23/2010	Katherine F. Allen	Updates from January 2010 NJ audit. App D was removed and made a controlled document #252. Updates to Sec's 3.2.1, 3.3.3.1, 4.1.2 (method blanks), and 4.2 (calibration). Section 4.2 (last 2 paragraphs deleted), and Section 11.0 (equipment list updated).
17	04/05/2011	Katherine F. Allen	Updates from Annual Review. See detailed change record.
18	10/07/2011	Katherine F. Allen	Updates from September 2011 AIHA-LAP, LLC audit. QA manual reworked.
19	08/20/2012	Katherine F. Allen	Updates from June 2012 NJ audit. See detailed change record.
20	10/15/2012	Katherine F. Allen	Updates from Sept 2012 NH audit. See detailed change record.
21	08/14/2013	Katherine F. Allen	Updates from June 2013 NY and MA Audits. See detailed change record.
22	09/03/2013	Katherine F. Allen	Updates from August AIHA-LAP, LLC audit. See detailed change record.

23	04/09/2015	Katherine F. Allen	Updates from annual review: See detailed change record.
24	10/20/2015	Katherine F. Allen	Updates from Sept 2015 AIHA-LAP, LLC audit. See detailed change record.
25	03/03/2017	Katherine F. Allen	Updates from annual SOP review: See detailed change record.
26	11/10/2017	Katherine F. Allen	Updates from September 2017 AIHA-LAP, LLC audit: See detailed change record.
27	01/18/2018	Katherine F. Allen	Updates from December 2017 NY Audit: See detailed change record.
28	04/30/19	Katherine F. Allen	Updates from annual SOP review and Annual QA Systems audit.

**Revision 12/12a**

**Detailed Change Record**

Introduction	Reference to "industrial hygiene" as well as "environmental"
Section 1.0	Reference to "compliance with all accrediting authorities, including ISO/IEC 17025"
Section 1.3.4	Added reference to accrediting authorities
Section 2.0	For job descriptions of Technical Director, QA Officer, Supervisor, and Analyst, academic and experience qualifications were added.
Section 2.1	Commitment of management to the QA policy statement and for improvements in the management system.
Section 2.2.2.4	"Ensures compliance with all accrediting authorities and organizations (AIHA-LAP, LLC – ISO/IEC 17025, NELAP, and various states)"
Section 3.3.4	Added North Carolina certification
Section 3.3.4 (12/07 edit)	Added Florida certification
Section 3.3.4.2	Internal PT program for AIHA-LAP, LLC fields of testing not covered by AIHA proficiency studies
Section 3.3.4.3	Written pre-approval for subcontracting needed; Con-Test is not responsible for the work of subcontract lab's which the client specifies that we use
Section 4.2.1.2	AIHA-LAP, LLC IHLAP RL's verified per matrix in each batch
Section 4.4 (12/07 edit)	Added ICP-MS method 6020 maintenance
Section 4.11	Procurement policy added
Section 4.12	Include a statement that lots of IH media are tested to ensure no contamination, and that records of such tests are maintained by each department; also stated is that Con-Test supplies IH sampling media to the clients, who perform the sampling.
Section 6.2.2 (12/07 edit)	Use of Infra-Red gun is specified regarding sample temperature
Section 6.2.3	Assignment of laboratory numbers: "environmental" samples changed to "all" samples
Section 6.2.5	Sample storage: A locked storage area will be provided should the client require secure storage for samples which require special handling due to legal proceedings.
Section 9.0	Addition of "management review"
Sections 9.0, 9.3	Section for "Corrective Actions/Preventative Actions" was added
Section 9.2	Internal audit (per AIHA-LAP, LLC, ISO/IEC 17025 requirements) must be conducted annually
Section 10.0 (12/07 edit)	Add TOC to analytical method list
Section 11.0(12/07 edit)	Update equipment list
Section 12.0 (12/07 edit)	TCLP sampling for VOA & metals: the verbiage for preservation with acid was deleted.
Section 14.2	AIHA-LAP, LLC IHLAP/ELLAP trainees must have a training period of 20 business day's duration, prior to completing a DOC and working independently on client samples. This 20-day period must be clearly documented on the IDOC training form.
Appendix A	Updated Organizational Chart
Appendix B	Addition of ISO/IEC 17025:2017
Appendix C	Edited "Training/IDOC" form to include "authorization" date, and specified 20-business-day training duration for AIHA-LAP, LLC IHLAP/ELLAP

### Revision 13

#### Detailed Change Record

Section 3.3.3.1	Include proper use of QC trends, including monitoring for presence of trends indicating that an analysis could be heading towards "out-of-control" situation.
Section 4.2	Edit to include calibration frequency of reference weights, reference thermometers, and analytical balances.
Section 4.4	Edit to include annual calibration of Conductivity meter and bi-annual calibration of Infra-Red thermometer gun.
Section 6.2.2	Edit to include bi-annual calibration of Infra-Red thermometer gun.
Section 8.5	New section, including a list of Standard Operating Procedures (SOP's). See Appendix E.
Section 10.0	Addition of ICP-MS methods, ICP method, and mercury method. Updating EPA reference to include EPA/600R-94-11, May 2004.
Section 11.0	Deleted Bausch & Lomb 601 spectrophotometer in equipment listing section.
Section 13.1	MCL exceedance policy
Appendix A	Updated Organizational chart
Appendix E	New appendix to include listing of Standard Operating Procedures (SOPs).

### Revision 14

#### Detailed Change Record

Section 3.3.4.3	Sub-contracting lab policy addition
Section 4.2	Eppendorf calibration frequency
Section 4.3	Eppendorf calibration frequency
Section 4.4	Eppendorf calibration frequency
Section 4.10	MDL policy for frequency
Section 11.0	Equipment section updated to include new Mercury Instrument, Beckman Centrifuge, flashpoint apparatus, and ENCON evaporation system.
Appendix A	Updated Organizational chart
Appendix E	Updated Listing of SOP's

### Revision 15

#### Detailed Change Record

Section 3.3.3.3.1	Addition of Non-Conforming work policy
Section 3.3.4	Inclusion of WA state certification for EPH and VPH
Section 6.2.3	Change in how laboratory numbers are assigned
Section 7.6	Change to Data Storage in respect to (new LIMS) Element
Section 15.1	Addition of communication to the subcontracting lab of special report requirements
Appendix A	Updated Organizational chart
Appendix C	Updated IDOC form
Appendix E	Updated Listing of SOP's

### Revision 16

#### Detailed Change Record

Section 9.2.2	Internal method audit section added
Appendix D	Appendix D was removed and made a controlled document #252
Section 3.2	Section updated for typos and changes in verbiage
Section 3.3.3.1	Section updated for changes in verbiage
Section 4.1.2	Method blank section updated for changes in verbiage
Section 4.2	Calibration section updated for changes in verbiage. Last 2 paragraphs removed from SOP
Section 11.0	Equipment List updated
Appendix A	Updated Organizational chart
Section 10.0	Addition of Herbicide Method SW-846 8151A

**Revision 17**

**Detailed Change Record**

Section 2.2 and 2.4	Deputies were added in absence of the Technical Director and QA Officer
Section 4.2, 4.3, and 4.4	Eppendorf calibration frequency change
Section 6.2.2	Sample Acceptance Policy added
Section 10.0	21 <sup>st</sup> edition of Standard Methods added to reference section. Method SW-846 6010B changed to SW-846 6010C. Flame and Furnace deleted. SW-846 8015B switched to SW-846 8015C and addition of SW-846 8270D and SW-846 8260C.
Appendix A	Updated Organizational chart
Appendix E	Updated Listing of SOP's

**Revision 18**

**Detailed Change Record**

QA Manual Retyped and Reformatted

Section 1.0	Objectives added
Section 2.2	Added Project Chemists are under Technical Director
Section 2.3	Deletion of Customer Services Manager under Administration Manager
Section 2.4	Used to be section 13.0: Addition of QA reports to management and monthly meeting with Technical Director.
Section 2.5	Addition of Laboratory Manager
Section 2.10	Used to be Appendix "A": Organization Chart and org chart updated
Section 3.2.1	Addition to Estimation of Uncertainty of Measurements and reference to the new SOP "Estimation of Uncertainty of Measurements"
Section 3.2.2.6	Addition of nonconforming work being immediately evaluated and "Customers notified and work is recalled when any aspect of its testing and/or calibration work, or the results of this work, do not conform to its procedures or the agreed requirements of the customer".
Section 3.2.2.7	Addition of Corrective actions and root cause investigations will be immediately issued.
Section 3.3.3	Addition of Control limits calculated annually with at least 20 data points.
Section 3.3.3.1	Addition of Control Charts assessed monthly.
Section 3.3.3.3	Addition of "Root Cause" investigation.
Section 3.3.3.3.1	Addition of Customers notified and work is recalled when any aspect of its testing and/or calibration work, or the results of this work, do not conform to its procedures or the agreed requirements of the customer, Corrective Action taken immediately, and deviations that result in nonconforming work shall be immediately evaluated.
Section 3.3.4.2	In-house AIHA-LAP, LLC PT's run twice annually instead of quarterly. Addition of a blank sample as well as 4 varying samples. Addition of unacceptable PT results immediately initiate a corrective action and a root cause investigation will begin. Addition of blind samples are made up and spiked by either the department Supervisor (Technical Manager) or the QA Officer.
Section 3.3.4.3	Included MCL exceedances must be reported by sub-lab within 24 hours.
Section 4.2	Addition of calibration certificates from external services must be accredited to ISO/IEC 17025:2017 by a recognized accrediting body. And Addition of Refer to Manufacturer's instructions for procedures on how to transport and store measuring equipment and reference standards. Addition of documented training for staff doing in house calibrations and verifications.
Section 4.2.1.1	Reporting Limits are not less than the lowest calibration standard.
Section 4.3	Addition of "For Equipment, Reference Standards, and Reference Materials is transported, stored, maintained, inspected, and cleaned according to manufacturer's instructions" and External Services for calibration of weights, NIST Thermometers, and Eppendorf's must be accredited to ISO/IEC 17025:2017 by a recognized accreditation body.
Section 4.3.1	New Section to include Equipment List which used to be Section 11.0. Equipment listing updated.
Section 4.10	MDL spiked reagent water changed to spiked media and addition of wipe material criteria.
Section 4.10.1	New Reporting Limit section

Section 4.13	Addition of "refer to manufacturer's instructions for the procedures for safe handling, transport, storage, use and planned maintenance of measuring equipment, reference materials, and reference standards to ensure proper functioning and in order to prevent contamination or deterioration".
Section 4.14	Addition of level of acceptable contamination for lead wipe sampling defined and corrective action performed if above this level.
Section 4.16	Section renamed Review of Requests, Tenders, and Contracts. Additional detail provided along with reference to SOP Review of Requests, Tenders, and Contracts, Doc #290.
Section 6.2.2	Addition of samples checked by log-in staff
Section 7.6	Data storage procedural change
Section 8.0 and 8.1	Addition of "all personnel concerned with testing and calibration activities within the laboratory familiarize themselves with the quality documentation and implement the policies and procedures in their work".
Section 8.5	Used to be Appendix "E": SOP listing and SOP listing Updated
Section 9.0	Addition of review of overall objectives to the management review.
Section 9.3	Addition of an Outline for Corrective/Preventative Actions and reference to the CA/PA SOP.
Sections 9.3.1, 9.3.2, 9.3.3, and 9.3.4	Additional details provided on the corrective/preventative action program.
Section 10.0	Addition of statement, "Deviations from test and calibration methods shall occur only if the deviation has been documented, technically justified, authorized, and accepted by the client" as well as will be noted on the final report.
Section 12.2	Addition to training section: "All personnel concerned with testing and calibration activities within the laboratory familiarize themselves with the quality documentation and implement the policies and procedures in their work".
Section 12.6	Used to be Appendix "C": Demonstration of Capability
Section 13.1	Addition of, "Clients notified and work is recalled when any aspect of its testing and/or calibration work, or the results of this work, do not conform to its procedures or the agreed requirements of the client" and "Deviations from test and calibration methods shall occur only if the deviation has been documented, technically justified, authorized, and accepted by the client"
Section 13.3	Corrective actions initiated immediately if warranted from client inquiry and reference of Corrective action section 9.3 in QA Manual and CA/PA SOP.
Section 14.0	Used to be Appendix "B": References

## Revision 19

### Detailed Change Record

Section 2.10	Updated Organizational chart
Section 3.3.4.1	Addition of Virginia and Maine Certifications
Section 8.3	Addition of written explanations for rerun samples and standards as well as anything that might need explanation in the future.
Section 8.5	Updated SOP listing

## Revision 20

### Detailed Change Record

Section 2.10	Updated Organizational chart
Section 5.2	Formulas for automated computations are initially verified then locked.
Section 8.5	Updated SOP listing

**Revision 21**

**Detailed Change Record**

Capabilities	Rephrasing
Section 2.10	Updated Organization chart
Section 4.3.1	Updated Equipment Listing
Section 4.3 and 4.4	IR Temperature guns calibrated quarterly
Section 7.0 and 7.3	Addition of items included on reports
Section 8.5	Updated SOP listing
Section 9.0	Managerial reviews identify author and be paginated.

**Revision 22**

**Detailed Change Record**

Section 2.10	Updated Organizational Chart
Section 4.3.1	Updated Equipment listing
Section 8.5	Updated SOP listing
Section 9.2	Addition of "latest" AIHA-LAP, LLC and NELAC site assessor's checklist to be used

**Revision 23**

**Detailed Change Record**

Section 2.0	Chemical Hygiene Officer (safety officer) added
Section 2.10	organizational chart removed and note added referring to external document.
Section 2.2	Updated Lab Technical Director description
Section 3.3.4.2	More information provided on proficiency samples
Section 4.2	NIST thermometer and weights calibrated every year
Section 4.12	Note added that if all media is purchased then the table of tests are not needed.
Section 4.3.1	Updated Equipment Listing
Section 6.2.2	Infrared temperature gun verified quarterly
Section 7.6	Third paragraph removed from data storage section and added that Lead and Copper potable water records need to be kept for a period of 12 years.
Section 8.0	Added other documents to master list of controlled documents
Section 8.1	Added that SOP's and QAM are available to personnel on F: Drive.
Section 8.5	Revision and date of review of each SOP removed and note added stating, for current revision and date of review see master list of controlled documents maintained by the QA department and available upon request.

**Revision 24**

**Detailed Change Record**

Section 3.3.3.1	Addition of lead control limit requirement
Section 4.2	NIST long stem thermometers purchased annually and digital sent out for calibration annually.
Section 4.2.2	Second Source standard traceable to ISO 17025 and ISO Guide 34.
Section 4.2.3	Standard traceable to ISO 17025 and ISO Guide 34.
Section 4.3.1	Equipment update
Section 4.11	Additional details of procurement added
Section 7.7	Reference to Records Maintenance Matrix added.

**Revision 25**

**Detailed Change Record**

Section 3.2.2	Additional statements added regarding free from undue pressures
Section 3.3.4.1	Deletion of WA certification
Section 4.3.1	Updated Equipment listing
Section 7.1	Addition of significant figures
Section 7.6	Updated server name to be SQL2014PRI.
Section 8.0	Additional comments added as to what is found on each document and list of SOPs updated to include any new SOP. Updated SOP listing.
Section 9.3.4	Added an internal audit may be necessary
Section 10.0	Addition of methods: EPA 537, ISO 25101, SM 5310B, EPA 300.0, 6010D, 6020B, 7303, 5503 and 6009 and deletion of some methods: SM5310C, 7300, NIOSH 1501, 1003, 7600, 3500, 1550 and 5026
Section 11.0	Updated preservation section
Section 13.1	Expanded MCL section to include MA 310 CMR42.13 requirements

**Revision 26**

**Detailed Change Record**

Section 3.3.4.1	Addition of VT Drinking Water certification
Section 3.3.4.2	Additional PT info added on how vendors are selected and reference to SOP PT Samples Doc #305 added.
Section 3.3.4.3	Statement added that additional information can be found in SOP Subcontracting, Document #239.
Section 4.2.2 and 4.2.3	ISO Guide 17034 added
Section 4.10	Revised MDL procedure
Section 4.13	"Humidity" deleted.
Section 4.16	Added COC is another form of contract
Section 4.11	Statement added that additional information can be found in SOP Evaluation of Vendors for Supplies, Document #231.
Section 4.12	Changes to procedure of chemical and reagent receipt. Statement add that additional information can be found in SOP Chemical Receipt, Document #114.
Section 4.13	Smoking prohibited on Con-Test Property.
Section 5.1	Hard copy data is stored in an archive building
Section 7.6	Inclusion of on-site data storage, additional archiving information added, and SOP Archiving Data, Document #358 referenced.
Section 8.0	Controlled Document #83 added.
Section 8.5	Addition of SOP's and controlled Doc #'s
Section 9.3.5	Additional detail on what a Preventive action is was added
Section 10.0	Methods EPA 624.1, 625.1, and 608.3 added
Section 13.1	Statement added that additional information can be found on Subcontracting in Con-Test SOP Doc #239
Section 13.3	Client Comments added to Client Complaint section

**Revision 27**

**Detailed Change Record**

Section 3.3.4.2	Additional information of PT samples provided. Alternate rounds between analysts and only analyze for dilutions if over calibration.
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Section 4.3	Additional information given on thermometer verifications: Added to apply any correction factors on NIST traceable thermometer calibration certificate and also verify at point of use.
Section 7.5	Least Squares Calibration calculation was removed and note in the beginning added that calculations are performed by Chemstation or equivalent instrument software or the LIMS Element.
Section 9.1	Additional information given about internal audits and when findings require need for corrective action and clients need to be notified. Also added, a follow up to verify the effectiveness of the corrective action taken after the internal audit.
Section 9.3.1	Time frame for corrective action and follow up stated.
Section 8.0	New procedures added for document control as well as "effective" date added.
Section 8.1	New procedures added for document control.

#### **Revision 28 Detailed Change Record**

Table of Contents	Updated Cross Reference to ISO 17025:2017
Section 1.0	Added management system documentation
Section 2.12	Added section on Impartiality
Section 2.13	Added section on Confidentiality
Section 2.14	Now Org chart section
Section 3.2.1	Added more on estimation of uncertainty
Section 4.2	Added to metrological traceability
Section 4.3	Added information to equipment section
Section 4.3.1	Updated Equipment listing
Section 4.11	added to externally provided products and services
Section 4.13	Added to Lab environment section
Section 4.15	Added to review of requests, tenders and contracts
Section 4.16	Added section on QAPPs
Section 5.0	Added to control of data and information management
Section 6.0	Added handling of test or calibration items
Section 7.0	Added information on Technical records
Section 7.4.1	Added section on reporting statements of conformity
Section 7.4.2	Added section on reporting opinions and interpretations
Section 7.4.3	Added section on amendments to reports
Section 9.4	Added section on risks and opportunities
Section 9.5	Added section on improvements
Section 10.1	Added section on selection and verification of methods
Section 10.2	Added section on validation of methods
Section 10.3	Updated methods listing
Section 12.1	Additions to personnel
Section 13.3	Additions to complaints

#### **Distribution/Training List**

See Employee Training Record File for signed training statements for trained user

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4.2 Confidentiality	Section 2.13
<b>5.0 Structural Requirements</b>	Section 2.0
<b>6.0 Resource Requirements</b>	
6.1 General	Section 4.3 and 12.0
6.2 Personnel	Section 12.0
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6.4 Equipment	Section 4.3
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6.6 Externally provided products and services	Section 4.11
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7.2.1 Selection and verification of methods	Section 10.1
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7.3 Sampling	N/A
7.4 Handling of test or calibration items	Section 6.0/Doc#268 and 375
7.5 Technical records	Section 7.1
7.6 Evaluation of measurement uncertainty	Section 3.2.1 and Doc#312
7.7 Ensuring the validity of results	Section 3.3.3 and 3.3.4.2
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7.8.5 Reporting sampling – specific requirements	N/A
7.8.6 Reporting statements of conformity	Section 7.4.1
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**ISO17025:2005 Reference**

**Con-Test QAM Section**

8.1.3	Option B	N/A
8.2	Management system documentation (Option A)	Section 1.0
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8.9	Management reviews (Option A)	Section 9.0

## CON-TEST Analytical Laboratory

### Location of Facility

Con-Test Analytical Laboratory, a full-service facility is located at 39 Spruce Street, East Longmeadow, Massachusetts 01028. The laboratory is easily accessible from both CT Interstate I-91 and I-90 (Massachusetts Turnpike).

### Brief Company History

Con-Test celebrated its thirtieth year in 2014. Con-Test was started in 1984 as a consulting and engineering firm with laboratory services and in 1994 the company was sold. In 1996 the laboratory was bought back and became strictly a family owned, independent laboratory.

We are proud to have established a reputation based on **quality, integrity, and reliability** within the environmental field. Initially, laboratory testing was limited to industrial hygiene analysis mainly in support of in-house consulting services. But the laboratory rapidly expanded its capabilities to include numerous techniques in air analysis, classical (wet) chemistry, metals, and organics.

Con-Test is presently a privately owned, independent laboratory which provides environmental and industrial hygiene analytical services with AIHA-LAP, LLC IHLAP and AIHA-LAP, LLC ELLAP (Environmental Lead) accreditation. Continuing to update our accreditations and technology, we also attained the nationally recognized NELAP accreditation and certification. We are also individually certified in many areas and states by a diverse group of recognized organizations and we have consistently demonstrated proficiency in numerous analyses and matrices under established programs.

## Capabilities

The laboratory has the capability for water, air, soil or solid matrices, and lead in soil, air, wipes and paint. The laboratory currently serves a diverse range of clients in an even broader range of analytical services. Analyses are performed to satisfy the following regulatory requirements and purposes:

- National Pollutant Discharge Elimination System (NPDES)
- Industrial Pretreatment Program (IPP)
- Resource Conservation and Recovery Act (RCRA)
- EPA Requirements
- OSHA Compliance Requirements
- Code of Federal Regulations (CFR) Requirements
- Massachusetts Department of Environmental Protection (DEP)
- Safe Drinking Water Act (SDWA)
- Clean Water Act
- Massachusetts Water Resources Authority (MWRA)
- Hazardous Waste Characterization (SW-846)
- Groundwater Monitoring Programs
- Industrial Hygiene/Indoor Air Quality (AIHA-LAP, LLC)
- Microbiology
- Well Water Testing
- State Certifications (MA, CT, NY, VT, RI, NH, NJ, NC, ME, VA and FL)
- Connecticut RCP (Reasonable Confidence Protocols)
- Massachusetts MCP (Massachusetts Contingency Plan)

Con-Test Analytical Laboratory is an established laboratory, which realizes the need for remaining on the cutting edge of environmental/industrial hygiene technology. Automation of systems to the greatest extent possible is a primary objective of the laboratory. Current applications and systems are continually being expanded and updated whenever possible to achieve unrivaled quality and information turnaround. Con-Test believes that the use of state-of-the art instrumentation, including data management systems is imperative in maintaining needed efficiency and effectiveness of services. The laboratory is equipped with the latest instrumentation including Gas Chromatographs (GC), GC Mass Spectrometers (GC/MS), LC/MS/MS, Thermo Discrete Gallery, Inductively Coupled Plasma-Atomic Emission Spectrometers (ICP-AES), Inductively Coupled Plasma – Mass Spectroscopy (ICP-MS), High Performance Liquid Chromatography (HPLC), Ion Chromatography (IC) and a Laboratory Information Management System (LIMS).

The laboratory is committed to providing analytical services of the highest quality achievable, offering a high level of client commitment, balancing response and prompt turnaround with quality and reliable analyses. The laboratory strives to maintain, and ultimately exceed, established quality standards when providing objective and cost affective services in today's competitive environmental/analytical marketplace. The laboratory's Quality Assurance program insures accuracy of data from testing methodologies to provide a high level of confidence in test results and is committed to continuous improvement.

## **1.0 Introduction, Objectives, and Quality Assurance Policy Statement**

The objective of the Con-Test Quality Assurance Program is to assure the production of the highest quality of data and service possible, with commitment to compliance with all regulatory authorities and organizations, including ISO/IEC 17025:2017. This manual outlines the quality control and quality assessment systems which are used to achieve Con-Test's Quality Assurance Goals. The QA program is management's tool to ensure commitment to quality and excellence. All personnel concerned with testing and calibration activities within the laboratory will familiarize themselves with the quality documentation and implement the policies and procedures in their work. All tests and calibrations shall always be carried out in accordance with stated methods and customers' requirements.

The laboratory management shall establish, document, and maintain policies and objectives for the fulfillment of the purposes of the ISO17025:2017 standard and shall ensure that the policies and objectives are acknowledged and implemented at all levels of the laboratory. The policies and objectives shall address the competence, impartiality and consistent operation of the laboratory. Laboratory management shall provide evidence of commitment to the development and implementation of the management system and to continually improve its effectiveness. All documentation, processes, systems, records, related to the fulfillment of the requirements of the ISO17025:2017 standard shall be included in, referenced from, or linked to the management system. All personnel involved in laboratory activities shall have access to the parts of the management system documentation and related information that are applicable to their responsibilities.

The Quality Assurance Program addresses all areas of Industrial Hygiene and Environmental chemistry.

### **1.1 Quality Control**

Quality control consists of specific procedures or measures adapted to specific operating conditions. These procedures, which apply to every phase of business done at Con-Test Analytical Laboratory, provide a quality structure upon which each procedure is constructed. The purpose is to ensure quality of data and service to our clients.

### **1.2 Quality Assessment**

Quality assessment involves the continuous evaluation of data and monitoring of analytical processes to ensure that quality control procedures are performing correctly.

### **1.3 Major Elements of the Quality Assurance Program**

**1.3.1** The use of appropriate methodologies by technically competent, well-trained personnel, using state of the art instrumentation and equipment.

**1.3.2** Adherence to well defined standard operating procedures, with emphasis on sound laboratory techniques.

- 1.3.3 Monitoring of analytical methods to ensure that data user's needs for precision, accuracy, and sensitivity are met. Assessment of data by use of quality control samples including (but not limited to); blanks, independent laboratory control samples, duplicate samples, matrix spiked samples, and surrogate spiked samples.
- 1.3.4 Internal and external system and performance audits to monitor compliance with procedures and accrediting authorities (AIHA-LAP, LLC – ISO/IEC 17025, NELAP, and various states), and assess performance of analytical methods.

## 2.0 Laboratory Structure, Personnel, and Responsibility

### Organizational Structure (See External Document #318)

#### 2.1 General Manager

The General Manager is immediately responsible for all functions pertaining to laboratory operations including overall financial monitoring and management (P&L), preparation of financial reports and statements, marketing, and overseeing issues concerning client relations and laboratory efficiency. Additional responsibilities include; laboratory personnel management including support and performance evaluation, cost analysis and pricing, and overall laboratory business coordination. The top management is committed to the quality assurance policy and objectives, while continually striving to improve the effectiveness of the management system.

#### 2.2 Laboratory Technical Director

The laboratory Technical Director is responsible for overseeing all aspects of Laboratories Technical operations. The Technical Director provides scientific management, organization, direction, and support to both clients and laboratory personnel to ensure that the highest quality and appropriate product is delivered. The Technical Director ensures compliance with all accrediting authorities and organizations (AIHA-LAP, LLC – ISO/IEC 17025, NELAP, and various states). The daily duties for this position include managing the Quality Control. The Technical Director is also responsible for addressing client and lab personnel questions or concerns with methodology and data quality, and makes recommendations on technical issues. The Technical Director must certify that personnel with appropriate educational and/or technical background perform all tests for which the laboratory is accredited. Such certification shall be documented: all employees must have on file a Demonstration of Capability, and documentation that they have read and understood the QA Manual and appropriate SOP's. He/she must ensure that the training of each member of the technical staff is kept up-to-date (on-going). Other major duties include: coordinating with General Manager and Quality Assurance Officer on technical issues, final review and approval of analysis reports and maintenance of technical as well as program standards. The

Technical Director shall possess a bachelor's degree in an applicable physical or biological science (with at least 24 college credits in chemistry and 4 college credits in microbiology), a minimum 3 years' relevant nonacademic analytical chemistry experience (a minimum of 2 years' experience must be in industrial hygiene/metals analyses within the laboratory's scope of accreditation; the remaining one year can be from other non-AIHA-LAP, LLC laboratory analytical procedures). The Technical Director must possess knowledge of IH chemistry calculations with respect to lead-in-air principles and calculations. Relevant academic experience may be substituted for work experience. A relevant master's degree shall be considered equivalent to one year of work experience. The Laboratory Manager has been named the deputy in the absence of the Technical Director.

### **2.3 Administrative Manager**

The Administrative Manager is responsible for managing the Administrative Assistant staffing. This individual is also responsible for all aspects of the corporate accounting system such as payroll, accounts payable, accounts receivable, collections, as well as preparation of financial reports (P&L) and statements.

### **2.4 Quality Assurance Officer**

It is the responsibility of the Quality Assurance Officer to maintain and administer all aspects of the laboratory's Quality Assurance plan therefore ensuring all QA goals are achieved. The Quality Assurance Officer assists the Technical Director in ensuring compliance with all accrediting authorities and organizations (AIHA-LAP, LLC – ISO/IEC 17025, NELAP, and various states). The QA officer addresses every analysis performed in the lab, including documentation of procedures, formulation and use of control charts, addressing of client and regulatory agency quality concerns and audits, and validation of data. The QA Officer also develops and maintains QC procedures for all analytical areas and prepares quality control reports, monthly or when applicable, for presentation to the laboratory director for routine assessment of measurement systems for precision and accuracy. The QA Officer shall possess a bachelor's degree in an applicable basic or applied science and have at least one year of nonacademic analytical experience appropriate to the types of analyses performed by the laboratory; or in lieu of a bachelor's degree, four years of nonacademic analytical experience. The QA Officer shall have documented training in statistics. Training in quality control procedures is strongly encouraged. The Technical Director has been named deputy in the absence of the QA Officer.

- 2.4.1** The Quality Assurance Officer prepares Quality Assurance Reports for review by the laboratory management on a regular basis (monthly). The main structure of a report is based on summarization of one or more of

the following categories: Quality Assurance Activities, Quality Control Performance, Corrective Actions, and QA review of data packages as part of internal audits. Each month the Technical Director and the QA Officer meet and discuss the contents of the monthly report.

## 2.5 Laboratory Manager

It is the responsibility of the Laboratory Manager to oversee staff and production management and to meet the needs of clients on data completeness and delivery. The Laboratory Manager is responsible for production control, monthly management reports, staff management, training, industry events, quality systems, cost control, add new products or market segments, innovation and data review. In addition to management of all departments in the laboratory.

## 2.6 Operations Director

The Operations Director assists in laboratory renovations and design, improvements in the facility and work flow, standardization of lab processes and maintenance of leading-edge technology, as well as final review and approval of analysis reports. The operations director also heads up the IT department, and is the LIMS administrator.

## 2.7 Section Heads/ Supervisors

It is the duty of each Section Head to perform and maintain proficiency in the analysis of specified areas and techniques, provide training, supervision, and direction to analysts, insure that work flows smoothly, that quality and turnaround standards are maintained and ultimately exceeded, ensure safety measures are being followed, and to assist development of projects, planning and quality control program in the specified area.

A Supervisor shall possess a bachelor's degree in chemistry, biology, or a closely related field, and have at least 30 college credits in chemistry (or 4 college credits in microbiology for a microbiology supervisor). A supervisor shall have a minimum 2 years' experience in chemical analysis (or a minimum one-year experience in microbiology for a microbiology supervisor).

Per MA DEP regulations, the following requirements apply:

Inorganic chemistry I (includes AA Spectroscopy): the supervisor shall have a minimum of 2 years' laboratory experience in chemical analysis, including 6 months training or experience in the operation of an AA spectrophotometer.

Inorganic chemistry II (Includes ICP): the laboratory supervisor shall have a minimum of 2 years' laboratory experience in chemical analysis, including one-year training or experience in ICP methods.

Organic chemistry I (includes GC): the laboratory supervisor shall have a minimum of 2 years' experience in chemical analysis, including 6 months training or experience in the operation of a GC.

Organic chemistry II (includes GC/MS): the laboratory supervisor shall have a minimum of 2 years' experience in chemical analysis, including 6 months training or experience in GC methods and one-year training or experience in the operation of a GC/MS.

## 2.8 Chemical Hygiene Officer (Safety Officer)

The Chemical Hygiene Officer is responsible for the development and implementation of the Chemical Hygiene Plan for the laboratory.

- Responsible individuals will be designated for duties to insure compliance with safety, training and medical monitoring requirements of the plan
  - The laboratory supervisors are responsible for conducting regular hazard inspections using the Department Safety Check List (Document#316), either by themselves or a designated individual in the department. The completed checklist is forwarded to the Chemical Hygiene Officer at the end of each month. The Chemical Hygiene Officer addresses any deficiencies and retains the checklists in a binder.
- Ensuring laboratory personnel are using the proper personal protective equipment
- Evaluation of Hood Performance, Coordinate the operation, acquisition and maintenance of fume hoods, emergency safety showers, eyewashes and fire extinguishers
- Hazardous Chemical and Waste training
- Evaluating circumstances requiring pre-approval for work, i.e. dangerous samples or procedures using dangerous reagents
- Provisions for working with Particularly Hazardous Substances
- Enforcement of safety policies
- Provide technical expertise and administrative support to the laboratory community in the area of laboratory safety and health, and direct inquiries to appropriate resources
- Ensure that extremely hazardous substances are appropriately handled and stored and that specific standard operating procedures are developed and followed which instruct all personnel in the safe use of these substances
- Review specific operating procedures for the use, disposal, spill clean-up, and decontamination of extremely hazardous chemicals and substances
- Investigate all incident reports, chemical spills and near-misses to prevent repeat incidents
- Act as a liaison between the laboratory and management bringing unresolved and potentially serious health and safety problems to their attention

- Chemical Hygiene/Safety Committee containing representatives from all departments/areas of the company
- Ensuring all employees receive proper safety training
- Helps maintain SDS sheets

## 2.9 Individual Analysts

It is the responsibility of each analyst to be cognizant of always maintaining and ultimately exceeding quality standards during the generation of consistently reliable data of the highest achievable.

At Contest, it is the duty of each and every employee to help foster an attitude of continuous improvement in the laboratory with regard to decreasing turnaround in all areas, improving quality of results and providing excellent customer service to produce “delighted clients” who have no reason to go anywhere else.

Per AIHA-LAP, LLC policy, an analyst shall possess a bachelor’s degree in chemistry or a related science. A technician is one who does not have a degree in chemistry or a related science. An AIHA-LAP, LLC analyst must complete in-house training per AIHA-LAP, LLC policies (see section 12.0 of this QA Manual).

Per MA DEP regulations, the following requirements apply:

Instrumentation analysts shall possess a high school diploma or equivalent and 8 college credits in chemistry for an instrumentation analyst; have a minimum of 6 months training or experience in the operation of the appropriate instrumentation except for GC/MS or ICP. One year of training or experience is required for the operation of GC/MS or ICP.

Non-instrumentation analyst shall possess a minimum of a high school diploma or equivalent; an analyst shall receive specialized training in the methods to be performed.

## 2.10 Statement of Confidence

Due to the inherent nature of work provided by Con-Test, employees are required to work with confidentiality. Information concerning analysis data and reports is considered confidential and will be released only to a client or their authorized representative.

Only authorized personnel have access to, and the responsibility for control and issuance of data, materials, and supplies.

## **2.11 Laboratory Security**

Con-Test Analytical Laboratory is a secure laboratory. In order to assure our clients strictest confidentiality, Con-Test has several security measures, including a building security system and laboratory entry system restricting access to only authorized personnel. Unauthorized sample contact or data manipulation is therefore controlled.

## **2.12 Impartiality**

- 2.12.1** Laboratory activities shall be undertaken impartially and structured and managed so as to safeguard impartiality.
- 2.12.2** The laboratory management shall be committed to impartiality.
- 2.12.3** The laboratory shall be responsible for the impartiality of its laboratory activities and shall not allow commercial, financial or other pressures to compromise impartiality.
- 2.12.4** The laboratory shall identify risks to its impartiality on an on-going basis. This shall include those risks that arise from its activities, or from its relationships, or from the relationships of its personnel. However, such relationships do not necessarily present a laboratory with a risk to impartiality.
- 2.12.5** If a risk to impartiality is identified, the laboratory shall be able to demonstrate how it eliminates or minimizes such risk.

## **2.13 Confidentiality**

- 2.13.1** The laboratory shall be responsible, through legally enforceable commitments, for the management of all information obtained or created during the performance of laboratory activities. The laboratory shall inform the customer in advance, of the information it intends to place in the public domain. Except for information that the customer makes publicly available, or when agreed between the laboratory and the customer (e.g. for the purpose of responding to complaints), all other information is considered proprietary information and shall be regarded as confidential.
- 2.13.2** When the laboratory is required by law or authorized by contractual arrangements to release confidential information, the customer or individual concerned shall, unless prohibited by law, be notified of the information provided.
- 2.13.3** Information about the customer obtained from sources other than the customer (e.g. complainant, regulators) shall be confidential between the customer and the laboratory. The provider (source) of this information shall be confidential to the laboratory and shall not be shared with the customer, unless agreed by the source.
- 2.13.4** Personnel, including any committee members, contractors, personnel of external bodies, or individuals acting on the laboratory's behalf, shall keep confidential all information obtained or created during the performance of laboratory activities, except as required by law.

#### **2.14 Con-Test Analytical Laboratory organization chart**

To view organizational chart, see External Document #318.

### **3.0 Quality Assurance Objectives**

The purpose of Con-Test's Quality Assurance Plan is to ensure the production of quality, objective, and cost affective services to our clients. The laboratory operation offers a high level of client commitment, balancing response and prompt turnaround with quality and reliable analyses.

#### **3.1 Quality Assurance Goals**

- 3.1.1** Establish and maintain the quality management and assurance systems in the production of consistently reliable and accurate "quality data" of known precision and accuracy.
- 3.1.2** Monitor analytical methods to insure use of appropriate, EPA, State, or recognized agency endorsed or approved methodology insuring that client's need for precision, accuracy, and sensitivity are met or ultimately exceeded.
- 3.1.3** Insure the use of sound laboratory techniques and practices, by competent trained individuals.
- 3.1.4** Establish and maintain Standard Operating Procedures for all processes producing uniformity and definition.
- 3.1.5** Maintain systems for early identification of problems and defined procedures for quick resolution.
- 3.1.6** Promote a positive attitude toward improvement of total quality.

#### **3.2 Measurement of Data**

In the pursuit of the highest data quality achievable, Con-Test utilizes specific procedures applicable to defined situations in the tracking and evaluation of data and data systems.

### **3.2.1 Use of Quality Control Measures**

**3.2.1.1** Quality control measures are part of the daily laboratory routine from which data quality is assessed and controlled. These defined processes are built into each analysis or Standard Operating Procedure. Standard Operating Procedures address all aspects and processes performed in the lab and ensure correct definition and proper utilization through incorporation of method specific QC into applicable methodology. An overview of the entire process and its utilization is addressed in the following sections.

**3.2.1.2** Most Quality Control data, which is obtained during sample analysis provides an indication of the "Quality" of sample data and therefore is provided in laboratory deliverable packages with the applicable sample data. It must be noted that not all reports will contain QC information. This does not mean that the same care and attention was not given to all samples but that regulations dictated that specific QC measures be analyzed on an alternate sample in the analytical batch. Other QC measures are not reported to clients because it does not provide supplemental information about the sample and is therefore not helpful.

**3.2.1.3** Evaluation of measurement uncertainty – The laboratory shall identify the contributions to measurement uncertainty. When evaluating measurement uncertainty, all contributions that are of significance, including those arising from sampling, shall be taken into account using appropriate methods of analysis.

**3.2.1.4** A laboratory performing calibrations, including of its own equipment, shall evaluate the measurement uncertainty for all calibrations.

**3.2.1.5** A laboratory performing testing shall evaluate measurement uncertainty. Where the test method precludes rigorous evaluation of measurement uncertainty, an estimation shall be made based on an understanding of the theoretical principles or practical experience of the performance of the method.

**3.2.1.6** The components of uncertainty are identified and estimated for all quantitative tests in the laboratory using the standard quality control procedures for determining precision and accuracy as outlined in section 4.0 of this manual. These include but are not limited to the use of standard reference material; laboratory fortified sampling media or blanks and their duplicates, and sample duplicates.

**3.2.1.7** Primary components of uncertainty arise from: instrument calibration bias, instrument noise/drift, instrument response/line voltage transients, purity of reagents/variation of reagent addition, and analyst technique (including dilutions and subjective measurements).

**3.2.1.8** Quality control results associated with samples are reported in the QC summary report that accompanies the sample results. Where necessary for the interpretation of the test results and when requested, the overall estimate of uncertainty is reported to the client.

**3.2.1.9** See SOP "Estimation of Uncertainty of Measurements" controlled document #312 for details on the procedure of estimating uncertainty as well as an example of how Con-Test calculates the estimation of uncertainty.

### **3.2.2 Laboratory Data Integrity and Ethics Policy**

Con-Test Analytical Laboratory understands the importance of environmental testing data to nearly every significant public health and environmental management decision made and consequently has developed this policy to ensure that strict ethical standards are adhered to in the performance of analytical procedures and reporting of analytical results. Con-Test will ensure that its management and personnel are free from any undue internal and external commercial, financial and other pressures and influences that may adversely affect the quality of their work. Con-Test Analytical Laboratory is committed to compliance with all applicable laws, regulations, and other requirements that are imposed upon the laboratory in the conduct of its business, and to practice the highest professional laboratory standards. See SOP Ethics, controlled document #392 for expanded detail.

#### **3.2.2.1 Principles and Program Components**

- 1) The laboratory is ethically and morally obligated to provide data that is precise, accurate, and of known and documented quality.
- 2) The laboratory will self-police its operations in order to maintain data user confidence.
- 3) Data integrity training will be provided to all employees.
- 4) A quality assurance officer will be appointed to insure compliance with the ethics policy within the laboratory.
- 5) An enforcement policy through disciplinary action will be implemented.
- 6) A confidential mechanism will be implemented for anonymously reporting alleged misconduct that will require a full investigation.
- 7) Procedures are described for guidance on the recall of data if and when necessary.
- 8) Internal auditing and corrective action procedures are in place to detect integrity issues.
- 9) Internal data integrity investigations will be thoroughly documented.

### **3.2.2.2 Role of Quality Assurance Officer within Ethics Program**

A Quality Assurance Officer (QAO) is appointed within the laboratory with direct access to the laboratory director and highest levels of management. Among other duties the Quality Assurance Officer will be responsible for compliance within the laboratory and adherence to the data integrity policy. The QA Officer also maintains an internal auditing system whereby all analytical methods are audited at least annually to detect and correct systematic errors, improper practices, and non-compliance. Internal audits are conducted on a pre-determined schedule, in response to external audit findings, based on client complaints, or anonymous allegations of misconduct. A master list of corrective actions is maintained and progress in the resolution of corrective actions is reported to management on a monthly basis.

### **3.2.2.3 Data Integrity and Ethics Training Program**

Data Integrity Training shall be provided as a formal part of new employee orientation and must also be provided on an annual basis for all current employees. Topics covered shall be documented in writing and provided to all trainees. The training will include training in the critical need for honesty and full disclosure in analytical reporting, acceptable and unacceptable scientific practices, including proper manual integration, calibration, and documentation procedures. The laboratory ethics policy will be discussed including the mission statement and consequences of non-compliance including possible enforcement and disciplinary actions. The initial data integrity training and annual refresher training shall have a signature attendance sheet that demonstrates all staff has participated and understand their obligations related to data integrity.

### **3.2.2.4 Enforcement Actions**

Employees who violate the laboratory data integrity policy or knowingly bypass required quality control or quality assurance procedures will be disciplined consistent with the severity of circumstances surrounding the violation. Individuals who knowingly and intentionally falsify data or otherwise commit criminal acts will not be tolerated. Individuals who are discovered using improper practices including "peak juicing", "peak shaving", inappropriate and inconsistent manual integration, falsifying dates, inappropriate changes in the concentrations of standards, and fabricating data ("dry Lab"), after investigation, will be subject to disciplinary action up to and including immediate termination as specified in the employee personnel handbook.

### **3.2.2.5 Internal Investigations, Reporting, and Monitoring**

While it is hoped that allegations of misconduct or violations of the laboratory ethics and data integrity policy will be brought to the attention of supervisors, senior management or the Quality Assurance Officer, issues may also be raised and reporting privately and anonymously to any of the same individuals without fear of reprisal. In the case that employees wish to anonymously report misconduct, a locked drop-box is provided. The QA Officer routinely checks the lock box for reports containing anonymous allegations. All allegations of misconduct will be investigated free from the influence of those being investigated. All investigations and resolutions to allegations of misconduct will be conducted privately and discreetly and must be reported to senior management.

### **3.2.2.6 Data Recall**

In the normal course of business, periodically there will be some reports submitted to customers with erroneous data. There may be many possible causes for the erroneous data, including calculation errors, data entry errors, analytical problems that were not caught during data review, and deviations from standard operating procedures. Some erroneous data could be caused by misconduct or deceptive data recording practices by an individual within the laboratory.

Erroneous data (nonconforming work), once discovered, will immediately be evaluated and subject to the corrective action reporting procedures. When necessary, the customer is notified and work is recalled when any aspect of its testing and/or calibration work, or the results of this work, do not conform to its procedures or the agreed requirements of the customer. Revised report forms will be completed for each report involved, and the client will be notified that changes will be made to the report. A revised report will be issued. A corrective action form will be completed and the error will be recorded in the corrective action database and investigated, unless the error was a simple typographical error that did not affect the data. Discovery of erroneous data might lead to an investigation of improper practice and disciplinary action.

### **3.2.2.7 Proper and Improper Practices**

In the course of laboratory testing it is inevitable that some things will go wrong from time to time. Problems encountered in the laboratory should never be covered up. Improper practices can be perpetuated by inadequate training, ineffective internal assessments, and lack of independent QA review. Most improper practices are shortcuts, appearing to be done to save time and effort. In any case, a corrective action shall be issued immediately and a root cause investigation will be initiated.

Data should always be able to be reconstructed without having to talk to the analyst who performed the test and should stand by itself.

In the light of these principles, realities, attitudes, and the associated pressures, an extensive, although not all-inclusive list of proper and improper practices are presented below.

#### **3.2.2.7.1 Proper Practices**

- 1) Analytical results must be reported from actual analysis.
- 2) Record exceptions to and deviations from documented procedures.
- 3) Records must be complete to trace actual analysis and stand by themselves without discussion with analyst.
- 4) If calibration or QC is not within limits – consistently integrate peaks and perform corrective action of maintenance.
- 5) Only reject points from an MDL calculation using statistical evaluation or if a known error has occurred.
- 6) Document all calibration and QC data.
- 7) Adjust laboratory reporting limit and upper end of linearity based on current initial calibration.
- 8) Report and document problems and the need for corrective actions.
- 9) Report knowledge of unethical behavior to management.
- 10) Exceeded holding times must be reported to clients.
- 11) Document all manual integrations with before and after print-out, reason, name, and date.
- 12) Document all out-of-control events.
- 13) Retain non-compliant data or data for assays that did not work.
- 14) Document corrective actions and maintenance procedures.

#### **3.2.2.7.2 Improper Practices**

- 1) Fabrication of data or other information
- 2) Misrepresentation of QC sample results
- 3) Improper date/time setting or recording
- 4) Improper peak integration
- 5) Improper GC/MS tuning
- 6) Improper calibration and verification
- 7) Data file substitution or modification
- 8) Unwarranted sample dilution
- 9) Improper alteration of analytical conditions
- 10) Unwarranted manipulation of computer software
- 11) Concealment of a known problem malfunction issues

Any of these items shall have a corrective action issued, with a root cause investigation.

#### **3.2.2.7.3 Avoid Non-Authentic Data – Intentional or accidental reporting of incorrect data**

- 1) Wrong number of significant figures used in calculations and reports
- 2) Quality Control samples not analyzed or reported at proper frequency
- 3) Missing units, headers, and initials in the record

Any of these items shall have a corrective action issued, with a root cause investigation.

### **3.3 Specific Routine Procedures Used to Assess Data Precision and Accuracy**

#### **3.3.1 Precision: Assessment of Precision**

Precision, as defined by the Environmental Protection Agency (SW-846), "is the measure of the degree of agreement among duplicate sample analyses without assumption of knowledge of its true value." At Con-Test, precision is estimated by means of duplicate analyses expressed as relative percent difference or range. Duplicate control limits vary from zero (no difference between duplicate samples) to the historical mean of the applicable accumulated set of duplicate measurements plus three standard deviation units.

Con-Test analyzes duplicates at a frequency of at least 5% or one per batch in order to construct data control charts, and sometimes more frequently if required or deemed necessary.

#### **3.3.2 Accuracy: Assessment of Accuracy**

Accuracy, as defined by the EPA, "is the closeness of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy is the combination of bias and precision of an analytical procedure, which reflects the closeness of a measured value to the true value."

Bias is the deviation of the measured value from a known spiked amount due to matrix effects and other undeterminable sources.

By determining the recovery of a known amount of target analyte spiked into a sample (matrix spike) or medium blank, Con-Test monitors the accuracy of an analytical process. An indication of laboratory total

accuracy can be obtained after the accumulation of a significant number of observations.

Matrix spikes, as well as matrix spike duplicates are utilized for the assessment of accuracy and precision. Con-Test utilizes control limits for accuracy based on the historical mean percent recovery of the applicable accumulated population plus or minus three standard deviation units.

### **3.3.3 Assessment of Data Quality**

Historical monitoring and evaluation of performance through the use of X bar and R control charts provides a reliable way of assessing quality of data. Through the compiling and plotting of historical data points (duplicate and spike results) a historical data point spread or control chart (assuming a normal distribution) using the population is obtained. Through the use of statistics, specifically the calculation of the mean value of the population and the standard deviation (average difference from the mean value), control limits are calculated annually, using at least 20 data points. The purpose of control limits is to demonstrate that the method is performing in a state of statistical control.

#### **3.3.3.1 Control Charts and Control Limits**

Control charts provide a tool for distinguishing the pattern of indeterminate (random) variation from the determinate (assignable cause) variation.

The control chart is actually a graphical representation of quality control efficiency. The data from a series of analyses can be plotted with the vertical scale in units of the test result and the horizontal scale in units of time or sequence of analysis. The mean value of the population and standard deviation can be calculated and the spread can be established.

A minimum of twenty data points is normally required to determine chart limits. The determination of appropriate control limits or statistically acceptable deviations can be based on the capability of the procedure as known from past experience or can be arbitrarily set at a desired level (prescriptive limits). Commonly, the limits are set at three standard deviation units on each side of the mean.

If a procedure is "in control", the results will almost always fall within the established statistical control limits. The charts may also disclose trends and cycles from assignable causes.

Control charts are generated and assessed on a regular basis; in order to identify, explain, and correct any observed trends in a timely manner. A "trend" is defined as 7 consecutive points on either side of the mean. Trends indicate issues, which necessitate explanation. If trend continues a corrective action shall be needed. Charts are generated according to a schedule. They are assessed and trends are identified by the following criteria:

- Must span 7 or more analysis dates
- Must be outside the 90-110% recovery window
- If the chart is for RPD, and the chart trend is below the mean, then it is not designated as a trend
- The mean may be skewed, due to an extreme outlying point, causing a false trend
- If all data points for an analyte are always below 70% recovery, an investigation is warranted. (It may need to be classified as a difficult compound, or a corrective action may be issued)
- For "real time" trend analysis, only review the last quarter (3 months) of data: anything further back is too old for real-time viewing

Any trends that are identified are logged into a database, and assigned to the analyst, who will investigate the trend and write an explanation, and then forward it back to the QA department.

When evaluating control charts, the following general criteria are considered:

- 1 Measurement > Control Limit  
Analyze another  
Stop test if > Control Limit
- 2 of 3 successive point > Warning Limit  
Analyze another  
Stop test if > Warning Limit evaluate bias and correct

- 4 out of 5 points exceed 1 standard deviation or decreasing or increasing order on the same side of the central line.  
Analyze another  
Stop test if exceeds 1 standard deviation or same pattern and correct
- 7 Successive points on the same side of the central line.  
Stop test and correct

In some cases, the laboratory monitors and establishes its own control limits, in order to meet method requirements, method specified control limits take precedence over those established in the laboratory. Data outside laboratory control limits but within method specified limits may be considered of sufficient accuracy to report.

For the AIHA, LAP-LLC lead program, laboratory determined statistical acceptance limits and frequencies must be at least as stringent as the interim limits of 80-120%.

### 3.3.3.2 Con-Test Classification System for Waters and Wastes

The laboratory has developed control charts and acceptance limits based on general matrix stability and characteristics. Most waters and wastes can be adequately categorized and evaluated under two major groupings; Potable & Non-Potable Water. Classification of Waters for the purpose of comparison and evaluation of data to establish control limits is based on the following table and comments.

Con-Test Classification of Waters and Wastes  
Categorization of Potable and Non-Potable Water

#### Potable Water

- Public Drinking Water
- Well Water (other than monitoring)
- Water (depending on matrix characteristics)\*
- Bulk or Bottled Water
- Other

#### Non-Potable Water

- Wastewater
- Effluent of Discharge Waters
- Storm Water (matrix related)
- Water (depending on matrix)\*
- Monitoring Well Water
- Leachate
- Ground Water (other than effluent)
- Recreational water (Pools, Beaches)
- Streams, Lakes, Rivers
- Other

\*If the sample has been evaluated by the client as "WATER" it may be compared to either of the above categories according to the laboratories' discretion (determined matrix characteristics).

Samples previously classified by Clients in one of the above categories may occasionally be laboratory re-classified and subsequently compared to matrix control limits other than the one which was specified by the client when deemed more applicable by the laboratory. This is based upon laboratory matrix characterization including; appearance, matrix consistency, and matrix components. If difficulties encountered in the analysis of a sample can reasonably be determined as matrix and not system related, a sample matrix may be compared to limits other than one listed on the chain of custody or categorized as Other than one of the above.

#### **3.3.3.3 Out of Control Events:**

An " Out of control Event" is any event, which does not fall within established control limits. Con-Test laboratory takes immediate corrective action whenever quality control data is outside acceptance limits. Data is either not reported or reported as qualified data until the root cause of the problem is determined and corrected. Records are kept of all out of control events.

If the sample values do not meet the minimal acceptance criteria, a root cause investigation is conducted to determine, correct, and document the source or suspected cause of the variance. The root cause investigation continues until acceptance criteria are met or the data is flagged with an appropriate explanation of the variance. Attempting to accurately identify the root cause of the variance shall involve initiation of a formal corrective action.

The following steps are taken for these events:

The analyst/technician will attempt to determine why the analytical values exceed the control limits and correct the problem if identified. Calibration-related out of control events are documented on non-conformance forms. Out of control events detected during control chart review are logged into a database, and assigned to the analyst, who will investigate the

trend and write an explanation, and the forward it back to the QA department.

Additional actions include:

- **Data Integrity Validation**

A check of data transcription from log books, calculations, method requirements, reviews of sample matrix data and other possible causes.

- **Data Re-evaluation**

The analyst will re-analyze / possibly re-prepare both the quality control samples and samples a second time if the samples are such that significant degradation has not occurred or sufficient sample is available.

Additional QC measures can be utilized to eliminate suspect sources of error. (I.e. Fortified Blanks can be prepared to run with the samples to eliminate suspicion of inaccuracy in spiking procedures and/or spiking equipment).

- **Determination of Root Cause**

In the event a consistent bias is discovered in procedure, method, or the like, a formal corrective action is initiated to ensure that the problem is tracked to resolution.

#### **3.3.3.3.1**

##### **Nonconforming Work**

When necessary, the customer is notified and work is recalled when any aspect of its testing and/or calibration work, or the results of this work, do not conform to its own procedures or the agreed requirements of the customer. Deviations that result in nonconforming work shall be immediately evaluated. Correction is taken immediately, together with any decision about the acceptability of the nonconforming work.

Non-conforming QC samples such as infrequent LCS/MS/CCV failures are addressed through case narrative notes with the analytical report and/or sample re-preparation and/or reanalysis when applicable.

Non-conforming QC problems will be addressed by the QA department immediately through corrective action. This will start a root cause investigation including routine data review, data validation, internal or external audits as follows: An evaluation of the significance and extent of the problem will be conducted by the QA department, with oversight by management staff including the laboratory manager and laboratory director. If the problem significantly affects previously reported data, the client is notified by the project chemist assigned to the particular client and a new report will be issued after the problem is corrected. If a significant problem is found that is not able to be addressed and corrected immediately, all affected work will be halted in the laboratory by the QA department and/or laboratory manager. Clients with affected samples will be notified by their project chemist, and work will be subcontracted to a qualified laboratory at the clients' request. Work will not be resumed on affected analyses until a root cause analysis of the technical aspects of the procedure is performed by laboratory management, previously reported results are reviewed for accuracy and method compliance, and the QA department has approved changes that will bring the method into full compliance. When all three of these conditions have been met, the laboratory director will again allow work to be accepted for these procedures.

#### **3.3.3.4 Sample Matrix Interferences**

Samples, which indicate the presence of interferences, are normally treated in one or more of the following ways in an attempt to eliminate the interference(s) and obtain a defensible, valid result.

- The sample is successively diluted and reanalyzed to eliminate interferences.
- Modification of sample matrix is used to remove interferences or to stabilize the analyte of interest.
- The sample is analyzed by method of Standard Additions.
- An applicable (approved) alternate method or wavelength which is not subject to the interference(s) is utilized.

- Various sample/extract clean-up procedures may be employed.
- 

#### **3.3.3.5 Non-method Performance Factors**

The following are examples of non-method performance factors:

- Sample non-homogeneity
- Method applicability questionable due to sample matrix or other factors outside the control of the laboratory.
- Client did not submit samples according to method required or recommended procedure (i.e. field blank/media blank for background or contamination determination, etc.).

#### **3.3.3.6 Data Conclusions**

If upon reanalysis the data meets acceptance criteria and it can be reasonably assumed the original variance or bias in technique or procedure has since been eliminated or corrected, the analysis may continue and results are reported.

If the result continues to fall outside the established control limit range and the laboratory method performance factors for that analyte are shown to be in control, the variance is judged to be matrix related, not system related. The data user is informed that the result for that analyte is suspect due to matrix chemical or physical effects and analysis by an alternate method if possible, should be considered.

Result data is flagged with the appropriate message on the analysis report if the interference could not be satisfactorily eliminated or response was marginal.

If analysis results are rejected or considered of questionable integrity they may not be utilized or plotted on the X bar and R charts.

### **3.3.4 Certification, Accreditation, & Regulatory Agencies**

Con-Test Laboratory holds and maintains certification and accreditation from a number of different state, federal, local, and regulatory agencies encompassing all regulated services.

#### **3.3.4.1 Certifications and Licenses**

Original certificates are displayed in the log-in reception area. Copies are available on the network and in a binder in the QA department.

Con-Test holds certifications/accreditations and licenses with the following agencies:

- AIHA-LAP, LLC Accreditation # 100033
- AIHA-LAP, LLC Environmental Lead Laboratory Accreditation Program (ELLAP) (NLLAP recognized)
- Commonwealth of Massachusetts Chemical Analysis of Potable, Non-Potable, and Microbiological Analysis of Water Certificate of Approval, Lab ID #MA0100
- Connecticut State Approved Public Health Laboratory # PH-0567 – Potable Water, Wastewater, Sewage, and Soil
- ELAP/1° NELAP Accreditation, State of New York Environmental Laboratory Certification Lab ID #10899 – Solid & Hazardous Waste, Air and Emissions, Potable Water, and Non-Potable Water
- New Hampshire (State of), Department of Environmental Services  
Lab ID #2516 - 2° NELAP Accreditation - Drinking Water, Wastewater, Solids, and Air  
Lab ID #2557 - 1° NELAP Accreditation for EPH and VPH and PFAS
- Rhode Island and Providence Plantations, Department of Health, Analytical Laboratory Certification (Certification # LA000112)

- Vermont Lead Regulatory Program, Vermont Department of Health – License # LL015036
- Vermont Department of Health Drinking Water – Lab ID# VT-255716 (PFAS and Lead and Copper)
- New Jersey, Department of Environmental Protection, Lab ID # MA007 - 1° and 2° NELAP Clean Air Program (CAP) – Atmospheric Organics, Atmospheric Inorganics (Non-Metals) and DW PFAS
- North Carolina (State of), Department of the Environmental and Natural Resources Lab ID # 652 – Wastewater and Solids and Hazardous Waste
- North Carolina Department of Health and Human Services, Lab ID #25703 – DW lead and Copper only
- Florida, Department of Health, Lab ID # E871027 - 2° NELAP Accreditation Air and Emissions
- State of Maine Certification Program Lab ID #MA00100 Certificate #2011028 Drinking Water, Wastewater, and Solids
- Commonwealth of Virginia Department of General Services Division of Consolidated Laboratory Services Lab ID #460217 - 2° NELAP Accreditation Certificate #1827 Drinking Water, Wastewater, Solids, and Air

#### **3.3.4.2 Participation in Proficiency Sample Programs**

In the maintenance of certification and accreditation in the applicable areas, Con-Test participates in a wide range of environmental laboratory proficiency programs in which Con-Test's expertise is demonstrated through the analysis of proficiency samples. Proficiency samples are managed, analyzed, and reported in the same manner as real environmental samples. They utilize the same staff and

methods as used for routine analysis of that analyte as well as procedures, equipment, facilities and frequency of analysis. Dilutions are performed following the same protocols as for samples and if multiple analysts analyze the same test method, they will rotate who runs each PT round.

Those proficiencies which are regularly participated in include the following:

- New York State DOH Proficiency Studies (two potable and two non-potable rounds per year)
- DMR QA Studies (performed annually)
- AIHA-LAP, LLC Proficiency Analytical Testing (IHPAT) Program (four rounds per year)
- AIHA-LAP, LLC Environmental Lead Proficiency Analytical Testing (ELPAT) Program (four rounds per year)
- Commercial Vendor ("Environmental Resource Associates" (ERA)) WP, WS, AE, and Soil studies

Selection of Proficiency vendors is based on Vendors accreditation status. They must have ISO/IEC 17025:2017, ISO/IEC 17043:2010, and ISO/IEC Guide 34:2009 or ISO 17034:2016 accreditation. We have evaluated the following PT providers and found they have the above stated criteria; therefore, we have approved the use of them:

- 1) ERA
- 2) Phenova
- 3) Absolute Standards
- 4) NSI
- 5) AIHA-PAT Program
- 6) NYSDOH

An Internal QC program is run for AIHA-LAP, LLC Fields of Testing not covered by the AIHA-LAP, LLC proficiency studies (total/respirable dust, Hg in Air, TO-11, TO-15, and TO-10A). Twice annually, the laboratory shall prepare a minimum of 4 independently prepared blind samples at varying levels, as well as a blank, with the resulting data treated as it would be in a round robin program. These blind samples are made up and spiked by either that department supervisor (technical manager), or by the QA Officer.

Acceptance criteria for results are from the laboratory-generated control limits (which have been established by the

control charting program, and are generated and reviewed annually).

The QA Officer and Technical Director carefully review results of Proficiency tests when available. Any unacceptable result will immediately initiate a corrective action, and a "root cause" investigation will begin. The original runs and paperwork are reviewed with the analyst to determine possible root causes. Corrective actions, including additional maintenance of equipment, quality control sample analysis, or modifications to

SOPs are implemented when necessary. A make-up proficiency sample is ordered and analyzed and licensing authorities are notified in a report, if appropriate, of corrective actions.

Additional details on Proficiency Testing can be found in SOP PT Samples Document #305.

#### **3.3.4.3 Use of External Laboratories**

When samples are received for an analysis which is not performed by the laboratory, a qualified outside laboratory is found to perform the analysis. Only outside laboratories that have demonstrated proficiency in the analysis requested are selected. Laboratories are deemed proficient if they are:

- 1) Accredited by AIHA-LAP, LLC
- 2) Certified by a state or recognized "Quality" agency
- 3) Accredited under NELAP for any part of the testing covered under NELAP.

The laboratory shall advise the client in writing of its intention to subcontract any portion of the testing to another party and the written approval from the client will be retained. The laboratory shall retain records demonstrating that these two requirements have been met.

Only laboratories following approved and standard methods will be used for outside work. When work is placed with a NELAP laboratory, the final report cover sheet will indicate the laboratory's NELAP id.

For AIHA-LAP, LLC and NELAP analyses, written pre-approval from the client is required. This may include "blanket" approval for any current or future projects.

Con-Test Analytical Laboratory is responsible to the client for subcontractors' work, except in the case where the client or a regulatory authority specifies which subcontractor is to be used.

Communication to the subcontracting laboratory of any special report requirements, like immediately notifying Con-Test of MCL drinking water exceedances is facilitated by the Chain of Custody. The following is stamped on all subcontracting chain of custodies: "Subcontracted lab must notify Con-Test Analytical Lab of any MCL exceedance within 24 hours of obtaining valid data".

Con-Test Analytical Laboratory requires each of our subcontracting laboratories to provide current copies of all the certificates they hold for each state they are certified in. In addition, Con-Test Analytical reserves the right to audit any subcontracting laboratory that we send large volumes of business. A qualified representative from Con-Test Analytical will perform this on-site inspection.

Additional information on subcontracting samples can be found in Con-Test SOP Subcontracting, document #239.

#### **3.3.4.4 Non-Routine Industrial Hygiene Samples**

New analytical procedures for the laboratory and or non-routine samples require special attention. Validation of method by a three-step process is required. This includes the determination of single-operator precision and bias, analysis of independently prepared unknown samples, and determination of method ruggedness.

Method development includes determination of recovery and stability of analyte on the medium, precision and accuracy of analytical measurement. Clients are informed of the non-routine, non-regulatory nature of these special tests. Incompletely developed, qualitative tests are reported as "estimated" or "semi-quantitative" with appropriate notes or qualifiers.

## 4.0 Internal Quality Control Checks and Frequency

Con-Test employs a wide range of quality control checks adapted to specific situations and methodology in the assessment of data quality thus ensuring production of data of known precision and bias. Record generation for quality control begins when the samples arrive in the laboratory, continues through analysis and evaluation and ends with the plotting of quality control results on X bar and R charts. Each project is unique and therefore in each work plan, the numbers and types of blanks, references, duplicates, and spiked samples (etc.) will vary. Minimum frequencies are specified below.

Due to the inherent variability and substantial number of distinct methodologies and applicable Quality Control measures only a generalization of QC measures and frequency by major department is offered below.

### 4.1 Blanks

For all analytical determinations, blank analyses are performed as a routine procedure when samples are analyzed. Blank determinations are analysis specific and are subjected to the same preparation methodology as regular samples. Blank analysis determines when background peaks or materials are sufficiently low (or absent) to permit the analysis of samples to proceed.

If satisfactory blanks are not obtained in these steps, additional steps are taken to determine cause and to eliminate the source of contamination.

At Con-Test one or more of the following types of blanks is analyzed individually or multiply throughout an analysis run.

#### 4.1.1 Reagent Blanks

A reagent blank consists of laboratory pure water and any reagents added to the sample during analysis or straight solvent.

Reagent blanks are run for use in monitoring baseline correction and are inserted at regular intervals during large batches of samples to check for carryover contamination and/or instrument baseline drift.

#### 4.1.2 Method Blanks

A method blank must be carried through the complete sample preparation and analytical procedure. The method blank is used to document contamination or background resulting from the analytical process.

At least one method blank is analyzed for each applicable analysis batch. One method blank is analyzed per batch of twenty samples or less. Results from

method blanks are not subtracted from corresponding sample results but are reported along with samples for evaluation by the data user.

#### **4.1.3 Trip Blanks**

Trip blanks are analyzed for determination of contamination attributable to shipping and handling procedures. This type of blank is especially useful in documenting contamination of volatile organics samples. Trip blanks are analyzed when applicable.

#### **4.1.4 Holding Blanks**

Holding blanks are kept in the volatile organics refrigerator and analyzed periodically to determine contamination from sources also being held for analysis in the refrigerator. Holding blanks are analyzed every two weeks or when contamination is suspected.

### **4.2 Calibration**

- 4.2.1** The laboratory shall establish and maintain metrological traceability of its measurement results by means of a documented unbroken chain of calibrations, each contributing to the measurement uncertainty, linking them to an appropriate reference.
- 4.2.2** The laboratory shall ensure that measurement results are traceable to the International System of Units (SI) through:
  - a) Calibration provided by a competent laboratory; or
  - b) Certified values of certified reference materials provided by a competent producer with stated metrological traceability to the SI; or
  - c) Direct realization of the SI units ensured by comparison, directly or indirectly, with national or international standards.
- 4.2.3** When metrological traceability to the SI units is not technically possible, the laboratory shall demonstrate metrological traceability to an appropriate reference, e.g.:
  - a) Certified values of certified reference materials provided by a competent producer;
  - b) Results of reference measurement procedures, specified methods, or consensus standards that are clearly described and accepted as providing measurement results fit for their intended use and ensures by suitable comparison.
- 4.2.4** Verification and/or validation of equipment, such as balances, thermometers, and spectrophotometers, shall be performed with National Institute of Standards and Technology (NIST) traceable standards. Calibration certificates must indicate NIST Traceability along with the measurement results and the associated uncertainty and/or a statement of compliance with an identified metrological specification, such as tolerance. External services used for

calibration of weights, NIST thermometers and Eppendorf's must be accredited to ISO/IEC 17025:2017 by a recognized accreditation body. Reference standards, such as Class S weights and NIST traceable thermometers, are used for calibration only and shall be calibrated by an organization that can provide traceability to NIST and be accredited to ISO/IEC 17025:2017 by a recognized accreditation body. NIST Digital thermometer is sent out annually for calibration. Long stem NIST traceable thermometers are purchased annually. Reference weights and reference thermometers are re-calibrated every year. Analytical balances must be checked each day of use with a minimum of two ASTM Class 1 weights, in ranges appropriate to the laboratory's weighing needs. Measurements produced in the laboratory are based upon comparison to analyzed standards. The reference standard results are utilized to generate calibration curves, which are then used in the quantification of sample results. Eppendorf pipettes are calibrated annually by an outside vendor, and on a weekly basis they are verified by the analyst to ensure that they remain within specifications. Laboratory staff performing in-house calibrations and verifications shall have received documented training.

Refer to manufacturer's instructions for procedures on how to transport and store measuring equipment and reference standards.

#### **4.2.4 Instrument Calibration**

All instruments are calibrated using standard solutions of known concentrations. The standards are either purchased Certified Reference Materials (CRM's) that are traceable to NIST, ISO/IEC 17025 and ISO Guide 34/ISO Guide 17034, when they are available, or carefully prepared by the laboratory. Major analytical equipment calibrated with standard materials includes: gas chromatographs, GC/MS, IC, HPLC, ICP, ICP/MS, Lachat Auto Ion-Analyzer, UV-VIS spectrophotometer, and analytical balances.

##### **4.2.4.1 Initial Calibration**

Initial calibration of any analytical instrument is instrument, as well as methodology, dependent. Calibration normally consists of use of several levels of a reference standard and a blank.

Generally, instrument standard calibration (and therefore sample quantification) in the Organics department is based on calibration curves comprised of 3-5 standards of known concentration; for the Metals department, 2-5 standards; and for Wet Chemistry, 3-5 standards. All the above are excluding the calibration blank, if required. The minimum number of standards used is often dictated by the SOP or method.

Sufficient raw data are retained to reconstruct the calibration used to calculate the sample result. Calibration standards include a concentration at or below the regulatory/decision level but above the laboratory's detection limit. Reporting limits are not less than the lowest calibration standard.

For AIHA-LAP, LLC samples a RL verification is analyzed with each batch of samples. This is a standard spiked at the reporting limit. Annually a matrix matched reporting limit (RL) verification needs to be analyzed.

Results of samples must be within the calibration range (bracketed by standards) or the results must be flagged as having less certainty, unless reported to the MDL and qualified with a "J" flag at the request of the client. Results over calibration for will not be reported unless requested by the client.

Note: Due to CT RCP requirements to report two dilutions, clients requesting to follow CT RCP protocols will be requesting to report data over the calibration with "E" qualifiers if applicable.

If calibration parameters are outside of method specified performance criteria, data will be flagged as estimated or not reported until a valid calibration is obtained.

#### **4.2.5 Calibration Validation through use of Laboratory Control Samples (LCS's) and/or Reference Materials**

All calibrations must be verified by a second source of material which is independent from the calibration standards. They consist of either a laboratory control matrix spiked with analytes representative of the target analytes (LCS) or certified material (Reference) or ICV standard.

All calibrations must be validated by this second source material prior to sample analysis. Reference materials are traceable to NIST, ISO/IEC 17025 and ISO Guide 34/ISO Guide 17034, when available.

#### **4.2.6 Calibration Check Samples**

Calibration Check Standards are utilized to determine the stability of calibration of an instrument between periodic re-calibrations, or for assessment of linearity agreement between subsequent calibration standards and corresponding curves.

The Organics department analyzes one or more check standards consisting of all required compounds when validating use of a previously calculated calibration curve. With longer analysis runs throughout the laboratory these samples are run periodically to verify continuous instruments calibration stability and ensure consistent performance of the method.

Where traceability to the SI is not technically possible or reasonable, the laboratory shall use certified reference materials provided by a competent supplier (refer to ISO/IEC 17025 4.6.4), or use specified methods and/or consensus standards that are clearly described and agreed to by all parties concerned. A competent supplier is an NMI or an accredited reference material producer (RMP) that conforms with ISO guide 34/ISO Guide 17034 in combination with ISO/IEC 17025, or ILAC Guidelines for the Competence of Reference Material Producers, ILAC G12. Conformance is demonstrated through accreditation by an ILAC recognized signatory.

#### **4.3 Laboratory Instruments/Equipment, Maintenance Logs, and Reference Standards and Materials**

- 4.3.1** The laboratory shall have access to equipment (including, but not limited to, measuring instruments, software, measurement standards, reference materials, reference data, reagents, consumables, or auxiliary apparatus) that is required for the correct performance of laboratory activities and that can influence the results.
- 4.3.2** When the laboratory uses equipment outside its permanent control, it shall ensure that the requirements for equipment of the ISO17025:2017 standard are met.
- 4.3.3** The laboratory has procedures for handling, transport, storage, use and planned maintenance of equipment in order to ensure proper functioning and to prevent contamination or deterioration.
- 4.3.4** The laboratory shall verify that equipment conforms to specified requirements before being placed or returned to service.
- 4.3.5** The equipment used for measurement shall be capable of achieving the measurement accuracy and/or measurement uncertainty required to provide a valid result.
- 4.3.6** Measuring equipment shall be calibrated when:
  - 4.3.6.1** The measurement accuracy or measurement uncertainty affects the validity of the reported results, and/or
  - 4.3.6.2** Calibration of the equipment is required to establish the metrological traceability of the reported results.

Note: Types of equipment having an effect on the validity of the reported results can include:

  - those used for the direct measurement of the measurand, e.g. use of a balance to perform a mass measurement;
  - those used to make corrections to the measured value, e.g. temperature measurements;

-those used to obtain a measurement result calculated from multiple quantities.

- 4.3.7** The laboratory shall establish a calibration program, which shall be reviewed and adjusted as necessary in order to maintain confidence in the status of calibration.
- 4.3.8** All equipment requiring calibration or which has a defined period of validity shall be labelled, coded or otherwise identified to allow the user of the equipment to readily identify the status of calibration or period of validity.
- 4.3.9** Equipment that has been subjected to overloading or mishandling, gives questionable results, or has been shown to be defective or outside specified requirements, shall be taken out of service. It shall be isolated to prevent its use or clearly labelled or marked as being out of service until it has been verified to perform correctly. The laboratory shall examine the effect of the defect or deviation from specified requirements and shall initiate the management of nonconforming work procedure. (See section 3.2.2.6).
- 4.3.10** When intermediate checks are necessary to maintain confidence in the performance of the equipment, these checks shall be carried out according to a procedure.
- 4.3.11** When calibration and reference material data include reference values or correction factors, the laboratory shall ensure the reference values and correction factors are updated and implemented, as appropriate, to meet specified requirements.
- 4.3.12** The laboratory shall take practicable measures to prevent unintended adjustments of equipment from invalidating results.
- 4.3.13** Records shall be retained for equipment which can influence laboratory activities. The records shall include the following, where applicable:
  - 4.3.13.1** the identity of equipment, including software and firmware version;
  - 4.3.13.2** the manufacturer's name, type identification, and serial number or other unique identification;
  - 4.3.13.3** evidence of verification that equipment conforms with specified requirements;
  - 4.3.13.4** the current location
  - 4.3.13.5** calibration dates, results of calibrations, adjustments, acceptance criteria, and the due date of the next calibration or the calibration interval;
  - 4.3.13.6** documentation of reference materials, results, acceptance criteria, relevant dates and the period of validity;
  - 4.3.13.7** the maintenance plan and maintenance carried out to date, where relevant to the performance of the equipment;
  - 4.3.13.8** details of any damage, malfunction, modification to, or repair of, the equipment.
- 4.3.14** The laboratory shall be furnished with all items of equipment (including reference standards and materials) required for the correct performance of tests for which accreditation is sought. In those cases, where the laboratory

needs to use equipment outside its permanent control it shall ensure that the relevant requirements of this standard are met.

- 4.3.15** Equipment, Reference Materials, and Reference Standards are transported, stored, maintained, inspected, and cleaned according to the manufacturer's instructions. Any defective item of equipment is clearly marked and taken out of service until it has been shown to perform satisfactorily.
- 4.3.16** Each item of equipment, reference standard, or reference material is labeled to show its calibration status. As a mechanism for tracking instrument performance, logbooks are provided for each instrument (GC, GC/MS, LC/MS/MS, ICP, ICP/MS, HPLC, IC, Thermo Discrete Gallery, UV/VIS Spectrophotometers, microscopes, balances, TOC analyzer, and incubators). Equipment, reference materials, and reference standard records include:
- 1) Name of item of equipment or reference model
  - 2) Manufacturer, identification, model number, serial number
  - 3) Date of installation and dates of service
  - 4) Current location
  - 5) Condition when received
  - 6) Copy of manufacturer's instructions or manuals
  - 7) Dates and results of calibrations/verifications and date of next calibration/verification
  - 8) Details of maintenance carried out to date, and planned for the future
  - 9) History of any damage, malfunction, modification, or repair
- 4.3.17** The laboratory supervisors are responsible for this data and periodically examine all these books. Any significant change in a critical parameter triggers further examination and possible instrument service.

These books along with preventative maintenance act as an operational tool for minimizing instrument down time, and maintaining them in optimum condition.

- 4.3.18** Support equipment is calibrated/ verified annually using NIST traceable references over the range of use. Balances, ovens, refrigerators, freezers, incubators, and water baths are checked with NIST traceable references and recorded. The accuracy of all thermometers, are verified annually by comparison with a certified NIST traceable thermometer, applying any correction factors stated on the NIST Traceable thermometer certificate of calibration. IR temperature guns and dial thermometers must be calibrated quarterly. All thermometers are compared at the temperature of their use during the verification. Additional monitoring as prescribed by the test method SOP is recorded. Eppendorf pipettes are calibrated on an annual basis by an outside vendor, and verified weekly by the analyst to ensure that it remains in specifications. External services used for calibration of weights, certified thermometers and Eppendorf's must be accredited to ISO/IEC 17025:2017 by a recognized accreditation body.

**4.3.19** The sterilization temperature and cycle times of each autoclave run for biological tests are recorded by use of appropriate chemical or biological sterilization indicators. A maximum-temperature registering thermometer is used with each autoclave run, to ensure that the sterilization temperature of each cycle is reached. Spore suspensions are used weekly to verify the autoclave operation. The autoclave timer is checked quarterly by a stopwatch and recorded. Autoclave tape is only used as an indicator that each batch has been exposed to the sterilization process.

**4.3.20** Refrigerator and freezer temperatures are recorded twice daily, with acceptance criteria of  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$  for refrigerators and less than  $0^{\circ}\text{C}$  for freezers. Incubator temperatures are recorded twice daily (with readings separated by at least 4 hours), with acceptance ranges of  $35.0^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$  (for total coliform and HPC),  $44.5^{\circ}\text{C} \pm 0.2^{\circ}\text{C}$  (for fecal coliform),  $41^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$  (for Enterococci) and  $20.0^{\circ}\text{C} \pm 1^{\circ}\text{C}$  (for BOD).

**4.3.21 Equipment List**

The following is a list of commonly utilized major analytical equipment. Please note this is not a complete listing.

<u>Equipment</u>	<u>Number</u>	<u>Make and Model</u>
Gas Chromatographs	17	Agilent/Hewlett Packard – 5890/6890/7890 2-PID-FID 3-FID-FID 10-ECD-ECD 2-TCD-FID
GC/MS	18	Agilent/Hewlett Packard – MSD 5970/5972/5973/5975 7-Purge and Trap – EST 6-Direct Inject 5-Air Entech Auto samplers
LC/MS/MS	1	Agilent 6400 Series Triple Quadrupole LC/MS system
Concentration Workstations	9	3-N EVAP 6-Buchi Syncore Turbovaps

TCLP Extractors	4	80 station capacity
Sonic dismembrator	1	Fisher Model 500
Microwave Extractor/Digester	2	MARS Xpress
<u>Equipment</u>	<u>Number</u>	<u>Make and Model</u>
Mercury Analyzer System	1	Perkin Elmer FIMS 100
Ion Chromatograph	1	Dionex ICS 2000
ICP	3	Perkin Elmer – Optima 4300 Dual View Simultaneous
ICP-MS	2	Perkin Elmer ELAN 9000 Agilent7800/7900 ICP-MS
UHPLC	1	Dionex Ultimate 3000
Digestion Block	2	SPC Science Digi-Prep MS
Automated Analyzer	1	Lachat Quikchem 8000 FIA+
Spectrophotometer	2	ThermoSpectronic Genesys 20
	1	ThermoSpectronic Genesys 30
	1	ThermoSpectronic 10S UV-/Vis
Discrete Gallery	1	ThermoFisher Scientific
Kjeldahl Apparatus	1	FOSS Tecator Digester
NH3/TKN Distillation Unit	1	FOSS Kjeltec8100 Distillation Unit
Flashpoint Apparatus	2	1-PetroTest PM4, closed cup 1-Koehler closed cup
Microscopes	3	Olympus (BH2)
pH/ Ion Meter	4	1-Thermo Orion-Versa Star pro 1-Orion EA 920 1-ThermoElectron Orion 420A+ 1-Accumet AB15
Conductivity Meter	1	YSI Model 35

TOC analyzer	1	Teledyne Lotix TOC Combustion Unit
BOD auto analyzer	1	Skalar Model 21088903-01 BOD analyzer
Turbidimeter	2	1-VWR Model 46210-200 1-Intertek WTW Turb 550
Beckman Centrifuge	1	Beckman Model J6-HC
ENCON Evaporator System	1	Model DE4-B
Soxhlet Extractors	225	Soxhlet glassware and heating mantles
Analytical Balances	17	

#### 4.3.22 Annual Preventative Maintenance

In order to maintain instruments in optimum working condition, minimize instrument down time and delayed results, Con-Test maintains service contracts with regularly scheduled preventative maintenance guidelines. Service contracts and preventative maintenance schedules are standard for sophisticated and vital equipment such as GC's, GC/MS, HPLC, IC, ICP, ICP-MS, UV-VIS Spectrophotometer, Thermo Discrete Gallery, and the TOC analyzer. In the event of unavoidable down time Con-Test has alternate methods of analysis for most analytes.

Common routine maintenance activities should be performed according to the following schedule.

<u>Instrument</u>	<u>Method</u>	<u>Activity</u>	<u>Frequency</u>
GC/MS VOA-Purge and Trap	624 8260	Check Gas	Daily
		System Bake	Daily
		Replace Septa	As Needed
		Clean/Replace Liner	As Needed
		Change Column	As Needed
		Change Ferrules	As Needed
		Replace Trap	As Needed
		Change Vacuum Pump Oil	Twice Per Year
GC/MS Semi-VOA	625 8270	Check Gas	Daily
		System Bake	Daily
		Replace Septa	Daily

		Replace Glass Wool	Daily
		Clean/Replace Liner	As Needed
		Change Column	As Needed
		Change Ferrules	As Needed
		Change Vacuum Pump Oil	Twice Per Year
GC	608, 8081, 8082 602, 8015, 8100	Check Gas	Daily
		Replace Septa	Daily
		Replace Glass Wool	As Needed
		Clean/Replace Liner	As Needed
		Change Column	As Needed
		Change Ferrules	As Needed
Eppendorf Pipettes		Calibration/Verification	Annual by vendor Weekly by Analyst
<u>Instrument</u>	<u>Method</u>	<u>Activity</u>	<u>Frequency</u>
Infrared Thermometer Gun		Calibration/Verification	Quarterly
ICP	6010 200.7	Check/Change Pump Tubing	Daily
		Change Capillary Tubing	As Needed
		Clean Nebulizer	Monthly/ As Needed
		Clean Spray Change	Monthly/ As Needed
		Clean Torch	As Needed
ICP-MS	6020 200.8	Check/Change Pump Tubing	Daily
		Change Torch	As Needed
		Change Injector	As Needed
		Clean Gem Cone Tips	As Needed
		Clean Scott Spray Chamber	As Needed
Mercury Cold Vapor	7470 7471 245.2 NIOSH 6009	Clean Cell	Monthly
		Clean Windows	Monthly
		Change Tubing	As Needed
Thermo Discrete Gallery Nitrate and Nitrite	Easy System (1-Reagent) Rinse/Flush System		Daily
pH/Ion Meter & Electrodes	SM 4500 H-B SW-846 9040	Rinse/Clean Electrodes	Daily

Conductivity Meter & Bridge	SM 2510B	Rinse/Clean Bridge	Daily
		Replatinize Bridge	As Needed
		Calibration	Annual
UV Lamp (Microbiology)	SM 9223	Clean with Ethanol with cloth	As Needed

#### 4.4 Surrogate Additions

Surrogates are organic compounds added to a sample, which are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which are not formally found in environmental samples.

Surrogate additions are regularly utilized in the organics section of the laboratory. Organic compounds are added to a sample just before processing so that the overall efficiency of a method can be determined. Surrogate spikes and their recovery are used to create control charts for the organics section. If the surrogate recovery is outside of the control limits, the data is considered questionable and the sample is re-analyzed to confirm possible matrix interference, spiking procedure problems, or reported as estimated data.

#### 4.5 Duplicate Analysis

Laboratory duplicates (smallest number of replicates) are two sample aliquots split in the laboratory from the same container and analyzed independently under identical conditions. From the analysis of duplicates a measure of precision or repeatability associated with the laboratory procedure can be obtained. The comparison of results for duplicate samples to what has been previously achieved provides assurance that the methodology is performing within establishing limits of precision. A large number of data points are usually needed to calculate control limits representative of analyzed data.

It is standard practice in the Wet Chemistry and Metals laboratories to prepare and analyze one duplicate for each 10-20 samples or one per batch analyzed. Samples selected for duplicate analysis are at random on this basis. The number of duplicate samples performed may be more frequent if dictated by the method, SOP, or statement of work.

#### 4.6 Sample Matrix Spikes (MS)

A matrix spike is an aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A sample matrix spike is usually utilized to provide a means of assessing accuracy for the method used on a specific sample matrix. The recovery of the spiked analyte is expressed as a percent of

the amount of target analyte added to the sample. The purpose of this procedure is to evaluate the consistent deviation of measured values from the true value as a result of systematic errors and to determine if sample matrix composition has any effect on analyte recovery. This procedure facilitates the identification of possible method interfering substances (matrix bias) which may be present in the spiked sample so that appropriate action can be taken. This enables the laboratory to ensure methodology is performing with established limits of accuracy.

It is standard practice in the laboratory to prepare and analyze one matrix spike for each 10-20 samples or one per batch analyzed. The number of spiked samples performed can be more frequent if dictated by the method, SOP, or statement of work.

#### **4.7 Sample Matrix Spike Duplicates (MSD)**

Matrix spike duplicates, as defined in SW-846: "Intra-laboratory split samples spiked with identical concentrations of target analyte, which undergo the same processes". Matrix spikes and matrix spike duplicates are routinely analyzed periodically in the accumulation of precision and accuracy data or when conditions exist where matrix applicability is questionable or matrix interferences are suspected.

#### **4.8 Laboratory Fortified Blanks (LFB) and LFB Duplicates**

It is standard practice in the laboratory to prepare and analyze one duplicate for each 10-20 samples or one per analytical batch. LFB's reflect achieved accuracy under ideal conditions for a methodology and analysis procedure but do not provide an indication of system or method accuracy with respect to bias associated with a given sample matrix. Laboratory Fortified Blanks may be also known as Blank Spikes (BS) or Laboratory Control Samples (LCS).

#### **4.9 Method Detection Limits (MDL)**

The MDL has been determined by the laboratory and documented for each analyte where spiking solutions are available.

Revised MDL procedure from 2016 MUR Revision 2 for all drinking water and wastewater certified analyses, including Lead:

- 1) The MDL procedure now uses method blanks to calculate an MDL, in addition to the spiked samples that have always been used to calculate the MDL. The new Definition is "The method detection limit (MDL) is defined as the minimum measured concentration of a substance that can be reported with 99% confidence that the measured concentration is distinguishable from method blank results" The value calculated from the spike samples is called the MDL<sub>s</sub>. The MDL<sub>s</sub> calculation is the same as the MDL calculation in Revision 1.11. The method blank samples are

used to calculate the  $MDL_b$ , which is a very similar calculation that also calculates 99% confidence level that the result is derived from the sample rather from contamination/noise. The MDL is the higher of the two values (either the  $MDL_s$  calculated using spiked samples or the  $MDL_b$ , calculated using method blanks). EPA considers this change important because as detector sensitivity improves, the background contamination of the laboratory, consumable supplies, and equipment can be more important in determining the detection limit than the sensitivity of the instrument.

- 2) The MDL now requires that the samples used to calculate the MDL are representative of laboratory performance throughout the year, rather than on a single day. (Con-Test has always performed over at least three days).
- 3) A laboratory has the option to pool data from multiple instruments to calculate one MDL that represents multiple instruments.
- 4) Additionally, a streamlined approach to determine whether a new instrument can be added to a group of instruments with an already established MDL, and Laboratory have the option to use only the last six months of method blank data or the fifty most recent method blanks, whichever yields the greatest number of method blanks to calculate the MDL value derived from method blanks ( $MDL_b$ )
- 5) After initial MDL is established, every year thereafter quarterly 2 RL/LOQ samples are performed. At the end of the year the 8 points are tabulated in an MDL-S, and compared to current MDL.

Other details:

- 1) Spike MDL at 2-10 times the estimated MDL
- 2) Run spiked replicates in at least 3 separate preparation and analysis batches.
- 3) Multiple instruments – At least 2 spike replicates on each instrument
- 4) If blanks give ND,  $MDL_b$  does not apply
- 5) Addendum for MDL determined on a specific matrix
- 6) No 10X rule
- 7) Use all method blanks unless batch was rejected

For wipe samples, the MDL shall be determined using wipe materials meeting ASTM E1792, "Standard Specification for Wipe Sampling Materials for Lead in Surface Dust", or with wipe materials meeting specifications issued by EPA (reference EPA publication, "Interpretive Guidance for the Federal Program TSCA Sections 402/403", March 14, 2002 and/or subsequent EPA published guidance). The spiked media is at an estimated concentration between the actual MDL and 10X the actual MDL. The MDL is the product of 3.14 times the calculated standard deviation for 7 replicates. Under ideal conditions, the MDL should be about one-fifth the practical and routinely achievable detection level that can be reported with relatively good certainty that any reported value is reliable.

All data points produced in an MDL study must be used in the calculation, unless: 1) a point is a statistical outlier (outside 99% confidence limits), 2) a point (or a whole run, if a multiple point run, as with organics or metals analyses) is eliminated if suspect (e.g. incomplete analysis due to a leak or spill). Reasons for elimination must be documented.

MDL studies are run annually for all drinking water methods and all lead analyses. The wet chemistry department and the metals departments run MDL studies annually. The organics department, if it is not a drinking water method, will run a one-time MDL study and repeat if conditions change, receive new instrumentation or new methodology occurs.

#### **4.9.1 Reporting Limit (RL) Verification**

Reporting limits will not be less than the lowest calibration standard. For AIHA-LAP, LLC minimum reporting limits shall be established initially by analyzing media spiked samples, prepared at the desired minimum reporting limit concentration, and taken through the entire analytical process, including applicable steps of extraction, digestion, or distillation procedures. Individual methods will dictate limits of acceptability for the Reporting Limit (RL) verification. If a particular method does not prescribe RL/LOQ verification limits, then +/- 50% of the true value will be used for the acceptance limit, except for the metals department who go by +/- 10% for Lead. This procedure will be performed Quarterly.

For AIHA-LAP, LLC daily reporting limit verifications will be analyzed that is a standard spiked at the reporting limit. This has the same criteria as the Quarterly LOQ/RL verification.

#### **4.10 Procurement**

The objective of the procurement policy is to ensure purity & quality of reagents & consumables used in all laboratory procedures.

Department Supervisors are responsible for testing and reviewing consumables and reagents before analytical use & purchase. If all method standards are met, a purchase order is submitted to the administrative supervisor for purchase. The administrative supervisor maintains a list of preferred, approved vendors.

Any commercially prepared standards shall be accompanied by a certificate of analysis. Certificates are kept on file in the appropriate departments. Any commercial prepared standards should be accompanied by a certificate of analysis. Certificates are kept on file in appropriate departments. The QA office maintains a master binder of Vendor Certifications. Any hazardous materials should be accompanied with a material safety data sheet (MSDS) and stored in the appropriate department storage area. New consumable lot numbers and/or vendors are tested by analysts prior to analytical use and purchase.

The vendors that are selected to use are for various reasons, including some of the following reasons:

- 1- Pricing (Some offer Discounts)
- 2- Availability of Product

- 3- Good History
- 4-Has the proper certifications

For additional information, see Con-Test SOP on Evaluation of Vendors for Supplies, Document #231

#### **4.11 Chemical Control Program**

- 4.11.1** The laboratory shall ensure that only suitable externally provided products and services that affect laboratory activities are used, when such products and services:
  - a) are intended for incorporation into the laboratory's own activities;
  - b) are provided, in part or in full, directly to the customer by the laboratory, as received from the external provider;
  - c) are used to support the operation of the laboratory.
- 4.11.2** the laboratory shall have a procedure and retain records for:
  - a) defining, reviewing and approving the laboratory's requirements for externally provided products and services;
  - b) defining the criteria for evaluation, selection, monitoring of performance and re-evaluation of the external providers;
  - c) ensuring that externally provided products and services conform to the laboratory's established requirements, or when applicable, to the relevant requirements of this document, before they are used or directly provided to the customer;
  - d) taking any actions arising from evaluations, monitoring of performance and re-evaluations of the external providers.
- 4.11.3** the laboratory shall communicate its requirements to external providers for:
  - a) the products and services to be provided;
  - b) the acceptance criteria;
  - c) competence, including any required qualification of personnel;
  - d) activities that the laboratory, or its customer, intends to perform at the external provider's premises.
- 4.11.4** All Reagents, Chemicals, and Standards are received in the Inventory Storage Department. An employee of that department checks the packing slip (if provided) against the material in the package. Any discrepancy is reported to the Inventory Supervisor.
- 4.11.5** When a material is accepted, the packing slip gets stamped and noted with the employee receiving the delivery along with the date, employee who checked delivery with date, the Element Order number (If applicable), date material is entered into Element Inventory (consumables) System, and the Element ID (if applicable).

- 4.11.6** Most standards are received and delivered directly to the appropriate department. All other chemicals/reagents are given Element ID's and labeled with that ID. They are then stored in the Inventory Storage Area. Element maintains each materials' chemical name, description, receipt date, expiration date, lot number, manufacturer, and volume received.
- 4.11.7** Traceability of standards and standard materials are also documented. Tracking of standards (stock, intermediate or working) is accomplished by the use of a Standard Log or Element. Certificates of analysis for purchased standards and information on laboratory manufactured standards are also kept in either the Standard Log or Element.
- 4.11.8** The laboratory maintains reagent grade type, deionized water, using a Nano-pure water system. This water is available for use in reagents and standards as well as in analysis determinations.
- 4.11.9** Additional information of Chemical and reagent receipt can be found in SOP Chemical receipt, Document #114. Additional information on using approved vendors can be found in SOP for Evaluation of Vendors for Supplies, Document #231.
- 4.11.10** The quality of the reagent water is tested routinely. It must meet the following criteria for microbiology testing (as defined in Table 9020I of SM 9000):  
**NOTE: If all media is purchased the following tests do not need to be conducted as the reagent water is not utilized.**

TEST	MONITORING FREQUENCY	LIMIT
Chemical Tests:		
Conductivity	Continuously, or with each use	>0.5 mega ohms resistance, or <2 umhos/cm at 25°C
pH	With each use	5.5 - 7.5
Total Organic Carbon	Monthly	<1.0 mg/L
Heavy Metals, single (Cd, Cr, Cu, Ni, Pb, and Zn)	Annually (or more frequently if a problem arises)	<0.05 mg/L
Heavy Metals, totals	Annually (or more frequently if a problem arises)	≤ 0.1 mg/L
Ammonia/Organic Nitrogen	Monthly	< 0.1 mg/L
Total Residual Chlorine	Monthly, or with each use	<DL
Bacteriological Tests:		
Heterotrophic Plate Count (SM 9215)	Monthly	<500 CFU/mL (Per 310 CMR 42.08(5)(c)(12d)

**4.11.11** Microbiology Media must have both positive and negative cultures analyzed for each new lot number, to determine performance compared to a previously acceptable lot. "Quanti-Cult" kits (Idexx/Remel) are used, and contain the following organisms:

Escherichia coli	(T. coliform + and E. coli +)
Klebsiella pneumonia	(T. coliform + and E. coli -)
Pseudomonas aeruginosa	(T. coliform – and E. coli -)

**4.11.12** Industrial Hygiene sampling media lots (filters, wipes, tubes) need to be tested prior to analysis, to ensure there is no contamination. Results of such testing must be maintained in each department.

Industrial Hygiene sampling media are supplied to the client, who is responsible for collecting samples.

#### **4.12 Laboratory Environment**

**4.12.1** The facilities and environmental conditions shall be suitable for the laboratory activities and shall not adversely affect the validity of results.

Note: Influences that can adversely affect the validity of results can include, but are not limited to, microbial contamination, dust, electromagnetic disturbances, radiation, humidity, electrical supply, temperature, sound and vibration.

**4.12.2** The requirements for facilities and environmental conditions necessary for the performance of the laboratory activities shall be documented.

**4.12.3** The laboratory shall monitor, control and record environmental conditions in accordance with relevant specifications, methods or procedures or where they influence the validity of the results.

**4.12.4** Measures to control facilities shall be implemented, monitored and periodically reviewed and shall include, but not be limited to:

**4.12.4.1** Access to and use of areas affecting laboratory activities

**4.12.4.2** Prevention of contamination, interference or adverse influences on laboratory activities

**4.12.4.3** Effective separation between areas with incompatible laboratory activities.

**4.12.5** When the laboratory performs laboratory activities at sites or facilities outside its permanent control, it shall ensure that the requirements related to facilities and environmental conditions of this documents are met.

**4.12.6** Calibration and testing occur only within the laboratory, designed, built and maintained as laboratory space. All spaces are temperature controlled.

Electronic balances are located away from drafts and doorways and mounted on marble slabs in areas where their use would be affected by vibrations. Biological work areas are sterilized between uses. Neighboring test areas of incompatible activities are effectively separated. Specific work areas are defined and access is controlled. (Only authorized laboratory personnel and escorted visitors may enter the work area). Housekeeping is a major concern for the laboratory. Each employee is required to act in a manner that promotes neatness and cleanliness in following Good Laboratory Practices. All work areas are to be free of clutter and possible contaminants. The importance of maintaining clean work areas cannot be overemphasized. Smoking is prohibited on Con-Test property. Work areas include entries to the laboratory, sample receipt, sample storage, laboratory analysis, chemical and waste storage, and data handling and storage.

All equipment, reference standards, and reference materials required for the accredited tests are available in the laboratory. Records are maintained for all equipment, reference standards, and reference measurement materials, and services used by the laboratory. Reference materials traceable to national standards of measurement or to national standard reference materials are stored away from heavy use areas or major equipment that may affect the proper operation of the materials. Refer to manufacturer's instructions for the procedures for safe handling, transport, storage, use and planned maintenance of measuring equipment, reference materials, and reference standards to ensure proper functioning and in order to prevent contamination or deterioration. Certificates of Traceability are available for the reference thermometer and the Class S weights. The reference materials and standards are used only for calibration to maintain the validity of performance.

#### **4.13 Control of Contamination**

**Lead Wipe Sampling:** Housekeeping shall be adequate to prevent contamination of samples (Dust, paint, etc.). Work areas have non-porous coatings to eliminate the possibility of prolonged counter contamination. In order to determine surface levels of lead in the Metals laboratory and therefore avoid possible contamination of samples, wipe sampling is performed on a regular basis. If any sample displays contamination (defined as a detected result at the reporting limit), clean area, re-sample, and re-test the contaminated site. Refer to SOP Internal Wipe Sampling, Document Number 32.

#### **4.14 Total Quality Management (TQM)**

Quality and turnaround ultimately determine the satisfaction of customers. Con-Test is not merely striving to meet client expectations but to constantly exceed them. Total Quality Management is an effective strategy for success by involving the entire resources of the organization. By tracking quality, educating and empowering employees, quality concerns can be addressed quickly and efficiently, while providing an opportunity for tomorrow's leaders to come forward.

Each project represents a problem to solve or an opportunity for improvement. The key to a quality improvement project is that the problem is scheduled for investigation and resolution. Quality Improvement follows the Define, Measure, Analyze, Implement, and Control Model.

#### **4.15 Review of Requests, Tenders, and Contracts**

- 4.15.1** The laboratory shall have a procedure for the review of requests, tenders, and contracts. The procedure shall ensure that:
- a) the requirements are adequately defined, documented and understood;
  - b) the laboratory has the capability and resources to meet the requirements;
  - c) where external providers are used, the requirements of Sec 4.11 of this QAM are applied and the laboratory advises the customer of the specific laboratory activities to be performed by the external provider and gains the customer's approval;
  - d) the appropriate methods or procedures are selected and are capable of meeting the customer's requirements.
- 4.15.2** The laboratory shall inform the customer when the method requested by the customer is considered to be inappropriate or out of date.
- 4.15.3** When the customer requests a statement of conformity to a specification or standard for the test or calibration (e.g. pass/fail), the specification or standard and the decision rule shall be clearly defined. Unless inherent in the requested specification or standard, the decision rule selected shall be communicated to, and agreed with, the customer.
- 4.15.4** Any differences between the request or tender and contract shall be resolved before laboratory activities commence. Each contract shall be acceptable both to the laboratory and the customer. Deviations requested by the customer shall not impact the integrity of the laboratory or the validity of the results.
- 4.15.5** The customer shall be informed of any deviation from the contract.
- 4.15.6** If a contract is amended after work has commenced, the contract review shall be repeated and any amendments shall be communicated to all affected personnel.
- 4.15.7** The laboratory shall cooperate with customers or their representatives in clarifying the customer's request and in monitoring the laboratory's performance in relation to the work performed.
- 4.15.8** Records of reviews, including any significant changes, shall be retained. Records shall also be retained of pertinent discussions with a customer relating to the customer's requirements or the results of the laboratory activities.
- 4.15.9** Contract review is a primary function and integral part of the quality system at Con-Test. All contracts are reviewed and accepted only if the requirements are clearly understood, and the company has the capability and capacity to fulfill client expectations. Communication is maintained with the client from the time a request is processed through commencement of work. This includes informing the client of any deviation from the contract and obtaining approval to beginning testing. If a contract needs to be amended after work has

commenced, it will be communicated to the client and the contract will be amended with a hand-filled in correction.

**4.15.10** All new work is initiated by the Laboratory Management, delegating responsibilities for new work according to available resources. The staff meets prior to initiation of new work in order to determine if appropriate facilities and resources are available. The plan for any new testing shall be reviewed and approved by the Laboratory Director before commencing such work. After agreement is reached, facilities and resources are organized to efficiently perform the work. For any new testing requirements, the designated employee shall write a standard operating procedure based upon the appropriate reference method and demonstrate capability to perform those tests prior to reporting results. In addition, a Chain of Custody (COC) serves as another form of contract. This document serves as an order for work to be performed by Con-Test Analytical Laboratory. Unless otherwise governed under separate contract, by signing this document, the client agrees to the terms and conditions listed on the chain of custody. The SOP(s) shall be under document control and Demonstration of Capability Statement(s) must be on file. See SOP Review of Requests, Tenders, and Contracts, Document Number 29.

#### **4.16 Quality Assurance Project Plan (QAPP)**

**4.16.1** After contracts are reviewed and mutually agreed upon between the client and the laboratory, a Quality Assurance Project Plan (QAPP) is developed. This is a written document outlining the procedures a monitoring project will use to ensure the data it collects and analyzes meets project requirements. It is an invaluable planning and operating tool that outlines the project's methods, storage and analysis.

**4.16.2** Elements of a QAPP include:

- 4.16.2.1** Title and Approval Page
- 4.16.2.2** Table of Contents
- 4.16.2.3** Distribution List
- 4.16.2.4** Project/Task Organization
- 4.16.2.5** Problem Definition/Background
- 4.16.2.6** Project/Task Description
- 4.16.2.7** Data Quality Objectives for Measurement Data (DQOs) which includes:
  - 4.16.2.7.1** Precision
  - 4.16.2.7.2** Accuracy
  - 4.16.2.7.3** Measurement Range (Required Reporting Limits)
  - 4.16.2.7.4** Representativeness
  - 4.16.2.7.5** Comparability
  - 4.16.2.7.6** Completeness

- 4.16.2.8 Training Requirements/Certifications
- 4.16.2.9 Documentation and Records
- 4.16.2.10 Sampling Process Design
- 4.16.2.11 Sampling methods requirements
- 4.16.2.12 Sample Handling and Custody Requirements
- 4.16.2.13 Analytical Method Requirements
- 4.16.2.14 Quality Control Requirements
- 4.16.2.15 Equipment Testing, Inspection, and Maintenance Requirements
- 4.16.2.16 Instrument Calibration and Frequency
- 4.16.2.17 Inspection and Acceptance Requirements for Supplies
- 4.16.2.18 Data Acquisition Requirements
- 4.16.2.19 Data Management
- 4.16.2.20 Assessments and Response Actions
- 4.16.2.21 Reports
- 4.16.2.22 Data Review, validation and Verification Requirements
- 4.16.2.23 Validation and Verification Methods
- 4.16.2.24 Reconciliation with Data Quality Objectives

4.16.3 Typically, the client will provide the QAPP to Con-Test Analytical and we will go through to evaluate if all the needs can be met. Specific SOPs are provided, methods to be used determined and special handling requirements noted. Additionally, special project reporting limits and method detection limits will be evaluated along with required QA/QC. Con-Test determines all of its MDLs according to the new 2016 EPA procedure, "Definition and Procedure for the Determination of the Method Detection Limit", Rev2. Annually reporting limits and method detection limits are evaluated, therefore can be subject to change.

If any element cannot be met, Con-Test Analytical Laboratory will discuss with the client to decide which course of action to take. If any changes arise during the life of the project, Con-Test Analytical Laboratory will inform the client and make any adjustments necessary. QAPPs are typically reviewed annually with client to determine any changes.

## 5.0 Information Management (Network Design/LIMS)

- 5.1 The laboratory shall have access to the data and information needed to perform laboratory activities.
- 5.2 The laboratory information system (LIMS) used for the collection, processing, recording, reporting, storage or retrieval of data shall be validated for the functionality, including the proper functioning of interfaces within the laboratory information management system by the laboratory before introduction. Whenever there are changes, including laboratory software configuration of modifications to commercial off-the-shelf software, they shall be authorized, documented, and validated before implementation.

- 5.3** The laboratory information management system shall:
- a) be protected from unauthorized access;
  - b) be safeguarded against tampering and loss;
  - c) be operated in an environment that complies with provider or laboratory specifications or, in the case of non-computerized systems, provides conditions which safeguard the accuracy of manual recording and transcription;
  - d) be maintained in a manner that ensures the integrity of the data and information;
  - e) include recording system failures and appropriate immediate and corrective actions.
- 5.4** When a laboratory information management system is managed and maintained off-site or through an external provider, the laboratory shall ensure that the provider or operator of the system complies with all applicable requirements of the ISO17025:2017 standard.
- 5.5** The laboratory shall ensure that instructions, manual, and reference data relevant to the laboratory information management system are made readily available to personnel.
- 5.6** Calculations and data transfers shall be checked in an appropriate and systematic manner.
- 5.7** For more efficient tracking of samples, processing of analysis data, and document control, Con-Test currently employs a Laboratory Information Management System or LIMS as well as a PC network. These systems provide authorized personnel with fingertip access to analysis information as well as user access to valuable organizational programs and applications.

By utilizing a media in which quality of data is easily controlled, the speed, efficiency and accuracy with which laboratory data is delivered is maximized.

#### **5.8 Con-Test LIMS Definition:**

The Con-Test LIMS is a file server PC Network based database that contains all information related to an analytical job that is received at the laboratory. All functions, including log-in, data transfer from instruments, billing, report generation, quality control and archive maintenance are handled by the system. The major benefits of the system are rapid report generation, standardization of report format, and minimization of human error due to inaccurate calculations, data transcriptions and misspellings.

Client specific information regarding fees, invoice history, and address are maintained in tables in the relational database. After an analysis passes quality control inspection, if all tests ordered at log-in for the job have been entered into the database the reports will be generated automatically by the LIMS. Reports are standardized in that long lists of compounds do not need to be reentered via a word processor with each analysis. Standard report elements including method references and limits of detection are maintained in files or tables that the report generator accesses. Invoice, Certificate of

Analysis, Data Tabulations, and Quality Control Summary are generated at the same time and routinely are mailed together.

Data that is generated by computerized analytical instruments including Gas Chromatographs (GC), Gas Chromatograph/Mass Spectrometers (GC/MS), Inductively Coupled Plasma – Mass Spectroscopy (ICP/MS), and Inductively Coupled Plasma (ICP), is automatically transferred from the instrument into the database where the data is reviewed and edited by the analysts, only if necessary (ex. wrong file transferred). Any calculations that are required to determine the final analytical result are performed by the database and reviewed by the analyst. Transcription errors between instrument and report as well as calculation errors are virtually eliminated by this process.

All data relevant to an analytical job is maintained active on the file server for at least one year. After this time data is archived onto tapes from which it can be restored as needed. Hard copies of data including chain-of-custody documentation are maintained for 10 years in an archive storage building.

#### **5.9 Verification of Formulas and Automated Computations**

Extensive program validation is performed before the use of any automated system. Automated computations and systems are programmed and thoroughly reviewed by professionals and not utilized until the system has undergone and satisfactorily completed an extensive validation process in order to ensure accurate generation of data. Formulas for automated computations are verified initially and then locked so they cannot be changed.

### **6.0 Sample Control and Management - (Handling of test or calibration items)**

- 6.1** The laboratory shall have a procedure for the transportation, receipt, handling, protection, storage, retention, and disposal or return of test or calibration items (samples), including all provisions necessary to protect the integrity of the sample, and to protect the interests of the laboratory and the customer. Precautions shall be taken to avoid deterioration, contamination, loss or damage to the sample during handling, transporting, storing/waiting, and preparation for testing. Handling instructions provided with the item shall be followed.
- 6.2** The laboratory shall have a system for the unambiguous identification of test or calibration items. The identification shall be retained while the item is under the responsibility of the laboratory. The system shall ensure that items will not be confused physically or when referred to in records or other documents. The system shall, if appropriate, accommodate a sub-division of an item or groups of items and the transfer of items.
- 6.3** Upon receipt of the test or calibration item, deviations from specified conditions shall be recorded. When there is doubt about the suitability of an item for test or

calibration, or when an item does not conform to the description provided (COC), the laboratory shall consult the customer for further instructions before proceeding and shall record the results of this consultation. When the customer requires the item to be tested or calibrated acknowledging a deviation from specified conditions, the laboratory shall include a disclaimer (qualifier) in the report indicating which results may be affected by the deviation.

- 6.4 When items need to be stored or conditioned under specified environmental conditions, these conditions shall be maintained, monitored and recorded.

#### 6.5 **Laboratory Couriers (Transportation of Samples)**

Con-Test provides sample pick up and laboratory transportation service for regular clients with certain geographical and sample size limitations. This service is only available upon approval by Con-Test sample control personnel.

At the time of pick up, complete and proper documentation (chain of custody forms) must be signed and turned over to Con-Test Couriers.

#### 6.6 **Laboratory Sample Custody**

##### 6.6.1 **Chain of Custody**

Chain-of-custody documentation must be maintained for each transfer of sample. All individuals who handle samples will be required to sign and date paperwork.

##### 6.6.2 **Sample Receipt and Inspection**

The laboratory receives samples by mail, courier pick-up, and by personal delivery. When samples arrive at the laboratory, the laboratory courier or client relinquishes custody of samples to the sample custodian with proper documentation of the transfer recorded on the chain of custody form.

Chain of custody documentation is required with all samples. The samples are then removed from the shipping or transportation containers and visually inspected for damage such as leakage, breakage, or contamination by one of the log-in staff.

The samples received are then compared with accompanying custody and analysis specification forms to make sure that the paperwork agrees with the labels on each sample container. The pH is taken on applicable samples and noted on the sample receipt checklist. Clients are encouraged to include a

temperature blank in the cooler when samples are transported to the laboratory. Sample coolers that are carried by the laboratory couriers will contain a bottle of water that is used to monitor the temperature of the cooler. In all cases when a temperature blank is present, the temperature is recorded on the chain of custody and sample receipt form. If a temperature blank is not in the cooler, an Infra-Red thermometer gun is used to record the sample temperature. The accuracy of the Infra-Red thermometer gun must be verified quarterly. In cases where the temperature is not actually measured for any reason, a comment is put on the chain of custody form as to whether the samples were cold or at ambient temperature when received. Sample receipt form is documented with the procedure used for temperature measurement.

If samples are damaged or do not agree with the paperwork, then the Project Chemist is notified at once, and the appropriate action, listed below, is taken immediately to remedy the situation.

- Samples that are damaged upon receipt at the laboratory are immediately reported to the client so that a decision can be made by the client to void that particular sample or replace it.
- Incomplete sampling information on sampling sheets is brought to the attention of the client.
- Missing samples or missing paperwork is also brought to the attention of the appropriate person.
- Clients are advised of missed holding times and improper containers, temperatures, preservatives or the like.

In any case, clients shall be immediately notified of deficiencies or deviations for possible resolution. Decisions or comments made by the laboratory or client are documented on the chain of custody for future reference. See below for Sample Acceptance Policy:

## **Sample Acceptance Policy**

Con-Test Analytical Laboratories' Sample Acceptance Policy is based on the requirements outlined in the NELAC standard. Samples not meeting the acceptance criteria will not be accepted by the laboratory or will be qualified on the final report. This policy will be available to clients along with sampling instructions, on-line on our company website [www.contestlabs.com](http://www.contestlabs.com), and in our Quality Manual.

All samples submitted to Con-Test Analytical Laboratories must:

- 1) Be accompanied by a chain of custody with proper, full and complete documentation, including sample identification, location, state sample was collected in, date and time of collection, the collector's name, type of preservation (if any), type of sample (matrix), any special comments concerning the sample, tests requested, and desired turn-around time. It is the client's responsibility to communicate specific methods or required detection limits.
- 2) Be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine identity of a sample, it will be rejected and the client will be contacted for further instructions or re-sampling.
- 3) Be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or re-sampling. If analysis is possible, the final report will be qualified. Samples must be appropriately sealed to prevent leakage or cross-contamination.
- 4) Samples should be shipped in a manner to preserve the sample's safety, quality, and integrity. It is the client's responsibility to ship samples to the lab at the appropriate temperature for sample preservation. Sample temperature will be monitored upon receipt.
- 5) Adhere to specified holding times. If samples are received past the holding time or will expire before the analysis can commence, the client will be notified and asked how to proceed. If the samples are analyzed, they will be qualified in the final report.
- 6) Contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the client will be contacted for further instruction or re-sampling.

If samples show signs of damage, contamination or inadequate preservation, the client will be contacted. If analysis is performed, the final report will be qualified. If analysis can't be performed the client will be notified for further instructions or re-sampling.

### **6.6.3 Assignment of Laboratory Numbers**

Each sample that meets the minimum acceptance requirements for receipt by the laboratory is assigned a unique identification number.

Laboratory sample numbers begin with the last two digits of the year in which the sample was logged in. Then, follows a letter which corresponds to the month the sample was received. "A" = January, "B" = February, "C" = March, etc....

The following four-digit number specifies the work order number, followed by the 2-digit individual sample identification (15A0000-00) which is assigned in ascending order depending on the day and time of receipt.

### **6.6.4 Internal Sample Tracking & Analysis Scheduling**

After assigning individual laboratory identification number the sample custodian records the appropriate information on the chain of custody. The sample custodian then enters the information for each sample into the Laboratory Information Management System (LIMS).

This includes but not limited to; requested analysis, sample ID, log-in date and time, submitter ID, laboratory due date and priority, date sampled, sample matrix, container, preservative, date received, receiver, and other appropriate laboratory identifications.

Upon completion of data entry, the LIMS generates the appropriate forms which are utilized to initiate and track the samples through the laboratory process. The original chain of custody record is scanned into LIMS so it may be viewed by analysts to get required information. The original chain of custody is then attached to a cover sheet and forwarded to a project manager for review.

A work order summary is generated by the LIMS for each work order to ensure tests have been logged in correctly. The work order summary is compared to the chain of custody for each sample.

Samples are then transferred into the appropriate laboratory section, preserved if necessary, and moved into one of the sample storage area refrigerators (pending analysis). Samples remain there until the analysis is to be performed. The requested analysis is then scheduled to be performed by the appropriate analyst or supervisor noting the holding time of the samples.

#### **6.6.5 Log Out and Storage of Samples**

Samples are stored in defined, secure areas at all times. Samples are removed from pending analysis storage to pending disposal storage when samples have been analyzed and applicable reports completed and issued.

Aqueous samples are stored for a minimum of one month, soil samples for a minimum of two months before characterization and disposal or can be returned to clientele upon request. Clients may request longer retention times.

A locked storage area will be provided should the client require secure storage for samples which require special handling due to legal proceedings.

#### **6.6.6 Disposal of Samples and Wastes**

Appropriate samples and wastes are characterized and disposed of according to the appropriate Federal, State, & local regulations. Whenever possible, non-hazardous waste is recycled. Hazardous wastes are disposed of through Licensed Hazardous Waste Firms.

### **7.0 Data: Generation, Verification & Approval, Reports, Reduction & Storage**

#### **7.1 Technical Records**

- 7.1.1** The laboratory shall ensure that technical records for each laboratory activity contain the results, report and sufficient information to facilitate, if possible, identification of factors affecting the measurement result and its associated measurement uncertainty and enable the repetition of the laboratory activity under conditions as close as possible to the original. The technical records shall include the date and the identity of personnel responsible for each laboratory activity and for checking data and results. Original observations, data and calculations shall be recorded at the time they are made and shall be identifiable with the specific task.
- 7.1.2** The laboratory shall ensure that amendments to technical records can be tracked to previous versions or to original observations. Both the original and amended data and files shall be retained, including the date of alteration, an indication of the altered aspects and the personnel responsible for the alterations.

## **7.2 Data Generation**

Upon notification of the analysis from sample queries, the analyst or technician responsible for the analysis or preparation collects the sample(s) from cold storage and using standard operating procedures, completes the preparation and subsequent analysis under specified, controlled conditions (including the appropriate QA/QC measures). Before the analysis of any sample, it is the responsibility of the project manager to verify that all information was correctly recorded into LIMS and matches the chain of custody.

Errors which are detected are brought to the attention of project managers and corrected before analysis begins. Upon completion of the analytical run, the analyst or technician makes the appropriate calculations, verifies quality control data, completes bench-sheets, and any other accompanying paperwork, and organizes the data (logs all information into the specified permanently bound data book or creates a data printout package).

From this point, the analyst/technician enters into the LIMS and batches or selects the samples which were analyzed in their analytical run. The LIMS assigns the group a unique batch identification number which is used for efficient tracking.

Raw data can be entered into the LIMS in two ways. LIMS has the capability of accepting raw data directly downloaded from analytical equipment or excel spreadsheets or if the data is not downloaded, it can be entered manually. Once the raw data is entered, the analyst/technician must enter his/her initials and date of analysis along with any factors associated with the sample, which must be taken into account for calculations to achieve the desired sample result or concentration. This may include sample volume or weight, final volume of preparation, dilution factor, concentration factor, air volume, square feet or the like.

Upon entering all required data, the LIMS performs the needed calculations. The analyst/technician checks the LIMS calculated values for the samples against his/her calculated values to ensure there have been no errors (transcription, calculation etc....). The analyst/technician then saves the data which was previously entered into memory and exits the system. All data is entered into the LIMS. The data and paperwork is then submitted to quality control for approval. When raw data is being evaluated, at least three significant figures is used. Data reported to client gets reported to two significant figures.

## **7.3 Data verification and Approval**

Appointed and trained data review personnel are responsible for verifying all data entries before it is released to clients. The initial demonstration of capability (IDOC) represents the validation of the analytical method. After the generation and reduction of data by the analyst/technician, analysis documentation, chromatograms, printouts,

and any and all other pertinent data acquired are submitted for Data Quality Review. Data reviewers are specified and trained for each analytical procedure.

Data verification includes examination of calibrations, spike recoveries and sample duplicates against benchmark limits as well as checking for transcription errors and spot-checking for calculation errors. Instrument printouts are also examined and transcriptions verified.

If at any time the data submitted by an analyst/technician does not meet specified quality requirements or is considered questionable, the data is rejected and returned to the analyst/technician for review and reanalysis, if necessary. The new data must be then approved in the same manner. Quality control personnel also verify that appropriate data flags, comments, and narratives are added when needed.

Once these verifications have been made, the data is QC approved in the LIMS and automatically is moved into the report generation phase of the LIMS.

#### **7.4 Report Generation and Management Review of Reports**

The Laboratory Information Management System (LIMS) automatically organizes data once it has been approved into several predefined formats dependent on several factors including; the sample type, parameters, and number of samples. Laboratory deliverable packages have been designed to include all required information as well as additional valuable details on the total quality of information. Report formats are easily interpretable because they are provided in a form which is clear and concise. Data is presented in a means which does not require knowledge of statistics or major data manipulations or conversions in order to be easily utilized by data users.

Final reports are first thoroughly reviewed and then signed by designated personnel before release to clients. If samples or reports are involved in litigation, it is the policy of the laboratory to follow the advice and direction of the court regarding records that are subpoenaed or samples that are impounded.

Final test reports contain the following information: The first page contains Con-test's address, fax and phone number, client name, client address, project location, client job number, project number, laboratory work order number, signature of project manager, and report date. The next section contains PO number (if applicable), summary of analyses found in report along with client sample ID, laboratory ID # and matrix, case narrative summary, signature of person signing off the report with the following statements that include: "The results of analyses reported only relate to samples submitted to the Con-Test Analytical Laboratory for testing" and "I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge

and belief, accurate and complete". Then the results for each test are given, which include results, RL, MDL (if applicable), units, dilution factor, any data flags, method, date prepared, date/time analyzed, analyst, project location, date received, field sample #, sample ID #, sample matrix and date sampled. The next section of the report contains sample extraction data. This includes for each test method that is applicable, the lab ID, batch number, initial volume, final volume, and date prepared. Next is the Quality Control Section which includes for each batch for each test method the results for the Blank, LCS, LCS Dup, sample duplicates, matrix spikes, and any other reported QC that is applicable to the analysis being performed. This section is followed by the Flag/Qualifier summary section which gives the definition of each data flag used in the final test report. The next section is the Certifications summary which states for each compound/analyte found in the report, what states we are certified for that particular method. Then we have a listing of all certifications/accreditations we hold and when each expires along with the certification number. Lastly, the chain of custody and sample receiving checklist are included. Each report is paginated along with work order ID and final test report date and time, so that each page is easily identifiable.

#### **7.4.1 Reporting Statements of Conformity**

- 7.4.1.1** When a statement of conformity to a specification or standard is provided, the laboratory shall document the decision rule employed, taking into account the level of risk (such as false accept and false reject and statistical assumptions) associated with the decision rule employed, and apply the decision rule.
- 7.4.1.2** The laboratory shall report on the statement of conformity, such that the statement clearly identifies:
  - a) to which results the statement of conformity applies;
  - b) which specifications, standards or parts thereof are met or not met;
  - c) the decision rule applied (unless it is inherent in the requested specification or standard).

#### **7.4.2 Reporting Opinions and Interpretations**

- 7.4.2.1** When opinions and interpretations are expressed, the laboratory shall ensure that only personnel authorized for the expression of opinions and interpretations release the respective statement. The laboratory shall document the basis upon which the opinions and interpretations have been made.
- 7.4.2.2** The opinions and interpretations expressed in reports shall be based on the results obtained from the tested or calibrated item and shall be clearly identified as such.
- 7.4.2.3** When opinions and interpretations are directly communicated by dialogue with the customer, a record of the dialogue shall be retained.

### 7.4.3 Amendments to reports

- 7.4.3.1 When an issued report needs to be changed, amended or re-issued, any change of information shall be clearly identified and, where appropriate, the reason for the change included in the report.
- 7.4.3.2 Amendments to a report after issue shall be made only in the form of a further document, or data transfer, which includes the statement, "Amendment to report, serial number (or as otherwise identified)", or an equivalent form of wording.
- 7.4.3.3 When it is necessary to issue a complete new report, this shall be uniquely identified and shall

## 7.5 Procedures and Format for Reporting Data to State, Local, and/or Federal Officials

Deliverables can include complete state and federal regulatory compliance forms, if required. All data reported is organized in a standard laboratory format unless otherwise requested, specified, or required by client and/or by a governing agency such as the United States Environmental Protection Agency or State Department of Environmental Protection. Con-Test's general analysis format includes all information required by Laboratory certifying agencies.

In certain situations, {such as reporting results for Agency Proficiencies or under the Safe Drinking Water Act (SDWA)} special forms are required for the reporting of data. The format dictated by the applicable forms is completed by the Laboratory and submitted to the appropriate individual or organization. Records of the results in the required formats are archived as normal formatted data.

## 7.6 Data Reduction

The following equations are commonly utilized in the reduction of analysis data and are performed by either Chemstation or equivalent instrument software or by the LIMS Element:

### Precision Chart Limit Calculations performed by Element:

- a) Calculate R

$$R = R/n \text{ where: } n = \text{total number of R values}$$

- b) Determine the Standard Deviation ( $S_R$ ) for R

$$S_R = \frac{(R - R_i)^2}{n-1} \text{ for } n < 25$$

- c) Calculate the Upper Control Limit for R

$$UCL_R = R + 3 (S_R)$$

- d) Calculate the Upper Warning Limit for R

$$UWL_R = R + 2 (S_R)$$

Accuracy Chart Limits Calculations performed by Element:

- a) Calculate X

$$X = \sum X/n \quad \text{where: } n = \text{Total number of X values}$$

- b) Determine the Standard Deviation ( $S_x$ ) for X

$$S_x = \frac{\sum (X - X_i)^2}{n-1} \quad \text{for } n < 25$$

use n in place of n-1 for  $n \geq 25$

- c) Calculate the Upper Control Limit for X

$$UCL_x = X + 3 (S_x)$$

- d) Calculate the Upper Warning Limit for X

$$UWL_x = X + 2 (S_x)$$

- e) Calculate the Lower Warning Limit for X

$$LWL_x = X - 2 (S_x)$$

- f) Calculate the Lower Warning Limit for X

$$LCL_x = X - 3 (S_x)$$

Percent Recovery Calculation performed by Element:

The following equation is used to compute percent recovery (%R). The value of %R is then compared to the laboratory established control limits to determine bias and associated interferences.

$$\%R = (x_1 - x_2)/x_3 \times 100$$

Where:

- x1 = measured value for spiked sample
- x2 = measured value for un-spiked sample
- x3 = known value of the spike in the sample

Relative Percent Difference Calculation performed by Element:

The following equation is used to calculate Relative Percent Difference (RPD):

$$RPD = [V1 - V2] / V3 \times 100$$

Where: [V1 - V2] = Absolute difference between the two values  
V3 = Average of the two values

Range: Based on Recovery

$$\text{Recovery Value for } X_1 = \frac{X_{1R}}{X_{1S}}$$

$$\text{Recovery Value for } X_2 = \frac{X_{2R}}{X_{2S}}$$

$$\text{Range, } R = [X_1 - X_2] \text{ [Absolute Value]}$$

Where:  $X_{1R}$  = mg reported  
 $X_{1S}$  = mg spiked on media  
 $X_{2R}$  = mg reported  
 $X_{2S}$  = mg spiked on media

$$\text{Mean Recovery Value, } X = \frac{X_1 + X_2}{2}$$

External Standard Calibration

The ratio of the detector response to the amount (mass) of analyte in the calibration standard is defined as the calibration factor (CF). The CF can also be calculated using the concentration of the standard rather than the mass in the denominator of the equation.

$$CF = \frac{\text{Peak Area (or Height) of the Compound in the Standard}}{\text{Mass of the Compound Injected}}$$

Internal Standard Calibration performed by Chemstation or equivalent

For each of the initial calibration standards, calculate the RF values for each target compound relative to one of the internal standards as follows:

$$RF = \frac{A_S \times C_{IS}}{A_{IS} \times C_S}$$

Where:

$A_S$  = Peak Area (or height) of the analyte or surrogate

$A_{IS}$  = Peak Area (or height) of the internal standard

$C_S$  = Concentration of the analyte or surrogate, in ug/L

$C_{IS}$  = Concentration of the internal standard, in ug/L

Note that in the equation above, RF is unit less, i.e., the units from the two area terms and the two concentration terms cancel out. Therefore, units other than ug/L may be used for the concentrations of the analyte, surrogate, and internal standard, provided that both  $C_S$  and  $C_{IS}$  are expressed in the same units. The mass of the analyte and internal standard may also be used in calculating the RF value.

Linear Calibration Using Response Factors performed by Chemstation or equivalent

To evaluate the linearity of the initial calibration, calculate the mean CF (external standard calibration) or RF (internal standard calibration), the standard deviation (SD), and the RSD as follows:

$$\text{Mean CF} = \overline{CF} = \frac{\sum_{i=1}^n CF_i}{n} \qquad \text{Mean RF} = \overline{RF} = \frac{\sum_{i=1}^n RF_i}{n}$$

$$SD = \sqrt{\frac{\sum_{i=1}^n (CF_i - \overline{CF})^2}{n - 1}} \qquad SD = \sqrt{\frac{\sum_{i=1}^n (RF_i - \overline{RF})^2}{n - 1}}$$

$$RSD = \frac{SD}{CF} \times 100$$

$$RSD = \frac{SD}{RF} \times 100$$

Where n is the number of calibration standards and RSD is expressed as a percentage (%). If the RSD of the calibration or response factors is less than or equal to 20% over the calibration range, then linearity through the origin

may be assumed, and the average calibration or response factor may be used to determine sample concentrations.

#### Non-linear Calibration performed by Chemstation or equivalent Instrument software

In situations where the analyst knows that the instrument response does not follow a linear model over a sufficiently wide working range, or when the other approaches described here have not met the acceptance criteria, a non-linear calibration model may be employed.

NOTE: It is not EPA's intent to allow non-linear calibration to be used to compensate for detector saturation at higher concentrations or to avoid proper instrument maintenance.

Thus, non-linear calibration should not be employed for methods or instruments previously shown to exhibit linear calibration for the analytes of interest.

When using a calibration model for quantitation, the curve must be continuous, continuously differentiable and monotonic over the calibration range. The model chosen should have no more than four parameters, i.e., if the model is polynomial, it may be no more than third order, as in the equation:

$$y = ax^3 + bx^2 + cx + d$$

The statistical considerations in developing a non-linear calibration model require more data than the more traditional linear approaches described above. Whereas SW-846 methods employ five standards for a linear (first order) calibration model, a quadratic (second order) model requires six standards, and a third order polynomial requires seven standards.

Most curve fitting programs will use some form of least squares minimization to adjust the coefficients of the polynomial (a, b, c, and d, above) to obtain the polynomial that best fits the data.

The "goodness of fit" of the polynomial equation is evaluated by calculating the weighted coefficient of the determination (COD).

$$\text{COD} = \frac{\sum_{i=1}^n (y_{\text{obs}} - \bar{y})^2 - (n-1) \sum_{i=1}^n (y_{\text{obs}} - y_i)^2}{(n-p) \sum_{i=1}^n (y_{\text{obs}} - \bar{y})^2}$$

Where:

$y_{obs}$  = Observed response (area) for each concentration from each initial calibration standard

$\bar{y}$  = Mean observed response from the initial calibration

$Y_i$  = Calculated (or predicted) response at each concentration from the initial calibration(s)

$n$  = Total number of calibration points (i.e., 6 for a quadratic model; 7 for a third order model)

$p$  = Number of adjustable parameters in the polynomial equation (i.e., 3 for a third order; 2 for a second order polynomial)

Under ideal conditions, with a “perfect” fit of the model to the data, the coefficient of the determination will equal 1.0. In order to be an acceptable non-linear calibration, the COD must be greater than or equal to 0.99.

## 7.7 Data Storage

Con-Test Analytical Laboratory takes a layered approach to ensure the preservation of our hard copy and electronic laboratory records. Hard copy data includes log books, data and analysis books, instrument printouts and raw data. These records are kept in paper form at the laboratory until archiving is required. Throughout the year, hard copy data is transferred to an on-site storage facility. This secure, permanent storage is organized and accessible through coded file boxes. We additionally have older data stored off site at a document storage facility (Meyer Records Management) for years 2009-2013.

The Quality Assurance is responsible for overseeing the Data Archiving process. A team approach (Department Analyst/Employee, Manager/Supervisor, and Quality Control) is required to transfer printed documents from both facilities (Laboratory and Administration) to Archives. The person packing each box is responsible to put content information on both ends of the box along with dates so the Quality Assurance department can catalog contents. The Quality Assurance department is responsible for cataloging, indexing, labeling and assigning a location in the archive storage building for each box. The QA department will maintain a spreadsheet to track all this information on the Q:/Archiving folder. Any person requesting archived data will need to go through the QA department to handle request. The QA department will quarterly ascertain what documents can be destroyed. For additional information on archiving, see SOP Archiving data, document #358.

In most cases, an instrument's raw data has also been electronically stored into our LIMS (Laboratory Information Management System) database. This data is organized and accessible through our database server (SQL2014PRI). Final reports (including chain of custody documents) are also stored on this server. SQL2014PRI, along with our domain controller, benefit from a nightly backup routine (Monday - Friday). This practice is facilitated through the use of tape media. Backup and restoration procedures are guided with the use of current IT standard operating procedures.

At the close of each month, electronic data is preserved onto CD/DVD-ROM (Read Only Memory). By request, preserved CD/DVD-ROM data can be restored for client inquiry or quality control purposes. In all cases, the above-mentioned records will be retained for a period of ten years. The only exception to this rule is Lead and Copper potable water records needs to be stored for a period of 12 years. The hardcopy record is kept for 10 years and the electronic copy is kept for at least 12 years. Clients will be notified prior to facility closing, and records will be transferred according to their instruction.

#### **7.8 Quality Record Storage**

Quality records, which consist of internal audits, corrective actions/preventative actions, proficiency testing results, certificates of accreditation, Standard Method books, AIHA-LAP, LLC modules, the TNI standard, other miscellaneous methods, and calibration records for thermometers, balances, weights, spectrophotometers, Eppendorf pipettes, and conductivity meter are kept in the Quality Assurance office. They are stored in file cabinets and book shelves, which the Quality Assurance Officer maintains. Other Quality records, such as individual Initial Demonstrations of Capabilities, personnel training files, and controlled documents are stored in an auxiliary room, in locked file cabinets. These records can only be accessed by the QA Officer and Technical Director.

In all cases, the above-mentioned records will be retained for a period of at least ten years. Clients will be notified prior to facility closing in the event the laboratory will no longer be conducting business, and records will be transferred according to the client's instruction. Refer to Con-Test Analytical Laboratory's "records matrix", controlled document #387, for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records.

### **8.0 Document Control**

All Con-Test Laboratory documentation is carefully controlled by the Lab Director and Quality Assurance Officer. This includes the Con-Test Laboratory Quality Assurance Manual, standard methods, and standard operating procedures. The responsibility for maintaining and approving documents falls directly upon the Lab Director and Quality Assurance Officer. Under the authority of top management, it is required that all personnel concerned with testing and calibration activities within the laboratory familiarize themselves with the quality documentation and implement the policies and procedures in their work.

After final approval of documentation by the Laboratory Director, the documents are placed in the controlled document program, distributed through “checkwriters” where personnel view an unprintable pdf copy and “E-sign” that they have read and understood the latest version, and are made readily available, to those individuals and/or companies whom those changes affect directly or indirectly. Clients receive “Non-Controlled” pdf copies. All documents are password protected and are “Read-Only”. All Con-Test personnel may view “Controlled” pdf copies on the F:/drive, which are not printable. If anyone needs to print out a copy, they must contact the QA department and be assigned the copy. This is tracked through an excel spreadsheet. This copy must be returned back to the QA department. All documents are uniquely identified, including a controlled document number, effective date, revision number, page numbering, the total number of pages, and the issuing authorities.

The Controlled Document Program is described in detail in the “Controlled Document” SOP, document #83.

To ensure utilization and proper representation of the Laboratory Quality Assurance Program, the QA Manual is reviewed, updated as needed, and then approved by the management annually. Interim additions or revisions may be affixed as the occasion arises. Also, included on the master list of controlled documents are all logbooks, manuals, checklists, instructions, chains of custodies, and guidance documents. All SOP’s are reviewed at least annually. If any SOP has not been reviewed during the current year, it will be passed out to the applicable reviewer during the annual SOP review. This takes places at the end of every year.

### **8.1 Availability to Laboratory Personnel**

The Con-Test Laboratory Quality Assurance Manual, Standard Methods and Procedures are in the controlled document program and are available to all personnel on the F: Drive/Administration/QC1/controlled documents in pdf format Folder. These SOP’s are not able to be printed. If anyone needs to print out a copy, they must contact the QA department and be assigned the copy. This is tracked through an excel spreadsheet. This copy must be returned back to the QA department. Under, the authority of top management, it is required that all personnel concerned with testing and calibration activities within the laboratory familiarize themselves with the quality documentation and implement the policies and procedures in their work.

### **8.2 Client Availability**

Con-Test documents are updated and revised on a regular basis to reflect current procedure and policy. Those changes or revisions are readily available to clients upon request and/or in periodic client updating.

### **8.3 Corrections to Documents and Data**

Log books, forms, data sheets, and chains of custody are formal laboratory records and need to be treated as such. Records shall be made in indelible ink, black is preferred. There are to be no omissions in the data. Erasures, "white-outs", removal of pages, and scribbling over are not acceptable ways of correcting errors.

Corrections should be kept to a minimum by exercising caution when transcribing data. Unfortunately, errors cannot be avoided completely and when they occur, they should be corrected according to the following procedures:

- Draw a single line through the incorrect entry, insert the correct entry into the closest space available and initial and date the correction.
- Groups of related errors on a single page should have one line through the entries and should be initialed and dated with a short comment on reason of deletion of data.

In order to establish a clear audit trail and to avoid any uncertainty about how and why specific procedures were followed in the laboratory, when a run is repeated or something occurs that is not routine, a note explaining this must be made on the cover sheet or bench sheet.

### **8.4 SOP Revision, Adoption of New Procedures & Departure from Existing Procedures**

Standard Operating Procedures are reviewed and updated to reflect current methodology and procedure on at least an annual basis. SOP's are typically laboratory derivations of approved methodology. (Ex. Standard Methods, SW-846, EPA, NIOSH, and ASTM methods) Laboratory methods are continuously monitored for durability and credible agency endorsement.

Periodically methods may be reevaluated with support or approval revoked or other methods could be deemed acceptable alternatives.

Methodology is to reflect current needs and whenever possible it should be approved by a reputable organization. New methods or procedures may be adopted as necessary. Interim procedures may be appended to documents on approval by laboratory management.

Departures from documented procedures must be approved by management and/or Quality Control Department, depending on the nature of the departure. Documentation of variance from procedure should be on data and in the final report to the client, if the data is affected by the variance. The chain-of-custody form and laboratory bench sheets may also need to contain the documentation in some cases.

## 8.5 Complete Listing of Standard Operating Procedures

Note: for current revision and dates of review see master list of controlled documents, maintained by the QA department and available upon request.

### Wetchemistry

<u>SOP</u>	<u>Document #</u>	<u>SOP Title</u>
SOP Autoclave	88	Autoclave Procedure
SOP ALK	2	Total Alkalinity
SOP NH3NESS	3	Ammonia
SOP MBAS	56	Anionic Surfactants as MBAS
SOP Balance-CAL	6	Balance Calibration
SOP BOD	47	Biological Oxygen Demand (BOD)
SOP COD	55	Chemical Oxygen Demand (COD)
SOP Chloride	58	Chloride
SOP TRC/FRC	43	Chlorine, Total and Free Residual
SOP Color	18	Color
SOP COND	44	Conductivity
SOP Cyanide	59	Cyanide
SOP DO	98	Dissolved Oxygen
SOP Dust	37	Dust, Total & Respirable
SOP Felron	92	Ferrous Iron
SOP FOG1664	93	Method 1664B
SOP Flashpoint	60	Flashpoint, Pensky-Martins Closed Cup Method
SOP Fluoride	17	Fluoride
SOP Glassware Wetchem	71	Glassware Washing: Wet Chemistry Dept.
SOP HARD	63	Total Hardness
SOP Ignitibility	103	Ignitibility
SOP Cr+6	70	Hexavalent Chromium

SOP MICRO	96	Microbiological Analysis of Water
SOP NO3NO2	4	Nitrate/Nitrite – Nitrogen
SOP NO2	42	Nitrite – Manual Method
SOP NO2Lachat	388	Nitrite by Lachat SM4500 NO3-F and Lachat 10-107-04-1-A
SOP ODOR	91	Odor
SOP Paint Filter	126	Paint Filter by Method 9095B
SOP pH	64	pH
SOP Phenol	65	Total Phenolics
SOP Phos	10	Phosphate, Total & Ortho
SOP RXT	87	Reactivity
SOP SOLPER	9	Solids – Percent Solids (Total Solids in Solid and Semisolid Samples)
SOP SOLVOL&FIX	115	Solids – Volatile Solids – Fixed Solids
SOP SOLPER VOL/FIX	8	Solids – Percent Volatile Solids/Fixed Solids (Fixed & Volatile Solids in Solid & Semisolid Samples)
SOP SOLSETT	24	Solids – Settleable Solids
SOP TDS	23	Solids – Total Dissolved Solids
SOP TS	21	Solids – Total Solids
SOP TSS	5	Solids – Total Suspended Solids
SOP Sulfate	66	Sulfate
SOP Sulfide	67	Sulfide
SOP TKN	68	Total Kjeldahl Nitrogen (TKN)
SOP TURB	69	Turbidity
SOP TOCWater 3510B	99B	Total Organic Carbon – Method SM 5310B
SOP TOC Solid	376	Total Organic Carbon in Solid Samples by SW-846 9060A and Lloyd Kahn
SOP ORP	273	Oxidation Reduction Potential (ORP)
SOP Persulfate	275	Persulfate Anion (Groundwater)
SOP Pipet	11	Pipette Washing Protocol
SOP IC300.0	73	Determination of Inorganic Anions by IC (Method EPA 300.0)

**Metals Department**

<u>SOP</u>	<u>Document #</u>	<u>SOP Title</u>
SOP DIGIPREP	57	Digiprep Jr. Digestion Apparatus
SOP Glassware Metals	28	Washing Glassware Standard Procedure
SOP TurbMet	16	Metals Turbidity Screening Determination
SOP ICP200.7	22	ICP (Inductively Coupled Plasma Optical Emission Spectroscopy, 200.7, Potables and Wastewaters)
SOP ICP6010	72	ICP (Inductively Coupled Plasma Optical Emission Spectroscopy, 6010C, Non-Potables and Solids)
SOP AirMetals	40	Metals in Air
SOP 3050B	29	Acid Digestion of Solid Materials (Soils, Sediments, Solids, Sludge/Wipes/Lead in Paint)
SOP 3051 MetalsMicro	135	Method 3051A: Microwave Assisted Digestion of Soils, Sediments, Sludge's, and Oils
SOP INT Wipe	32	Internal Wipe Sampling
SOP Hg	27	Mercury (Cold Vapor Technique) EPA 245.1, SW-846 7470A/7471B
SOP Hg in Air	131	Mercury in Air – Method NIOSH 6009
SOP MetalsWaters	39	Preliminary Treatment for Water Matrix Metals
SOP 200.8	112	ICP-MS EPA 200.8
SOP 6020A	113	ICP-MS SW-846 6020A
SOP Dissolved Metals Prep	394	Dissolved Metals Prep
SOP MetalsAirFilter	247	Determination of Metals in Suspended Particulate Matter (40 CFR App G) Air Filter

**Organics/Air Lab**

<u>SOP</u>	<u>Document #</u>	<u>SOP Title</u>
SOP RSK-175	140	Sample Prep and Calculations for Dissolved Gas Analysis in Water Samples Using a GC Headspace Equilibrium Technique
SOP Glassware/Ext	97	SOP for Washing Organics/Extractions Glassware
SOP CIP	86	Chromatographic Integration Procedures
SOP 504.1	75	EPA 504.1: 1,2-Dibromoethane (EDB) & 1,2-Dibromo-3-Chloropropane (DBCP)

SOP 524.2	34	Volatile Organics by GC/MS (Method EPA 524.2)
SOP 602	116	Volatile Organics by GC (Method EPA 602)
SOP 608	33	Organochlorine Pesticides & PCB's (EPA 608)
SOP 624	35	Volatile Organics by GC/MS (Method EPA 624)
SOP 625	20B	Semi-Volatile Organics (Method EPA 625)
SOP PM-10PM2.5PEM	250	Determination of Particulate Matter as PM-10, PM-2.5, and IP-10A – Determination of Fine Particulate Matter in Indoor Air Using Size Specific Impaction
SOP PCB OIL	26	PCB's in Oil (Method EPA 600/4-81-045)
SOP PCB Shake and Shoot	453	Shake and Shoot PCB Screen Method 3580A Modified
SOP 8082	51	Polychlorinated Biphenyls (PCB's) by GC Method SW-846 8082A
SOP 8081	53	Organochlorine Pesticides by GC Method SW-846 8081B
SOP 8260	50	Volatile Organics by GC/MS (Method SW-846 8260 B/C)
SOP 8270	20	Analytical Analysis of Semi-Volatile Organics (Method SW-846 8270D)
SOP Method3C	80	EPA Method 3C – Determination of Carbon Dioxide, Methane, Nitrogen, and Oxygen from Stationary Sources
SOP TO13A	77	Compendium Method TO-13A – Determination of Polycyclic Aromatic Hydrocarbons (PAHs) In Ambient Air Using GC/MS
SOP TO14A	46	Compendium Method TO-14 – Determination of Volatile Organic Compounds (VOC's) in Air Collected in Specially Prepared Canisters and Analyzed by GC/MS
SOP TO15	45	Compendium Method TO-15 – Determination of Volatile Organic Compounds (VOC's) in Air Collected in Specially Prepared Canisters and Analyzed by GC/MS
SOP TO17	49	Compendium Method TO-17 – Determination of Volatile Organic Compounds (VOC's) in Air Using Active Sampling onto Sorbent Tubes and Analyzed by GC/MS
SOP APH	110	Air-Phase Petroleum Hydrocarbons by GC/MS Method MADEP APH
SOP 3510CWaterExt	403	Water Extraction Procedure Method SW-846 3510C
SOP 3546 Microwave	100	Method 3546 Microwave Extraction Procedure
SOP 8015_8100	25	Total Petroleum Hydrocarbons(GC/FID)Methods SW-846 8100M/8015C/D
SOP Deter of Form in Air	228	Determination of Formaldehyde Air Collected in Specially prepared Canisters and Analyzed by GC/MS

SOP EPH	102	Analytical Analysis of Extractable Petroleum Hydrocarbons MA EPH by GC/FID
SOP GRO	105	Gasoline Range Organics (GRO) EPA 8015C/D
SOP VPH	101	Volatile Petroleum Hydrocarbons (VPH) Mass DEP VPH Method
SOP TCLP Ext	89	Extraction Procedure for Toxicity Characteristic Leaching Procedure
SOP PCB NIOSH 5503	109	Polychlorinated Biphenyls (PCB's) in Air NIOSH 5503
SOP Can Cleaning	111	Can Cleaning Procedure
SOP CTETPH	54	CT ETPH: Analysis of Extractable Petroleum Hydrocarbons (ETPH) using Methylene Chloride, GC/FID
SOP 8151A	255	Chlorinated Herbicides by Gas Chromatography Using Methylation Derivatization SW-846 8151A
SOP Florisil 3620C	251	Method 3620C Florisil Cleanup of Pesticides
SOP Copper Cleanup	395	Removal of Sulfur via Activated Copper SW-846 3660B
SOP TVOC	120	Determination of Total Volatile Organic Compounds (TVOC) in air Collected in specially Prepared canisters and analyzed by GC/MS
SOP 3540CSOXHLET	127	Method 3540C – Soxhlet Extraction Procedure For Polychlorinated Biphenyls (PCB's)
SOP SPLPmod	138	Extraction Procedure for Synthetic Precipitation Leaching Procedure Modified ZHE Procedure for 8260 Analysis
SOP SPLP	137	Extraction Procedure for Synthetic Precipitation Leaching Procedure Method 1311
SOP PCB Homolog	285	SOP for the Determination of PCB Homologues In Air by GC/MS by EPA Method 680
SOP Congener	289	Determination of PCB Congeners by GC/MS
SOP 6200	270	Volatile Organics by GC/MS – Method SM (20 <sup>th</sup> ) 6200B
SOP Air Order Completion	279	Summa Canister Air Order Completion
SOP Flow Controller Log Air	281	Flow Controller Logbook – Air Department
SOP Summa and Flow Controller Evaluation	282	Summa Canister and Flow Controller Evaluation Air Department
SOP TO-4A/TO-10A	311	Compendium Method TO-4A/TO-10A by ASE Extraction (Method 3545) and Soxhlet extraction (Method 3540C)
SOP TO-11A	295	Determination of Formaldehyde and Other Carbonyl Compounds in Ambient Air Using

		Adsorbent Cartridge Followed by HPLC (Compendium Method TO-11A)
SOP ALC/GLY	122	Alcohols/Glycols by GC/FID Method SW846 8015C/D
SOP 1,4-Dioxane8270	314	Low Level 1,4-Dioxane by8270 GC/MS (SIM) Using Large Volume Injection/Programmable Temperature Vaporization Inlet
SOP 1,4-Dioxane8260	121	1,4-Dioxane in water by Heat Purge & Trap, GC/MS (Method 8260B/C Sim)
SOP 8315A	301	Method 8315A: Determination of Formaldehyde & Carbonyl Compounds by High Performance Liquid Chromatography (HPLC) for Liquid & Solid Samples
SOP Airlab TICs	81	Tentatively Identified Compounds in Air
SOP Solvent Distillation	353	Solvent Distillation
SOP Ext Lot Check	396	Extraction Glassware Lot Check
SOP Ext Shift Transition	450	Extractions Shift Transition SOP
SOP Compositing Samples	347	Compositing Samples
SOP PFAS	434	Determination of Selected Perfluorinated Alkyl Acids (PFAAs) in Drinking Water by Solid Phase Extraction & Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) Drinking Water method EPA 537.1 and ISO 25101
SOP PFAS Isotope Dilution	454	Determination of Selected Perfluorinated Alkyl Acids (PFAAS) by Solid Phase Extraction & Isotope Dilution by Liquid Chromatography /Tandem Mass Spectrometry (LC/MS/MS)
SOP Buchi Solvent Recovery	382	Buchi Solvent Recovery Testing

**General**

<b><u>SOP</u></b>	<b><u>Document #</u></b>	<b><u>SOP Title</u></b>
SOP Bottle Prep	291	Bottle Prep
SOP Controlled Documents	83	Procedure for Maintaining Controlled Documents
SOP Courier	242	Courier
SOP Chem Receipt	114	Chemical/Reagent Purchase, Receipt, and Storage
SOP CorrActionPrevActions	84	Procedure for Implementing Corrective Actions/Preventative Actions
Con-Test Handbook	349	Con-Test Analytical Laboratory Employee Handbook
SOP Data Review	390	Data Quality Review
SOP PT Samples	305	SOP for Proficiency Testing Samples
SOP Haz Waste	108	Sample Handling, Disposal and Hazardous Waste Handling Process

SOP Water Evap Room	119	Water Evaporation System Operation
SOP Chemical Hygiene Plan	252	Chemical Hygiene Plan
Hazardous Waste Cont. Plan	400	Con-Test Analytical Laboratory Hazardous Waste Contingency Plan
Emergency Action Plan	401	Con-Test Analytical Laboratory Emergency Action Plan
SOP HowToRetrieveFindAnd ReduceElectronicFilesInElement	246	How to Retrieve, Find, and Reduce Electronic Files in Element
SOP Methanol Vial Prep	130	Methanol Vial Prep
SOP HCL Vial Prep	129	HCL Vial Prep
SOP Nitric Acid Bottle Prep	133	Nitric Acid Bottle Prep
SOP Sodium BiSulfateVialPrep	132	Sodium Bisulfate Vial Prep
SOP Sulfuric Acid Bottle Prep	134	Sulfuric Acid Bottle Prep
SOP DIWaterVialPrep	293	DI Water Vial Preparation
SOP NaOH Bottleprep	292	Sodium Hydroxide Bottle Preparation
SOP Employee Annual Review	253	Employee Annual Review
SOP Client Inquiries	237	Client Inquiries
SOP Subcontracting	239	Subcontracting
SOP Invoice Revision	287	Revision to Invoice Requisition
SOP Review of Requests Tenders and Contracts	290	Review of Requests, Tenders, and Contracts
SOP Revisions to Reports	245	Revision to Reports
SOP Evaluation of Vendors For Supplies	231	Evaluation of Vendors for Supplies
SOP Credit Card Processing	230	Credit Card Processing Procedure
SOP Employee Hiring/ Job Posting	232	Employee Hiring/Job Posting SOP
SOP Monthly Invoicing Of Clients	249	Creating a Monthly Invoice for a Client
SOP Verbal and Written Violation Notices	235	Verbal and Written Violation Notices
SOP Log-in Procedures	268	Log-in Procedure

SOP Air log-in	375	Air Log-in Procedures
SOP Estimation of Uncertainty	312	Estimation of Uncertainty of Measurements
SOP Sample Disposal	340	Sample Disposal
SOP Temp Gun	128	Taking Temperatures of Samples using Temperature Gun
SOP New Client Assignments	233	New Client Assignments & Client Notification
Con-Test Organizational Chart	318	Con-Test Organizational Chart
Con-Test Statement of Quals.	357	Con-Test Analytical Laboratory Statement of Qualifications
SOP Data Package Assembly	405	Data Package Assembly
SOP Ethics	392	SOP for Data Integrity and Ethics
SOP Mint Miner	397	Mint Miner
SOP Lunch Break Waiver	391	SOP for Lunch Break Waivers
SOP Archiving Data	358	Archiving Hardcopy Data SOP
SOP Termination of Employment	364	Termination of Employment Procedures
SOP Telephone Reception	363	Telephone Reception
SOP Air Media Recovery	433	Air Media Recovery
SOP American Express	354	American Express Expenses
SOP Thermometer Ver.	461	Thermometer Verification Procedure
SOP Sample Pick-up	447	Sample Pick-up Procedure
SOP Bottle Order	445	Bottle Order Procedure
SOP WO Review	448	Work Order Review Procedure

## 9.0 Internal Performance, Systems Audits, Management Review and Corrective/Preventative Actions

Performance and Systems Audits are a valuable tool in evaluating procedures and identifying current and potential problems thus allowing for immediate corrective/preventative actions and "root cause" analyses to begin.

Performance and Systems audits are an important part of monitoring laboratory adherence to established policy and procedure. Various internal performance and systems audits are conducted routinely throughout the year.

Management Review – The overall objectives shall be established, and shall be reviewed during management review. The quality policy statement is issued under the authority of top management. The following overall objectives are found throughout the Quality Assurance Manual, including Section 1.0:

- The laboratory management's commitment to good professional practice and to the quality of testing and calibration in servicing clients
- Con-Test's standard of service
- The purpose of the management system related to quality
- The requirement, that all personnel concerned with testing and calibration activities within the laboratory familiarize them-selves with the quality documentation and implement the policies and procedures in their work.
- The laboratory management's commitment to comply with the ISO: IEC 17025:2017 standard and to continually improve the effectiveness of the management system.

Annually the laboratory's top management shall conduct a review of the laboratory's management system and testing/calibration activities to ensure their continuing suitability and effectiveness, and to introduce necessary changes or improvements. The elements of the review include:

- 1) The overall objectives as discussed above and in section 1.0
- 2) The suitability of policies and procedures
- 3) Reports from managerial and supervisory personnel, including QA Officer's monthly reports.
- 4) Outcome of recent internal audits
- 5) Corrective and Preventative actions
- 6) Assessments by external bodies (audits by MA, AIHA-LAP, LLC, NELAC, client audits)
- 7) Results of inter-laboratory comparisons or proficiency tests (PT results)
- 8) Changes in the volume and type of work
- 9) Customer feedback (client surveys)
- 10) Complaints
- 11) Recommendations for improvement
- 12) Other relevant factors, e.g. QA/QC activities, resources, and staff training

Results from the management review feed into the laboratory planning system and include the goals, objectives and action plans for the coming year. Findings from the management reviews and the actions that arise from them shall be recorded. The management shall ensure that those actions are carried out immediately and within appropriate time frame. Managerial reviews must include identification and signature of the author as well as be paginated.

Corrective Actions/Preventative Actions are instituted immediately when nonconforming work or departures from policies and procedures in the management system or technical operations have been identified.

## **9.1 Performance Audits (Internal)**

Internal Performance Audits are designed to measure the consistency, efficiency, and proficiency of the laboratory in obtaining the known true value of prepared samples, submitted as analyst blinds, for one or various tests. The Quality Assurance Officer administers performance audits and results are presented to the Laboratory Director for review and possible corrective actions.

Internal audits are performed according to a schedule that is made each January. The QA Officer ensures adherence to the schedule. All methods and the Quality and Management Systems are internally audited once a year according to the schedule. This assures all elements of the Quality system and testing activities are addressed.

Immediate corrective action is taken when audit findings cast doubt on the correctness or validity of the calibrations or test results. A corrective action will be initiated as soon as possible with a two-week due date. A follow-up date of 30 days will be assigned after the corrective action is completed, to verify the effectiveness of the corrective action taken after the internal audit. Clients will be notified within 48 hours unless further investigation is needed, by email or phone call, when their work is affected by the findings of the internal audit that casts doubt on the validity of the results.

## **9.2 System Audits**

System audits are intensive laboratory system inspections evaluating laboratory adherence to approved procedure. These inspections are performed either by internal or external laboratory (regulatory agency) personnel at regular scheduled intervals.

Annually, the laboratory must conduct an internal audit which is compliant with AIHA-LAP, LLC and NELAC requirements: the purpose of this audit is to verify that laboratory operations continue to comply with the requirements of ISO/IEC 17025:2017 and the AIHA-LAP, LLC program requirements. The latest AIHA-LAP, LLC site assessor's checklist and latest NELAC assessor's checklist shall be used for this internal systems audit, to ensure that all elements are evaluated.

### **9.2.1 Internal Quality and Management Systems Audit**

The Quality Assurance Officer, Laboratory Manager, Laboratory Technical Director or other trained staff may perform internal Quality and Management Systems Audits. All discrepancies and deviations are immediately documented for review and subsequent correction by internal administration and personnel through the corrective action program. It is the intention of laboratory management to perform internal Quality and Management Systems Audits annually.

### **9.2.2 Internal Method Audits**

The Quality Assurance Officer, Laboratory Manager, Laboratory Technical Director or other trained staff may perform internal method audits. All discrepancies and deviations are immediately documented for review and subsequent correction by internal administration and personnel through the corrective action program. It is the intention of laboratory management to audit each method annually. These internal method audits ensure that methods are being followed, SOPs are up to date, each method gets data validated, and also incorporate data integrity checks. These audits consist of both quality control and quality assurance review.

### **9.2.3 External Audits**

In the maintenance of certification and accreditation, external laboratory agencies require system audits by agency personnel to be performed. Upon issuance of a system audit report by said agencies to the Quality Assurance Officer, the laboratory shall be required to correct cited audit deficiencies. Continued certification and accreditation normally is based upon fulfillment of audit corrective actions to cited deficiencies.

### **9.2.4 Audit Findings and Corrective Action**

Upon completion and issuance of audit reports to the Quality Assurance Officer, audit deficiencies and findings are codified per major laboratory area. The findings are then presented to the Laboratory Director for review, evaluation, and formulation of corrective action implementation strategies.

## **9.3 Corrective actions/Preventative Actions**

### Outline for Corrective/Preventative Actions:

- 1) Discovery/identification
- 2) Determination of root cause(s) via root cause analysis
- 3) Identify potential corrective action(s)
- 4) Choose according to the magnitude and risk of the problem
- 5) Implement the corrective action(s)
- 6) Monitor

For more details regarding the Corrective Action/Preventative Action Program, refer to SOP Corrective Actions/Preventative Actions, document number 84.

- 9.3.1** A problem with the management system or with technical operations may be identified through a variety of activities, including nonconforming work, internal/external audits, QA & management reviews, customer feedback/inquiries, and from staff observations. This is the discovery/identification step of the corrective/preventative action process.

A corrective action will be initiated as soon as possible with a due date of 2 weeks. More complex corrective actions will be assigned an appropriate longer time frame. A follow-up will then take place a month after the corrective action is completed.

- 9.3.2** The procedure for corrective action shall start with an investigation to determine the root cause(s) of the problem. Each investigation (root cause analysis) is different based upon the type of nonconformance, complexity of the problem, and range of impact. The points to take in to consideration when doing a root cause analysis are: personnel, samples, methods, controls and data. For details on each point, refer to SOP Corrective Actions/Preventative Actions, document number 84.

- 9.3.3** The laboratory documentation and records of all non-conforming events requiring corrective action shall include the determined cause(s) and corrective action taken. Where corrective action is needed, the laboratory shall identify potential corrective actions. It shall select and implement the action(s) most likely to eliminate the problem and prevent recurrence. Corrective actions shall be appropriate to the magnitude and risk of the problem.

- 9.3.4** After the best corrective/preventative action is chosen, it will be implemented immediately and monitored for effectiveness through follow-up investigations and if warranted put into the policing program. If deemed necessary, an internal audit will be conducted in that area of activity the issue occurred as soon as possible.

- 9.3.5** Preventative actions are defined as a change implemented to address a weakness in the management system that is not yet responsible for causing non-conforming work. Its main focus is to avoid creating non-conformances and commonly include improvements in efficiency. Any time a more efficient way is found in the lab a preventative action should be filed.

#### **9.4 Risks and opportunities**

- 9.4.1** The laboratory shall consider the risks and opportunities associated with the laboratory activities in order to:
- a) give assurance that the management system achieves its intended results;
  - b) enhance opportunities to achieve the purpose and objectives of the laboratory;

- c) prevent, or reduce, undesired impacts and potential failures in the laboratory activities;
  - d) achieve improvement.
- 9.4.2** The laboratory shall plan: actions to address these risks and opportunities; and how to integrate and implement these actions into its management system; and evaluate the effectiveness of these actions.
- 9.4.3** Actions taken to address risks and opportunities shall be proportional to the potential impact on the validity of laboratory results.
- 9.4.4** Risks and opportunities are assessed with each new bid, contract, QAPP, change of vendor, new employee hire or any new situation encountered by Con-Test by the applicable management personnel.

## **9.5 Improvements**

- 9.5.1** The laboratory shall identify and select opportunities for improvement and implement any necessary actions. Opportunities for improvement can be identified through the review of the operational procedures, the use of the policies, overall objectives, audit results, corrective actions, management review, suggestions from personnel, risk assessment, analysis of data, and proficiency testing results.
- 9.5.2** The laboratory shall seek feedback, both positive and negative, from its customers. The feedback shall be analyzed and used to improve the management system, laboratory activities and customer service. Examples of types of feedback include customer satisfaction surveys, communication records and review of reports with customers.
- 9.5.3** Con-Test sends out a survey with each final report to the client and additionally conducts an annual survey. Client services management uses the results of the survey to make improvements to the company.

## **10.0 Analytical Methods**

### **10.1 Selection and verification of methods**

- 10.1.1** The laboratory shall use appropriate methods and procedures for all laboratory activities and, where appropriate, for evaluation of the measurement uncertainty as well as statistical techniques for analysis of data.
- 10.1.2** All methods, procedures and supporting documentation, such as instructions, standards, manuals and reference data relevant to the laboratory activities, shall be kept up to date and shall be made readily available to personnel.
- 10.1.3** The laboratory shall ensure that it uses the latest valid version of a method unless it is not appropriate or possible to do so. When necessary, the application of the method shall be supplemented with additional details to ensure consistent application.
- 10.1.4** When the customer does not specify the method to be used, the laboratory shall select an appropriate method and inform the customer of the method

chosen. Methods published either in international, regional or national standards, or by reputable organizations, or in relevant scientific texts or journals, or as specified by the manufacturer of the equipment, are recommended. Laboratory-developed or modified methods can also be used.

- 10.1.5** The laboratory shall verify that it can properly perform methods before introducing them by ensuring that it can achieve the required performance. Records of the verification shall be retained. If the method is revised by the issuing body, verification shall be repeated to the extent necessary.
- 10.1.6** When method development is required, this shall be a planned activity and shall be assigned to competent personnel equipped with adequate resources. As method development proceeds, periodic review shall be carried out to confirm that the needs of the customer are still being fulfilled. Any modifications to the development plan shall be approved and authorized.
- 10.1.7** Deviations from methods for all laboratory activities shall occur only if the deviation has been documented, technically justified, authorized, and accepted by the customer.

## **10.2 Validation of Methods**

- 10.2.1** The laboratory shall validate non-standard methods, laboratory-developed methods and standard methods used outside their intended scope or otherwise modified. The validation shall be as extensive as is necessary to meet the needs of the given application or field of application.
- 10.2.2** When changes are made to a validated method, the influence of such changes shall be determined and where they are found to affect the original validation, a new method validation shall be performed.
- 10.2.3** The performance characteristics of validated methods, as assessed for the intended use, shall be relevant to the customers' needs and consistent with specified requirements.
- 10.2.4** The laboratory shall retain the following records of validation:
  - a) The validation procedure used;
  - b) Specification of the requirements;
  - c) Determination of the performance characteristics of the method;
  - d) Results obtained;
  - e) A statement on the validity of the method, detailing its fitness for the intended use.

- 10.3** The following is a listing of analytical methods commonly utilized by Con-Test Analytical Laboratory. Deviations from tests and calibration methods shall occur only if the deviation has been documented, technically justified, authorized, and accepted by the client. Deviations will be noted on the final report.

*Please note: This is not a complete listing of analytical method. For information concerning other utilized analytical methods contact one of our project chemists.*

**Analytical Methodology**  
**Water/Wastewater**

<u>Bacteriological Analyses</u>	<u>Method Number</u>	<u>Reference</u>
Coliform, Total	SM 9222B	8
	SM 9223 (Colisure)	8
	SM 9223B-Colilert	8
Coliform, Fecal	SM 9222D	8
	SM 9223B-Colilert18	8
E.coli	SM 9223B-Colilert	8
Enterococci	SM 9223 (Enterolert)	8
Heterotrophic Plate Count (HPC)	Simplate	8

<u>Inorganic Mineral Analyses</u>	<u>Method Number</u>	<u>Reference</u>
Alkalinity (Titrimetric)	SM 2320 B	8
Chloride (Argentometric) Chloride (IC)	SM 4500-Cl B	8
	EPA 300.0	21
Chromium, Hexavalent (Manual, Colorimetric)	SM 3500-Cr B	8
	SW-846 7196 A	3
Conductivity (Wheatstone Bridge)	SM 2510 B	8
Dissolved Oxygen (Membrane electrode method)	SM 4500-O G	8
Ferrous Iron (Spectrophotometric)	SM 3500-Fe D	8
Fluoride (Ion Selective Electrode) Fluoride (IC)	SM 4500-F C	8
	EPA 300.0	21
Hardness (Titrimetric, EDTA) pH (Electrode)	SM 2340 C	8
	SM 4500-H B	8
	SW-846 9040 B	3
Solids, Total	SM 2540 B	8
Solids, Total Dissolved	SM 2540 C	8
Solids, Total Suspended	SM 2540 D	8
Solids, Settleable	SM 2540 F	8
Sulfate (Turbidimetric)	ASTM D516	15

Sulfate (IC)	EPA 300.0	21
Sulfide (Iodometric Back Titration)	SM 4500-S <sup>2</sup> F	8

<u>Nutrient Analyses</u>	<u>Method Number</u>	<u>Reference</u>
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Ammonia-N	SM 4500-NH <sub>3</sub> C -titration	8
Ammonia-N	EPA 350.1 Semi-Automated	27
Nitrite-N (Manual Spectrophotometer)	SM 4500-NO <sub>2</sub> B	8
Nitrite (IC)	EPA 300.0	21
Nitrate-N and Nitrite (Discrete Gallery) Enzymatic Reduction	Systea Easy (1-Reagent)	26
Nitrate (IC)	EPA 300.0	21
Total Kjeldahl Nitrogen (Organic N) (Titrimetric)	SM (19-21) 4500-N <sub>org</sub> B, C	8
Phosphate, Ortho (Colorimetric)	SM 4500-P E	8
Phosphate, Ortho (IC)	EPA 300.0	21
Phosphate, Total (Colorimetric)	SM 4500-P E	8

<u>Demand Analyses</u>	<u>Method Number</u>	<u>Reference</u>
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BOD (5 day) (Dissolved Oxygen Consumption)	SM 5210 B	8
CBOD (5 day) (Carbonaceous DO Consumption)	SM 5210 B	8
COD (Colorimetric)	EPA 410.4	1
Chlorine, Total Residual (Colorimetric)	SM 4500-Cl G	8
TOC (Total Organic Carbon)	SM 5310 B	8

<u>Physical Analyses</u>	<u>Method Number</u>	<u>Reference</u>
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Color (Visual Comparison)	SM 2120 B	8
Odor (Threshold Odor)	SM 2150 B	8
Turbidity (Nephelometric)	EPA 180.1	1

<u>Other</u>	<u>Method Number</u>	<u>Reference</u>
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Bromide (IC)	EPA 300.0	21
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Oil and Grease (FOG) (Hexane Extraction)	SW-846 1664B	22
Phenols (Colorimetric)	EPA 420.1	1
Cyanide, Total (Manual Spectrophotometer)	SM 4500-CN E	8
	SW-846 9014	3
Physiologically Available Cyanide (Manual Spec.)	SW-846 9014	16
<b><u>Volatile Organics</u></b>	<b><u>Method Number</u></b>	<b><u>Reference</u></b>
Purgeable Aromatics (GC)	EPA 602	4
Purgeables (GC/MS)	EPA 624.1	4
Drinking Water Purgeables (GC/MS)	EPA 524.2	5
EDB/DBCP	EPA 504.1	5
<b><u>Semi-Volatile Organics</u></b>	<b><u>Method Number</u></b>	<b><u>Reference</u></b>
Base/Neutrals & Acids	EPA 625.1	4
Priority Pollutants Pesticides/PCB's	EPA 608.3	4
CT Extractable Petroleum Hydrocarbons	CT ETPH	12
MA Volatile Petroleum Hydrocarbons	MA VPH	13
MA Extractable Petroleum Hydrocarbons	MA EPH	14
<b><u>Other Organics</u></b>	<b><u>Method Number</u></b>	<b><u>Reference</u></b>
PFAA's (LC/MS/MS)	EPA 537.1	23
PFAA's (LC/MS/MS)	ISO 25101	24

#### **Metals Analyses**

Waters, soils and other materials may be analyzed for metals by Inductively Coupled Argon Plasma – Atomic Emission Spectroscopy (ICP) and/or Inductively Coupled Plasma Mass Spectrometry (ICP-MS). Non-aqueous samples are generally treated as a solid waste and SW-846 methods are applied.

Analyte	Water/ Wastewater (Ref 3, 18, 20)	Drinking Water (Ref 18, 20)	Non-Aqueous (Solids/Wastes) (Ref 3)
Aluminum (Al)	200.7/6010C+D 6020B	200.7	6010C+D/6020 A+B
Antimony (Sb)	200.7/6010C+D 200.8/6020A+B	200.8	6010C+D/6020A+B
Arsenic (As)	200.7/6010C+D 200.8/6020A+B	200.8	6010C+D/6020A+B
Barium (Ba)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Beryllium (Be)	200.7/6010C+D 200.8/6020A+B	200.8	6010C+D/6020A+B
Boron (B)	200.7/6010C+C	200.7	6010C+D
Cadmium (Cd)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Calcium (Ca)	200.7/6010C+D	200.7	6010C+D
Chromium (Cr)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Cobalt (Co)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Copper (Cu)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Iron (Fe)	200.7/6010C+B 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Lead (Pb)	200.7/6010C+D 200.8/6020A+B	200.8	6010C+D/6020A+B
Magnesium (Mg)	200.7/6010C+D	200.7	6010C+D
Manganese (Mn)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B

Mercury (Hg)	245.1/7470A	245.1	7471B
Molybdenum	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Nickel (Ni)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Potassium (K)	200.7/6010C+D	200.7	6010C+D
Selenium (Se)	200.7/6010C+D 200.8/6020A+B	200.8	6010C+D/6020A+B
Silver (Ag)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Sodium (Na)	200.7/6010C+D	200.7	6010C+D
Thallium (Tl)	200.7/6010C+D 200.8/6020A+B	200.8	6010C+D/6020A+B
Tin (Sn)	200.7/6010C+D	200.7	6010C+D
Vanadium (V)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B
Zinc (Zn)	200.7/6010C+D 200.8/6020A+B	200.7/200.8	6010C+D/6020A+B

Note: EPA Method 200.7 and SW-846 Method 6010C+D are “Inductively Coupled Plasma – Atomic Emission Spectroscopy” (ICP) methods.

Note: EPA Method 200.8 and SW-846 Method 6020A+B are “Inductively Coupled Plasma Mass Spectrometry” (ICP-MS) methods.

**Analytical Methodology**  
**Test Methods for Evaluating Solid Wastes; SW-846**

<u>Waste Evaluation</u>	<u>Method Number</u>	<u>Reference</u>
Paint Filter Liquids Test	SW-846 9095A	3
Corrosivity (pH solid)	SW-846 9045	3

Flashpoint	SW-846 1010A	3
Ignitability	SW-846 1030	3
Reactivity: Cyanide and Sulfide	SW-846 Chapter 7.3.3.2	3
TCLP (Toxicity Char. Leaching Procedure)	SW-846 1311	3
SPLP (Synthetic Precipitation Leaching Procedure)	SW-846 1312	3
PCB in Oil	EPA 600/4-81-045	17
Total Organic Carbon (TOC)	SW-846 9060A	3
Cyanide	SW-846 9014	3
Hexavalent Chromium (FCr+6)	SW-846 7196A	3

**Sample Preparation Methods**

<b><u>Inorganic Prep Techniques</u></b>	<b><u>Method Number</u></b>	<b><u>Reference</u></b>
Acid digestion of Aqueous samples	3005A/3010C	3
Acid digestion for Oils, Greases, and Waxes	3051A	3
Acid digestion of Sediments and Sludges	3050B	3
Microwave Extraction	3051A	3
<b><u>Organic Prep Techniques</u></b>	<b><u>Method Number</u></b>	<b><u>Reference</u></b>
Separatory Funnel Liquid-Liquid Extraction	3510C	3
Sonication Extraction	3550B	3
Pressurized Fluid Extraction	3545	3
Microwave Extraction	3546	3
Soxhlet Extraction	3540C	3

<u>Organic Analytical Methods</u>	<u>Method Number</u>	<u>Reference</u>
Priority Pollutant Pesticides/PCB's	8081B/8082A	3
GC/MS Method for Volatile Organics	8260C/D	3
GC/MS Method for Semi-Volatile Organics	8270C/D/E	3
Fuel Hydrocarbons	8015M	3*
Fuel Hydrocarbons	8100M	3*
GRO and DRO	8015C/D	3
Herbicides	8151A	3
CT Extractable Petroleum Hydrocarbons	CT ETPH	12
Volatile Petroleum Hydrocarbons	MA VPH	13
Extractable Petroleum Hydrocarbons	MA EPH	14

M = Modified \* = In-house Standard Operating Procedure

**Environmental Lead  
 Commonly Utilized Methodology**

<b>Air</b>	NIOSH 7303, Lead ICP-AES
<b>Paint</b>	SW-846 Modified Method 6010C (3050B), Lead ICP-AES
<b>Dust Wipes</b>	SW-846 Modified Method 6010C (3050B), Lead ICP-AES
<b>Soil</b>	SW-846 Method 6010C (3050B), Lead ICP-AES

**Analytical Methodology – Air**

<u>Analyte</u>	<u>Collection Media</u>	<u>Method No.</u>
Metals:		Modified NIOSH
Arsenic (As)	37 mm Cassette w/MCE Filter	7303 (6)
Beryllium (Be)	37 mm Cassette w/MCE Filter	7303 (6)
Cadmium (Cd)	37 mm Cassette w/MCE Filter	7303 (6)
Chromium (Cr)	37 mm Cassette w/MCE Filter	7303 (6)
Copper (Cu)	37 mm Cassette w/MCE Filter	7303 (6)
Lead (Pb)	37 mm Cassette w/MCE Filter	7303 (6)
Nickel (Ni)	37 mm Cassette w/MCE Filter	7303 (6)

Zinc (Zn)	37 mm Cassette w/MCE Filter	7303	(6)
Metals by ICP	37 mm Cassette w/MCE Filter	7303	(6)

Note: Only the most commonly requested Air Analyses Methods are listed. Other analytes and alternative methods are available. Please check with project chemist for more details.

**Note: It is required that a blank be submitted for all wipe and air analyses**

<u>Analyte</u>	<u>Analytical Methodology – Air</u>	
	<u>Collection Media</u>	<u>Method No.</u>
Dust, Total	37 mm Cassette w/PVC Filter	0500 (6)
Dust, Respirable	37 mm Cassette w/PVC Filter	0600 (6)
PCB'S in Air	Florisil Sorbent Tubes	5503 (6)
Hg in Air	Hopcalite Sorbent Tube	6009 (6)
TO-4	PUF	10
TO-10A	PUF	10
TO-13A	PUF	10
TO-14/TO-15	Summa Canister	10
APH	Summa Canister	11
Method 3C (Fixed Gases)	Summa Canister	9
TO-17	Sorbent Tube	10

### References

- 1.0 USEPA – “Methods for Chemical Analysis of Water and Wastes” – EPA 600/4-79-020, Revised 1983.
- 2.0 APHA – “Standard Methods for the Examination of Water and Wastewater”, 17<sup>th</sup> edition, 1989.
- 3.0 USEPA – “Methods for Evaluating Solid Waste, Physical/Chemical Methods”, 3<sup>rd</sup> edition, USEPA November, 1986 (SW846), and updates. (Update V, Rev 5, July 2014)
- 4.0 “Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act”, 40CFR Part 136.
- 5.0 USEPA – “Methods for the Determination of Organic Compounds in Drinking Water”, EPA 600/4-88/039, December 1988, and updates.
- 6.0 NIOSH Manual of Analytical Methods
- 7.0 OSHA Manual of Analytical Methods

- 8.0 APHA – “Standard Methods for the Examination of Water and Wastewater”, 18<sup>th</sup>, 19<sup>th</sup>, 20<sup>th</sup>, 21<sup>st</sup>, 22<sup>nd</sup>, 23<sup>rd</sup> Editions
- 9.0 EPA Technology Transfer Network Emission Measurement Center. CFR Promulgated Test Methods <http://www.epa.gov.ttn/emc/promgate.html>
- 10.0 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air.
- 11.0 Method for the Determination of Air-Phase Petroleum Hydrocarbons (APH). Public Comment Draft 1.0, Massachusetts DEP, ORS, BWSC. February 2000.
- 12.0 Analysis of Extractable Petroleum Hydrocarbons (ETPH) Using Methylene Chloride GC/FID. University of Connecticut ERI. March 1999.
- 13.0 Method for Determination of Volatile Petroleum Hydrocarbons (VPH). Massachusetts DEP, ORS, BWSC. Rev 2.1, February 2018.
- 14.0 Method for the Determination of Extractable Petroleum Hydrocarbons (EPH). Massachusetts DEP, ORS, BWSC. Revision 1.1, May 2004.
- 15.0 ASTM, “American Society of Testing and Materials”, 2002
- 16.0 “Method for the Determination of Physiologically Available Cyanide (PAC)”, Massachusetts DEP, ORS, BWSC, August 2004.
- 17.0 “The Determination of PCB’s in Transformer, Fluid and Waste Oils”, USEPA Method EPA 600/4-81-045, September 1982.
- 18.0 USEPA Supplement 1 of “Methods for the Determination of Metals in Environmental Samples”, EPA 600R-94-11, May 1994, Method EPA 200.7, Rev 4.4. EMMC Version 1994.
- 19.0 USEPA Supplement 1 of “Methods for the Determination of Metals in Environmental Samples”, EPA 600R-94-11, May 1994, Method EPA 245.1, Rev 3.0 EMMC Version 1994.
- 20.0 USEPA Supplement 1 of “Methods for the Determination of Metals in Environmental Samples”, EPA 600R-94-11, May 1994, Method EPA 200.8, Rev 5.4. EMMC Version 1994.
- 21.0 USEPA “Methods for Determination of Inorganic Substances in Environmental Samples”, EPA 300.0 (Determination of Inorganic Anions by Ion Chromatography”), Rev 2.1, August 1993.
- 22.0 “Method 1664, Revision B: N-Hexane Extractable Material (HEM: Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM; Non-Polar Material) by Extraction and Gravimetry”, EPA-821-R-98-002; PB99-121949, February 2010.

- 23.0 EPA Method 537 and EPA 537.1, "Determination of Selected Perfluorinated Alkyl acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS)", Version 1.1, September 2009.
- 24.0 Method ISO 25101:2009, "Determination of perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) – Method for unfiltered samples using solid phase extraction and liquid chromatography/mass spectrometry", April 30, 2009.
- 25.0 "TNI NELAC Standard", The NELAC Institute, Rev 2009 and Rev 2016.
- 26.0 Systea Easy (1-Reagent) Nitrate Method, Revision November 12, 2011. Craig Chinchilla
- 27.0 40 CFR 136 – Table of approved EPA methods

## 11.0 Sampling and Preservation Requirements

Information shall be available to clients through Con-Test Analytical Laboratory. Con-Test Analytical Laboratory will assist clients in obtaining information regarding recommended procedure, sampling materials, sampling containers, preservatives, and shipping instructions. This includes laboratory request for client submittal of field blanks or blank sampling media. Con-Test will also direct clients to the appropriate agencies (Federal, State, Local Officials, Field Services, and Consulting Services, etc.) or channels when information is unavailable through the laboratory. This information is available upon request, through our project chemists. Multiple tests may be able to be combined in one container as long as sufficient sample amount is submitted or method dictates otherwise. Please consult the laboratory on which ones.

### Sampling and Preservation Requirements

#### Water

**Key:**

*Holding Time = Time allowable between time of sampling and before specified analysis begins.*

*Parameter = Test      mL = Milliliters      P = Polyethylene Container*

*G = Glass Container      P/G = Either P or G      HNO<sub>3</sub> = Nitric Acid*

*H<sub>2</sub>SO<sub>4</sub> = Sulfuric Acid      NaOH = Sodium Hydroxide      Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> = Sodium Thiosulfate*

<u>Parameter</u>	<u>Container</u>	<u>Preservative</u>	<u>Holding Time</u>
Alkalinity	100 mL P/G (Needs its own container with no headspace)	Cool to 4°C	14 Days
Ammonia (as N)	100 mL P/G	Cool to 4°C, H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Bacteria Tests (T.Coliform) And Enterococci	100 mL P Bacteria cup	0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> Cool to 4°C	30 Hours
Fecal Coliform	100 mL P Bacteria cup	0.008% Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> Cool to 4°C	6 Hours

Biological Oxygen Demand (BOD)	1000 mL P/G	Cool to 4°C	48 Hours
Carbonaceous BOD	1000 mL P/G	Cool to 4°C	48 Hours
Chemical Oxygen Demand (COD)	50 mL P/G	Cool to 4°C, H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Chloride	200 mL P/G	None required	28 Days
Chlorine, Residual	100 mL P/G	None required	Analyze Immediately
Color	100 mL P/G	Cool to 4°C	48 Hours
Cyanide, Total and Amenable	500 mL P/G	Cool to 4°C NaOH to pH>12 0.6g Ascorbic <sup>1</sup>	14 Days <sup>2</sup>
PAC	500 mL G	NaOH to pH>12	14 Days
Ferrous Iron	500 mL P/G	HNO <sub>3</sub> to pH<2	6 months (48 hrs. if Unpreserved)
Fluoride	100 mL P	None required	28 Days
Hardness	100 mL P/G	HNO <sub>3</sub> or H <sub>2</sub> SO <sub>4</sub> to pH<2	6 months
Ignitability	50 mL P/G	Cool to 4°C	ASAP/7 days
Metals 500 mL P(A)/G(A)	HNO <sub>3</sub> to pH<2	6 months	
Chromium, Hexavalent	200 mL, P(A)/G(A) MCP soils need its own container	Cool to 4°C	24 Hours
Mercury	200 mL, P(A)/G(A)	HNO <sub>3</sub> to pH<2	28 Days
TKN	200 mL P/G	H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Nitrate/Nitrite as N	50 mL P/G	Cool to 4°C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Nitrate as N	50 mL P/G	Cool to 4°C	48 Hours
Nitrite as N	50 mL P/G	Cool to 4°C	48 Hours
Odor	200 mL G only	Cool to 4°C	Analyze Immediately
Oil and Grease	1 Liter G only	Cool to 4°C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Total Organic Carbon (TOC)	25 mL P/G or 40mL VOA vial	Cool to 4°C H <sub>2</sub> SO <sub>4</sub> or HCL to pH<2	28 Days
Orthophosphate	100 mL P(A)/G(A)	Cool to 4°C	48 Hours Field Filtered within 15 minutes
Dissolved Oxygen	300 mL G	None required	Analyze Immediately

pH	30 mL P/G	Cool to 4°C	Analyze Immediately
Total Phenol	500 mL Amber G	Cool to 4°C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Total Phosphate	100 mL P/G	Cool to 4°C H <sub>2</sub> SO <sub>4</sub> to pH<2	28 Days
Settleable Solids	1000 mL P/G	Cool to 4°C	48 Hours
Total Solids (TS)	100 mL P/G	Cool to 4°C	7 Days
Total Suspended Solids (TSS)	100 mL P/G	Cool to 4°C	7 Days
Total Dissolved Solids (TDS)	100 mL P/G	Cool to 4°C	7 Days
Specific Conductance (Conductivity)	100 mL P/G	Cool to 4°C	28 Days
Sulfate	250 mL P/G	Cool to 4°C	28 Days
Sulfide	100 mL P/G	Cool to 4°C Add 4 drops of 2N Zinc acetate, NaOH pH>9	7 Days
Surfactants (MBAS)	500 mL P/G	Cool to 4°C	48 Hours
Turbidity	50 mL P/G	Store in a dark place Cool to 4°C	48 Hours

<sup>1</sup> Should only be used in the presence of residual chlorine.

<sup>2</sup>Maximum holding time is twenty-four hours when sulfide is present. Optionally, Sulfide can be removed by the Addition of cadmium nitrate (etc.) powder before preservation until a negative spot test is obtained on lead acetate test paper.

<u>Parameter</u>	<u>Container</u>	<u>Preservative</u>	<u>Holding Time</u>
Volatile Organics (602, 624)	(2) 40 mL VOA Vials w/Teflon lined lid	Cool to 4°C HCL to pH<2, Zero headspace	14 Days
Base Neutral/Acid extractables (625)	(2) Liter amber G, w/Teflon lined lid	Cool to 4°C	7 Days until extraction 40 Days after ext.
Pesticide extraction (608/8081B)	(2) 1 Liter amber G, w/Teflon lined lid	Cool to 4°C pH 5-9	7 Days until extraction 40 Days after ext.
Herbicide extraction	(2) 1 Liter amber G,	Cool to 4°C	7 Days until extraction 40 Days after ext.
EDB/DBCP (504.1)	(2) 40 mL VOA Vials w/Teflon lined lid	Cool to 4°C HCL to pH<2, Zero headspace	28 Days
Polychlorinated Biphenyls (PCBs) (608/8082A)	(2) 1-Liter amber G, w/Teflon lined lid	Cool to 4°C	CT – 7 Days until ext. MA – 1 yr. until ext. 40 Days after ext. NO HT under SW-846
Purgeable Aromatic Hydrocarbons	(2) 40 mL VOA	Cool to 4°C	14 Days

(602)	Vials w/Teflon lined lid	HCL to pH<2, Zero headspace	
Benzene, Toluene, Xylene (BTEX, 602)	(2) 40 mL VOA Vials w/Teflon lined lid	Cool to 4°C HCL to pH<2, Zero headspace	14 Days
Total Organic Halogens (TOX)	250 mL amber G, w/Teflon lined lid	Cool to 4°C Zero headspace	14 Days
Total Petroleum Hydrocarbons (TPH)	1 Liter amber G, w/Teflon lined lid	Cool to 4°C H <sub>2</sub> SO <sub>4</sub> to pH<2	14 Days
PFAA's (EPA 537.1)	250 mL Polypropylene bottle With polypropylene screw cap	Cool to 4°C	14 days to extract 28 days from ext

### Sampling and Preservation Requirements Solids

<u>Parameter</u>	<u>Container</u>	<u>Preservative</u>	<u>Holding Time</u>
Volatile Organics (8260C/D)	(1) 8 oz. Amber G, w/Teflon lined lid	Cool to 4°C	14 Days
Volatile Organics (8260C/D with 5035)	(3) 40 mL VOA Vials w/Teflon lined lid	Cool to 4°C (2)vials preserved w/ Na Bisulfate (1)vial preserved w/ methanol	14 Days
Base Neutral/Acid Extractables (8270D/E)	(1) 8 oz. G w/Teflon lined lid	Cool to 4°C	7 Days until ext. 40 Days after ext.
Herbicides (8151A)	(1) 8 oz. G w/Teflon lined lid	Cool to 4°C	14 Days
Pesticides (8081B)	(1) 8 oz. G w/Teflon lined lid	Cool to 4°C	7 Days until ext. 40 Days after ext.
PCB (8082A)	(1) 8 oz. G w/Teflon lined lid	Cool to 4°C	CT – 7 Days until ext. MA – 1 year until ext. 40 Days after ext. No HT under SW-846
Benzene, Toluene, Xylenes (BTEX)	(1) 8 oz. G w/Teflon lined lid	Cool to 4°C	14 Days
Total Petroleum Hydrocarbons (TPH)	(1) 8 oz. G w/Teflon lined lid	Cool to 4°C	14 Days
Cyanide	20 Grams P/G	Cool to 4°C	N/A
Metals, Total	(1) 8 oz. G w/Teflon lined lid	Cool to 4°C	6 Months
TKN	20 Grams P/G	Cool to 4°C	N/A

Total Organic Carbon (TOC)	10 Grams P/G	Cool to 4°C	N/A
pH	50 Grams P/G	Cool to 4°C	N/A

### Hazardous Waste Characterization

TCLP Metals	(2) 8 oz. glass containers
Reactivity PCB's	with a Teflon lined lid is
Volatile Organics	sufficient sample amount to
Corrosivity	perform Hazardous Waste
Reactivity	characterization
-Cyanide	
-Sulfide	

### EPA Method 1311 – TCLP Sampling Requirements Aqueous Liquid Samples (approx. 100% liquid)

Volatile Organics: (2) 40 mL VOA vials with no head space  
8 RCRA Metals: (1) 500 mL Nalgene Bottle  
BNA's: (2) One liter amber wide mouth glass bottles with Teflon lined lid  
Pesticides/Herbicides: (2) One liter amber wide mouth glass bottles with Teflon lined lid

### Solid Samples (approx. 100% solid or paint)

(1) 8 oz. wide mouth glass jar with Teflon lined cap packed tightly

### Mixed Samples (solid mixed with water or mostly water)

Please contact laboratory as to the nature of the material so that appropriate sample amounts will be provided.

### Non-Aqueous Liquid (mostly solvent)

(1) 4 oz. wide mouth glass jar (with Teflon lined cap)

Note: TCLP analysis is generally inappropriate; sample will be run to determine percent of suspected solvents.

## 12.0 Personnel Qualifications: Training

### 12.1 Personnel

Con-Test is committed to producing and utilizing technically competent, well trained individuals. Each new analyst undergoes a Quality Assurance/Control Policy Orientation and reads the current copy of the Quality Assurance Manual. They must sign off that

they have read the current QA Manual as well as any other appropriate controlled SOP's. Analysts will also read any applicable method that corresponds to the SOP's they've read. A Data Integrity and Ethics class is provided which they will have annual refreshers of and they will receive any needed supplies.

- 12.1.1** All personnel of the laboratory, either internal or external, that could influence the laboratory activities shall act impartiality, be competent and work in accordance with the laboratory's management system.
- 12.1.2** The laboratory shall document the competence requirements for each function influencing the results of laboratory activities, including requirements for education, qualification, training, technical knowledge, skills and experience.
- 12.1.3** The laboratory shall ensure that the personnel have the competence to perform laboratory activities for which they are responsible and to evaluate the significance of deviations.
- 12.1.4** The management of the laboratory shall communicate to personnel their duties, responsibilities and authorities.
- 12.1.5** The lab has procedures and retains records for:
  - 12.1.5.1** Determining the competence requirements (see section 2.0)
  - 12.1.5.2** Selection of personnel
  - 12.1.5.3** Training of personnel
  - 12.1.5.4** Supervision of personnel
  - 12.1.5.5** Authorization of personnel
  - 12.1.5.6** Monitoring competence of personnel
- 12.1.6** The laboratory shall authorize personnel to perform specific laboratory activities, including but not limited to, the following:
  - 12.1.6.1** Development, modification, verification and validation of methods
  - 12.1.6.2** Analysis of results, including statements of conformity or opinions and interpretations
  - 12.1.6.3** Report, review, and authorization of results.

## **12.2 Employee Training**

It is the responsibility of the Laboratory Director to ensure that the staff is competent to perform laboratory analysis. Laboratory staff is trained by experienced analysts and supervisors in techniques where proficiency has been demonstrated by past performance. New analysts continue to perform under the supervision and direction of experienced analysts until sufficient information is obtained for Demonstration of Capability (DOC). See section 12.6.

AIHA-LAP, LLC IHLAP/ELLAP trainees must have a training period of 20 business day's duration, prior to completing a DOC and working independently on client samples. This 20-day period must be clearly documented on the IDOC training form.

A Demonstration of Capability must be performed prior to using any test method, and any time there is a change in instrument type, personnel, or method. The laboratory,

through QC charting, has historical data adequately demonstrating current analyst capability to meet laboratory generated acceptance criteria.

Where the analyst has demonstrated capability through analysis and QC charting of Laboratory Control Samples with acceptable results, this procedure for demonstrating continued proficiency to perform the test method will be used for the DOC Certification Statement. All new analysts will perform an initial DOC. Continued proficiency can also be demonstrated through acceptable performance on proficiency samples.

Laboratory staff performing in-house calibrations and verifications shall have received documented training. This includes in-house verifications of thermometers and Eppendorf's. All personnel concerned with testing and calibration activities within the laboratory will familiarize themselves with the quality documentation and implement the policies and procedures in their work.

### 12.3 Training Documentation

Laboratory personnel performance is documented throughout training and the time spent at Con-Test. Employees are evaluated on a regular basis and their performance on external and internal proficiency samples documented.

The laboratory will maintain a training file, which contains:

- 1) A statement from each employee that they have read, understood, and is using the latest version of the laboratory Quality Assurance Manual and SOP's. The statement will be signed and dated.
- 2) A statement from each employee that they have read acknowledged and understood their personal ethical and legal responsibilities including the potential punishments and penalties for improper, unethical, or illegal actions. The statement will be signed and dated.
- 3) A Demonstration of Capability (DOC) for each employee for each accredited method.
- 4) Documentation of any training courses, seminars, and/or workshops.
- 5) Documentation of each employee's continued proficiency to perform each test method by one of the following annually:
  - a) Acceptable performance of a blind sample (single blind to the analyst) for each method;
  - b) Another Demonstration of Capability;
  - c) Successful analysis of a blind performance sample on a similar test method using the same technology (e.g. GC/MS volatiles by purge and trap for Methods 524.2, 624.1, or 8260) would only require documentation for one of the test methods;

- d) At least four consecutive Laboratory Control Samples with acceptable levels of precision and accuracy;
- e) If a-d cannot be performed, analysis of authentic samples that have been analyzed by another trained analyst with statistically indistinguishable results.

#### 12.4 Metals Analysis Training Program (As required per ELLAP)

##### Environmental Lead Analysis

Prospective analysts for Lead in environmental samples shall have training and aptitude in chemistry, biology, physics, or a related physical science. Analysts receive specific training in the techniques required for analysis either formally from an instrument manufacturer, an educational institution or on-the-job (in house).

In house (on-the job) training proceeds as follows:

New analysts are required to read the instrument manual regarding operation of the instrument, calibration, hardware and software. The analyst is also required to read the relevant Laboratory Standard Operating Procedures and review reference methods in the appropriate methods manuals. This is done under the supervision of the metals section supervisor.

After a mandatory QA orientation, each analyst is then taught, one-on-one, the daily operating procedures for the respective methods concerning preparation of standards, order of analysis, QC criteria, operation of the instrument from start-up to shut-down, as well as the operation of any auxiliary software for the calculation of results. Conditions for data rejection are discussed along with the proper procedure to be followed when an out of control event occurs.

Each analyst is required to run external reference samples to determine his/her proficiency in the operation of the instrument before he/she is allowed to do sample determinations. Sample preparation personnel must be trained in the proper use of the analytical balance, preparation of glassware, and volumetric techniques. Previous training is acceptable as long as the metals section supervisor evaluates the performance of the prospective analyst through observation and comparison of standard reference preparations with known values. Analysts and technicians are trained using AIHA-LAP, LLC Policy:

*All analysts and technicians shall be trained with the SOP's in use in the laboratory and with the instrument and equipment operation manuals. All analysts and technicians shall complete a minimum of four (4) independent test runs of sample preparation and/or instrumental analysis for each matrix.*

*Independent runs are defined as analytical runs consisting of at least five (5) samples of known content, one of which is a certified reference material (CRM) or proficiency*

*testing material, separated by a period of time sufficient to evaluate the performance of any previous independent run. For sample preparation training, the recoveries of the associated reference materials or proficiency training samples for each run must be within  $\pm 20\%$  of the certified value, 75% of the time. For instrumental analysis training, the recoveries of the associated reference materials or proficiency training samples for each run must be within  $\pm 10\%$  of the certified value, 75% of the time. The reference/proficiency test samples utilized shall be representative of the matrices and mass ranges that the analyst will encounter during routine sample analysis.*

Training checklists are completed for each person by the metals supervisor to ensure competency of individuals in each applicable area. This documentation is to be kept in the laboratory records.

The minimum total experience required before complete independent operation is allowed (i.e. absence of the instructor or immediate supervisor >30% of the time during work operations) is listed below.

Sample Preparation: 3 Months per method  
Sample Analysis: 6 Months per instrument

#### **12.5 Education and Training in Ethical and Legal Responsibilities Including the Potential Punishments and Penalties for Improper, Unethical, or Illegal Action**

An employee handbook (controlled document #349) is distributed to each employee upon hire; ethical and legal responsibilities are addressed within. New employees are trained in the Laboratory Ethics and Data Integrity policy as specified in Section 3.2.2 of this manual.

#### **12.6 Procedure for Demonstration of Capability**

A demonstration of capability (DOC) must be made prior to using any test method, and at any time there is a significant change in instrument type, personnel, or test method.

In general, this demonstration does not test the performance of the method in real world samples, but in applicable and available clean matrix (a sample of a matrix in which no target analytes or interferences are present at concentrations that impact the results of a specific test method), e.g. water, solids, biological tissue and air. However, before any results are reported using this method, actual sample spike results may be used to meet this standard, i.e. at least four consecutive matrix spikes within the last twelve months. In addition, for analytes, which do not lend themselves to spiking, e.g. TSS, the demonstration of capability may be performed using quality control samples.

All demonstrations shall be documented through the use of the form in section 12.6.1.

The following steps, which are adapted from the EPA test methods published in 40 CFR Part 136, Appendix A, shall be performed if required by mandatory test method or regulation. Note: for analytes for which spiking is not an option and for which quality control samples are not readily available, the 40 CFR approach is one way to perform this demonstration. It is the responsibility of the laboratory to document that other approaches to DOC are adequate; this shall be documented in the laboratory's Quality Manual.

- a) A quality control sample shall be obtained from an outside source. If not available, the QC sample may be prepared by the laboratory using stock standards that are prepared independently from those used in instrument calibration.
- b) The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration approximately 10 times the method-stated or laboratory-calculated method detection limit.
- c) At least four aliquots shall be prepared and analyzed according to the test method either concurrently or over a period of days.
- d) Using all of the results, calculate the mean recovery ( $\bar{x}$ ) in the appropriate reporting units (such as  $\mu\text{g/L}$ ) and the standard deviations of the population samples ( $n-1$ ) (in the same units) for each parameter of interest.
- e) When it is not possible to determine mean and standard deviations, such as for presence/absence tests and logarithmic values, the laboratory will assess performance against established and documented criteria.
- f) Compare the information from (d) above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory-generated acceptance criteria (if there are not established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin.
- g) If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.
- h) When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to 1) or 2) below.
  - 1) Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with c) above.
  - 2) Beginning with c) above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem

with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with c).

#### **12.6.1 Certification Statement**

The following certification statement shall be used to document the completion of each demonstration of capability. A copy of the certificate statement shall be retained in the personnel records of each affected employee.

**See next page for DOC**

**CON-TEST ANALYTICAL LABORATORY  
 TRAINING and IDOC (Initial Demonstration of Capability)  
 (Must be completed BEFORE any client samples are analyzed)**

**Analyst:** \_\_\_\_\_  
**Analyte/Method Reference:** \_\_\_\_\_  
 ex. Metals ICP EPA 200.7, Sulfide SM4500 S<sup>2</sup> E, VOA EPA 624

**Matrix:** \_\_\_\_\_

The analyst attests that they have read, understood, and/or performed the following:

SOP _____	Rev# _____	<u>Initial and date as reviewed</u>
-----------	------------	-------------------------------------

<b>Method Reference(s):</b> (Example: SW846 8260C)	<u>Initial and date as reviewed</u>
_____	_____
_____	_____
_____	_____

<b>Instrument Manual(s):</b>	<u>Initial and date as reviewed</u>
_____	_____
_____	_____
_____	_____

MA DEP CAM (if any)	Rev# _____	_____
CT RCP (if any)	Ver# _____	_____

On-the-Job Training (provide dates: minimum 20-business-days for IHLAP/ELLAP)  
 \_\_\_\_\_  
 \_\_\_\_\_

We, the undersigned, CERTIFY that:  
 The analyst identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the NELAP program, have met the Demonstration of Capability.  
 The test method(s) was performed by the analyst identified on this certification.  
 A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.  
 The data associated with the demonstration of capability are true, accurate, complete and self-explanatory.  
 All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

**Method-Specific IDOC (attached and completed with reduced data) OR 4 LFBs (attached and completed with reduced data)**

**ANALYST SIGNATURE:** \_\_\_\_\_  
 Analyst has reviewed all checked materials SIGNATURE \_\_\_\_\_ Date \_\_\_\_\_

**SUPERVISOR APPROVAL:** \_\_\_\_\_  
 signature \_\_\_\_\_ authorization date \_\_\_\_\_

**LAB. DIRECTOR APPROVAL:** \_\_\_\_\_  
 signature \_\_\_\_\_ authorization date \_\_\_\_\_

**QA OFFICER APPROVAL:** \_\_\_\_\_  
 signature \_\_\_\_\_ authorization date \_\_\_\_\_

## 13.0 Other Quality Considerations

### 13.1 Communication with Clients

Effective communication between the laboratory and its clients is of crucial importance to our ability to generate quality results. Con-Test will immediately notify clients of any problems when and if they arise.

Con-Test also encourages clients to contact the laboratory for technical assistance and to evaluate Con-Test services rendered, as a part of our continuous improvement (TQM) policy.

Any drinking water analysis where the amount detected exceeds the regulatory level (MCL) needs to be reported to the project chemist immediately, that is, as soon as realized by the analyst, for client notification, which must occur within 24 hours of obtaining the valid data. The laboratory must identify, in writing, those samples needing special reports (MCL exceedance) when the laboratory subcontracts with another laboratory. All reports, with the exception of reports submitted to the EPA in a format approved by the Department, for finished drinking water analysis, must indicate the maximum contaminant level for each analyte measured where a maximum contaminant level has been established by the Department.

Communication to the subcontracting laboratory of any special report requirements, like immediately notifying Con-Test of MCL exceedances is facilitated by the chain of custody. For MCL exceedances, the following is stamped on all subcontracting chain of custody: "Subcontracted lab must notify Con-Test Analytical Lab of any MCL exceedance within 24 hours of obtaining valid data". Additional information can be found on Subcontracting, from Con-Test Analytical Laboratory SOP on Subcontracting, Document #239.

MCL exceedances and Data reporting must meet MA 310 CMR 42.13 (5) requirements:

*"A certified laboratory shall be required to have current knowledge of all Federal and Massachusetts standards for all categories in which it has been certified or provisionally certified, and to report analytical results in a timely manner.*

- (a) Upon obtaining Valid data, a certified laboratory shall notify its clients of the results of all samples that exceed any EPA – or Department – established maximum contaminant level (MCL), maximum residual disinfection level or reportable concentration, or that identify the presence of regulated microbiological organisms in potable water. Notification must clearly indicate that a regulatory limit has been exceeded. The date, time, and manner of notification must be documented and kept on file.*
- (b) A laboratory that accepts potable water samples for analysis must notify its client public water system of the results of all samples that exceed a regulatory limit. Data indicating an exceedance of a regulatory limit must be*

validated and the validated data reported as soon as possible, not to exceed 24 hours after the completion of sample analysis. Such notification must be given within 24-hours of the completion of the analysis of the sample whether or not the laboratory accepting the sample subcontracted the analysis to another laboratory.

- (c) Laboratories must identify, in writing, those samples needing special reports (e.g. MCL exceedance) when the laboratory subcontracts with another laboratory.
- (d) Laboratories accepting samples to be analyzed for the purpose of determining regulatory compliance must ensure that analytical data are reported in a timely manner to meet their clients' reporting requirements. A laboratory that has had regulatory compliance samples subcontracted to it by another laboratory must release analytical data to the client laboratory within the timeline arranged by the laboratories.
- (e) Laboratories must have written standard operating procedures to ensure that the requirements of 310 CMR 42.13 (5)(a)-(d) are met."

#### **CON-TEST PROCEDURE TO HANDLE THIS REQUIREMENT:**

-Con-test ensures that once all known drinking water MA samples submitted for regulatory compliance have been analyzed, the data is reviewed (validated), and reported in a timely manner to meet the clients' needs, and any MCL exceedance is immediately relayed from the analyst to the Project manager as soon as sample is verified. The project manager then immediately contacts the client's public water system and client (within the 24-hour from analysis requirement), typically by email and relays the MCL exceedance. This email is retained to show date and time of the notification. Drinking water MA samples are not loaded onto instruments on Friday nights and over the weekend, as the process of notification is difficult. Special requests can be done with permission by supervisors. The client must supply contact information for the client and the clients' public water system that can be used over the weekend by the analyst if a notification is needed due to a MCL exceedance.

-Con-Test rarely sub contracts Drinking water MA samples for regulatory compliance, however if the situation comes up, Con-Test will relay to sub lab that MA 310 CMR regulations must be followed and have their data reported in a timely manner to meet our clients' needs as well as be given ample time to be able to let our clients know of a MCL exceedance in the required 24- hour time frame. This will be documented in the Project manager's email. Likewise, if another lab subcontracts to Con-Test we will ensure they have analytical results to report to their clients in a timely manner and within enough time to notify their client within 24 hours from analysis for any MCL exceedance.

When necessary the client is notified and work is recalled when any aspect of the testing and/or calibration work, or the results of the work, do not conform to the procedures or the agreed requirements of the client. Deviations from test and calibration methods shall only occur if the deviation has been documented, technically justified, authorized, and accepted by the client.

### **13.2 Communication with Regulatory Agencies**

It is imperative to maintain effective communication with various Federal, State, and Local regulatory agencies. Con-Test maintains close contact and is constantly reviewing pertinent sources of information such as publications and periodicals etc. for changes in legislation and approved methodology.

### **13.3 Complaints/Client Inquiries/Comments**

- 13.3.1** Client Inquiries about testing data are handled immediately. All inquiries are documented on Client Inquiry Forms by project chemists who have initial client contact. Any supporting data (e.g. final reports) are attached to the inquiry form, which is forwarded to the QA department for entry into a client inquiry tracking database. The QA staff assigns an investigator, who returns the form with a response.
- 13.3.2** The investigator checks all appropriate paperwork, computer printouts, log book entries, and calculations associated with the results in question. Sometimes the sample is reanalyzed.
- 13.3.3** If through the client inquiry investigation, there is an issue with the data, a corrective action is immediately initiated by the QA department. The corrective action shall start with an investigation to determine the root cause(s) of the problem. See section 9.3 and/or the Corrective/Preventative Action SOP for more detail on corrective actions.
- 13.3.4** The inquiry resolution after being signed off from the supervisor is forwarded back to the QA department where the resolution is logged into the client inquiry tracking database, and the form (with supporting data) is returned to the initiating project chemist. The client is then notified by the project chemist of the response.
- 13.3.5** If no errors or reasons to suspect the data are found and the sample has not been removed from the laboratory the sample may still be re-analyzed, at the request of the client. If the reanalysis yields substantially different results, there will be no charge for the entire test: otherwise the reanalysis will be charged to the client at the normal rate as a separate sample.
- 13.3.6** The laboratory shall have a documented process to receive, evaluate and make decisions on complaints.
- 13.3.7** A description of the handling process for complaints shall be available to any interested party upon request. Upon receipt of a complaint, the laboratory shall confirm whether the complaint relates to laboratory activities that is responsible for and, if so, shall deal with it. The laboratory shall be responsible for all decisions at all levels of the handling process for complaints.

- 13.3.8** The process for handling complaints shall include at least the following elements and methods:
- a) description of the process for receiving, validating, investigating the complaint, and deciding what actions are to be taken in response to it;
  - b) tracking and recording complaints, including actions undertaken to resolve them;
  - c) ensuring that any appropriate action is taken.
- 13.3.9** The laboratory receiving the complaint shall be responsible for gathering and verifying all necessary information to validate the complaint.
- 13.3.10** Whenever possible, the laboratory shall acknowledge receipt of the complaint, and provide the complainant with progress reports and the outcome.
- 13.3.11** The outcomes to be communicate to the complainant shall be made by, or reviewed and approved by, individuals not involved in the original laboratory activities in question.
- 13.3.12** Whenever possible, the laboratory shall give formal notice of the end of the complaint handling to the complainant.
- 13.3.13** Any and all client complaints or comments are logged into excel spreadsheet database by the project manager of that client. All client complaints are handled immediately. If the issue is just a comment, it is simply logged and noted. If it is a complaint, the project manager will additional notify the QA department to initiate a corrective action. The corrective action shall start with an investigation to determine the root cause(s) of the problem. See section 9.3 and/or the Corrective/Preventative Action SOP for more detail on corrective actions. This notification will be noted in the client complaint/comment database. Routinely the client complaint/comment log is reviewed by client services manager and the QA department.

## 14.0 References

- 14.1 Code of Federal Regulations (CFR), Protection of Environment, Title 40, Section 136 & 141, Revised July 1, 1993, 94, 95, 2012, 2016.
- 14.2 USEPA – Supplemental I of “Methods for the Determination of Metals in Environmental Samples”, EPA/600R-94-11, Revised May 1994.
- 14.3 USEPA – “Methods for Evaluating Solid Waste, Physical/Chemical Methods”, Quality Control, 3<sup>rd</sup> Edition, USEPA November 1990 (SW846).
- 14.4 USEPA – “Methods for Evaluation Solid Waste, Physical/Chemical Methods”, Quality Control, 3<sup>rd</sup> Edition Proposed Update, USEPA December 1987 (SW846)
- 14.5 USEPA, Good Automated Laboratory Practices, December 1990.
- 14.6 APHA – “Standard Methods for the Examination of Water and Wastewater”, 1010, 1020, 1030, & 1040, 17<sup>th</sup> edition, 1989.
- 14.7 APHA – “Standard Methods for the Examination of Water and Wastewater”, 18<sup>th</sup>, 19<sup>th</sup>, and 21<sup>st</sup>, 22<sup>nd</sup>, 23<sup>rd</sup> Editions, 1992, 1995, 2005, 2012, 2017.
- 14.8 AIHA-LAP, LLC Policy Modules reference, September 13, 2011 and 2017 updates.
- 14.9 ACIL Data Integrity Initiative, American Council of Independent Laboratories, January 2003.
- 14.10 NELAC 2003 Standard Quality Systems Section 5.5.2.7
- 14.11 Preventing Improper Laboratory Practices, Advanced Systems, Inc. September 2005.
- 14.12 ISO/IEC 17025:2017, “General Requirements for the Competence of Testing and Calibration Laboratories”, 2017 Revision.
- 14.13 NELAC TNI Standard – The NELAC Institute, 2009 + 2016

**NEW YORK STATE DEPARTMENT OF HEALTH  
WADSWORTH CENTER**



Expires 12:01 AM April 01, 2020  
Issued April 01, 2019  
Revised November 22, 2019

**CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE**

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

**MR. TOD KOPYSCINSKI  
CON-TEST ENVIRONMENTAL LAB  
39 SPRUCE STREET  
EAST LONGMEADOW, MA 01028**

**NY Lab Id No: 10899**

*is hereby APPROVED as an Environmental Laboratory in conformance with the  
National Environmental Laboratory Accreditation Conference Standards (2003) for the category  
**ENVIRONMENTAL ANALYSES POTABLE WATER**  
All approved analytes are listed below:*

**Non-Metals**

Chloride	EPA 300.0 Rev. 2.1
Color	SM 21-23 2120B (-01)
Cyanide	SM 20, 21-23 4500-CN E
Fluoride, Total	EPA 300.0 Rev. 2.1 SM 21-23 4500-F C (-97)
Nitrite (as N)	SM 21-23 4500-NO2 B (-00)
Orthophosphate (as P)	EPA 300.0 Rev. 2.1
Solids, Total Dissolved	SM 21-23 2540C (-97)
Sulfate (as SO4)	ASTM D516-07, 11; 16 EPA 300.0 Rev. 2.1

**Volatile Aromatics**

1,2,4-Trimethylbenzene	EPA 524.2
1,2-Dichlorobenzene	EPA 524.2
1,3,5-Trimethylbenzene	EPA 524.2
1,3-Dichlorobenzene	EPA 524.2
1,4-Dichlorobenzene	EPA 524.2
2-Chlorotoluene	EPA 524.2
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2
n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2
sec-Butylbenzene	EPA 524.2
Styrene	EPA 524.2
tert-Butylbenzene	EPA 524.2
Toluene	EPA 524.2
Total Xylenes	EPA 524.2

**Perfluorinated Alkyl Acids**

Perfluorooctanesulfonic acid (PFOS)	EPA 537 EPA 537.1
Perfluorooctanoic acid (PFOA)	EPA 537 EPA 537.1

**Trihalomethanes**

Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2
Total Trihalomethanes	EPA 524.2

**Volatile Aromatics**

1,2,3-Trichlorobenzene	EPA 524.2
1,2,4-Trichlorobenzene	EPA 524.2

**Volatile Halocarbons**

1,1,1,2-Tetrachloroethane	EPA 524.2
1,1,1-Trichloroethane	EPA 524.2
1,1,2,2-Tetrachloroethane	EPA 524.2

**Serial No.: 60714**

Property of the New York State Department of Health. Certificates are valid only at the address shown, must be conspicuously posted, and are printed on secure paper. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify the laboratory's accreditation status.



	<b>State of South Carolina</b>  Request for Quote	Solicitation:	5400019500
		Date Issued:	March 12, 2020
		Procurement Officer:	E. Madison Winslow <i>E. Madison Winslow</i>
		Phone:	803-898-3487
		E-Mail Address:	<a href="mailto:winsloem@dhec.sc.gov">winsloem@dhec.sc.gov</a>

DESCRIPTION: **EPA Method 533 for Per-and Polyfluoroalkyl Substances (PFAS) Analysis**

USING GOVERNMENTAL UNIT: **South Carolina Department of Health and Environmental Control**

*The Term "Offer" Means Your "Bid" or "Proposal". See "Submitting Your Paper Offer or Modification" provision.*

**SUBMIT YOUR OFFER ONLINE AT THE FOLLOWING URL: <http://www.procurement.sc.gov>**  
**(See Page 3 and 4 for Instructions)**  
**By e-mail to [winsloem@dhec.sc.gov](mailto:winsloem@dhec.sc.gov)**

SUBMIT OFFER BY (Opening Date/Time): **March 27, 2020/2:30 pm ET** (See "Deadline For Submission Of Offer" provision)

QUESTIONS MUST BE RECEIVED BY: **March 19, 2020/2:30 pm ET** (See "Questions From Offerors" provision)

NUMBER OF COPIES TO BE SUBMITTED: **See Page 3 for Instructions**

CONFERENCE TYPE: N/A DATE & TIME: N/A  <small>(As appropriate, see "Conferences - Pre-Bid/Proposal" &amp; "Site Visit" provisions)</small>	LOCATION: N/A
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<b>AWARD &amp; AMENDMENTS</b>	Award will be posted on <b>March 30, 2020</b> . The award, this solicitation, any amendments, and any related notices will be posted at the following web address: <a href="http://www.procurement.sc.gov">http://www.procurement.sc.gov</a>
-------------------------------	--

You must submit a signed copy of this form with Your Offer. By signing, You agree to be bound by the terms of the Solicitation. You agree to hold Your Offer open for a minimum of thirty (30) calendar days after the Opening Date. (See "Signing Your Offer" provision.)

<b>NAME OF OFFEROR</b>  Eurofins Eaton Analytical, LLC  <small>(full legal name of business submitting the offer)</small>	Any award issued will be issued to, and the contract will be formed with, the entity identified as the Offeror. The entity named as the offeror must be a single and distinct legal entity. Do not use the name of a branch office or a division of a larger entity if the branch or division is not a separate legal entity, i.e., a separate corporation, partnership, sole proprietorship, etc.
---	--

<b>AUTHORIZED SIGNATURE</b>    <small>(Person must be authorized to submit binding offer to contract on behalf of Offeror.)</small>	<b>DATE SIGNED</b>  3/27/2020
--	-------------------------------------

<b>TITLE</b>  President  <small>(business title of person signing above)</small>	<b>STATE VENDOR NO.</b>  7000233321  <small>(Register to Obtain S.C. Vendor No. at <a href="http://www.procurement.sc.gov">www.procurement.sc.gov</a>)</small>
--	--

<b>PRINTED NAME</b>  John Cosgrove, PHD  <small>(printed name of person signing above)</small>	<b>STATE OF INCORPORATION</b>  Delaware  <small>(If you are a corporation, identify the state of incorporation.)</small>
--	--

**OFFEROR'S TYPE OF ENTITY: (Check one)** (See "Signing Your Offer" provision.)

Sole Proprietorship
  Partnership
  Other \_\_\_\_\_  
 Corporate entity (not tax-exempt)
  Corporation (tax-exempt)
  Government entity (federal, state, or local)

**PAGE TWO**

**(Return Page Two with Your Offer)**

<p><b>HOME OFFICE ADDRESS</b> (Address for offeror's home office / principal place of business)</p> <p>Eurofins Eaton Analytical, LLC 110 South Hill Street South Bend, IN 46617</p>	<p><b>NOTICE ADDRESS</b> (Address to which all procurement and contract related notices should be sent.) (See "Notice" clause)</p> <p>Eurofins Eaton Analytical, LLC 110 South Hill Street South Bend, IN 46617</p> <p>574-233-4777 _____ Area Code - Number - Extension Facsimile</p> <p>JosephMattheis@EurofinsUS.com _____ E-mail Address</p>
--	--

<p><b>PAYMENT ADDRESS</b> (Address to which payments will be sent.) (See "Payment" clause)</p> <p>Eurofins Eaton Analytical, LLC PO Box 95362 Grapevine, TX 76099-9733</p> <p>____ Payment Address same as Home Office Address ____ Payment Address same as Notice Address <b>(check only one)</b></p>	<p><b>ORDER ADDRESS</b> (Address to which purchase orders will be sent) (See "Purchase Orders and "Contract Documents" clauses)</p> <p>____ Order Address same as Home Office Address <input checked="" type="checkbox"/> Order Address same as Notice Address <b>(check only one)</b></p>
--	--

**ACKNOWLEDGMENT OF AMENDMENTS**  
Offerors acknowledges receipt of amendments by indicating amendment number and its date of issue. (See "Amendments to Solicitation" Provision)

Amendment No.	Amendment Issue Date						
1	3/20/2020						

<b>DISCOUNT FOR PROMPT PAYMENT</b> (See "Discount for Prompt Payment" clause)	10 Calendar Days (%)  NA	20 Calendar Days (%)	30 Calendar Days (%)	____ Calendar Days (%)
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**PREFERENCES - A NOTICE TO VENDORS (SEP. 2009):** On June 16, 2009, the South Carolina General Assembly rewrote the law governing preferences available to in-state vendors, vendors using in-state subcontractors, and vendors selling in-state or US end products. This law appears in Section 11-35-1524 of the South Carolina Code of Laws. A summary of the new preferences is available at [www.procurement.sc.gov/preferences](http://www.procurement.sc.gov/preferences). **ALL THE PREFERENCES MUST BE CLAIMED AND ARE APPLIED BY LINE ITEM, REGARDLESS OF WHETHER AWARD IS MADE BY ITEM OR LOT. VENDORS ARE CAUTIONED TO CAREFULLY REVIEW THE STATUTE BEFORE CLAIMING ANY PREFERENCES. THE REQUIREMENTS TO QUALIFY HAVE CHANGED. IF YOU REQUEST A PREFERENCE, YOU ARE CERTIFYING THAT YOUR OFFER QUALIFIES FOR THE PREFERENCE YOU'VE CLAIMED. IMPROPERLY REQUESTING A PREFERENCE CAN HAVE SERIOUS CONSEQUENCES.** [11-35-1524(E)(4)&(6)]

**PREFERENCES - ADDRESS AND PHONE OF IN-STATE OFFICE:** Please provide the address and phone number for your in-state office in the space provided below. An in-state office is necessary to claim either the Resident Vendor Preference (11-35-1524(C)(1)(i)&(ii)) or the Resident Contractor Preference (11-35-1524(C)(1)(iii)). Accordingly, you must provide this information to qualify for the preference. An in-state office is not required, but can be beneficial, if you are claiming the Resident Subcontractor Preference (11-35-1524(D)).

\_\_\_\_ In-State Office Address same as Home Office Address \_\_\_\_ In-State Office Address same as Notice Address **(check only one)**

March 27, 2020

E. Madison Winslow  
South Carolina Department of Health and Environmental Control  
Attn: Procurement Services Division  
301 Gervais Street, 4th Floor  
Columbia SC 29201-3073

**RE: Solicitation 5400019500 EPA Method 533 for Per-and Polyfluoroalkyl Substances (PFAS) Analysis**

Dear E. Madison Winslow:

Eurofins Eaton Analytical, LLC (Eurofins) is pleased to submit a response to the SC DHEC for EPA Method 533 for Per-and Polyfluoroalkyl Substances (PFAS) Analysis. Eurofins is a full-service water quality testing laboratory that is ISO 17025 & TNI accredited to perform water quality compliance analysis in all 50 states. Specific to this project are our **EPA Method 533 TNI certification through the State of Utah and Method 533 certification in the State of Arizona**. Both are attached along with other relevant certifications. We have over 100,000 combined square feet of laboratory space and 200 qualified staff at our East and West coast laboratories and service centers.

Critical to the success of the contract laboratory in support of your Laboratory Testing needs are:

- **Capacity:** Our Monrovia, CA lab can process 600 Method 533 samples per month. Our South Bend, IN lab can process 350 Method 533 Samples per month.
- **Redundancy:** In light of the Covid-19 pandemic and the timing relative to the project time line ending June 30, 2020, Eurofins is uniquely capable to support SC-DHEC and the project requirements. Affiliated Eurofins Laboratories throughout the US add additional redundantly qualified capacity of ~ 1,000 samples per month.
- **Single Source Solution:** Eurofins will provide a clear contact chain with backup and project continuity the focus.
- **Technical Expertise:** Eurofins is the recognized expert in water quality analysis. Staff are involved at the Federal level serving in stakeholder, author and contributor roles in the development of analytical methods, regulatory monitoring requirements and compliance data assessment.
- **Inclusive pricing:** On January 30, 2020, DHEC published "Strategy to Assess the Impact of Per-and Polyfluoroalkyl Substances on Drinking Water in South Carolina". Based on the priorities described, the initial sample locations will emphasize sites with higher probability of PFAS impacts. This will likely increase the frequency of analyses of Field Reagent Blanks as required in Method 533. Eurofins per sample pricing includes the cost of the analyses of Field Reagent Blanks as specified in the Method and the Solicitation and subsequent Addendum.

We are grateful for the opportunity to provide the South Carolina Department of Health and Environmental Control with firm, fixed pricing for its water testing requirements. We appreciate the opportunity to provide the enclosed bid response for Per-and Polyfluoroalkyl Substances (PFAS) Analysis contract and welcome questions as appropriate.

Respectfully submitted,  
**Eurofins Eaton Analytical, LLC**



John Cosgrove, PhD  
President – Authorized Signature

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## BUSINESS PROFILE

### GENERAL INFORMATION

Company Name: Eurofins Eaton Analytical, LLC (Eurofins)

Years in Business: 50

Main Contact Person: Joe Mattheis, Account Manager  
[JosephMattheis@EurofinsUS.com](mailto:JosephMattheis@EurofinsUS.com)  
P: (919) 376-7978

Authorized Representative to conduct contract negotiations:  
John Cosgrove, President  
[JohnCosgrove@EurofinsUS.com](mailto:JohnCosgrove@EurofinsUS.com)  
P: (626) 386-1100

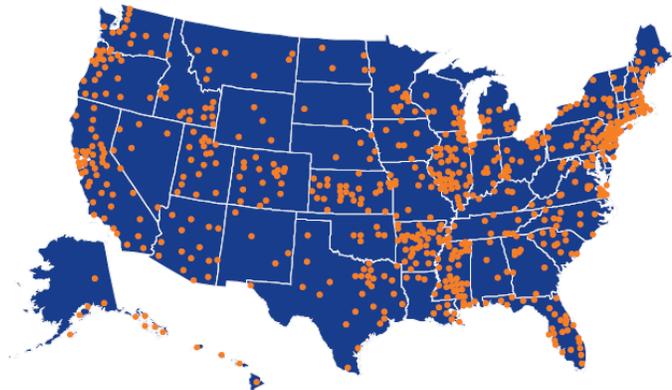
Full Mailing Address: 750 Royal Oaks Drive, Suite 100, Monrovia, CA 91016  
P: (626) 386-1100

Number of Full Time Employees: >200

Fed Tax ID: 46-0565341

### QUALIFICATIONS OVERVIEW

Eurofins is **the largest potable water** focused commercial **laboratory in the United States**, serving more than 1000 clients across the U.S. and in more than 100 foreign countries. We are a full service environmental testing laboratory certified in 50 states and territories under the Safe Drinking Water Act and/or the National Environmental Laboratory Accreditation Program (TNI). We routinely analyze over 200 individual water quality parameters for water and analyses according to 40CFR 141 and other acceptable test methodologies. Our firm routinely spends up to \$1 million per year on lab equipment to remain the leader in water-quality related testing. Major clients include public and private water utilities, municipalities and county governments, multi-nationals, state governments, industry associations, and the US EPA. Our strengths are regulatory knowledge, a strong quality assurance program, methods development, and a dedication to client service. Eurofins has a long history with PFAS testing that includes our two primary laboratories providing ~ 40% of US Method 537 analyses during the Third Unregulated Monitoring Rule (UCMR3).



## FACILITIES

Eurofins Eaton Analytical's combined 100,000 square feet of full-service water testing laboratories are located in Monrovia, CA and South Bend, IN.

### ***Eurofins Eaton Analytical***

750 Royal Oaks Drive, Suite 100  
Monrovia, CA 91016  
800-566-5227



### ***Eurofins Eaton Analytical***

110 South Hill Street  
South Bend, IN 46617  
800-332-4345



Eurofins has been in operation since 1969 and has a proud and successful history serving the water industry with high quality, reliable and efficient water quality services. Our staff is actively involved in regulatory program development and analytical methods. Highlights include:

- EPA contractor for the National Pesticide Survey (1987-88).
- Information Collection Rule accredited laboratory (1997-99).
- EPA contractor for UCMR1 (2001-05), UCMR2 (2008-10) and UCMR3 (2013-2015)
- EPA 314 method Co-Author for Perchlorate
- WaterRF 4167 (Methods for PPCP analysis) Co-Principal Investigator
- Federal contract laboratory for USGS, USBR and US Armed Forces
- State contract laboratory for AR, AS, AZ, DE, GU, ID, MN, MS, NJ, NV and UT
- PFAS EPA Method validator for EPA 537 and EPA 533

## **CAPABILITY TO MANAGE AND PERFORM SERVICES**

Eurofins Eaton Analytical has been analyzing PFAS for over 10 years which includes the initial EPA PFAS data collection and analysis when the two labs provided ~ 40% of US Method 537 analyses during the Third Unregulated Monitoring Rule (UCMR3). Existing national occurrence data for PFOS, PFOA and other PFAS are based on results from EPA's UCMR3 program which was a national data gathering effort of public water systems in 2013-15.

Eurofins employs over 200 professionals dedicated to water testing, the largest analytical resource for water quality analyses in the country. The State of South Carolina will benefit from the assignment of staff with decades of experience that will provide seamless service from bottle kit delivery to report uploading and communications during routine and special circumstances

The combined expertise of our staff exceeds 300 years, more than any other commercial testing laboratory in the US. Our staff tenure and stability is also an accomplishment rarely seen within the laboratory industry as well. We possess the analytical capabilities, highly trained technical staff, and capacity to produce high quality, on-time data for the SC DHEC.

Eurofins has the advantage of access a network of laboratories (Eurofins Eaton Analytical's two facilities and Eurofins Lancaster Laboratories Environmental) that can easily analyze the number of samples expected from South Carolina for this contract with a **monthly capacity of 950 samples at Standard turnaround time. Our South Bend, IN lab can process 350 Method 533 samples per month. Our Monrovia, CA lab can process 600 Method 533 Samples per month.** Combined **we have dedicated 10+ instruments** as well as our experienced staff are more than adequate to accommodate South Carolina volume of samples while also meeting your standard and rush TAT requests. In addition, we are actively working to double our PFAS instrumentation as well as the staff, laboratory space and management needed to support them.

In light of the Covid-19 pandemic and the timing relative to the project time line ending June 30, 2020 we bring redundancy to the project to ensure project continuity. Eurofins is uniquely capable to support SC-DHEC and the project requirements. Affiliated Eurofins Laboratories throughout the US add additional redundantly qualified capacity of ~ 1,000 samples per month. Should a worst case scenario arise at one of our primary labs, we can respond, adjust and deliver.

Eurofins' vast capacity, expertise, and customer service specialists encourage ease of use and one-stop-shopping for South Carolina as seen in the staffing below:

### **STAFFING**

**Dr. John Cosgrove, President**, has the responsibility in ensuring the operational efficiency and accuracy of laboratory procedures, cost analysis, overhead control, marketing, and project management across all lab facilities. John has over 25 years of experience in the laboratory services industry. He earned his PhD from the University of Nottingham, England; Masters of Science from the University of Edinburgh, Scotland and Bachelors of Science from Kings College, University of London.

**Matthew Hartz, Laboratory Director of the South Bend Laboratory**, has over 28 years of environmental laboratory experience and oversees the day-to-day operational and customer service activities, ensuring that adequate resources are available to fulfill the obligations of the Drinking Water Laboratory located in South Bend, IN. He holds a BS in Biology with a minor in Chemistry from Central Michigan University.

**Fred Haley, Laboratory Director of the Monrovia Laboratory**, responsible for overall laboratory operation and performance. He has over 30 years of experience as a Chemist, Field Chemist, Project Manager, Laboratory Director, and VP of Operations. Mr. Haley holds a BS degree in Chemistry from California Polytechnic State University Pomona.

**Dr. Yongtao (Bruce) Li, Technical Director**, has over 31 years of experience in water research, specialty testing, treatability testing, and analytical services. He is a recognized scientist and invited critical reviewer of manuscripts for over a dozen of peer-reviewed analytical journals and has authored/coauthored over 30 peer-reviewed research articles, 50 conference publications, and 70 standard operating protocols. Dr. Li ensures that staff members receive adequate training and certifies that analysts are competent to perform designated methods. He ensures consistency and technical accuracy of Standard Operating Procedures for analytical methods. Dr. Li is also responsible for overseeing research and development activities, as well as instrument utilization and method optimization. Dr. Li earned his BS and MS in Chemistry from Northeast Normal University in Changchun, China and earned his Ph.D. degree in analytical chemistry from Southern Illinois University at Carbondale.

**Nathan Trowbridge, Client Services Manager of the South Bend Laboratory**, has over 27 years of environmental laboratory experience and oversees the day-to-day activities of customer-facing staff. Mr. Trowbridge is responsible for ensuring that the service needs of our clients are met through the supervision of our project management staff in South Bend. He has direct access to all levels of laboratory management to ensure that adequate resources are available to meet the requirements of all client projects. He holds a BS in Chemistry and Biology from Valparaiso University.

**Kasey Riley, Client Services Manager of Monrovia Laboratory**, has over 15 years of experience as a microbiologist and Project Manager helping clients with drinking water and wastewater. Ms. Riley is uniquely positioned to be an Analytical Services Manager. As a Microbiology Supervisor and Principal Analyst for EPA Method 1623, she has hands on experience in all areas of the microbiology laboratory. As an Analytical Services Manager her primary focus is to maintain client relations and provide exceptional client service. Ms. Riley has a Bachelor's of Science in Biological Sciences from the University of Northern Colorado.

**Bill Reeves, Quality Assurance Manager**, has over 20 years of environmental laboratory experience. He has been in his current role as Quality Assurance Manager for over 4 years. He is responsible for ensuring that all water testing is conducted in strict adherence to Eurofins Quality Assurance Manual, that Eurofins at all times meets the US EPA requirements for analytical testing. The QA department performs audits of the laboratory, reviews system documentation for compliance and consistency, and identifies areas for preventive and corrective action. He holds a BS of Science Applied Engineering from Michigan State University.

**Rhonda Day, Technical Manager**, has over 28 years of environmental laboratory experience, with thirteen of those years in a management role. She is responsible for the day-to-day operations of the Organics,

Sample Preparation and the Shipping and Receiving departments and ensures that there are adequate resources to perform the requested analyses. She holds a BS with Honors in Chemistry from Beloit College.

**Jon Werbianskyj, Technical Manager** has over 21 years of environmental laboratory experience, with two years in the management role. Mr. Werbianskyj oversees the day-to-day operations of the inorganics and microbiology departments. He ensures that there are adequate resources to perform the requested analyses. He holds a BS in Natural Resources and Environmental Management with a Chemistry minor from Ball State University.

**Donna Martis, Shipping and Receiving Manager** has over 28 years of environmental laboratory experience at our South Bend, IN location. She has two years in this management role; however she has overseen the day-to-day operations of shipping, receiving and sample login for many years.

### **INSTRUMENTATION**

Our instruments and equipment have been selected from reputable manufacturers based upon accuracy, reliability, ease of operation and maintenance. The instruments and equipment are maintained and calibrated in accordance with the laboratory's procedures, referenced methods, and manufacturer's requirements. These activities are documented in the data and/or logbooks specific to each instrument.

When adding new instrumentation we prefer to purchase the same or next generation of the same model of LC/MS/MS systems because they have proven to be consistent, reliable and rugged. Our chemists are familiar with the system set-up and software which enables us to bring new systems on-line quickly. Having interchangeable parts among the systems aids in maintenance events and minimizes unexpected down time. Eurofins corporate encourages the sharing of operational best practices among the labs which facilitates consistency and continual improvement.

Eurofins analyzes targeted PFAS analysis by EPA Method 537.1 and EPA 533 or by our proprietary method. Each of these methods uses Solid Phase Extraction (SPE) with liquid chromatography tandem mass spectrometry (LC-MS/MS). Eurofins maintains 10 dedicated instruments specifically for these methods. The EPA methods have identical sampling, preservation, and holding time requirements. Our proprietary method measures 21 additional compounds for a total of 39 PFAS analytes.

### **LABORATORY'S EXPERIENCE IN ANALYSES FOR DW SYSTEMS**

Eurofins has served and supported regulators and the water system community in the United States and abroad with testing and technical consulting. Our experience profile demonstrates that we are the undisputed market leader in drinking water analysis. Eurofins history as an analytical testing provider to the drinking water industry is extensive and unparalleled. In recognition of our superior brand and commitment to quality, our technical experts are routinely utilized by customers on a consultative basis. Projects of recognition of this effort are described below:

## SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL

Contact: Mary Ann Fuller - Program Manager  
Drinking Water Compliance Monitoring Section  
SC DHEC Bureau of Water  
Address: 2600 Bull Street, Columbia, SC, 29203  
Phone: 803-898-2382  
Email: [FULLERMA@dhec.sc.gov](mailto:FULLERMA@dhec.sc.gov)

Eurofins served as the UCMR3 and UCMR4 contractor for the State of South Carolina Department of Health and Environmental Control. The scope of services included all required testing and reporting under the UCMR3 and UCMR4 promulgated regulations. The requirements included coordinating with central project management, shipping sample kits on an established schedule and as needed to a central DHEC location, central reporting and invoicing, and electronic data deliverable preparation and upload of data directly to EPA SDWARS database

- SC State-wide UCMR3 & UCMR4 Analytical Services Contractor
- Contract Term: 2013 – 2015 (UCMR3) 2018-Present(UCMR4)
- Central coordination of projects details
- Shipping of sample kits for regularly scheduled sampling events
- Central reporting and Invoicing
- EDD required reporting and SDWARS upload of data

## STATE OF ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (IEPA)

Contact: Tom Weiss, Division Manager of Laboratory Sourcing  
Address: 825 North Rutledge Springfield, Illinois 62702  
Phone: 217-557-2420  
Email: [Tom.Weiss@Illinois.gov](mailto:Tom.Weiss@Illinois.gov)

Our laboratory has performed analyses for public water supplies (PWS) that participate in the Community Water Supply Testing Program for analyses not performed at the IEPA's laboratory. This allowed us, the contractor, to send the necessary kits and sampling materials, instructions and other paperwork at the start of the sampling period.

- The projected number of Samples included 500 to the Northwestern region and 2000 to the Northeastern Region.
- We were required by IEPA to communicate directly with the PWS if the receipt of a sample did not allow the holding time to be met. We were to manage samples with holding times less than 48 hours and must be set up on the day of sample receipt. We continued to execute the appropriate time lines in order to ship the sample kits to the facility early in the sampling period, so that there was more adequate time for collection, analysis, the collection of necessary resamples, and sample reporting. Sample kits were to be sent for resamples in a timely fashion, and specific program requirements. Sample kits always had an adequate number of re-useable ice packs if

sample temperature at the time of receipt for specific program requirements. Eurofins staff in conjunction with the IEPA's Division of Laboratories Quality Assurance Section complied with any/all evaluations that IEPA required during the program and our ability to conduct analyses.

- The following testing services have been provide to ILEP for disinfection By-Product Testing, Radiological Testing, Asbestos Testing, and Enhanced Surface Water Treatment Testing and in addition have been asked to test for EPA 537; 537.1 and 537 modified V1.1

#### MINNESOTA DEPARTMENT OF HEALTH

Contact: Anita Smith, Compliance Officer  
Address: 601 Robert Street North, St. Paul, MN 55164  
Phone: 651-201-4665  
Email: [Anita.smith@State.MN.US](mailto:Anita.smith@State.MN.US)

Eurofins has been providing professional services with respect to ongoing and ever changing needs of the Minnesota Department of Health dating back to the year of 2006. Below is an overview of work requested and completed by Eurofins for the MN Dept. of Health.

- Eurofins supports the Minnesota Department of Health by providing the following services for UCMR4, Chlorite and Bromide testing on an ongoing basis. Our dedicated staff and tenure at this facility has over 26 years of experience, compliance and regulatory knowledge. This alone allows our diverse client partnerships to rest at night knowing Eurofins will perform services with quality front and center.
- Preparing and ensuring all samples that are collected and submitted to the laboratory for analysis. Services include costs for bottles, coolers, chains of custody, and shipping or pickup services sufficient to get samples to the lab within hold time and temperature compliance standards. Sample bottles shall be clearly labeled and contain the correct preservatives as required. All analyses shall be performed within holding times and shall be conducted in accordance with all requirements now and hereafter set forth by the EPA.
- Eurofins records lab results in units acceptable to the EPA and the State of Minnesota. In addition the results shall also be supplied to the Department of Health in both EDD formats.
- QC Level II laboratory results must have reporting limits less than or equal to applicable regulatory limits. If the laboratory is unable to achieve a required reporting limit, then a narrative discussing the issue will be included in the report.
- In conjunction any Industrial pretreatment samples are analyzed using methods and procedures outlined in 40 CFR 136. Drinking water samples are analyzed using methods and procedures outlined in 40 CFR 141. All compliance forms come prefilled to the greatest extent possible.
- Eurofins standard TAT for all reports has been within 10 days of sample receipt unless otherwise note and predetermined by client or lab guidelines.

## CITY OF ROCHESTER, NY, WATER QUALITY LABORATORY

Contact: John Maier, Lab Director  
Address: 7412 Rix Hill Road, Hemlock, NY 14466  
Phone: 585-428-6011  
Email: [MaierJ@cityofrochester.gov](mailto:MaierJ@cityofrochester.gov)

- Eurofins has provided SDWA testing services for the City of Rochester, NY from 2012 to 2019. For 7 years, we have provided laboratory testing services including and not excluded to: PFAS, Metals, LT2, UCMR3, Microcystins, and UCMR4.
- In addition, we have tested for Asbestos in drinking water. Compliance sampling including; HAA's, THM's, TOC, Bromide, Hexavalent Chrome, Cyanide, and Mercury.
- Eurofins supported the City of Rochester for the Lead and Copper Rule analyzing 60 Copper Samples in 2018 and 100 Lead samples in 2018.
- Also, Eurofins provided analytical testing services for: Pesticides, PCB's, Taste & Odor, Dioxin, POC's and DBP's.

## LABORATORY QUALIFICATIONS

### QUALITY CERTIFICATION

Eurofins laboratories have been audited and accredited by EPA in support of special regulatory programs (TNI, ICR, UCMR, SWDA and LT2) in the last 20 years. We strive to educate ourselves and provide as much knowledge as we support our clients. We collaborate with EPA on analytical methods, detection limit feasibility relative to proposed regulatory thresholds, best practices and acceptable precision & accuracy. This firsthand collaboration and interaction directly with regulators helps us stay abreast of the priorities for future regulations and our testing capabilities reflect that.

#### **Eurofins is accredited by three primary organizations for this contract:**

The National Environmental Accreditation Conference Institute (TNI)

SC Department of Health and Environmental Control

The U.S. Environmental Protection Agency (EPA)

Eurofins is also a TNI-accredited laboratory and [currently holds EPA 533 certification](#) in our Monrovia, CA location. Both facilities also hold certification with the State of South Carolina and EPA UCMR4 approval. The laboratory is **accredited** in 50 states and other territories to perform comprehensive water quality analyses. Our accreditation program relies on our rigorous quality system and includes more stringent and comprehensive standards than non-TNI laboratories.

Our extensive list of Federal and State accreditations reflects our commitment to quality, above and beyond the minimum requirements. These extensive accreditations and approvals also subject Eurofins to frequent on-site audits, blind proficiency testing and quality documentation through the year, in contrast to most laboratories that are audited or evaluated by the same regulatory agency every two or three years.

## **ANALYTICAL SERVICES AND DATA QUALITY**

Our approach to meeting the technical and service requirements for the State of South Carolina is comprised of many components of our operation. Those components include a state-of-the-art facility, extensive instrument inventory, highly trained and dedicated staff, Quality Assurance/Quality Control Programs, including our Environmental Quality Policy Manual (attached), Laboratory Information Management Systems (LIMS), Technical Qualifications, Accreditations, and Federal and State EPA methods (attached). We also have the financial strength and a stable and secure workforce which are very critical to any laboratory's ability to support large projects.

Our laboratory takes appropriate measures to consistently provide our clients with high quality data. Eurofins has established Quality Control procedures which ensure that data is generated within acceptable limits of precision and accuracy as required by the method. The results of quality control samples (Surrogates, Duplicates, Matrix Spikes and Laboratory Control Samples) are uploaded to the LIMS using data reduction software. The LIMS compares the QC results with the statistically derived acceptance limits and identifies results that are out of specification. If the results are not within the acceptance criteria, corrective action suitable to the situation must be taken. The corrective action includes reanalysis of the sample or emailed notification from your project manager. This notification will explain, in detail, the QC that is out of specification and the options you have for reporting the data. Our strict standards and quality systems ensure that we generate data and provide services that meet the requirements of our clients and sustain the rigors of regulatory review and legal scrutiny.

Data Quality is of upmost importance to our operations. Eurofins actively participates in proficiency test programs, using externally supplied reference standards, twice a year. Our PFAS proficiency tests from the last two years are provided for potable and non-potable water. We have staff dedicated to support PFAS testing, who can assist with interpretation and perform expert witness testimony if needed.

## **PRACTICES UTILIZED TO ELIMINATE CROSS-CONTAMINATION**

PFAS compounds are found in many commonly used materials and the potential for cross-contamination is a concern in the field and the laboratory. Eurofins has taken numerous steps to ensure that background concentrations of PFAS compounds do not cross contaminate your samples in the laboratory. We avoid the use of PTFE materials in the lab by removing Teflon™ O-rings and seals from our instruments and replacing them with PTFE-free products. PFAS samples are prepared and extracted in an area designated specially up fitted for that purpose. The glassware cleaning area is also separate from the instrument labs. Ultra-pure PFAS-free deionized (DI) water is used during PFAS extraction and analysis. We can provide this same water to clients for use in the field for decontamination, field and/or equipment blanks. A check of our lab gloves and deionized water is performed with every extraction batch in the form of a method blank. The lids provided with sample bottles do not have Teflon™ lining. We are happy to provide guidance to field samplers about ways to avoid cross-contamination at the site and during sample shipment.

## SAMPLE RECIEVING

Eurofins can accept samples Monday through Friday (8:00 am to 5:00 pm) and Saturday (9:00 am to 12:00 pm). Commercial and Cargo carriers, UPS, Federal Express shipments and client deliveries received on Saturdays are completely unpacked, logged into our LIMS, properly stored, and in some cases analysis is started if rush TAT testing is scheduled in advance. Sample receipt outside of the hours listed above can be accommodated and are handled by our trained security staff. Samples are placed in sealed refrigerator storage and appropriate documentation and notifications are made so that regular shift employees attend to the samples immediately upon arrival of next work shift.

## SAMPLE STORAGE

Eurofins inspects all samples upon receipt. We will contact SC DHEC immediately whenever samples are received with breakage, leakage, missing container labels, incomplete paperwork or excessive temperature. Each cooler temperature is measured and recorded on the sample custody form. Tracking numbers are then assigned to each sample and scheduled for analysis. Analytical Departments are notified to retrieve any samples with short holding times or samples requiring rush turnaround times so processing can commence immediately. Remaining samples are stored at 4°C in walk-in refrigerators. Temperatures in all cold storage areas are measured twice each day to ensure required temperature is maintained.

## BOTTLEWARE

As stated previously, Eurofins will provide sample containers at no cost. Sample containers will be delivered to the site via Fed Ex or UPS Ground Shipping. For waters, the high-density polyethylene (HDPE) bottles are 250 ml in size, and for samples suspected of being a chlorinated source, can be preserved with Trizma crystals. Lids are free of Teflon™ lining and have been thoroughly tested to ensure that they are PFAS-free. Our sample containers are purchased pre-cleaned and certified. We have specially cleaned and tested PFAS-free deionized water that we use for all aspects of the PFAS extraction and analysis. We provide this water to clients for their field and equipment blanks.

## PFAS FIELD COLLECTION CONSIDERATIONS

Because PFAS can be found in a number of consumer products, several recommended practices [compiled from various state agencies] that are listed below should be followed during the collection of samples to avoid potential cross contamination:

- Sticky notes products, markers, waterproof field books, plastic clipboards should not be used (Masonite or aluminum clipboards are recommended); binders, spiral hard cover notebooks, or glue materials should not be used at any time during sample handling, or field activity.
- All samples should be collected in high density polyethylene plastic (HDPE) bottles with an unlined cap that is Teflon™ free.
- The field personnel involved with sample collection and handling should avoid wearing new clothing (i.e., at least 6 washings with PFAS-free detergent since purchase) as well as breathable waterproof and tear proof textiles and fabric softeners.

- Personnel collecting samples should not wear anti-stain and/or water resistant clothing or shoes immediately prior to or during sample collection. Rain gear made from polyurethane and wax-coated material is recommended.
- Personnel collecting and handling samples should wear nitrile gloves at all times while collecting and handling samples. Gloves should be changed frequently during sampling collection and handling.
- Sunblock/insect repellents used on site should consist of 100% natural ingredients and should be PFAS-free.
- Sample collectors should not use cosmetics, moisturizers, hand cream, or other related products.
- Many food and snack products are packaged in wrappers treated with PFAS. Therefore, hands should be thoroughly washed after handling fast food, carryout food, or snacks.
- No food or drink should be brought on site, with the exception of bottled water and hydration drinks.
- Reusable ice packs should not be used to cool samples or be used in sample coolers.
- The use of decontamination soaps containing fluoro-surfactants must be avoided. An anionic detergent is recommended.

**MINORITY PARTICIPATION (DEC 2015)**

Is the bidder a South Carolina Certified Minority Business? [ ] Yes  No

Is the bidder a Minority Business certified by another governmental entity? [ ] Yes  No

If so, please list the certifying governmental entity:  N/A

Will any of the work under this contract be performed by a SC certified Minority Business as a subcontractor? [ ] Yes  No

If so, what percentage of the total value of the contract will be performed by a SC certified Minority Business as a subcontractor?  N/A

Will any of the work under this contract be performed by a minority business certified by another governmental entity as a subcontractor? [ ] Yes  No

If so, what percentage of the total value of the contract will be performed by a minority business certified by another governmental entity as a subcontractor?  N/A

If a certified Minority Business is participating in this contract, please indicate all categories for which the Business is certified:

- Traditional minority  N/A
- Traditional minority, but female
- Women (Caucasian females)
- Hispanic minorities
- DOT referral (Traditional minority)
- DOT referral (Caucasian female)
- Temporary certification
- SBA 8 (a) certification referral
- Other minorities (Native American, Asian, etc.)

(If more than one minority contractor will be utilized in the performance of this contract, please provide the information above for each minority business.)

The Department of Administration, Division of Small and Minority Business Contracting and Certification, publishes a list of certified minority firms. The Minority Business Directory is available at the following URL:  
<http://osmba.sc.gov/directory.html> [04-4015-3]

## IX. ATTACHMENTS TO SOLICITATION

- A. Nonresident Taxpayer Registration Affidavit Income Tax Withholding
- B. Offeror's Checklist
- C. EPA Method 533 (separate attachment)

### NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING

#### IMPORTANT TAX NOTICE - NONRESIDENTS ONLY

Not Applicable

Withholding Requirements for Payments to Nonresidents: Section 12-8-550 of the South Carolina Code of Laws requires persons hiring or contracting with a nonresident conducting a business or performing personal services of a temporary nature within South Carolina to withhold 2% of each payment made to the nonresident. The withholding requirement does not apply to (1) payments on purchase orders for tangible personal property when the payments are not accompanied by services to be performed in South Carolina, (2) nonresidents who are not conducting business in South Carolina, (3) nonresidents for contracts that do not exceed \$10,000 in a calendar year, or (4) payments to a nonresident who (a) registers with either the S.C. Department of Revenue or the S.C. Secretary of State and (b) submits a Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to the person letting the contract.

The withholding requirement applies to every governmental entity that uses a contract ("Using Entity"). Nonresidents should submit a separate copy of the Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to every Using Entity that makes payment to the nonresident pursuant to this solicitation. Once submitted, an affidavit is valid for all contracts between the nonresident and the Using Entity, unless the Using Entity receives notice from the Department of Revenue that the exemption from withholding has been revoked.

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Section 12-8-540 requires persons making payment to a nonresident taxpayer of rentals or royalties at a rate of \$1,200.00 or more a year for the use of or for the privilege of using property in South Carolina to withhold 7% of the total of each payment made to a nonresident taxpayer who is not a corporation and 5% if the payment is made to a corporation. Contact the Department of Revenue for any applicable exceptions.

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For information about other withholding requirements (e.g., employee withholding), contact the Withholding Section at the South Carolina Department of Revenue at 803-898-5383 or visit the Department's website at: [www.sctax.org](http://www.sctax.org)

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This notice is for informational purposes only. This agency does not administer and has no authority over tax issues. All registration questions should be directed to the License and Registration Section at 803-898-5872 or to the South Carolina Department of Revenue, Registration Unit, Columbia, S.C. 29214-0140. All withholding questions should be directed to the Withholding Section at 803-896-1420.

PLEASE SEE THE "NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING" FORM (FORM NUMBER I-312) LOCATED AT:

<http://www.sctax.org/Forms+and+Instructions/withholding/default.htm>

[09-9005-1]



# State of South Carolina

Request for Quote  
Amendment - I

Solicitation: 5400019500  
Date Issued: March 20, 2020  
Procurement Officer: E. Madison Winslow  
*E. Madison Winslow*  
Phone: 803-898-3487  
E-Mail Address: winsloem@dhec.sc.gov

DESCRIPTION: **EPA Method 533 for Per-and Polyfluoroalkyl Substances (PFAS) Analysis**

USING GOVERNMENTAL UNIT: **South Carolina Department of Health and Environmental Control**

*The Term "Offer" Means Your "Bid" or "Proposal". See "Submitting Your Paper Offer or Modification" provision.*

**SUBMIT YOUR OFFER ONLINE AT THE FOLLOWING URL: <http://www.procurement.sc.gov>**  
**(See Page 3 and 4 for Instructions)**  
**By e-mail to [winsloem@dhec.sc.gov](mailto:winsloem@dhec.sc.gov)**

SUBMIT OFFER BY (Opening Date/Time): **March 27, 2020/2:30 pm ET** (See "Deadline For Submission Of Offer" provision)

QUESTIONS MUST BE RECEIVED BY: ~~March 19, 2020/2:30 pm ET~~ (See "Questions From Offerors" provision)

NUMBER OF COPIES TO BE SUBMITTED: **See Page 3 for Instructions**

CONFERENCE TYPE: N/A DATE & TIME: N/A  (As appropriate, see "Conferences - Pre-Bid/Proposal" & "Site Visit" provisions)	LOCATION: N/A
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<b>AWARD &amp; AMENDMENTS</b>	Award will be posted on <b>March 30, 2020</b> . The award, this solicitation, any amendments, and any related notices will be posted at the following web address: <a href="http://www.procurement.sc.gov">http://www.procurement.sc.gov</a>
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You must submit a signed copy of this form with Your Offer. By signing, You agree to be bound by the terms of the Solicitation. You agree to hold Your Offer open for a minimum of thirty (30) calendar days after the Opening Date. (See "Signing Your Offer" provision.)

NAME OF OFFEROR <b>Eurofins Eaton Analytical, LLC</b>  (full legal name of business submitting the offer)	Any award issued will be issued to, and the contract will be formed with, the entity identified as the Offeror. The entity named as the offeror must be a single and distinct legal entity. Do not use the name of a branch office or a division of a larger entity if the branch or division is not a separate legal entity, i.e., a separate corporation, partnership, sole proprietorship, etc.
--	--

AUTHORIZED SIGNATURE  <i>John Cosgrove</i>  (Person must be authorized to submit binding offer to contract on behalf of Offeror.)	DATE SIGNED  3/27/2020
---	------------------------------

TITLE <b>President</b>  (business title of person signing above)	STATE VENDOR NO. <b>7000233321</b>  (Register to Obtain S.C. Vendor No. at <a href="http://www.procurement.sc.gov">www.procurement.sc.gov</a> )
---	--

PRINTED NAME <b>John Cosgrove PhD</b>  (printed name of person signing above)	STATE OF INCORPORATION <b>Delaware</b>  (If you are a corporation, identify the state of incorporation.)
--	---

OFFEROR'S TYPE OF ENTITY: (Check one) (See "Signing Your Offer" provision.)

Sole Proprietorship  Partnership  Other \_\_\_\_\_

Corporate entity (not tax-exempt)  Corporation (tax-exempt)  Government entity (federal, state, or local)

COVER PAGE - ON-LINE ONLY (MAR. 2015)

**PAGE TWO**

(Return Page Two with Your Offer)

<p><b>HOME OFFICE ADDRESS</b> (Address for offeror's home office / principal place of business)</p> <p>Eurofins Eaton Analytical, LLC 110 South Hill Street South Bend, IN 46617</p>	<p><b>NOTICE ADDRESS</b> (Address to which all procurement and contract related notices should be sent.) (See "Notice" clause)</p> <p>Eurofins Eaton Analytical, LLC 110 South Hill Street South Bend, IN 46617</p> <p>574-233-4777 _____ Area Code - Number - Extension Facsimile</p> <p>JosephMattheis@EurofinsUS.com _____ E-mail Address</p>
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<p><b>PAYMENT ADDRESS</b> (Address to which payments will be sent.) (See "Payment" clause)</p> <p>Eurofins Eaton Analytical, LLC PO Box 95362 Grapevine, TX 76099-9733</p> <p><input type="checkbox"/> Payment Address same as Home Office Address <input type="checkbox"/> Payment Address same as Notice Address <b>(check only one)</b></p>	<p><b>ORDER ADDRESS</b> (Address to which purchase orders will be sent) (See "Purchase Orders and "Contract Documents" clauses)</p> <p><input type="checkbox"/> Order Address same as Home Office Address <input checked="" type="checkbox"/> Order Address same as Notice Address <b>(check only one)</b></p>
--	--

**ACKNOWLEDGMENT OF AMENDMENTS**  
Offerors acknowledges receipt of amendments by indicating amendment number and its date of issue. (See "Amendments to Solicitation" Provision)

Amendment No.	Amendment Issue Date						
1	3/20/2020						

<b>DISCOUNT FOR PROMPT PAYMENT</b> (See "Discount for Prompt Payment" clause)	10 Calendar Days (%)	20 Calendar Days (%)	30 Calendar Days (%)	____ Calendar Days (%)
--	----------------------	----------------------	----------------------	------------------------

**PREFERENCES - A NOTICE TO VENDORS (SEP. 2009):** On June 16, 2009, the South Carolina General Assembly rewrote the law governing preferences available to in-state vendors, vendors using in-state subcontractors, and vendors selling in-state or US end products. This law appears in Section 11-35-1524 of the South Carolina Code of Laws. A summary of the new preferences is available at [www.procurement.sc.gov/preferences](http://www.procurement.sc.gov/preferences). ***ALL THE PREFERENCES MUST BE CLAIMED AND ARE APPLIED BY LINE ITEM, REGARDLESS OF WHETHER AWARD IS MADE BY ITEM OR LOT. VENDORS ARE CAUTIONED TO CAREFULLY REVIEW THE STATUTE BEFORE CLAIMING ANY PREFERENCES. THE REQUIREMENTS TO QUALIFY HAVE CHANGED. IF YOU REQUEST A PREFERENCE, YOU ARE CERTIFYING THAT YOUR OFFER QUALIFIES FOR THE PREFERENCE YOU'VE CLAIMED. IMPROPERLY REQUESTING A PREFERENCE CAN HAVE SERIOUS CONSEQUENCES.*** [11-35-1524(E)(4)&(6)]

**PREFERENCES - ADDRESS AND PHONE OF IN-STATE OFFICE:** Please provide the address and phone number for your in-state office in the space provided below. An in-state office is necessary to claim either the Resident Vendor Preference (11-35-1524(C)(1)(i)&(ii)) or the Resident Contractor Preference (11-35-1524(C)(1)(iii)). Accordingly, you must provide this information to qualify for the preference. An in-state office is not required, but can be beneficial, if you are claiming the Resident Subcontractor Preference (11-35-1524(D)).

\_\_\_\_ In-State Office Address same as Home Office Address \_\_\_\_ In-State Office Address same as Notice Address **(check only one)**

## AMENDMENT ONE

### Solicitation No. 5400019500

DESCRIPTION: EPA Method 533 for Per-and Polyfluoroalkyl Substances (PFAS) Analysis

#### AMENDMENTS TO SOLICITATION (JAN 2004)

(a) The Solicitation may be amended at any time prior to opening. All actual and prospective Offerors should monitor the following web site for the issuance of Amendments: [www.procurement.sc.gov](http://www.procurement.sc.gov) (b) Offerors shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date in the space provided for this purpose on Page Two, (3) by letter, or (4) by submitting a bid that indicates in some way that the bidder received the amendment. (c) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged. [02-2A005-1]

#### QUESTIONS FROM OFFERORS – AMENDMENT (JUN 2017)

THE SOLICITATION IS AMENDED AS PROVIDED HEREIN. INFORMATION OR CHANGES RESULTING FROM QUESTIONS WILL BE SHOWN IN A QUESTION-AND-ANSWER FORMAT. ALL QUESTIONS RECEIVED HAVE BEEN REPRINTED BELOW. THE “STATE’S RESPONSE” SHOULD BE READ WITHOUT REFERENCE TO THE QUESTIONS. THE QUESTIONS ARE INCLUDED SOLELY TO PROVIDE A CROSS-REFERENCE TO THE POTENTIAL OFFEROR THAT SUBMITTED THE QUESTION. QUESTIONS DO NOT FORM A PART OF THE CONTRACT; THE “STATE’S RESPONSE” DOES. **ANY RESTATEMENT OF PART OR ALL OF AN EXISTING PROVISION OF THE SOLICITATION IN AN ANSWER DOES NOT MODIFY THE ORIGINAL PROVISION EXCEPT AS FOLLOWS: UNDERLINED TEXT IS ADDED TO THE ORIGINAL PROVISION. STRICKEN TEXT IS DELETED.** [02-2A097-1]

#### Questions and Answers

1. **QUESTION:** In section 3.2.2.1 it states “Bidders must be certified for this method” and section 4.2 requests proof of certification. Method 533 is a new method and we are in the process of obtaining certification. Our request for certification will be submitted to TNI within a month, can we bid on this solicitation?

**STATE’S RESPONSE:** There is nothing preventing the vendor from bidding on the solicitation. However, certification must be provided prior to an award being issued. The award for this solicitation is currently scheduled to be posted on March 30, 2020.

## VIII. BIDDING SCHEDULE / PRICE-BUSINESS PROPOSAL

### BIDDING SCHEDULE (NOV 2007)

Line Number	Quantity	Unit of Measure	Unit Price	Extended Price
0001	1.000	each	\$385	\$385
<b>Product Category:</b> 98991 - Water Sampling and Analysis Services				
<b>Item Description:</b> Sample analysis – Method 533				
<b>Tendering Text:</b> See specifications in Section III.				
<b>Internal Item Number: 1</b>				
Question	Mandatory / Optional	Multiple Responses Accepted?	Response	
The bidder has read and understands all Amendments.	Mandatory	No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
1. The Submitter has read and understands the terms and conditions of this solicitation.	Mandatory	No	<input checked="" type="checkbox"/> Yes. I have read and understand the terms and conditions.	
2. The offer is in accordance with the terms and conditions of this solicitation.	Mandatory	No	<input checked="" type="checkbox"/> Yes. I have read and understand the terms and conditions.	
Are you requesting the SC Resident Contractor Preference? See The SC Procurement Code, Section 11-35-1524(C) (1) (III) and Section IIB of this Solicitation for more Information. For a FAQ on these Preferences, Please See <a href="http://www.procurement.sc.gov/preferences">www.procurement.sc.gov/preferences</a>	Mandatory	No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Are you requesting the SC Resident Subcontractor Preference-2%? See the SC Procurement Code, Section 11-35-1524(D) and IIB & VIIB of this solicitation for more information. For a FAQ on these preferences, please see <a href="http://www.procurement.sc.gov/preferences">www.procurement.sc.gov/preferences</a>	Mandatory	No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Are you requesting the SC Resident Subcontractor Preference-4%? See the SC Procurement Code, Section 11-35-1524(D) and IIB & VIIB of this solicitation for more information. For a FAQ on these preferences, please see <a href="http://www.procurement.sc.gov/preferences">www.procurement.sc.gov/preferences</a>	Mandatory	No	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
Can bidder meet the June 1, 2020 Performance Time-Frame?	Mandatory	No	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	



# CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)  
01/02/2020

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

**IMPORTANT:** If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

<b>PRODUCER</b> Willis Towers Watson Northeast, Inc. fka Willis of Pennsylvania, Inc. c/o 26 Century Blvd P.O. Box 305191 Nashville, TN 372305191 USA	<b>CONTACT NAME:</b> Willis Towers Watson Certificate Center <b>PHONE (A/C No. Ext):</b> 1-877-945-7378 <b>FAX (A/C No):</b> 1-888-467-2378 <b>E-MAIL ADDRESS:</b> certificates@willis.com														
	<table border="1"> <thead> <tr> <th>INSURER(S) AFFORDING COVERAGE</th> <th>NAIC #</th> </tr> </thead> <tbody> <tr> <td>INSURER A: HDI Global Insurance Company</td> <td>41343</td> </tr> <tr> <td>INSURER B: Travelers Property Casualty Company of Ame</td> <td>25674</td> </tr> <tr> <td>INSURER C: AXA Insurance Company</td> <td>33022</td> </tr> <tr> <td>INSURER D:</td> <td></td> </tr> <tr> <td>INSURER E:</td> <td></td> </tr> <tr> <td>INSURER F:</td> <td></td> </tr> </tbody> </table>		INSURER(S) AFFORDING COVERAGE	NAIC #	INSURER A: HDI Global Insurance Company	41343	INSURER B: Travelers Property Casualty Company of Ame	25674	INSURER C: AXA Insurance Company	33022	INSURER D:		INSURER E:		INSURER F:
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INSURER D:															
INSURER E:															
INSURER F:															
<b>INSURED</b> Eurofins Eaton Analytical, LLC 750 Royal Oaks Drive, Suite 100, Monrovia, CA 91016 USA															

**COVERAGES**      **CERTIFICATE NUMBER:** WL5130477      **REVISION NUMBER:**

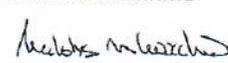
THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
A	<input checked="" type="checkbox"/> <b>COMMERCIAL GENERAL LIABILITY</b> <input type="checkbox"/> CLAIMS-MADE <input checked="" type="checkbox"/> OCCUR  GEN'L AGGREGATE LIMIT APPLIES PER: <input checked="" type="checkbox"/> POLICY <input checked="" type="checkbox"/> PRO-JECT <input checked="" type="checkbox"/> LOC OTHER:			GLD1313805	01/01/2020	01/01/2021	EACH OCCURRENCE \$ 2,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$ 1,000,000 MED EXP (Any one person) \$ 10,000 PERSONAL & ADV INJURY \$ 1,000,000 GENERAL AGGREGATE \$ 2,000,000 PRODUCTS - COMP/OP AGG \$ 2,000,000	
B	<b>AUTOMOBILE LIABILITY</b> <input checked="" type="checkbox"/> ANY AUTO <input type="checkbox"/> OWNED AUTOS ONLY <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS ONLY <input type="checkbox"/> NON-OWNED AUTOS ONLY <input type="checkbox"/> AUTOS ONLY			HC2JCAP-162D3822-20	01/01/2020	01/01/2021	COMBINED SINGLE LIMIT (Ea accident) \$ 1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$	
A	<input checked="" type="checkbox"/> <b>UMBRELLA LIAB</b> <input checked="" type="checkbox"/> OCCUR <input type="checkbox"/> EXCESS LIAB <input type="checkbox"/> CLAIMS-MADE <input type="checkbox"/> DED <input checked="" type="checkbox"/> RETENTION \$ 250,000			CUD1314005	01/01/2020	01/01/2021	EACH OCCURRENCE \$ 15,000,000 AGGREGATE \$ 15,000,000	
B	<b>WORKERS COMPENSATION AND EMPLOYERS' LIABILITY</b> ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	Y/N	No	N/A	HC2NUB-157D3795-20	01/01/2020	01/01/2021	<input checked="" type="checkbox"/> PER STATUTE <input type="checkbox"/> OTH-ER E.L. EACH ACCIDENT \$ 1,000,000 E.L. DISEASE - EA EMPLOYEE \$ 1,000,000 E.L. DISEASE - POLICY LIMIT \$ 1,000,000
B	<b>Workers Compensation And Employers' Liability</b> -Per Statute			HRJUB-4F195715-20	01/01/2020	01/01/2021	EL Each Accident \$1,000,000 EL Disease - EA Empl. \$1,000,000 EL Disease - Pol Lim. \$1,000,000	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

SEE ATTACHED

**CERTIFICATE HOLDER**      **CANCELLATION**

For Bid or Proposal Purposes Only	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.
	AUTHORIZED REPRESENTATIVE 

AGENCY CUSTOMER ID: \_\_\_\_\_

LOC #: \_\_\_\_\_



**ADDITIONAL REMARKS SCHEDULE**

<b>AGENCY</b> Willis Towers Watson Northeast, Inc. fka Willis of Pennsylvania, Inc.		<b>NAMED INSURED</b> Eurofins Eaton Analytical, LLC 750 Royal Oaks Drive, Suite 100, Monrovia, CA 91016 USA	
<b>POLICY NUMBER</b> See Page 1		<b>EFFECTIVE DATE:</b> See Page 1	
<b>CARRIER</b> See Page 1	<b>NAIC CODE</b> See Page 1		

**ADDITIONAL REMARKS**

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 FORM TITLE: Certificate of Liability Insurance

INSURER AFFORDING COVERAGE: HDI Global Insurance Company NAIC#: 41343  
 POLICY NUMBER: EOD 1313905    EFF DATE: 01/01/2020    EXP DATE: 01/01/2021

TYPE OF INSURANCE:	LIMIT DESCRIPTION:	LIMIT AMOUNT:
Professional Liability	Each Claim	\$5,000,000
	Policy Aggregate	\$5,000,000

INSURER AFFORDING COVERAGE: AXA Insurance Company NAIC#: 33022  
 POLICY NUMBER: XFR0077075LI18A    EFF DATE: 01/01/2018    EXP DATE: 01/01/2021

TYPE OF INSURANCE:	LIMIT DESCRIPTION:	LIMIT AMOUNT:
Pollution Liability	Each Claim	\$5,000,000
	Policy Aggregate	\$5,000,000
	Retention	\$35,000

# State of Utah

Department of Health

Environmental Laboratory Certification Program

*Certification is hereby granted to*

Eurofins Eaton Analytical, LLC - Monrovia

750 Royal Oaks Drive Ste 100  
Monrovia, CA 91016

*Has conformed with the  
2009 TNI Standard*

*Scope of accreditation is limited to the  
State of Utah accredited fields that accompany  
this Certificate*

EPA Number: CA00006

Expiration Date: 1/31/2021

Certificate Number: CA000062020-18



Robyn M. Atkinson, Ph.D, HCLD  
Director, Utah Public Health Laboratory



*Continued accredited status depends on successful ongoing participation in the program.*





State of Utah  
 Gary R. Herbert  
 Governor  
 Spencer J. Cox  
 Lieutenant Governor

**Utah Department of Health**

Dr. Joseph K. Miner  
 Executive Director

**Division of Disease Control and Prevention**

Robyn M. Atkinson, Ph.D, HCLD  
 Director, Utah Public Health Laboratory



**EPA Number: CA00006**

**Attachment to Certificate Number: CA000062020-18**

Page 1 of 16

Eurofins Eaton Analytical, LLC - Monrovia

**Start Date Expires AB**

**Program/Matrix: CWA (Non Potable Water)**

**Method Enterolert®**

Enterococci 01/01/18 01/31/21 UT

**Method Enzyme Substrate Coliform Test (Colisure®)**

Escherichia coli 01/01/18 01/31/21 UT

Total coliforms 01/01/18 01/31/21 UT

**Method EPA 100.2**

Asbestos 01/01/18 01/31/21 UT

**Method EPA 120.1**

Conductivity 01/01/18 01/31/21 UT

**Method EPA 160.4**

Residue-volatile 01/01/18 01/31/21 UT

**Method EPA 180.1**

Turbidity 01/01/18 01/31/21 UT

**Method EPA 200.7**

Aluminum 01/01/18 01/31/21 UT

Antimony 01/01/18 01/31/21 UT

Barium 01/01/18 01/31/21 UT

Beryllium 01/01/18 01/31/21 UT

Boron 01/01/18 01/31/21 UT

Cadmium 01/01/18 01/31/21 UT

Calcium 01/01/18 01/31/21 UT

Chromium 01/01/18 01/31/21 UT

Cobalt 01/01/18 01/31/21 UT

Copper 01/01/18 01/31/21 UT

Iron 01/01/18 01/31/21 UT

Lead 01/01/18 01/31/21 UT

Magnesium 01/01/18 01/31/21 UT

Manganese 01/01/18 01/31/21 UT

Molybdenum 01/01/18 01/31/21 UT

Nickel 01/01/18 01/31/21 UT

Potassium 01/01/18 01/31/21 UT

Silica as SiO2 01/01/18 01/31/21 UT

Silver 01/01/18 01/31/21 UT

Sodium 01/01/18 01/31/21 UT

Strontium 01/01/18 01/31/21 UT



Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: CWA (Non Potable Water)**

Thallium	01/01/18	01/31/21	UT
Tin	01/01/18	01/31/21	UT
Titanium	01/01/18	01/31/21	UT
Total hardness as CaCO3	01/01/18	01/31/21	UT
Vanadium	01/01/18	01/31/21	UT
Zinc	01/01/18	01/31/21	UT

**Method EPA 200.8**

Aluminum	01/01/18	01/31/21	UT
Antimony	01/01/18	01/31/21	UT
Arsenic	01/01/18	01/31/21	UT
Barium	01/01/18	01/31/21	UT
Beryllium	01/01/18	01/31/21	UT
Cadmium	01/01/18	01/31/21	UT
Chromium	01/01/18	01/31/21	UT
Cobalt	01/01/18	01/31/21	UT
Copper	01/01/18	01/31/21	UT
Lead	01/01/18	01/31/21	UT
Manganese	01/01/18	01/31/21	UT
Molybdenum	01/01/18	01/31/21	UT
Nickel	01/01/18	01/31/21	UT
Selenium	01/01/18	01/31/21	UT
Silver	01/01/18	01/31/21	UT
Thallium	01/01/18	01/31/21	UT
Tin	01/01/18	01/31/21	UT
Titanium	01/01/18	01/31/21	UT
Vanadium	01/01/18	01/31/21	UT
Zinc	01/01/18	01/31/21	UT

**Method EPA 218.6**

Chromium VI	01/01/18	01/31/21	UT
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**Method EPA 300.0**

Bromide	01/01/18	01/31/21	UT
Chloride	01/01/18	01/31/21	UT
Nitrate as N	01/01/18	01/31/21	UT
Nitrate-nitrite	01/01/18	01/31/21	UT
Nitrite as N	01/01/18	01/31/21	UT
Sulfate	01/01/18	01/31/21	UT

**Method EPA 314**

Perchlorate	01/01/18	01/31/21	UT
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**Method EPA 331.0**

Perchlorate	01/01/18	01/31/21	UT
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**Method EPA 335.4**

Total cyanide	01/01/18	01/31/21	UT
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**Method EPA 350.1**

Ammonia as N	01/01/18	01/31/21	UT
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**Method EPA 351.2**

Kjeldahl Nitrogen (Total Kjeldahl Nitrogen-TKN)	01/01/18	01/31/21	UT
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Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: CWA (Non Potable Water)****Method EPA 353.2**

Nitrate as N	01/01/18	01/31/21	UT
Nitrate-nitrite	01/01/18	01/31/21	UT
Nitrite as N	01/01/18	01/31/21	UT

**Method EPA 365.1**

Orthophosphate as P	01/01/18	01/31/21	UT
Phosphorus, total	01/01/18	01/31/21	UT

**Method EPA 410.4**

Chemical oxygen demand	01/01/18	01/31/21	UT
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**Method EPA 420.1**

Total phenolics	01/01/18	01/31/21	UT
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**Method EPA 420.4**

Total phenolics	01/01/18	01/31/21	UT
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**Method EPA 522**

1,4-Dioxane (1,4- Diethyleneoxide)	01/01/18	01/31/21	UT
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**Method EPA 900.0 (GPC)**

Gross-alpha	01/01/18	01/31/21	UT
Gross-beta	01/01/18	01/31/21	UT

**Method Legionella pneumophila in water**

Legionella pneumophila	09/04/18	01/31/21	UT
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**Method Multiple Tube Fermentation Qualitative (LTB): Total Coliform**

Total coliforms	01/06/20	01/31/21	UT
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**Method SM 2120 B-2011**

Color	01/01/18	01/31/21	UT
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**Method SM 2150 B-2011**

Odor	01/06/20	01/31/21	UT
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**Method SM 2320 B-2011**

Alkalinity as CaCO <sub>3</sub>	01/01/18	01/31/21	UT
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**Method SM 2340 B-2011**

Total hardness as CaCO <sub>3</sub>	01/01/18	01/31/21	UT
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**Method SM 2340 C-2011**

Calcium hardness as CaCO <sub>3</sub>	02/04/20	01/31/21	UT
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**Method SM 2510 B-2011**

Conductivity	01/01/18	01/31/21	UT
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**Method SM 2540 B-2011**

Residue-total	01/01/18	01/31/21	UT
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**Method SM 2540 C-2011**

Residue-filterable (TDS)	01/01/18	01/31/21	UT
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**Method SM 2540 D-2011**

Residue-nonfilterable (TSS)	01/01/18	01/31/21	UT
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**Method SM 2540 E-2011**

Residue-volatile	01/01/18	01/31/21	UT
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**Method SM 2540 F-1997**

Residue-settleable	01/01/18	01/31/21	UT
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Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: CWA (Non Potable Water)**

Method	Start Date	Expires	AB
<b>Method SM 3500-Cr B-2011</b> Chromium VI	01/01/18	01/31/21	UT
<b>Method SM 4500-Cl G-2011</b> Free chlorine	01/01/18	01/31/21	UT
Total chlorine	10/29/18	01/31/21	UT
Total residual chlorine	01/01/18	01/31/21	UT
<b>Method SM 4500-CN<sup>-</sup> F-2011</b> Total cyanide	01/01/18	01/31/21	UT
<b>Method SM 4500-CN<sup>-</sup> G-2011</b> Amenable cyanide	01/01/18	01/31/21	UT
<b>Method SM 4500-H+ B-2011</b> pH	01/01/18	01/31/21	UT
<b>Method SM 4500-NH3 H-2011</b> Ammonia as N	01/01/18	01/31/21	UT
<b>Method SM 4500-O G-2011</b> Oxygen, dissolved	01/01/18	01/31/21	UT
<b>Method SM 4500-P E-2011</b> Orthophosphate as P	01/01/18	01/31/21	UT
Phosphorus, total	01/01/18	01/31/21	UT
<b>Method SM 4500-S2<sup>-</sup> D-2011</b> Sulfide	01/01/18	01/31/21	UT
<b>Method SM 4500-SiO2 C-2011</b> Silica as SiO2	01/01/18	01/31/21	UT
<b>Method SM 5210 B-2011</b> Biochemical oxygen demand	01/01/18	01/31/21	UT
Carbonaceous BOD, CBOD	01/01/18	01/31/21	UT
<b>Method SM 5220 D-2011</b> Chemical oxygen demand	01/01/18	01/31/21	UT
<b>Method SM 5310 C-2011</b> Dissolved organic carbon (DOC)	01/01/18	01/31/21	UT
Total organic carbon	01/01/18	01/31/21	UT
<b>Method SM 5540 C-2011</b> Surfactants - MBAS	01/01/18	01/31/21	UT
<b>Method SM 9215 B (PCA)-2004</b> Heterotrophic plate count	01/01/18	01/31/21	UT
<b>Method SM 9221 B-2001</b> Total coliforms	02/04/20	01/31/21	UT
<b>Method SM 9221 E (EC)-2006</b> Fecal coliforms	02/04/20	01/31/21	UT
<b>Method SM 9221 F (EC MUG)</b> Escherichia coli	02/04/20	01/31/21	UT
<b>Method SM 9223 B (Colilert® Quanti-Tray®)</b> Escherichia coli	01/01/18	01/31/21	UT
Total coliforms	01/01/18	01/31/21	UT

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: CWA (Non Potable Water)****Method SM 9223 B (Colilert®)**

Escherichia coli

01/01/18 01/31/21 UT

Total coliforms

01/01/18 01/31/21 UT

**Method SM 9223 B (Colilert®-18 Quanti-Tray®)**

Escherichia coli

01/01/18 01/31/21 UT

Total coliforms

01/01/18 01/31/21 UT

**Method SM 9230 B (NaCl)**

Enterococci

01/01/18 01/31/21 UT

**Method SM 9230 B (PSE)**

Fecal streptococci

01/01/18 01/31/21 UT

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)****Method ChlordioX Plus**

Chlorine dioxide	09/04/18	01/31/21	UT
Chlorite	09/04/18	01/31/21	UT

**Method Cylindrospermopsin Plate by ELISA Procedure**

Microcystin-LA (MC-LA)	09/04/18	01/31/21	UT
Microcystin-LF (MC-LF)	09/04/18	01/31/21	UT
Microcystin-LR (MC-LR)	09/04/18	01/31/21	UT
Microcystin-YR (MC-LY)	09/04/18	01/31/21	UT
Microcystin-YR (MC-RR)	09/04/18	01/31/21	UT
Microcystin-YR (MC-YR)	09/04/18	01/31/21	UT
Nodularin-R (NOD)	09/04/18	01/31/21	UT

**Method Disinfection By-Products Liquid/Liquid and GC/ECD**

Total haloacetic acids	01/01/18	01/31/21	UT
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**Method Enterolert®**

Enterococci	01/01/18	01/31/21	UT
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**Method EPA 100.2**

Asbestos	01/01/18	01/31/21	UT
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**Method EPA 150.1**

pH	01/01/18	01/31/21	UT
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**Method EPA 1613B**

2,3,7,8-Tetrachlorodibenzo- p-dioxin (2,3,7,8-TCDD)	01/01/18	01/31/21	UT
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**Method EPA 180.1**

Turbidity	01/01/18	01/31/21	UT
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**Method EPA 200.7**

Aluminum	01/01/18	01/31/21	UT
Barium	01/01/18	01/31/21	UT
Beryllium	01/01/18	01/31/21	UT
Boron	01/01/18	01/31/21	UT
Cadmium	01/01/18	01/31/21	UT
Calcium	01/01/18	01/31/21	UT
Chromium	01/01/18	01/31/21	UT
Copper	01/01/18	01/31/21	UT
Iron	01/01/18	01/31/21	UT
Magnesium	01/01/18	01/31/21	UT
Manganese	01/01/18	01/31/21	UT
Molybdenum	01/01/18	01/31/21	UT
Nickel	01/01/18	01/31/21	UT
Potassium	01/01/18	01/31/21	UT
Silica as SiO <sub>2</sub>	01/01/18	01/31/21	UT
Silver	01/01/18	01/31/21	UT
Sodium	01/01/18	01/31/21	UT
Total hardness as CaCO <sub>3</sub>	01/01/18	01/31/21	UT
Vanadium	01/01/18	01/31/21	UT
Zinc	01/01/18	01/31/21	UT

**Method EPA 200.8**

Aluminum	01/01/18	01/31/21	UT
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Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)**

	Start Date	Expires	AB
Antimony	01/01/18	01/31/21	UT
Arsenic	01/01/18	01/31/21	UT
Barium	01/01/18	01/31/21	UT
Beryllium	01/01/18	01/31/21	UT
Cadmium	01/01/18	01/31/21	UT
Chromium	01/01/18	01/31/21	UT
Copper	01/01/18	01/31/21	UT
Lead	01/01/18	01/31/21	UT
Manganese	01/01/18	01/31/21	UT
Mercury	12/20/18	01/31/21	UT
Molybdenum	01/01/18	01/31/21	UT
Nickel	01/01/18	01/31/21	UT
Selenium	01/01/18	01/31/21	UT
Silver	01/01/18	01/31/21	UT
Thallium	01/01/18	01/31/21	UT
Uranium	01/01/18	01/31/21	UT
Vanadium	01/01/18	01/31/21	UT
Zinc	01/01/18	01/31/21	UT
<b>Method EPA 218.6</b>			
Chromium VI	01/01/18	01/31/21	UT
<b>Method EPA 218.7</b>			
Chromium VI	01/01/18	01/31/21	UT
<b>Method EPA 300.0</b>			
Bromide	01/01/18	01/31/21	UT
Chlorate	01/01/18	01/31/21	UT
Chloride	01/01/18	01/31/21	UT
Chlorite	01/01/18	01/31/21	UT
Nitrate as N	01/01/18	01/31/21	UT
Nitrate-nitrite	01/01/18	01/31/21	UT
Nitrite	01/01/18	01/31/21	UT
Nitrite as N	01/01/18	01/31/21	UT
Sulfate	01/01/18	01/31/21	UT
<b>Method EPA 300.1</b>			
Bromate	01/01/18	01/31/21	UT
Bromide	01/01/18	01/31/21	UT
Chlorate	01/01/18	01/31/21	UT
Nitrite as N	01/06/20	01/31/21	UT
<b>Method EPA 314</b>			
Perchlorate	01/01/18	01/31/21	UT
<b>Method EPA 317.0</b>			
Bromate	01/01/18	01/31/21	UT
<b>Method EPA 331.0</b>			
Perchlorate	01/01/18	01/31/21	UT
<b>Method EPA 335.4</b>			
Total cyanide	01/01/18	01/31/21	UT
<b>Method EPA 353.2</b>			

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)**

	Start Date	Expires	AB
Nitrate as N	01/01/18	01/31/21	UT
Nitrate-nitrite	01/01/18	01/31/21	UT
Nitrite as N	01/01/18	01/31/21	UT
<b>Method EPA 365.1</b>			
Orthophosphate as P	01/01/18	01/31/21	UT
<b>Method EPA 504.1</b>			
1,2,3-Trichloropropane	01/01/18	01/31/21	UT
1,2-Dibromo-3-chloropropane (DBCP)	01/01/18	01/31/21	UT
1,2-Dibromoethane (EDB, Ethylene dibromide)	01/01/18	01/31/21	UT
<b>Method EPA 505</b>			
Alachlor	01/01/18	01/31/21	UT
Aldrin	01/01/18	01/31/21	UT
Aroclor-1016 (PCB-1016)	01/01/18	01/31/21	UT
Aroclor-1221 (PCB-1221)	01/01/18	01/31/21	UT
Aroclor-1232 (PCB-1232)	01/01/18	01/31/21	UT
Aroclor-1242 (PCB-1242)	01/01/18	01/31/21	UT
Aroclor-1248 (PCB-1248)	01/01/18	01/31/21	UT
Aroclor-1254 (PCB-1254)	01/01/18	01/31/21	UT
Aroclor-1260 (PCB-1260)	01/01/18	01/31/21	UT
Chlordane (tech.)(N.O.S.)	01/01/18	01/31/21	UT
Dieldrin	01/01/18	01/31/21	UT
Endrin	01/01/18	01/31/21	UT
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	01/01/18	01/31/21	UT
Heptachlor	01/01/18	01/31/21	UT
Heptachlor epoxide	01/01/18	01/31/21	UT
Methoxychlor	01/01/18	01/31/21	UT
Toxaphene (Chlorinated camphene)	01/01/18	01/31/21	UT
<b>Method EPA 515.4</b>			
2,4,5-T	01/01/18	01/31/21	UT
2,4-D	01/01/18	01/31/21	UT
2,4-DB	01/01/18	01/31/21	UT
3,5-Dichlorobenzoic acid	01/01/18	01/31/21	UT
Acifluorfen	01/01/18	01/31/21	UT
Bentazon	01/01/18	01/31/21	UT
Dacthal (DCPA)	01/01/18	01/31/21	UT
Dacthal Acid Metabolites	01/01/18	01/31/21	UT
Dalapon	01/01/18	01/31/21	UT
DCPA di acid degradate	01/01/18	01/31/21	UT
DCPA mono-acid	01/01/18	01/31/21	UT
Dicamba	01/01/18	01/31/21	UT
Dichloroprop (Dichlorprop)	01/01/18	01/31/21	UT
Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)	01/01/18	01/31/21	UT
Pentachlorophenol	01/01/18	01/31/21	UT
Picloram	01/01/18	01/31/21	UT
Silvex (2,4,5-TP)	01/01/18	01/31/21	UT
<b>Method EPA 522</b>			
1,4-Dioxane (1,4- Diethyleneoxide)	01/01/18	01/31/21	UT

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)****Method EPA 524.2**

Method	Start Date	Expires	AB
1,1,1-Trichloro-2,2,2-trifluoroethane (Freon 113a)	01/01/18	01/31/21	UT
1,1,1,2-Tetrachloroethane	01/01/18	01/31/21	UT
1,1,1-Trichloroethane	01/01/18	01/31/21	UT
1,1,2,2-Tetrachloroethane	01/01/18	01/31/21	UT
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	01/01/18	01/31/21	UT
1,1,2-Trichloroethane	01/01/18	01/31/21	UT
1,1-Dichloroethane	01/01/18	01/31/21	UT
1,1-Dichloroethylene	01/01/18	01/31/21	UT
1,1-Dichloropropene	01/01/18	01/31/21	UT
1,2,3-Trichlorobenzene	01/01/18	01/31/21	UT
1,2,3-Trichloropropane	01/01/18	01/31/21	UT
1,2,4-Trichlorobenzene	01/01/18	01/31/21	UT
1,2,4-Trimethylbenzene	01/01/18	01/31/21	UT
1,2-Dichlorobenzene (o-Dichlorobenzene)	01/01/18	01/31/21	UT
1,2-Dichloroethane (Ethylene dichloride)	01/01/18	01/31/21	UT
1,2-Dichloropropane	01/01/18	01/31/21	UT
1,3,5-Trimethylbenzene	01/01/18	01/31/21	UT
1,3-Dichlorobenzene	01/01/18	01/31/21	UT
1,3-Dichloropropane	01/01/18	01/31/21	UT
1,4-Dichlorobenzene	01/01/18	01/31/21	UT
2,2-Dichloropropane	01/01/18	01/31/21	UT
2-Chlorotoluene	01/01/18	01/31/21	UT
4-Chlorotoluene	01/01/18	01/31/21	UT
4-Isopropyltoluene (p-Cymene,p-Isopropyltoluene)	01/01/18	01/31/21	UT
Benzene	01/01/18	01/31/21	UT
Bromobenzene	01/01/18	01/31/21	UT
Bromochloromethane	01/01/18	01/31/21	UT
Bromodichloromethane	01/01/18	01/31/21	UT
Bromoform	01/01/18	01/31/21	UT
Carbon disulfide	01/01/18	01/31/21	UT
Carbon tetrachloride	01/01/18	01/31/21	UT
Chlorobenzene	01/01/18	01/31/21	UT
Chlorodibromomethane	01/01/18	01/31/21	UT
Chloroethane (Ethyl chloride)	01/01/18	01/31/21	UT
Chloroform	01/01/18	01/31/21	UT
cis-1,2-Dichloroethylene	01/01/18	01/31/21	UT
cis-1,3-Dichloropropene	01/01/18	01/31/21	UT
Dibromomethane (Methylene bromide)	01/01/18	01/31/21	UT
Dichlorodifluoromethane (Freon-12)	01/01/18	01/31/21	UT
Ethylbenzene	01/01/18	01/31/21	UT
Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)	01/01/18	01/31/21	UT
Hexachlorobutadiene	01/01/18	01/31/21	UT
Hexachloroethane	01/01/18	01/31/21	UT
Isopropylbenzene	01/01/18	01/31/21	UT
Methyl bromide (Bromomethane)	01/01/18	01/31/21	UT
Methyl chloride (Chloromethane)	01/01/18	01/31/21	UT
Methyl tert-butyl ether (MTBE)	01/01/18	01/31/21	UT

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)**

	Start Date	Expires	AB
Methylene chloride (Dichloromethane)	01/01/18	01/31/21	UT
Naphthalene	01/01/18	01/31/21	UT
n-Butylbenzene	01/01/18	01/31/21	UT
Nitrobenzene	01/01/18	01/31/21	UT
n-Propylbenzene	01/01/18	01/31/21	UT
sec-Butylbenzene	01/01/18	01/31/21	UT
Styrene	01/01/18	01/31/21	UT
T-amylmethylether (TAME)	01/01/18	01/31/21	UT
tert-Butyl alcohol	01/01/18	01/31/21	UT
tert-Butylbenzene	01/01/18	01/31/21	UT
Tetrachloroethylene (Perchloroethylene)	01/01/18	01/31/21	UT
Toluene	01/01/18	01/31/21	UT
Total trihalomethanes	01/01/18	01/31/21	UT
trans-1,2-Dichloroethylene	01/01/18	01/31/21	UT
trans-1,3-Dichloropropylene	01/01/18	01/31/21	UT
Trichloroethene (Trichloroethylene)	01/01/18	01/31/21	UT
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	01/01/18	01/31/21	UT
Vinyl chloride (chloroethene)	01/01/18	01/31/21	UT
Xylene (total)	01/01/18	01/31/21	UT

**Method EPA 525.2**

2,4-Dinitrotoluene (2,4-DNT)	01/01/18	01/31/21	UT
2,6-Dinitrotoluene (2,6-DNT)	01/01/18	01/31/21	UT
4,4'-DDD	01/01/18	01/31/21	UT
4,4'-DDE	01/01/18	01/31/21	UT
4,4'-DDT	01/01/18	01/31/21	UT
Acenaphthene	01/01/18	01/31/21	UT
Acenaphthylene	01/01/18	01/31/21	UT
Alachlor	01/01/18	01/31/21	UT
Aldrin	01/01/18	01/31/21	UT
Anthracene	01/01/18	01/31/21	UT
Atrazine	01/01/18	01/31/21	UT
Benzo(a)anthracene	01/01/18	01/31/21	UT
Benzo(a)pyrene	01/01/18	01/31/21	UT
Benzo(b)fluoranthene	01/01/18	01/31/21	UT
Benzo(g,h,i)perylene	01/01/18	01/31/21	UT
Benzo(k)fluoranthene	01/01/18	01/31/21	UT
bis(2-Ethylhexyl)adipate (di(2-ethylhexyl)adipate)	01/01/18	01/31/21	UT
Bromacil	01/01/18	01/31/21	UT
Butachlor	01/01/18	01/31/21	UT
Butyl benzyl phthalate	01/01/18	01/31/21	UT
Chlordane (tech.)(N.O.S.)	01/01/18	01/31/21	UT
Chrysene	01/01/18	01/31/21	UT
Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)	01/01/18	01/31/21	UT
Diazinon	01/01/18	01/31/21	UT
Dibenz(a,h) anthracene	01/01/18	01/31/21	UT
Dieldrin	01/01/18	01/31/21	UT
Diethyl phthalate	01/01/18	01/31/21	UT
Dimethyl phthalate	01/01/18	01/31/21	UT

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)**

	Start Date	Expires	AB
Di-n-butyl phthalate	01/01/18	01/31/21	UT
Di-n-octyl phthalate	01/01/18	01/31/21	UT
Endrin	01/01/18	01/31/21	UT
EPTC (Eptam, s-ethyl-dipropyl thio carbamate)	09/04/18	01/31/21	UT
Fluoranthene	01/01/18	01/31/21	UT
Fluorene	01/01/18	01/31/21	UT
gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)	01/01/18	01/31/21	UT
Heptachlor	01/01/18	01/31/21	UT
Heptachlor epoxide	01/01/18	01/31/21	UT
Hexachlorobenzene	01/01/18	01/31/21	UT
Hexachlorocyclopentadiene	01/01/18	01/31/21	UT
Indeno(1,2,3-cd) pyrene	01/01/18	01/31/21	UT
Methoxychlor	01/01/18	01/31/21	UT
Metolachlor	01/01/18	01/31/21	UT
Metribuzin	01/01/18	01/31/21	UT
Molinate	01/01/18	01/31/21	UT
Naphthalene	01/01/18	01/31/21	UT
Napropamide	01/01/18	01/31/21	UT
Phenanthrene	01/01/18	01/31/21	UT
Propachlor (Ramrod)	01/01/18	01/31/21	UT
Pyrene	01/01/18	01/31/21	UT
Simazine	01/01/18	01/31/21	UT
Terbacil	09/04/18	01/31/21	UT
Thiobencarb	01/01/18	01/31/21	UT
Trifluralin (Treflan)	01/01/18	01/31/21	UT

**Method EPA 531.2**

3-Hydroxycarbofuran	01/01/18	01/31/21	UT
Aldicarb (Temik)	01/01/18	01/31/21	UT
Aldicarb sulfone	01/01/18	01/31/21	UT
Aldicarb sulfoxide	01/01/18	01/31/21	UT
Carbaryl (Sevin)	01/01/18	01/31/21	UT
Carbofuran (Furaden)	01/01/18	01/31/21	UT
Methiocarb (Mesurol)	01/01/18	01/31/21	UT
Methomyl (Lannate)	01/01/18	01/31/21	UT
Oxamyl	01/01/18	01/31/21	UT
Propoxur (Baygon)	01/01/18	01/31/21	UT

**Method EPA 533**

11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11-CI-PF3OUdS)	02/25/20	01/31/21	UT
1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid (8:2 FTS)	02/25/20	01/31/21	UT
1H, 1H, 2H, 2H-Perfluorohexanesulfonic acid (4:2 FTS)	02/25/20	01/31/21	UT
1H, 1H, 2H, 2H-Perfluorooctanesulfonic acid (6:2 FTS)	02/25/20	01/31/21	UT
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	02/25/20	01/31/21	UT
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-CI-PF3ONS)	02/25/20	01/31/21	UT
Hexafluoropropyleneoxide dimer acid (HFPO-DA)(GenX)	02/25/20	01/31/21	UT
Nonfluoro-3,6-dioxaheptanoic acid (NFDHA)	02/25/20	01/31/21	UT
Perfluoro(2-ethoxyethane) sulfonic acid (PFEEESA)	02/25/20	01/31/21	UT
Perfluoro-3-methoxypropanoic acid (PFMPA)	02/25/20	01/31/21	UT
Perfluoro-4-methoxybutanoic acid (PFMBA)	02/25/20	01/31/21	UT

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)**

Perfluorobutane sulfonic acid (PFBS)	02/25/20	01/31/21	UT
Perfluorobutanoic acid (PFBA)	02/25/20	01/31/21	UT
Perfluorodecanoic acid (PFDA)	02/25/20	01/31/21	UT
Perfluorododecanoic acid (PFDOA)	02/25/20	01/31/21	UT
Perfluoroheptane sulfonic acid (PFHpS)	02/25/20	01/31/21	UT
Perfluoroheptanoic acid (PFHpA)	02/25/20	01/31/21	UT
Perfluorohexane sulfonic acid (PFHxS)	02/25/20	01/31/21	UT
Perfluorohexanoic acid (PFHxA)	02/25/20	01/31/21	UT
Perfluorononanoic acid (PFNA)	02/25/20	01/31/21	UT
Perfluorooctane sulfonic acid (PFOS)	02/25/20	01/31/21	UT
Perfluorooctanoic acid (PFOA)	02/25/20	01/31/21	UT
Perfluoropentane sulfonic acid (PFPeS)	02/25/20	01/31/21	UT
Perfluoropentanoic acid (PFPeA)	02/25/20	01/31/21	UT
Perfluoroundecanoic acid (PFUnDA)	02/25/20	01/31/21	UT

**Method EPA 537**

Perfluorobutane sulfonate (PFBS)	01/01/18	01/31/21	UT
Perfluorobutanoic acid (PFBA)	01/01/18	01/31/21	UT
Perfluorodecanoic acid (PFDA)	01/01/18	01/31/21	UT
Perfluorododecanoic acid (PFDOA)	01/01/18	01/31/21	UT
Perfluoroheptanoic acid (PFHpA)	01/01/18	01/31/21	UT
Perfluorohexane sulfonate (PFHXxS)	01/01/18	01/31/21	UT
Perfluorohexanoic acid (PFHxA)	01/01/18	01/31/21	UT
Perfluorononanoic acid (PFNA)	01/01/18	01/31/21	UT
Perfluorooctane sulfonate (PFOS)	01/01/18	01/31/21	UT
Perfluorooctanoic acid (PFOA)	01/01/18	01/31/21	UT
Perfluoropentanoic acid (PFPeA)	01/01/18	01/31/21	UT
Perfluorotetradecanoic acid (PFTDA)	01/01/18	01/31/21	UT
Perfluorotridecanoic acid (PFTTrDA)	01/01/18	01/31/21	UT
Perfluoroundecanoic acid (PFUnDA)	01/01/18	01/31/21	UT

**Method EPA 537.1**

11-Chloroeicosafuoro-3-oxaundecane-1-sulfonic acid (11-Cl-PF3OUdS)	09/19/19	01/31/21	UT
4,8-Dioxa-3H-perfluorononanoic acid (DONA)	06/01/19	01/31/21	UT
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9-Cl-PF3ONS)	06/01/19	01/31/21	UT
Hexafluoropropyleneoxide dimer acid (HFPO-DA)(GenX)	06/01/19	01/31/21	UT
N-Ethylperfluorooctane sulfonamido acetic acid (NEtFOSAA)	06/01/19	01/31/21	UT
N-Methylperfluorooctane sulfonamido acetic acid (NMeFOSAA)	06/01/19	01/31/21	UT
Perfluorobutane sulfonic acid (PFBS)	06/01/19	01/31/21	UT
Perfluorodecanoic acid (PFDA)	06/01/19	01/31/21	UT
Perfluorododecanoic acid (PFDOA)	06/01/19	01/31/21	UT
Perfluoroheptanoic acid (PFHpA)	06/01/19	01/31/21	UT
Perfluorohexane sulfonic acid (PFHxS)	06/01/19	01/31/21	UT
Perfluorohexanoic acid (PFHxA)	06/01/19	01/31/21	UT
Perfluorononanoic acid (PFNA)	06/01/19	01/31/21	UT
Perfluorooctane sulfonic acid (PFOS)	06/01/19	01/31/21	UT
Perfluorooctanoic acid (PFOA)	06/01/19	01/31/21	UT
Perfluorotetradecanoic acid (PFTDA)	06/01/19	01/31/21	UT
Perfluorotridecanoic acid (PFTTrDA)	06/01/19	01/31/21	UT
Perfluoroundecanoic acid (PFUnDA)	06/01/19	01/31/21	UT

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)****Method EPA 545**

Method	Start Date	Expires	AB
Anatoxin-a	09/04/18	01/31/21	UT
Cylindrospermopsin	09/04/18	01/31/21	UT

**Method EPA 546**

Microcystin-LA (MC-LA)	01/06/20	01/31/21	UT
Microcystin-LF (MC-LF)	01/06/20	01/31/21	UT
Microcystin-LR (MC-LR)	01/06/20	01/31/21	UT
Microcystin-YR (MC-LY)	01/06/20	01/31/21	UT
Microcystin-YR (MC-RR)	01/06/20	01/31/21	UT
Microcystin-YR (MC-YR)	01/06/20	01/31/21	UT
Nodularin-R (NOD)	01/06/20	01/31/21	UT

**Method EPA 547**

Glyphosate	01/01/18	01/31/21	UT
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**Method EPA 548.1**

Endothall	01/01/18	01/31/21	UT
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**Method EPA 549.2**

Diquat	01/01/18	01/31/21	UT
Paraquat	01/01/18	01/31/21	UT

**Method EPA 551.1**

1,1,1-Trichloro-2-propanone	01/01/18	01/31/21	UT
1,1-Dichloro-2-propanone	01/01/18	01/31/21	UT
1,2-Dibromo-3-chloropropane (DBCP)	01/01/18	01/31/21	UT
1,2-Dibromoethane (EDB, Ethylene dibromide)	01/01/18	01/31/21	UT
Bromochloroacetonitrile	01/01/18	01/31/21	UT
Bromodichloromethane	01/01/18	01/31/21	UT
Bromoform	01/01/18	01/31/21	UT
Chloral hydrate	01/01/18	01/31/21	UT
Chlorodibromomethane	01/01/18	01/31/21	UT
Chloroform	01/01/18	01/31/21	UT
Chloropicrin	01/01/18	01/31/21	UT
Dibromoacetonitrile	01/01/18	01/31/21	UT
Dichloroacetonitrile	01/01/18	01/31/21	UT
Total trihalomethanes	01/01/18	01/31/21	UT
Trichloroacetonitrile	01/01/18	01/31/21	UT

**Method EPA 552.3**

Bromoacetic acid	01/01/18	01/31/21	UT
Bromochloroacetic acid	01/01/18	01/31/21	UT
Bromodichloroacetic acid(BDCAA)	01/01/18	01/31/21	UT
Chloroacetic acid	01/01/18	01/31/21	UT
Chlorodibromoacetic acid(CDBAA)	01/01/18	01/31/21	UT
Dalapon	01/01/18	01/31/21	UT
Dibromoacetic acid	01/01/18	01/31/21	UT
Dichloroacetic acid	01/01/18	01/31/21	UT
Total haloacetic acids	01/01/18	01/31/21	UT
Tribromoacetic acid (TBAA)	01/01/18	01/31/21	UT
Trichloroacetic acid	01/01/18	01/31/21	UT

**Method EPA 900.0**

Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)**

	Start Date	Expires	AB
Gross-alpha	01/01/18	01/31/21	UT
Gross-beta	01/01/18	01/31/21	UT

**Method Eurofins Eaton Analytical - Nitrosamines in Drinking Water by GC/MS/MS**

n-Nitrosodiethylamine	08/12/19	01/31/21	UT
n-Nitrosodimethylamine	08/12/19	01/31/21	UT
n-Nitroso-di-n-butylamine	08/12/19	01/31/21	UT
n-Nitrosodi-n-propylamine	08/12/19	01/31/21	UT
n-Nitrosomethylethylamine	08/12/19	01/31/21	UT
n-Nitrosomorpholine	08/12/19	01/31/21	UT
n-Nitrosopiperidine	08/12/19	01/31/21	UT
n-Nitrosopyrrolidine	08/12/19	01/31/21	UT

**Method GA Tech Ra-226/228**

Radium-226	01/01/18	01/31/21	UT
Radium-228	01/01/18	01/31/21	UT

**Method Legionella pneumophila in water**

Legionella pneumophila	09/04/18	01/31/21	UT
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**Method Pseudalert® (MPN)**

Pseudomonas aeruginosa	01/06/20	01/31/21	UT
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**Method SM 2120 B-2011**

Color	01/06/20	01/31/21	UT
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**Method SM 2150 B-2011**

Odor	01/01/18	01/31/21	UT
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**Method SM 2320 B-2011**

Alkalinity as CaCO <sub>3</sub>	01/01/18	01/31/21	UT
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**Method SM 2330 B-2000**

Corrosivity	01/01/18	01/31/21	UT
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**Method SM 2340 B-2011**

Total hardness as CaCO <sub>3</sub>	01/01/18	01/31/21	UT
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**Method SM 2340 C-2011**

Calcium hardness as CaCO <sub>3</sub>	02/04/20	01/31/21	UT
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**Method SM 2510 B-2011**

Conductivity	01/01/18	01/31/21	UT
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**Method SM 2540 C-2011**

Residue-filterable (TDS)	01/01/18	01/31/21	UT
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**Method SM 4500-Cl G-2011**

Free chlorine	01/01/18	01/31/21	UT
Total chlorine	10/29/18	01/31/21	UT
Total residual chlorine	01/01/18	01/31/21	UT

**Method SM 4500-ClO<sub>2</sub> D**

Chlorine dioxide	01/01/18	01/31/21	UT
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**Method SM 4500-CN<sup>-</sup> F**

Cyanide	01/01/18	01/31/21	UT
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**Method SM 4500-CN<sup>-</sup> G**

Cyanide	01/01/18	01/31/21	UT
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Eurofins Eaton Analytical, LLC - Monrovia

Start Date Expires AB

**Program/Matrix: SDWA (Potable Water)****Method SM 4500-F<sup>-</sup> C-2011**

Fluoride 01/06/20 01/31/21 UT

**Method SM 4500-H+ B**

pH 01/01/18 01/31/21 UT

**Method SM 4500-P E**

Orthophosphate as P 01/01/18 01/31/21 UT

**Method SM 4500-SiO<sub>2</sub> C-2011**Silica as SiO<sub>2</sub> 01/01/18 01/31/21 UT**Method SM 5310 C-2011**

Dissolved organic carbon (DOC) 01/01/18 01/31/21 UT

Total organic carbon 01/01/18 01/31/21 UT

**Method SM 5540 C**

Surfactants - MBAS 01/01/18 01/31/21 UT

**Method SM 5910 B**

UV 254 01/01/18 01/31/21 UT

**Method SM 6251 B**

Bromoacetic acid 01/01/18 01/31/21 UT

Bromochloroacetic acid 01/01/18 01/31/21 UT

Chloroacetic acid 01/01/18 01/31/21 UT

Dibromoacetic acid 01/01/18 01/31/21 UT

Dichloroacetic acid 01/01/18 01/31/21 UT

Total haloacetic acids 01/01/18 01/31/21 UT

Trichloroacetic acid 01/01/18 01/31/21 UT

**Method SM 7110 C (GPC)**

Gross-alpha 01/01/18 01/31/21 UT

**Method SM 7500-Rn B**

Radon-222 01/01/18 01/31/21 UT

**Method SM 9215 B (PCA)-2004**

Heterotrophic plate count 01/01/18 01/31/21 UT

**Method SM 9221 B (LTB) + C MPN**

Total coliforms 01/01/18 01/31/21 UT

**Method SM 9221 B-2001**

Total coliforms 01/01/18 01/31/21 UT

**Method SM 9221 E (EC)-2006**

Escherichia coli 01/06/20 01/31/21 UT

Fecal coliforms 02/04/20 01/31/21 UT

Total coliforms 01/06/20 01/31/21 UT

**Method SM 9221 F (EC MUG)**

Escherichia coli 01/01/18 01/31/21 UT

**Method SM 9223 B (Colilert® Quanti-Tray®)**

Escherichia coli 01/01/18 01/31/21 UT

Total coliforms 01/01/18 01/31/21 UT

**Method SM 9223 B (Colilert®)**

Escherichia coli 01/01/18 01/31/21 UT

Eurofins Eaton Analytical, LLC - Monrovia

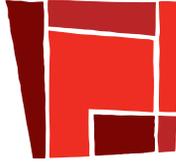
Start Date	Expires	AB
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**Program/Matrix: SDWA (Potable Water)**

Total coliforms	01/01/18	01/31/21	UT
<b>Method SM 9223 B (Colilert®-18 Quanti-Tray®)</b>			
Escherichia coli	01/01/18	01/31/21	UT
Total coliforms	01/01/18	01/31/21	UT
<b>Method SM 9223 B (Colilert®-18)</b>			
Escherichia coli	01/01/18	01/31/21	UT
Total coliforms	01/01/18	01/31/21	UT
<b>Method SM 9223 B (Colisure®)</b>			
Escherichia coli	01/01/18	01/31/21	UT
Total coliforms	01/01/18	01/31/21	UT
<b>Method SM 9223 B-2004</b>			
Escherichia coli	01/06/20	01/31/21	UT
Total coliforms	01/06/20	01/31/21	UT
<b>Method SM 9230 B (NaCl)</b>			
Enterococci	01/01/18	01/31/21	UT
<b>Method SM 9230 B (PSE)</b>			
Fecal streptococci	01/01/18	01/31/21	UT

The Utah Environmental Laboratory Certification Program (ELCP) encourages clients and data users to verify the most current certification letter for the authorized method.

The analytes by method which a laboratory is authorized to perform at any given time will be those indicated in the most recent certificate letter. The most recent certification letter supersedes all previous certification or authorization letters. It is the certified laboratory's responsibility to review this letter for discrepancies. The certified laboratory must document any discrepancies in this letter and send notice to this bureau within 15 days of receipt. This certificate letter will be recalled in the event your laboratory's certification is revoked.



ARIZONA DEPARTMENT  
OF HEALTH SERVICES

## ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: Fred Haley

Owner/Representative: John Cosgrove

*Eurofins Eaton Analytical, LLC - Monrovia*  
**AZ0778**

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

**PERIOD OF LICENSURE FROM: 12/15/2019 TO: 12/15/2020**



A handwritten signature in black ink, likely belonging to Steven D. Baker.

Steven D. Baker, Chief  
Office of Laboratory Licensure & Certification  
Bureau of State Laboratory Services

## Arizona Department Of Health Services Office of Laboratory Licensure and Certification

250 N.17th Avenue, Phoenix, Arizona 85007-3246

### SDW

Parameter	EPA Method	Certified On
DETERMINATION OF SELECTED PERFLUORINATED ALKYL ACIDS (LC/MS/MS)	EPA 537.1	4/12/2019 10:27:07 AM
1, 4-DIOXANE BY GC/MS	EPA 522	5/22/2012 12:00:00 AM
1-BUTANOL, 1,4-DIOXANE, 2-METHOXYETHANOL AND 2-PROPEN-1-OL (SPE-GC/MS)	EPA 541	10/31/2018 3:33:42 PM
ACETANILIDE PARENT COMPOUND - ADDITIONAL	EPA 525.2 (2.0)	8/20/2009 12:00:00 AM
ALKALINITY	SM 2320B (2011)	4/6/1996 12:00:00 AM
ALUMINUM	EPA 200.7 (4.4)	9/30/1996 12:00:00 AM
ALUMINUM	EPA 200.8 (5.4)	11/17/1995 12:00:00 AM
ANTIMONY	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM
ARSENIC	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM
ASBESTOS	EPA 100.2 (6/94)	12/26/2019 10:28:24 AM
BARIUM	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
BARIUM	EPA 200.8 (5.4)	12/21/1994 12:00:00 AM
BERYLLIUM	EPA 200.7 (4.4)	1/10/1994 12:00:00 AM
BERYLLIUM	EPA 200.8 (5.4)	11/17/1995 12:00:00 AM
BROMATE	EPA 300.1 (1.0)	6/5/2001 12:00:00 AM
BROMATE	EPA 317.0 (2.0)	11/6/2006 12:00:00 AM
BROMIDE	EPA 300.0 (2.1)	4/20/2003 12:00:00 AM
BROMIDE	EPA 300.1 (1.0)	11/16/2001 12:00:00 AM
CADMIUM	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
CADMIUM	EPA 200.8 (5.4)	12/21/1994 12:00:00 AM
CALCIUM	EPA 200.7 (4.4)	9/26/1994 12:00:00 AM
CARBAMATES BY HPLC/POST COLUMN	EPA 531.2 (1.0)	8/14/2003 12:00:00 AM
CARBAMATES BY HPLC/POST COLUMN - ADDITIONAL	EPA 531.2 (1.0)	8/14/2003 12:00:00 AM
CARBON, DISSOLVED ORGANIC	SM 5310C (2011)	10/23/2008 12:00:00 AM
CARBON, TOTAL ORGANIC	SM 5310C (2011)	3/24/1999 12:00:00 AM
CHLORAMINE	SM 4500-CL G (2011)	9/22/2003 12:00:00 AM

**SDW**

Parameter	EPA Method	Certified On
CHLORATE	EPA 300.1 (1.0)	5/29/2012 12:00:00 AM
CHLORIDE	EPA 300.0 (2.1)	11/24/1993 12:00:00 AM
CHLORINATED ACIDS AND DALAPON BY GC-ECD	EPA 515.4 (1.0)	8/14/2003 12:00:00 AM
CHLORINATED ACIDS AND DALAPON BY GC-ECD ADDITIONAL	EPA 515.4 (1.0)	10/23/2008 12:00:00 AM
CHLORINATED ACIDS BY HPLC/PDA/UV	EPA 555 (1.0)	2/21/2017 1:36:30 PM
CHLORINATED ACIDS BY HPLC/PDA/UV - ADDITIONAL	EPA 555 (1.0)	2/21/2017 1:36:31 PM
CHLORINE DIOXIDE	CHLORDIO X PLUS	12/19/2019 12:35:55 PM
CHLORINE, TOTAL RESIDUAL AND FREE	SM 4500-CL G (2011)	4/6/1996 12:00:00 AM
CHLORITE	EPA 300.0 (2.1)	12/19/2019 12:33:29 PM
CHROMIUM TOTAL	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
CHROMIUM TOTAL	EPA 200.8 (5.4)	11/17/1995 12:00:00 AM
CHROMIUM, HEXAVALENT BY IC	EPA 218.7 (1.0)	12/19/2019 12:26:41 PM
COBALT	EPA 200.8 (5.4)	5/22/2012 12:00:00 AM
COLIFORMS, FECAL	SM 9221E (2006)	12/11/2002 12:00:00 AM
COLIFORMS, TOTAL AND E.COLI, BY COLILERT (ONPG-MUG)	SM 9223B (2004) AND IDEXX	4/2/1998 12:00:00 AM
COLIFORMS, TOTAL, AND E.COLI, BY COLISURE	SM 9223B (2004) AND IDEXX	12/31/2018 8:37:09 AM
COLOR	SM 2120B (2011)	7/20/1997 12:00:00 AM
COPPER	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
COPPER	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM
CORROSIVITY	SM 2330B (2010)	8/16/1993 12:00:00 AM
CYANIDE	EPA 335.4 (1.0)	7/15/1996 12:00:00 AM
CYANIDE	SM 4500 CN F (2011)	4/6/1996 12:00:00 AM
CYANIDE	SM 4500 CN B (2011)	4/6/2096 12:00:00 AM
CYANIDE	SM 4500 CN C (2011)	4/6/2096 12:00:00 AM
CYANIDE, AVAILABLE/AMENABLE	SM 4500-CN G (2011)	12/11/2002 12:00:00 AM
CYLINDROSPERMOPSIN AND ANATOXIN-A (LC/ESI-MS/MS)	EPA 545	10/31/2018 3:39:54 PM
DBP BY MICRO-LIQUID EXTRACTION/GC-ECD	SM 6251B (1994)	12/14/2098 12:00:00 AM
DBP, SOLVENTS AND PESTICIDES	EPA 551.1 (1.0)	10/25/2004 12:00:00 AM

## SDW

Parameter	EPA Method	Certified On
DBP,SOLVENTS & PESTICIDES - ADDITIONAL	EPA 551.1 (1.0)	10/23/2008 12:00:00 AM
DETERMINATION OF PER - AND PFAS (ESPE / LCMS)	EPA 533	3/18/2020 11:46:15 AM
DETERMINATION OF SELECT SEMIVOLATILE ORGANIC CHEMICALS IN DRINKING WATER BY SPE / GC-MS	EPA 530	11/14/2018 2:00:34 PM
DETERMINATION OF SELECTED PERFLUORINATED ALKYL ACIDS (LC/MS/MS)	EPA 537	5/22/2012 12:00:00 AM
DETERMINATION OF SEMIVOLATILE ORGANIC CHEMICALS IN DRINKING WATER BY SPE / CAPILLARY COLUMN / GC -MS	EPA 525.3	11/14/2018 2:00:00 PM
DIOXIN	EPA 1613 REV B (10/94)	5/7/2010 12:00:00 AM
DIQUAT	EPA 549.2 (1.0)	2/20/2001 12:00:00 AM
EDB/DBCP	EPA 504.1 (1.1)	11/12/1996 12:00:00 AM
ENDOTHALL	EPA 548.1 (1.0)	12/21/1994 12:00:00 AM
FLUORIDE	SM 4500-F C (2011)	7/15/1996 12:00:00 AM
GLYPHOSATE	EPA 547 (7/90)	11/24/1993 12:00:00 AM
GROSS ALPHA	SM 7110C (2011)	9/9/2014 12:00:00 AM
GROSS ALPHA	EPA 900.0	12/16/2019 3:26:33 PM
GROSS ALPHA AND BETA	EPA 900.0	10/27/2003 12:00:00 AM
HALOACETIC ACIDS & DALAPON	EPA 552.3 (1.0)	12/11/2017 11:05:51 AM
HARDNESS	SM 2340 B (2011), CA AND MG	11/24/1993 12:00:00 AM
HARDNESS	EPA 200.7 (4.4), CA AND MG	10/25/2004 12:00:00 AM
HETEROTROPHIC PLATE COUNT	SM 9215B (2004)	9/2/2003 12:00:00 AM
HORMONES BY LC/MS/MS	EPA 539	5/22/2012 12:00:00 AM
HYDROGEN ION (pH)	SM 4500-H B (2011)	11/30/1997 12:00:00 AM
HYDROGEN ION (pH)	EPA 150.1	8/16/1993 12:00:00 AM
IRON	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
LEAD	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM
MAGNESIUM	EPA 200.7 (4.4)	9/26/1994 12:00:00 AM
MANGANESE	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
MANGANESE	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM
MERCURY	EPA 200.8 (5.4)	12/31/2018 8:37:09 AM
METHYLENE BLUE ACTIVE SUBSTANCES	5540 C (2011)	12/31/2018 8:37:09 AM

**SDW**

Parameter	EPA Method	Certified On
MICROCYSTINS AND NODULARIN (SPE AND LC/MS/MS)	EPA 544	10/31/2018 3:35:00 PM
MOLYBDENUM	EPA 200.8 (5.4)	5/22/2012 12:00:00 AM
NICKEL	EPA 200.7 (4.4)	1/10/1994 12:00:00 AM
NICKEL	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM
NITRATE	EPA 300.0 (2.1)	11/24/1993 12:00:00 AM
NITRATE	EPA 353.2 (2.0)	4/2/1998 12:00:00 AM
NITRITE	EPA 300.0 (2.1)	1/10/1994 12:00:00 AM
NITRITE	EPA 353.2 (2.0)	12/11/2002 12:00:00 AM
NITROSAMINES BY MS/MS - ADDITIONAL	EPA 521 (1.0)	8/20/2009 12:00:00 AM
ODOR	SM 2150B (2011)	10/29/2003 12:00:00 AM
ORGANICS BY GC/MS	EPA 525.2 (2.0)	2/22/2006 12:00:00 AM
ORGANICS BY GC/MS - ADDITIONAL	EPA 525.2 (2.0)	12/5/2006 12:00:00 AM
ORTHOPHOSPHATE	EPA 365.1 (2.0)	11/17/1995 12:00:00 AM
ORTHOPHOSPHATE	SM 4500-P E (2011)	4/6/1996 12:00:00 AM
ORTHOPHOSPHATE	SM 4500-P F (2011)	3/20/2008 12:00:00 AM
PARAQUAT	EPA 549.2 (1.0)	2/2/2001 12:00:00 AM
PERCHLORATE	EPA 314.0	3/30/2001 12:00:00 AM
PERCHLORATE	EPA 331.0	10/23/2008 12:00:00 AM
PESTICIDES AND PCBS BY GC	EPA 505 (2.1)	4/3/2003 12:00:00 AM
PESTICIDES AND PCBS BY GC - ADDITIONAL	EPA 505 (2.1)	10/23/2008 12:00:00 AM
RADIUM 226	RADIUM 226	12/31/2018 8:37:09 AM
RADIUM 228	R-228	12/31/2018 8:37:09 AM
RADON	SM 7500-RN B	2/22/2019 1:27:57 PM
RESIDUE, FILTERABLE (TDS)	SM 2540 C (2011)	4/6/1996 12:00:00 AM
SELENIUM	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM
SILICA	EPA 200.7 (4.4)	11/17/1995 12:00:00 AM
SILICA	SM 4500-SIO2C (2011)	3/24/2008 12:00:00 AM
SILVER	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
SILVER	EPA 200.8 (5.4)	11/17/1995 12:00:00 AM
SODIUM	EPA 200.7 (4.4)	9/26/1994 12:00:00 AM

**SDW**

Parameter	EPA Method	Certified On
SPECIFIC CONDUCTANCE	SM 2510B(2011)	4/6/1996 12:00:00 AM
STRONTIUM	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
STRONTIUM	EPA 200.8 (5.4)	5/22/2012 12:00:00 AM
SULFATE	EPA 300.0(2.1)	11/24/1993 12:00:00 AM
THALLIUM	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM
TOTAL COLIFORMS BY MTF	SM 9221B & C	12/23/1997 12:00:00 AM
TOTAL MICROCYSTINS AND NODULARINS (AELIA)	EPA 546	10/31/2018 3:39:55 PM
TURBIDITY, NEPHELOMETRIC (NTU)	EPA 180.1 (2.0)	2/10/1998 12:00:00 AM
URANIUM	EPA 200.8 (5.4)	9/8/2004 12:00:00 AM
UV - ABSORPTION AT 254 NM	SM 5910B (2011)	7/10/1999 12:00:00 AM
VANADIUM	EPA 200.8 (5.4)	5/22/2012 12:00:00 AM
VOCS BY GC/MS	EPA 524.2 (4.1)	1/15/2003 12:00:00 AM
VOCS BY GC/MS-ADDITIONAL	EPA 524.2 (4.1)	10/23/2008 12:00:00 AM
ZINC	EPA 200.7 (4.4)	11/24/1993 12:00:00 AM
ZINC	EPA 200.8 (5.4)	12/19/1994 12:00:00 AM

Total Count: 127

**WW**

Parameter	EPA Method	Certified On
ESCHERICHIA COLI BY COLILERT MPN, IN CONJUNCTION WITH SM 9221B AND 9221C	SM 9223B (2004)	12/19/2019 12:27:48 PM
ALKALINITY, TOTAL	SM 2320B (2011)	4/2/1998 12:00:00 AM
ALPHA- TOTAL PCI PER LITER	EPA 900.0	10/18/1999 12:00:00 AM
ALUMINUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
ALUMINUM	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
AMMONIA	EPA 350.1 (2.0)	12/23/1997 12:00:00 AM
ANTIMONY	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
ANTIMONY	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
ARSENIC	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
BARIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
BARIUM	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
BERYLLIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
BERYLLIUM	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM

## WW

Parameter	EPA Method	Certified On
BETA-TOTAL PCI PER LITER	EPA 900.0	10/18/1999 12:00:00 AM
BIOCHEMICAL OXYGEN DEMAND/CARBONACEOUS BIOCHEMICAL OXYGEN DEMAND	SM 5210B (2011)	11/30/1997 12:00:00 AM
BORON	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
BROMIDE	EPA 300.0 (2.1)	4/2/1998 12:00:00 AM
CADMIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
CADMIUM	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
CALCIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
CARBON, TOTAL ORGANIC (TOC)	SM 5310 C (2011)	4/2/1998 12:00:00 AM
CHEMICAL OXYGEN DEMAND	EPA 410.4 (2.0)	12/23/1997 12:00:00 AM
CHEMICAL OXYGEN DEMAND	SM 5220 D (2011)	10/27/2003 12:00:00 AM
CHLORIDE	EPA 300.0 (2.1)	4/2/1998 12:00:00 AM
CHLORINE TOTAL RESIDUAL	SM 4500-CL G (2011)	4/2/1998 12:00:00 AM
CHLORINE, FREE	HACH 8021	10/23/2008 12:00:00 AM
CHROMIUM TOTAL	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
CHROMIUM TOTAL	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
CHROMIUM(VI) HEXAVALENT	SM 3500-CR B (2011)	12/11/2017 11:05:51 AM
CHROMIUM, HEXAVALENT	EPA 218.6 (3.3)	11/20/2007 12:00:00 AM
COBALT	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
COBALT	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
COLIFORMS, TOTAL, BY MTF	SM 9221B (2006)	4/2/1998 12:00:00 AM
COLOR	SM 2120 B (2011)	7/20/1997 12:00:00 AM
COPPER	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
COPPER	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
CYANIDE, AVAILABLE	4500-CN G (2011)	12/31/2018 8:37:09 AM
CYANIDE, TOTAL	SM 4500CN-F (2011)	10/16/2007 12:00:00 AM
CYANIDE, TOTAL	EPA 335.4 (1.0)	10/16/2007 12:00:00 AM
FLUORIDE	SM 4500-F C (2011)	12/23/1997 12:00:00 AM
FLUORIDE	SM 4500-F B (2011)	12/23/2097 12:00:00 AM
HARDNESS	SM 2340B (2011)	4/2/2098 12:00:00 AM
HARDNESS	EPA 200.7 (4.4)	10/23/2008 12:00:00 AM

## WW

Parameter	EPA Method	Certified On
HYDROGEN ION (pH)	SM 4500-H B (2011)	3/10/1998 12:00:00 AM
IRON	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
KJELDAHL, TOTAL NITROGEN	EPA 351.2 (2.0)	11/30/2097 12:00:00 AM
LEAD	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
LEAD	EPA 200.7 (4.4)	12/19/2019 12:37:05 PM
MAGNESIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
MANGANESE	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
MANGANESE	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
METHYLENE BLUE ACTIVE SUBSTANCES	SM 5540C (2011)	7/10/1999 12:00:00 AM
MOLYBDENUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
MOLYBDENUM	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
NICKEL	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
NICKEL	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
NITRATE	EPA 300.0 (2.1)	4/2/1998 12:00:00 AM
NITRATE-NITRITE (AS N)	EPA 353.2 (2.0)	12/23/1997 12:00:00 AM
NITRITE (AS N)	EPA 300.0 (2.1)	4/2/1998 12:00:00 AM
NITRITE (AS N)	EPA 353.2 (2.0)	10/16/2007 12:00:00 AM
ORTHOPHOSPHATE	SM 4500-P E (2011)	11/20/2007 12:00:00 AM
ORTHOPHOSPHATE	EPA 365.1 (2.0)	3/20/2008 12:00:00 AM
ORTHOPHOSPHATE	SM 4500-P F (2011)	3/20/2008 12:00:00 AM
OXYGEN, DISSOLVED	SM 4500-O G (2011)	10/25/2004 12:00:00 AM
PHENOLS	EPA 420.1 (1978)	12/11/2002 12:00:00 AM
PHENOLS	EPA 420.4 (1.0)	12/11/2017 11:05:51 AM
PHOSPHORUS, TOTAL	EPA 365.1 (2.0)	4/26/1999 12:00:00 AM
PHOSPHORUS, TOTAL	SM 4500-P F (2011)	1/16/1999 12:00:00 AM
PHOSPHORUS, TOTAL	SM 4500-P E (2011)	10/25/2004 12:00:00 AM
POTASSIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
RESIDUE NONFILTERABLE (TSS)	SM 2540D (2011)	11/30/1997 12:00:00 AM
RESIDUE TOTAL	SM 2540B (2011)	12/5/2006 12:00:00 AM
RESIDUE VOLATILE	EPA 160.4 (1971)	10/27/2003 12:00:00 AM
RESIDUE VOLATILE	SM 2540E (2011)	12/11/2017 11:05:51 AM

**WW**

Parameter	EPA Method	Certified On
RESIDUE, FILTERABLE	SM 2540C (2011)	12/23/1997 12:00:00 AM
RESIDUE, SETTLEABLE SOLIDS	SM 2540F (2011)	12/11/2002 12:00:00 AM
SELENIUM	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
SILICA, DISSOLVED	EPA 200.7 (4.4)	9/2/2003 12:00:00 AM
SILICA, DISSOLVED	SM 4500-SIO2C (2011)	10/23/2008 12:00:00 AM
SILVER	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
SILVER	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
SODIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
SPECIFIC CONDUCTANCE	SM 2510B (2011)	12/23/1997 12:00:00 AM
SPECIFIC CONDUCTANCE	EPA 120.1 (1982)	12/11/2002 12:00:00 AM
STRONTIUM	EPA 200.7 (4.4)	11/17/1995 12:00:00 AM
SULFATE	EPA 300.0 (2.1)	4/2/1998 12:00:00 AM
SULFIDE	SM 4500-S2- D (2011)	12/5/2006 12:00:00 AM
THALLIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
THALLIUM	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
TIN	EPA 200.7 (4.4)	10/18/1999 12:00:00 AM
TIN	EPA 200.8 (5.4)	10/23/2008 12:00:00 AM
TITANIUM	EPA 200.7 (4.4)	10/23/2008 12:00:00 AM
TITANIUM	EPA 200.8 (5.4)	10/23/2008 12:00:00 AM
TURBIDITY, NTU	EPA 180.1 (2.0)	2/8/1998 12:00:00 AM
VANADIUM	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
VANADIUM	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM
ZINC	EPA 200.7 (4.4)	4/2/1998 12:00:00 AM
ZINC	EPA 200.8 (5.4)	4/2/1998 12:00:00 AM

Total Count: 98

**Instrument**

Instrument	Instrument Code	Quantity	Certified On
GAS CHROMATOGRAPH	GC	16	10/10/2016 3:48:13 PM
COUNTERS FOR RADIOACTIVITY	COUNT	6	11/29/2018 3:08:50 PM
GAS CHROMATOGRAPH/MASS SPECTROMETER	GC/MS	23	11/29/2018 3:08:50 PM

**Instrument**

Instrument	Instrument Code	Quantity	Certified On
HIGH PERFORMANCE LIQUID CHROMATOGRAPH	HPLC	6	10/7/2019 1:36:06 PM
AUTOMATED AUTOANALYZER	AUTOANALYZER	7	10/7/2019 1:36:06 PM
INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETER	ICP/MS	3	10/7/2019 1:36:06 PM
ION CHROMATOGRAPH	IC	11	10/7/2019 1:36:06 PM
HIGH PERFORMANCE LIQUID CHROMATOGRAPH/MASS SPEC	HPLC/MS	7	10/7/2019 1:36:06 PM
INDUCTIVELY COUPLED PLASMA SPECTROMETER	ICP	1	10/7/2019 1:36:06 PM

Total Count: 9

**Software**

Software Code	Certified On
CHEMSTATION - GC/MS	8/7/2012 2:18:48 PM
CHROMELEON (DIONEX) - IC	8/7/2012 2:18:48 PM
PERKIN ELMER - ICP	8/7/2012 2:18:48 PM
CHROMELEON - GC	8/7/2012 2:18:48 PM
CHROMELEON - HPLC	8/7/2012 2:18:48 PM
PERKIN ELMER - MA	12/11/2017 11:05:51 AM
MassLynx	12/11/2017 11:05:51 AM
Varian - Workstation	12/11/2017 11:05:51 AM
Thermo - TraceFinder	12/11/2017 11:05:51 AM
Analyst	12/11/2017 11:05:51 AM
Multiquant	12/11/2017 11:05:51 AM
Metrohm - Tiamo	12/11/2017 11:05:51 AM
Mitsubishi - TOX-100 Pro	12/11/2017 11:05:51 AM
GE Analytical Data-5310C	12/11/2017 11:05:51 AM
GE Analytical Data Pro-2	12/11/2017 11:05:51 AM
Seal AQ-2	12/11/2017 11:05:51 AM
ESI SC	12/11/2017 11:05:51 AM
OI - Winflow	12/13/2016 12:46:50 PM
AGILENT MASS HUNTER - ICP/MS	12/13/2016 12:46:50 PM
PERKIN ELMER - ICP/MS	12/13/2016 12:46:50 PM

**Software**

Software Code	Certified On
CANNBERRA - COUNTER FOR RADIOACTIVITY	12/13/2016 12:46:50 PM
OMNION (LCHAT) - AUTO ANALYZER	12/13/2016 12:46:50 PM
FIMS - MA	12/13/2016 12:46:50 PM
OTHER - HPLC/MS	12/13/2016 12:46:50 PM

Total Count: 24



April 03, 2019

LINDA GEDDES  
EUROFINS EATON ANALYTICAL INC  
750 ROYAL OAKS DR STE 100  
MONROVIA, CALIFORNIA 91016-3629

Laboratory ID # 87016  
Certificate # 87016001

Dear Linda Geddes:

Your certificate and associated parameter/method list(s) are enclosed. These documents now represent the certificate of record for your laboratory. Any certificate(s) and associated parameter list(s) received prior to your receipt of these documents are now null and void and should be destroyed. Please be reminded that all environmental data submitted to the Department is reviewed to ensure that the reporting laboratory possesses the necessary certification. Data reported by laboratories without the proper certification will be addressed by the affected enforcement programs.

If you have any questions or problems are detected concerning your certificate, please contact our office within ten (10) working days at (803)896-0970 or by e-mail at [labcerthelp@dhec.sc.gov](mailto:labcerthelp@dhec.sc.gov).

Sincerely,

Bennie L. Cockerel, Jr., Program Manager  
Office of Environmental Laboratory Certification  
Bureau of Environmental Health Services

Enclosures

*Register on our website at [www.scdhec.gov/labcert](http://www.scdhec.gov/labcert) to receive e-mail updates for the Laboratory Certification Program. Subscribing is easy and you'll automatically receive new posts to our website.*



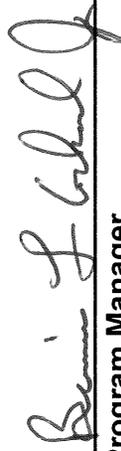
# Environmental Laboratory Certification Program

*In accordance with the provisions of Regulation 61-81, entitled "State Environmental Laboratory Certification Regulations"*

**EUROFINS EATON ANALYTICAL INC  
750 ROYAL OAKS DR STE 100  
MONROVIA, CALIFORNIA 91016-3629**

*is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of the data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).*

Laboratory Director: LINDA GEDDES  
Certifying Authority: CA  
Date of Issue: March 29, 2019  
Date of Expiration: February 01, 2021  
Certificate Number: 87016001

  
Program Manager

Office of Environmental Laboratory Certification

**SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM**

**EUROFINS EATON ANALYTICAL INC (Laboratory ID 87016)**

**Laboratory Director: LINDA GEDDES**

**Certifying Authority: CA**

**Certificate Number: 87016001**

**Date of Issue: March 29, 2019  
Expiration Date: February 01, 2021**

**SAFE DRINKING WATER ACT**

**DISINFECTION BY-PRODUCTS**

BROMATE	EPA 300.1 (1997)	ION CHROMATOGRAPHY
BROMATE	EPA 317.0 (2001)	ION CHROMATOGRAPHY & POST COLUMN REACTION
CHLORITE	EPA 300.0 (1993)	ION CHROMATOGRAPHY

**INORGANIC - MINERAL**

CHLORIDE	EPA 300.0 (1993)	ION CHROMATOGRAPHY
HYDROGEN-ION CONC. (PH)	EPA 150.1 (1983)	ELECTROMETRIC MEASUREMENT
HYDROGEN-ION CONC. (PH)	SM 4500-H B-2011	ELECTROMETRIC MEASUREMENT
SPECIFIC CONDUCTANCE	SM 2510 B-2011	CONDUCTANCE AT 25 DEGREES C
SULFATE	EPA 300.0 (1993)	ION CHROMATOGRAPHY

**INORGANIC - NUTRIENT**

NITRATE-NITRITE (N02&N03)	EPA 300.0 (1993)	ION CHROMATOGRAPHY
NITRATE-NITROGEN	EPA 300.0 (1993)	ION CHROMATOGRAPHY
NITRITE-NITROGEN	EPA 300.0 (1993)	ION CHROMATOGRAPHY

**INORGANIC - RESIDUE**

RESIDUE, FILTERABLE (TDS)	SM 2540 C-2011	GRAVIMETRIC (180)
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**INORGANIC - TRACE METAL**

ALUMINUM	EPA 200.7 (1994)	ICP/AES
ALUMINUM	EPA 200.8 (1994)	ICP/MS
ANTIMONY	EPA 200.8 (1994)	ICP/MS
ARSENIC	EPA 200.8 (1994)	ICP/MS
BARIUM	EPA 200.7 (1994)	ICP/AES
BARIUM	EPA 200.8 (1994)	ICP/MS
BERYLLIUM	EPA 200.7 (1994)	ICP/AES
BERYLLIUM	EPA 200.8 (1994)	ICP/MS
CADMIUM	EPA 200.7 (1994)	ICP/AES
CADMIUM	EPA 200.8 (1994)	ICP/MS
CALCIUM	EPA 200.7 (1994)	ICP/AES
CALCIUM	EPA 200.7 (1994)	ICP/AES
CHROMIUM	EPA 200.8 (1994)	ICP/MS
CHROMIUM	EPA 200.8 (1994)	ICP/MS
COPPER	EPA 200.7 (1994)	ICP/AES
COPPER	EPA 200.8 (1994)	ICP/MS
IRON	EPA 200.7 (1994)	ICP/AES

**SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM**

**EUROFINS EATON ANALYTICAL INC (Laboratory ID 87016)**  
**Laboratory Director: LINDA GEDDES**  
**Certifying Authority: CA**  
**Certificate Number: 87016001**

**Date of Issue: March 29, 2019**  
**Expiration Date: February 01, 2021**

**SAFE DRINKING WATER ACT**

**INORGANIC - TRACE METAL**

LEAD	EPA 200.8 (1994)	ICP/MS
MAGNESIUM	EPA 200.7 (1994)	ICP/AES
MANGANESE	EPA 200.7 (1994)	ICP/AES
MANGANESE	EPA 200.8 (1994)	ICP/MS
NICKEL	EPA 200.7 (1994)	ICP/AES
NICKEL	EPA 200.8 (1994)	ICP/MS
SELENIUM	EPA 200.8 (1994)	ICP/MS
SILICA, TOTAL	EPA 200.7 (1994)	ICP/AES
SILVER	EPA 200.7 (1994)	ICP/AES
SILVER	EPA 200.8 (1994)	ICP/MS
SODIUM	EPA 200.7 (1994)	ICP/AES
THALLIUM	EPA 200.8 (1994)	ICP/MS
ZINC	EPA 200.7 (1994)	ICP/AES
ZINC	EPA 200.8 (1994)	ICP/MS

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**SYNTHETIC ORGANIC COMPOUNDS (SOCS)**

N-METHYLCARB. & CARBAMATES - HPLC	EPA 531.2 (2001)
ORG. COMPOUNDS BY LIQ. SOL. EXT. - GC/MS	EPA 525.2 (1995)
ORGANOHALIDE PEST & PCBs BY MICROEXT. -	EPA 505 (1995)

**TRIHALOMETHANES**

CHLORINATED DBP, SOLVENTS, PEST/HERB -	EPA 551.1 (1995)
PURGEABLE ORGANICS - GC/MS	EPA 524.2 (1995)

**VOLATILES (VOCS)**

PURGEABLE ORGANICS - GC/MS	EPA 524.2 (1995)
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SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

EUROFINS EATON ANALYTICAL INC (Laboratory ID 87016)

Certifying Authority: CA Date of Issue: March 29, 2019

Certificate Number: 87016001 Expiration Date: February 01, 2021

SAFE DRINKING WATER ACT

---SYNTHETIC ORGANIC COMPOUNDS  
(SOCS)---

-----TRIHALOMETHANES-----

EPA 524.2 (1995)

BROMODICHLOROMETHANE  
BROMOFORM  
CHLORODIBROMOMETHANE  
CHLOROFORM

EPA 551.1 (1995)

BROMODICHLOROMETHANE  
BROMOFORM  
CHLORODIBROMOMETHANE  
CHLOROFORM

-----VOLATILES (VOCS)-----

EPA 524.2 (1995)

1,1,1-TRICHLOROETHANE  
1,1,2-TRICHLOROETHANE  
1,1-DICHLOROETHENE  
1,2,4-TRICHLOROBENZENE  
1,2-DICHLOROBENZENE  
1,2-DICHLOROETHANE  
1,2-DICHLOROPROPANE  
1,4-DICHLOROBENZENE  
BENZENE  
CARBON TETRACHLORIDE  
CHLOROBENZENE  
CIS-1,2-DICHLOROETHENE  
ETHYLBENZENE  
METHYLENE CHLORIDE  
STYRENE  
TETRACHLOROETHENE  
TOLUENE  
TRANS-1,2-DICHLOROETHENE  
TRICHLOROETHENE  
VINYL CHLORIDE  
XYLENE, TOTAL

EPA 531.2 (2001)

3-HYDROXYCARBOFURAN  
ALDICARB  
ALDICARB SULFONE  
ALDICARB SULFOXIDE  
CARBARYL  
CARBOFURAN  
METHOMYL  
OXAMYL

EPA 505 (1995)

ALACHLOR  
CHLORDANE  
ENDRIN  
GAMMA-BHC (LINDANE)  
HEPTACHLOR  
HEPTACHLOR EPOXIDE  
METHOXYCHLOR  
PCBS (AS AROCLORS)

EPA 525.2 (1995)

ALACHLOR  
ALDRIN  
ATRAZINE  
BENZO(A)PYRENE  
BUTACHLOR  
CHLORDANE  
DI(2-ETHYLHEXYL)ADIPATE  
DI(2-ETHYLHEXYL)PHTHALATE  
DIELDRIN  
ENDRIN  
GAMMA-BHC (LINDANE)  
HEPTACHLOR  
HEPTACHLOR EPOXIDE  
HEXACHLOROBENZENE  
HEXACHLOROCYCLOPENTADIENE  
METHOXYCHLOR  
SIMAZINE



United States Environmental Protection Agency  
Office of Water  
Office of Ground Water and Drinking Water  
Standards and Risk Management Division  
Technical Support Center  
UCMR Laboratory Approval Program

Based on the review of submitted applications and successful participation in a Proficiency Testing (PT) Study for the fourth Unregulated Contaminant Monitoring Rule (UCMR 4), EPA has granted the status of "approved" to your laboratory for the method(s) listed below to the following laboratory at the listed address:

Eurofins Eaton Analytical, Inc. - CA  
750 Royal Oaks Dr; Ste 100  
Monrovia, CA 91016

The application and PT criteria are listed in the "UCMR 4 Laboratory Approval Requirements and Information Document, Version 2.0." Your laboratory is now "approved" to conduct UCMR 4 analyses using the following method(s):

**LabID:** CA00006

<b>Method Name</b>	<b>Status</b>	<b>Date</b>
EPA 200.8	Approved	2/6/2017
EPA 525.3	Approved	6/19/2017
EPA 530	Approved	6/19/2017
EPA 541	Approved	2/6/2017
EPA 544	Approved	4/3/2017
EPA 545	Approved	2/6/2017
EPA 546	Approved	2/6/2017
EPA 552.3	Approved	4/3/2017

#### **End of Method List**

This information will be included in the list of UCMR 4 approved laboratories on our website. Your approval status will be maintained during UCMR 4 by continuing to meet the criteria given in the "UCMR 4 Laboratory Approval Requirements and Information Document, Version 2.0," and any revisions to the aforementioned document. Please be aware that you are only permitted to conduct UCMR 4 analyses using those methods for which you have EPA approval. Should you wish to comment on any of these determinations, please write to:

UCMR 4 Laboratory Approval Coordinator  
USEPA, Technical Support Center  
26 W. Martin Luther King Drive (MS 140)  
Cincinnati, OH 45268  
UCMR\_Lab\_Approval@epa.gov



United States Environmental Protection Agency  
Office of Water  
Office of Ground Water and Drinking Water  
Technical Support Center  
UCMR Laboratory Approval Program

Based on the review of submitted applications for each of the listed methods, EPA has granted the status of "authorized" to your laboratory for the method(s) listed below to the following laboratory at the listed address:

Eurofins Eaton Analytical, Inc. - CA  
750 Royal Oaks Drive; Suite 100  
Monrovia, CA 91016

The application criteria are listed in the "UCMR 4 Laboratory Approval Requirements and Information Document, Version 2.0." Your laboratory is now "authorized" to conduct UCMR 4 analyses using the following method(s):

**LabID:** CA00006

<b>Method Name</b>	<b>Status</b>	<b>Date</b>
SM 5310 C	Authorized	12/27/2016
EPA 300.0 (Rev. 2.1)	Authorized	12/27/2016

**End of Method List**

This information will be included in the list of UCMR 4 approved laboratories. Your status will be maintained during UCMR 4 by continuing to meet the criteria given in the "UCMR 4 Laboratory Approval Requirements and Information Document, Version 2.0," and any revisions to the aforementioned document. Please be aware that you are only permitted to conduct UCMR 4 analyses using those methods for which you have EPA approval. Should you wish to comment on any of these determinations, please write to:

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26 W. Martin Luther King Drive (MS 140)  
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# OREGON

## Environmental Laboratory Accreditation Program



NELAP Recognized

**Eurofins Eaton Analytical, Inc.-South Bend**

**4074**

110 South Hill Street  
South Bend, IN 46617

IS GRANTED APPROVAL BY ORELAP UNDER THE 2009 TNI STANDARDS, TO PERFORM ANALYSES ON ENVIRONMENTAL SAMPLES IN MATRICES AS LISTED BELOW :

<i>Air</i>	<i>Drinking Water</i>	<i>Non Potable Water</i>	<i>Solids and Chem. Waste</i>	<i>Tissue</i>
	Chemistry	Microbiology		
	Microbiology			
	Radiochemistry			

AND AS RECORDED IN THE LIST OF APPROVED ANALYTES, METHODS, ANALYTICAL TECHNIQUES, AND FIELDS OF TESTING ISSUED CONCURRENTLY WITH THIS CERTIFICATE AND REVISED AS NECESSARY.

ACCREDITED STATUS DEPENDS ON SUCCESSFUL ONGOING PARTICIPATION IN THE PROGRAM AND CONTINUED COMPLIANCE WITH THE STANDARDS.

CUSTOMERS ARE URGED TO VERIFY THE LABORATORY'S CURRENT ACCREDITATION STATUS IN OREGON.

*Christopher L. Redman*

Christopher L. Redman, BA  
Oregon State Public Health Laboratory  
ORELAP Program Manager  
3150 NW. 229th Ave, Suite 100  
Hillsboro, OR 97124

EFFECTIVE DATE : 09/17/2017

EXPIRATION DATE : 09/16/2018

Certificate No : 4074 - 005





# OREGON

## Environmental Laboratory Accreditation Program



### ORELAP Fields of Accreditation

ORELAP ID: 4074

Eurofins Eaton Analytical, Inc.-South Bend

EPA CODE: IN00035

110 South Hill Street

Certificate: 4074 - 005

South Bend, IN 46617

Issue Date: 9/17/2017 Expiration Date: 9/16/2018

**As of 9/17/2017 this list supersedes all previous lists for this certificate number.**

MATRIX	Reference	Code	Analyte	Code	Description
<b>Drinking Water</b>	EPA 150.1			10008409	pH - Electrometric Measurement
		1900	pH		
	EPA 1623			10236609	Filtration/IMS/FA: Cryptosporidium and Giardia
		2510	Cryptosporidia		
		2545	Giardia		
	EPA 180.1 2			10011800	Turbidity - Nephelometric
		2055	Turbidity		
	EPA 200.2			10013000	Sample Preparation Procedure for Spectrochemical Determination of Total Recoverable Elements - Revision 2.8
		8031	Extraction/Preparation		
	EPA 200.7 4.4			10013806	ICP - metals
		1035	Calcium		
		1070	Iron		
		1085	Magnesium		
		1125	Potassium		
		1990	Silica as SiO <sub>2</sub>		
		1155	Sodium		
	EPA 200.8 5.4			10014605	Metals by ICP-MS
		1000	Aluminum		
		1005	Antimony		
		1010	Arsenic		
	1015	Barium			
	1020	Beryllium			
	1030	Cadmium			
	1040	Chromium			
	1055	Copper			
	1075	Lead			
	1090	Manganese			
	1100	Molybdenum			
	1105	Nickel			
	1140	Selenium			
	1150	Silver			
	1165	Thallium			
	3035	Uranium			
	1185	Vanadium			
	1190	Zinc			



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### Drinking Water

EPA 218.6 3.3		10028009	Dissolved Hexavalent Chromium by Ion Chromatography
	1045 Chromium VI		
EPA 218.7 1		10268414	Determination of Hexavalent Chromium in Drinking Water by Ion Chromatography with Post-column Derivatization and UV-VIS Spectroscopic Determination
	1045 Chromium VI		
EPA 245.1 3		10036609	Mercury by Cold Vapor Atomic Absorption
	1095 Mercury		
EPA 300.0 2.1		10053200	Methods for the Determination of Inorganic Substances in Environmental Samples
	1540 Bromide		
	1570 Chlorate		
	1575 Chloride		
	1595 Chlorite		
	1730 Fluoride		
	1810 Nitrate as N		
	2000 Sulfate		
EPA 300.1 1.0		10275602	Determination of Inorganic Anions in Drinking Water by Ion Chromatography
	1535 Bromate		
EPA 317.0 EPA 317.0		10237602	Inorganic Oxyhalide Disinfection Byproducts in Drinking Water
	1535 Bromate		
EPA 331.0 1.0		10059708	Determination of Perchlorate in Drinking Water by Liquid Chromatography Electrospray Mass Spectrometry (LC/ESI/MS)
	1895 Perchlorate		
EPA 335.4 EPA 335.4		10061402	Methods for the Determination of Inorganic Substances in Environmental Samples
	1635 Cyanide		
EPA 353.2 2		10067604	Nitrate/Nitrite Nitrogen - Automated, Cadmium
	1810 Nitrate as N		
	1820 Nitrate-nitrite		
	1840 Nitrite as N		
EPA 504.1 1.1		10082801	EDB/DBCP/TCP micro-extraction, GC/ECD
	4570 1,2-Dibromo-3-chloropropane (DBCP)		
	4585 1,2-Dibromoethane (EDB, Ethylene dibromide)		



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Drinking Water	EPA 505 2.1		10083406	Organohalide pesticides/PCBs (Drinking Water)
		8880		Aroclor-1016 (PCB-1016)
		8885		Aroclor-1221 (PCB-1221)
		8890		Aroclor-1232 (PCB-1232)
		8895		Aroclor-1242 (PCB-1242)
		8900		Aroclor-1248 (PCB-1248)
		8905		Aroclor-1254 (PCB-1254)
		8910		Aroclor-1260 (PCB-1260)
		7250		Chlordane (tech.)
		8870		PCBs
		8250		Toxaphene (Chlorinated camphene)
	EPA 515.3 1		10088401	Chlorinated acids Liquid/Solid and GC/ECD
		8655		2,4,5-T
		8545		2,4-D
		8560		2,4-DB
		8600		3,5-Dichlorobenzoic acid
		8505		Acifluorfen
		8530		Bentazon
		8540		Chloramben
		8550		Dacthal (DCPA)
		8555		Dalapon
		8595		Dicamba
		8605		Dichloroprop (Dichlorprop)
		8620		Dinoseb (2-sec-butyl-4,6-dinitrophenol, DNBP)
		6605		Pentachlorophenol
		8645		Picloram
		8650		Silvex (2,4,5-TP)
	EPA 522 1		10088570	1,4-Dioxane in Drinking Water by SPE and GC/MS SIM
		4735		1,4-Dioxane (1,4- Diethyleneoxide)
	EPA 524.2 4.1		10088809	Volatile Organic Compounds GC/MS Capillary Column
		5105		1,1,1,2-Tetrachloroethane
		5160		1,1,1-Trichloroethane
		5110		1,1,2,2-Tetrachloroethane
		5165		1,1,2-Trichloroethane
		7450		1,1-Dichloro-2-propanone
		4630		1,1-Dichloroethane
		4640		1,1-Dichloroethylene
		4670		1,1-Dichloropropene
		5150		1,2,3-Trichlorobenzene
		5180		1,2,3-Trichloropropane



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### Drinking Water

EPA 524.2 4.1	5155	1,2,4-Trichlorobenzene
	5210	1,2,4-Trimethylbenzene
	4610	1,2-Dichlorobenzene
	4635	1,2-Dichloroethane (Ethylene dichloride)
	4655	1,2-Dichloropropane
	5215	1,3,5-Trimethylbenzene
	4615	1,3-Dichlorobenzene
	4660	1,3-Dichloropropane
	4620	1,4-Dichlorobenzene
	4480	1-Chlorobutane
	4665	2,2-Dichloropropane
	4410	2-Butanone (Methyl ethyl ketone, MEK)
	4535	2-Chlorotoluene
	4860	2-Hexanone (MBK)
	5020	2-Nitropropane
	4540	4-Chlorotoluene
	4910	4-Isopropyltoluene (p-Cymene)
	4995	4-Methyl-2-pentanone (MIBK)
	4315	Acetone
	4340	Acrylonitrile
	4355	Allyl chloride (3-Chloropropene)
	4375	Benzene
	4385	Bromobenzene
	4390	Bromochloromethane
	4395	Bromodichloromethane
	4400	Bromoform
	4450	Carbon disulfide
	4455	Carbon tetrachloride
	4470	Chloroacetonitrile
	4475	Chlorobenzene
	4575	Chlorodibromomethane
	4485	Chloroethane (Ethyl chloride)
	4505	Chloroform
	4645	cis-1,2-Dichloroethylene
	4680	cis-1,3-Dichloropropene
	4595	Dibromomethane (Methylene bromide)
	4625	Dichlorodifluoromethane (Freon-12)
	4725	Diethyl ether
	4810	Ethyl methacrylate
	4765	Ethylbenzene
	4770	Ethyl-t-butylether (ETBE) (2-Ethoxy-2-methylpropane)
	4835	Hexachlorobutadiene
	4840	Hexachloroethane



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### Drinking Water

EPA 524.2 4.1	4870	Iodomethane (Methyl iodide)
	4900	Isopropylbenzene (Cumene)
	5240	m+p-xylene
	4925	Methacrylonitrile
	4945	Methyl acrylate
	4950	Methyl bromide (Bromomethane)
	4960	Methyl chloride (Chloromethane)
	4990	Methyl methacrylate
	5000	Methyl tert-butyl ether (MTBE)
	4975	Methylene chloride (Dichloromethane)
	5005	Naphthalene
	4435	n-Butylbenzene
	5015	Nitrobenzene
	5090	n-Propylbenzene
	5250	o-Xylene
	5035	Pentachloroethane
	5080	Propionitrile (Ethyl cyanide)
	4440	sec-Butylbenzene
	5100	Styrene
	4370	T-amylmethylether (TAME)
	4420	tert-Butyl alcohol
	4445	tert-Butylbenzene
	5115	Tetrachloroethylene (Perchloroethylene)
	5120	Tetrahydrofuran (THF)
	5140	Toluene
	5205	Total trihalomethanes
	4700	trans-1,2-Dichloroethylene
	4685	trans-1,3-Dichloropropylene
	4605	trans-1,4-Dichloro-2-butene
	5170	Trichloroethene (Trichloroethylene)
	5175	Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)
	5235	Vinyl chloride
	5260	Xylene (total)

EPA 525.2 2

10090003

Semi-Volatile by SPE extraction and GC/MS

7355	4,4'-DDD
7360	4,4'-DDE
7365	4,4'-DDT
5500	Acenaphthene
5505	Acenaphthylene
7005	Alachlor
7025	Aldrin
5555	Anthracene



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### Drinking Water

EPA 525.2 2	7065	Atrazine
	5575	Benzo(a)anthracene
	5580	Benzo(a)pyrene
	5590	Benzo(g,h,i)perylene
	5600	Benzo(k)fluoranthene
	5585	Benzo[b]fluoranthene
	6062	bis(2-Ethylhexyl)adipate
	7130	Bromacil
	7160	Butachlor
	5670	Butyl benzyl phthalate
	7310	Chlorthalonil (Daconil)
	5855	Chrysene
	6065	Di(2-ethylhexyl) phthalate (bis(2-Ethylhexyl)phthalate, DEHP)
	5895	Dibenz(a,h) anthracene
	7470	Dieldrin
	6070	Diethyl phthalate
	6135	Dimethyl phthalate
	5925	Di-n-butyl phthalate
	7540	Endrin
	7555	EPTC (Eptam, s-ethyl-dipropyl thio carbamate)
	6270	Fluorene
	7120	gamma-BHC (Lindane, gamma-HexachlorocyclohexanE)
	7685	Heptachlor
	7690	Heptachlor epoxide
	6275	Hexachlorobenzene
	6285	Hexachlorocyclopentadiene
	6315	Indeno(1,2,3-cd) pyrene
	7810	Methoxychlor
	7835	Metolachlor
	7845	Metribuzin
	7875	Molinate
	6615	Phenanthrene
	8040	Prometryn
	8045	Propachlor (Ramrod)
	6665	Pyrene
	8125	Simazine
	8180	Terbacil
	8220	Thiobencarb
	8295	Trifluralin (Treflan)

EPA 531.2 1

10091302

Carbamate Pesticides by Post-column Derivatization HPLC/Fluorescence

7710 3-Hydroxycarbofuran



# OREGON

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South Bend, IN 46617

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### Drinking Water

EPA 531.2 1	7010	Aldicarb (Temik)	
	7015	Aldicarb sulfone	
	7020	Aldicarb sulfoxide	
	7195	Carbaryl (Sevin)	
	7205	Carbofuran (Furaden)	
	7800	Methiocarb (Mesurol)	
	7805	Methomyl (Lannate)	
	7940	Oxamyl	
	8080	Propoxur (Baygon)	
EPA 537 1.1	10091675	Perfluorinated Alkyl Acids in Drinking Water by SPE and LC/MS/MS	
	4846	2-(N-Ethyl-perfluorooctane sulfonamido) acetic acid (EtFOSAA)	
	4847	2-(N-Methyl-perfluorooctane sulfonamido) acetic acid (MeFOSAA)	
	6911	Perfluorobutane Sulfonate (PFBS)	
	6905	Perfluorodecanoic acid (PFDA)	
	6903	Perfluorododecanoic (PFDDA)	
	6908	Perfluoroheptanoic acid (PFHpA)	
	6910	Perfluorohexane Sulfonate (PFHS)	
	6913	Perfluorohexanoic acid (PFHXA)	
	6906	Perfluorononanoic acid (PFNA)	
	6912	Perfluorooctanoic acid	
	6909	Perfluorooctanoic Sulfonate (PFOS)	
	6902	Perfluorotetradecanoic acid (PFTDA)	
	9563	Perfluorotridecanoic (PFTRIA)	
	6904	Perfluoroundecanoic acid (PFUDA)	
EPA 547	10092009	Glyphosate by Direct Aqueous Injection by Post-column Derivatization and HPLC/Fluorescence	
	9411	Glyphosate	
EPA 548.1 1	10092805	Endothall by Ion Exchange, Methylation and GC/MS	
	7525	Endothall	
EPA 549.2 1	10093400	Diquat/Paraquat by Liquid/Liquid Extraction and HPLC/UV-VIS	
	9390	Diquat	
	9528	Paraquat	
EPA 551.1 1	10094801	Chlorination Disinfection Byproducts, Liquid/Liquid Extraction and GC/ECD	
	5190	1,1,1-Trichloro-2-propanone	
	7450	1,1-Dichloro-2-propanone	
	7140	Bromochloroacetonitrile	
	4395	Bromodichloromethane	
	4400	Bromoform	
	4460	Chloral hydrate	



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EPA 551.1 1	4575	Chlorodibromomethane		
	4505	Chloroform		
	7270	Chloropicrin		
	7420	Dibromoacetonitrile		
	7440	Dichloroacetonitrile		
	5205	Total trihalomethanes		
	8270	Trichloroacetonitrile		
EPA 552.2 1			10095804	Haloacetic Acid/Dalapon, Liquid/Liquid Extraction, Derivatization and GC/ECD
	9312	Bromoacetic acid		
	9315	Bromochloroacetic acid		
	8535	Bromodichloroacetic acid(BDCAA)		
	9336	Chloroacetic acid		
	9339	Chlorodibromoacetic acid(CDBAA)		
	9357	Dibromoacetic acid		
	9360	Dichloroacetic acid		
	9414	Total haloacetic acids		
	9639	Tribromoacetic acid (TBAA)		
	9642	Trichloroacetic acid		
EPA 552.3 1			10239608	Haloacetic Acid/Dalapon, Microextraction, Derivatization and GC/ECD
	9312	Bromoacetic acid		
	9315	Bromochloroacetic acid		
	8535	Bromodichloroacetic acid(BDCAA)		
	9336	Chloroacetic acid		
	9339	Chlorodibromoacetic acid(CDBAA)		
	9357	Dibromoacetic acid		
	9360	Dichloroacetic acid		
	9414	Total haloacetic acids		
	9639	Tribromoacetic acid (TBAA)		
	9642	Trichloroacetic acid		
EPA 556 1			10097004	Determination of Carbonyl Compounds in Drinking Water by Pentafluorobenzylhydroxylamine Derivatization and Capillary Gas Chromatography with Electron Capture Detection
	4300	Acetaldehyde		
	5570	Benzaldehyde		
	4430	Butylaldehyde (Butanal)		
	4545	Crotonaldehyde		
	4560	Cyclohexanone		
	4565	Decanal		
	4815	Formaldehyde		
	9413	Glyoxal		



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EPA 556 1	4820	Heptanal		
	3825	Hexanaldehyde (Hexanal)		
	7266	Methyl glyoxal		
	9525	n-Octaldehyde (Octanal)		
	6575	Nonanal		
	6935	Propanal (Propionaldehyde)		
	4040	Valeraldehyde (Pentanal, Pentanaldehyde)		
EPA 906			10114008	Tritium
	3030	Tritium		
NJ ECLS-R-GA 8			90014394	NJ Environmental and Clinical Laboratory Services 48 Hour Rapid Gross Alpha Test
	2830	Gross-alpha		
SM 2120 B 22nd Ed			20039014	Color - Visual Comparison Method
	1605	Color		
SM 2320 B 21st ED			20045403	Alkalinity by Titration Method
	1505	Alkalinity as CaCO3		
SM 2320 B 22nd Ed			20045414	Alkalinity by Titration
	1615	Corrosivity		
SM 2330 B 22nd Ed			20003365	Calcium Carbonate Indices
	1615	Corrosivity		
SM 2340 B 22nd Ed			20046417	Hardness - Hardness by Calculation
	1760	Hardness (calc.)		
	1804	Magnesium Hardness		
SM 2340 B-97 1997			20046600	Hardness by calculation
	1550	Calcium hardness as CaCO3		
	1755	Total hardness as CaCO3		
SM 2510 B 22nd Ed			20048413	Conductivity by Probe
	1610	Conductivity		
SM 2540 C 22nd Ed			20050424	Total Dissolved Solids Dried at 180 deg C
	1955	Residue-filterable (TDS)		
SM 4500-CI G 22nd Ed			20081418	Chlorine (Residual) - DPD Colorimetric Method
	1945	Residual free chlorine		
SM 4500-CI G 21st ED			20081407	Chlorine by DPD Colorimetric Method
	1940	Total residual chlorine		
SM 4500-F C 22nd Ed			20102210	Fluoride by Ion Selective Electrode
	1730	Fluoride		



# OREGON

## Environmental Laboratory Accreditation Program



### ORELAP Fields of Accreditation

ORELAP ID: 4074

Eurofins Eaton Analytical, Inc.-South Bend

EPA CODE: IN00035

110 South Hill Street

Certificate: 4074 - 005

South Bend, IN 46617

Issue Date: 9/17/2017 Expiration Date: 9/16/2018

**As of 9/17/2017 this list supersedes all previous lists for this certificate number.**

Drinking Water	Method	Parameter	Method ID	Method Description
	SM 4500-P E 21st Ed	1870 Orthophosphate as P	20124009	Phosphorus by Ascorbic Acid Method
	SM 5310 C 21st Ed	1710 Dissolved organic carbon (DOC) 2040 Total organic carbon	20138607	TOC by Persulfate-Ultraviolet or Heated-Persulfate Oxidation Method
	SM 5910 B 22nd Ed	2060 UV 254	20146218	UV-Absorbing Organic Constituents - Ultraviolet Absorption Method
	SM 7110 B (GPC) 22nd Ed	2830 Gross-alpha 2840 Gross-beta	20156814	Gross alpha/beta by Evaporation by Proportional Count
	SM 7110 C (GPC) 22nd Ed	2830 Gross-alpha	20158810	Gross alpha by Coprecipitation
	SM 7500-Ra B (GPC) 22nd Ed	2965 Radium-226	20170416	Radium - Precipitation Method
	SM 7500-Ra D 22nd Ed	2970 Radium-228	20173415	Radium by Sequential Precipitation Method
	SM 7500-RN B 22nd Ed	2985 Radon	20173711	Radon by Liquid Scintillation Method
	SM 9215 E SimPlate®	2555 Heterotrophic plate count	20185302	Fluorogenic Quantitative (SimPlate®): Heterotrophic Bacteria
	SM 9223 B (Colilert Quanti-Tray)-2004 22nd Ed	2525 Escherichia coli 2500 Total coliforms	20211614	Enzyme Substrate Coliform Test (Colilert Quanti-Tray)
	SM 9223 B (Colilert) 22nd Ed	2525 Escherichia coli 2500 Total coliforms	20212413	Enzyme Substrate Coliform Test (Colilert) P/A
	SM 9223 B (Colilert-18) 22nd Ed	2525 Escherichia coli 2500 Total coliforms	20214419	Enzyme Substrate Coliform Test (Colilert-18)
	SM 9223 B (Colisure) 22nd Ed	2525 Escherichia coli 2500 Total coliforms	20231612	Enzyme Substrate Coliform Test (Colisure)
Non-Potable Water	EPA 1623	2510 Cryptosporidia	10236609	Filtration/IMS/FA: Cryptosporidium and Giardia

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**Non-  
Potable  
Water**

EPA 1623

2545

Giardia



Healthy People. Healthy Communities.

S.C. Department of Health and  
Environmental Control

# Environmental Laboratory Certification Program

*In accordance with the provisions of Regulation 61-81, entitled "State Environmental Laboratory Certification Regulations"*

**EUROFINS EATON ANALYTICAL LLC  
110 S HILL ST  
SOUTH BEND, INDIANA 46617-2702**

*is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of the data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).*

Laboratory Director: MATTHEW HARTZ  
Certifying Authority: OR  
Date of Issue: November 14, 2019  
Date of Expiration: September 16, 2020  
Certificate Number: 95005001

Program Manager  
Office of Environmental Laboratory Certification

**SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM**

**EUROFINS EATON ANALYTICAL LLC (Laboratory ID 95005)**  
**Laboratory Director: MATTHEW HARTZ**  
**Certifying Authority: OR**  
**Certificate Number: 95005001**

**Date of Issue: November 14, 2019**  
**Expiration Date: September 16, 2020**

**SAFE DRINKING WATER ACT**

**DISINFECTION BY-PRODUCTS**

BROMATE	EPA 300.1 (1997)	ION CHROMATOGRAPHY
BROMATE	EPA 317.0 (2001)	ION CHROMATOGRAPHY & POST COLUMN REACTION
BROMIDE	EPA 300.0 (1993)	ION CHROMATOGRAPHY
CHLORITE	EPA 300.0 (1993)	ION CHROMATOGRAPHY
UV254	SM 5910 B-2011	UV-ABSORBING ORGANIC CONSTITUENTS

**INORGANIC - DEMAND**

TOTAL AND DISSOLVED ORGANIC CARBON	SM 5310 C-2011	PERSULFATE OXIDATION (TOC)
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**INORGANIC - MINERAL**

ALKALINITY	SM 2320 B-2011	TITRIMETRIC
CHLORIDE	EPA 300.0 (1993)	ION CHROMATOGRAPHY
FLUORIDE	EPA 300.0 (1993)	ION CHROMATOGRAPHY
FLUORIDE	SM 4500-F C-2011	ELECTRODE (MANUAL)
HYDROGEN-ION CONC. (PH)	EPA 150.1 (1983)	ELECTROMETRIC MEASUREMENT
SPECIFIC CONDUCTANCE	SM 2510 B-2011	CONDUCTANCE AT 25 DEGREES C
SULFATE	EPA 300.0 (1993)	ION CHROMATOGRAPHY

**INORGANIC - MISCELLANEOUS**

TEMPERATURE	SM 2550 B-2010	THERMOMETRIC
TURBIDITY	EPA 180.1 (1993)	NEPHELOMETRIC

**INORGANIC - NUTRIENT**

NITRATE-NITROGEN	EPA 300.0 (1993)	ION CHROMATOGRAPHY
NITRATE-NITROGEN	EPA 353.2 (1993)	CADMIUM REDUCTION (AUTOMATED)
NITRITE-NITROGEN	EPA 353.2 (1993)	CADMIUM REDUCTION (AUTOMATED)
ORTHOPHOSPHATE	SM 4500-P E-2011	ASCORBIC ACID (MANUAL SINGLE REAGENT)

**INORGANIC - RADIOLOGICAL**

TRITIUM	EPA 906.0 (1980)	LIQUID SCINTILLATION
URANIUM	EPA 200.8 (1994)	ICP/MS

**INORGANIC - RESIDUE**

RESIDUE, FILTERABLE (TDS)	SM 2540 C-2011	GRAVIMETRIC (180)
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**SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM**

**EUROFINS EATON ANALYTICAL LLC (Laboratory ID 95005)**  
**Laboratory Director: MATTHEW HARTZ**  
**Certifying Authority: OR**  
**Certificate Number: 95005001**

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**SAFE DRINKING WATER ACT**

**INORGANIC - TRACE METAL**

ALUMINUM	EPA 200.8 (1994)	ICP/MS
ANTIMONY	EPA 200.8 (1994)	ICP/MS
ARSENIC	EPA 200.8 (1994)	ICP/MS
BARIUM	EPA 200.8 (1994)	ICP/MS
BERYLLIUM	EPA 200.8 (1994)	ICP/MS
CADMIUM	EPA 200.8 (1994)	ICP/MS
CALCIUM	EPA 200.7 (1994)	ICP/AES
CHROMIUM	EPA 200.8 (1994)	ICP/MS
COPPER	EPA 200.8 (1994)	ICP/MS
IRON	EPA 200.7 (1994)	ICP/AES
LEAD	EPA 200.8 (1994)	ICP/MS
MAGNESIUM	EPA 200.7 (1994)	ICP/AES
MANGANESE	EPA 200.8 (1994)	ICP/MS
MERCURY	EPA 245.1 (1994)	COLD VAPOR (MANUAL)
NICKEL	EPA 200.8 (1994)	ICP/MS
SELENIUM	EPA 200.8 (1994)	ICP/MS
SILICA, TOTAL	EPA 200.7 (1994)	ICP/AES
SILVER	EPA 200.8 (1994)	ICP/MS
SODIUM	EPA 200.7 (1994)	ICP/AES
THALLIUM	EPA 200.8 (1994)	ICP/MS
ZINC	EPA 200.8 (1994)	ICP/MS

**MICROBIOLOGY**

CRYPTOSPORIDIUM	EPA 1623 (2005)	CRYPTOSPORIDIUM BY FILTRATION/IMS/FA
HETEROTROPHIC BACTERIA	SIMPLATE (2000)	IDEXX SIMPLATE MULTIPLE WELL TEST METHOD
TOTAL COLIFORM/E. COLI	COLISURE TEST (1994)	IDEXX COLISURE PRESENCE/ABSENCE CPRG TEST
TOTAL COLIFORM/E. COLI(MPN)	SM 9223 B-2004	COLILERT/COLILERT-18

**SYNTHETIC ORGANIC COMPOUNDS (SOCS)**

CHLORINATED ACIDS - GC/ECD	EPA 515.3 (1996)
DIQUAT & PARAQUAT - HPLV/UV	EPA 549.2 (1997)
EDB, DBCP AND 1,2,3 TCP BY MICROEXT.-GC	EPA 504.1 (1995)
ENDOTHALL - GC/MS	EPA 548.1 (1992)
GLYPHOSATE - HPLC/FLUORESCENCE	EPA 547 (1990)
HALOACETIC ACIDS & DALAPON - GC/ECD	EPA 552.2 (1995)
N-METHYLCARB. & CARBAMATES - HPLC	EPA 531.2 (2001)
ORG. COMPOUNDS BY LIQ. SOL. EXT. - GC/M	EPA 525.2 (1995)
ORGANOHALIDE PEST & PCBS BY MICROEXT. -	EPA 505 (1995)

**SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM**

**EUROFINS EATON ANALYTICAL LLC (Laboratory ID 95005)**

**Laboratory Director: MATTHEW HARTZ**

**Certifying Authority: OR**

**Certificate Number: 95005001**

**Date of Issue: November 14, 2019**

**Expiration Date: September 16, 2020**

**SAFE DRINKING WATER ACT**

**TRIHALOMETHANES**

CHLORINATED DBP, SOLVENTS, PEST/HERB -	EPA 551.1 (1995)
PURGEABLE ORGANICS - GC/MS	EPA 524.2 (1995)

**VOLATILES (VOCS)**

PURGEABLE ORGANICS - GC/MS	EPA 524.2 (1995)
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SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

EUROFINS EATON ANALYTICAL LLC (Laboratory ID 95005)

Certifying Authority: OR

Certificate Number: 95005001

Date of Issue: November 14, 2019

Expiration Date: September 16, 2020

SAFE DRINKING WATER ACT

---SYNTHETIC ORGANIC COMPOUNDS  
(SOCS)---

EPA 504.1 (1995)  
1,2-DIBROMO-3-CHLOROPROPANE(DBCP)  
1,2-DIBROMOETHANE (EDB)

EPA 505 (1995)  
CHLORDANE  
PCBS (AS AROCLORS)  
TOXAPHENE

EPA 515.3 (1996)  
2,4,5-TP (SILVEX)  
2,4-D  
DALAPON  
DICAMBA  
DINOSEB  
PENTACHLOROPHENOL  
PICLORAM

EPA 525.2 (1995)  
ALACHLOR  
ALDRIN  
ATRAZINE  
BENZO(A)PYRENE  
BUTACHLOR  
DI(2-ETHYLHEXYL)ADIPATE  
DI(2-ETHYLHEXYL)PHTHALATE  
DIELDRIN  
ENDRIN  
GAMMA-BHC (LINDANE)  
HEPTACHLOR  
HEPTACHLOR EPOXIDE  
HEXACHLOROETHYLENE  
HEXACHLOROCYCLOPENTADIENE  
METHOXYCHLOR  
METOLACHLOR  
METRIBUZIN  
PROPACHLOR  
SIMAZINE

EPA 531.2 (2001)  
3-HYDROXYCARBOFURAN  
ALDICARB  
ALDICARB SULFONE  
ALDICARB SULFOXIDE  
CARBARYL  
CARBOFURAN  
METHIOCARB  
METHOMYL  
OXAMYL  
PROPOXUR

EPA 547 (1990)  
GLYPHOSATE

EPA 548.1 (1992)  
ENDOTHALL

EPA 549.2 (1997)  
DIQUAT

EPA 552.2 (1995)  
DIBROMOACETIC ACID  
DICHLOROACETIC ACID  
MONOBROMOACETIC ACID  
MONOCHLOROACETIC ACID  
TRICHLOROACETIC ACID

-----TRIHALOMETHANES-----

EPA 524.2 (1995)  
BROMODICHLOROMETHANE  
BROMOFORM  
CHLORODIBROMOMETHANE  
CHLOROFORM

EPA 551.1 (1995)  
BROMODICHLOROMETHANE  
BROMOFORM  
CHLORODIBROMOMETHANE  
CHLOROFORM

-----VOLATILES (VOCS)-----

EPA 524.2 (1995)  
1,1,1-TRICHLOROETHANE  
1,1,2-TRICHLOROETHANE  
1,1-DICHLOROETHENE  
1,2,4-TRICHLOROBENZENE  
1,2-DICHLOROBENZENE  
1,2-DICHLOROETHANE  
1,2-DICHLOROPROPANE  
1,4-DICHLOROBENZENE  
BENZENE  
CARBON TETRACHLORIDE  
CHLOROETHYLENE  
CIS-1,2-DICHLOROETHENE  
ETHYLBENZENE  
METHYLENE CHLORIDE  
STYRENE  
TETRACHLOROETHENE  
TOLUENE  
TRANS-1,2-DICHLOROETHENE  
TRICHLOROETHENE  
VINYL CHLORIDE  
XYLENE, TOTAL



November 15, 2019

MATTHEW HARTZ  
EUROFINS EATON ANALYTICAL LLC  
110 S HILL ST  
SOUTH BEND, INDIANA 46617-2702

Laboratory ID # 95005  
Certificate # 95005001

Dear Matthew Hartz:

Your current certificate and associated parameter/method list(s) are enclosed. These documents now represent the certificate of record for your laboratory. All previous certificate(s) and associated parameter list(s) received are now null and void and should be destroyed. Please be reminded that all environmental data submitted to the Department is reviewed to ensure that the reporting laboratory possesses the necessary certification. Data reported by laboratories without the proper certification will be addressed by the affected enforcement programs.

If you have any questions or problems are detected concerning your certificate, please contact our office within ten (10) working days at (803)896-0970 or by e-mail at [labcerthelp@dhec.sc.gov](mailto:labcerthelp@dhec.sc.gov).

Sincerely,

Bennie L. Cockerel, Jr., Program Manager  
Office of Environmental Laboratory Certification  
Bureau of Environmental Health Services

Enclosures

*Register on our website at [www.scdhec.gov/labcert](http://www.scdhec.gov/labcert) to receive e-mail updates for the Laboratory Certification Program. Subscribing is easy and you'll automatically receive new posts to our website.*



United States Environmental Protection Agency  
Office of Water  
Office of Ground Water and Drinking Water  
Standards and Risk Management Division  
Technical Support Center  
UCMR Laboratory Approval Program

Based on the review of submitted applications and successful participation in a Proficiency Testing (PT) Study for the fourth Unregulated Contaminant Monitoring Rule (UCMR 4), EPA has granted the status of "approved" to your laboratory for the method(s) listed below to the following laboratory at the listed address:

Eurofins Eaton Analytical, Inc. - IN  
110 S. Hill Street  
South Bend, IN 46617

The application and PT criteria are listed in the "UCMR 4 Laboratory Approval Requirements and Information Document, Version 2.0." Your laboratory is now "approved" to conduct UCMR 4 analyses using the following method(s):

**LabID:** IN00035

<b>Method Name</b>	<b>Status</b>	<b>Date</b>
EPA 200.8	Approved	2/6/2017
EPA 525.3	Approved	2/6/2017
EPA 530	Approved	2/6/2017
EPA 541	Approved	2/6/2017
EPA 544	Approved	4/3/2017
EPA 545	Approved	2/6/2017
EPA 546	Approved	2/6/2017
EPA 552.3	Approved	4/3/2017

**End of Method List**

This information will be included in the list of UCMR 4 approved laboratories on our website. Your approval status will be maintained during UCMR 4 by continuing to meet the criteria given in the "UCMR 4 Laboratory Approval Requirements and Information Document, Version 2.0," and any revisions to the aforementioned document. Please be aware that you are only permitted to conduct UCMR 4 analyses using those methods for which you have EPA approval. Should you wish to comment on any of these determinations, please write to:

UCMR 4 Laboratory Approval Coordinator  
USEPA, Technical Support Center  
26 W. Martin Luther King Drive (MS 140)  
Cincinnati, OH 45268  
UCMR\_Lab\_Approval@epa.gov



United States Environmental Protection Agency  
Office of Water  
Office of Ground Water and Drinking Water  
Technical Support Center  
UCMR Laboratory Approval Program

Based on the review of submitted applications for each of the listed methods, EPA has granted the status of "authorized" to your laboratory for the method(s) listed below to the following laboratory at the listed address:

Eurofins Eaton Analytical, Inc. - IN  
110 S. Hill Street  
South Bend, IN 46617

The application criteria are listed in the "UCMR 4 Laboratory Approval Requirements and Information Document, Version 2.0." Your laboratory is now "authorized" to conduct UCMR 4 analyses using the following method(s):

**LabID:** IN00035

<b>Method Name</b>	<b>Status</b>	<b>Date</b>
SM 5310 C	Authorized	1/10/2017
EPA 300.0 (Rev. 2.1)	Authorized	1/10/2017

**End of Method List**

This information will be included in the list of UCMR 4 approved laboratories. Your status will be maintained during UCMR 4 by continuing to meet the criteria given in the "UCMR 4 Laboratory Approval Requirements and Information Document, Version 2.0," and any revisions to the aforementioned document. Please be aware that you are only permitted to conduct UCMR 4 analyses using those methods for which you have EPA approval. Should you wish to comment on any of these determinations, please write to:

UCMR 4 Laboratory Approval Coordinator  
USEPA, Technical Support Center  
26 W. Martin Luther King Drive (MS 140)  
Cincinnati, OH 45268  
UCMR\_Lab\_Approval@epa.gov