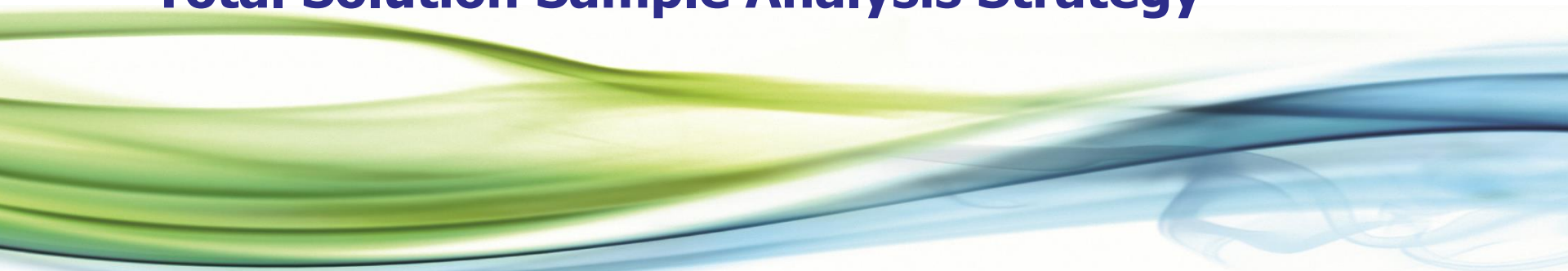


Streamline your Drinking Water Sample Preparation and Analysis

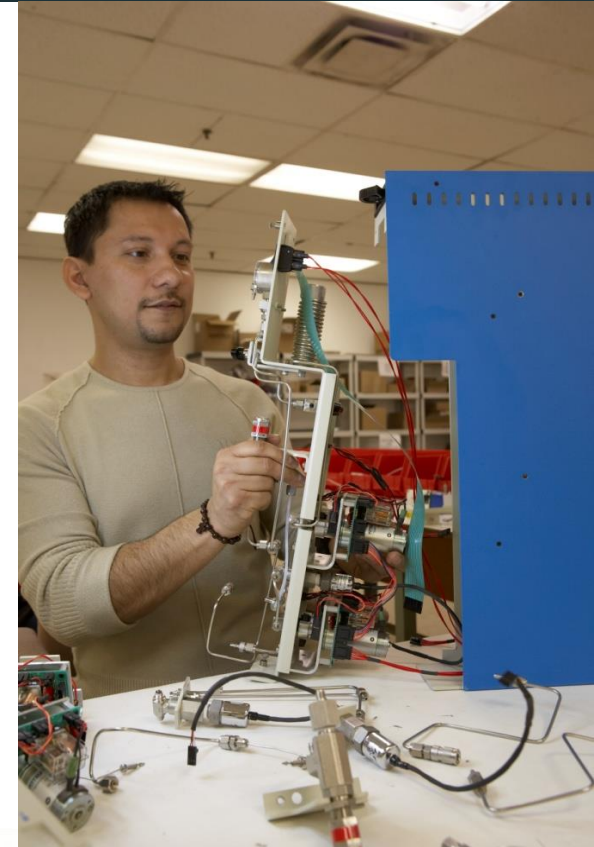


Agenda

- **FMS, Inc. Fluid Management Systems**
 - **Sample Prep vs Analytical Runs in time**
 - **Sample Analysis Workflow**
 - **Sample Prep Workflow**
 - **Total Solution Sample Analysis Strategy**
- 

- **FMS - Fluid Management Systems**
- **Founded in 1986**
- **Manufactures Total Solution Sample Preparation and Consumables for GC, GC/MS, LC and LC/MS**

Made in the USA



Made in the USA

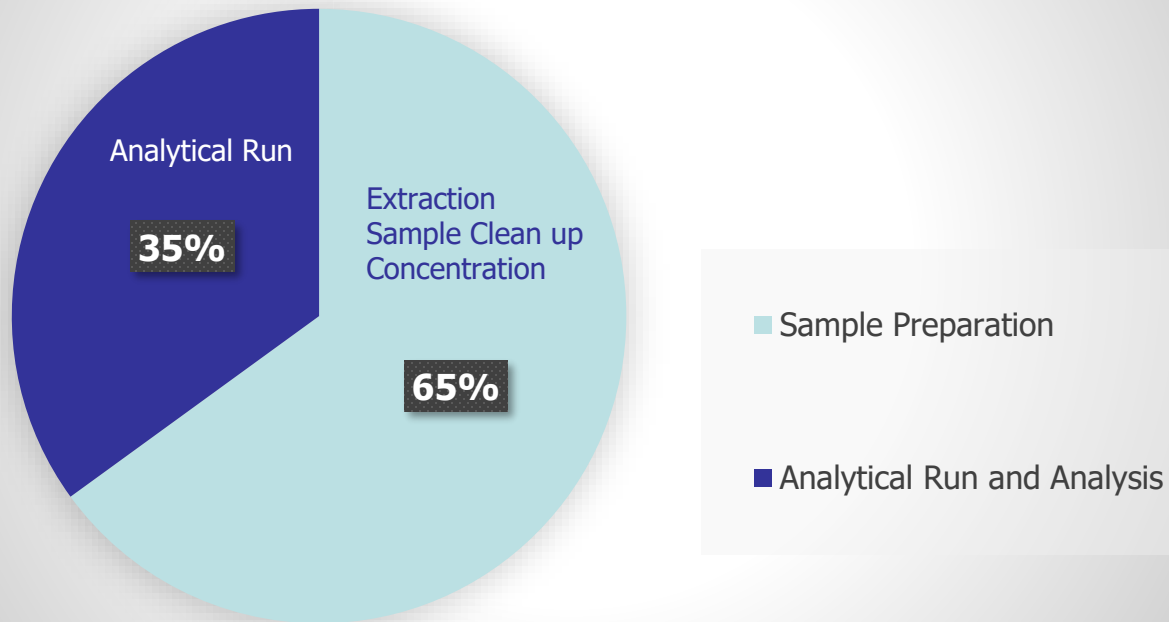


Class 1000 Cleanroom for Consumables Manufacturing



Laboratory Workflow Breakdown

Sample Prep versus Analytical in Time



FMS Sample Preparation Workflow

Sample Preparation consist of three main instruments:

1- Extraction 2- Sample Clean-Up 3- Concentration = Total Prep



**PLE
Extraction**



**Solid Phase
Extraction**

+



**PowerPrep
Sample Cleanup**

+



**SuperVap
Concentration**

=



Total Sample Prep

Solid Phase Extraction front end for GC/MS and LC/MS



EconoTrace®



TurboTrace®



TurboTrace® ABN



TurboTrace® PFC



NanoTrace®



Direct to Vial Concentration

SuperVap® – Concentration System

- 6 Position 250ml Vessel
- 12 Position 50ml Vessel
- 12 Position 20,40,60 ml vial
- 24 Position 2 and 4 ml vial



Automated Concentration for PFAs

- SuperVap PFC
 - 24 positions
 - 15ml Conical vials
 - No Teflon Components



Objective

- **Develop as many SPE procedures for the testing lab using a single extraction platform.**
- **Minimize manual steps to lessen error and maximize limited man hours**
- **High Throughput, Low Cost Sample Prep for Liquids**



Reasons for SPE

- **Reduced solvent**
- **Reduced glassware**
- **Simplified procedures**
- **Automation versus manual protocols =
Reproducibility**



Determining Factors

- **Closed System**
- **Handle Sample Volumes of any size**
- **Ability to load samples**
 - **Positive Pressure**
 - **Positive Pressure or Vacuum**
- **Easily handle a wide variety of cartridge designs and sizes without cumbersome modifications.**

Determining Factors

- **Ability to dry cartridges by both vacuum and positive gas pressure (N₂ or CO₂).**
- **Automated Bottle Rinse**
- **Parallel Extraction**
- **Hyphenate Extraction, Drying and Concentration**



Comparison of LLE/CLE vs. Automated SPE Methods

LLE/CLE

Open to laboratory background

Uses >360mls solvent

Shaking / Continuous process

Forms emulsions requiring centrifuging

Little Selectivity

Requires water removal

Automated SPE

Closed system

Uses <60mls solvent

Filtration process

No emulsions formed

Wide Selectivity (adsorbent)

In-line water removal

Fast and Unattended



Comparison of LLE/CLE vs. Automated SPE Methods

LLE/CLE

No Separation of waste

More volume to evaporate

Massive solvent emission

CLE high electrical costs

Requires lots of solvent for cleaning

Automated SPE

Separates Aqueous and
Organic Waste

<60mls solvent to
evaporate

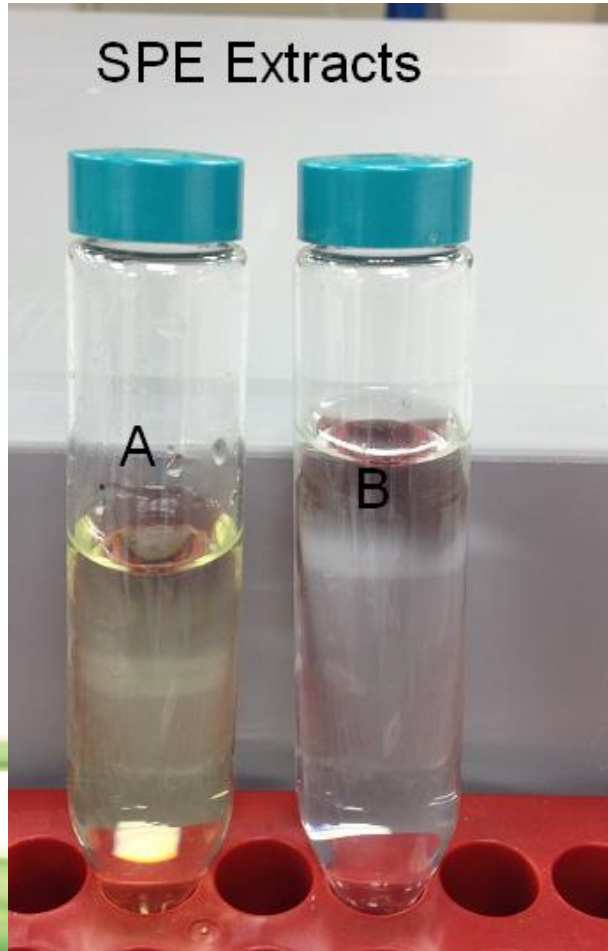
6 times less solvent
emission

Easily Capture Solvent

Lower solvent costs

Lower Disposal Costs

No subsequent Emulsions in Extracts to deal with



Reduced Solvent Usage



Methods

- **EPA Method 506 Phthalates and Adipate Esters**
- **EPA Method 508.1 Chlorinated Pesticides, Herbicides, and Organohalides**
- **EPA Method 515.2 Chlorinated Acids**
- **EPA Method 521 Nitrosamines**
- **EPA Method 525.2 Semi-volatiles**
- **EPA Method 525.3 Semi-volatiles**
- **EPA Method 526 Semi-volatiles**
- **EPA Method 527 Selected Pesticides and Flame Retardants**
- **EPA Method 528 Phenols**

Methods

- **EPA Method 529 Explosives**
- **EPA Method 532 Phenylurea Compounds**
- **EPA Method 533 Per and PolyFluoroalkyl Substances Anion Exchange**
- **EPA Method 535 Chloroacetanilide and other Acetamide Herbicides**
- **EPA Method 537 Selected Per and PolyFluoroalkyl Substances**
- **EPA Method 537.1 Selected Per and PolyFluoroalkyl Substances**
- **EPA Method 548.1 Endothall**

Methods

- **EPA Method 549.2 Diquat and Paraquat**
- **EPA Method 550.1 PAH's**
- **EPA Method 552.1 Haloacetic Acids and Dalapon**
- **EPA Method 553 Benzidines and Nitrogen Containing Pesticides**



EconoTrace SPE



EconoTrace SPE

Fully Automated

**Modular and expandable
from 1 to 4 Modules**

**High Throughput Runs
8 Sample Extractions in Parallel**

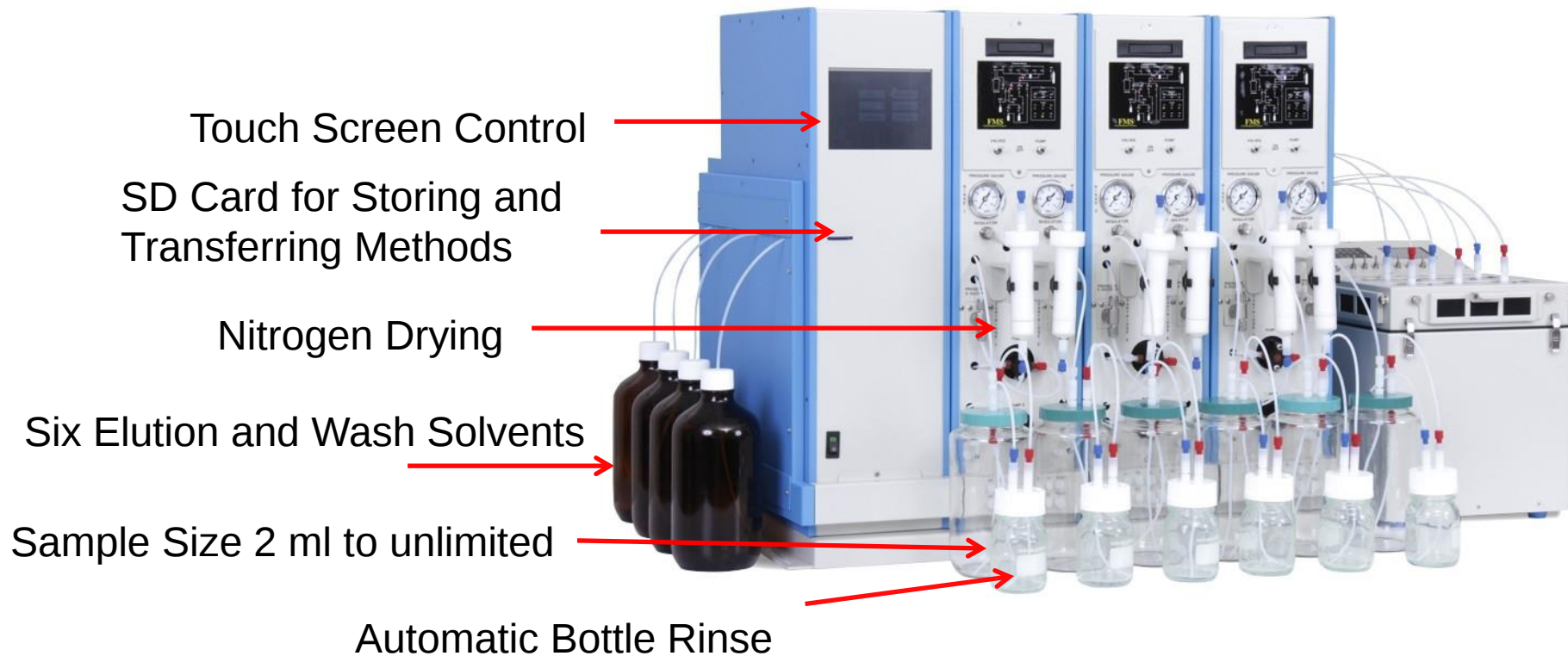
**Uses Positive Pressure Pumping
for Precise delivery of
Conditioning Solvent,
Sample and Elution Solvent**

Automatic Bottle Rinse

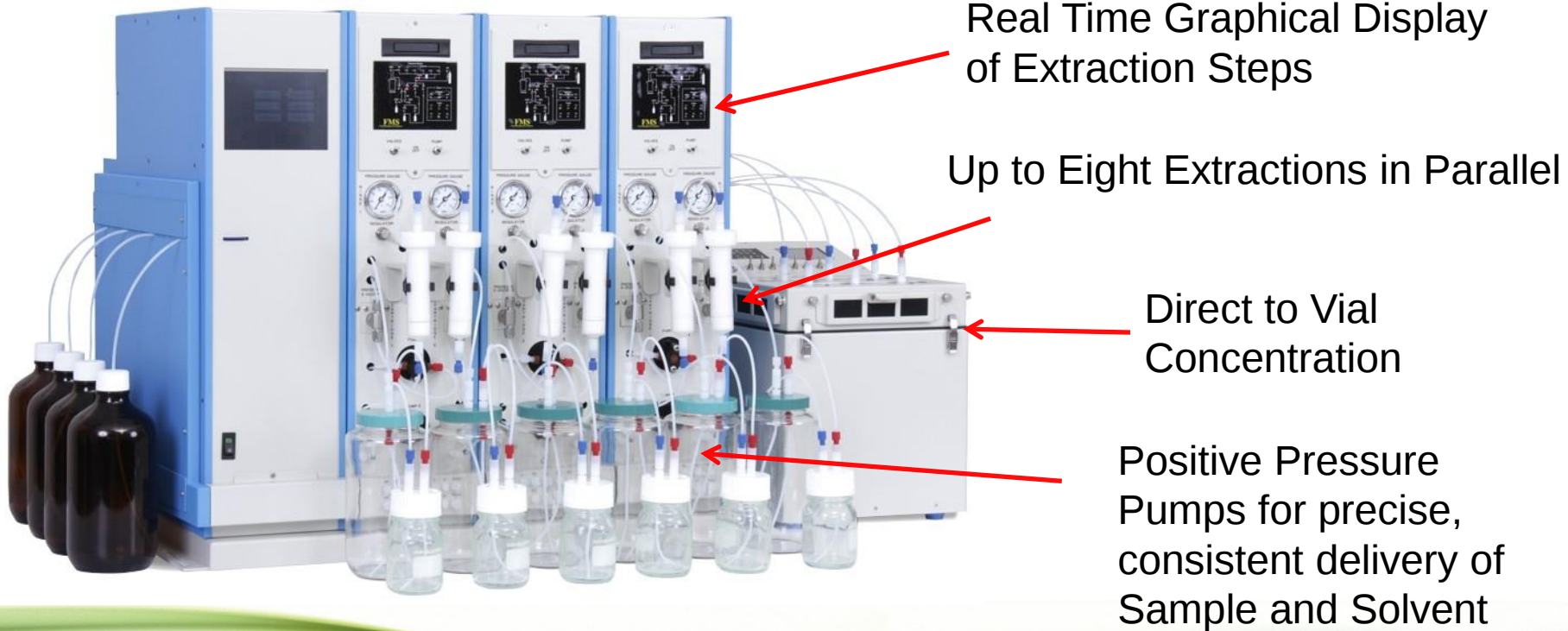
Delivers extract directly to a Concentrator



EconoTrace SPE



EconoTrace SPE



Sample Sizes Unlimited



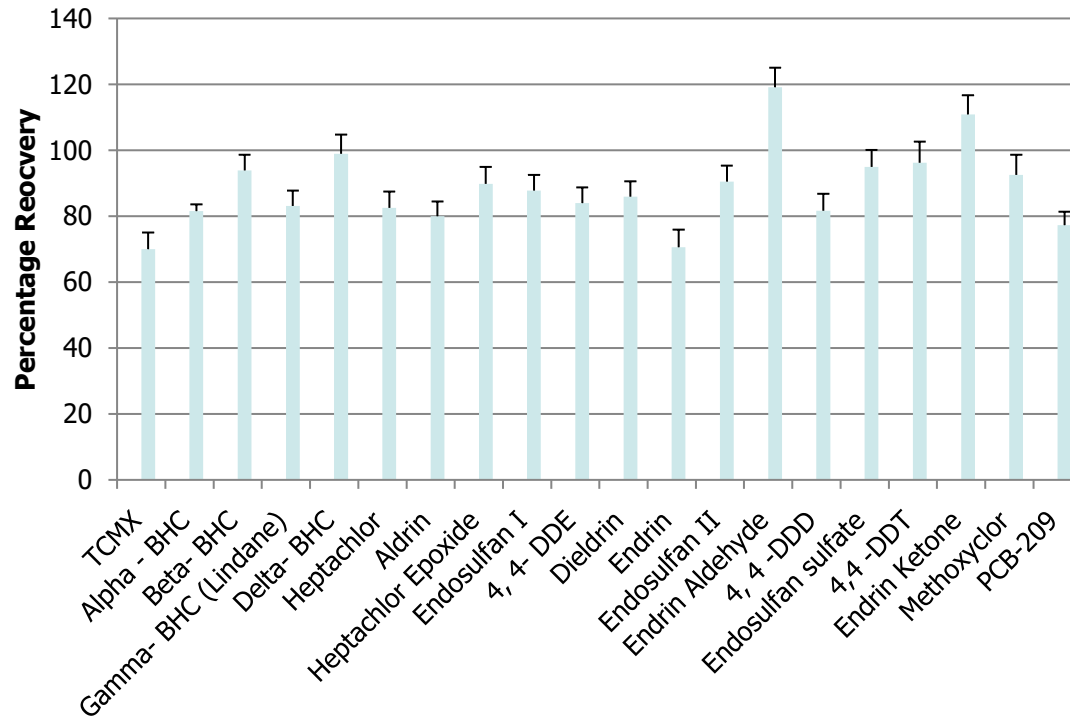
SPE Cartridges



Drying Cartridges



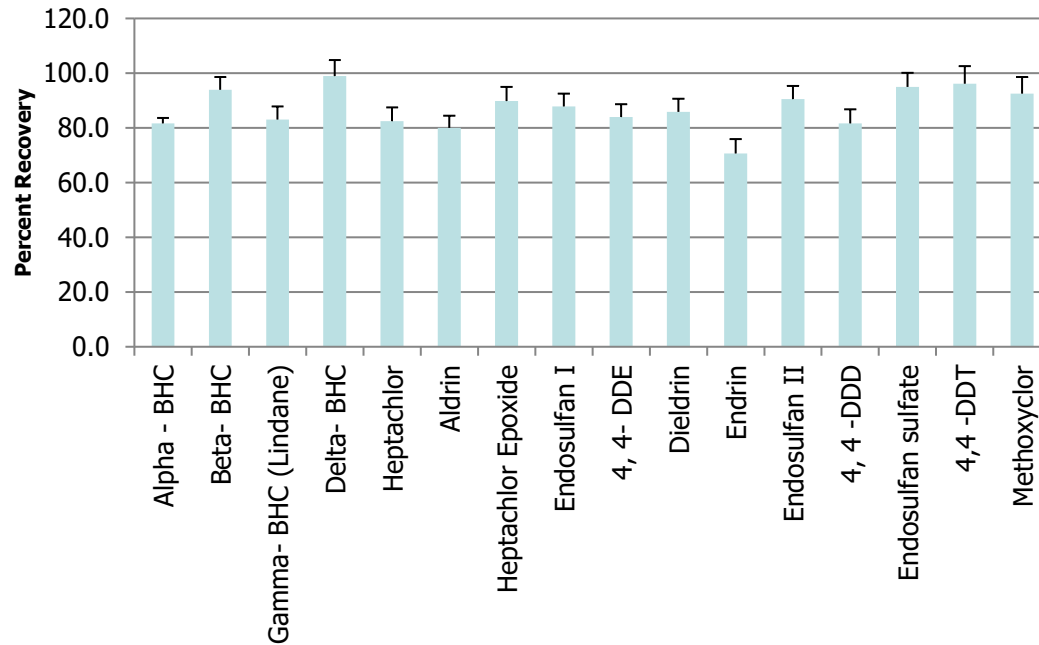
508 OCPs



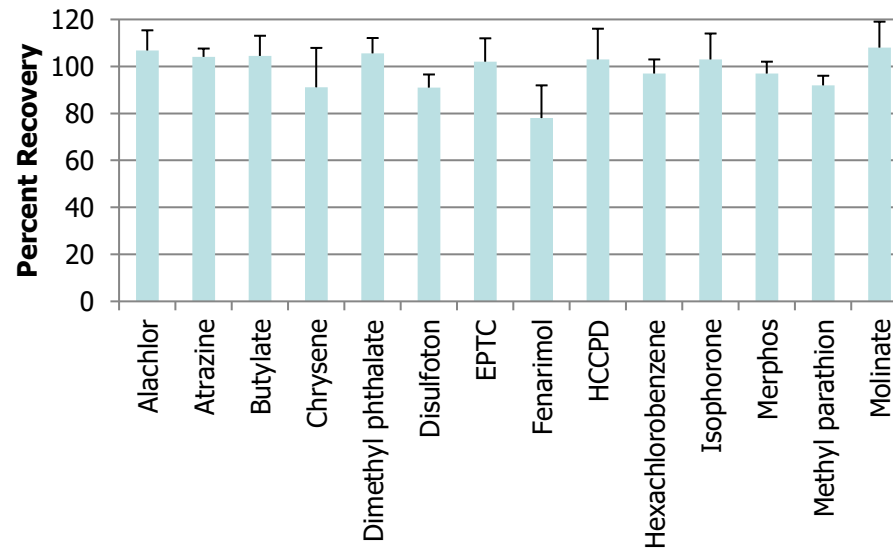
522 1,4-dioxane

	1,4-dioxane-d8	1,4-dioxane	STD
Replicate	recovery	conc. (ug/L)	DEV
1	89.59%	1.056	
2	84.59%	0.962	0.05
3	82.15%	1.03	

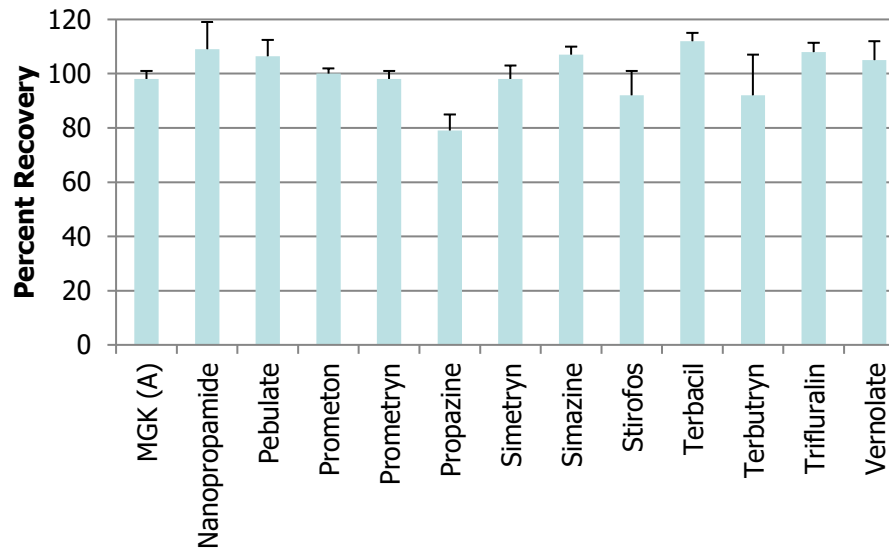
525.3 OCPs (Drinking Water)



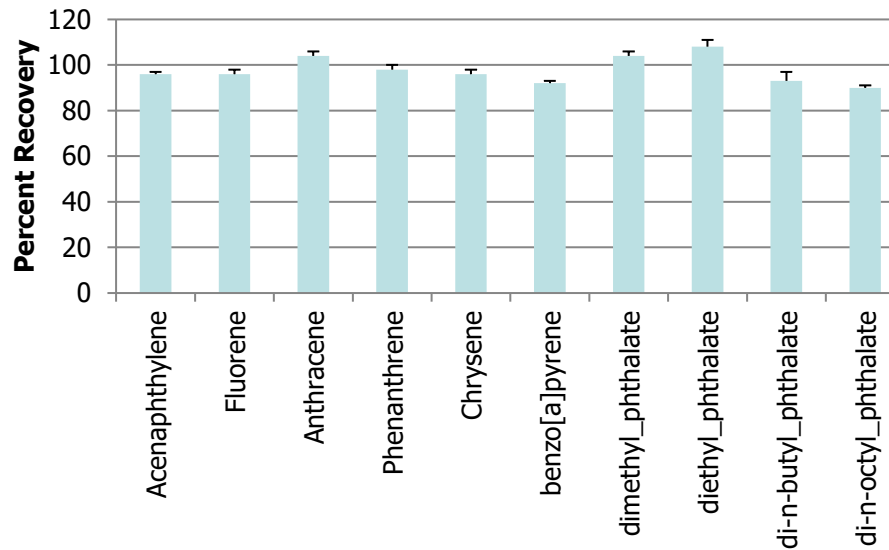
525.3 SVOCs (Drinking Water, 1)



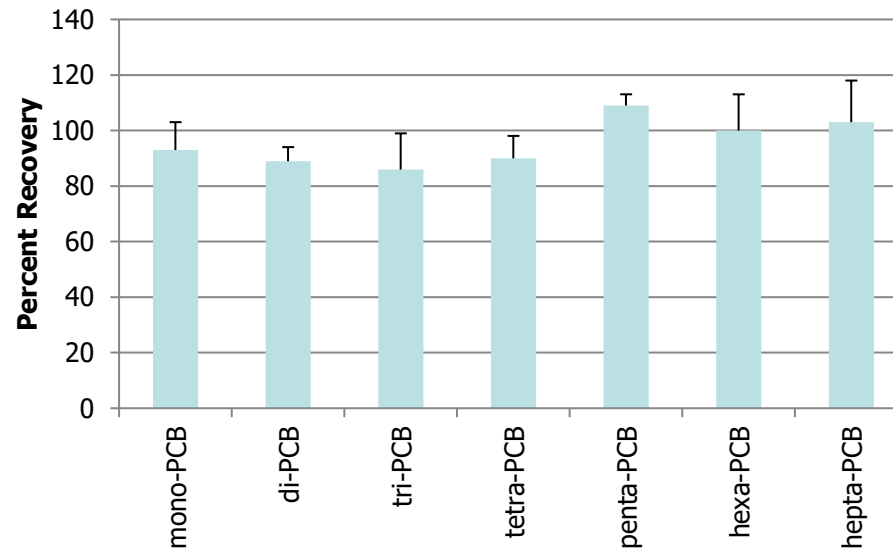
525.3 SVOCs (Drinking Water, 2)



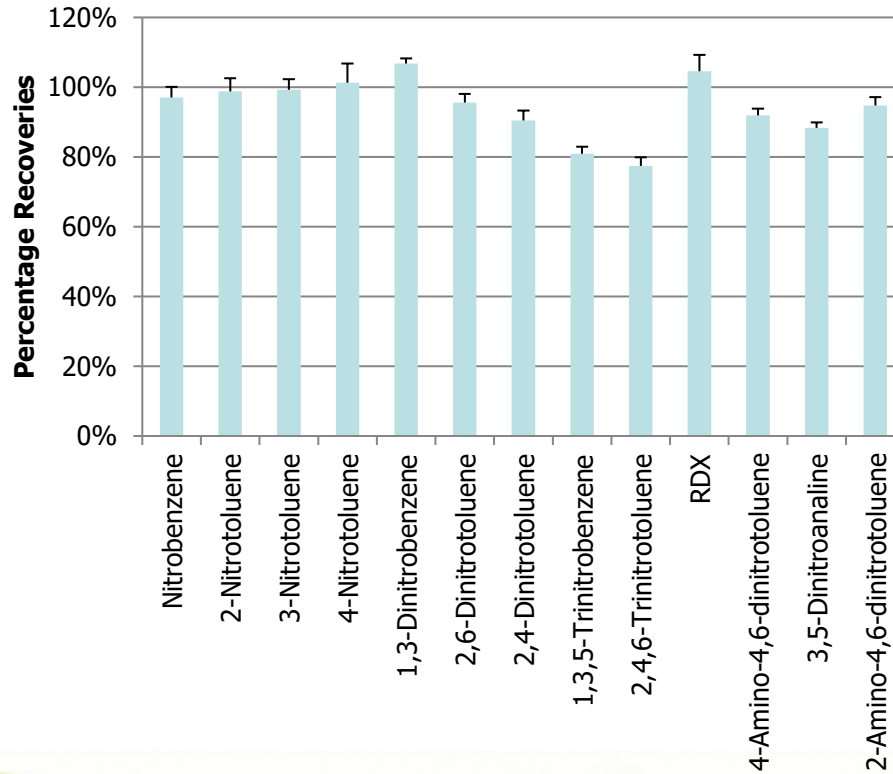
525.3 PAHs and phthalates (Drinking Water)



525.3 PCBs (Drinking Water)



529 Explosives



548.1 Endothall

Table 1.

	Endothall	Percent
Replicates	Concentration	Recovery
Sample #1	47.6 µg/mL	95.2%
Sample #2	49.3 µg/mL	98.6%
Sample #3	48 µg/mL	96.0%
	Std Deviation	2.7%

Table 2.

	Endothall	Percent
Replicates	Concentration	Recovery
RL Sample #1	5.18 µg/mL	103.6%
RL Sample #2	5.55 µg/mL	111.0%
	RPD	4.5%

549.2 Diquat and Paraquat

Table with recoveries for the 549.2 compounds

Compound	% Recovery	Stdev
Diquat	92.7	3.3
Paraquat	84.2	4.9

TurboTrace SPE

For all liquid types



TurboTrace SPE for PFAS/PFOS

Fully Automated

**Modular and expandable
from 1 to 6 Modules**

**High Throughput Runs Sample
Extraction in Parallel**

**Uses Positive Pressure Pumping
for Precise delivery of
Elution and Wash Solvent**

**Uses Vacuum or
Positive Pressure Pumping
to Load Samples**



TurboTrace SPE

Touch Screen Control

**SD Card for Storing and
Transferring Methods**

Six Elution and Wash Solvents

Sample Size 2 ml to unlimited

Automatic Bottle Rinse



TurboTrace SPE



**Real Time Graphical Display
of Extraction Steps**

Automatic Liquid Level Sensor

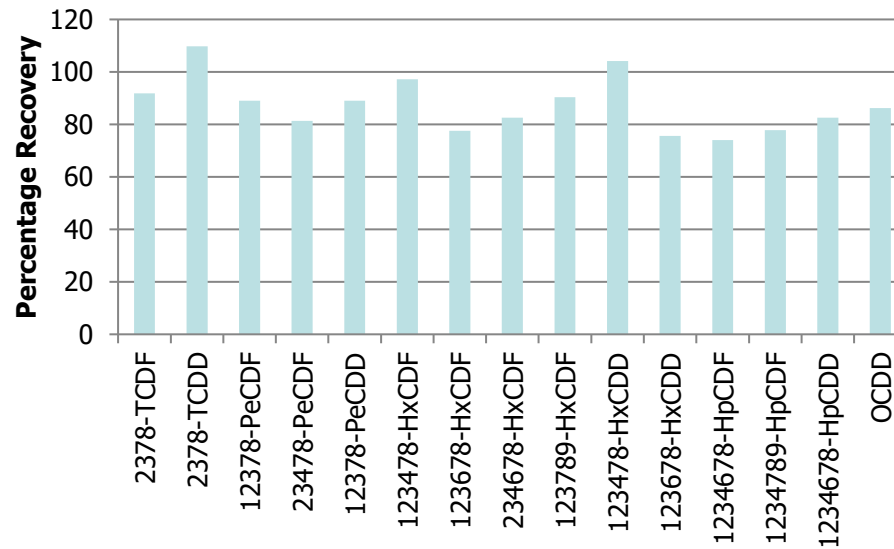
**Direct to Vial
Concentration**

**Positive Pressure
Pump for precise,
consistent delivery
of Sample and
Solvent**

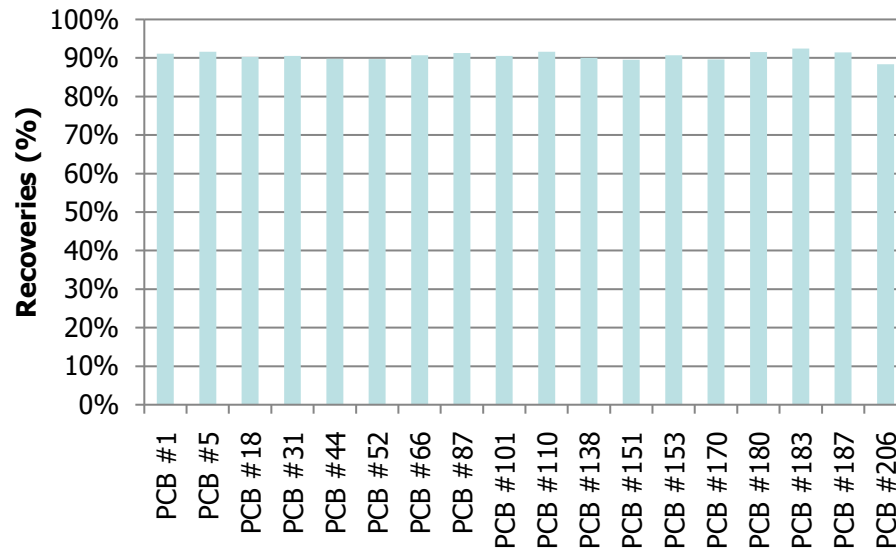
Automated Fast Flow Sample Processing



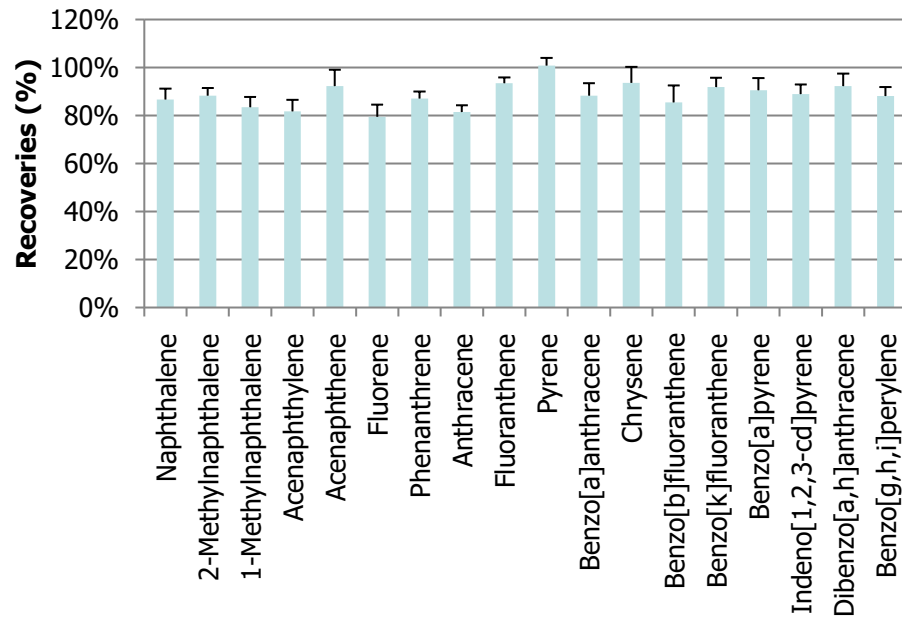
1613 Dioxins/Furans in Water



1668C PCBs in Water



PAHs in Water



SPE Systems for PFAS extraction

EPA Method 533
EPA Method 537

EconoTrace PFC

TurboTrace PFC



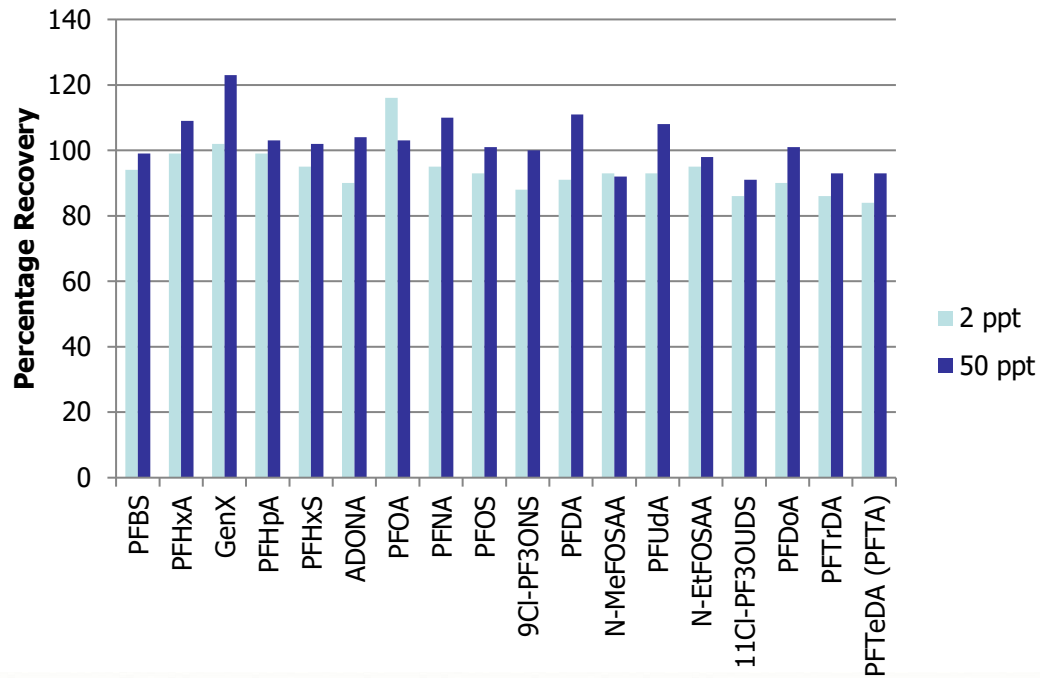
All Inert Delrin, HDPE, Peek and
Stainless Steel Surfaces

Automated Concentration for PFAs

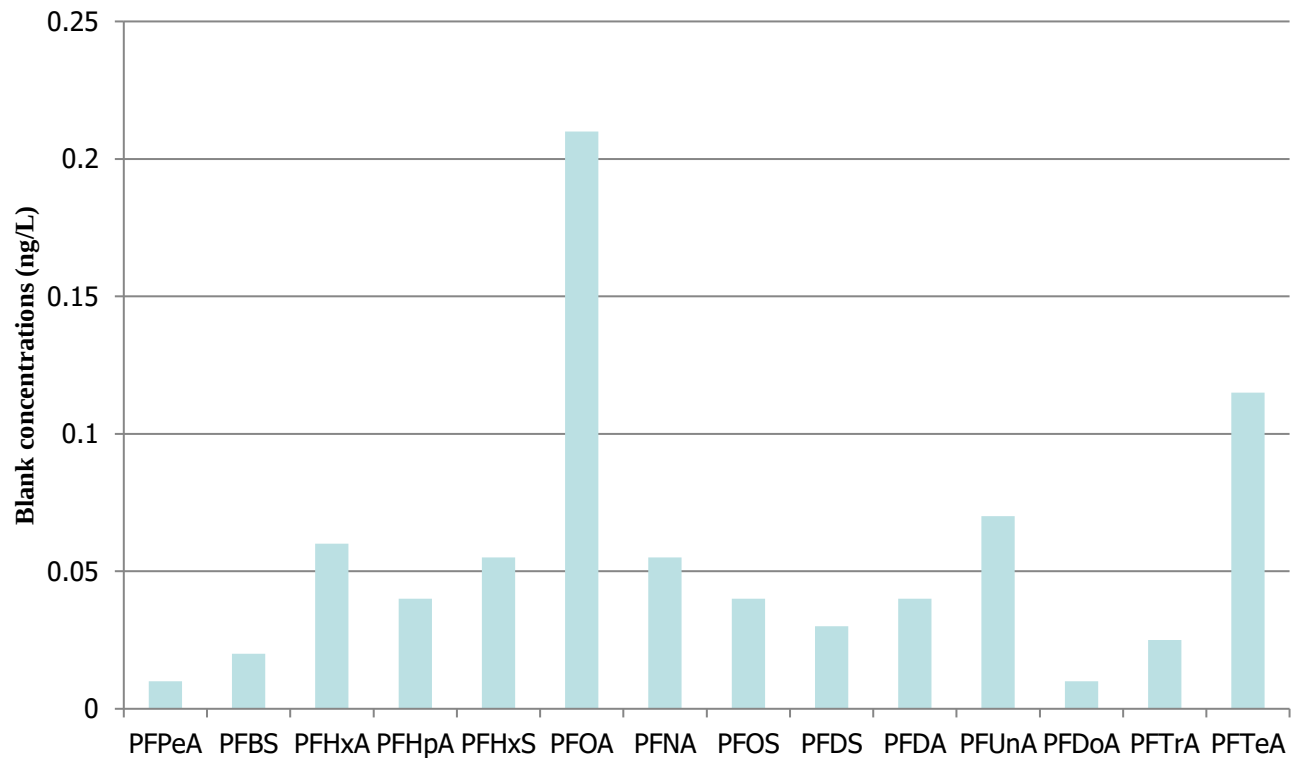
- SuperVap PFC
 - 24 positions
 - 15ml Conical vials



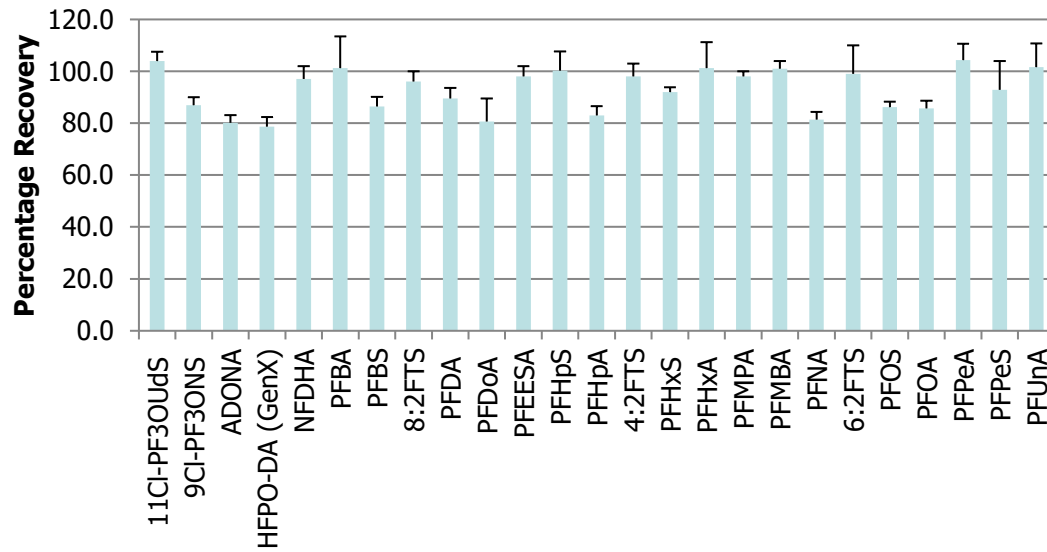
EPA 537.1



PFAS Background



EPA 533



Automated SPE in Summary

- **One Step SPE and Concentration will reduce errors, labor costs, solvent usage and increase your sample throughput**
 - **Automates and Combines the Extraction and Concentration steps in Sample Prep Processing**
 - **Inline Concentration/Evaporation with direct to GC vial tubes**
 - **Provides the Fastest Automated Sample Processing available for SPE Cartridges and Columns**
- 

Automated SPE in Summary

- **Handles a wide range of Sample sizes and matrix types**
- **Uses all SPE Cartridge and Column sizes**
- **Comply with existing methods that require vacuum, positive pressure and precise delivery of sample and solvents**
- **Program and store an unlimited amount of methods**



Summation

- **Automated SPE extractions and Concentration is a very green technique**
 - **Reduces Solvent Use**
 - **Reduces Solvent Disposal Costs**
 - **Reduces Solvent emissions**
 - **Separates Organic from Aqueous Waste**
- **FMS automated SPE systems deliver consistent, reproducible results**
- **Capable of performing inline extract drying**

Questions?

