Project Quality Assurance Project Plan

PFAS Monitoring at Los Alamos National Laboratory and Vicinity, Los Alamos, New Mexico
Assistance Agreement between the U.S. DOE and the State of New Mexico
Grant Award# DE-EM0002420

Submitted by:
New Mexico Environment Department
DOE Oversight Bureau, Los Alamos Section

APPROVAL PAGE

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CONTENTS

ACRONYMS

DOE	United States Department of Energy
DOE-OB	Department of Energy Oversight Bureau
DOE EM-LA	Department of Energy Environmental Management – Los Alamos
DQO	data quality objective
EIM	Environmental Information Management Database
EPA	United States Environmental Protection Agency
HDPE	high density polyethylene
HF	hydrofluoric acid
IFGMP	Interim Facility-Wide Groundwater Monitoring Plan
LANL	Los Alamos National Laboratory
LDPE	low density polyethylene
LOS	Los Alamos Section of the DOE Oversight Bureau
MCL	maximum contaminant level
MRL	minimum reportable limit
NMED	New Mexico Environment Department
PCBs	polychlorinated biphenyls
PFAS	per- and polyfluoroalkyl substances
ppt	parts per trillion
PQAPP	Project Quality Assurance Project Plan
QA	quality assurance
QC	quality control
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedures
TA	Technical Area
TOP	total oxidizable precursor

INTRODUCTION

The Department of Energy Oversight Bureau (DOE-OB) conducts independent environmental monitoring of U.S. Department of Energy (DOE) operations in New Mexico and provides transparent, unbiased, and publicly available information to the citizens of New Mexico. The Los Alamos office of the DOE Oversight Bureau (LOS) monitors a variety of environmental media at Los Alamos National Laboratory (LANL) to assess the potential impacts of past and present activities. The purpose of this project is to identify legacy sources and establish current concentrations of per- and polyfluoroalkyl substances (PFAS) in multiple environmental media including groundwater, surface water, stormwater, dry and wet atmospheric deposition, and biota from LANL and the vicinity

This Project Quality Assurance Project Plan (PQAPP) is a companion document to the DOE-OB Quality Assurance Project Plan (QAPP; in development) and Standard Operating Procedures (SOPs; in development). DOE-OB's Standard Operating Procedures will follow the guidance document established by the California State Water Quality Control Board (CSWRCB, 2019) (Appendix III) and Michigan Department of Environmental Quality's Fish Tissue PFAS Sampling Guidance (Michigan Department of Environmental Quality 2019). All relevant policies and procedures specified in the Bureau QAPP and SOPs will be followed for this project. Any additional procedures unique to this project will be included in this PQAPP.

When changes affect the scope, implementation, or outcome of this PQAPP, it will be revised to keep project information current. The DOE-OB Bureau Chief, with the assistance of the QA Officer, will determine the impact of any changes to the technical and quality objectives of the project. This PQAPP will be reviewed annually by the DOE-OB Bureau Chief to determine the need for revision.

1.0 PROJECT MANAGEMENT

1.1 Distribution List

The DOE-OB Bureau Chief will distribute copies of this approved PQAPP and any subsequent revisions to the project personnel listed below. Upon receipt of the PQAPP, those on the distribution list will sign the receiving form (see Appendix I) and return to the Bureau Chief.

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1.2 Project Organization

This section lists the roles and responsibilities of persons that will draft, manage, and/or use this PQAPP. A project organizational chart (Figure 1) displays the hierarchy of the project participants.

Table 1. Project Roles and Responsibilities.

Name	Role	Responsibilities	Contact Information
Christopher Catechis	Project Management	Review and approval of PQAPP, PQAPP distribution	(505) 383-2074 chris.catechis@state.nm.us
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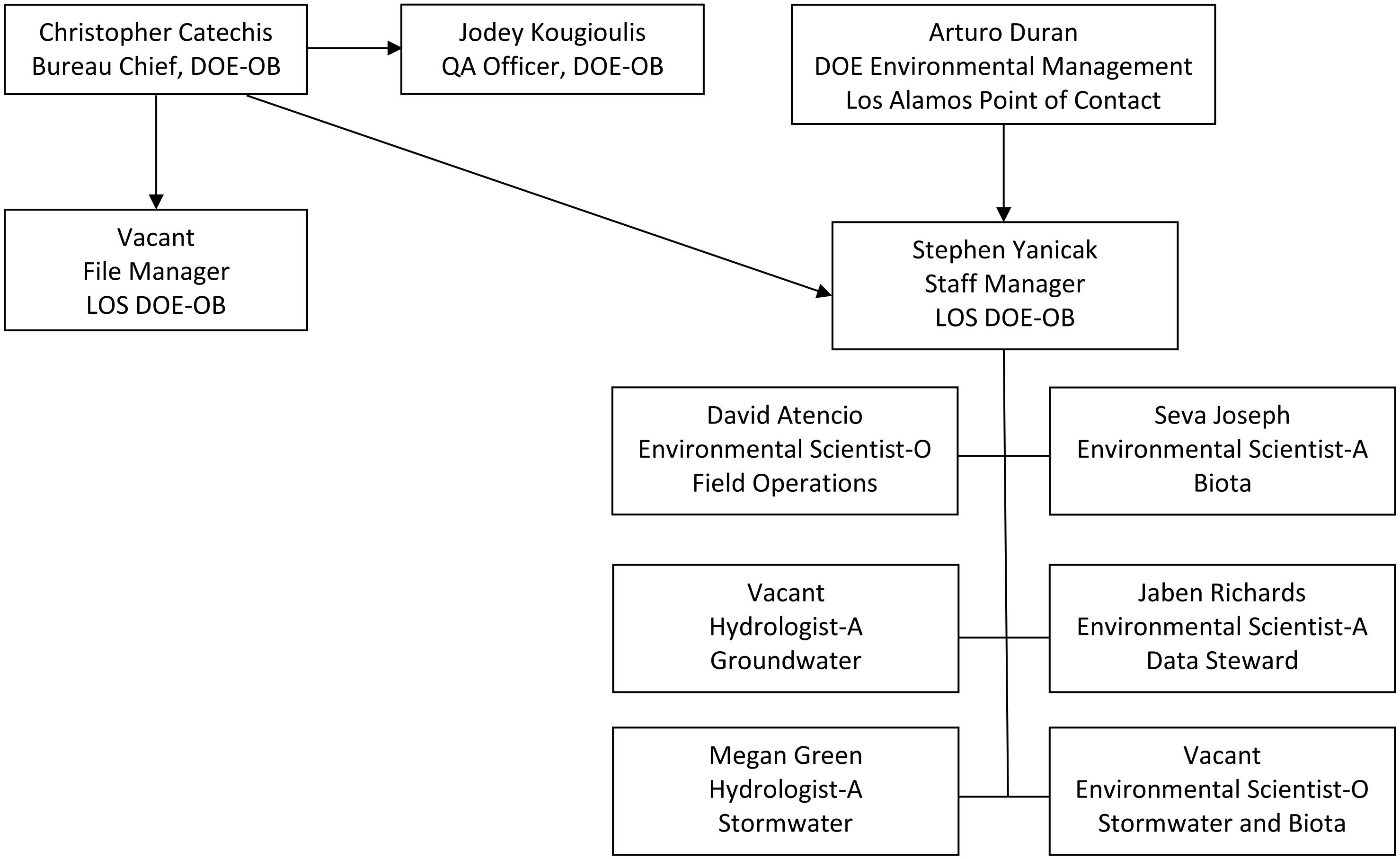
1.3 Line of Authority Description

Figure 1. Project Organizational Chart.



1.4 Problem Definition/Background

Per- and polyfluoroalkyl substances (PFAS) are emerging contaminants of concern that are present in the environment and pose potential health risks to humans. Ecological and health risks are of great concern to many stakeholders due to the widespread distribution and persistence of PFAS in the environment and the large variety of PFAS chemicals (>5000) for which environmental fate and transport is currently uncharacterized. PFAS are manmade compounds developed in the early 1940s that are found in a wide array of consumer and industrial products. They are used to make products more resistant to stains, grease, water, and temperature and to reduce friction. PFAS manufacturing and processing facilities, facilities using PFAS in production of other products, airports, and military installations are some of the contributors of PFAS releases into the air, soil, and water.

Due to their widespread use and persistence in the environment, most people in the United States have been exposed to PFAS. There is evidence that continued exposure above specific levels to certain PFAS may lead to adverse health effects. The health effects of PFAS are being studied world-wide. Some studies in humans with PFAS exposure have shown 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, and increase the risk of cancer. Due to industry and regulatory concerns about the potential health and environmental impacts, there has been a reduction in the manufacture and use of long-chain PFAAs since 2000. Manufacturers have been developing replacement technologies, including shorter-chain PFAS (ADONA and Gen-X compounds)

The NMED DOE Oversight Bureau - Los Alamos Section (LOS) is beginning PFAS monitoring. This document is the Quality Assurance and Quality Control planning document for collecting multi-media samples to determine the presence of PFAS in the environment potentially originating from LANL operating facilities and/or contaminated sites. Groundwater samples will be collected from monitoring wells, Los Alamos County and Santa Fe County water supply wells, regional and perched-intermediate depth springs, and Pueblo de San Ildefonso water supply wells. Additional sampling media may include soil, sediment, wastewater treatment facility effluent, surface water, stormwater, dry and wet atmospheric deposition, fish tissue, sediments, and biofilm. These data will complement our current environmental surveillance programs for other contaminants of concern (e.g., radionuclides, PCBs, water-soluble organic compounds, nutrients, and metals), and aid our understanding of the presence, concentrations, and distribution of PFAS within and around LANL.

Los Alamos National Laboratory and the associated residential and commercial areas of Los Alamos and White Rock are located in Los Alamos County, in north-central New Mexico, approximately 60 miles north northeast of Albuquerque and 25 miles northwest of Santa Fe (Figure 2). The Laboratory covers approximately 43-square-miles of the Pajarito Plateau, a landscape of finger-like mesas separated by deep west-to-east-oriented canyons cut by predominantly ephemeral and intermittent streams. Mesa tops range in elevation from approximately 7,800 feet on the flanks of the Jemez Mountains to about 6,200 feet at the edge of

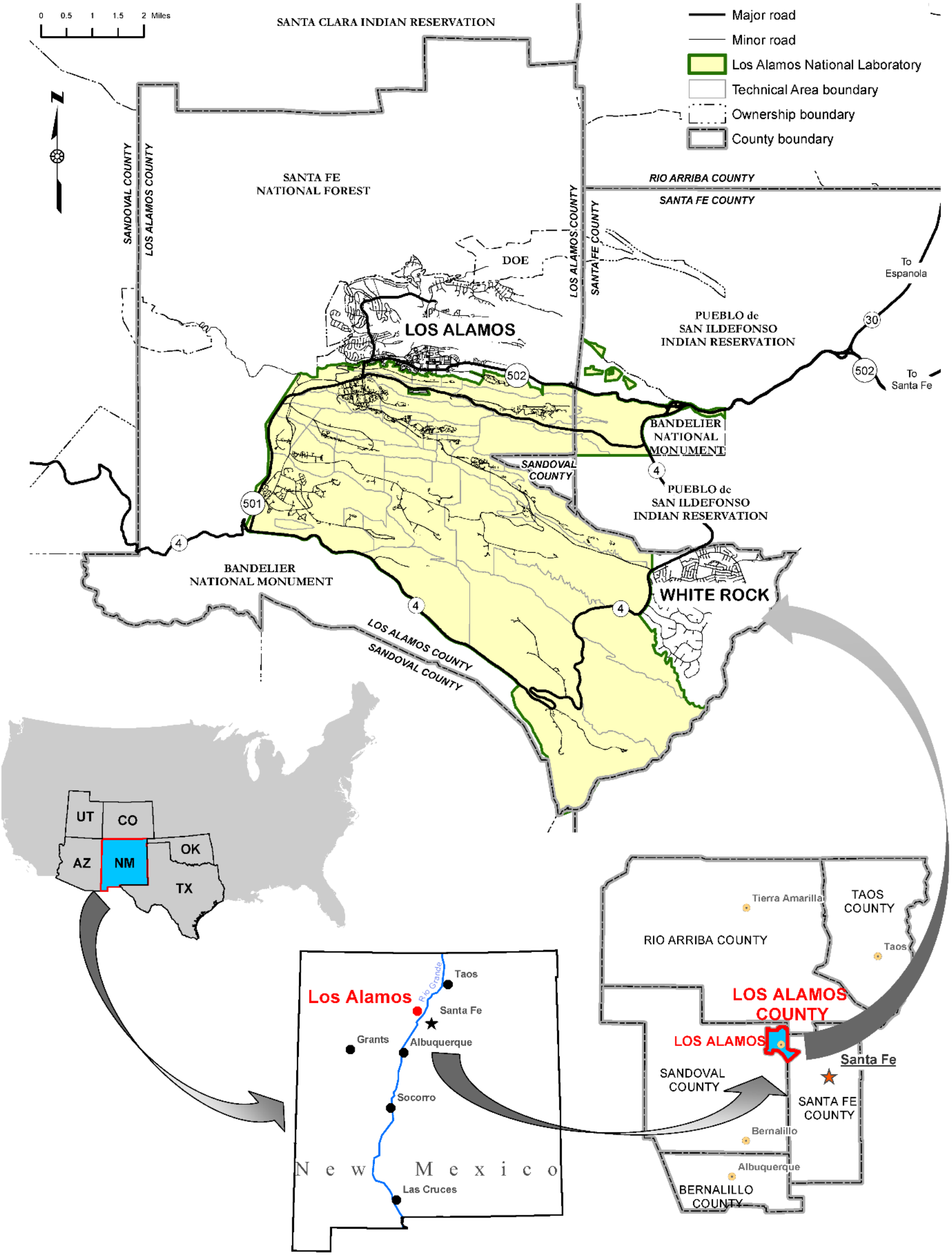
White Rock Canyon. Most Laboratory and community developments are confined to the mesa tops.

Potential uses for of PFAS at LANL and vicinity include aqueous firefighting foams (AFFF) , surfactants, and metal plating-processing (chromium, uranium, tin, copper, etc.) with hydrofluoric (HF) acid, which was used during the Manhattan Project at Oakridge, Tennessee and Los Alamos, New Mexico. High priority areas at LANL are those most likely to have used PFAS, including the Chemistry and Metallurgy Research Facility (TA-3) and Plutonium Processing Facility (TA-55) effluents, which are transferred to the Radioactive Liquid Waste Treatment Facility (TA-50) for chemical processing. PFAS may have been used to coat steel pipes in continuous contact with concentrated HF acid. TA-50, discharges were released to Mortandad Canyon between 1963 and 2010. Over 1.3 billion liters (L) of treated liquid waste (18-20 million L/yr) were released by 1998. Since November of 2010, no liquid waste had been discharged. A mechanical system is now used to evaporate the liquids and the resulting sludge is disposed of. Active and former wastewater treatment plants (WWTP) are also known sources of PFAS. Cooling tower water treated WWTP effluent from TA-3 are released to Sandia Canyon and Los Alamos County WWTP discharges to Pueblo Canyon since the early- to mid-1950s. LANL WWTP (TA-46) affects Cañada del Buey and former criticality activities at TA-18 impact Pajarito Canyon. Los Alamos and Pueblo-Acid Canyons received Manhattan Project liquid waste discharges starting in the mid-1940s. LANL burn areas for firefighting training (TA-49) affect Water Canyon with the potential use of AFFF. In addition, during the 2000 Cerro Grande and 2011 Los Conchas fires, firefighting retardant that may have contained PFAS was repeatedly applied by air tankers on the western mountainous boundary of the facility. TA-49 was used as a staging area for firefighters during the Cerro Grande Fire.

Recent detections of PFAS at other federal facilities have sparked public interest in these contaminants. It is likely that the U.S. EPA will likely set maximum contaminant levels (MCLs) for many PFAS, including perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), and perfluorohexanesulfonic acid (PFHxS). The current lifetime health advisory level is set at 70 parts per trillion (ppt) for single and multiple PFAS (USEPA, 2016). Due to legacy operations that may have used PFAS, and concern about PFAS in groundwater, they are being added to LANL's Interim Facility-Wide Groundwater Monitoring Plan (IFGMP) for the 2020 Monitoring Year (beginning October 1, 2019). In response, LOS has added PFAS to its environmental monitoring program. It will be important for LOS to identify legacy sources and to establish current concentrations of PFAS in multi-media samples at LANL and vicinity.

LOS will collect groundwater samples for a PFAS analysis during LANL IFGMP campaigns with a focus on perched groundwater and the regional aquifer below several watersheds potentially impacted by PFAS. The sampling will occur during select IFGMP campaigns scheduled by N3B (LANL contractor) in 2019 and 2020. The NMED Hazardous Waste Bureau (HWB) has done some preliminary monitoring and collected samples for PFAS analysis at LANL including springs, intermediate-depth groundwater, and regional aquifers below LANL.

To investigate the presence of PFAS in and around the LANL environment, LOS may monitor other potentially contaminated media including soil, sediment, surface water, stormwater, dry and wet atmospheric deposition, and biota. PFAS have been shown to bioaccumulate in wildlife and migrate from soil to water. PFAS adsorb to solid organic matter and soils to a varying degree based on their carbon lengths with longer chain PFAS adsorbing more than short chain compounds. To investigate the movement of contaminants off LANL property, stormwater samples may be collected and analyzed for PFAS. Monitoring will be conducted when sufficient volumes of stormwater are collected from canyons with potential PFAS sources. Monitoring will help determine if contaminants, including PFAS, are moving into the Rio Grande, which serves as an important irrigation and municipal water supply for downstream communities, including the City of Santa Fe. The Rio Grande will be monitored by collecting and analyzing surface water, sediments, fish, and biofilm samples from the river upstream and downstream of LANL. Biofilms are an assemblage of microscopic organisms that take up and bind or adsorb contaminants from the water. Unlike most persistent organic pollutants, most PFAS have a low affinity to lipids and tend to bind to proteins. Consumption of fish that have accumulated PFAS is a potential pathway of human exposure. Edible portions of fish caught in the Rio Grande may be analyzed for PFAS.



Map #19-048-05, Created by Brad McKown, IFPROG, March 11, 2019

Figure 2. Los Alamos National Laboratory, New Mexico.

1.5 Project/Task Description

The purpose of this project is to include PFAS in DOE-OB multi-media monitoring at LANL. PFAS are being added in response to the recent interest in the environmental and health impacts of these potentially toxic compounds found in groundwater, drinking water, food and the environment. Therefore, it is important to identify potential historical sources and to establish current levels of PFAS in groundwater, springs, stormwater, atmospheric deposition, sediments, and biota at and within the vicinity of LANL.

1.6 Quality Objectives

The objectives of this project are to monitor for PFAS in the environment including 1) determine the presence or absence of ppt levels of PFAS in soil, sediment, groundwater, biota, atmospheric deposition, and storm and surface water in and around LANL property, 2) determine whether any detectable levels of PFAS exceed existing criteria or thresholds developed by states such as New Hampshire, 3) gain an understanding of the contribution of atmospheric deposition to regional PFAS concentrations and 4) where PFAS are found to identify the potential contaminant sources. EPA has a health advisory level (HA) of 70 ppt for both PFOA and PFOA (https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos). Using the most recent and best science available, New Hampshire Department of Environmental Services (https://www4.des.state.nh.us/nh-pfas-investigation/?p=1044) is proposing the following drinking water standards as Maximum Contaminant Levels (MCL) that are protective for the most sensitive populations over a lifetime of exposure:

PFAS	**Final Proposed MCL**
PFOA	12 ppt
PFOS	15 ppt
PFHxS	18 ppt
PFNA	11 ppt

1.6a Type of data needed to support intended uses

There is very limited information about the sources, presence/absence, concentrations, distribution, or types of PFAS at and around LANL. In response to this deficiency and as part of the State’s current efforts to improve understanding of PFAS in the environment, LOS is conducting PFAS monitoring at LANL and vicinity to locate, identify, and monitor these emerging contaminants of concern. This monitoring will generate data on the location, concentration, and types of PFAS. Analysis will include the 14 to 23 PFAS included in EPA Modified Method 537.

1.6b Specify Tolerable Limits

The quality of the information used for this project will be ensured by the following data quality indicator requirements described in Table 2. Compound names for common PFAS, CAS numbers, minimum reporting and detection limits in different environmental media provided by TestAmerica and

ALS are provided in Tables 3 and 4, respectively. Table 5 provides a summary of sample container, preservation, and holding times from TestAmerica Method 537 Modified method.

NOTE: Please check the analyte list for TestAmerica for analyzing perfluorobutanoic acid (PFBA) and perfluoropentanoic acid (PFPeA) in water. TestAmerica and ALS should analyze for the same PFAS compounds

Table 2. Data Quality Indicators.

Data Quality Indicator	**Description**	**Data Acquisition**
Precision	The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is a measure of the variability in the results of replicate measurements due to random error.	When sample size and budget allow, replicate samples will be collected. Field replicate relative percent difference (RPD) should be < 40% for concentrations greater than 5 times the analytical reporting limit.
Accuracy	The degree of agreement between an observed value and accepted reference value.	Accuracy will be based on the use of laboratory methods determined to be reliable and using rigorous QC procedures.
Bias	Bias is the difference between the population mean and the true value.	Laboratory analysis bias will be assessed through laboratory control samples and matrix (primary and duplicate) spike samples.
Representativeness	The degree to which the data accurately and precisely represent a characteristic of an environmental condition.	A wide range of sites within priority areas will be sampled.
Comparability	The measure of confidence that one data set can be compared to another.	Methods for data collection and analysis are standardized and reproducible. Some sample collection (particularly groundwater) will co-occur with LANL sampling and will be suitable for comparison.
Completeness	The proportion of the planned data that is collected and of acceptable quality.	The project manager will consider the study to have achieved completeness if 95% of the samples are collected and analyzed acceptably.
Sensitivity	The capability of an analytical method to discriminate between measurement responses representing different levels of the variable of interest.	Presence or absence of the compound(s) of interest will be determined according to Method Detection Limits (MDLs) and Method Reporting Limits (MRLs). Quantification of analyte(s) concentrations(s) are based on a calibration curve.

Table 3. Data quality objectives (DQOs) for minimum reportable limits (MRL) in aqueous matrices from TestAmerica and ALS Method 537 Modified method summary.

Analyte	**Acronym**	**CAS #**	**537 v1.1**	**537.1**	**MDL, ng/L**	**MRL, ng/L**
Perfluorohexanoic acid	PFHxA	307-24-4	X	X	8.9	2-20
Perfluoroheptanoic acid	PFHpA	375-85-9	X	X	0.7	2-5
Perfluoroheptane sulfonic acid	PFHpS	375-92-8		X	0.5	5
Perfluorooctanoic acid	PFOA	335-67-1	X	X	0.4	2
Perfluorononanoic acid	PFNA	375-95-1	X	X	1.4	2-5
Perfluorodecanoic acid	PFDA	335-76-2	X	X	1.2	2-5
Perfluorodecane sulfonic acid	PFDS	335-77-3		X	0.9	5
Perfluoroundecanoic acid	PFUnA	2058-94-8	X	X	1.5	2-5
Perfluorododecanoic acid	PFDoA	307-55-1	X	X	1.2	2-5
Perfluorotridecanoic acid	PFTrDA	72629-94-8	X	X	1.9	2-5
Perfluorotetradecanoic acid	PFTeDA	376-06-7	X	X	2.4	5
Perfluorobutanoic acid	PFBA	375-22-4		X	0.2	5
Perfluorobutanesulfonic acid	PFBS	375-73-5	X	X	0.3	2-5
Perfluorohexanesulfonic acid	PFHxS	355-46-4	X	X	0.8	2-5
Perfluorooctanesulfonic acid	PFOS	1763-23-1	X	X	0.3	2-5
Perfluorooctanesulfonamide	FOSA	754-91-6		X	0.6	5
N-Methyl perfluorooctane sulfonamide	MeFOSA	31506-32-8		X	0.4	5
N-Ethyl perfluorooctane sulfonamide	EtFOSA	4151-50-2		X	1.9	5
N-Methyl perfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7		X	0.5	5
N-Ethyl perfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2		X	0.2	5
Perfluoropentanoic Acid	PFPeA	2706-90-3		X	1.6	5
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	X	X	0.9	5
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	X	X	0.9	5
Perfluoro-2-proxypropanoic acid	GenX (HFPO-DA for 537.1)	13252-13-6		X	0.4	2-5
Dodecafluoro-3H-4,8-dioxanonanoic acid	ADONA	958445-44-8 919005-14-4 (537.1)		X		2
9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	F-53B Major 9Cl-PF3OUdS (537.1)	756426-58-1 (537.1)		X		2

Analyte	**Acronym**	**CAS #**	**537 v1.1**	**537.1**	**MDL, ng/L**	**MRL, ng/L**
11-chloroeicosafluoro-3-oxanonane-1-sulfonate	F-53B Minor 11Cl-PF3OUdS (537.1)	763051-92-9 (537.1)		X		2

Table 4. Sample container, preservation, and holding times from TestAmerica Method 537 Modified method.

Methods	Containers	Temperature	Preservative*	Holding Time
537 V1.1 and 537.1 for water isotope dilution LC/MS/MS	2 – 250 ml polypropylene with polypropylene lid	≤ 10°C for first 48 hours ≤ 6°C after 48 hours	1.25 grams Trizma	14 days to extraction, 28 days after extraction
537 modified - isotope dilution LC/MS/MS (solids)	2-5 grams in polypropylene container	frozen	frozen	14 days to extraction, 28 days after extraction

*Only for chlorinated drinking water samples

1.7 Special Training

LOS has qualified and experienced scientific staff having applicable skills and scientific background to carry out and administer this project. Supplemental training may include PFAS webinars provided by analytical laboratories, meetings with the PFAS Technical Task Group, and training opportunities organized by LANL, NMED, and associated contractors.

1.8 Documents and Records

The DOE-OB Bureau Chief will provide copies of this PQAPP and any subsequent revisions to all individuals included on the distribution list. The PQAPP, protocol documents, acknowledgement form, and monitoring reports will be maintained in the project file at LOS.

2.0 Data Generation and Acquisition

2.1 Sampling Process Design

All available sites within LANL and vicinity will be considered for sampling. Sites will be selected based on expertise of potential sources and historic activities to identify the highest priority sites for monitoring. These sites include, but are not limited to, the Chemistry and Metallurgy Research Facility (TA-3) and Plutonium Processing Facility (TA-55), the Radioactive Liquid Waste Treatment Facility (TA-

50) for chemical processing, Mortandad Canyon, Sandia Canyon , Pueblo Canyon, Cañada del Buey, and Pajarito Canyon and LANL burn areas for firefighting training (TA-49) affecting Water Canyon.

2.2 Sampling Methods

2.2a Atmospheric Deposition Sampling

The primary objective of the Atmospheric Deposition Sampling Program is to quantify baseline levels of polychlorinated biphenyls (PCBs) in both wet and dry atmospheric deposition. The existing infrastructure of the Atmospheric Deposition Sampling Program will be used to extend the primary objective to include PFAS. Maximum contaminant levels (MCLs) likely will soon be set by EPA or states for many of the PFAS in multimedia environments. Recent studies have already shown detectable levels of PFAS in atmospheric deposition worldwide (Kwok et al. 2010 and Taniyasu et al. 2013). Therefore, it is imperative to establish baseline levels of PFAS in atmospheric deposition around LANL so that the data can be considered when establishing surface water MCLs, or for interpreting PFAS concentrations in surface-water samples.

Sampling will be conducted in accordance with NMED DOE OB SOP *for Atmospheric Deposition Sampling* (In Development), summarized as follows. Wet atmospheric deposition samples will be collected by removing the container that has been out for one quarter and replacing it with a decontaminated stainless steel container. The container containing precipitation from the previous quarter will then be mixed to ensure sample homogenization and will be poured into PFAS-free 250 ml HDPE bottles that are provided by the analytical laboratory. During sample collection, all guidance set forth by the California State Water Quality Control Board (2019) will be followed.

2.2b Biofilm and Fish Sampling

Biofilm and fish will be monitored to determine if PFAS are being released into the Rio Grande. While bioaccumulation has been documented, biomagnification does not seem to be a significant factor with PFAS, and several studies have indicated there is not a strong correlation between PFAS concentrations and fish length (Michigan Department of Environmental Quality 2019). Biofilms are an aggregation of microscopic bacteria, fungi, algae, and protozoans in a complex polymer linked assemblage. Biofilms growing on rocks in rivers and streams take up and bind contaminants from the water and contribute to the base of the food web. They can be used to assess the spatial distribution of contaminants. Biofilms have proven to be highly effective in source identification studies for various toxic contaminants (Hobbs 2018). Samples will be collected from the Rio Grande below Pojoaque River (above inputs from LANL) and the Rio Grande below Frijoles Canyon (below the cumulative inputs from LANL). If PFAS are shown to be present, additional sites may be added to help identify the sources.

Fish will be caught according to New Mexico Environment Department, Fish Community Sampling Standard Operating Procedure Section 11.4 (NMED 2013). Fish tissue samples will be collected according to Michigan Department of Environmental Quality's Fish Tissue PFAS Sampling Guidance (Michigan Department of Environmental Quality 2019). Larger fish of legal size will be selected. Boneless, skinless filets of fish will be collected in a manner to minimize cross contamination and stored and shipped in PFAS free containers provided by analytical laboratory.

Biofilm and water from two sites on the Rio Grande will be analyzed for PFAS to screen for the presence of these contaminants and test the use of biofilms for monitoring these compounds. If sufficient biofilm is present, samples will be collected from the Rio Grande below Pojoaque River (above inputs from LANL) and the Rio Grande below Frijoles Canyon (below the cumulative inputs from LANL).

Biofilm will be collected according to methods used by Washington State Department of Ecology (2019). Rocks with visible biofilm will be collected from each site. Rocks with large green or brown filamentous periphyton will be avoided. Prior to collecting the biofilm, any loose silt or debris on the rock will be gently shaken off underwater, taking care not to slough off the biofilm. The biofilm will be scraped off each rock with a decontaminated stainless-steel knife and placed into a PFAS free polyethylene or high-density polyethylene (HDPE) container. If necessary, samples will be decanted to remove excess water prior to freezing. The containers will be labeled and placed in polypropylene or HPDE resealable storage bags.

2.2c Groundwater Sampling

Groundwater sampling at LANL is conducted based on the annual Interim Facility-wide Groundwater Monitoring Plan (IFGMP) document and is typically performed by LANL contractors. Potential groundwater monitoring sites are listed in Appendix II. All necessary equipment for well sampling, including generators, stainless steel pipes attached to well heads (“sampling trees”), silicon tubing, and field parameter measurement instruments, is provided by the contractor. Because LOS does not have the necessary equipment to independently sample monitoring wells, sampling is performed at the same time as LANL contractors. LOS does have the equipment needed to independently sample springs discharging on the Pajarito Plateau.

Groundwater sampling will be conducted according to the guidance document established by the California State Water Quality Control Board (2019). Samples will be collected directly from the wellhead into PFAS-free 250 ml HDPE bottles that are provided by the analytical laboratory.

The following steps shall be followed when sampling groundwater for PFAS:

- Sample bottles shall be transported to and from the sampling location in the sealed plastic bag provided by the laboratory.
- Powder free Nitrile gloves shall be worn before and during sample collection.
- Samplers shall avoid contact with any materials other than nitrile gloves and the plastic bags provided by the laboratory.
- Sample bottles shall be removed from the bag just before collecting a sample.
- Open the bottle carefully and fill the bottle to at least the neck of the bottle. Do not overfill or rinse the container.
- Collect or provide appropriate QA/QC samples, including sample duplicates, field reagent blanks, equipment blanks, and matrix spike samples (primary and duplicate) according to a well-specific sampling and analysis plan. Coordinate with analytical laboratory on matrix spike samples.
- Tightly close the lid on the bottle to ensure no sample water can leak.

- Write Environmental Information Management (EIM) generated “SAMPLE ID” from Field Form onto the label provided by the laboratory; write in date and sample time with pencil or ballpoint pen.
- Place sample bottles back inside the plastic bag provided by the laboratory.
- Ensure sample ID, date, and time of sample collection on the Field Form matches what is written on the sample bottles.

2.2d Surface Water and Stormwater Sampling

Surface water shall be monitored to determine if PFAS are being released into the Rio Grande surface water. Samples will be collected from the Rio Grande below Pojoaque River (above inputs from LANL) and the Rio Grande below Frijoles Canyon (below the cumulative inputs from LANL). When stormwater is observed flowing or pooled in intermittent or ephemeral systems it may be sampled. Grab samples of surface and storm water samples will be collected according to guidance document established by the California State Water Quality Control Board (2019), “Drinking Water Sample Collection for Per- and Polyfluorinated Alkyl Substances (PFAS) Sampling Guidance SWRCB Division of Drinking Water April 2019 (Appendix III)”.

2.3 Sample Handling and Custody

Samples are brought back to the LOS office, stored, and shipped to analytical laboratories according to guidance from the California State Water Resources Control Board (2019).

All samples should be collected in a manner to eliminate cross contamination. Keep PFAS sample containers in a separate decontaminated ice chest provided by the laboratory performing PFAS analysis. Chemical or Blue ice is not used to chill environmental samples collected for PFAS analysis. Decontaminate ice chest with a 10 percent Liquinox® soap and deionized water solution, rinsed with PFAS-free DI water or tap water from a confirmed PFAS-free source and a final rinse with PFAS-free DI water. PFAS sample collection should be conducted first before any other monitoring and samples kept in a separate ice chest. Collect samples in prelabeled containers provided by the lab. Write any required information such as data and time on the label with ballpoint pen or pencil. Place the sample container in the bag that it came in or another PFAS-free polypropylene or HPDE resealable bag. PFAS free Chain of Custody seals can be placed on the outside of the bag or on the cooler before shipping. Samples should be stored in decontaminated ice chests at least 1/3 filled with wet ice in resealable polypropylene or HDPE bags.

Samples should not exceed 50 degrees Fahrenheit (10 degrees Celsius) and be shipped within 48 hours of collection. Water samples should be stored at less than 42.8 degrees Fahrenheit (6 degrees Celsius) but not frozen. Other sample media should be frozen and shipped on dry ice.

Pack the bottles in their individual bags upright in a decontaminated ice chest. A polyethylene cooler liner may be applied to the inside of the cooler for additional protection against contamination. Ensure that the bottles cannot move sideways. Any extra space around the bags should be packed with ice to 1/3 the depth of the ice chest.

- Put additional ice inside of double plastic bags and place these on top of the bottles.
- Chain of custody (COC) forms are created in EIM and are signed by LOS staff before shipment and analytical laboratory staff upon receipt. Place the COC in a sealed plastic bag (1 gallon) on the top inside of the cooler.
- Seal the ice chest firmly with PFAS-Free shipping tape, wrapping it around multiple times. The use of Uline Strapper Tape is recommended to secure the ice chest. Ice chests may be sealed with PFAS free custody tape in addition to shipping tape.

Field data sheets/sample collection forms are stored with the LOS project managers. Digital data from the analytical laboratories is stored on the DOE-OB shared drive and backed up monthly on external hard drive by the LOS data steward. Hard copies of data are filed by the LOS data steward and kept in perpetuity.

2.4 Analytical Method

The analytical method currently used to determine the presence of PFAS in drinking water is EPA Method 537.1 - Determination of Selected Per- and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction (SPE) and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) (Shoemaker, J. and Dan Tettenhorst, 2018). EPA Method 537.1 can be used to quantitate 18 PFAS in drinking water. Soil, sediment, and tissue samples are analyzed with a modified Method 537 (Table 6). They may be extracted by SPE or with a KOH/methanol solution using an orbital shaker for 3 hours followed by sonication for 12 hours. The mixture is centrifuged, and the solvent is filtered before analyzing using isotope dilution and LC/MS/MS. A modified Method 537.1 will be used. The analytical laboratory will have the option to perform total oxidizable precursor (TOP) assay on specified aliquots to quantitate presence or absence of PFAS precursors.

Table 5. Detection Limits from TestAmerica and ALS Method 537 Modified method summary.

Matrix	Nominal Sample Size	Detection Limit	Reporting Limit	Working Range
Water	250 mL	0.16 ng/L – 8.9 ng/L	2.0 ng/L – 20 ng/L	2 ng/L to 400 ng/L
Soil/Sediment	5 g	0.03 ug/kg – 0.39µg/kg	0.2 µg/kg – 2.0 µg/kg	0.2 µg/kg - 40 µg/kg
Tissue	1 g	TBD	1.0 µg/kg – 10 µg/kg	1.0 µg/kg – 200 µg/kg

2.5 Quality Control Procedures

Quality control (QC) activities are technical activities performed on a routine basis to quantify the variability that is inherent to any environmental data measurement activity. The results obtained from the QC analysis, or data quality assessment, may identify areas where the variability can be reduced or eliminated in future data collection efforts, thereby improving the overall quality of the project being implemented.

Cross contamination of samples will be avoided by following the procedures described in *Drinking Water Sample Collection for Per- and Polyfluorinated Alkyl Substances (PFAS) Sampling Guidance SWRCB Division of Drinking Water April 2019* (California State Water Quality Control Board 2019) including:

1. "Wash hands before beginning the sampling event with Alconox® or Liquinox® soap and deionized water. Wear clean, powderless nitrile gloves when handling sampling equipment and containers. Change gloves any time there is an opportunity for cross contamination.
2. Using only PFAS-free containers provided by the analytical laboratory. The sample container must be kept sealed and only open during the sample collection. The sampling container cap or lid should never be placed the ground, or on any other surface unless it is PFAS-free.
3. A ball point pen or pencil can be used to label samples and sample bags. Non-waterproof preprinted labels can also be used.
4. Decontaminate all dedicated sampling equipment by washing with a 2-3% percent Liquinox® solution and triple rinsing with PFAS-free deionized water. "

PFAS are detected at very low levels (ppt) in environmental matrices. Therefore, there could be materials used by the sampler, or present at the sampling site, that could contaminate the sample. PFAS are used in many personal care products (for, example sun screen and water proof clothing) and in food packaging and wrappers, especially fast food and snack products. As a precaution, all persons involved in the sampling event should minimize exposure to the following products, and ensure proper hand washing at each site and wearing powderless nitrile gloves:

- Minimize use on the day of the sample event, preferably **24 hours prior to the event**:
  - Cosmetics, moisturizers, sun blocks, insect repellants, fragrances, creams, or other personal care products (including hair products). Exceptions: Products that are known to be 100% natural.
- Other items that are likely to contain PFAS and need to be avoided include:
  - Pre-packaged food, fast food or items wrapped in aluminum foil
  - New or unwashed clothing
  - Clothing washed with fabric softeners or dried with anti-static sheets
  - Synthetic water-resistant/or stain-resistant materials (such as waterproof clothing and shoes such as Gore-Tex), waterproof or coated Tyvek® material (special attention to boots)
  - Teflon® and other fluoropolymer containing materials
  - Waterproof /treated paper on field notebooks
  - Waterproof markers (such as Sharpie®, etc.). Indelible pens that are ball point or gel and pencils are acceptable.
  - Adhesive paper products (such as Post-It ®Notes or scotch tape)
  - Sealable bags (e.g., zip-lock ® plastic bags) that are not provided by the laboratory. (Note: only ultra-clean polypropylene or HPDE material sealable bags are allowed)
  - Chemical or blue ice, which may contain PFAS and may not reduce and maintain the temperature of the samples adequately
- Avoid sampling during rain if possible (if necessary please use, vinyl or PVC rain gear)
- Fill gasoline in the vehicle the day before sampling

No food or beverage should be consumed in the sample site area. If food, drink or other activities, such as smoking, are necessary during the sampling event, first move away from the sample site. Before returning to the sampling site, wash hands thoroughly and put on fresh powderless nitrile gloves.

Place samples into a PFAS-free polyethylene or HDPE container. Bag individual sample containers with resealable polypropylene or HPDE bags. The custody seal should be placed over the seal of the bag, not on the sample container/lid. Samples should be transported in ice chests at least 1/3 filled with wet ice that is double bagged with polypropylene or HPDE bags resealable storage bags and kept cool until analyzed.

A Field Reagent Blank (FRB) is analyzed to assess the potential for PFAS cross contamination being introduced during the sampling process. The FRB consists of a sample bottled filled at the sample site using reagent water provided by the laboratory.

A Field Duplicate is a second sample collected from the source at the same time and place under identical circumstances as the field sample and treated the same throughout field and laboratory procedures.

An Equipment Blank is a sample of analyte-free water that is prepared in the field using the appropriate sampling equipment with an aliquot of PFAS-free, distilled and deionized water that is processed using applicable field equipment in the same manner as environmental samples. Equipment blanks are collected to demonstrate that sample-collection equipment and sample-processing equipment are not introducing contamination. Equipment blanks can be prepared for individual pieces of collection and processing equipment such as pumps and tubing.

For biofilm and fish sampling, an FRB will be collected during sampling and stored in the ice chest used to store and transport samples. The laboratory will provide the FRB sample bottle and the reagent water. Where adequate sample is available field duplicate will also be collected.

For groundwater sampling, field duplicates will be collected at approximately 20 percent of sites, and field blanks will be collected at approximately 50 percent of sites. One sample of certified PFAS-free water will be submitted per each sampling campaign to ensure certified PFAS-free water used for field blanks has non-detections for PFAS.

For atmospheric deposition sampling, approximately five equipment blanks will be collected after different decontamination procedures and equipment setups to determine the best scenario to avoid sample contamination. Additionally, one FRB will be collected during each quarterly sampling event.

2.6 Equipment and Materials

All field and non-field equipment will be inspected, tested and maintained, according to the manufacturer's specifications and associated equipment manual, prior to each sampling event. Any deficiencies in equipment will be noted and reported immediately. If the condition of equipment is in doubt, it will not be used and replaced by acceptable equipment. In the event of equipment failure, the resultant data will be rejected or qualified.

Because of the prevalence of PFAS in consumer products, there is the possibility of cross contamination of samples. Potential sources of cross-contamination include water used during decontamination, materials used within the sampling environment, sampling equipment, field clothing and personal protective equipment (PPE), sun and biological protection products, food packaging, and the environment itself. Staff must be aware of potential PFAS sources and take precautions to minimize influence on samples and use PFAS free monitoring equipment, supplies and sample containers. Allowable materials and supplies include HDPE, polypropylene, silicone, stainless steel, nylon, PVC, acetate, Uline Strapper Tape, non-coated paper products, powderless nitrile gloves, ballpoint pens and pencils. PFAS are known to adhere to glass (EPA 2009b) so it should not be used where it will come into direct contact with samples. Sampling materials and field supplies for the purposes of sampling for PFAS are divided into three groups (listed in California State Water Quality Control Board 2019):

1. Allowable materials: These materials are proven not to be sources of PFAS cross contamination and can be used during all sampling stages in the immediate sampling environment.
2. Staging area-only materials: These materials may contain PFAS and should not come into direct contact with the sample but can be used in the staging area away from sample bottles and equipment. Care should be taken to thoroughly wash hands and don new gloves after handling any of these materials.
3. Prohibited materials: These include items that are well-documented to contain PFAS and may present a threat to the integrity of the sample.

Materials that contain fluoropolymers are prohibited such as:

- Polytetrafluoroethylene (PTFE), that includes the trademarks Teflon® and Hostaflon®
- Polyvinylidene fluoride (PVDF), that includes the trademark Kynar®
- Polychlorotrifluoroethylene (PCTFE), that includes the trademark Neoflon ®
- Ethylene-tetrafluoro-ethylene (ETFE), that includes the trademark Tefzel®
- Fluorinated ethylene propylene (FEP), that includes the trademarks Teflon® and Hostaflon®
- Items or materials that contain any other fluoropolymer

Pumps, tubing, and sampling equipment should not include items or materials containing any fluoropolymer (potential items include tubing, valves, or pipe thread seal tape). Allowable materials include:

- High-density polyethylene (HDPE)
- Low-density polyethylene (LDPE) tubing
- Polypropylene
- Silicone
- Stainless-steel

2.7 Data Management

The mission of the DOE-OB is to "…conduct independent environmental monitoring of Department of Energy (DOE) operations in New Mexico and provide transparent, unbiased, and publicly available information to the citizens of New Mexico." To complete this mission, QA/QC and data management are of the utmost importance.

Data storage will be managed in the following manner: digital data received from the analytical laboratories will be stored on the DOE-OB shared drive and backed up monthly on external hard drive by the LOS data steward. Hard copies of data are filed by the LOS data steward and kept in perpetuity.

In addition to data storage, all data must be distributed to meet the mission of the DOE-OB. To this end, LOS data results will be made available to the general public and all landowners including the Federal government, local municipalities, and Pueblos through the EIM/Intellus New Mexico database website (https://www.intellusnm.com). All PFAS results uploaded to the EIM database by LOS are verified and validated and segregated by landowner (property where samples are collected) e.g., DOE, Santa Fe County, Los Alamos County, Pueblo de San Ildefonso. Prior to any release of data to the public database (Intellus), all landowners will have a review period of 30 to 60 days to comment on results or request a technical meeting with LOS where results can be discussed for clarification. Confirmatory and co-located data collected by LOS with LANL or other agencies will be evaluated and compared through graphical displays to summarize similarities and differences between the data.

2.8 Reports

Data summary reports will be prepared by investigators and submitted to the LOS Staff Manager annually. Reports will include a summary of the monitoring and analytical results. Analytical results collected from co-located sites will be considered confirmatory and compared with LANL's reported results. Results from both independently located and co-located stations will be compared with existing and applicable standards or benchmarks within and outside the State of New Mexico, such as the U.S. EPA, California, and Michigan. Findings in this report will be used to notify NMED and DOE of the presence, absence, and concentrations of PFAS in environmental samples collected at LANL and vicinity. Results will also be used to inform the LOS Section for scoping and developing future PFAS sampling campaigns. Results will be uploaded into the EIM database for availability to the public through the Intellus New Mexico database website (https://www.intellusnm.com).

3.0 DATA VALIDATION AND USABILITY

3.1 Data Review, Validation and Verification

Data review and verification are key steps for ensuring the integrity, suitability, and usability of the data. Validation and verification will be conducted during the course of this project.

3.2 Validation and Verification Methods

All data will be verified and validated for completeness, correctness, and conformance against specified methods and sample requirements. Data will be assessed to determine whether analytical laboratory data deliverables are meeting the specifications and standards set forth in the latest analytical New Mexico Environment Department Analytical Testing Services Price Agreement Contract # (60-667-15-26554) and our initial quality assurance screening criteria. Data validation and verification procedures are a set of checks applied at appropriate levels to verify data quality. These procedures include validation efforts and acceptance criteria performed at a project level data validation and include specific DQOs where the validator determines the appropriate quality and usability of data based on the intended use. Internal validation and verification procedures are independent of the auto-validation process which occurs as a function of EIM. These procedures are intended to be completed prior to data migration or upload to EIM or any other internal or external database, data deliverable to Department of Energy or the public.

3.3 Reconciliation with Data Quality Objectives

Reconciliation and acceptable Data Quality will be achieved if data validation and verification show no deviance from data quality criteria, or if deviance occurs, the appropriate qualifiers are applied. The validated and verified data can then be confidently used to assess whether the objectives of the program (Section 1.6) are being met.

4.0 REFERENCES

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5.0 APPENDICES

APPENDIX I

RECEIVING FORM

New Mexico Environment Department DOE Oversight Bureau

PFAS Monitoring at Los Alamos National Laboratory and Vicinity, Los Alamos, New Mexico

Quality Assurance Project Plan Acknowledgement Statement

This is to acknowledge that I have received a copy of the PFAS Monitoring at Los Alamos National Laboratory and Vicinity, Los Alamos, New Mexico Project *Quality Assurance Project Plan*.

As indicated by my signature below, I understand and acknowledge that it is my responsibility to read, understand, become familiar with and comply with the information provided in the document to the best of my ability.

____
Signature

____
Name (Please Print)

____
Date

APPENDIX II

POTENTIAL GROUNDWATER SAMPLING LOCATIONS

Location	**Monitoring Group**	**Type**	**Aquifer**
LADP-3	TA-21	Monitoring Well	Intermediate
LAOI(a)-1.1	TA-21	Monitoring Well	Intermediate
LAOI-3.2	TA-21	Monitoring Well	Intermediate
LAOI-3.2a	TA-21	Monitoring Well	Intermediate
LAOI-7	TA-21	Monitoring Well	Intermediate
R-6i	TA-21	Monitoring Well	Intermediate
TA-53i	TA-21	Monitoring Well	Intermediate
R-6	TA-21	Monitoring Well	Regional
R-64	TA-21	Monitoring Well	Regional
R-66	TA-21	Monitoring Well	Regional
R-9	TA-21	Monitoring Well	Regional
MCOI-5	Chromium Investigation	Monitoring Well	Intermediate
MCOI-6	Chromium Investigation	Monitoring Well	Intermediate
SCI-1	Chromium Investigation	Monitoring Well	Intermediate
SCI-2	Chromium Investigation	Monitoring Well	Intermediate
R-1	Chromium Investigation	Monitoring Well	Regional
R-11	Chromium Investigation	Monitoring Well	Regional
R-13	Chromium Investigation	Monitoring Well	Regional
R-15	Chromium Investigation	Monitoring Well	Regional
R-28	Chromium Investigation	Monitoring Well	Regional
R-33 S1	Chromium Investigation	Monitoring Well	Regional
R-33 S2	Chromium Investigation	Monitoring Well	Regional
R-35a	Chromium Investigation	Monitoring Well	Regional
R-35b	Chromium Investigation	Monitoring Well	Regional
R-35c (proposed new well near R-35a and R-35b)	Chromium Investigation	Monitoring Well	Regional
R-36	Chromium Investigation	Monitoring Well	Regional
R-42	Chromium Investigation	Monitoring Well	Regional
R-43 S1	Chromium Investigation	Monitoring Well	Regional
R-43 S2	Chromium Investigation	Monitoring Well	Regional
R-44 S1	Chromium Investigation	Monitoring Well	Regional
R-44 S2	Chromium Investigation	Monitoring Well	Regional
R-45 S1	Chromium Investigation	Monitoring Well	Regional
R-45 S2	Chromium Investigation	Monitoring Well	Regional

R-50 S1	Chromium Investigation	Monitoring Well	Regional
R-50 S2	Chromium Investigation	Monitoring Well	Regional
R-61 S1	Chromium Investigation	Monitoring Well	Regional
R-62	Chromium Investigation	Monitoring Well	Regional
R-67	Chromium Investigation	Monitoring Well	Regional
R-70 S1	Chromium Investigation	Monitoring Well	Regional
R-70 S2	Chromium Investigation	Monitoring Well	Regional
R-71 (proposed new well near R-61)	Chromium Investigation	Monitoring Well	Regional
R-72 (proposed new well near R-62)	Chromium Investigation	Monitoring Well	Regional
SIMR-2	Chromium Investigation	Monitoring Well	Regional
CrPZ-1	Chromium Investigation	Monitoring Well	Regional
CrPZ-2 S1	Chromium Investigation	Monitoring Well	Regional
CrPZ-2 S2	Chromium Investigation	Monitoring Well	Regional
CrPZ-3	Chromium Investigation	Monitoring Well	Regional
CrPZ-4	Chromium Investigation	Monitoring Well	Regional
CrPZ-5	Chromium Investigation	Monitoring Well	Regional
CrIN-1	Chromium Investigation	Injection Well	Regional
CrIN-2	Chromium Investigation	Injection Well	Regional
CrIN-3	Chromium Investigation	Injection Well	Regional
CrIN-4	Chromium Investigation	Injection Well	Regional
CrIN-5	Chromium Investigation	Injection Well	Regional
CrEX-1	Chromium Investigation	Extraction Well	Regional
CrEX-2	Chromium Investigation	Extraction Well	Regional
CrEX-3	Chromium Investigation	Extraction Well	Regional
CrEX-4	Chromium Investigation	Extraction Well	Regional
CrEX-5	Chromium Investigation	Extraction Well	Regional
Chromium Treatment Plant (influent)	Chromium Investigation	Water Treatment Plant	Treated Effluent
Chromium Treatment Plant (effluent)	Chromium Investigation	Water Treatment Plant	Treated Effluent
R-14 S1	MDA C	Monitoring Well	Regional
R-46	MDA C	Monitoring Well	Regional
R-60	MDA C	Monitoring Well	Regional
R-23i S1	TA-54	Monitoring Well	Intermediate
R-23i S2	TA-54	Monitoring Well	Intermediate
R-23i S3	TA-54	Monitoring Well	Intermediate
R-37 S1	TA-54	Monitoring Well	Intermediate
R-40 Si	TA-54	Monitoring Well	Intermediate
R-40 S1	TA-54	Monitoring Well	Intermediate
R-55i	TA-54	Monitoring Well	Intermediate

R-20 S1	TA-54	Monitoring Well	Regional
R-20 S2	TA-54	Monitoring Well	Regional
R-21	TA-54	Monitoring Well	Regional
R-23	TA-54	Monitoring Well	Regional
R-32 S1	TA-54	Monitoring Well	Regional
R-37 S2	TA-54	Monitoring Well	Regional
R-38	TA-54	Monitoring Well	Regional
R-39	TA-54	Monitoring Well	Regional
R-40 S2	TA-54	Monitoring Well	Regional
R-41 S2	TA-54	Monitoring Well	Regional
R-49 S1	TA-54	Monitoring Well	Regional
R-49 S2	TA-54	Monitoring Well	Regional
R-51 S1	TA-54	Monitoring Well	Regional
R-51 S2	TA-54	Monitoring Well	Regional
R-52 S1	TA-54	Monitoring Well	Regional
R-52 S2	TA-54	Monitoring Well	Regional
R-53 S1	TA-54	Monitoring Well	Regional
R-53 S2	TA-54	Monitoring Well	Regional
R-54 S1	TA-54	Monitoring Well	Regional
R-54 S2	TA-54	Monitoring Well	Regional
R-55 S1	TA-54	Monitoring Well	Regional
R-55 S2	TA-54	Monitoring Well	Regional
R-56 S1	TA-54	Monitoring Well	Regional
R-56 S2	TA-54	Monitoring Well	Regional
R-57 S1	TA-54	Monitoring Well	Regional
R-57 S2	TA-54	Monitoring Well	Regional
Bulldog Spring	TA-16 260	Spring	Spring
SWSC Spring	TA-16 260	Spring	Spring
Burning Ground Spring	TA-16 260	Spring	Spring
Martin Spring	TA-16 260	Spring	Spring
16-61439 (PRB Alluvial Seep)	TA-16 260	Spring	Spring
FLC-16-25280	TA-16 260	Monitoring Well	Alluvial
CdV-16-02656	TA-16 260	Monitoring Well	Alluvial
CdV-16-02657r	TA-16 260	Monitoring Well	Alluvial
CdV-16-02659	TA-16 260	Monitoring Well	Alluvial
CdV-16-611923	TA-16 260	Monitoring Well	Alluvial
MSC-16-06293	TA-16 260	Monitoring Well	Alluvial
MSC-16-06294	TA-16 260	Monitoring Well	Alluvial
CdV-16-611937	TA-16 260	Monitoring Well	Alluvial
16-26644	TA-16 260	Monitoring Well	Intermediate
CdV-9-1(i) S1	TA-16 260	Monitoring Well	Intermediate

CdV-16-1(i)	TA-16 260	Monitoring Well	Intermediate
CdV-16-2(i)r	TA-16 260	Monitoring Well	Intermediate
CdV-16-4ip S1	TA-16 260	Monitoring Well	Intermediate
CdV-37-1(i)	TA-16 260	Monitoring Well	Intermediate
R-25 S1	TA-16 260	Monitoring Well	Intermediate
R-25 S2	TA-16 260	Monitoring Well	Intermediate
R-25 S4	TA-16 260	Monitoring Well	Intermediate
R-25b	TA-16 260	Monitoring Well	Intermediate
R-26 PZ-2	TA-16 260	Monitoring Well	Intermediate
R-26 S1	TA-16 260	Monitoring Well	Intermediate
R-47i	TA-16 260	Monitoring Well	Intermediate
R-63i	TA-16 260	Monitoring Well	Intermediate
16-612309 (Surge Bed Monitoring Well)	TA-16 260	Monitoring Well	Intermediate
R-47	TA-16 260	Monitoring Well	Regional
CdV-R-15-3 S4	TA-16 260	Monitoring Well	Regional
CdV-R-37-2 S2	TA-16 260	Monitoring Well	Regional
R-18	TA-16 260	Monitoring Well	Regional
R-25 S5	TA-16 260	Monitoring Well	Regional
R-48	TA-16 260	Monitoring Well	Regional
R-58	TA-16 260	Monitoring Well	Regional
R-63	TA-16 260	Monitoring Well	Regional
R-68	TA-16 260	Monitoring Well	Regional
R-69	TA-16 260	Monitoring Well	Regional
R-27i	MDA AB	Monitoring Well	Intermediate
R-27	MDA AB	Monitoring Well	Regional
R-29	MDA AB	Monitoring Well	Regional
R-30	MDA AB	Monitoring Well	Regional
LA Canyon near Otowi Bridge	General Surveillance	Surface Water	Base Flow
Sandia Right fork at Pwr Plant	General Surveillance	Surface Water	Base Flow
Sandia below Wetlands	General Surveillance	Surface Water	Base Flow
Two Mile Canyon Below TA-59	General Surveillance	Surface Water	Base Flow
Ancho at Rio Grande	General Surveillance	Surface Water	Base Flow
Frijoles at Rio Grande	General Surveillance	Surface Water	Base Flow
Mortandad at Rio Grande	General Surveillance	Surface Water	Base Flow
Pajarito at Rio Grande	General Surveillance	Surface Water	Base Flow
Rio Grande at Frijoles	General Surveillance	Surface Water	Base Flow
Rio Grande at Otowi Bridge	General Surveillance	Surface Water	Base Flow
Vine Tree Spring	General Surveillance	Spring	Spring
Homestead Spring	General Surveillance	Spring	Spring

Starmer Spring	General Surveillance	Spring	Spring
Ancho Spring	General Surveillance	Spring	Spring
La Mesita Spring	General Surveillance	Spring	Spring
Upper La Mesita	General Surveillance	Spring	Spring
Sacred Spring	General Surveillance	Spring	Spring
Sandia Spring	General Surveillance	Spring	Spring
Lower Sandia Spring	General Surveillance	Spring	Spring
Spring 1	General Surveillance	Spring	Spring
Spring 2	General Surveillance	Spring	Spring
Spring 3	General Surveillance	Spring	Spring
Spring 3A	General Surveillance	Spring	Spring
Spring 3AA	General Surveillance	Spring	Spring
Spring 4	General Surveillance	Spring	Spring
Spring 4A	General Surveillance	Spring	Spring
Spring 4AA	General Surveillance	Spring	Spring
Spring 4B	General Surveillance	Spring	Spring
Spring 5	General Surveillance	Spring	Spring
Spring 5A	General Surveillance	Spring	Spring
Spring 5B	General Surveillance	Spring	Spring
Spring 6	General Surveillance	Spring	Spring
Spring 6A	General Surveillance	Spring	Spring
Spring 8A	General Surveillance	Spring	Spring
Spring 9	General Surveillance	Spring	Spring
Spring 9A	General Surveillance	Spring	Spring
LLAO-1b	General Surveillance	Monitoring Well	Alluvial
LLAO-4	General Surveillance	Monitoring Well	Alluvial
LAO-3a	General Surveillance	Monitoring Well	Alluvial
LAUZ-1	General Surveillance	Monitoring Well	Alluvial
PAO-5n	General Surveillance	Monitoring Well	Alluvial
CDBO-6	General Surveillance	Monitoring Well	Alluvial
MCO-5	General Surveillance	Monitoring Well	Alluvial
MCO-7	General Surveillance	Monitoring Well	Alluvial
18-MW-18	General Surveillance	Monitoring Well	Alluvial
PCAO-8	General Surveillance	Monitoring Well	Alluvial
WCO-1r	General Surveillance	Monitoring Well	Alluvial
POI-4	General Surveillance	Monitoring Well	Intermediate
R-3i	General Surveillance	Monitoring Well	Intermediate
TW-2Ar	General Surveillance	Monitoring Well	Intermediate
R-12 S1	General Surveillance	Monitoring Well	Intermediate
R-12 S2	General Surveillance	Monitoring Well	Intermediate
03-B-13	General Surveillance	Monitoring Well	Intermediate

PCI-2	General Surveillance	Monitoring Well	Intermediate
R-2	General Surveillance	Monitoring Well	Regional
R-24	General Surveillance	Monitoring Well	Regional
R-3	General Surveillance	Monitoring Well	Regional
R-4	General Surveillance	Monitoring Well	Regional
R-5	General Surveillance	Monitoring Well	Regional
R-7	General Surveillance	Monitoring Well	Regional
R-8	General Surveillance	Monitoring Well	Regional
R-9i	General Surveillance	Monitoring Well	Intermediate
R-19	General Surveillance	Monitoring Well	Regional
R-31	General Surveillance	Monitoring Well	Regional
R-10 S1	General Surveillance	Monitoring Well	Regional
R-10 S2	General Surveillance	Monitoring Well	Regional
R-10a	General Surveillance	Monitoring Well	Regional
R-16 S2	General Surveillance	Monitoring Well	Regional
R-16 S4	General Surveillance	Monitoring Well	Regional
R-16r	General Surveillance	Monitoring Well	Regional
R-34	General Surveillance	Monitoring Well	Regional
R-17 S1	General Surveillance	Monitoring Well	Regional
R-17 S2	General Surveillance	Monitoring Well	Regional
PM-1	LA County Supply Well	Supply Well	Regional
PM-2	LA County Supply Well	Supply Well	Regional
PM-3	LA County Supply Well	Supply Well	Regional
PM-4	LA County Supply Well	Supply Well	Regional
PM-5	LA County Supply Well	Supply Well	Regional
O-1	LA County Supply Well	Supply Well	Regional
O-2	LA County Supply Well	Supply Well	Regional
O-4	LA County Supply Well	Supply Well	Regional
G-1a	LA County Supply Well	Supply Well	Regional
G-2a	LA County Supply Well	Supply Well	Regional
G-3a	LA County Supply Well	Supply Well	Regional
G-4a	LA County Supply Well	Supply Well	Regional
Buckman 1	SF County Supply Well	Supply Well	Regional
Buckman 6	SF County Supply Well	Supply Well	Regional
Buckman 8	SF County Supply Well	Supply Well	Regional
SWA-1-1	Sandia Wetlands	Monitoring Well	Regional
SWA-1-2	Sandia Wetlands	Monitoring Well	Regional
SWA-1-3	Sandia Wetlands	Monitoring Well	Regional
SWA-2-4	Sandia Wetlands	Monitoring Well	Regional
SWA-2-5	Sandia Wetlands	Monitoring Well	Regional
SWA-2-6	Sandia Wetlands	Monitoring Well	Regional

SWA-3-7	Sandia Wetlands	Monitoring Well	Regional
SWA-3-8	Sandia Wetlands	Monitoring Well	Regional
SWA-3-9	Sandia Wetlands	Monitoring Well	Regional
SWA-4-10	Sandia Wetlands	Monitoring Well	Regional
SWA-4-11	Sandia Wetlands	Monitoring Well	Regional
SWA-4-12	Sandia Wetlands	Monitoring Well	Regional
Los Alamos Spring	Miscellaneous	Spring	Spring
Water Canyon Gallery Spring	Miscellaneous	Spring	Spring
Rio Grande at Otowi	Miscellaneous	Surface Water	Base Flow
Santa Fe River Near Santa Fe	Miscellaneous	Surface Water	Base Flow
Rio Grande Below Cochiti	Miscellaneous	Surface Water	Base Flow
Rio Grande below NM 74	Miscellaneous	Surface Water	Base Flow
Rio Grande at Espanola	Miscellaneous	Surface Water	Base Flow
Rio Chama at Chamita	Miscellaneous	Surface Water	Base Flow
Rio Grande at Buckman Landing	Miscellaneous	Surface Water	Base Flow
Water above SR-501 E252	Miscellaneous	Surface Water	Base Flow
Santa Fe Rvr at Tetilla Pk Rd	Miscellaneous	Surface Water	Base Flow
Rio Grande at Otowi	Miscellaneous	Surface Water	Base Flow
Rio Grande at NM 22	Miscellaneous	Surface Water	Base Flow
Rio Grande at BDD Intake	Miscellaneous	Surface Water	Base Flow
Rio Grande at Buckman Div SW	Miscellaneous	Surface Water Supply Intake	Base Flow
Rio Grande above Frijoles	Miscellaneous	Surface Water	Base Flow
Rio Grande above Mortandad	Miscellaneous	Surface Water	Base Flow
Black Mesa Well	Miscellaneous	Supply Well	Regional
Black Mesa Well 2	Miscellaneous	Supply Well	Regional
J. Martinez House Well	Miscellaneous	Supply Well	Regional
Sanchez House Well	Miscellaneous	Supply Well	Regional
Pajarito Well (Pump 1)	Miscellaneous	Supply Well	Regional
Pajarito Well (Pump 2)	Miscellaneous	Supply Well	Regional
New Community Well	Miscellaneous	Supply Well	Regional
Old Community Well	Miscellaneous	Supply Well	Regional
Los Alamos Waste Treatment Plant (Bayo STP)	Miscellaneous	Waste Water Treatment Plant	Treated Effluent
White Rock Waste Treatment Plant (White Rock STP)	Miscellaneous	Waste Water Treatment Plant	Treated Effluent
Santa Fe Waste Treatment Plant	Miscellaneous	Waste Water Treatment Plant	Treated Effluent
Espanola Waste Treatment Plant	Miscellaneous	Waste Water Treatment Plant	Treated Effluent

LANL Waste Water Treatment Plant (Outfall 13S)	Miscellaneous	Waste Water Treatment Plant	Treated Effluent
NPDES Outfall 01A001	Miscellaneous	Waste Water Treatment Plant	Treated Effluent
NPDES Outfall 03A027	Miscellaneous	Waste Water Treatment Plant	Treated Effluent

APPENDIX III

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD: DRINKING WATER SAMPLE COLLECTION FOR PER AND POLYFLUORINATED ALKYL SUBSTANCES (PFAS) SAMPLING GUIDANCE

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

DRINKING WATER SAMPLE COLLECTION FOR PER AND POLYFLUORINATED ALKYL SUBSTANCES (PFAS) SAMPLING GUIDANCE

Photo by Valerie Gregory

STATE WATER RESOURCES CONTROL BOARD DIVISION OF DRINKING WATER

***Revised* April 2019**

SWRCB PFAS Website: https://www.waterboards.ca.gov/pfas/
DDW PFAS Website https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html

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DRINKING WATER SAMPLE COLLECTION FOR

PER- AND POLYFLUORINATED ALKYL SUBSTANCES (PFAS) SAMPLING GUIDANCE

SWRCB Division of Drinking Water April 2019

INTRODUCTION

Obtaining representative samples and maintaining their integrity are critical elements of any monitoring program. Analytical methods may be standardized but the results of analyses are only as good as the sampling and the sample preservation methods. Sampling is the first key element in a monitoring program that must be performed properly to assure valid data. The goal of this sampling guidance is to present the steps for drinking water sampling on per and poly- fluorinated alkyl substances.

Per- and polyfluorinated alkyl substances (PFAS) are a large group of synthetic fluorinated chemicals widely used in industrial processes and consumer products. These synthetic compounds are very persistent in the environment. People are exposed to these compounds through food, food packaging, textiles, electronics, personal hygiene products, consumer products, air, soils, and drinking water. Studies indicate that continued exposure to low levels of PFAS may result in adverse health effects.

California water utilities tested drinking water supplies for Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonic Acid (PFOS) between 2013 and 2015, as required by United States Environmental Protection Agency (USEPA) under the third Unregulated Contaminant Monitoring Rule (UCMR3). In May 2016, the USEPA issued a lifetime health advisory for PFOS and PFOA in drinking water, advising municipalities that they should notify their customers of the presence of levels over 70 parts per trillion (ppt) of total combined PFOS and PFOA in community water supplies. USEPA recommended that the notification of customers include information on the increased risk to health, especially for susceptible populations. On July 13, 2018, the State Water Resources Control Board's Division of Drinking Water issued a drinking water notification level (NL) of 14 ppt for PFOA and a NL of 13 ppt for PFOS due to liver toxicity and cancer risks (for PFOA) and immunotoxicity risks (for PFOS).

The collection of PFAS drinking water data can support future regulatory determinations and other actions to protect public health. The analytical methodologies used to assess the presence of PFAS in drinking water are EPA Method 537.1 (released in November 2018), and EPA Method 537 Revision 1.1 (2009). These are the only methods validated by the USEPA and acceptable to the Division of Drinking Water for drinking water analyses.

PURPOSE OF SAMPLING GUIDANCE

Due to the prevalent nature of PFAS in commonly used sampling materials and personal protective equipment, as well as in clothing, food packaging and personal care products, careful procedures must be implemented to prevent cross-contamination of a field sample. The detection of PFAS at the low concentrations that pose a health risk requires careful planning, sampling and shipping techniques that ensure the integrity of the sample. This sampling guidance provides recommendations to reduce such cross-contamination sources and provides information for samplers to ensure collection of a valid sample. Results from sampling of drinking water sources should be reported electronically by the analyzing laboratory to the Division of Drinking Water.

QUALITY CONTROL FIELD SAMPLE TYPES

Due to the low detection limits of PFAS in the drinking water, the Division of Drinking Water is specifying the use of a field reagent blank sample and is recommending the collection of a field duplicate sample from the source, at the time that the field sample (source sample) is collected. These special quality control sample techniques must be discussed with the laboratory to ensure proper sample containers and materials are on hand when sampling begins in the field.

FIELD SAMPLE (Required)
The Field Sample is the sample collected from the source at a location prior to any treatment.

FIELD REAGENT BLANK (Required)
A Field Reagent Blank (FRB) is analyzed to assess the potential for PFAS cross- contamination being introduced during the sampling process and consists of a sample bottled filled at the sample site using reagent water provided by the laboratory. FRB must be collected at each sample site (i.e., each source being sampled) and stored in the ice chest used to store and transport samples. The laboratory will provide the FRB sample bottle, the reagent water and the preservative (if not already added to the sample bottle).

FIELD DUPLICATE (Recommended)
The Field Duplicate is a second sample collected from the source at the same time and place under identical circumstances as the Field Sample and treated exactly the same throughout field and laboratory procedures.

TRIP BLANK (Not Required)
The Trip Blank sample is generally used to evaluate potential cross-contamination from sample shipping and handling procedures. The Field Reagent Blank provides the same quality assurance under this sampling guidance, and therefore the Trip Blank is not a required sample for PFAS monitoring.

SAMPLING ACTIVITIES

Become thoroughly familiar with sample collection and shipping requirements before proceeding to the site to collect water samples. Ensure adequate sample containers are on hand to sample each site, including the trip blank and one field blank per site.

Keep clear and precise written field records. Implement the methods described in this document conscientiously and consistently. Departure from these procedures requires documentation in the field notebook.

All samples shall be collected directly from a sample tap on the well discharge line, with the well operating and at a location prior to any treatment. The well should be flushed either to the system or to waste (if it has not been in operation recently) at least 15 minutes before sample collection.

Use of a laboratory accredited to analyze for PFAS using EPA Method 537.1 or EPA Method 537 Revision 1.1 is required for samples reported to the Division of Drinking Water. A list of laboratories accredited by the California Environmental Laboratory Accreditation Program (ELAP) can be found at this internet site:
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html

AVOID SAMPLE CROSS-CONTAMINATION

PFAS compounds are detected at very low levels (parts per trillion). Therefore, there could be materials used by the sampler, or present at the sampling site, that could contaminate the sample. PFAS are used in many personal care products and in food packaging and wrappers, especially fast food and snack products. As a precaution, all persons involved in the sampling event should minimize exposure to the following products, and ensure proper hand washing at each site and wearing powderless nitrile gloves:

Minimize use on the day of the sample event, preferably **24 hours prior to the event**:
Cosmetics, moisturizers, sun blocks, insect repellants, fragrances, creams, or other personal care products (including hair products). Exceptions: Products that are known to be 100% natural.
Other items that are likely to contain PFAS and need to be avoided include:
Pre-packaged food, fast food or items wrapped in aluminum foil
New or unwashed clothing
Clothing washed with fabric softeners or dried with anti-static sheets
Synthetic water-resistant/or stain-resistant materials (such as waterproof clothing and shoes such as Gore-Tex), waterproof or coated Tyvek® material (special attention to boots)
Teflon® and other fluoropolymer containing materials
Waterproof /treated paper on field notebooks
Waterproof markers (such as Sharpie®, etc.). Indelible pens that are ball point or gel and pencils are acceptable.
Adhesive paper products (such as Post-It ®Notes or scotch tape)
Sealable bags (e.g., zip-lock ® plastic bags) that are not provided by the laboratory. (Note: only ultra-clean polypropylene or HPDE material sealable bags are allowed)
Chemical or blue ice, which may contain PFAS and may not reduce and maintain the temperature of the samples adequately
Avoid sampling during rain if possible (if necessary please use, vinyl or PVC rain gear)
Fill gasoline in the vehicle the day before sampling
No food or beverage should be consumed in the sample site area. If food, drink or other activities, such as smoking, are necessary during the sampling event, first move away

from the sample site. Before returning to the sampling site, wash hands thoroughly and put on fresh powderless nitrile gloves.

BEFORE SAMPLING

Complete materials and supplies checklist (Attachment A).
Familiarize yourself with each site being sampled.
Coordinate the sampling event with the accredited laboratory. The laboratory will provide containers, sample preservation, Chain of Custody (COC) forms, ice chest, quality control samples, and shipping instructions.
Bottles should be labeled before sample collection.
Ensure sufficient number of sample bottles and preservatives before departure. It is recommended to request extra bottles, in case of damage to bottles during shipping or handling during the sampling event.
Ensure that the ice chest interior is clean.
Fill the ice chest with wet ice (not dry ice, blue ice or reusable chemical ice) before departure for the sample collection event. Keep water drained from ice chest to avoid soaking the containers.
Ensure an adequate number of sealable bags are available to store all sample bottles.

SAMPLE COLLECTION PROCEDURE

Sampling taps and plumbing should be free of materials containing Teflon® (such as Teflon® tape at plumbing joints). If these cannot be avoided, ensure the tap has been flushed for at least 5 minutes.
Wash hands with prepared Alconox® or Liquinox® soap and deionized water before and after each sampling event.
Wear nitrile gloves while filling and sealing the sample bottles, using a new pair of nitrile gloves at each sample site.
Samples must be collected in a wide mouth 250 mL polypropylene bottle (provided by the laboratory) fitted with a polypropylene screw cap.
Each bottle needs to be preserved before sample collection with 5 g/L Trizma®[1], unless the preservative has been added to the bottles by the laboratory.
Ensure that the sample container is labeled appropriately, check that the label ID number on the sample container matches the COC form.
Field Reagent Blank (FRB) Procedure:

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[1] Trizma® is a buffering agent and removes free chlorine.

Collect the FRB prior to collection of the Field Sample and Field Duplicate.
At the sampling site, the sample personnel must open the empty FRB sample bottle, pour the reagent water into the sample bottle, seal and label this bottle as the FRB. Record the FRB identification number on the COC form.

The FRB is shipped back to the laboratory along with the site samples. The empty container that the field reagent water was poured out of must also be shipped back to the laboratory in the same shipment.

Field Sample & Field Duplicate Procedure:

Activate the well and flush until the water temperature has stabilized, or until a minimum of one well casing volume has been flushed out. It is recommended that **wells be allowed to flow for a minimum of 15 minutes** before sampling to ensure that the sample reflects the water quality of the source. The **sample tap should be flushed for a minimum of 5 minutes** to ensure the impact of local sources of PFAS cross-contamination, such as Teflon® tape and valve seats, are minimized.

Reduce the flow to a slow laminar stream to reduce air entrainment and overfilling of the bottle.

Uncap the sample bottle. Do not place the bottle cap on any surface when collecting the sample, and avoid all contact with the inside of the sample bottle or its cap.

Fill sample bottle, taking care not to flush out the sample preservation reagent. Samples do not need to be collected headspace free, but a volume of 250 mL is necessary for the sample analysis.

The Field Duplicate should be collected immediately following collection of the Field Sample, or as the laboratory instructs.

After collecting the sample(s), cap the bottle(s) and gently agitate by hand until preservative is dissolved.

Place the sample bottle(s) in an individual sealed plastic bag (provided by the laboratory), and then into the ice chest with ice surrounding the bottles. (Note: only ultra-clean polypropylene or HPDE material sealed bags are allowed).

A two-person sample team is recommended: One team member obtains the samples, and other records the samples in the COC form with the sample collection information.
If only one person is conducting the sampling, wearing layered nitrile gloves that must be discard from the transition from dirty hands to clean hands. Ensure care is taken to properly record all samples on the COC and conduct all the precautions noted in this guidance.
Record field site observations in the field notebook (not waterproof) - such as types of pipes and fittings, time well operated prior to sample, site characteristics, atmospheric conditions, personal items such as whether a break was taken for food, etc. Take

pictures documenting the specific conditions encountered and how the sample was collected. Record this information at the time of sampling.

Table 1. PFAS Sample Summary Information

Parameters	Minimum Requirements
Sample volume	250 mL
Container/cap	Polypropylene bottle/screw cap
Sample preservation	Trizma ®
Field Reagent Blank	One per sample site
Temperature	
After sample collection	<10°C (50°F) within 48 hours but not frozen
Sample stored	<6°C (42.8°F) but not frozen
Holding Time	
Extraction	Within 14 days of collection
Analyses	Within 28 days of extraction
Minimum Reporting Limit (MRL)	Report MRL with analytical results

AFTER SAMPLING

All team members coming out of the site sampling area must immediately conduct personal decontamination.
Remove your gloves and place them in a sealable plastic bag to be disposed at the end of the sample collection. Wash your hands with prepared Alconox ® or Liquinox® soap and rinse with deionized water.

SAMPLE SHIPPING

Samples should be stored in ice chests at least 1/3 filled with wet ice[2] and do not exceed 10°C (50°F) until analyzed at the laboratory. If the immediate delivery to the laboratory is not possible, samples should be stored or below 6°C (42.8°F) while independently

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[2] The use of chemical or blue ice is not recommended, as it may contain PFAS and may not maintain the necessary temperature of the samples during the shipping process

enclosed to their individual sealed bag provided but must not be frozen or stored in blue ice/chemical ice. Use fresh ice for packing and shipping.

Samples must arrive at the laboratory within 48 hours of sampling, and at a temperature between 10°C (50°F) and 0°C (32°F) but not frozen.

If samples are received at the laboratory more than 48 hours after sampling they must be between 6°C (42.8°F) and 0°C (32°F) but not frozen.

Samples stored in the lab must be held at or below 6°C (42.8°F) until extraction. Extraction should be as soon as possible but must be extracted within 14 days.

Pack the bottles (which are placed inside sealable plastic bags provided by the laboratory) upright in the ice chest. Ensure that the bottles cannot move sideways at all. Any extra space around the bags should be packed with ice to 1/3 the depth of the ice chest.

Put additional ice inside of double plastic bags and place these on top of the bottles.

The COC form will accompany all samples and be filled out at the same time samples are collected. The COC form is an integral part of sample QA/QC, each ice chest should include a COC.

Ensure that the COC is complete and ready to be signed by shipping company personnel prior to sealing the ice chest. Retain the sender's copy.

Place the COC in a sealed plastic bag (1 gallon) inside of the cooler.

NOTE: The general information in the COC could be filled out in advance of the field sample event.

Seal the ice chest firmly with PFAS-Free shipping tape, wrapping it around multiple times. The use of Uline Strapper Tape is recommended to secure the ice chest.

Attach plastic overnight carrier tags to the ice chest's handle, retain the marked sender's copy for the record tracking number.

Provide the shipping information to the laboratory and communicate the potential time of arrival of the samples.

LABORATORY METHODS AND DATA REPORTING

The analytical methodologies used to assess the presence of PFAS in drinking water are EPA Method 537.1 (released in November 2018), and EPA Method 537 Revision 1.1 (2009). These are the only methods validated by the USEPA and acceptable to the Division of Drinking Water (DDW) for drinking water analyses. Use of a laboratory accredited for either of these methods is required for samples to be reported to DDW. The primary differences between EPA Methods 537 Rev 1.1 and 537.1 are the number of constituents and the method detection levels. These are noted in the Table 2 below. Note that laboratories seeking accreditation after April 3, 2019, can only request accreditation for EPA Method 537.1. DDW is phasing out Method 537 Rev 1.1 as an acceptable method for PFAS in drinking water.

Laboratories accredited by ELAP are certified to analyze for the entire suite of analytes in each method. For sampling intended to be reported to DDW, all 14 or 18 analytes must be reported with each set of sample results. Reporting to DDW must be through the EDT (Electronic Data Transfer) process. The water utility should obtain the hard copy results that include the QC information and make it available to DDW on request. The results are due to DDW on the 10Th of the month following the date when analysis is completed by the laboratory or reported by the laboratory to the water system.

This guidance recommends the collection of Field Duplicate. <u>If the laboratory analyzes the Field Duplicate for any reason, the results must be reported EDT</u>.

Table 2. EPA Method target analytes and method detection limits

EPA Method 537 Rev 1.1* (14 PFAS analytes)		**EPA Method 537.1*** (18 PFAS analytes)	
Analyte	**Detection Limit[1] (ng/L)**	**Analyte**	**Detection Limit[1] (ng/L)**
PFBS	3.1	PFBS	1.8
PFHxA	1.6	PFHxA	1.0
PFHpA	0.5	PFHpA	0.71
PFHxS	2.0	PFHxS	1.4
PFOA	**1.7**	**PFOA**	**0.53**
PFOS	**1.4**	**PFOS**	**1.1**
PFNA	0.7	PFNA	0.7
PFDA	0.7	PFDA	1.6
NMeFOSAA	6.5	NMeFOSAA	2.4
PFUnA	2.8	PFUnA	1.6
NEtFOSAA	4.2	NEtFOSAA	2.8
PFDoA	1.1	PFDoA	1.2
PFTrDA	2.2	PFTrDA	0.72
PFTA	1.7	PFTA	1.1
		HFPO-DA	1.9
		ADONA	0.88
		9Cl-PF3ONS	1.4
		11CL-PF3OUdS	1.5

*in reagent water