Optimize your Sample Preparation Workflow for PFAS Analysis

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Purpose

- Workflows and tools for EPA method 1633 (draft)
- Bond Elut PFAS WAX and Carbon S for PFAS applications
- EPA method 1633 applications – wastewater and soils

PFAS Soils Analysis Workflow Consumables, Supplies and Hardware

Sample
(5 g)

Centrifuge tubes
50 mL (5610-2049)

Carbon S
(5610-2093)

Empty SPE tubes,
60 mL (12131012)

SPE Adapters
(12131001)

Glass Wool,
Silanized
(8500-1572)

Bond Elut PFAS
WAX 150 mg, 6 mL
(5610-2152)

Vac Elut SPS 24
(12234003)

Centrifuge tubes
15 mL (5610-2039)

Nylon Filters
(5190-5092)

Syringes
(9301-6476)

Polypropylene AS Vials
(5191-8151, 5191-8150)

PFC-free kit (5004-0006)
PFC delay column (5062-8100)
Analytical column Eclipse Plus
C18, 2.1 x 100 mm, 1.8 µm
(959758-902)

PFAS MRM Database (G1736AA)

1290 Infinity II LC
system

6470B triple
quadrupole LC/MS

Ordering Guide for PFAS Analyses

https://www.agilent.com/cs/library/brochures/brochure-PFAS-consumables-5994-2357EN-agilent-HR.pdf

Ordering guides for:

- EPA 537.1
- EPA 533
- EPA 1633 (draft Aug 2021)
- EPA 8327
- ASTM D7979
- ISO 21675:2019
- Agilent eMethod G5285AA/M5660AA Single method for 108 PFAS compounds.

Ordering Guide for PFAS Analyses

https://www.agilent.com/cs/library/brochures/brochure-PFAS-consumables-5994-2357EN-agilent-HR.pdf

EPA 1633 or similar: Determination of PFAS in aqueous (wa
sediments, biosolids, > 50 mg solids), and tissues by SPE ar
5994-4926EN View MyList

Product Category	Description
Sample preparation	Bond Elut PFAS WAX, 6 mL, 150 mg (
	Carbon S SPE Bulk Sorbent, 25 g bott
	Glass wool, silane-treated, 50 g, for ga
	Bond Elut Adapter cap for 1, 3, and 6
	Bond Elut Empty SPE cartridge 60 mL
	Bond Elut Empty SPE cartridge 140 m
	Vac Elut 20 Manifold long valve stopc
	Centrifuge tubes and caps, 15 mL, 50
	Vac Elut SPS 24 Manifold with collect
	Collection rack and funnel set for 12 (SPS 24 Manifold
	Captiva Premium Syringe Filter, polyp 25 mm diameter, 0.2 µm pore size, 10
	Captiva Premium Syringe Filter, polyp membrane, 15 mm diameter, 0.7 µm p
	Captiva Premium Syringe Filter, meth housing, glass fiber membrane, 28 m
	Captiva Disposable Syringe, 5 mL, 10

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PFAS_EPA 1633

PFAS_EPA 1633 — EMAIL | PRINT | DELETE

Enter part number — ADD TO LIST

PART NUMBER	DESCRIPTION	UNIT	LIST PRICE	YOUR PRICE	QTY
5610-2150	Bond Elut PFAS WAX, 150 mg, 6 mL, 30/pk	30 Pack	$204.00		
5610-2093	Carbon S Bulk, 25 g	1 Bottle	$302.00		
8500-1572	Glass wool, silane-trated, 50 g, for gas chromatography	1 Bottle	$180.00		
12131001	Adapter cap for 1, 3 and 6 mL Bond Elut cartridges, 15/pk	15 Pack	$98.83		
12131012	Empty SPE cartridge, 60 mL, 100/pk	100 Pack	$174.00		
12131042	Reservoir, 140 mL, 25/pk	25	$332.00		
12234520	Vac Elut 20 Stopcock valve, 20/pk	20 Pack	$175.00		
5610-2039	Centrifuge tubes and caps, 15 mL, 50/pk	50 Pack	$39.49		
12234003	Vac Elut SPS 24 Manifold with collection rack for 10 x 75 mm test tubes	1 Each	$3,630.00		
12234027	Collection rack and funnel set for 12 or 15 mL conical tubes, for Vac Elut SPS 24 Manifold	1 Each	$514.00		
5190-5092	Captiva Premium Syringe Filter, nylon membrane, 25 mm diameter, 0.2 µm pore, 100/pk	100 Pack	$259.00		
9301-6476	Captiva Disposable Syringe, 5 mL, Polypropylene, 100/pk	100 Pack	$72.26		
821725-901	ZORBAX RRHD Eclipse Plus C18, 2.1 mm, 1.8 µm, 1200 bar, UHPLC guard, 3/pk	3 Pack	$686.00		
959758-902	ZORBAX RRHD Eclipse Plus C18, 2.1 x 100 mm, 1.8 µm, 1200 bar	1 Each	$888.00		
5004-0006	InfinityLab PFC-free HPLC Conversion Kit	1 Kit	$3,490.00		
5062-8100	InfinityLab PFC Delay Column, 4.6 x 30 mm	1 Each	$829.00		
5067-5957	InfinityLab Quick Connect Fitting assembly with pre-fixed 0.12 x 105mm capillary	1 Each	$361.00		
5067-6166	InfinityLab Quick Connect Fitting assembly with pre-fixed 0.17 x 105mm capillary	1 Each	$359.00		
5067-5966	InfinityLab Quick Turn LC fitting	1 Each	$144.00		
5500-1191	Quick Turn capillary stainless steel 0.12 x 280 mm	1 Each	$50.66		

1 2

ADD TO CART

PFAS_EPA 1633 — EMAIL | PRINT | DELETE

Enter part number — ADD TO LIST

PART NUMBER	DESCRIPTION	UNIT	LIST PRICE	YOUR PRICE	QTY
5610-2150	Bond Elut PFAS WAX, 150 mg, 6 mL, 30/pk	30 Pack	$204.00		
5610-2093	Carbon S Bulk, 25 g	1 Bottle	$302.00		
8500-1572	Glass wool, silane-trated, 50 g, for gas chromatography	1 Bottle	$180.00		
12131001	Adapter cap for 1, 3 and 6 mL Bond Elut cartridges, 15/pk	15 Pack	$98.83		
12131012	Empty SPE cartridge, 60 mL, 100/pk	100 Pack	$174.00		
12131042	Reservoir, 140 mL, 25/pk	25	$332.00		
12234520	Vac Elut 20 Stopcock valve, 20/pk	20 Pack	$175.00		
5610-2039	Centrifuge tubes and caps, 15 mL, 50/pk	50 Pack	$39.49		

Login to your Agilent account (or create an account for first-time users) to see all your Favorite Product lists.

PFAS Analysis – Sample Preparation Products

Bond Elut PFAS WAX SPE

Property	Specification
Base Polymer	Poly(styrene-co-divinylbenzene) (PSDVB)
Functionalized	Diamino ligand
Chemistry	Weak anion exchange (WAX) and hydrophobic retention
WAX pKa	> 8
Particle size	45 µm

Part Number	Description
5610-2150	Bond Elut PFAS WAX, 150 mg, 6 mL, 30/pk
5610-2151	Bond Elut PFAS WAX, 200 mg, 6 mL, 30/pk
5610-2152	Bond Elut PFAS WAX, 500 mg, 6 mL, 30/pk

Bond Elut PFAS WAX

Specifically designed, developed and manufactured for PFAS applications

- Cleanliness
- Sorbent and cartridge formats compatible with all existing regulated methods
  - EPA method 533 for drinking water
  - EPA method 1633 (draft) for aqueous, solids, biosolids, and tissue samples
  - ISO 21675:2019 for drinking water, sea water, fresh water, and wastewater
- Performance equivalent to other commercial cartridges
- Fits into Agilent's existing PFAS workflows

Bond Elut PFAS WAX - Certificate of Analysis (CoA)

Agilent Product Name: Bond Elut PFAS WAX, 150 mg, 6 mL, 30/pk
Agilent Part Number: 5610-2150
FG Lot Number: 6678914-01
Media Lot Number: 0006678914

Raw Materials

Component Properties			
Properties	**Specifications**	**Results**	**Methods**
Tube Purity	Proprietary	Pass	GC FID Test
Frit Purity	Proprietary	Pass	HPLC QQQ Test

Product Specifications/Analysis

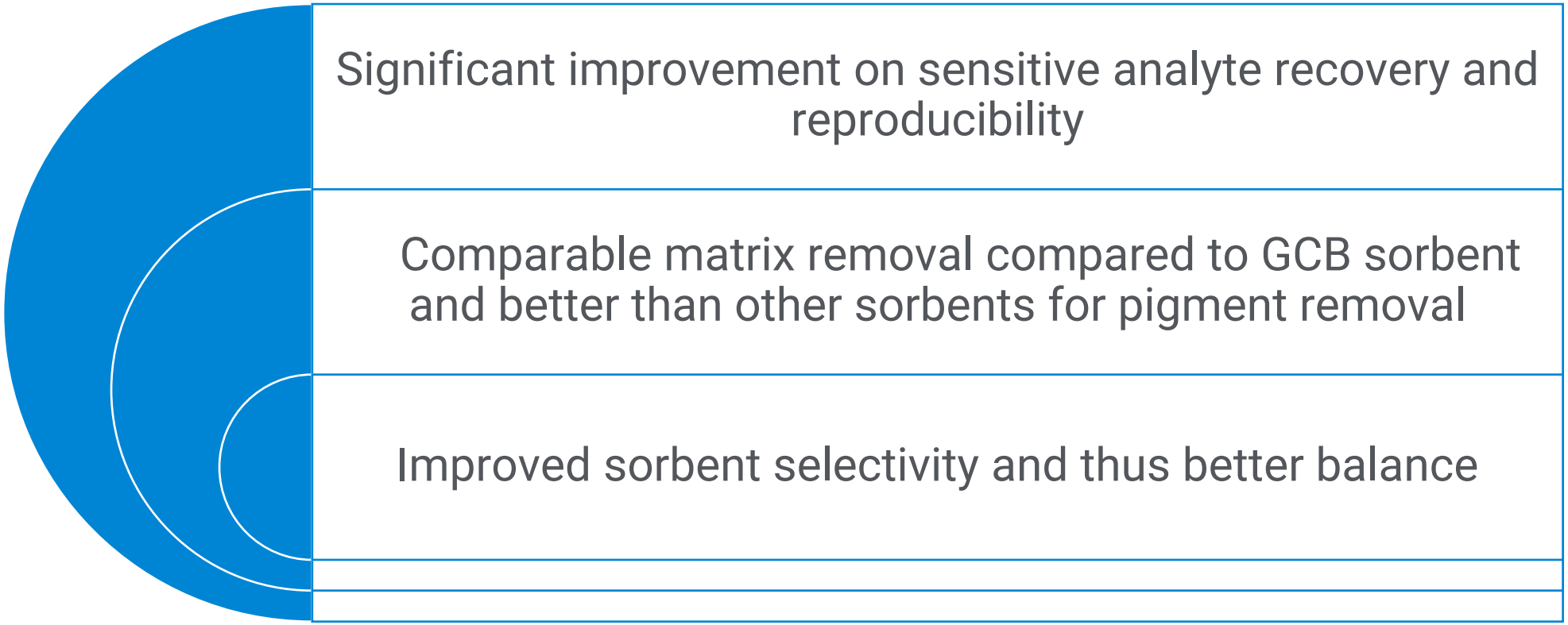
Polymeric Sorbent Properties			
Properties	**Specifications**	**Results**	**Methods**
Nitrogen Loading (%N)	1.6-2.1	1.9	CHNO-S Analysis
Average Particle Size D50(µm)	40.0-55.0	46.2	Laser Diffraction
Average Pore Diameter (Å)	50.0-250.0	157.5	Nitrogen Adsorption Isotherm
Turbidity (NTU)	≤7.0	0.5	Turbidity meter
Washable Residue (mg/g)	≤1.0	0.1	Methanol and Hexane gravimetric
Ion Exchange Capacity (meq/g)	0.40-0.82	0.63	Counter Ion Titration
Cleanliness Test	Proprietary	Pass	GC FID Test
Bed Mass Consistency	Proprietary	Pass	Weight Measurement
Flow Characteristics	Proprietary	Pass	Air Flow Test
PFAS Recovery	Proprietary	Pass	HPLC QQQ Test
PFAS Cleanliness	Proprietary	Pass	HPLC QQQ Test

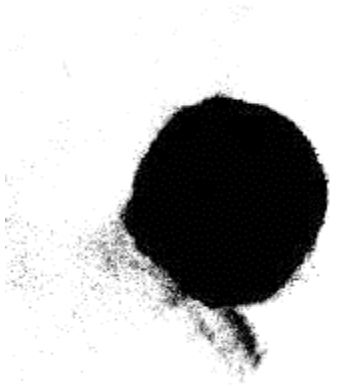
Visual and Microscopic Properties

Properties	Description
Color	White to Buff
Form and Appearance	Spherical, Free Flowing Beads

Carbon S Sorbent

Agilent Carbon S sorbent is an *advanced hybrid carbon material* with **optimized carbon content and pore structure** as a replacement for Graphitized Carbon Black (GCB)





Carbon S sorbent

Optimize your Sample Preparation Workflow for PFAS Analysis

Focus on EPA method 1633

Matthew Giardina, Ph.D.
Applications Chemist

Agilent Technologies, Inc.

Purpose

- Performance of the Bond Elut PFAS WAX SPE cartridges for PFAS extractions
- Analysis of PFAS in wastewater following EPA 1633 for aqueous samples
- Analysis of PFAS in soils following EPA 1633 for solid samples

Solid Phase Extraction – Bond Elut PFAS WAX

Performance evaluation

- Target compound – broad range of compounds
- Cleanliness - importance of low PFAS residue cartridges
- Recovery accuracy and precision – benchmark comparison

Bond Elut PFAS WAX - Target Compounds

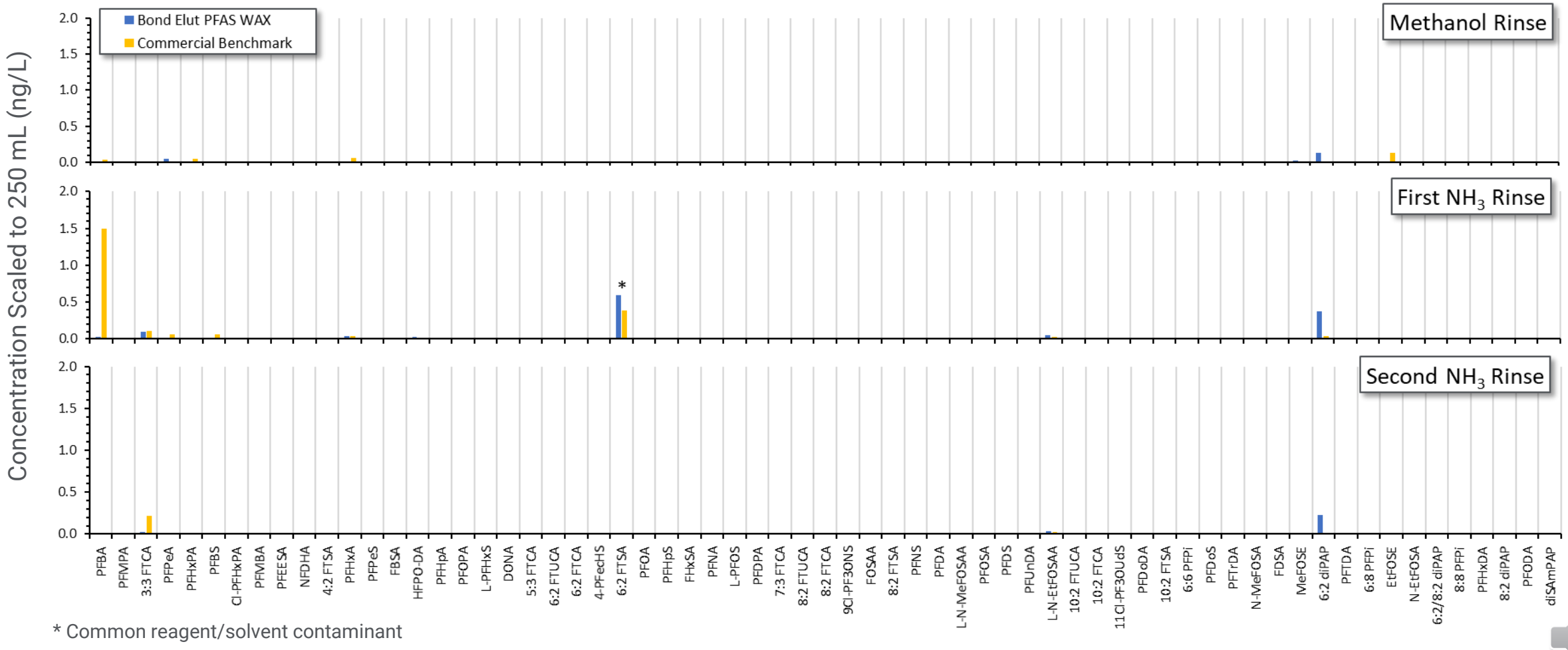
48 compounds across multiple methods + 17 additional compounds (65 total)

Acronym	ASTM D7968	EPA 537.1	ASTM D7979	EPA 8327	EPA 533	ISO 21675	EPA 1633	Added
PFBA	X		X	X	X	X	X	
PFPeA	X		X	X	X	X	X	
PFHxA	X	X	X	X	X	X	X	
PFHpA	X	X	X	X	X	X	X	
PFOA	X	X	X	X	X	X	X	
PFNA	X	X	X	X	X	X	X	
PFDA	X	X	X	X	X	X	X	
PFUnDA	X	X	X	X	X	X	X	
PFDoDA	X	X	X	X	X	X	X	
PFTrDA	X	X	X	X		X	X	
PFTDA	X	X	X	X		X	X	
PFHxDA						X		
PFODA						X		
PFBS	X	X	X	X	X	X	X	
PFPeS				X	X		X	
PFHxS	X	X	X	X	X	X	X	
PFHpS				X	X	X	X	
PFOS	X	X	X	X	X	X	X	
PFNS				X			X	
PFDS				X		X	X	
PFDoS							X	
4-PFecHS	X		X					
HFPO-DA		X			X	X	X	
DONA		X			X	X	X	
PFMPA					X		X	
NFDHA					X		X	
PFMBA					X		X	
6:2 FTCA	X		X					
8:2 FTCA	X		X					
10:2 FTCA	X		X					
3:3 FTCA	X						X	
5:3 FTCA	X		X				X	
7:3 FTCA	X		X				X	
6:2 FTUCA								X

Acronym	ASTM D7968	EPA 537.1	ASTM D7979	EPA 8327	EPA 533	ISO 21675	EPA 1633	Added
8:2 FTUCA			X			X		
10:2 FTUCA								X
PFHxPA								X
PFOPA								X
PFDPA								X
Cl-PFHxPA								X
6:2 diPAP								X
6:2/8:2 diPAP								X
8:2 diPAP						X		
PFEESA					X		X	
9Cl-PF3ONS		X			X	X	X	
11Cl-PF3OUdS		X			X		X	
4:2 FTSA				X	X		X	
6:2 FTSA				X	X	X	X	
8:2 FTSA				X	X	X	X	
10:2 FTSA								X
FBSA								X
FHxSA								X
PFOSA				X		X	X	
FDSA								X
N-MeFOSA						X	X	
N-EtFOSA						X	X	
FOSAA								X
N-MeFOSAA		X		X		X	X	
N-EtFOSAA		X		X		X	X	
MeFOSE							X	
EtFOSE							X	
6:6 PFPi								X
6:8 PFPi								X
8:8 PFPi								X
diSAmPAP								X
Total: 65	21 (2017)	18 (2018)	21 (2019)	24 (2019)	25 (2019)	30 (2019)	40 (2021)	17

Bond Elut PFAS WAX - Targeted Blank Results

- External calibration (no internal standard correction)
- Estimated concentrations scaled to 250 mL sample volume
- Most concentration extrapolated between zero and lowest calibrant, background subtracted

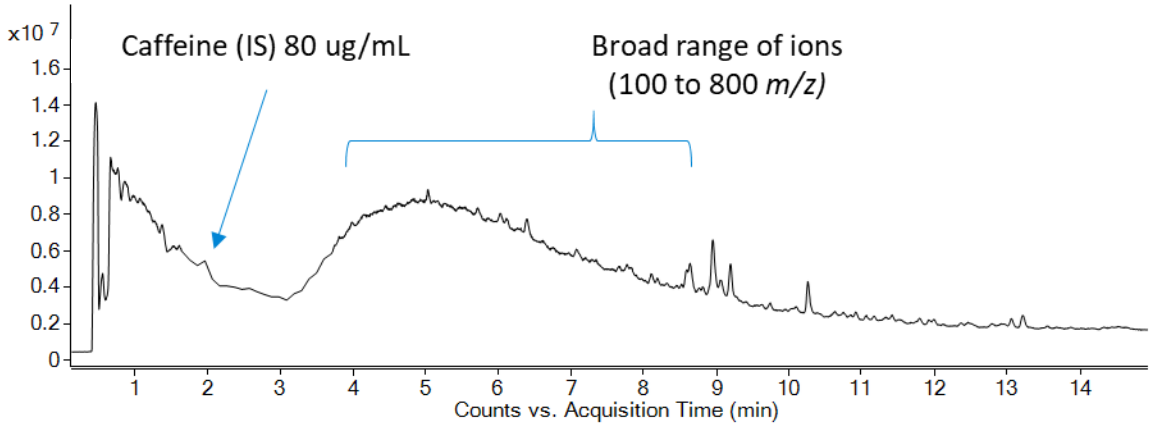


* Common reagent/solvent contaminant

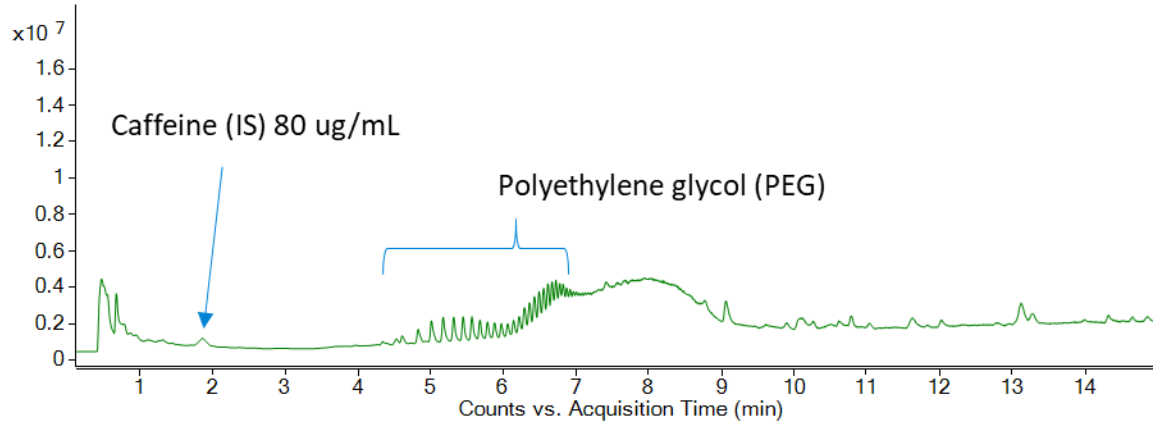
Bond Elut PFAS WAX - Untargeted Blank Results

Comparison to other commercial sorbents (positive ion mode)

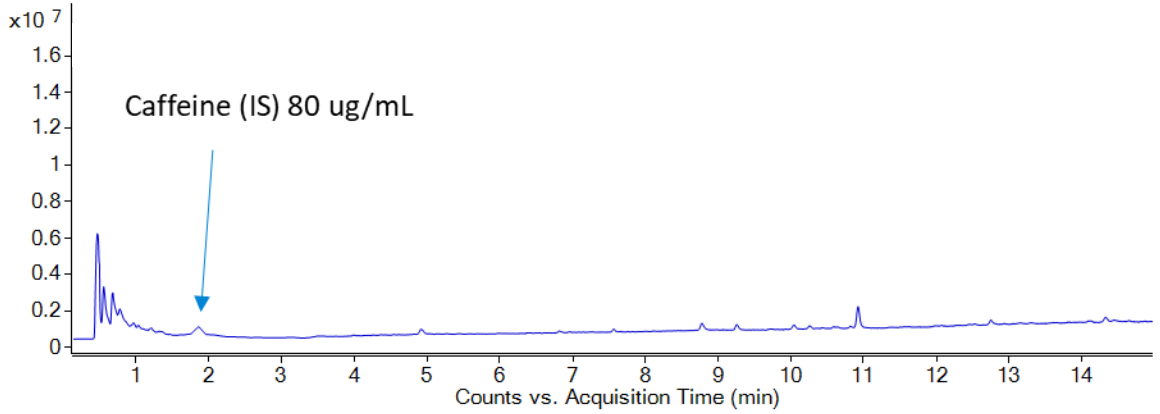
Benchmark Cartridge A



Benchmark Cartridge B

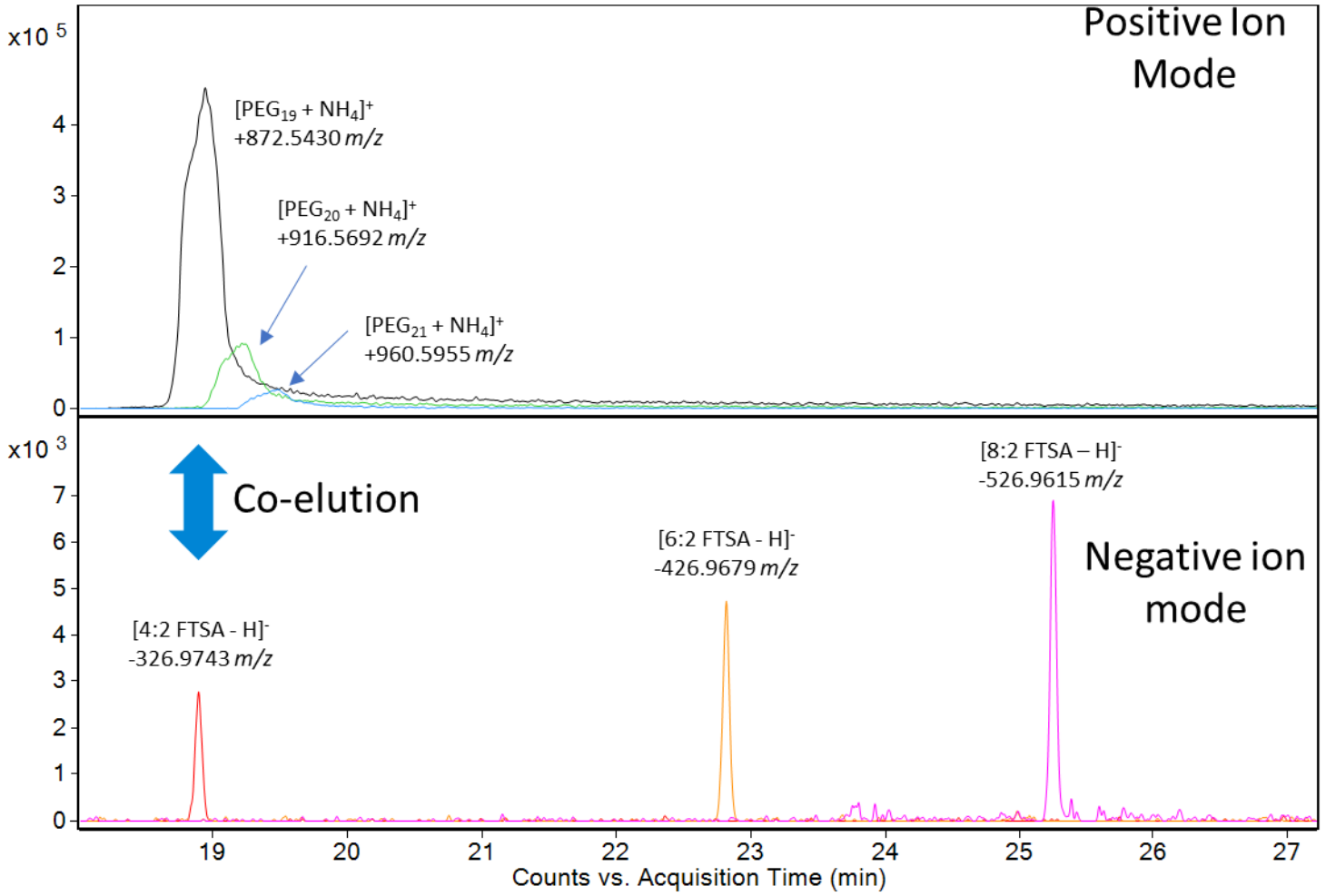


Bond Elut PFAS WAX



Bond Elut PFAS WAX - Untargeted Blank Results

Co-elution with PEG – matrix ionization enhancement

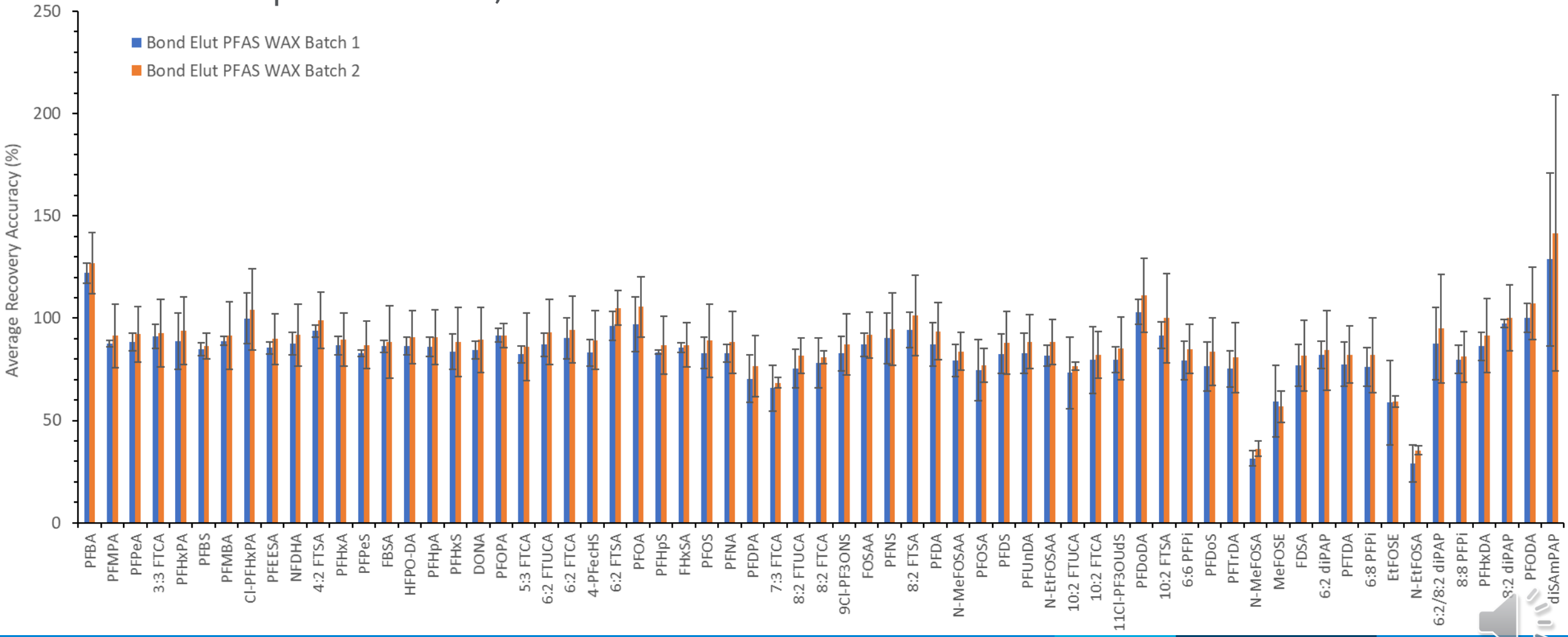


Calculated concentration/recovery

Compound	Calculated concentration (ng/L)	Actual concentration (ng/L)	Recovery (%)
4:2 FTSA	760	500	152
6:2 FTSA	496	500	99
8:2 FTSA	464	500	93

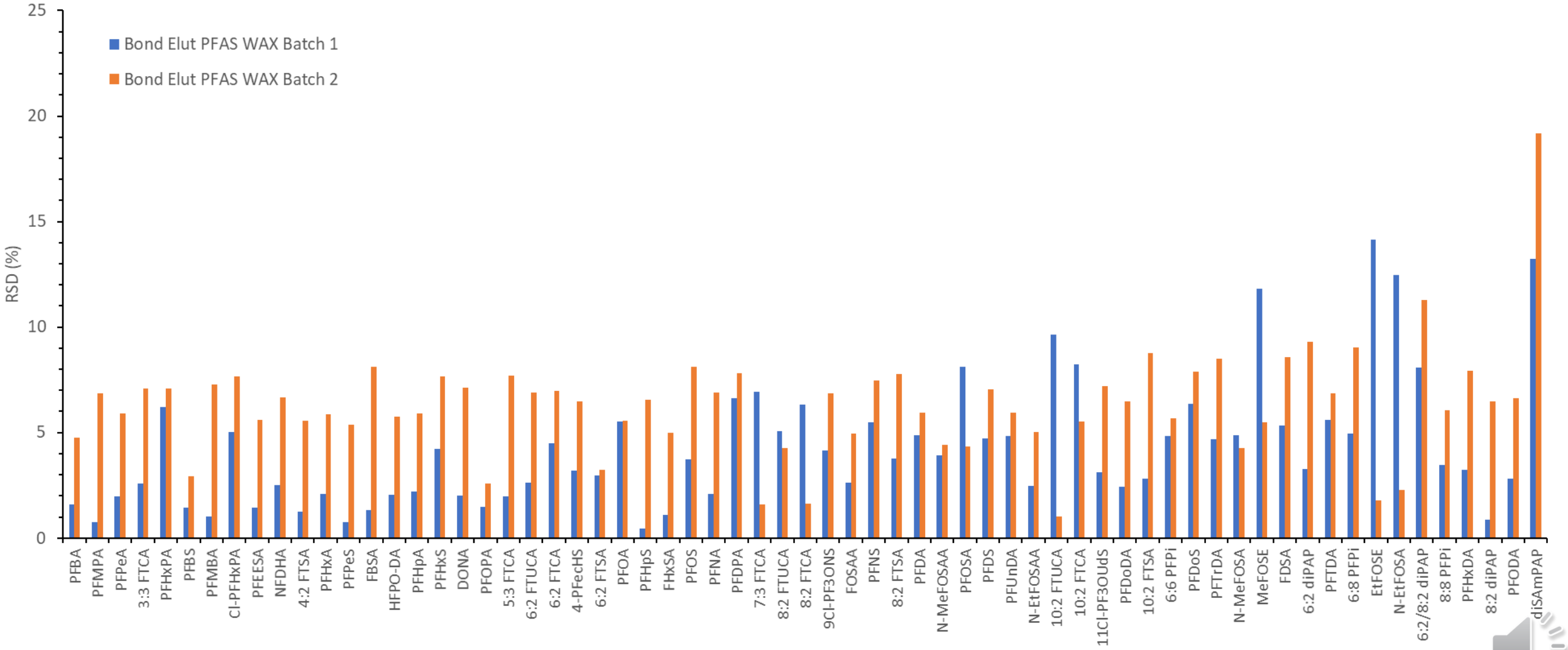
Bond Elut PFAS WAX - Recovery Results - Accuracy

- Mid-level spike at ranging from 20 to 200 ng/L in 250 mL reagent water
- External calibration (no internal standard correction)
- Error bars represent 95% CI, N=3



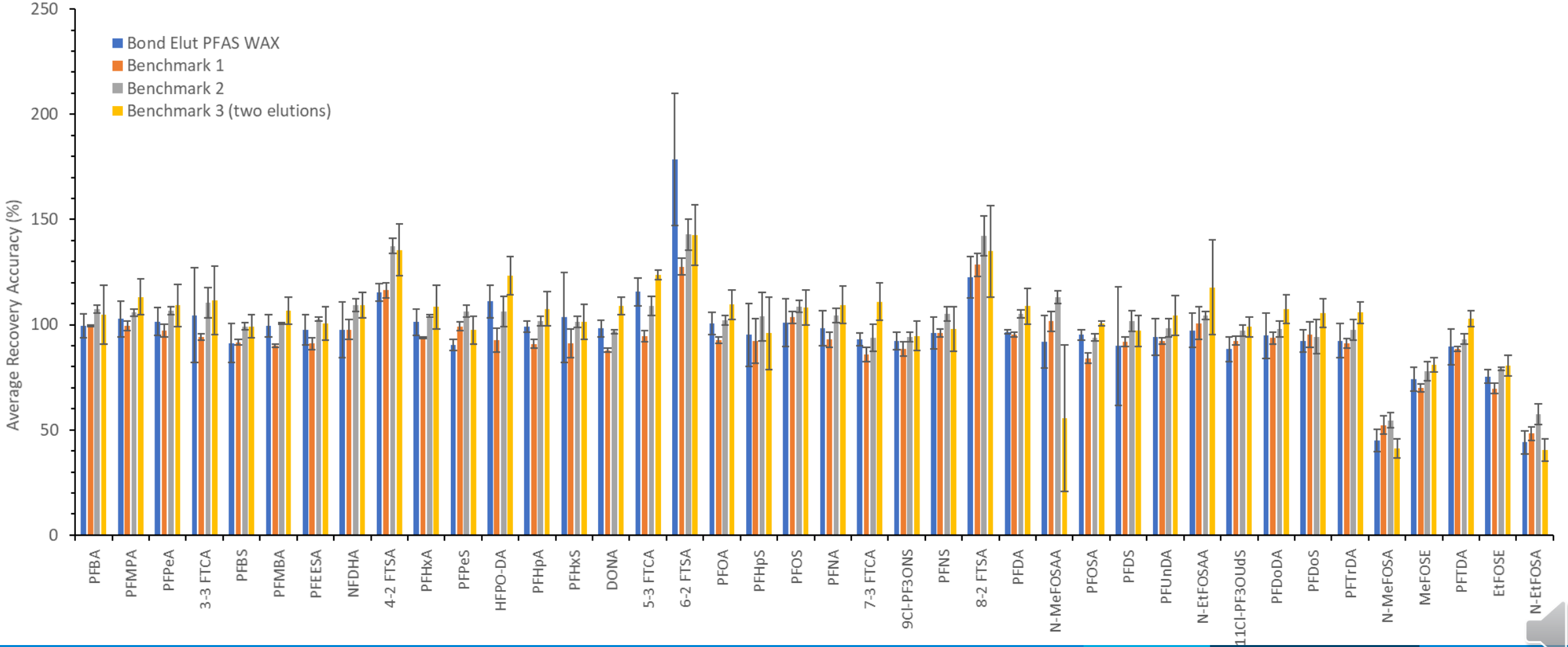
Bond Elut PFAS WAX - Recovery Results - Precision

- Mid-level spike at ranging from 20 to 200 ng/L in 250 mL reagent water
- External calibration (no internal standard correction)



Bond Elut PFAS WAX – Benchmark Comparison (EPA 1633 Targets)

- Mid-level spike at ranging from 20 to 200 ng/L in 250 mL reagent water
- External calibration (no internal standard correction)
- Error bars represent 95% CI, N=3



Application – EPA Method 1633 for Aqueous Wastewater

Experimental

- Follow EPA method 1633 for aqueous matrices
  - Wastewater
- Targets
  - 40 EPA method 1633 targets
- Quantitation
  - Co-extracted isotopically labeled internal standards
- Spike levels (500 mL)
  - Low level spike (MDL) – 0.5 to 12.5 ng/L
  - High level spike (P&A) – 25 to 500 ng/L
- Test samples
  - Wastewater effluent grab samples

Extraction Method – Aqueous Matrix

Sample Preparation
- Aqueous sample size: 500 mL in HDPE bottles
- No preservative
- Add EIS directly into sample bottles – swirl to mix
- Check pH is 6.0 – 7.0

Extraction Setup
- Clean silanized glass wool packed to half height of **Agilent Bond Elut PFAS WAX SPE cartridge**
- Adapters and large volume reservoirs in place

Condition SPE
- 15 mL - 1% ammonium in methanol
- 5 mL – 0.3M formic acid

Load Sample
- Pour samples into reservoir
- Pass through cartridge at 5 mL/min

Rinse Reservoir
- 2 x 5 mL reagent water
- 5 mL 1:1 0.1M formic acid/Methanol
- Dry under vacuum for 15 seconds

Elution
- Rinse sample bottle with 5 mL 1% methanolic ammonium hydroxide
- Transfer to SPE cartridge

Carbon Cleanup
- Add 25 uL concentrated acetic acid to each sample eluate & vortex
- Add 10 mg **Carbon S** to each sample
- Hand-shake for < 5 minutes then vortex for 30 seconds
- Centrifuge for 10 minutes at 2800 rpm

Internal Standard
- Add NIS to a clean collection tube

Filter
- Install a **Captiva Premium Nylon Syringe Filter** on a 5 mL polypropylene syringe
- Decant sample supernatant into syringe barrel
- Filter entire extract into NIS collection tube and vortex

Analysis
- Transfer an aliquot into a poly ALS vial for LCTQ analysis
- Store remaining at 0-4 °C

Initial Method Detection Limit Determination – Aqueous Matrix

- Following 40 CFR Part 136, Appendix B
- Seven replicates in reagent water

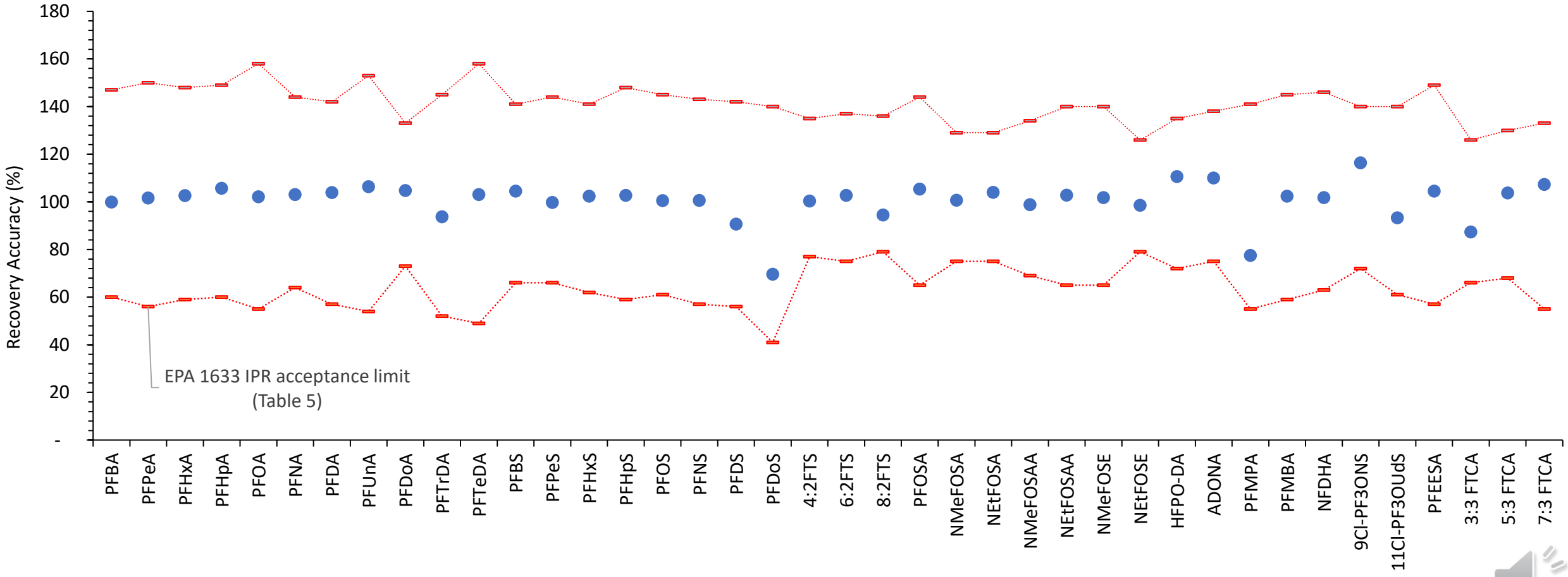
Analyte	Bond Elut PFAS WAX Initial MDL (ng/L)	EPA 1633 Aq. MDL (ng/L)*
PFBA	0.38	0.80
PFPeA	0.71	0.53
PFHxA	0.09	0.48
PFHpA	0.19	0.39
PFOA	0.23	0.55
PFNA	0.15	0.46
PFDA	0.15	0.53
PFUnA	0.13	0.44
PFDoA	0.29	0.37
PFTrDA	0.33	0.46
PFTeDA	0.38	0.51
PFBS	0.12	0.37
PFPeS	0.15	0.53
PFHxS	0.26	0.56
PFHpS	0.21	0.87
PFOS	0.39	0.64
PFNS	0.15	0.49
PFDS	0.23	0.90
PFDoS	0.44	0.64
4:2FTS	0.43	1.74

Analyte	Bond Elut PFAS WAX Initial MDL (ng/L)	EPA 1633 Aq. MDL (ng/L)*
6:2FTS	0.58	2.52
8:2FTS	0.84	2.58
PFOSA	0.20	0.32
NMeFOSA	0.09	0.41
NEtFOSA	0.17	0.43
NMeFOSAA	0.27	1.04
NEtFOSAA	0.34	0.80
NMeFOSE	1.41	3.93
NEtFOSE	1.97	5.13
HFPO-DA	0.60	1.54
ADONA	0.26	1.47
PFMPA	0.36	0.54
PFMBA	0.13	0.53
NFDHA	0.38	1.92
9Cl-PF3ONS	0.52	1.42
11Cl-PF3OUdS	1.38	1.78
PFEESA	0.26	0.79
3:3 FTCA	0.82	2.54
5:3 FTCA	3.77	9.92
7:3 FTCA	3.27	9.14

* EPA 1633 3rd Draft – Table 6, multi-lab validation results

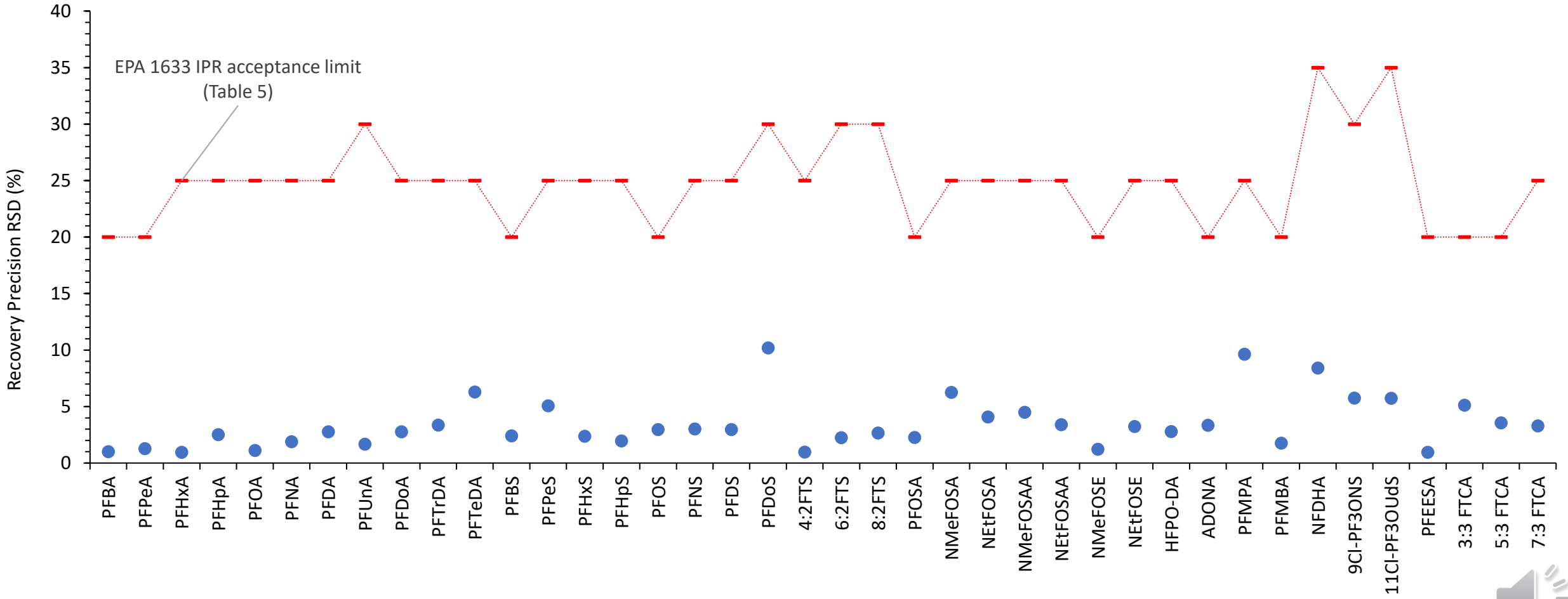
Accuracy – Aqueous Matrix

- Four replicate extractions in reagent water at mid-level concentration
- Average recovery 101% ranging from 69.6 to 116%



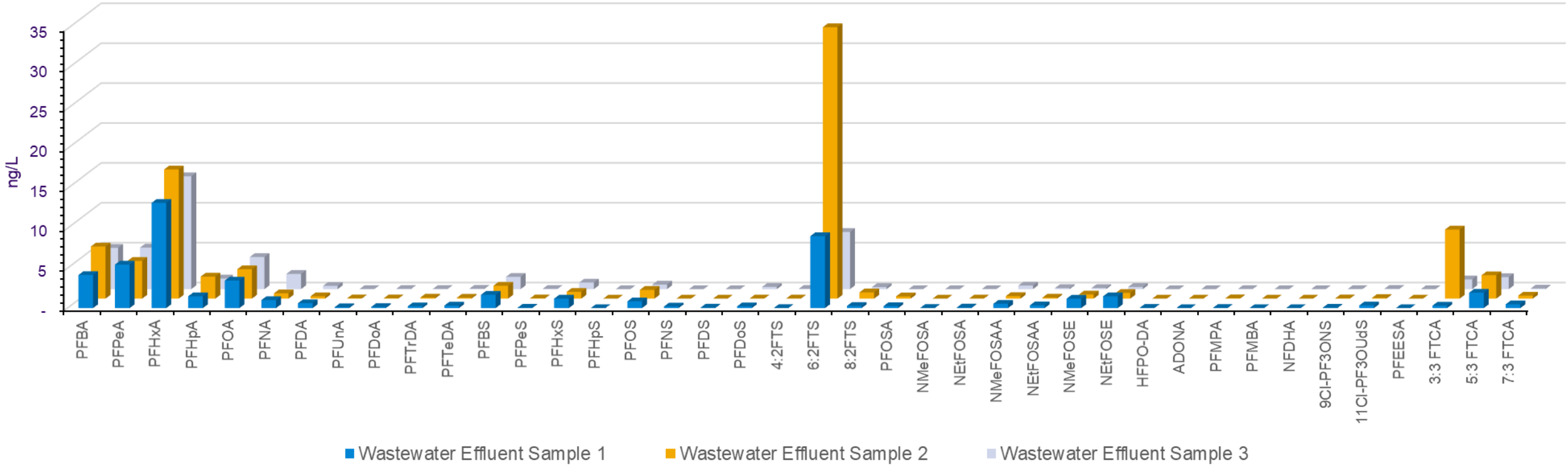
Precision – Aqueous Matrix

- Four replicate extractions in reagent water at mid-level concentration
- Average RSD 3.4% ranging from 0.9 to 10.2%



Wastewater Effluent Samples

- Three unique wastewater effluent grab samples were analyzed
- Perfluoroalkyl carboxylic acids were the most common group of compounds found
- 6:2 FTS was detected in all samples at up to 34 ng/L



Wastewater Effluent Spike Recovery

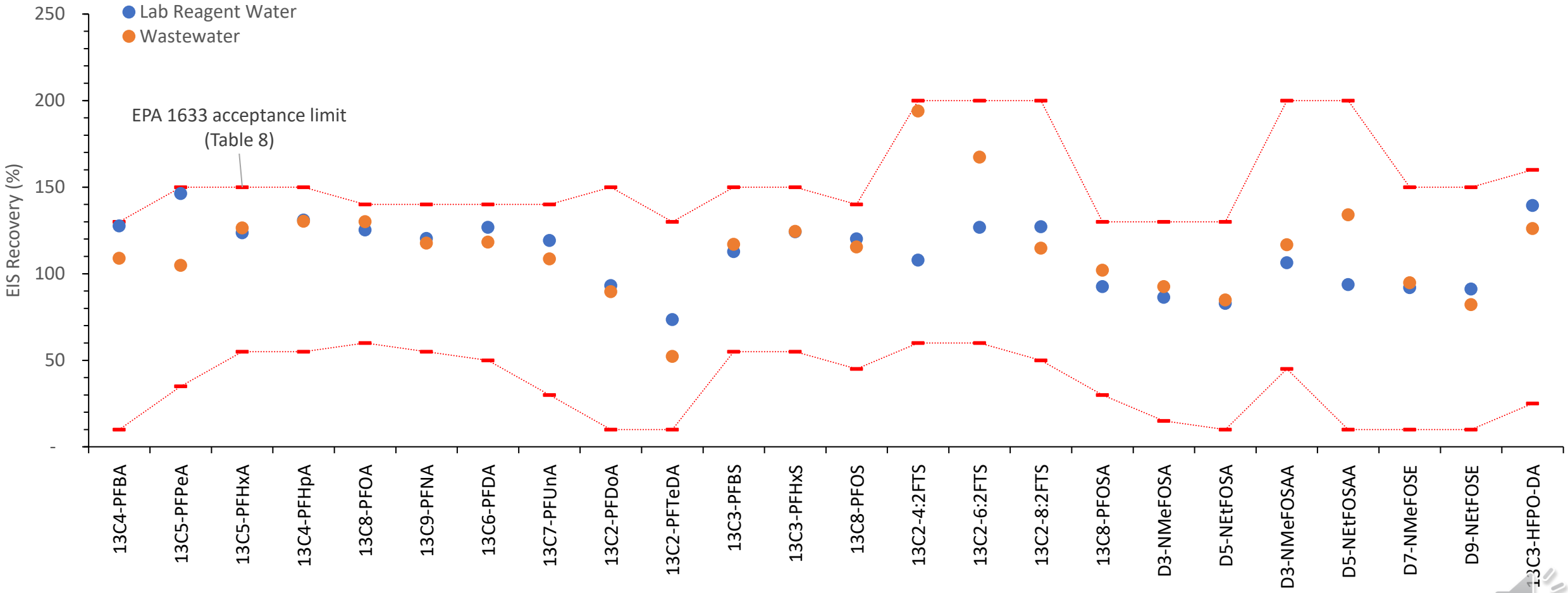
- Three to four replicates of the three wastewater samples were spiked
- Average background levels in unspiked samples were subtracted from spiked

Analyte	Spiked Concentration (ng/L)	Average Accuracy (Recovery)	Low Average Recovery Range	High Average Recovery Range
PFBA	50	91%	86%	99%
PFPeA	25	88%	84%	95%
PFHxA	12.5	93%	85%	103%
PFHpA	12.5	97%	91%	104%
PFOA	12.5	96%	87%	107%
PFNA	12.5	94%	85%	101%
PFDA	12.5	96%	90%	103%
PFUnA	12.5	95%	90%	101%
PFDoA	12.5	92%	87%	95%
PFTrDA	12.5	90%	85%	96%
PFTeDA	12.5	96%	88%	103%
PFBS	12.5	104%	92%	114%
PFPeS	12.5	92%	86%	98%
PFHxS	12.5	91%	88%	94%
PFHpS	12.5	99%	90%	105%
PFOS	12.5	97%	84%	105%
PFNS	12.5	82%	76%	87%
PFDS	12.5	70%	65%	76%
PFDoS	12.5	48%	45%	50%
4:2FTS	50	95%	90%	104%

Analyte	Spiked Concentration (ng/L)	Average Accuracy (Recovery)	Low Average Recovery Range	High Average Recovery Range
6:2FTS	50	95%	92%	99%
8:2FTS	50	89%	77%	105%
PFOSA	12.5	96%	88%	103%
NMeFOSA	12.5	89%	83%	93%
NEtFOSA	12.5	92%	81%	99%
NMeFOSAA	12.5	105%	100%	115%
NEtFOSAA	12.5	96%	92%	103%
NMeFOSE	125	92%	86%	101%
NEtFOSE	125	93%	89%	98%
HFPO-DA	50	109%	90%	120%
ADONA	50	111%	91%	122%
PFMPA	25	103%	95%	111%
PFMBA	25	102%	93%	106%
NFDHA	25	48%	39%	54%
9Cl-PF3ONS	50	100%	82%	109%
11Cl-PF3OUdS	50	74%	61%	84%
PFEESA	25	96%	93%	101%
3:3 FTCA	50	114%	97%	127%
5:3 FTCA	250	153%	136%	169%
7:3 FTCA	250	141%	117%	156%

Extracted Internal Standard (EIS) Recovery

- Three to four replicates of the three wastewater samples were spiked
- Average background levels in unspiked samples were subtracted from spiked



Application – EPA Method 1633 (draft) for Soil

Experimental

- Follow EPA method 1633 for solid matrices
  - Commercial topsoil
- Targets
  - 40 EPA method 1633 targets
- Quantitation
  - Co-extracted isotopically labeled internal standards
- Spike levels (5 g)
  - Low level spike (MDL) – 0.2 to 4 ng/g
  - Mid level spike (P&A) – 2 to 40 ng/g

Experimental – Solid Matrices

Sample Preparation
- Solid sample size: 5 g in 50 mL centrifuge tube
- Add DI water if needed
- Add EIS directly to sample
- (Spike with targets)

Extraction
- Add 10 mL of 0.3% methanolic ammonium hydroxide to each sample. Vortex, shake table for 30 min, centrifuge 2800 rpm for 10 min and decant into another tube
- Repeat with 15 mL, combine with previous extract
- Repeat with 5 mL, combine with previous extract
- Add 10 mg **Agilent Carbon S** to each extract, shake for 5, centrifuge, decant into another tube
- (Bring volume to 35 mL with water)
- Concentrate extracts at 55 C to 7 mL final volume
- Add 40-50 mL of reagent water and vortex (bring up to volume). Check pH 6.5 +/- 0.5.

Condition SPE
- Clean silanized glass wool packed to half height of **Agilent Bond Elut PFAS WAX SPE (150 mg, 6 mL)** cartridge
- Adapters and large volume reservoirs in place
- 15 mL - 1% methanolic ammonium hydroxide
- 5 mL – 0.3M formic acid

Load Sample
- Pour samples into reservoir
- Pass through cartridge at 5 mL/min

Rinse Reservoir
- 2 x 5 mL reagent water
- 5 mL 1:1 0.1M formic acid/Methanol
- Dry under vacuum for 15 seconds

Internal Standard
- Add NIS to a clean collection tube (15 mL centrifuge tube)

Elution
- Rinse sample bottle with 5 mL 1% methanolic ammonium hydroxide
- Transfer to SPE cartridge
- Collect eluate, adjust pH with acetic acid

Filter
- Install a **Captiva Premium Nylon Syringe Filter** on a 5 mL polypropylene syringe
- Decant sample supernatant into syringe barrel
- Collect filtered sample in polypropylene AS vial

Analysis
- Analyze by LCTQ

Initial Method Detection Limit (MDL) Determination – Solid Matrices

- Following 40 CFR Part 136, Appendix B
- Seven replicates in Ottawa sand

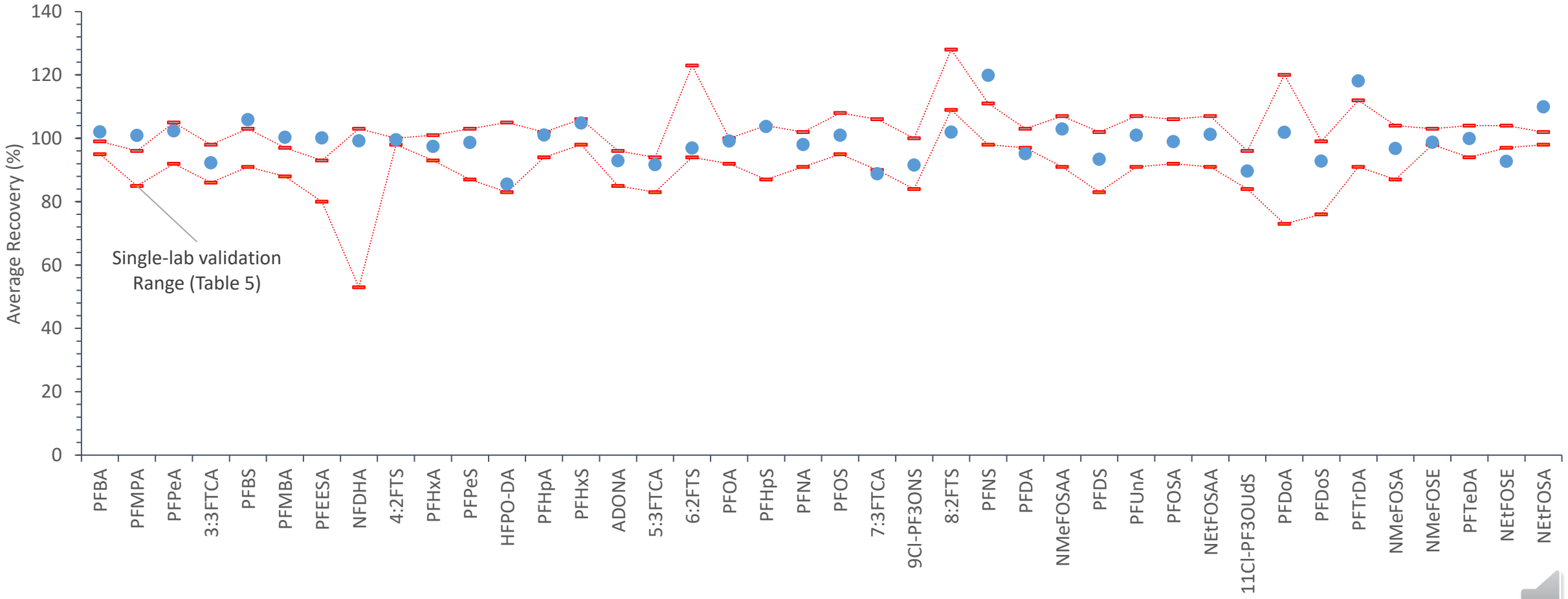
Analyte	Bond Elut PFAS WAX Initial MDL (ng/g)	EPA Draft 1633 Aq. MDL (ng/g)*
PFBA	0.111	0.401
PFPeA	0.022	0.021
PFHxA	0.037	0.020
PFHpA	0.039	0.029
PFOA	0.017	0.037
PFNA	0.021	0.086
PFDA	0.029	0.031
PFUnA	0.023	0.033
PFDoA	0.027	0.059
PFTrDA	0.031	0.038
PFTeDA	0.030	0.032
PFBS	0.034	0.014
PFPeS	0.051	0.015
PFHxS	0.030	0.018
PFHpS	0.050	0.057
PFOS	0.033	0.067
PFNS	0.043	0.046
PFDS	0.040	0.040
PFDoS	0.064	0.038
4:2FTS	0.087	0.282

Analyte	Bond Elut PFAS WAX Initial MDL (ng/g)	EPA Draft 1633 Aq. MDL (ng/g)*
6:2FTS	0.239	0.116
8:2FTS	0.122	0.225
PFOSA	0.061	0.068
NMeFOSA	0.045	0.049
NEtFOSA	0.099	0.038
NMeFOSAA	0.039	0.030
NEtFOSAA	0.029	0.044
NMeFOSE	0.267	0.203
NEtFOSE	0.255	0.203
HFPO-DA	0.194	0.136
ADONA	0.084	0.057
PFMPA	0.040	0.033
PFMBA	0.033	0.029
NFDHA	0.067	0.084
9Cl-PF3ONS	0.020	0.038
11Cl-PF3OUdS	0.058	0.071
PFEESA	0.026	0.018
3:3 FTCA	0.066	0.060
5:3 FTCA	0.101	0.363
7:3 FTCA	0.283	0.308

* EPA 1633 3rd Draft – Table 6, single-lab validation results

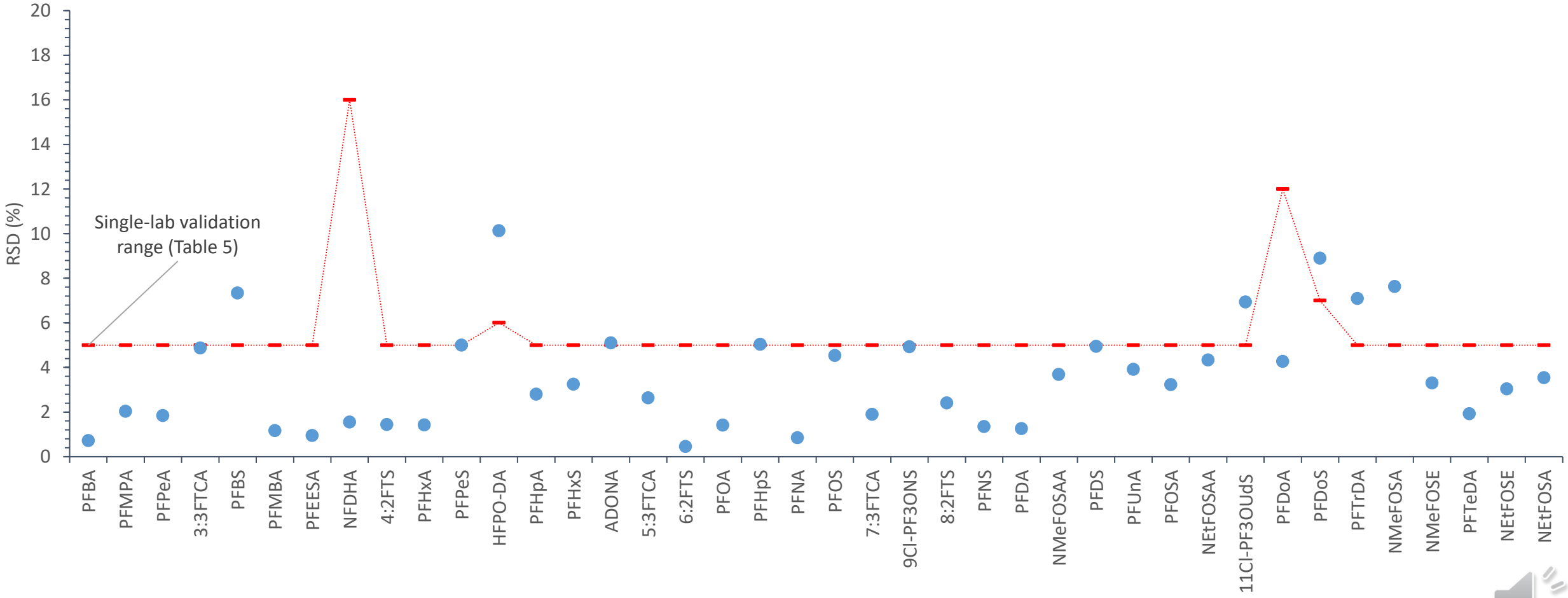
Accuracy – Solid Matrices

- Four replicate extractions in reagent sand at mid-level concentration
- Average recovery 99.8% ranging from 90.4 to 113.6%



Precision – Solid Matrices

- Four replicate extractions in reagent sand at mid-level concentration
- Average RSD 3.5% ranging from 0.05 to 10.1%



Topsoil Samples

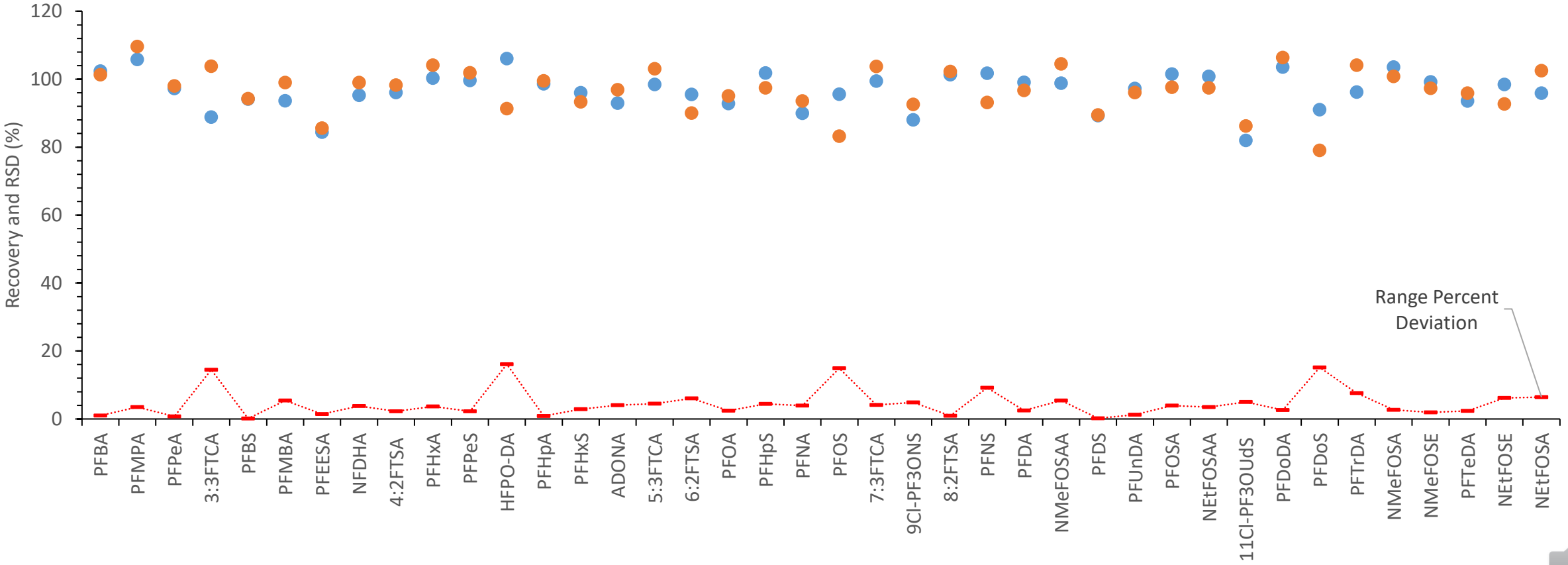
- Two replicate commercial topsoil samples were extracted
- Four compounds above ML 6:2FTS, PFOA, PFNA, and PFOS

Analyte	First Replicate (ng/g)	Second Replicate (ng/g)
PFBA	<ML	<ML
PFMPA	<ML	<ML
PFPeA	<ML	<ML
3:3FTCA	<ML	<ML
PFBS	<ML	<ML
PFMBA	<ML	<ML
PFEESA	<ML	<ML
NFDHA	<ML	<ML
4:2FTS	<ML	<ML
PFHxA	<ML	<ML
PFPeS	<ML	<ML
HFPO-DA	<ML	<ML
PFHpA	<ML	<ML
PFHxS	<ML	<ML
ADONA	<ML	<ML
5:3FTCA	<ML	<ML
6:2FTS	0.914	0.802
PFOA	0.227	0.203
PFHpS	<ML	<ML
PFNA	0.235	0.214

Analyte	First Replicate (ng/g)	Second Replicate (ng/g)
PFOS	0.395	0.325
7:3FTCA	<ML	<ML
9Cl-PF3ONS	<ML	<ML
8:2FTS	<ML	<ML
PFNS	<ML	<ML
PFDA	<ML	<ML
NMeFOSAA	<ML	<ML
PFDS	<ML	<ML
PFUnA	<ML	<ML
PFOSA	<ML	<ML
NEtFOSAA	<ML	<ML
11Cl-PF3OUdS	<ML	<ML
PFDoA	<ML	<ML
PFDoS	<ML	<ML
PFTrDA	<ML	<ML
NMeFOSA	<ML	<ML
NMeFOSE	<ML	<ML
PFTeDA	<ML	<ML
NEtFOSE	<ML	<ML
NEtFOSA	<ML	<ML

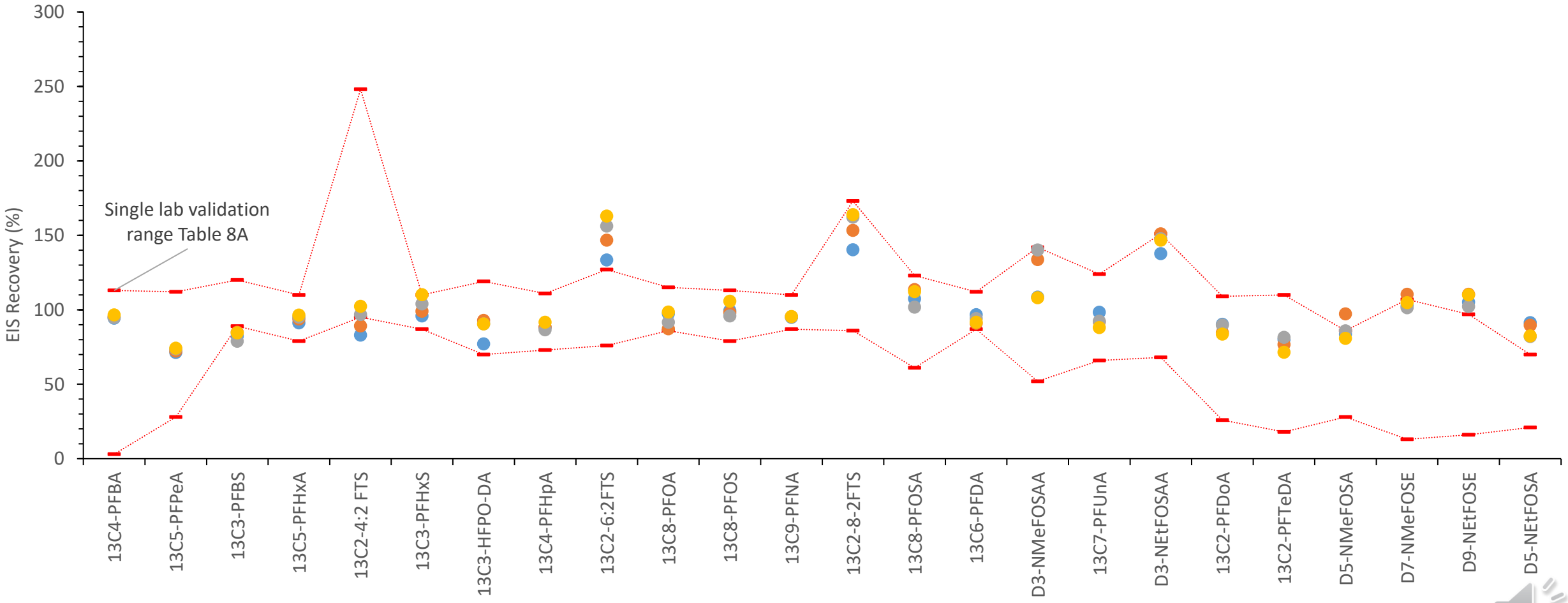
Topsoil Spike Recovery

- Two replicate commercial topsoil samples were spiked at mid-level concentration
- Background levels in unspiked samples were subtracted from spiked
- Average recovery was 96.8% ranging from 79.0 to 109.6%
- Average range deviation was 4.6% ranging from 0.1 to 16.1%



Extracted Internal Standard (EIS) Recovery

- Four replicates replicate topsoil samples spiked with EIS
- Average recovery was 100.9% ranging from 71.3 to 163.9%



Contributions

- Fit for purpose consumables, supplies, hardware and instrumentation are the keys to successful PFAS analysis
- Supplies should have very low residual PFAS contamination and not introduce contamination or interferences during sample processing
- Agilent's Bond Elut PFAS WAX and Carbon S provide outstanding performance for PFAS applications
- For more information, refer to application notes:
  - Analysis of PFAS in Aqueous Samples per EPA Draft Method 1633 Using Agilent Bond Elut PFAS WAX SPE Cartridges (5994-5226EN)
  - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Solid Samples Using Agilent Bond Elut PFAS WAX SPE Cartridges and Agilent Carbon S following EPA Draft Method 1633 (5994-5667EN)
- Contact: matthew_giardina@agilent.com