ERA Radiochemistry and PFAS Program

Presenter:

Brian Miller

About ERA

- ERA was founded in 1977
- Located in Golden, Colorado
- ERA was acquired by Waters Corporation in 2007.
- In 2011 ERA moved into a new 65,000 sq ft facility.

ERA PT an ISO 17034 CRM Offerings

Waters™ | ERA

- Drinking water
- Wastewater
- Soils
- Air & Emissions
- Microbiology
- Radiochemistry
- Custom Standards
- QuiK Response™

ACCREDITED PT PROVIDER TNI

ISO/IEC 17043:2010

ACCREDITED

PROFICIENCY TESTING PROVIDER
CERTIFICATE NO. 1539.01

ISO/IEC 17034:2016

ACCREDITED

REFERENCE MATERIAL PRODUCER
CERTIFICATE NO. 1539.03

ISO/IEC 17025:2017

ACCREDITED

CHEMICAL TESTING LABORATORY
CERTIFICATE NO. 1539.02

nqa. ISO 9001 Registered

ISO 9001:2008
CERTIFICATE NO. 10551

Radiochemistry Program

- Radiochemistry drinking water studies are offered quarterly.
- Radiochemistry drinking water studies are open for 45 days.
- MRAD PT studies are offered semiannually.
- MRAD studies are open for 60 days.
- All Radiochemistry study results are returned within 2 business days of the close of each study. ERA is the only provider to have final results in 2 days.

ERA RAD Drinking Water Program

- Radiochemistry drinking water studies consist of 6 standards.
- All standards are offered as PT's and CRM's.

	Activity Range	Units
Strontium-89/90		
Strontium-89	10 - 70	pCi/L
Strontium-90	3 - 45	pCi/L
Gamma Emitters		
Barium-133	10 - 100	pCi/L
Cesium-134	10 - 100	pCi/L
Cesium-137	20 - 240	pCi/L
Cobalt-60	10 - 120	pCi/L
Zinc-65	30 - 360	pCi/L
GroSS Alpha/Beta		
Gross Alpha (Th-230)	7 - 75	pCi/L
Gross Beta (Cs-137)	8 - 75	pCi/L

	Activity Range	Units
Iodine-131		
Iodine-131	3 - 30	pCi/L
NaturalS		
Radium-226	1 - 20	pCi/L
Radium-228	2 - 20	pCi/L
U-Nat	2 - 70	pCi/L
U-Nat (mass)	3 - 104	µg/L
TritiuM		
Tritium	1000 - 24000	pCi/L

MRAD PT Program

- The MRAD PT program offers performance evaluation standards designed for DOE testing laboratories.
- MRAD study standards consists of three different matrices:
  - Soil: 500cc white poly jar containing ~650g of spiked soil.
  - Vegetation: 500cc white poly jar containing ~250g spiked dry powdered vegetation.
  - Gross Alpha/Beta Air Filter
  - Multi-Isotope Air Filter
  - Whole volume H3, 250mL
  - Water Gross Alpha/Beta
  - Multi-Isotope water

MRAD PT and QC Samples

Water

PT Cat#	QC Cat#	Parameter	Activity Range	Units
805	615	Gross Alpha as Thorium-230	10.0 - 200	pCi/L
		Gross Beta as Cesium-137	10.0 - 200	pCi/L
806	616	Tritium	3000 - 30000	pCi/L
804	617	Americium-241	10.0 - 200	pCi/L
		Cesium-134	100 - 3000	pCi/L
		Cesium-137	100 - 3000	pCi/L
		Cobalt-60	100 - 3000	pCi/L
		Iron-55	100 - 3000	pCi/L
		Manganese-54	100 - 3000	pCi/L
		Plutonium-238	10.0 - 200	pCi/L
		Plutonium-239	10.0 - 200	pCi/L
		Strontium-90	50.0 - 1000	pCi/L
		Uranium-234	10.0 - 200	pCi/L
		Uranium-238	10.0 - 200	pCi/L
		Uranium (Nat)	20.0 - 400	pCi/L
		Uranium (Nat) mass	30.0 - 600	ug/L
		Zinc-65	100 - 3000	pCi/L

Soil

PT Cat#	QC Cat#	Parameter	Activity Range	Units
802	608	Actinium-228	500 - 5000	pCi/kg
		Americium-241	50.0 - 2000	pCi/kg
		Bismuth-212	500 - 5000	pCi/kg
		Bismuth-214	500 - 5000	pCi/kg
		Cesium-134	1000 10000	pCi/kg
		Cesium-137	1000 - 10000	pCi/kg
		Cobalt-60	1000 10000	pCi/kg
		Lead-212	500 - 5000	pCi/kg
		Lead-214	500 - 5000	pCi/kg
		Manganese-54	1000 10000	pCi/kg
		Plutonium-238	50.0 - 2000	pCi/kg
		Plutonium-239	50.0 - 2000	pCi/kg
		Potassium-40	5000 - 50000	pCi/kg
		Strontium-90	500 - 10000	pCi/kg
		Thorium-234	500 - 5000	pCi/kg
		Uranium-234	500 - 5000	pCi/kg
		Uranium-238	500 - 5000	pCi/kg
		Uranium (Nat)	1000 - 10000	pCi/kg
		Uranium (Nat) mass	1500 - 15000	ug/kg
		Zinc-65	1000 - 1000	pCi/kg

Air Filter

PT Cat#	QC Cat#	Parameter	Activity Range	Units
801	607	Gross Alpha as Thorium-230	5.00 - 100	pCi/Filter
		Gross Beta as Cesium-137	5.00 - 100	pCi/Filter
800	606	Americium-241	2.00 - 80.0	pCi/Filter
		Cesium-134	50.0 - 1500	pCi/Filter
		Cesium-137	50.0 - 1500	pCi/Filter
		Cobalt-60	50.0 - 1500	pCi/Filter
		Iron-55	50.0 - 1500	pCi/Filter
		Manganese-54	50.0 - 1500	pCi/Filter
		Plutonium-238	2.00 - 80.0	pCi/Filter
		Plutonium-239	2.00 - 80.0	pCi/Filter
		Strontium-90	5.00 - 200	pCi/Filter
		Uranium-234	2.00 - 80.0	pCi/Filter
		Uranium-238	2.00 - 80.0	pCi/Filter
		Uranium (Nat)	4.00 - 160	pCi/Filter
		Uranium (Nat) mass	6.00 - 240	ug/Filter
		Zinc-65	50.0 - 1500	pCi/Filter

Vegetation

PT Cat#	QC Cat#	Parameter	Activity Range	Units
803	609	Americium-241	50.0 - 5000	pCi/kg
		Cesium-134	300 3000	pCi/kg
		Cesium-137	300 - 3000	pCi/kg
		Cobalt-60	300 3000	pCi/kg
		Manganese-54	50.0 5000	pCi/kg
		Plutonium-238	300 - 3000	pCi/kg
		Plutonium-239	50.0 - 5000	pCi/kg
		Potassium-40	50.0 - 5000	pCi/kg
		Strontium-90	5000 - 50000	pCi/kg
		Thorium-234	500 - 10000	pCi/kg
		Uranium-234	50.0 - 500	pCi/kg
		Uranium-238	50.0 - 500	pCi/kg
		Uranium (Nat)	100 - 1000	pCi/kg
		Uranium (Nat) mass	150 - 1500	ug/kg
		Zinc-65	300 - 3000	pCi/kg

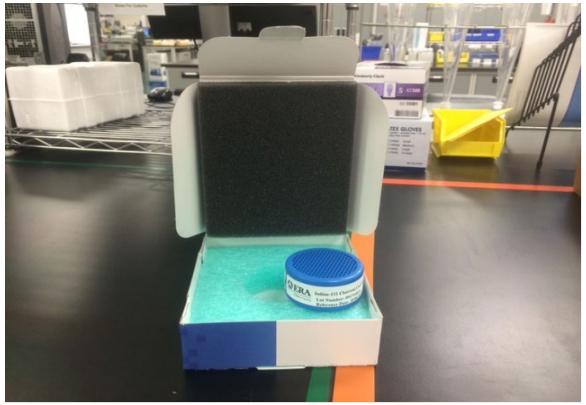
Radiochemistry Custom Standards

- ERA can manufacture Radiochemistry customs standards of various isotopes and matrices.

- Examples of Custom Standards:
  - Calibration Standards
  - Stock Solutions
  - Control Standards
  - Linearity Standards
  - Matrix Spiking Standards

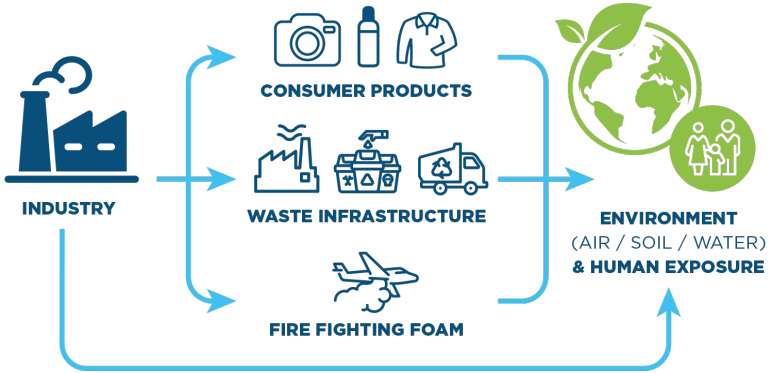
Radiochemistry Custom Standards

- Available Matrix that ERA can provide:
  - Drinking Water
  - Wastewater
  - Sea Water
  - Synthetic Urine
  - Various Food Matrices
  - Fish
  - Vegetation
  - Air Filters
  - Charcoal filters
  - Sludge
  - Cement
  - Soil
- Standards are available as concentrates or as ready-to-use whole volume solutions and each is supplied with a certification sheet.

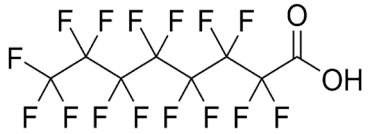


What are Per- and Polyfluoroalkyl Substances (PFAS)

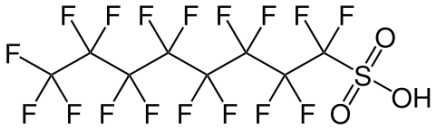
- **Man-made chemicals** used in industry and consumer products
  - Produced **since the 1940s**
- It is estimated that there are **over 5000 PFAS related compounds**
- Characterised by a chain of strong **fluorine-carbon bonds**
  - Very diverse group of substances with a number of sub-groups
- Unique properties
  - **Repel oil and water**
  - **Resistance to heat**



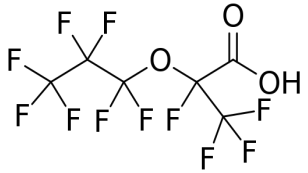
Source: https://www.wrd.org/content/pfas-remediation-program



PFOA



PFOS



GenX (HFPO-DA)

ERA's PFAS Product Description's

- ERA PFAS Aqueous Samples:
  - Drinking Water, Wastewater, Ground & Surface Water.
  - All aqueous samples:
    - Packaged in a 2 mL flame sealed ampule
    - Sample Volume ~1.8 mL of concentrate
    - Dilution instructions: 1000x
  - All have a 2 yr shelf life
  - PT samples offered quarterly:
    - Jan, Apr, Jul, & Oct.
  - QC samples readily available.

- ERA PFAS Soil Samples:
  - 10 g of spiked soil sealed in a 10 mL flame sealed ampule.
  - 2 yr shelf life
  - PT samples offered quarterly:
    - Jan, Apr, Jul, & Oct.
  - QC samples readily available.

ERA PFAS Program

- **WP Wastewater**
  - Certified for 44 analytes
  - Includes all 40 analytes for EPA 1633 and an additional 4 analytes (PFPrA, FHUEA, FOUEA, Bis(trifluoromethane) sulfonimide) for ASTM D8421-21
  - 20-400 ng/L
  - Designed for LC/MS/MS Methods
    - Method 1633
    - ASTM D8421-21
    - SW-846 Method 8327

Abbreviation	Analyte	Manufacturing Range			
PFBA	Perfluorobutanoic acid	40	-	400	ng/L
PFPeA	Perfluoropentanoic acid	40	-	400	ng/L
PFHxA	Perfluorohexanoic acid	20	-	200	ng/L
PFHpA	Perfluoroheptanoic acid	20	-	200	ng/L
PFOA	Perfluorooctanoic acid	20	-	200	ng/L
PFNA	Perfluorononanoic acid	20	-	200	ng/L
PFDA	Perfluorodecanoic acid	20	-	200	ng/L
PFUdA	Perfluoroundecanoic acid	20	-	200	ng/L
PFDoA	Perfluorododecanoic acid	20	-	200	ng/L
PFTrDA	Perfluorotridecanoic acid	20	-	200	ng/L
PFTeDA	Perfluorotetradecanoic acid	20	-	200	ng/L
PFBS	Perfluorobutanesulfonic acid	20	-	200	ng/L
PFPeS	Perfluoropentanesulfonic acid	20	-	200	ng/L
PFHxS	Perfluorohexanesulfonic acid	20	-	200	ng/L
PFHpS	Perfluoroheptanesulfonic acid	20	-	200	ng/L
PFOS	Perfluorooctanesulfonic acid	20	-	200	ng/L
PFNS	Perfluorononanesulfonic acid	20	-	200	ng/L
PFDS	Perfluorodecanesulfonic acid	20	-	200	ng/L
PFDoS	Perfluorododecanesulfonic acid	20	-	200	ng/L
4:2FTS	4:2 fluorotelomersulfonic acid	40	-	400	ng/L
6:2FTS	6:2 fluorotelomersulfonic acid	40	-	400	ng/L
8:2FTS	8:2 fluorotelomersulfonic acid	40	-	400	ng/L
PFOSA	Perfluorooctanesulfonamide	20	-	200	ng/L
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid	20	-	200	ng/L
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid	20	-	200	ng/L
NEtFOSA	N-ethyl perfluorooctanesulfonamide	20	-	200	ng/L
NMeFOSA	N-methyl perfluorooctanesulfonamide	20	-	200	ng/L
NEtFOSE	N-ethyl perfluorooctanesulfonamidoethanol	20	-	200	ng/L
NMeFOSE	N-methyl perfluorooctanesulfonamidoethanol	20	-	200	ng/L
3:3FTCA	3-Perfluoropropyl propanoic acid	40	-	400	ng/L
5:3FTCA	2H,2H,3H,3H-Perfluorooctanoic acid	40	-	400	ng/L
7:3FTCA	3-Perfluoroheptyl propanoic acid	40	-	400	ng/L
HFDO-DA	Hexafluoropropylene oxide dimer acid	40	-	400	ng/L
ADONA	4,8-dioxa-3H-perfluorononanoic acid	40	-	400	ng/L
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acic	40	-	400	ng/L
11Cl-PF3OUdS	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acic	40	-	400	ng/L
PFMBA	Perfluoro-4-methoxybutanoic acid	40	-	400	ng/L
PFMPA	Perfluoro-3-methoxypropanoic acid	40	-	400	ng/L
PFEESA	Perfluoro(2-ethoxyethane) sulfonic acid	40	-	400	ng/L
NFDHA	Nonafluoro-3,6-dioxaheptanoic acid	40	-	400	ng/L
PFPrA	Pentafluoropropanoic acid	40	-	400	ng/L
FHUEA	2H-perfluoro-2-octenoic acid	20	-	200	ng/L
FOUEA	2H-perfluoro-2-decenoic acid	20	-	200	ng/L
	Bis(trifluoromethane)sulfonimide	40	-	400	ng/L

WS Drinking Water PFAS Sample

- **WS Drinking Water**
  - Certified for 18 analytes
  - 50-500 ng/L
    (Except PFBS & HFDO-DA
    100-1000 ng/L)
  - Designed for EPA Method 537

Xevo TQ Absolute

Abbreviation	Analyte	Manufacturing Range
PFHxA	Perfluorohexanoic acid	50 - 500 ng/L
PFHpA	Perfluoroheptanoic acid	50 - 500 ng/L
PFOA	Perfluorooctanoic acid	50 - 500 ng/L
PFNA	Perfluorononanoic acid	50 - 500 ng/L
PFDA	Perfluorodecanoic acid	50 - 500 ng/L
PFUdA	Perfluoroundecanoic acid	50 - 500 ng/L
PFDoA	Perfluorododecanoic acid	50 - 500 ng/L
PFTrDA	Perfluorotridecanoic acid	50 - 500 ng/L
PFTeDA	Perfluorotetradecanoic acid	50 - 500 ng/L
PFBS	Perfluorobutanesulfonic acid	100 - 1000 ng/L
PFHxS	Perfluorohexanesulfonic acid	50 - 500 ng/L
PFOS	Perfluorooctanesulfonic acid	50 - 500 ng/L
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid	50 - 500 ng/L
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid	50 - 500 ng/L
ADONA	4,8-dioxa-3H-perfluorononanoic acid	50 - 500 ng/L
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	50 - 500 ng/L
11Cl-PF3OUdS	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	50 - 500 ng/L
HFDO-DA	Hexafluoropropylene oxide dimer acid	100 - 1000 ng/L

ERA PFAS Program

- **Soil**
  - Certified for 28 analytes
  - 20-100 µg/kg
    (Except HFPO-DA 40-100 µg/kg)

Xevo TQ XS

Abbreviation	Analyte	Manufacturing Range
PFBA	Perfluorobutanoic acid	20 - 100 µg/kg
PFPeA	Perfluoropentanoic acid	20 - 100 µg/kg
PFHxA	Perfluorohexanoic acid	20 - 100 µg/kg
PFHpA	Perfluoroheptanoic acid	20 - 100 µg/kg
PFOA	Perfluorooctanoic acid	20 - 100 µg/kg
PFNA	Perfluorononanoic acid	20 - 100 µg/kg
PFDA	Perfluorodecanoic acid	20 - 100 µg/kg
PFUdA	Perfluoroundecanoic acid	20 - 100 µg/kg
PFDoA	Perfluorododecanoic acid	20 - 100 µg/kg
PFTrDA	Perfluorotridecanoic acid	20 - 100 µg/kg
PFTeDA	Perfluorotetradecanoic acid	20 - 100 µg/kg
PFBS	Perfluorobutanesulfonic acid	20 - 100 µg/kg
PFPeS	Perfluoropentanesulfonic acid	20 - 100 µg/kg
PFHxS	Perfluorohexanesulfonic acid	20 - 100 µg/kg
PFHpS	Perfluoroheptanesulfonic acid	20 - 100 µg/kg
PFOS	Perfluorooctanesulfonic acid	20 - 100 µg/kg
PFNS	Perfluorononanesulfonic acid	20 - 100 µg/kg
PFDS	Perfluorodecanesulfonic acid	20 - 100 µg/kg
4:2FTS	4:2 fluorotelomersulfonic acid	20 - 100 µg/kg
6:2FTS	6:2 fluorotelomersulfonic acid	20 - 100 µg/kg
8:2FTS	8:2 fluorotelomersulfonic acid	20 - 100 µg/kg
PFOSA	Perfluorooctanesulfonamide	20 - 100 µg/kg
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid	20 - 100 µg/kg
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid	20 - 100 µg/kg
HFDO-DA	Hexafluoropropylene oxide dimer acid	40 - 100 µg/kg
ADONA	4,8-dioxa-3H-perfluorononanoic acid	20 - 100 µg/kg
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	20 - 100 µg/kg
11Cl-PF3OUdS	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	20 - 100 µg/kg

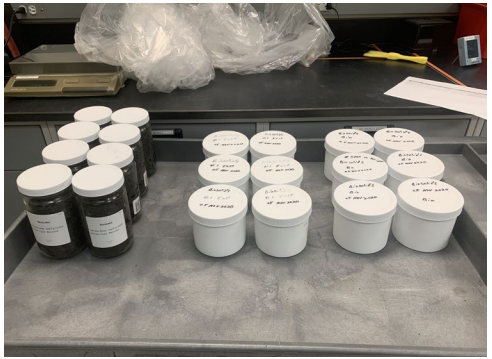
PFAS Ground Water and Surface Water Sample

- Ground Water and Surface Water
  - Certified for 32 analytes
  - 100-500 ng/L
  - Designed for EPA Method 537

Abbreviation	Analyte	Manufacturing Range
PFBA	Perfluorobutanoic acid	100 - 500 ng/L
PFPeA	Perfluoropentanoic acid	100 - 500 ng/L
PFHxA	Perfluorohexanoic acid	100 - 500 ng/L
PFHpA	Perfluoroheptanoic acid	100 - 500 ng/L
PFOA	Perfluorooctanoic acid	100 - 500 ng/L
PFNA	Perfluorononanoic acid	100 - 500 ng/L
PFDA	Perfluorodecanoic acid	100 - 500 ng/L
PFUdA	Perfluoroundecanoic acid	100 - 500 ng/L
PFDoA	Perfluorododecanoic acid	100 - 500 ng/L
PFTrDA	Perfluorotridecanoic acid	100 - 500 ng/L
PFBS	Perfluorobutanesulfonic acid	100 - 500 ng/L
PFPeS	Perfluoropentanesulfonic acid	100 - 500 ng/L
PFHxS	Perfluorohexanesulfonic acid	100 - 500 ng/L
PFOS	Perfluorooctanesulfonic acid	100 - 500 ng/L
PFNS	Perfluorononanesulfonic acid	100 - 500 ng/L
PFDS	Perfluorodecanesulfonic acid	100 - 500 ng/L
4:2FTS	4:2 fluorotelomersulfonic acid	100 - 500 ng/L
6:2FTS	6:2 fluorotelomersulfonic acid	100 - 500 ng/L
8:2FTS	8:2 fluorotelomersulfonic acid	100 - 500 ng/L
PFOSA	Perfluorooctanesulfonamide	100 - 500 ng/L
NEtFOSAA	N-ethyl perfluorooctanesulfonamidoacetic acid	100 - 500 ng/L
NMeFOSAA	N-methyl perfluorooctanesulfonamidoacetic acid	100 - 500 ng/L
HFDO-DA	Hexafluoropropylene oxide dimer acid	100 - 500 ng/L
ADONA	4,8-dioxa-3H-perfluorononanoic acid	100 - 500 ng/L
9Cl-PF3ONS	9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	100 - 500 ng/L
11Cl-PF3OUdS	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	100 - 500 ng/L
PFMBA	Perfluoro-4-methoxybutanoic acid	100 - 500 ng/L
PFMPA	Perfluoro-3-methoxypropanoic acid	100 - 500 ng/L
PFEESA	Perfluoro(2-ethoxyethane) sulfonic acid	100 - 500 ng/L
NFDHA	Nonafluoro-3,6-dioxaheptanoic acid	100 - 500 ng/L
PFPrA	Pentafluoropropanoic acid	100 - 500 ng/L

PFAS Method Project

- The past 2 years ERA has been involved in a large PFAS method development project.
- Project Scope:
  - 10 Participating Labs
  - 7 different lots of Wastewaters
  - 3 different lots of:
    - Surface Waters
    - Ground Waters
    - Soils
    - Sediments
    - Biosolids
    - Fish Tissue
  - 900 Aqueous spiked samples/lab
  - 300 Solid spiked samples/lab



PFAS Method Project

- All matrices were combined, homogenized and packaged.

PFAS Method Project

- PFAS Raw Material Organization
  - 646 PFAS Ampules order
  - Made in to 10 different spiking solutions.

PFAS Method Project

- Sample Organization
  - Samples were segregated in different locations in the facility for the spiking process to avoid an mis-spikes.

PFAS Method Project

- Sample Organization

PFAS Method Project

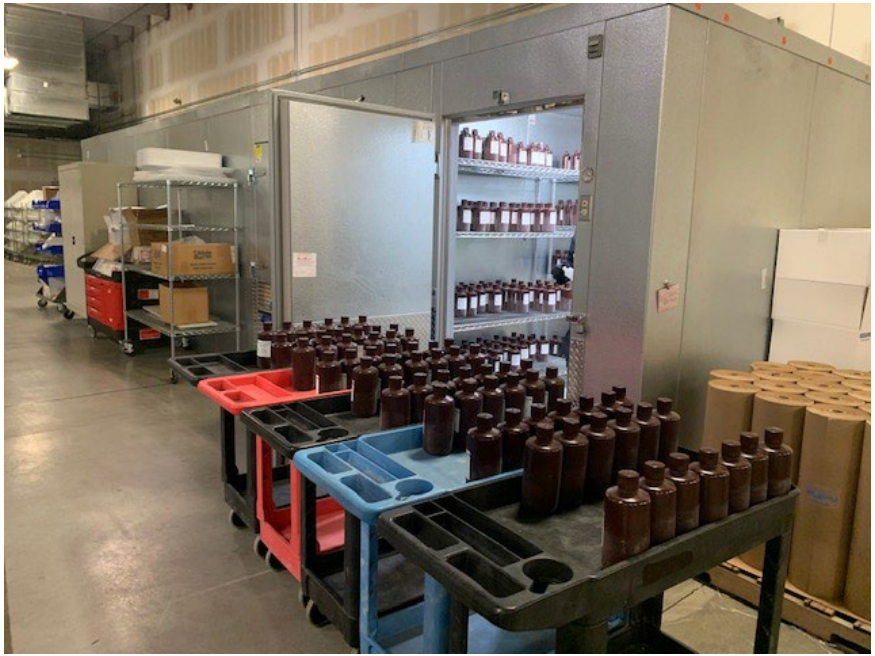
- Sample Spiking Process
  - (2) teams of threes were involved with the sample spiking process to ensure that each sample was spiked.

PFAS Method Project

- Project sample scope:
  - 1680 Aqueous Samples Spiked
  - 1260 Solid samples spiked

PFAS Method Project

- Samples were kitted and staged prior to shipping.



PFAS Method Project

- Packaging and cooler staging stations were created for each and specific lab shipment.