Rapid Field Sampling Solutions for On-Site Analysis Using Field Portable GC/MS

Information at the Source

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For a Cleaner Environment

Taking the Laboratory to the Field – Why?

- Sample vs Information

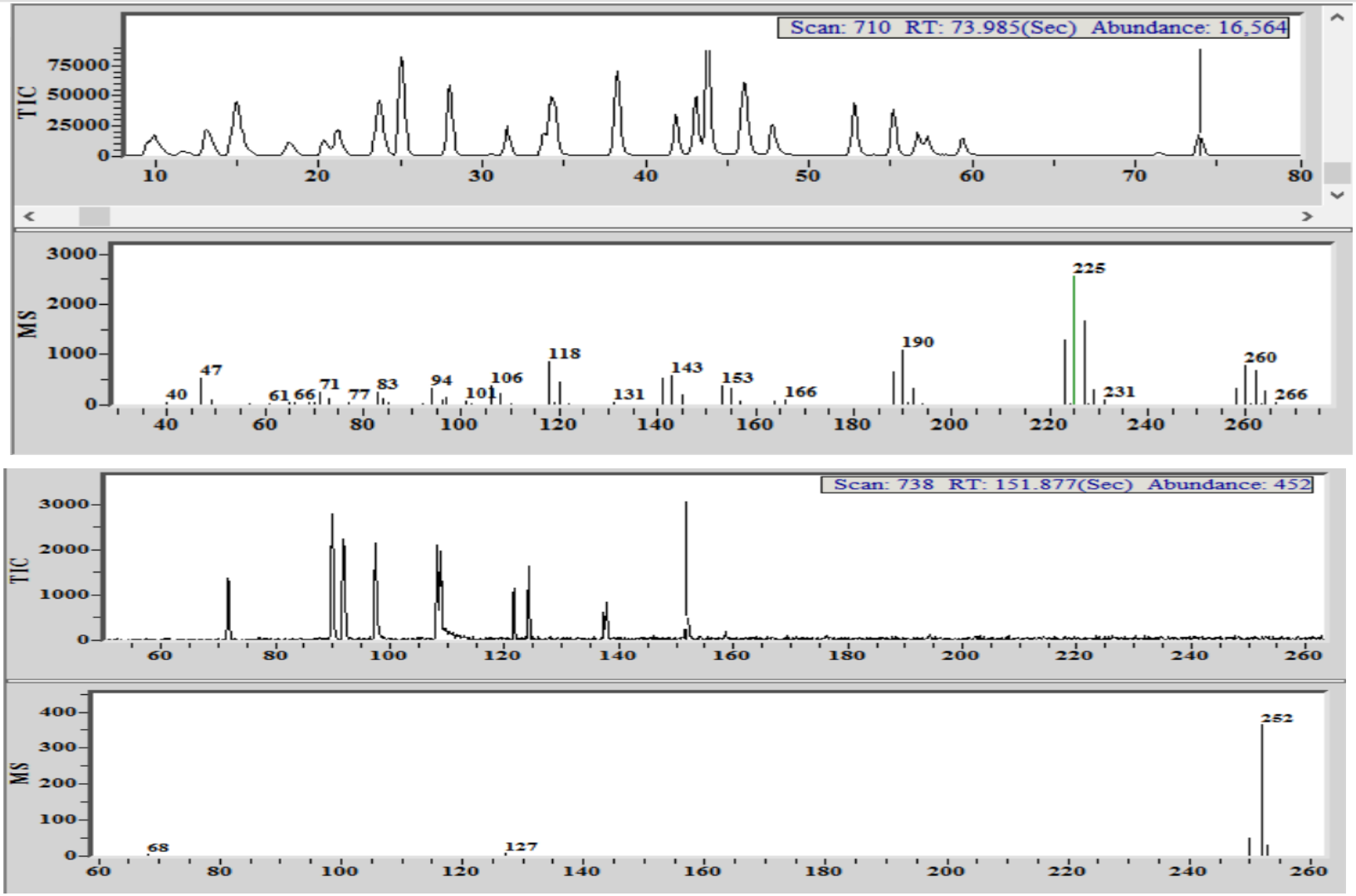
- Reasons to have the information:
  - **Time critical information** (biggest driving factor)
  - Making decisions that will effect safety and health
  - Positive economic impact
  - Guide further sampling activities
  - Sample can change during transport to a laboratory

- GC/MS provides for detection of target compounds and identification of unknowns

TRIDION™-9 GC/MS

- Dimensions: 38cm x 39 cm x 23 cm
- Weight: < 14.5 kg or 32 lbs
- Power: 24 volts DC, line or battery
- Sample Introduction: SPME or Needle Trap
- GC: MXT-5,5 m x 0.1 mm x .04um High Speed High Resolution (HSHR)
- Temperature Programmable 120°C/sec
- Electronic Pressure Control
- Ion Trap: Toroidal Ion Trap MS
- Mass Range: 43 to 500 Daltons
- Vacuum: turbo ,molecular/diaphragm pumps

Rapid Identification HSHR GC/MS



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Lessons Learned

Environmental Applications

- The field is not the lab!
- Conditions vary greatly
  - temperature, humidity, dust
- Laboratory methods don't necessarily work in the field
    - Performance based methods
    - Site specific methods
  - Adapting Laboratory equipment to the field
    - Needs to be more than rugged
- It is important to understand data quality objectives

The Laboratory Model

Standard operating procedures

- SW-846
  - Methods
  - Instrument configurations
    - A wide range of concentrations, analytes, volatility are generally not run on a single GC - MS
  - Sample collection methods
  - Sample Preparation Methods and Instrumentation

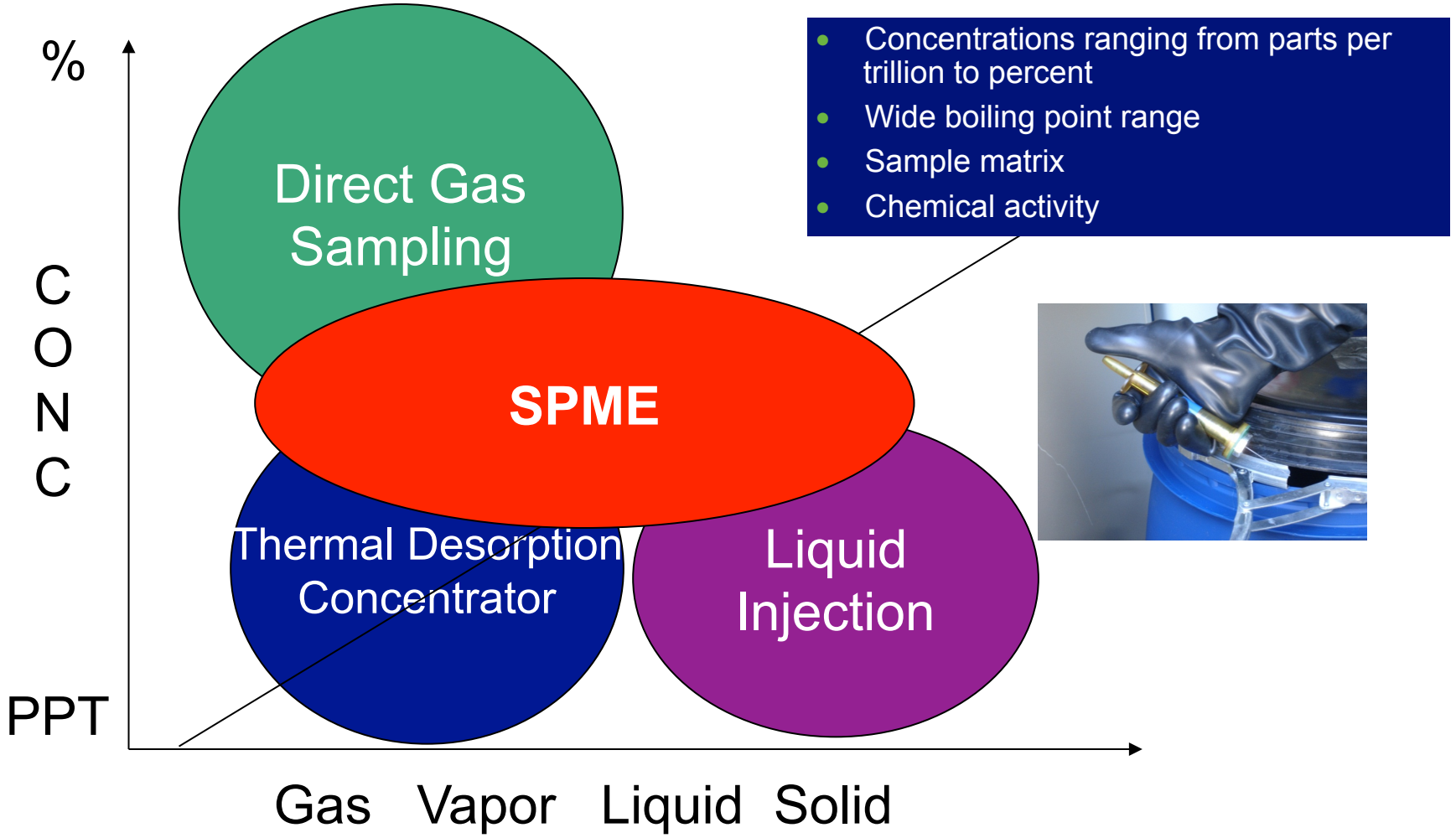
What is the Purpose of Field Analytical Data

- Meet all the criteria of SW-846 and provide the same level of QA/QC and data quality?
  - Not the primary role played by field analytical
- Provide data that meets the specific objectives of the site?
  - It is important to understand data quality objectives a set criteria that meet the site requirements
- Provide information when and where it is needed to make informed decisions?
  - Understanding the role of sampling and having the right tools

The Challenge of Sampling

- Two classes of samples
  - Volatile
  - Semi-Volatile
- Multiple Matrix
  - Air
  - Water
  - Soil
  - Sludge
- Sample prep needs to be adapted to the field
  - Varying atmospheric conditions
  - Undefined concentrations

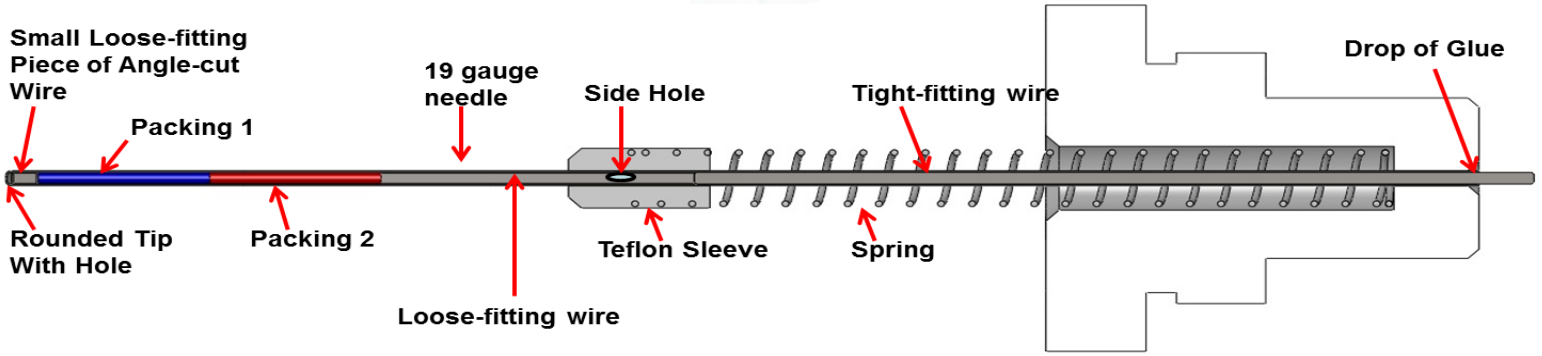
The Challenge of a Universal Sampler



- Concentrations ranging from parts per trillion to percent
- Wide boiling point range
- Sample matrix
- Chemical activity

CUSTODION™-NT (Needle Trap)

- Gas Phase Sampling
- Manual or Battery operated pump
- Detection Limits 10 – 50 ppb/v



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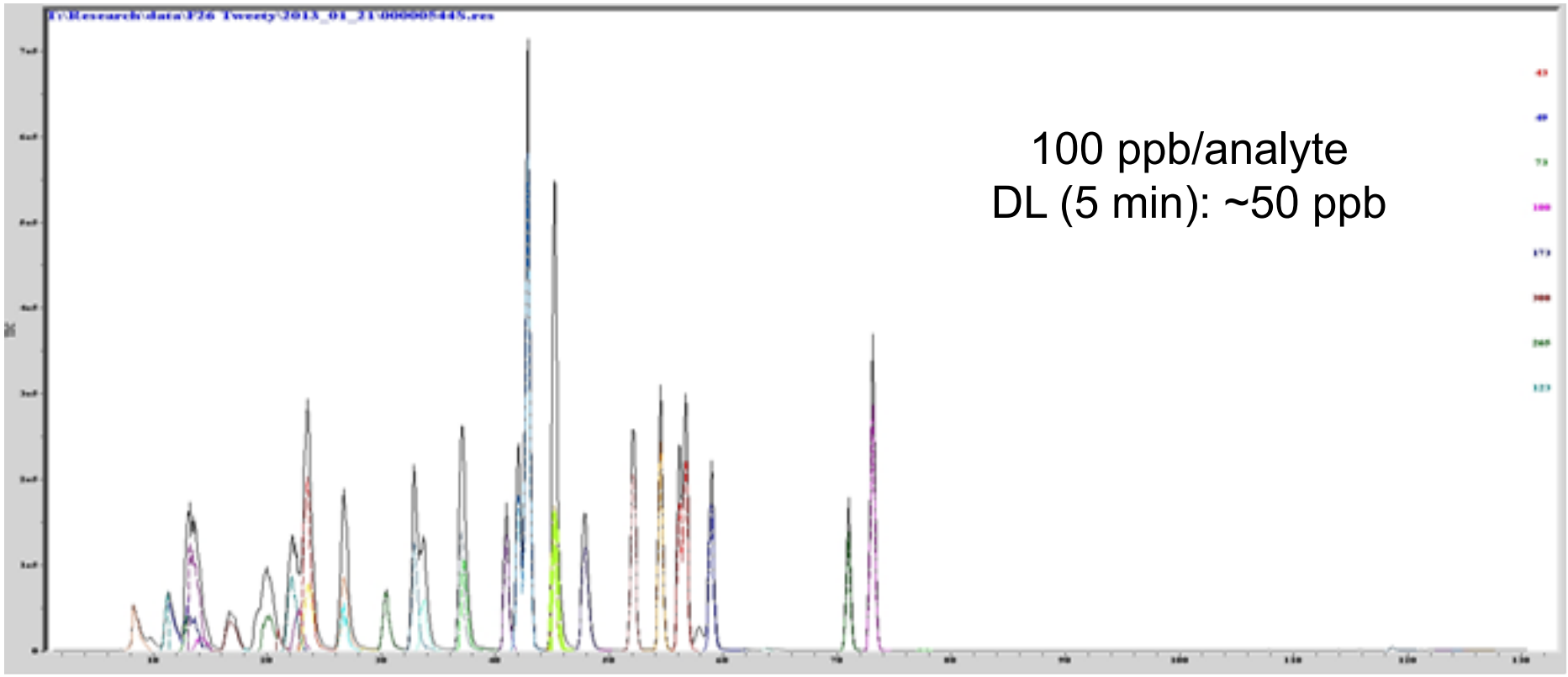
TO-15/17 Volatiles (VOCs) in Air

Results for 34 Compounds from an Air Calibration Mix



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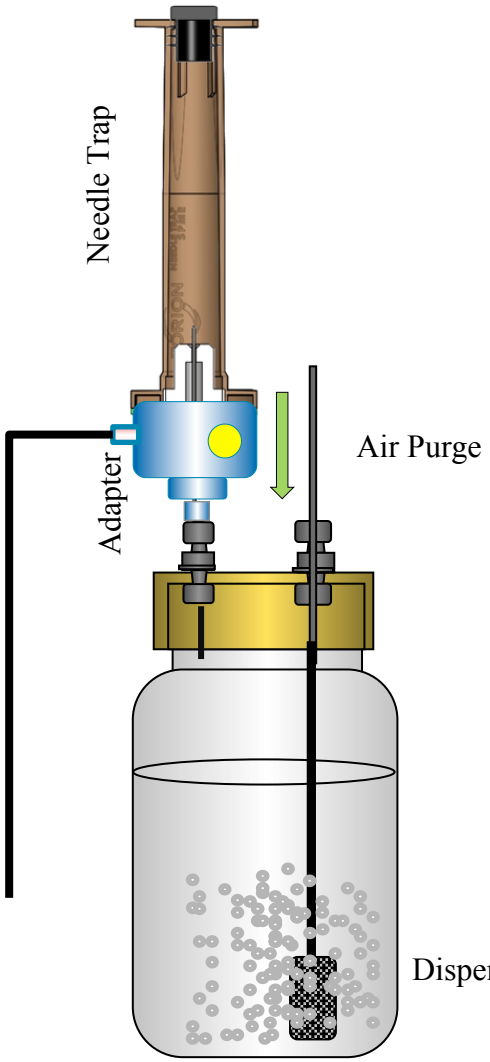
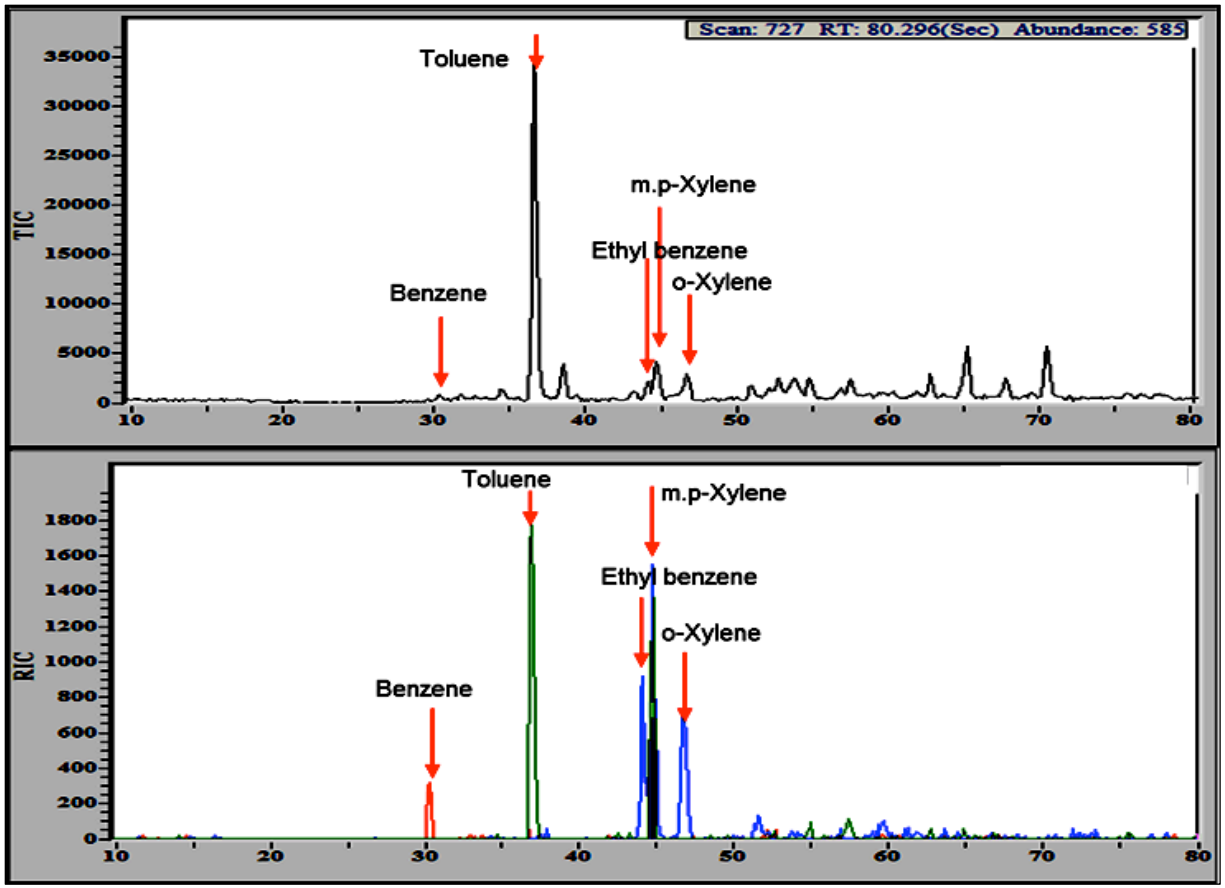
BTEX in Water





< 1 ug/L BTEX

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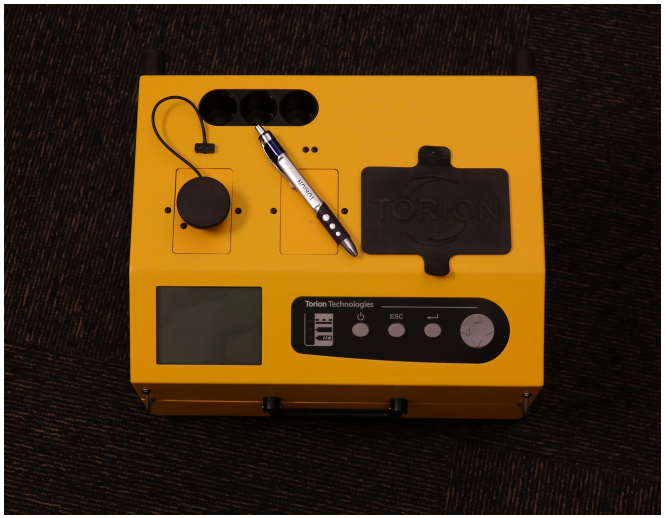
Design of a Field Sample Prep Station

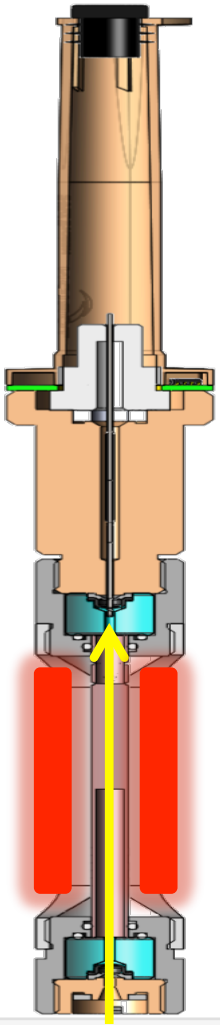
- Capable of multiple quantitative sample preparation techniques
  - Air
  - Water
  - Soil
- Operates on battery power
- Capable of covering a wide concertation range
- Provides easy mechanism for quantitative analysis
- Ideal if VOC and SVOC sample types can be run



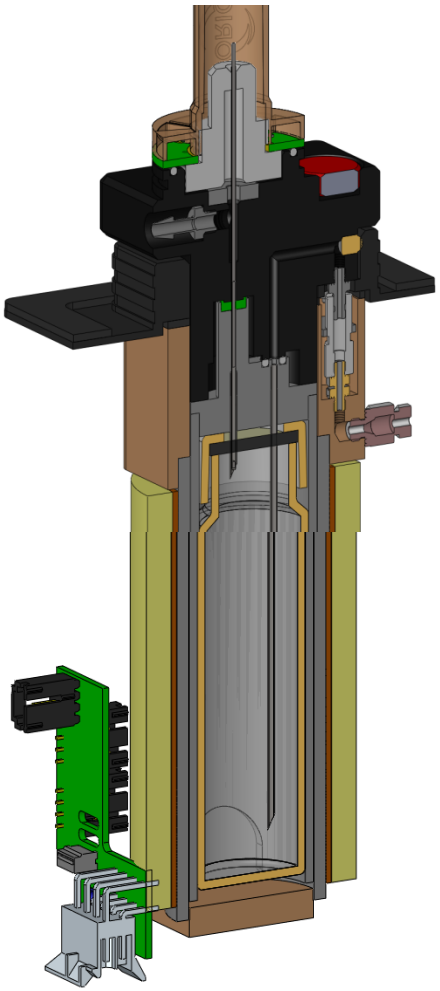
SPS-3

Three Functions

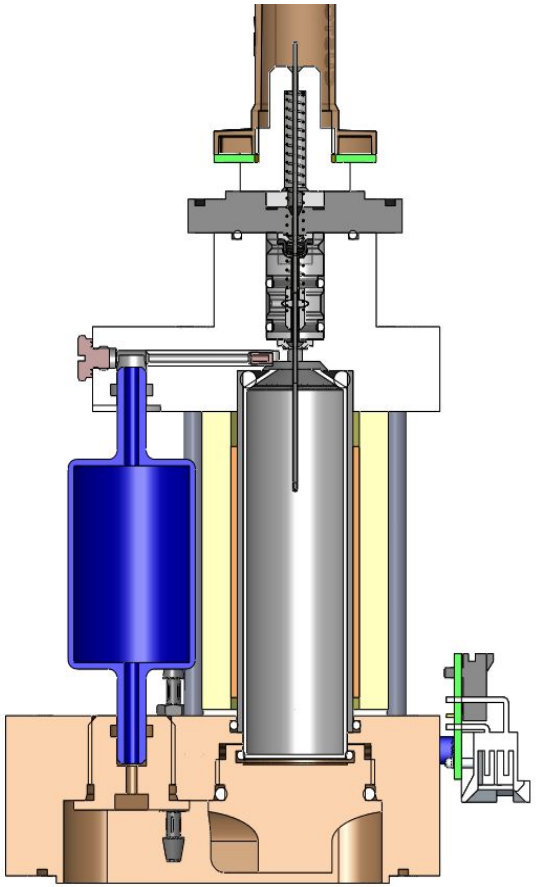
Thermal Desorption



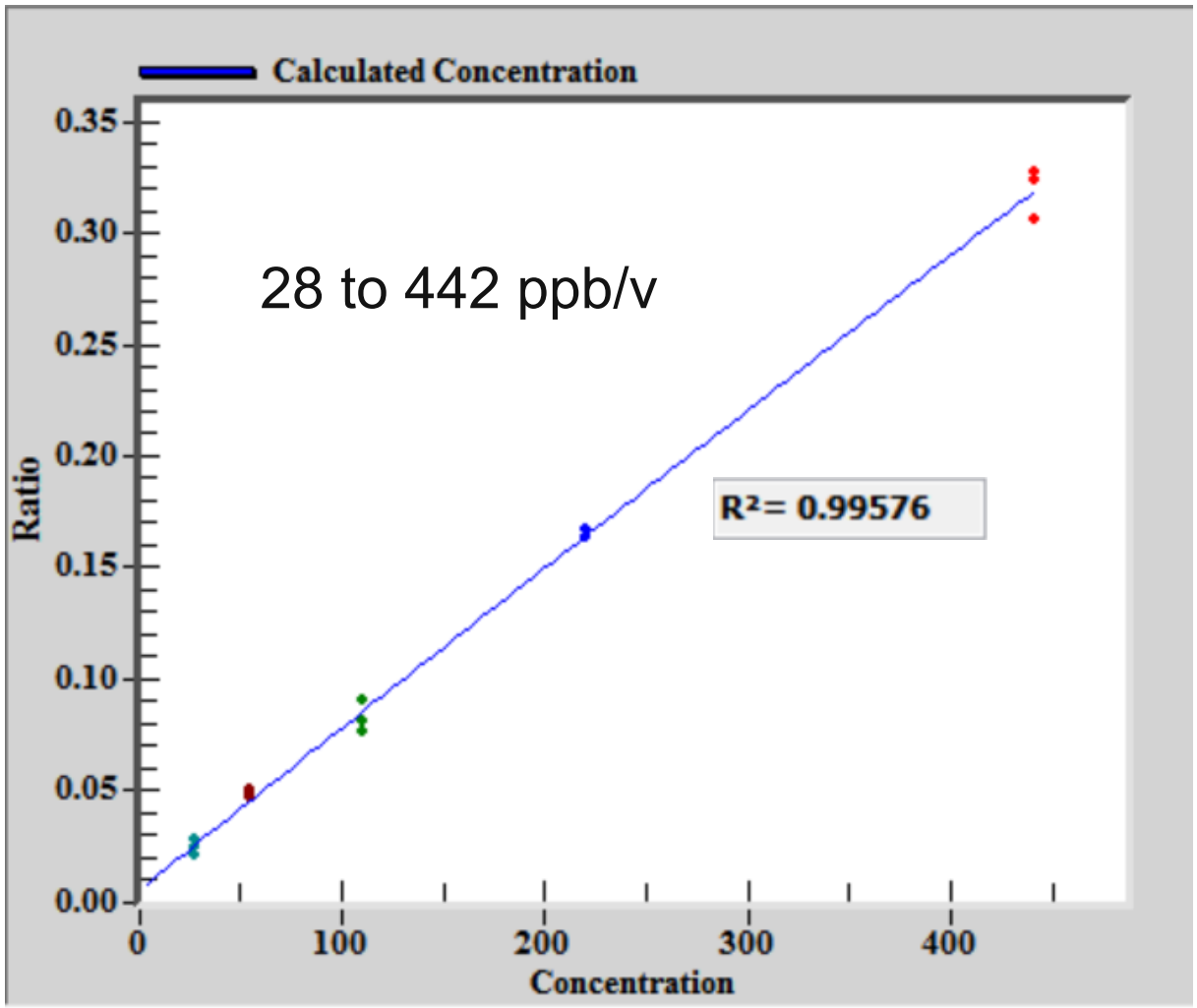
Headspace/P&T



Internal Standard



Internal Standard Curve Methylene Chloride



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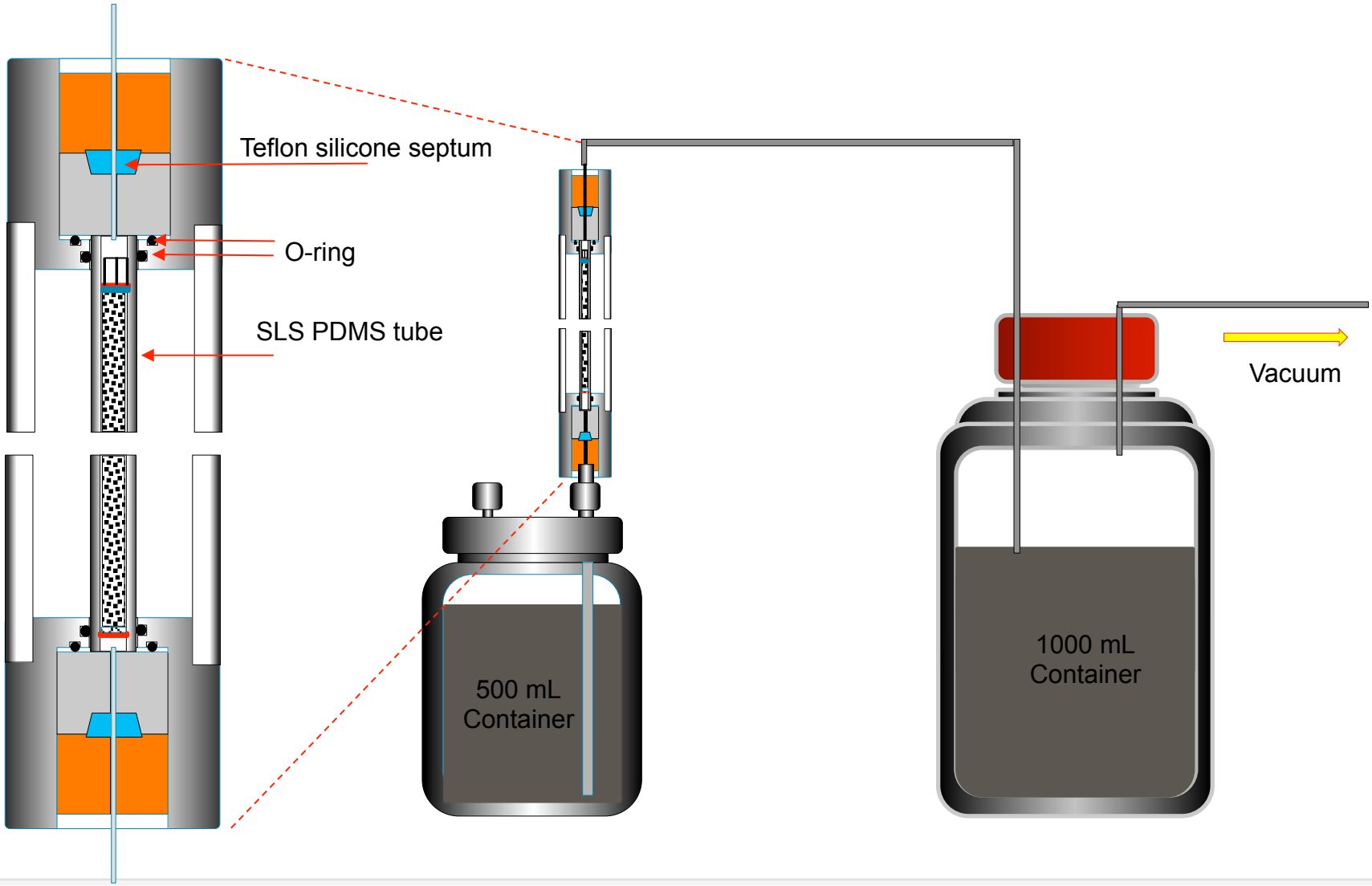
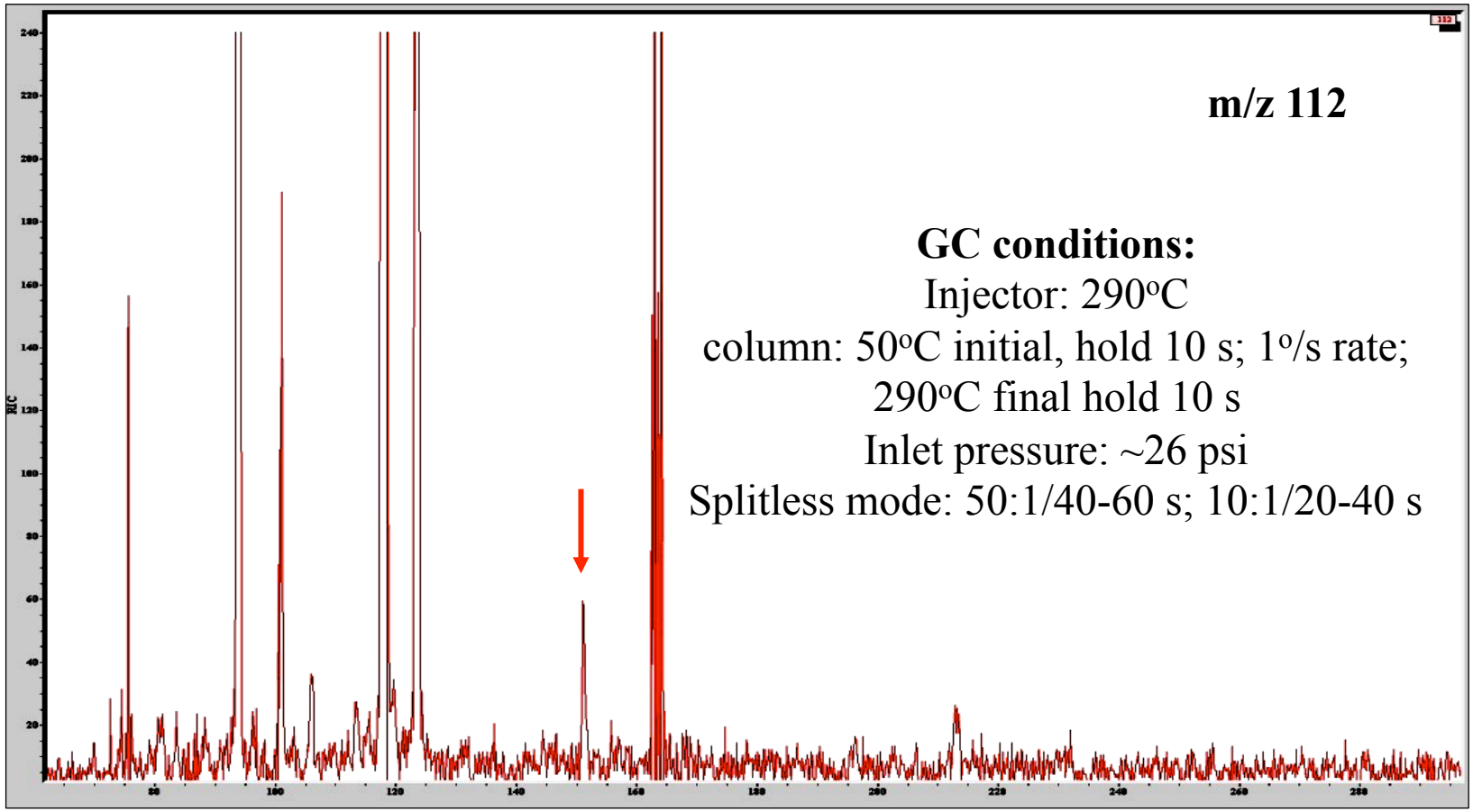
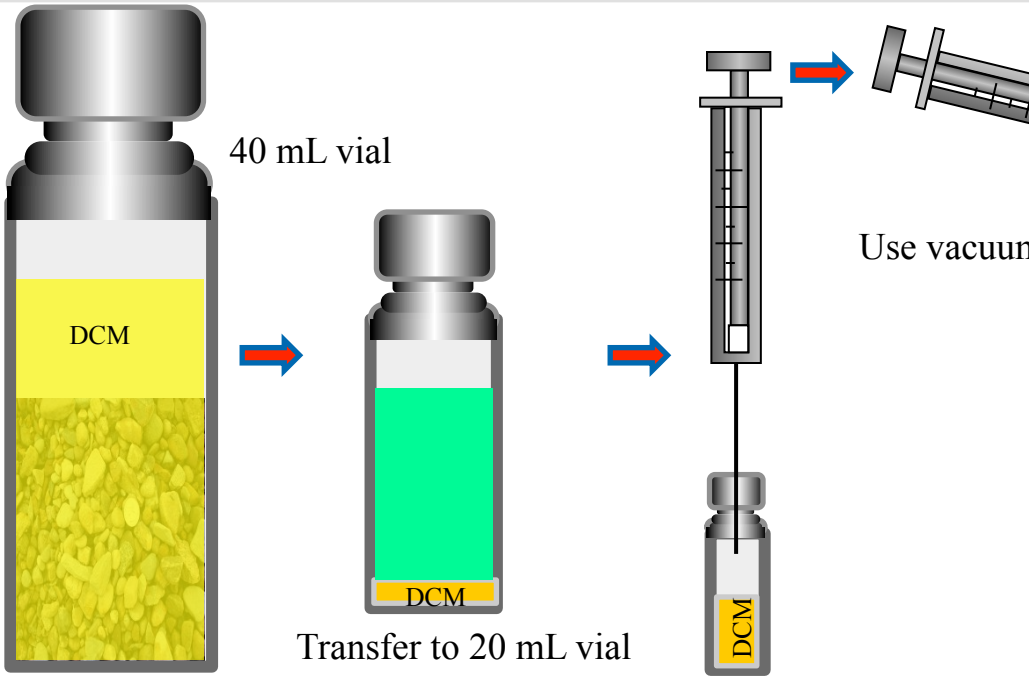
Thermal Desorption Extraction of SVOC

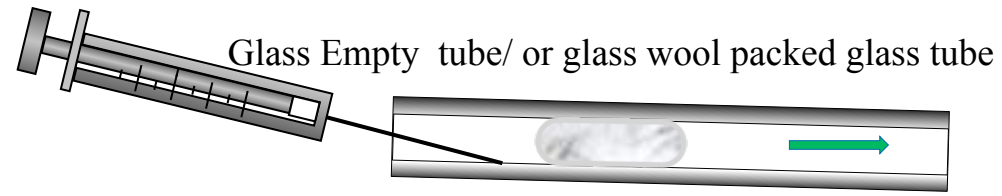


RIC 1 ppt Geosmin in Water

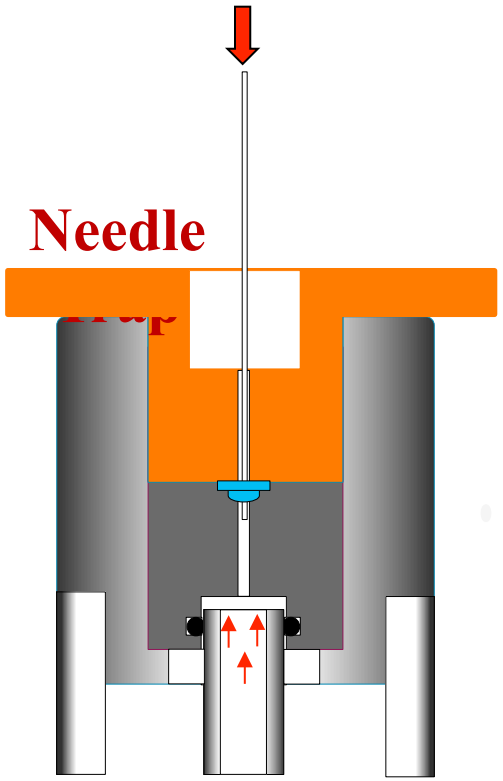


Micro Extraction Thermal Desorption





Use vacuum pump or leave the tube in air to evaporate the solvent



Sample Preparation Steps

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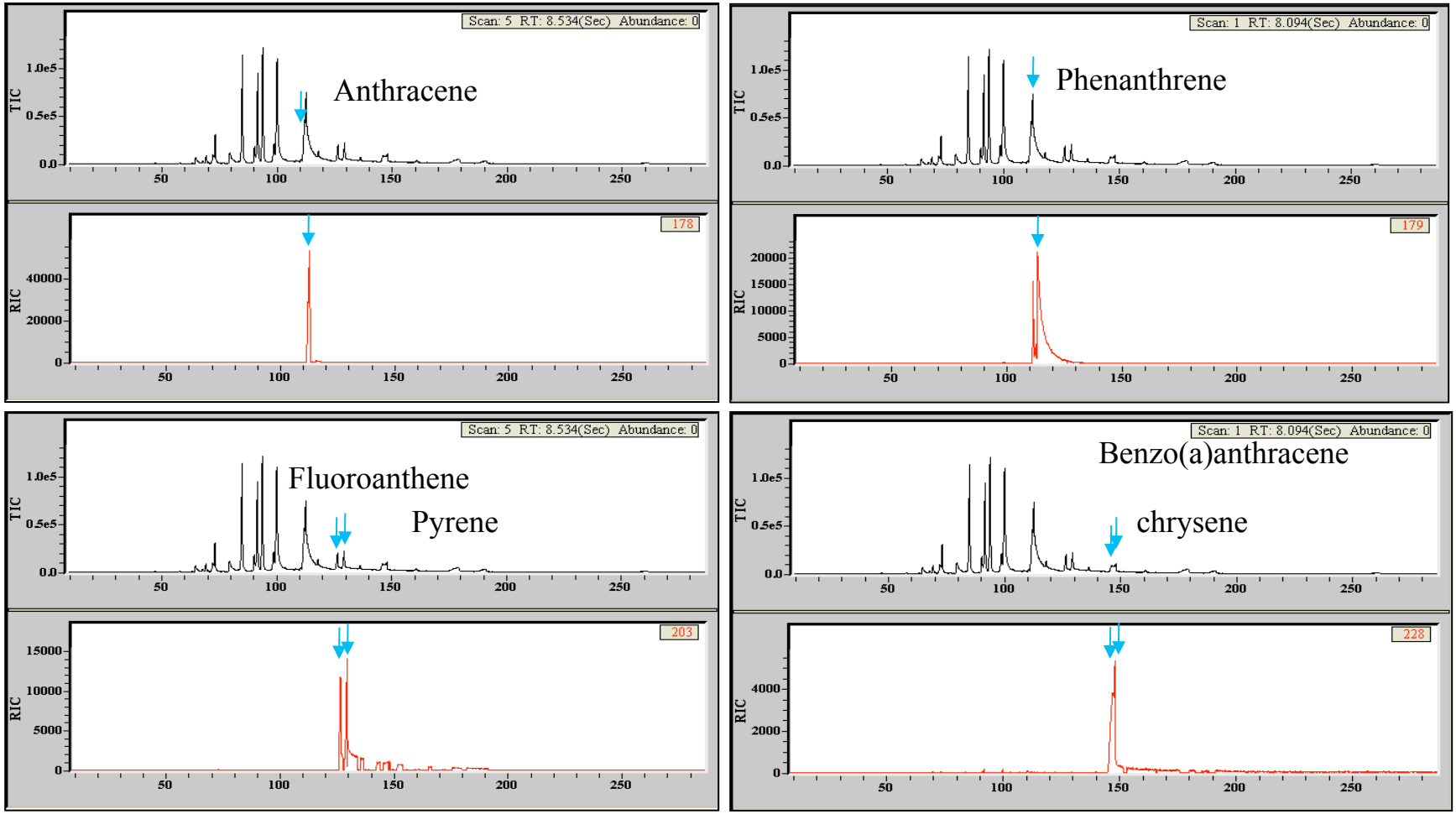
PAH Extracted from Gravel

0.25 ppm Spiked Sample



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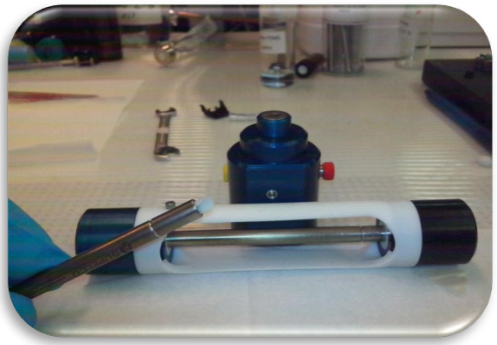
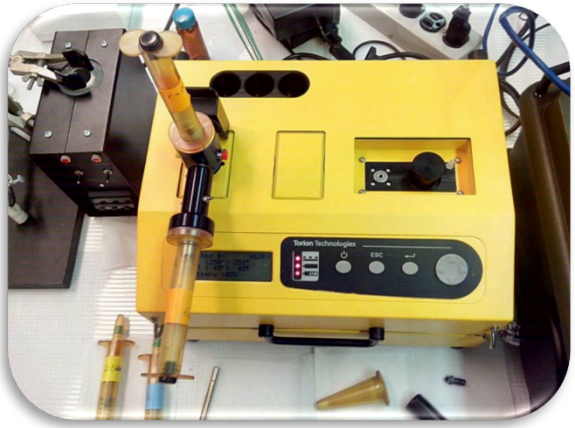
Advances in Solid Phase Extraction TFME

- SPME is a Universal Sampler that covers broad analyte range and multiple matrix
  - Limited Surface area
- Thin Film Membranes work on the same principle as SPME
  - Larger Surface Area
- Current Design
  - 25 X more analyte during sampling
  - 14 X at equilibrium

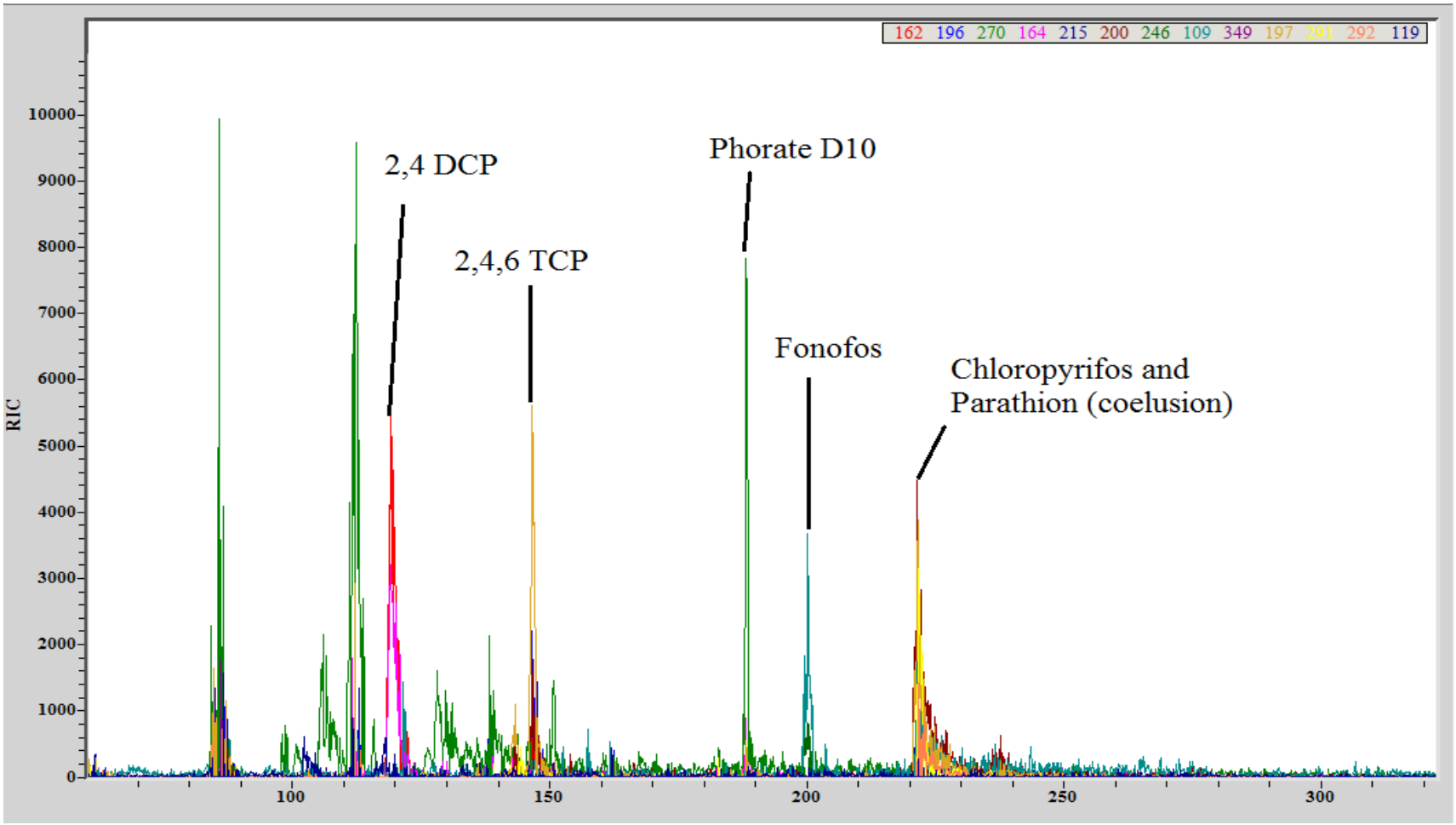
Coupling TFME with portable GC-MS:

- Portable GC-MS instrumentation offers an inherent advantage in generating immediately available results with no need for sample transport
- By coupling with more sensitive sampling technologies such as TFME, sensitivity can be increased
- Highly sensitive, inexpensive samplers can be deployed in a wide variety of locations simultaneously

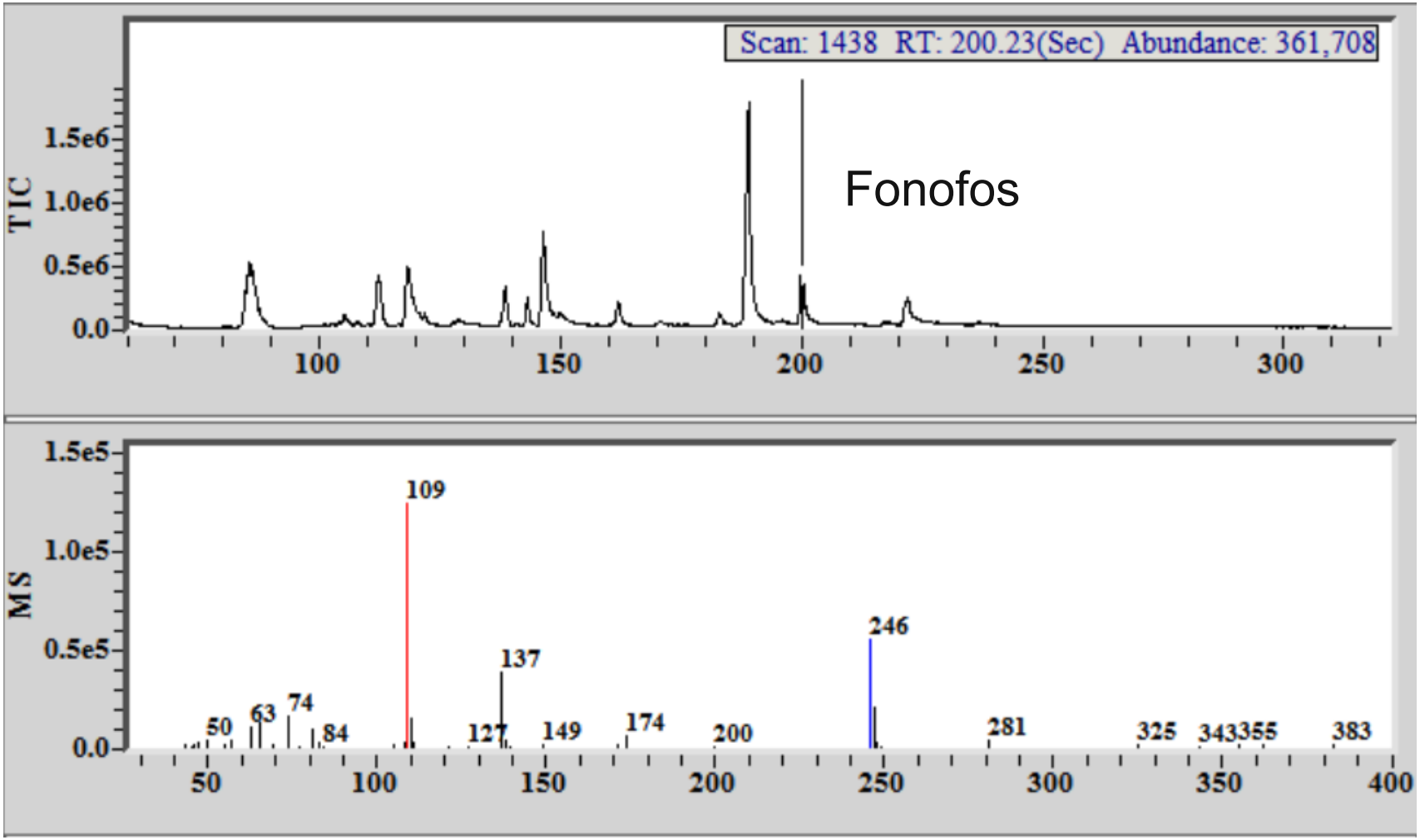




Demonstration of detection capability: Pesticide mixture at 100 ppt on T-9



10 ug/L Pesticide Mixture



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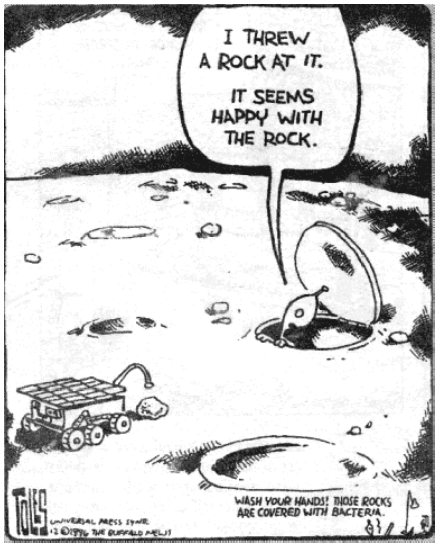
Summary



- Sampling remains a major challenge in accurately defining the state of our environment
- The combination of Field Portable GC/MS with rapid sampling tools for VOC and SVOC analysis provides data to make informed decisions at the site/source of the pollution
- The pace of development for in field sampling technologies must equal or exceed the development of instruments