Collection and extraction of PFAS using styrene-divinylbenzene resin and Accelerated Solvent Extraction (ASE)

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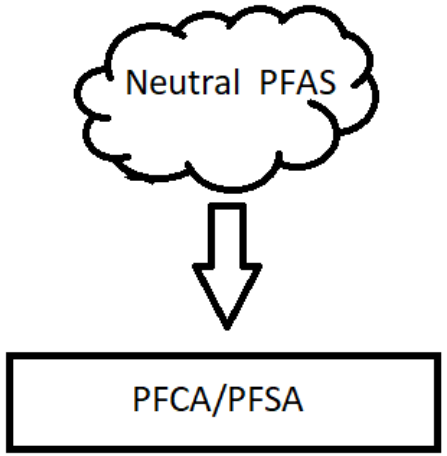
State of Environmental PFAS Analysis

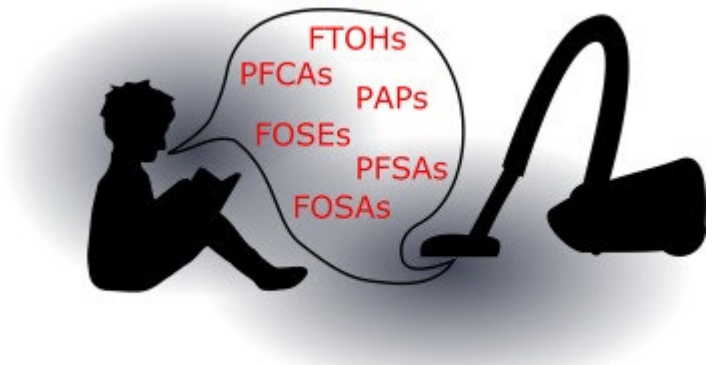
- **Volatile PFAS are present in air**
  - Neutral PFAS such as fluorotelomer alcohols (FTOH), perfluorinated sulfonamides (FOSA) and sulfonamide ethanols (FOSE) are volatile and capable of long-range atmospheric transport
  - Neutral PFAS are precursors to ionic PFAS compounds such as perfluoroalkyl carboxylates (PFCA) and perfluoroalkane sulfonates (PFSA)



Annika Jahnke, Urs Berger, Trace analysis of per- and polyfluorinated alkyl substances in various matrices—How do current methods perform?, Journal of Chromatography A,

State of Environmental PFAS Analysis

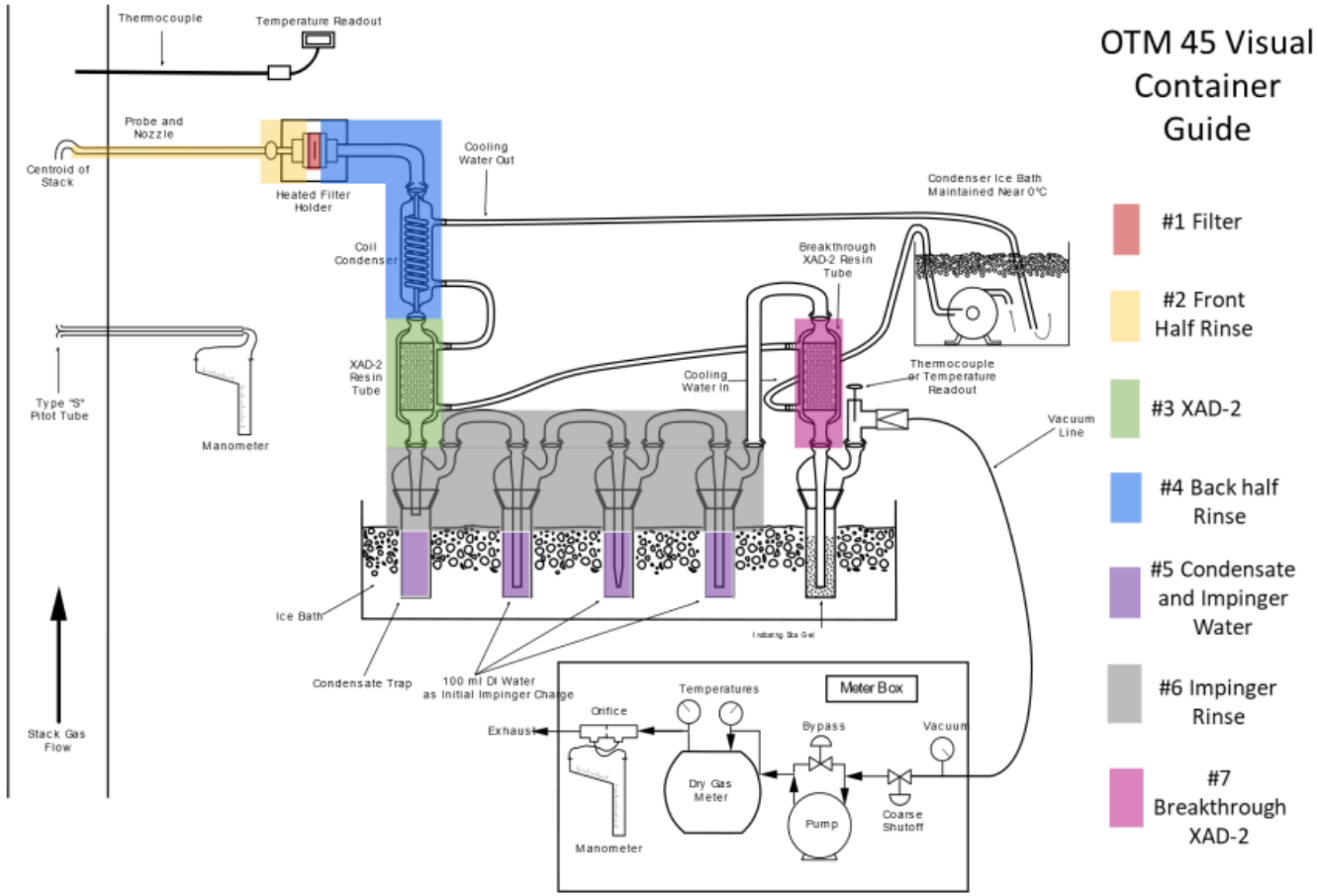
- **PFAS can be present in indoor air**
  - Off gassing of volatile PFAS from consumer products
  - Airborne dust containing PFAS from product wear and tear



Kerstin Winkens et al,Perfluoroalkyl acids and their precursors in floor dust of children's bedrooms – Implications for indoor exposure, Environmental International, Volume 119, 2018, Pages 493-502

Source Air Sampling – OTM-45

- Combines filter, XAD-2, and liquid impingers
- Suitable for C_4 to C_{18} PFAS compounds
- Many different PFAS classes (PFCA, PFSA, FOSA, FOSE, etc.)



OTM-45 – ASE Extraction

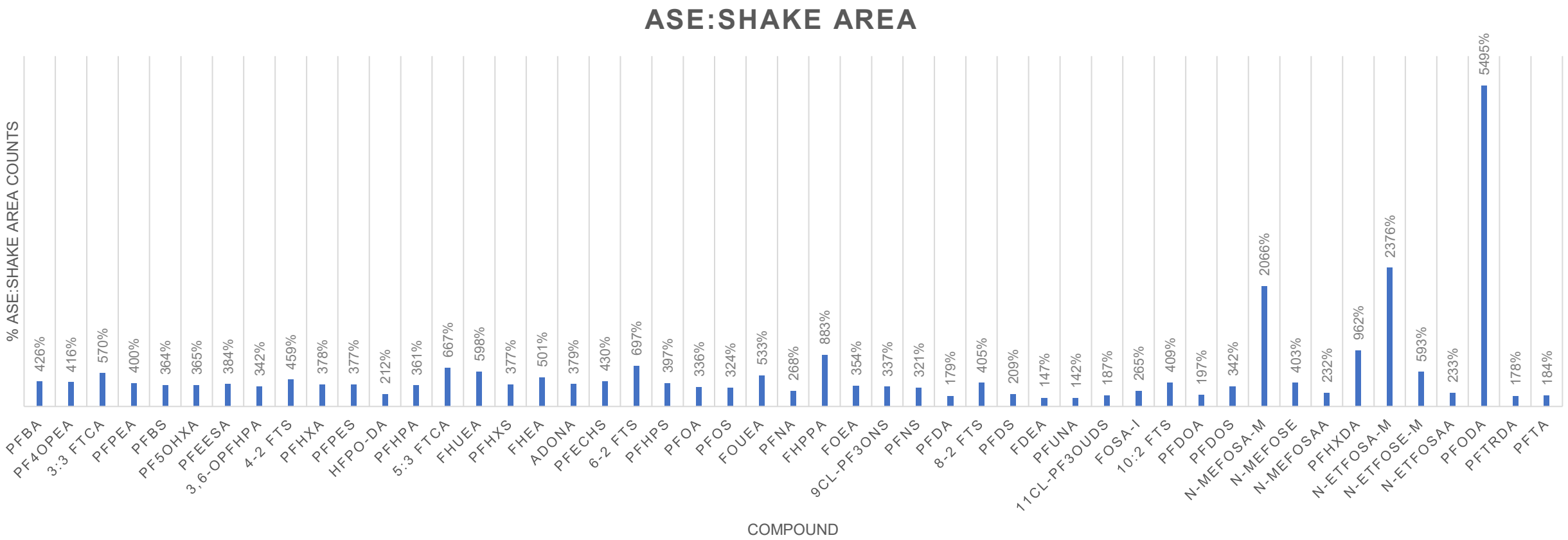
- **OTM-45 sample prep for XAD-2 fraction is two rounds of 16-hour shakeouts using 360 mL total solvent**
  - 32-hour extraction plus time for solvent blowdown

- **Accelerated Solvent Extraction (ASE) advantages**
  - Reduced time – ~45 minutes/sample
  - Reduced solvent use – <100mL solvent/sample
  - Higher extraction efficiency – 1.4 to 55 times more response on ASE

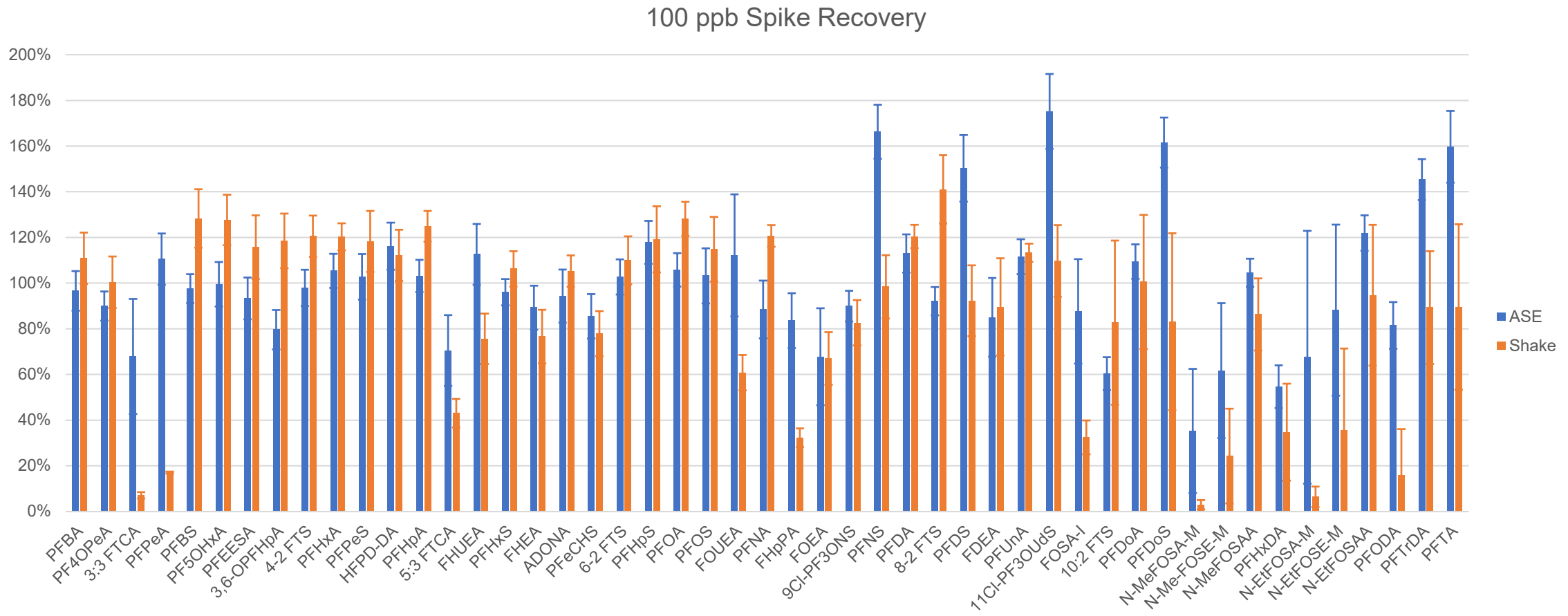
OTM-45 – ASE Extraction

- **Dionex ASE 350 Extraction Parameters**
  - Pressure – 1500 psi
  - Temperature – 120°C
  - Heating time – 6 minutes
  - Static time – 15 minutes
  - Cycles – 2
  - Rinse volume – 60%
  - Solvent – 4:1 Methanol:Acetonitrile

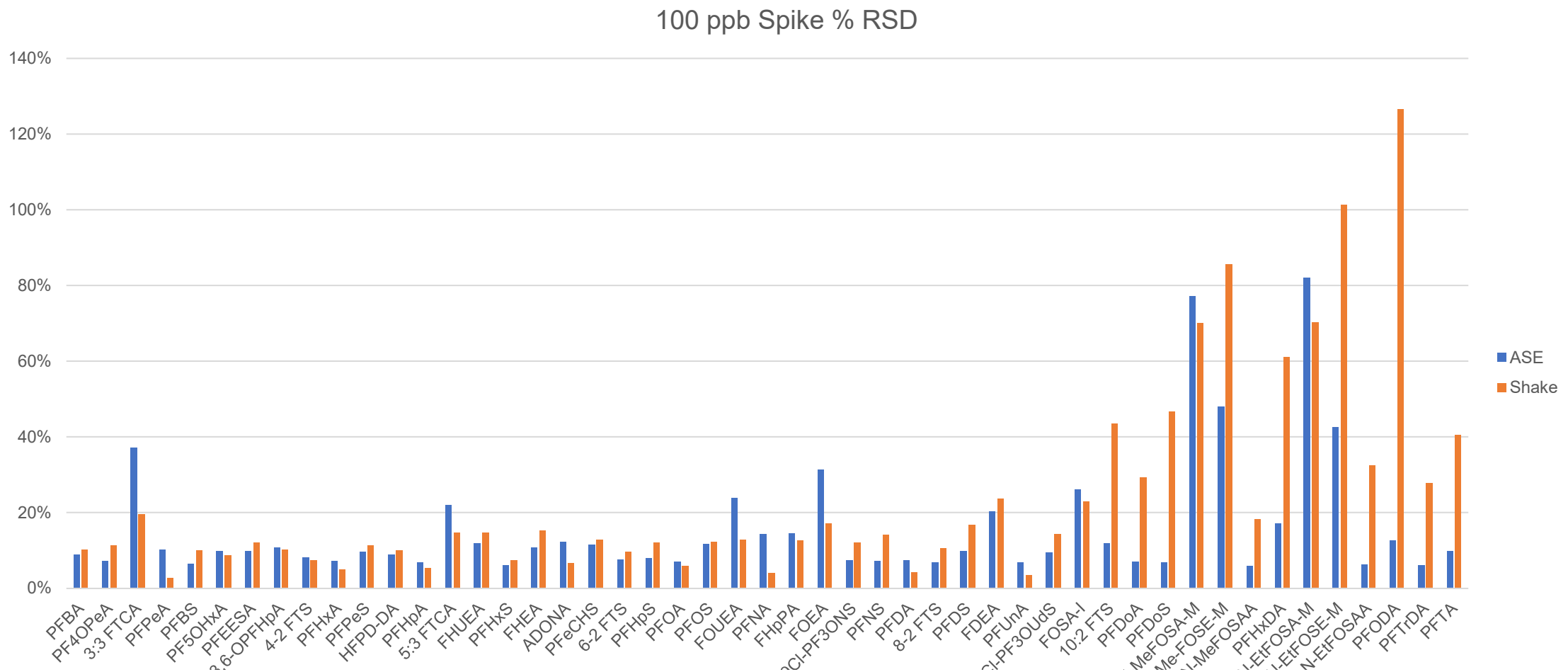
OTM-45 – ASE Extraction Efficiency



OTM-45 – ASE Extraction Accuracy



OTM-45 – ASE Extraction Precision



OTM-45 – ASE Extraction MDL

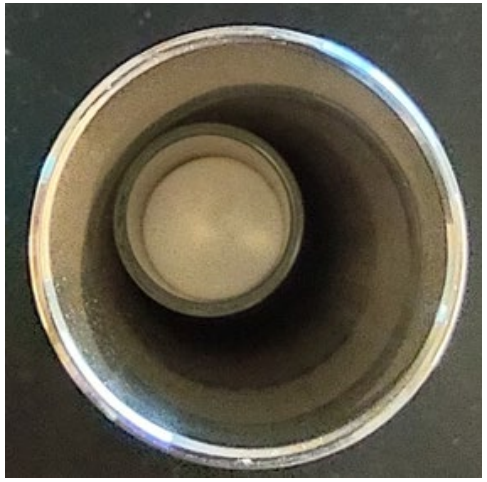
Name	OTM 45 MDL	Restek MDL	Name	OTM 45 MDL	Restek MDL	Name	OTM 45 MDL	Restek MDL
PFBA	2.08	0.06	FHEA		0.09	FDEA		0.07
PF4OPeA		0.02	ADONA	0.14	0.02	PFUnA	0.33	0.08
3:3 FTCA		0.05	PFeCHS		0.03	11Cl-PF3OUdS	0.18	0.04
PFPeA	0.2	0.03	6-2 FTS	0.29	0.02	FOSA-I	0.27	0.13
PFBS	0.17	0.07	PFHpS	0.08	0.03	10:2 FTS		0.04
PF5OHxA		0.01	PFOA	0.43	0.22	PFDoA	0.12	0.10
PFEESA		0.01	PFOS	0.35	0.04	PFDoS		0.06
3,6-OPFHpA		0.02	FOUEA		0.07	N-MeFOSA-M		0.07
4-2 FTS	0.20	0.02	PFNA	0.15	0.06	N-Me-FOSE-M		0.07
PFHxA	0.31	0.02	FHpPA		0.14	N-MeFOSAA	0.4	0.05
PFPeS	0.14	0.02	FOEA		0.18	PFHxDA		0.05
HFPO-DA	2.77	0.22	9Cl-PF3ONS	0.17	0.03	N-EtFOSA-M		0.17
PFHpA	0.21	0.10	PFNS	0.14	0.18	N-EtFOSE-M		0.05
5:3 FTCA		0.07	PFDA	0.13	0.05	N-EtFOSAA	0.39	0.08
FHUEA		0.06	8-2 FTS	0.27	0.07	PFODA		0.05
PFHxS	0.17	0.06	PFDS	0.17	0.32	PFTrDA	0.12	0.8
MDL values in ng/m3 air						PFTA	0.19	0.05

Ambient and Indoor Air Sampling

- Resin sampling from OTM-45 can be adapted to ambient and indoor air
- 8 g of Ultra-Clean Resin was packed into a small volume air sampler
- 20 µm frit to catch particulates
- TD tube used to catch any potential breakthrough compounds

Ambient and Indoor Air Sampling

- Small volume sampler can be fit into a 100 mL ASE cell for cleaning and extraction
- Removes the need to separately clean and extract resin, frits, and glass holder



Questions?

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