Rapid Analysis of PFAS in Soil using One Step Pressurized Liquid Extraction and Purification

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Introduction

- PLE® Overview
  - Pressurized Liquid Extraction as alternative to manual extraction
- Extraction and Cleanup for PFAS Testing application: soil
- Questions

Extractions for PFAS in Solids

- Current techniques
  - Manual Solvent Extraction, Centrifuging
    - Labor intensive
    - Inconsistent results
  - Sonication in Solvent, Centrifuging
    - Labor and Solvent Intensive
    - Inconsistent results

Pressurized Liquid Extraction

- An Extraction technique used in the AG/Environmental/Food Markets

- The Technique Incorporates:
  - Solvent
  - Pressure
  - Heat
  - Time

Why is PLE so effective?

- Performed near the solvent's supercritical region
- Under Programmable Pressure
- Creates a high degree of analyte solubility releasing them from the solid matrix

Extraction

- A solid or semi-solid sample is placed in the Pressurized Extraction Cell 5mL to 200mL

- The Extraction cell is capped and placed into the extraction device which can be pressurized to up 2500psi

Extraction

- The Extraction cell is filled with the extraction solvent put under pressure and depressurized
  - PFAS
- The Extract is flushed with Nitrogen into a collection vessel

The PLE®
Pressurized Liquid Extraction

PLE - Pressurized Liquid Extraction

- High Speed
- Modular and expandable from 1 to 8
- Process 1 to 8 samples in 10 to 15 min
- Extraction cell size 5 mL to 200 mL
- Real time plot of temperature and pressure
- Reduced Solvent Consumption
- Lower Energy Consumption
- In Cell Sample Cleanup

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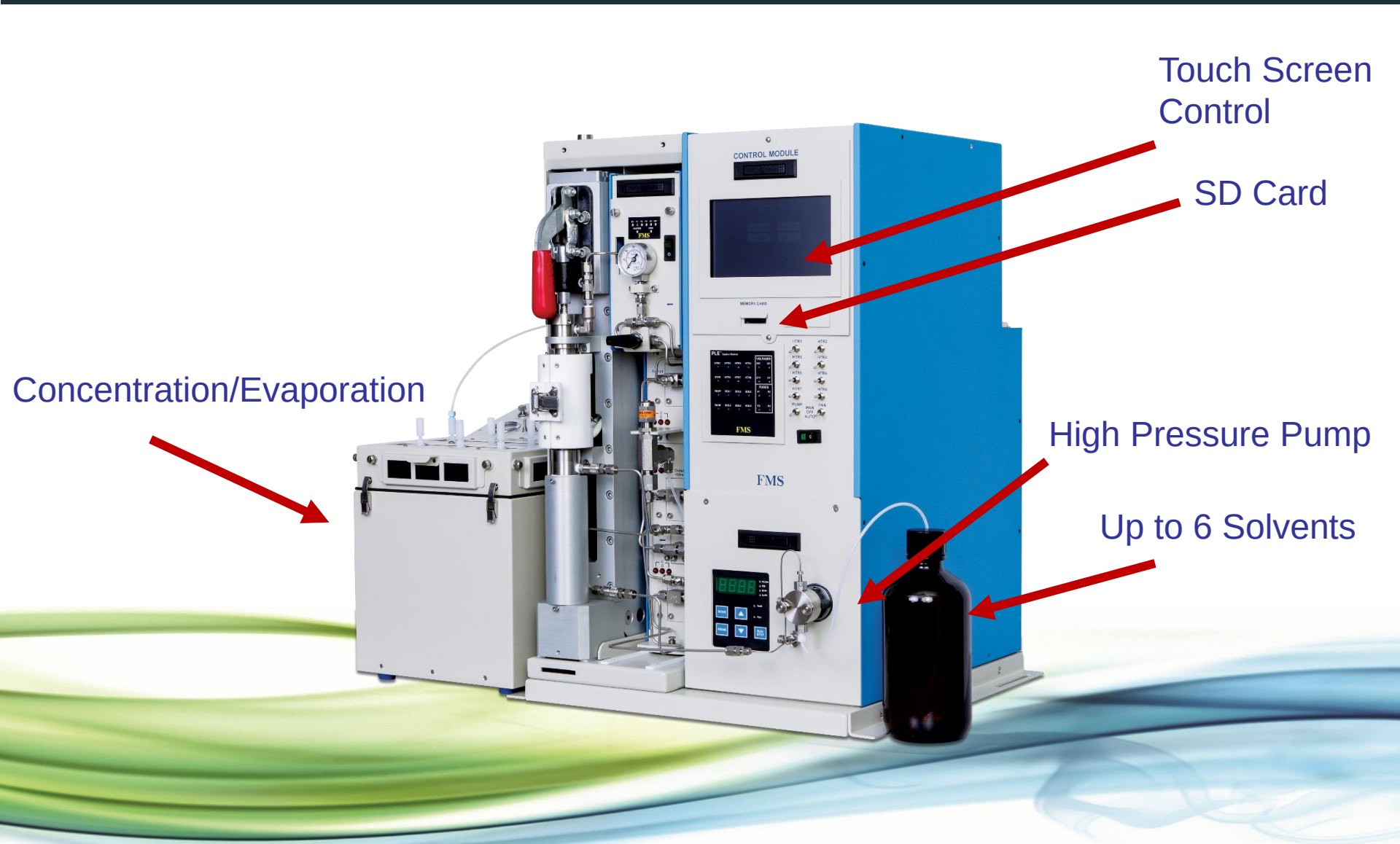

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Economical Extraction Cells

Production Cell

200ml

Easy to Use End Caps

Modular and Expandable

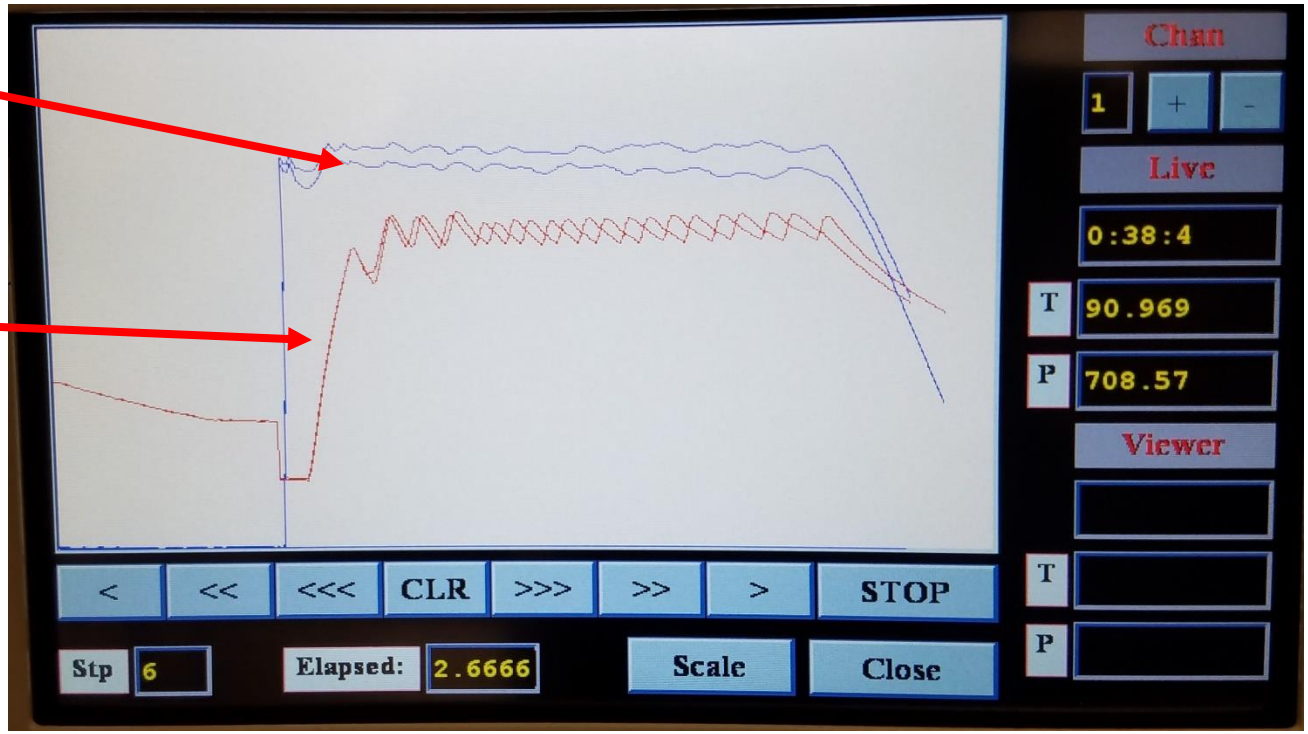
Expandable from 1 to 8 Modules

Parallel Extraction

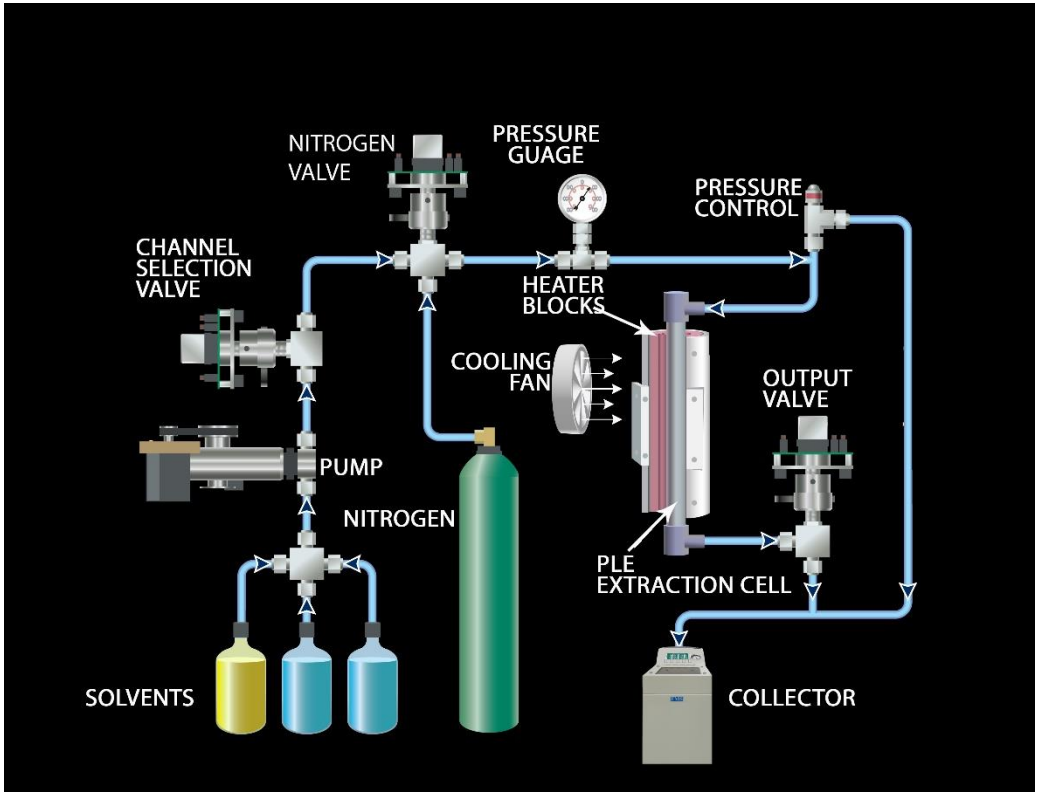
Method Documentation

Pressure

Temperature



Filling the Cell with Methanol



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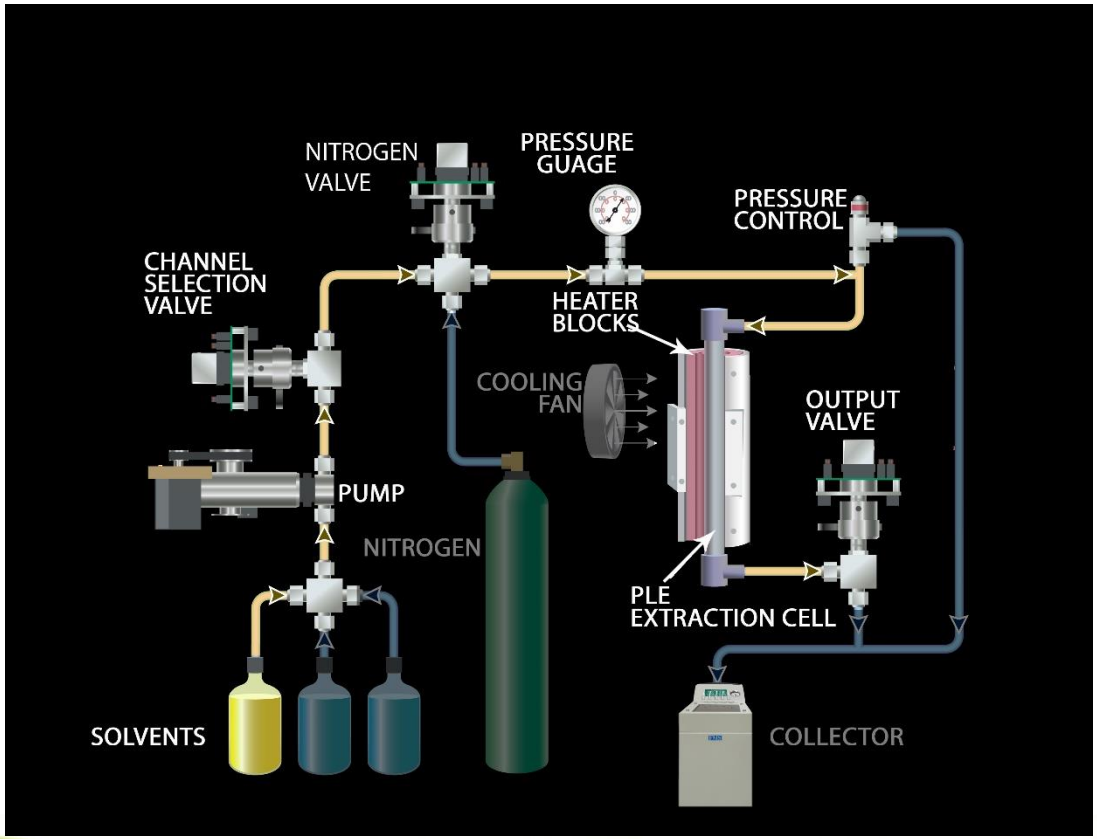
Pressurize the Cell



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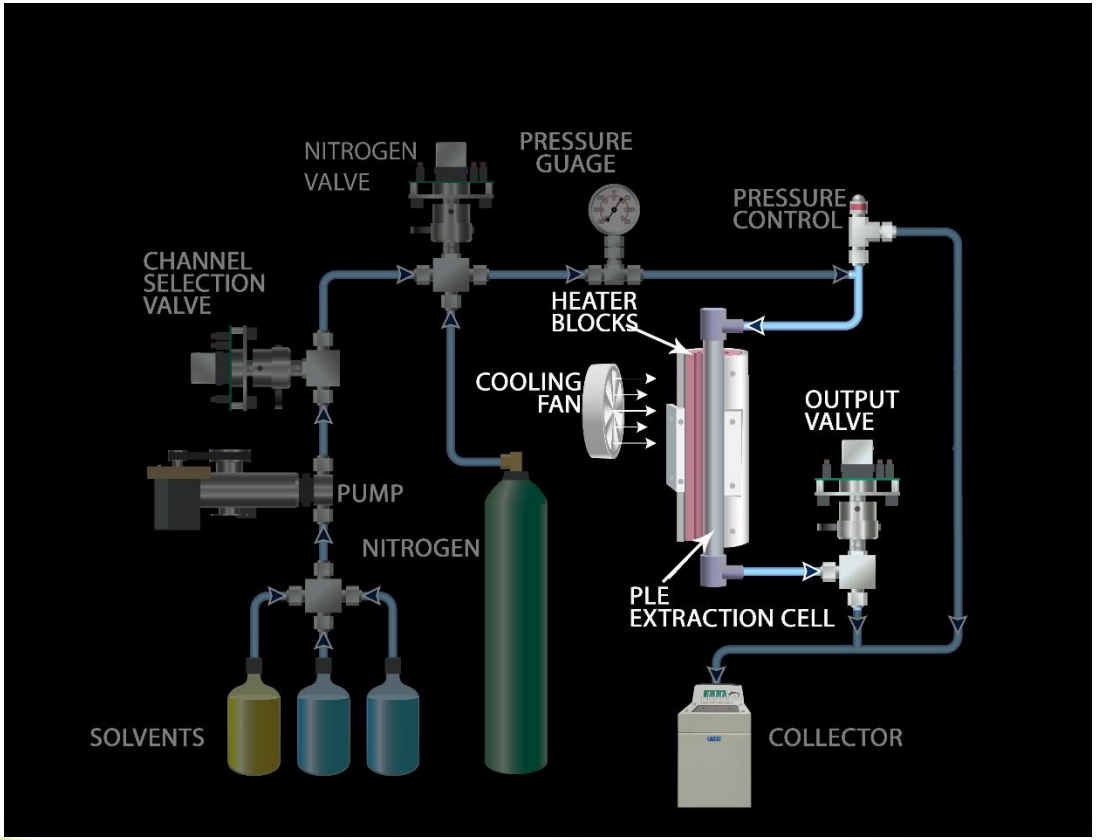
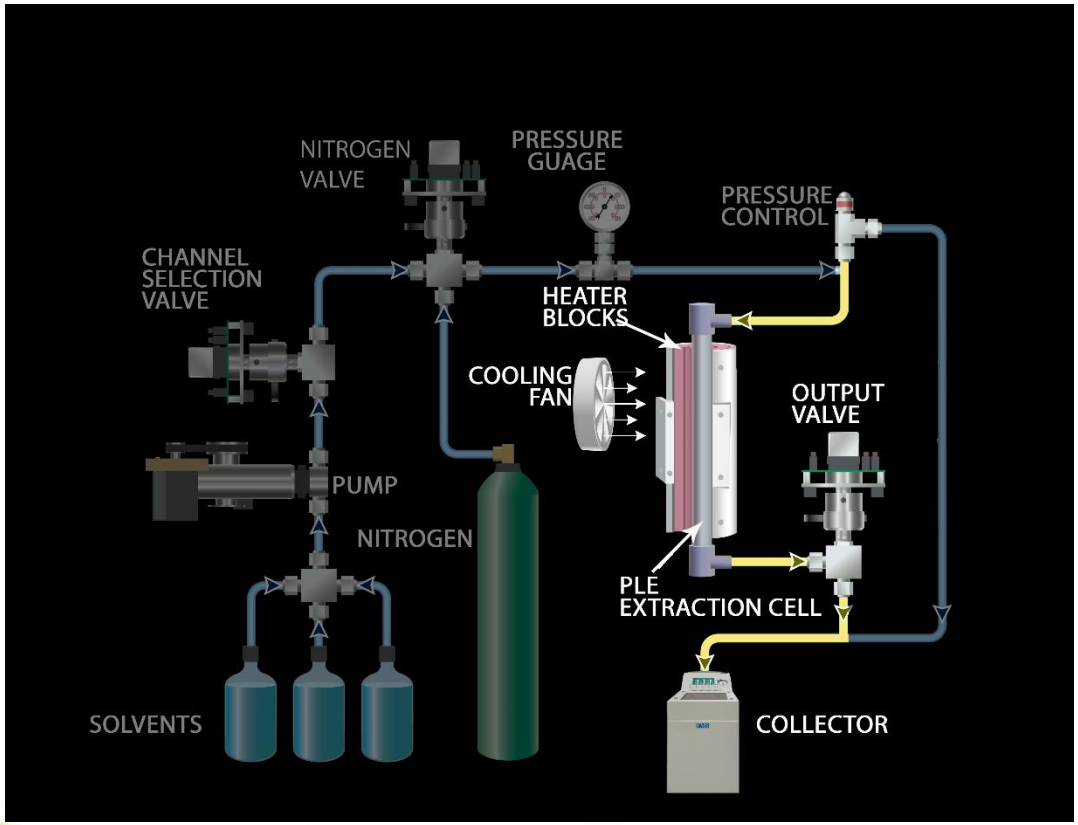
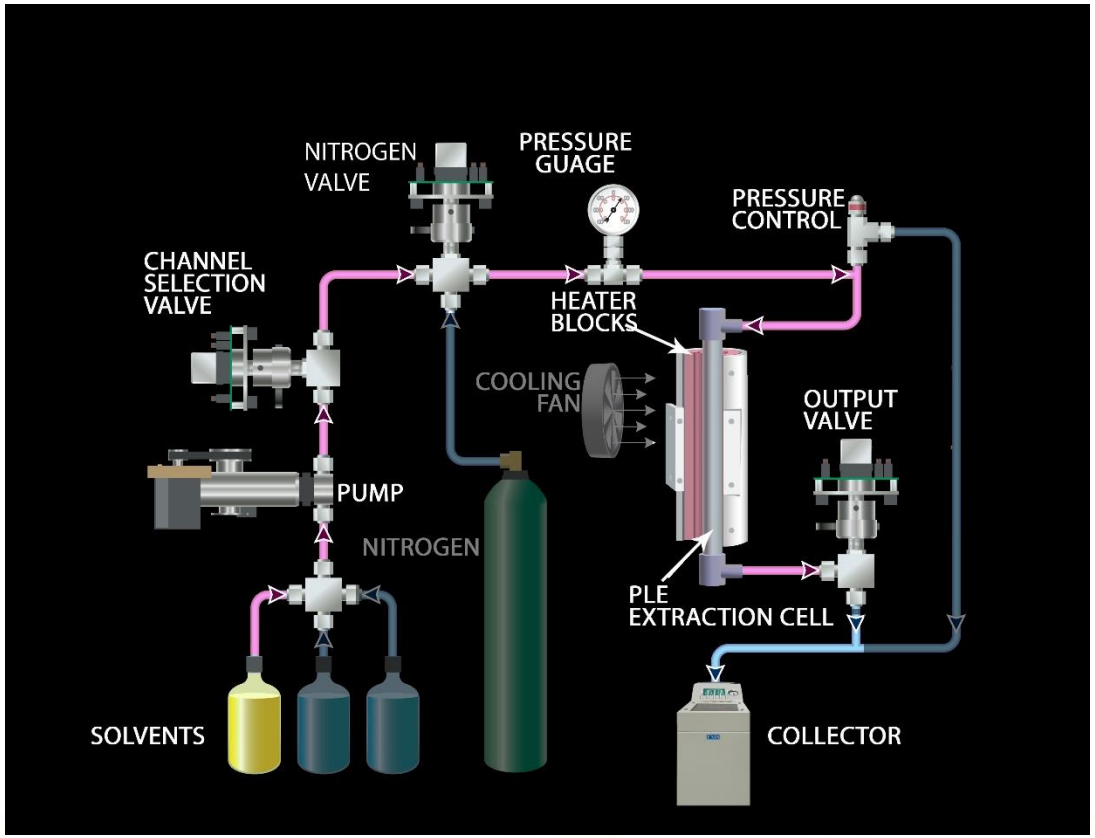
Maintain Pressure



Depressurize the Cell



Deliver the Extract to the Collection Vessel



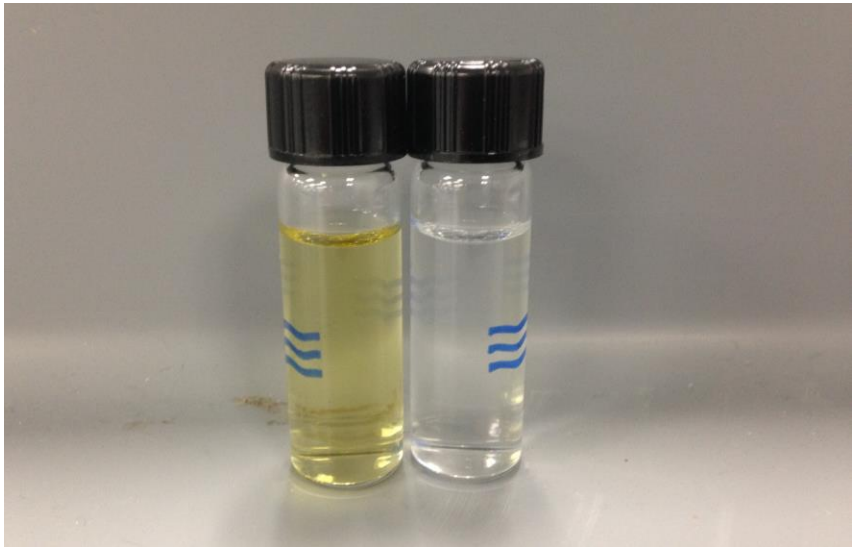
Pressurized Liquid Extraction for PFAS

- Works efficiently on all Sample Matrices
- Can be done efficiently at ambient temperature
  - Sand
  - Soil

Pressurized Liquid Extraction for PFAS

- High Speed extraction for PFAS
  - Up to 8 extracts per 40 min
  - Up to 96 extracts per 8hr shift
- Consistent, Reproducible Results
  - Automated System
  - Processor based controller with unlimited methods storage
  - Documentation of run conditions
- Save money
  - Solvent
  - Labor

Extract after Cleanup



Methanol Extraction

- Low Solvent Consumption
- Low Power Consumption
  - 110V 20 A circuit
- Ambient temperature extraction
- Touch Screen Control
- Preload methods

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Expandable

- 1 to 8 modules
- Run in Parallel
- Extract up to 8 samples
- in 40 min
- 96 samples per 8 h shift

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Easy to Use Cells

Soil extraction-SPE cleanup

- 5 g soil or sand in PLE cell
- Cell 40 mL
- Mixed with inert material
- Extraction near ambient temperature ~ 30 ^{o}C
- 10 min
- 1000 psi (~ 65 atm)
- Minimal cool down then nitrogen flush
- Final extract volume ~ 40 mL
- Cleanup over in-line Florisil/DVB cartridge

Automated Concentration for PFAS

SuperVap 24 PFC

- 24 positions
- 15ml Conical vials
- Timed Endpoint

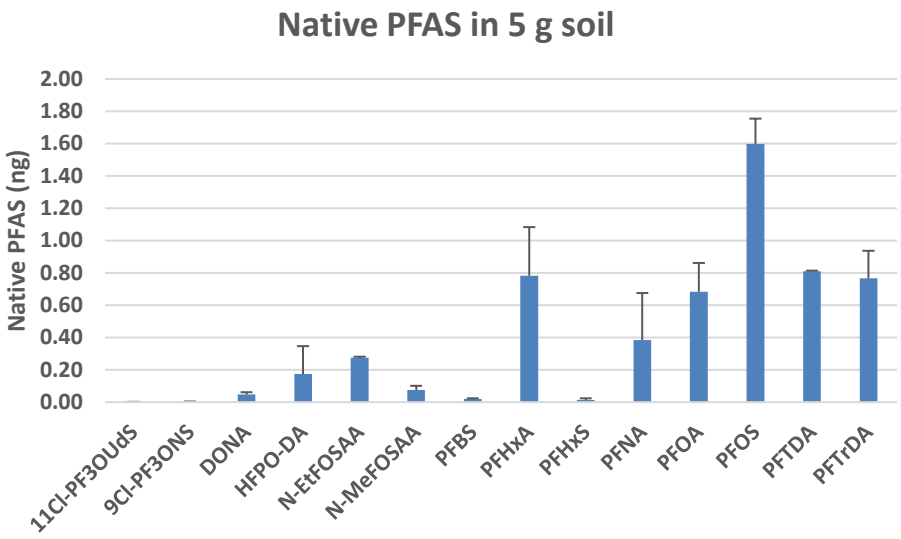
SuperVap 12 PFC

- 12 positions
- 50ml Conical vials
- Timed Endpoint

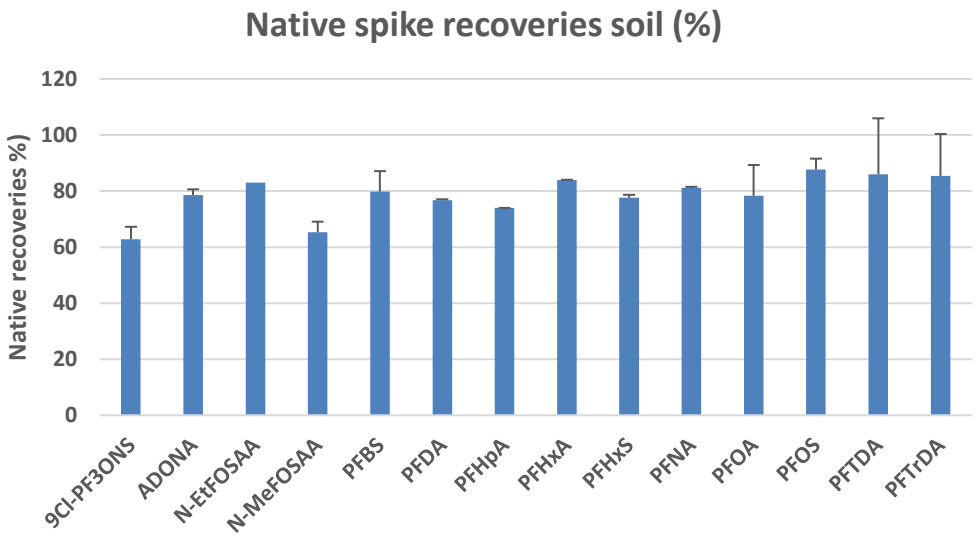
LC/MS

Agilent 6475

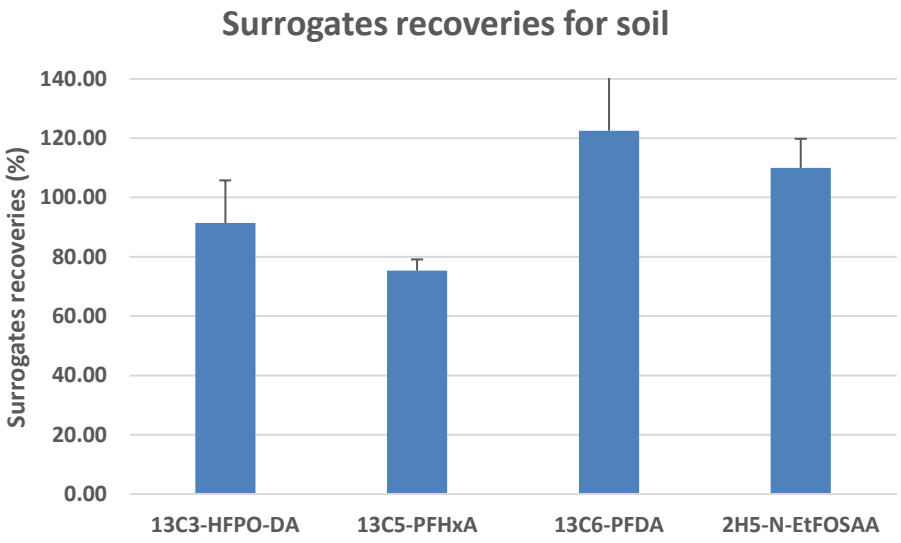
Native PFAS in soil



Native PFAS spike recoveries soil

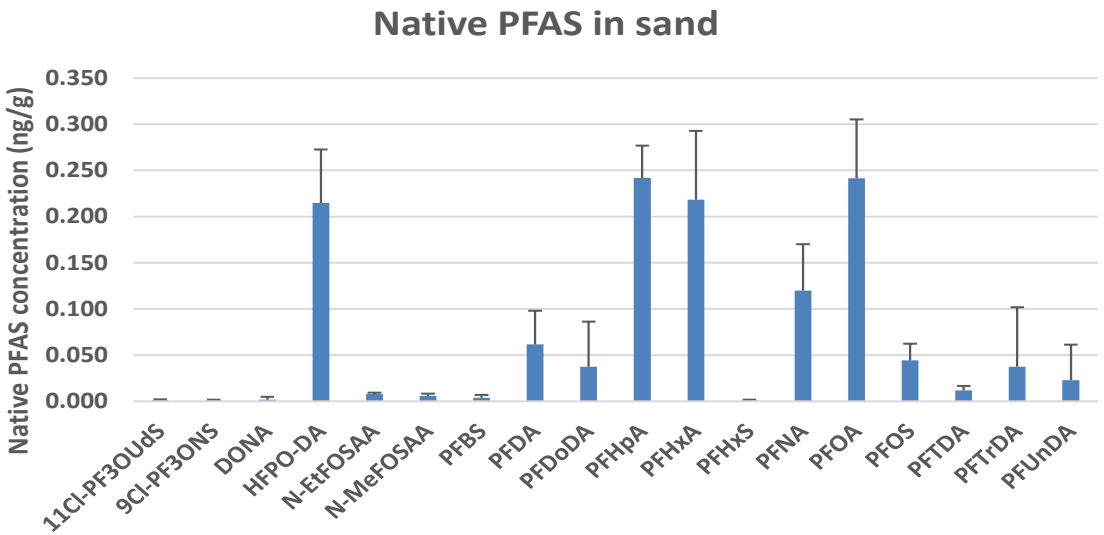


Labeled PFAS surrogates in soil (%)

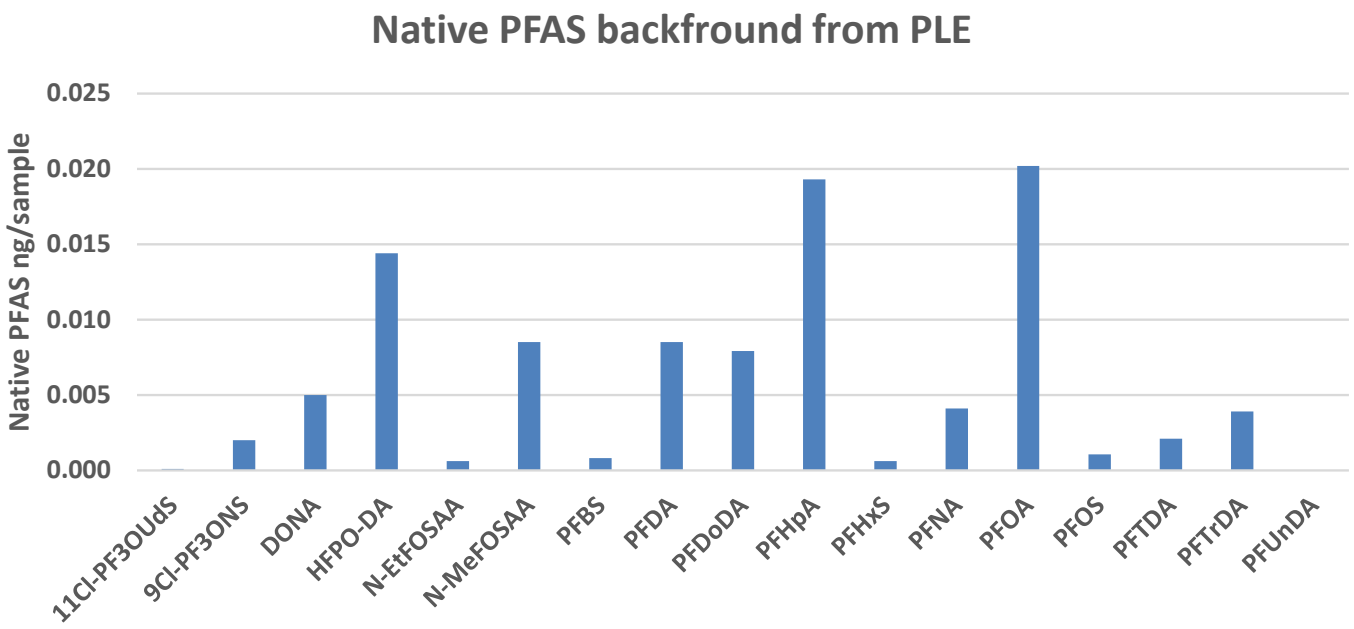


40-160 ng
PFAS spiked

Native PFAS in sand



Native PFAS background from PLE



Fast, Reproducible Extractions

- Using the PLE®
  - Sample Prep processes are combined into one step
    - Extraction
    - Cleanup with, e.g., Florisil/DVB
  - One Extraction Method for all Solid Matrices
  - Reduces error
  - Produces consistent, reproducible results
  - Increased productivity

Fast, Reproducible Extractions

- Faster and easier operator training
- Automatic documentation of extraction and cleanup and concentration conditions
- Reduced errors due to mistakes eliminating manual steps and conditions.
- Reduced solvent usage and disposal costs.

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Questions?

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