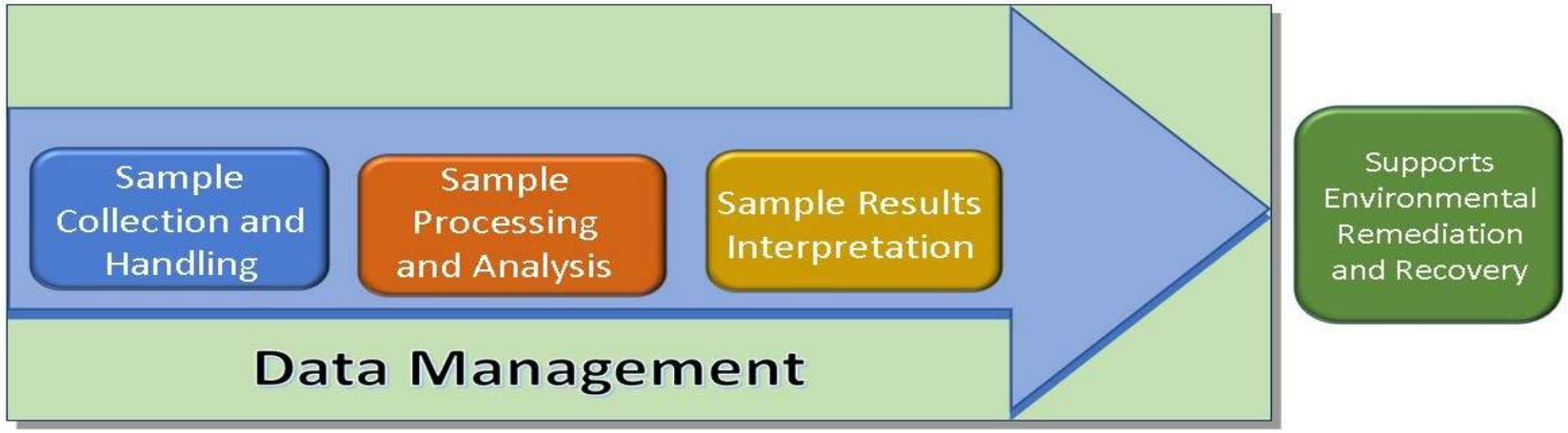
US EPA Office of Research and Development
Homeland Security Research Program

EPA's Environmental Sampling and Analytical Methods (ESAM) for Environmental Remediation and Recovery



EPA Tools and Resources Webinar
June 20, 2018

Sarah Taft, PhD

Why should you care about EPA's Environmental Sampling and Analytical Methods (ESAM)?

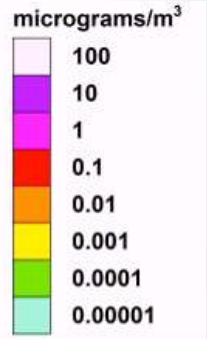
- *Problem:*
  - Events in 2001 highlighted major holes in sampling and analysis for large events
    - Inconsistencies in methods used to collect samples by different sampling teams
    - Different analysis methods used to characterize samples by multiple labs
  - Using multiple methods, it is impossible to interpret, communicate, or make decisions off the data

Why should you care about EPA's Environmental Sampling and Analytical Methods (ESAM)?

- *Problem:*
  - A future wide area incident is still a major concern!
  - **State, local and tribal public health and environmental agencies need to know what resources they have available**

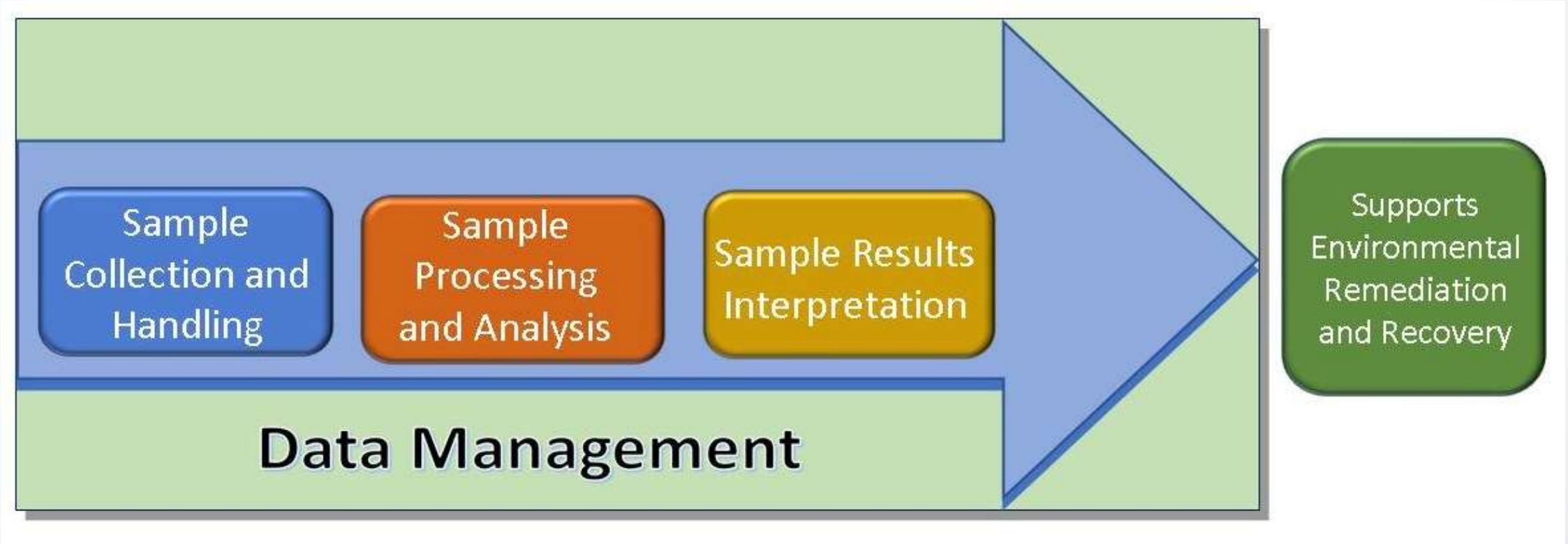
Video demonstration

New York Subway System (MTA)



Environmental Sampling and Analytical Methods Program (ESAM)

The ESAM tool supports decision makers by coordinating sampling and analysis needs to a chemical, biological, radiochemical, or biotoxin contamination incident.



https://www.epa.gov/homeland-security-research/environmental-sampling-analytical-methods-esam-program-home

Who helped develop ESAM?

How was ESAM developed?

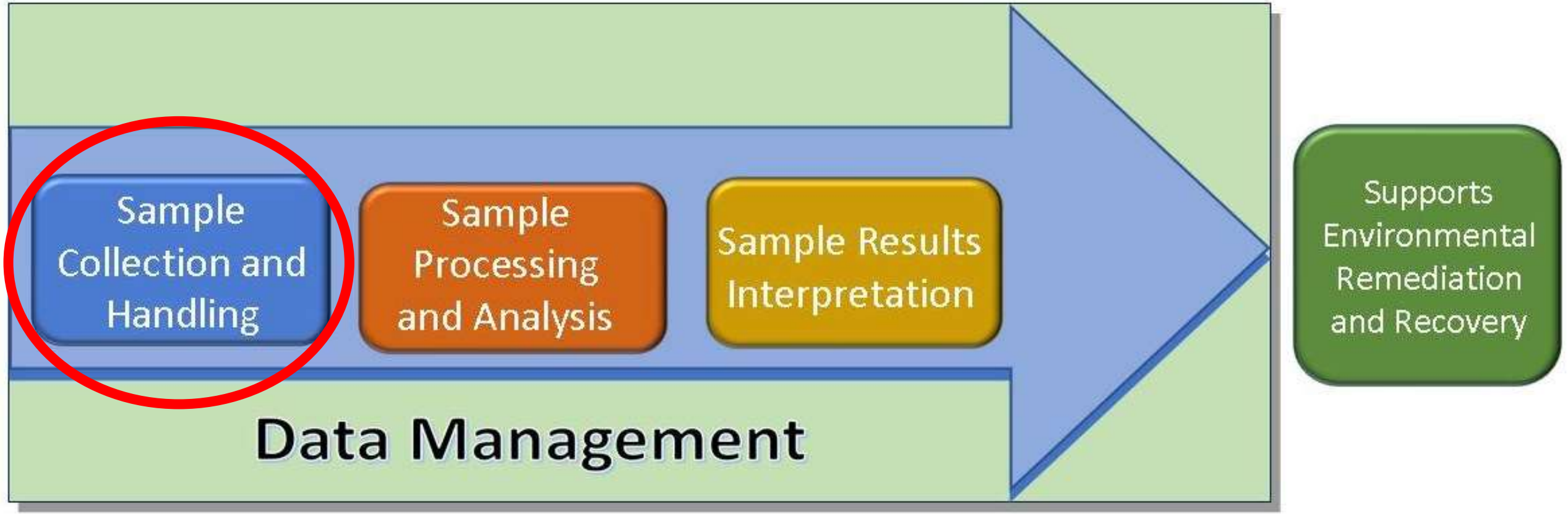
- Is there an EPA published method for measurement of the analyte in the sample type of interest?
- Is there a method that has been published by another federal agency or Voluntary Consensus Standard Body (VCSB)?
- Is there an EPA, federal or VCSB method that has been developed for measurement of the analyte in another environmental sample type?
- Are there methods that measure analytes similar to the analyte of concern?
- Are there procedures described and supported by data in a peer-reviewed journal article?

What types of contaminants and sample types?

Chemicals	Radiochemicals	Pathogens	Biotoxins

• 145 analytes
  • Chlorine
  • Fentanyl
  • VX
• 5 sample types
  • Solids
  • Non-drinking water
  • Drinking water
  • Air
  • Wipes
	• 36 analytes
	  • Cesium-137
	  • Plutonium-238/239
	  • Strontium-90
	• 10 sample types
	  • Drinking water
	  • Aqueous & liquid phase
	  • Soil & sediment
	  • Surface wipes
	  • Air filters
	  • Vegetation
	  • Brick
	  • Concrete
	  • Asphalt matrices
	  • Asphalt shingles
		• 33 analytes
		  • *Bacillus anthracis*
		  • *Legionella*
		  • *Cryptosporidium*
		  • *Noroviruses*
		• 5 sample types
		  • Aerosol
		  • Particulate
		  • Soil
		  • Drinking water
		  • Post decontamination waste water
			• 17 analytes
			  • Ricin
			  • Microcystins
			  • Botulinum neurotoxins
			• 5 sample types
			  • Aerosol
			  • Solid
			  • Particulate
			  • Non-drinking water
			  • Drinking water

Environmental Sampling and Analytical Methods Program (ESAM)



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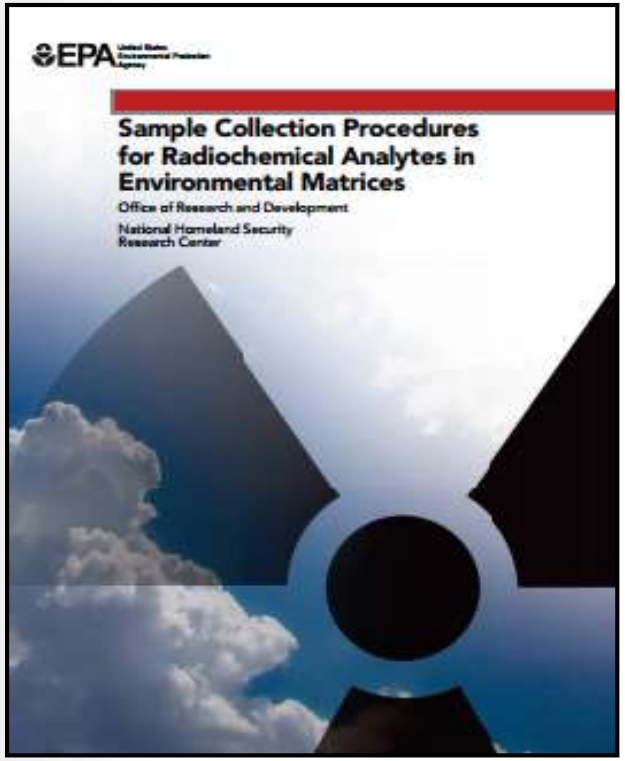
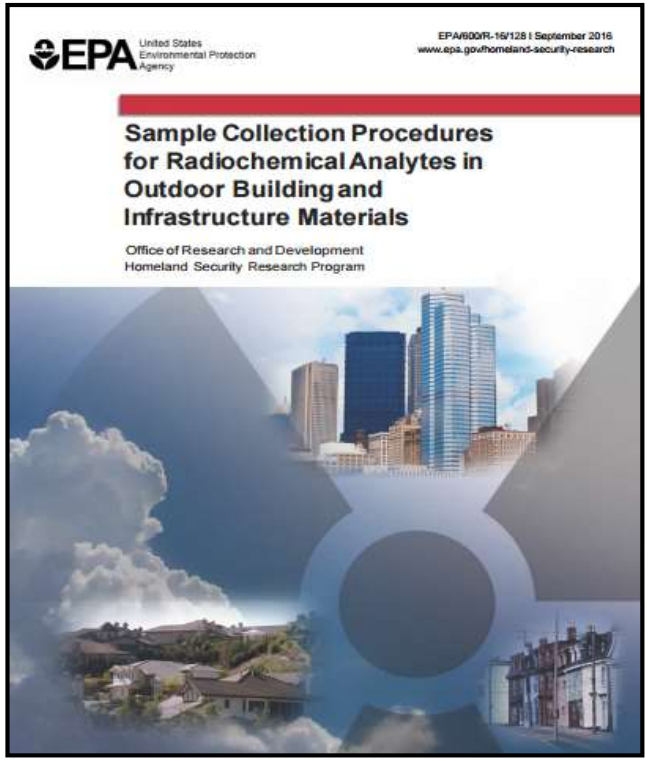
Sample Collection Information Document (SCID)

- Developed to facilitate transfer of field samples to the analytical laboratory by indicating specific requirements for:
  - Collection volume or weight
  - Sample containers
  - Holding times
  - Preservation or preparation
  - Packaging
  - Shipping labels

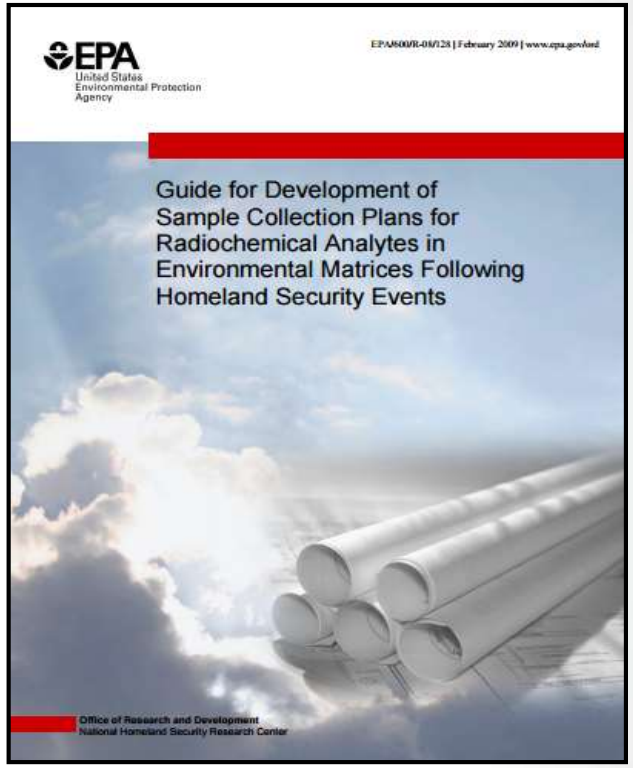
Example: Radiological Sample Collection



Procedure for **environmental sample collection** during site characterization, remediation, and final status phases



Procedure for **building materials sample collection** during site characterization, remediation, and final status phases



Framework to assist incident commanders, project managers, state and local authorities, contractors, and enforcement divisions in **developing sample collection plans**

Example: Biological Sample Collection

New composite sampling methods:

- Large sampling area
- Economic and rapid
- Small number of sampling personnel per area
- Reduced burden on processing labs

Robotic cleaner

Wet vacuum

Native air filters (e.g. HVAC)

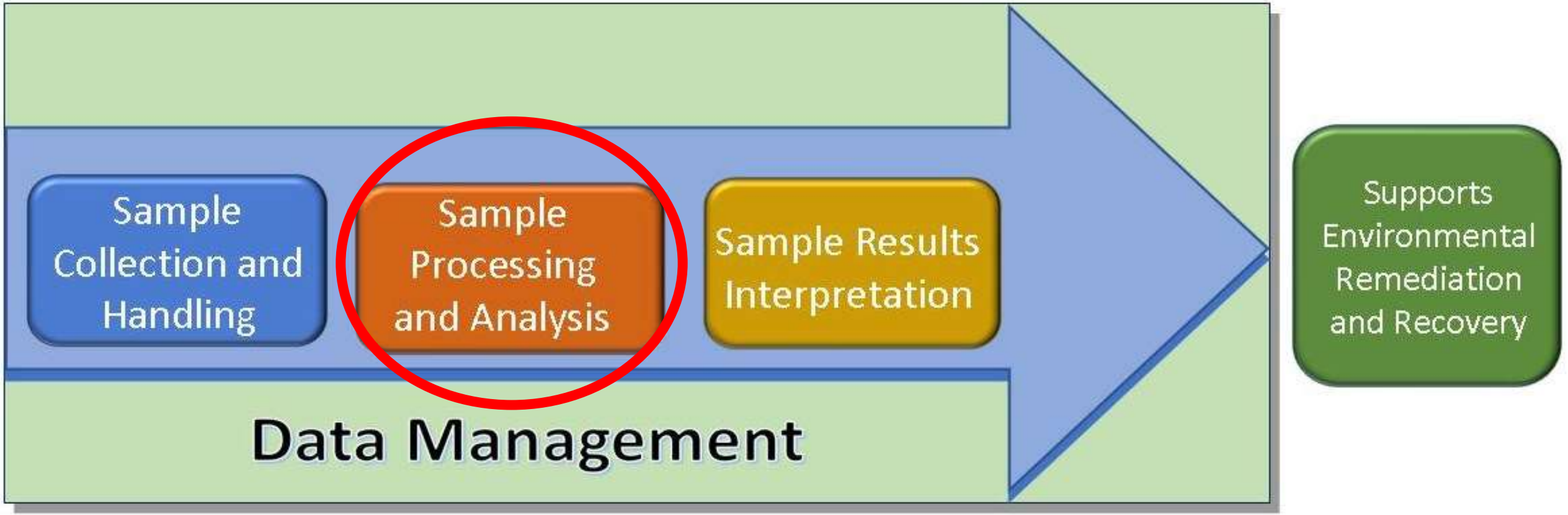
Activity-based sampling

Burkholderia pseudomallei incident at Tulane

- Primates infected with *B. pseudomallei* at Tulane National Primate Center

- Developed sample collection methods and sampling plans for outdoor facilities

Environmental Sampling and Analytical Methods Program (ESAM)



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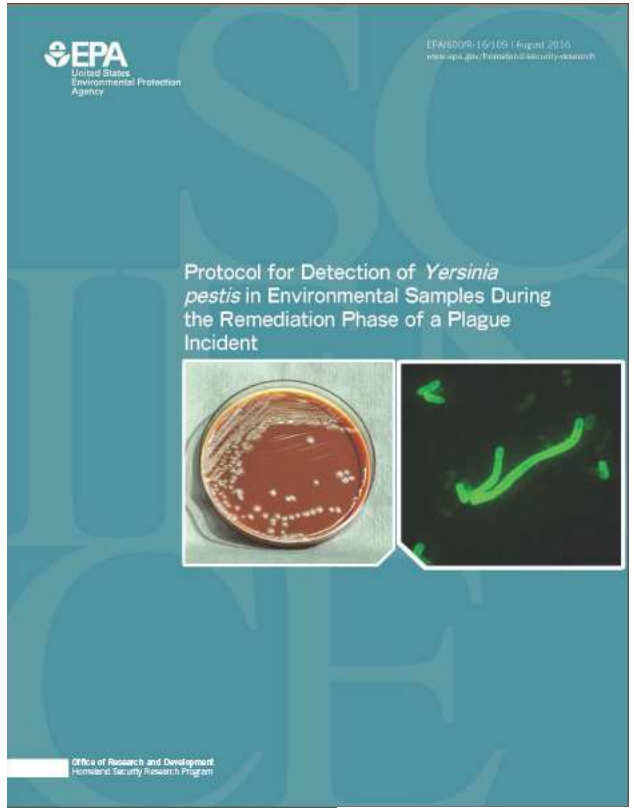
Selected Analytical Methods (SAM)

- Identifies a single, selected method for each analyte/sample type in a specific matrix (e.g. soil, water, air)
  - Permits sharing of sample load between laboratories
  - Increases the speed of analysis
  - Improves data comparability
  - Simplifies potential outsourcing analytical support

Selected Analytical Methods (SAM) Applicability Tiers

SAM Applicability Tier I	**Analyte/sample type is a target of the method.** Multi-laboratory evaluated will allow implementation for the analyte/sample type with no modifications. Data available for all aspects of method performance and quality control measures supporting its use.
SAM Applicability Tier II	**Method has been used by laboratories to address the analyte/sample type, but not multi-lab validated.** (1) The analyte/sample type is a target of the method, but method performance/quality control measures need further evaluation (e.g., single-lab tested). (2) The analyte/sample type is not a target of the method, but limited data for method performance/ quality control may be available.
SAM Applicability Tier III	**Analyte/sample type is not a target of the method, and/or no reliable data supporting the method's fitness for its intended use are available**.

New Processing and Analysis Methods in ESAM



Biological and Biotoxin:

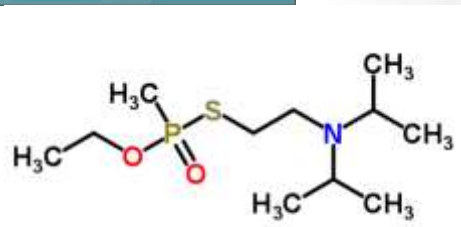
- *Yersinia pestis*
- *Francisella tularensis*
- Ricin

Chemical:

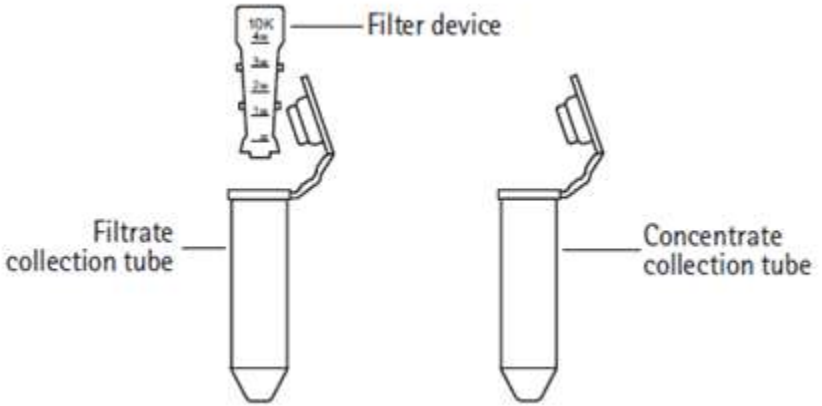
- VX
- EA-2192, VX Degradation Product
- Semivolatile Organic Compounds (21 sVOCs)
- Organophosphorus-based Pesticides

Radiochemical:

- Cf -252, Cm -244, and Sr - 89
- Rapid radiochemical methods for concrete, brick, asphalt, shingles, limestone and granite



Ricin Incident in Boulder, CO



Sample Processing Procedure for Post-Decontamination Ricin Samples using 0.5 mL Ultrafiltration Devices

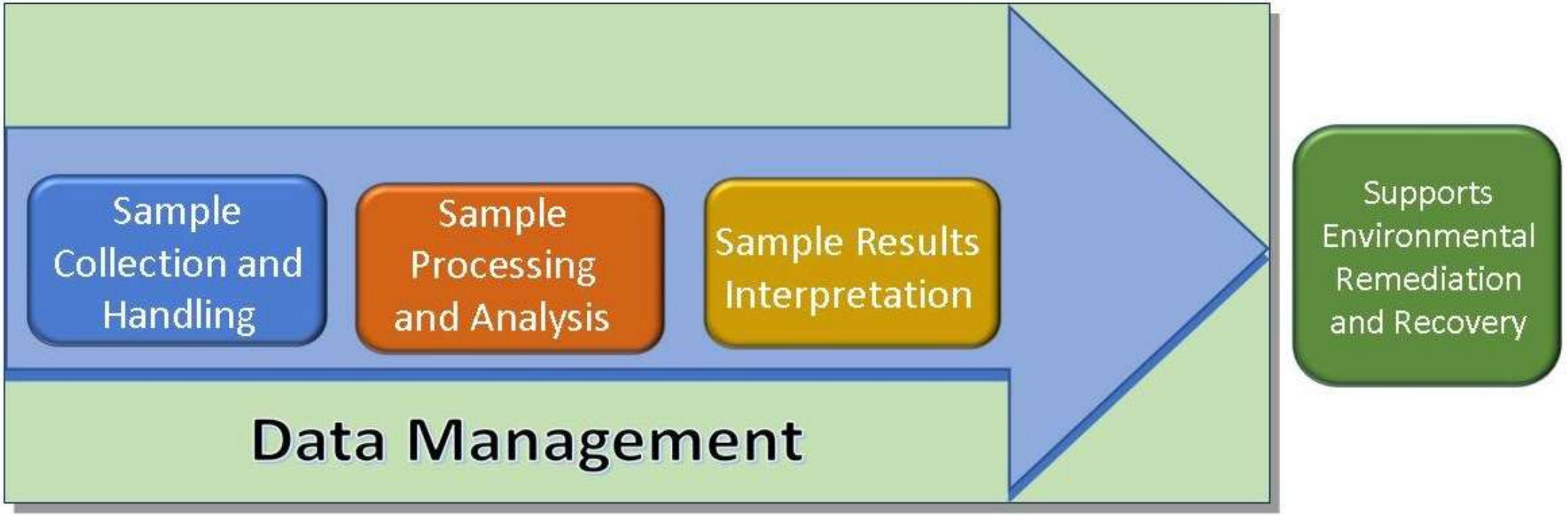
Method directly from ESAM

Arsenic Incident near Louisville, KY

- Soil samples found high in arsenic (As) near Louisville, KY

- There was concern that As in samples was due to past Lewisite production in the region
  - Used As in chicken feed
- Environmental Response Laboratory Network (ERLN) analyzed the samples using the new LC/MS-MS method and further confirmed by GC/MS found in ESAM
- The analysis confirmed that the arsenic was not from Lewisite contamination

Environmental Sampling and Analytical Methods Program (ESAM)



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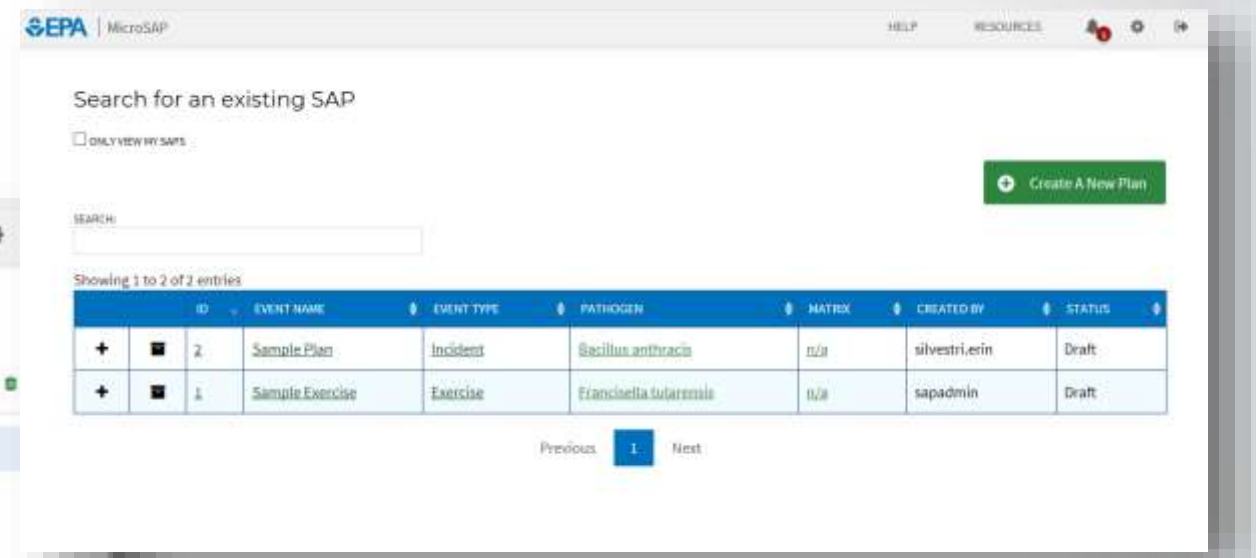
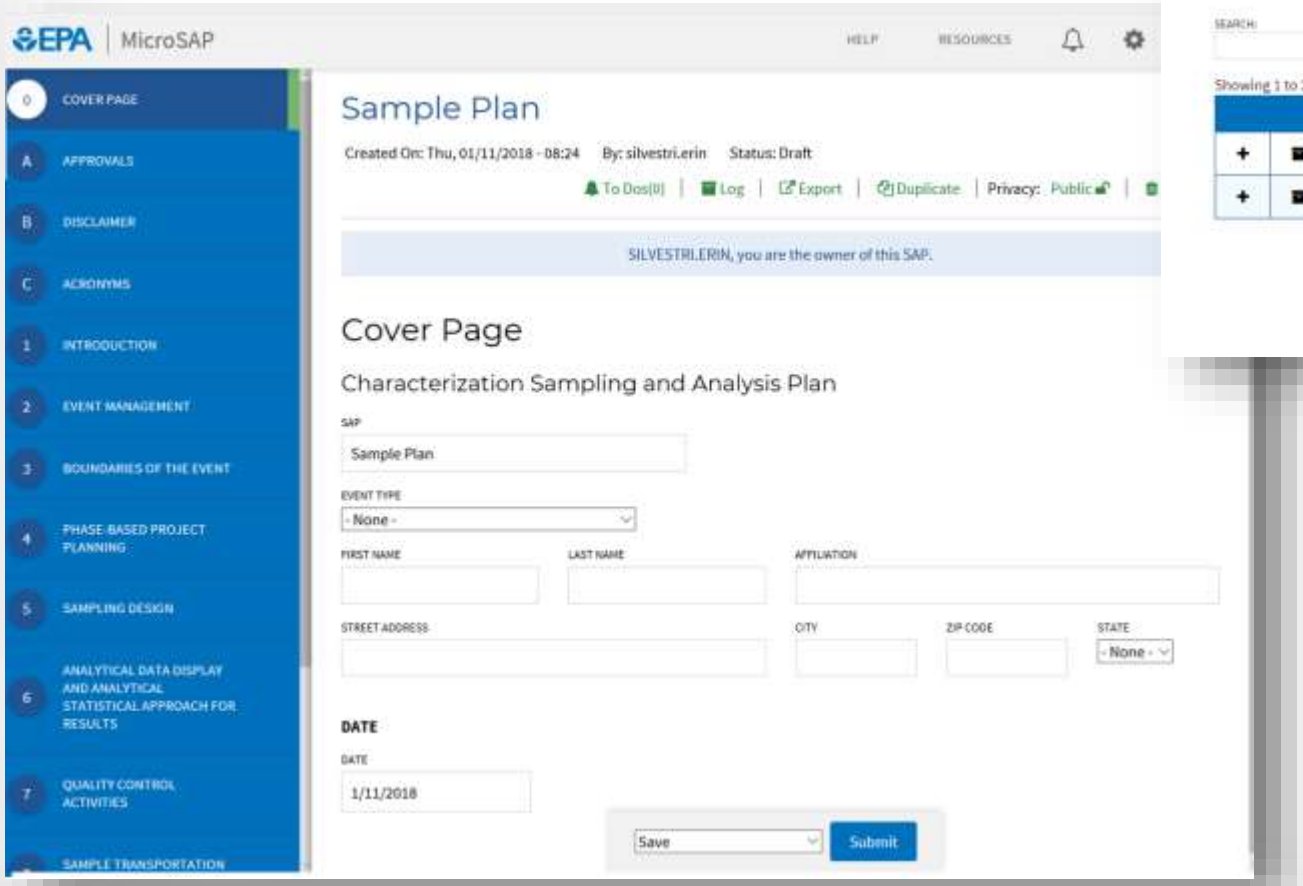
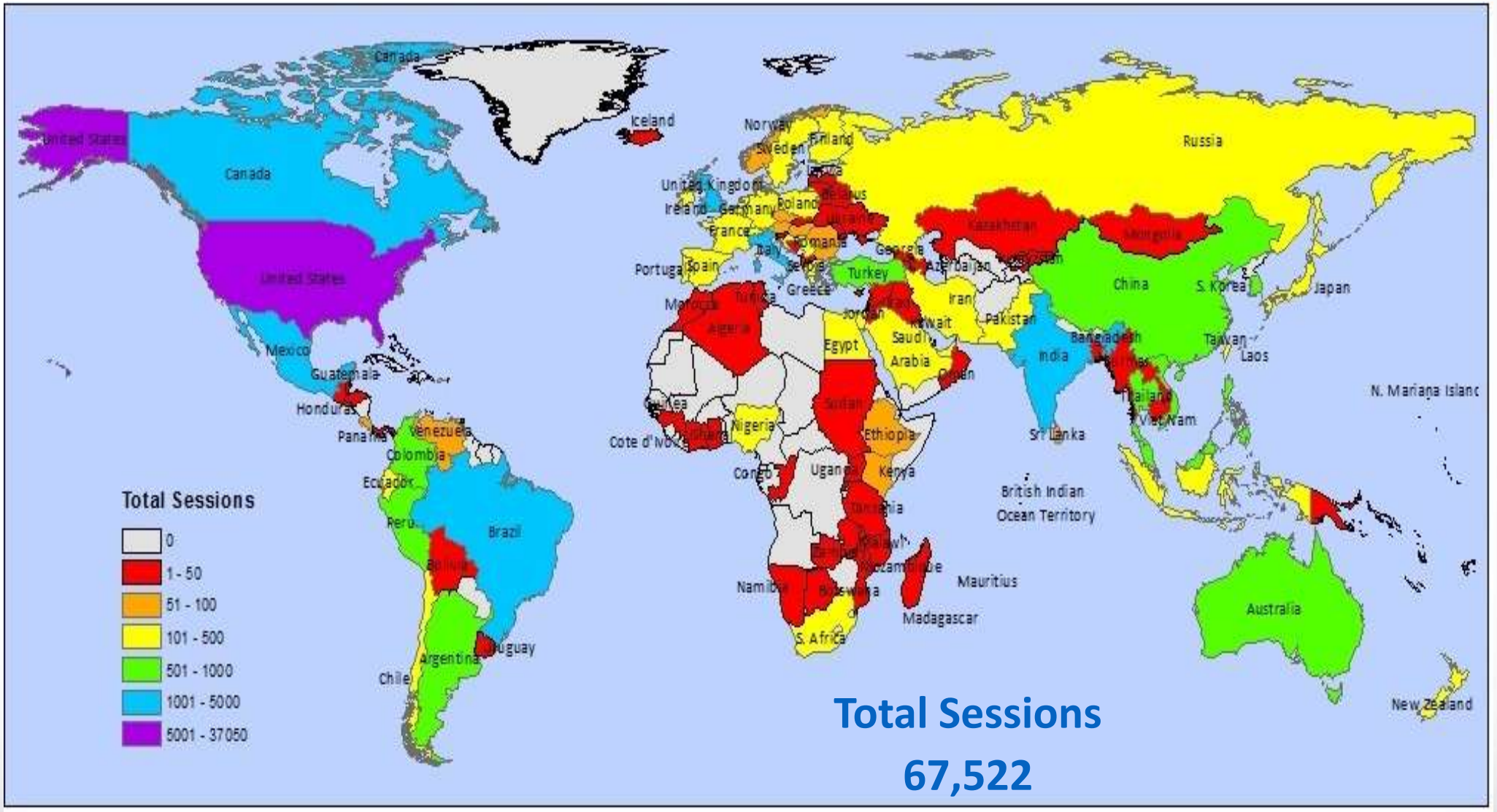
Sampling Design Planning - MicroSAP





MicroSAP was developed as an online tool to assist with development of microbial sampling and analysis plans. It is applicable for site characterization, verification sampling, and post-decontamination sampling stages of a contamination incident.

Who is using ESAM?



Who is using ESAM?

Total Sessions

37,007

California (4,982)

Texas (2,579)

Ohio (2,082)

New York (1,895)

Pennsylvania (1,728)

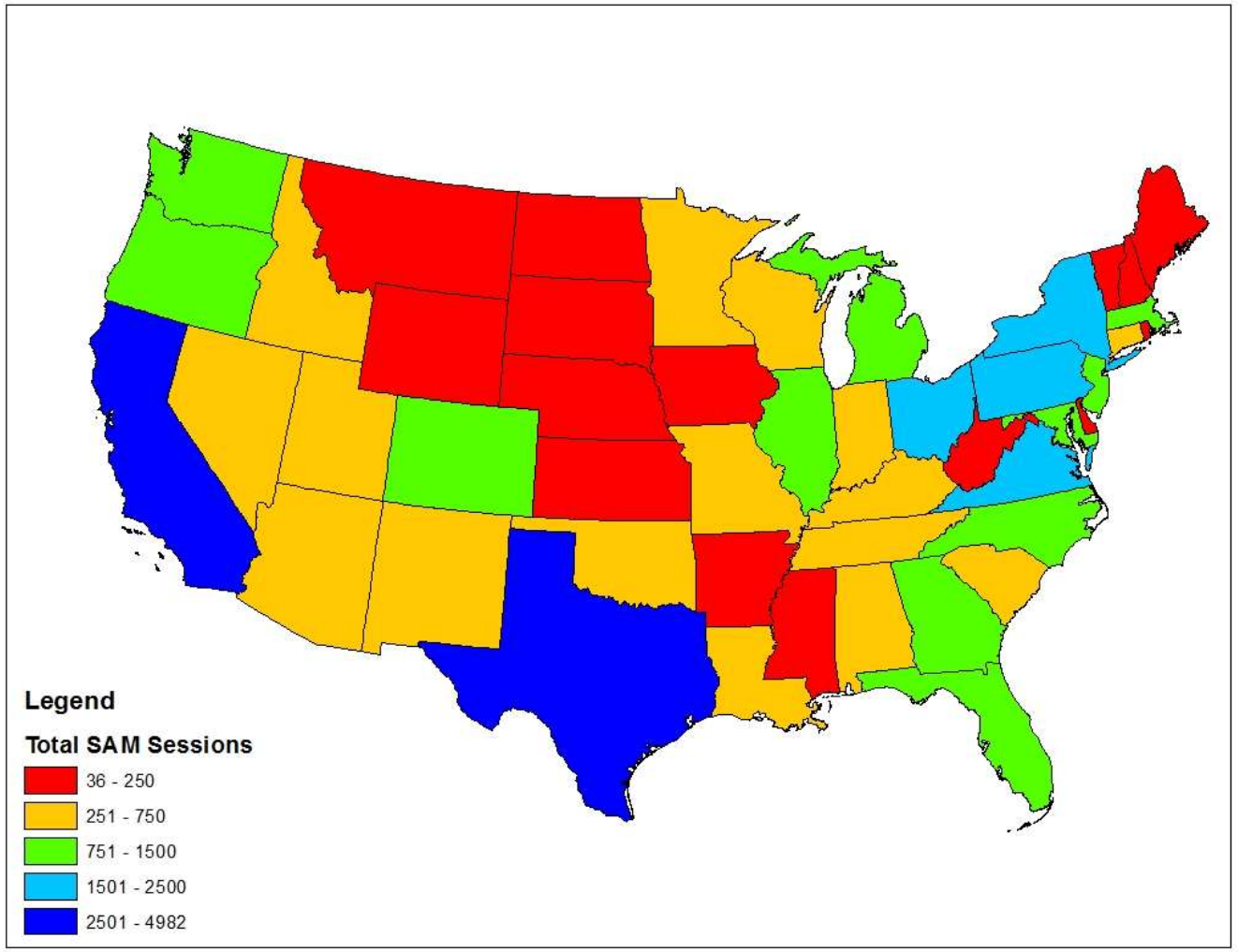
Virginia (1,728)

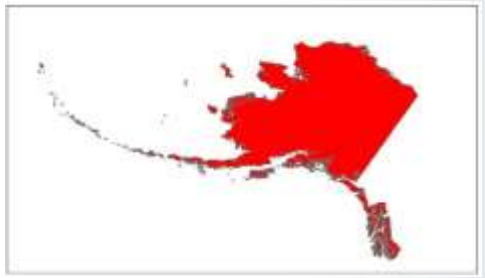
New Jersey (1,408)

North Carolina (1,355)

Washington (1,314)

Colorado (1,286)

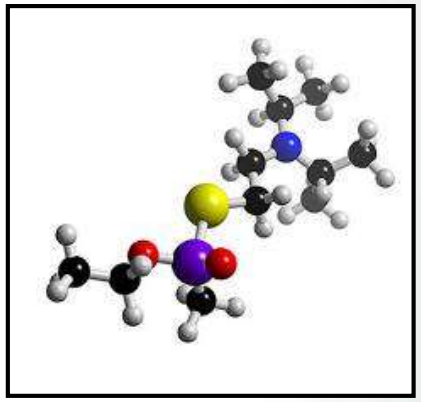




What is most popular from ESAM?

CHEMISTRY Methods:

- Acid Digestion of Sediments, Sludges, and Soils (Method 3050b)
- Polychlorinated Biphenyls (PCBs) by Gas Chromatography (Method 8082a)
- Volatile Organic Compounds (VOCs) in Air Analyzed by GC/MS (Method TO 15)



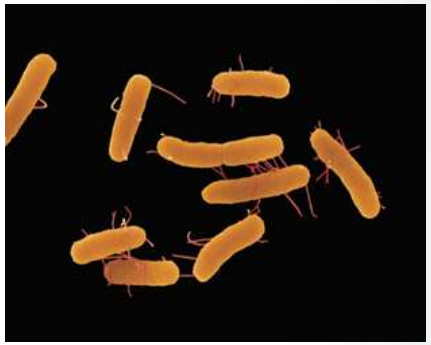
RADIOCHEMISTRY Methods:

- Alpha and Gross Beta in Drinking Water (Method 900.0)
- Gamma Emitting Radionuclides in Drinking Water (Method 901.1)
- Radium-226 in Drinking Water – Radon Emanation Technique (Method 903.1)

What is most popular from ESAM?

BIOLOGICAL Methods:

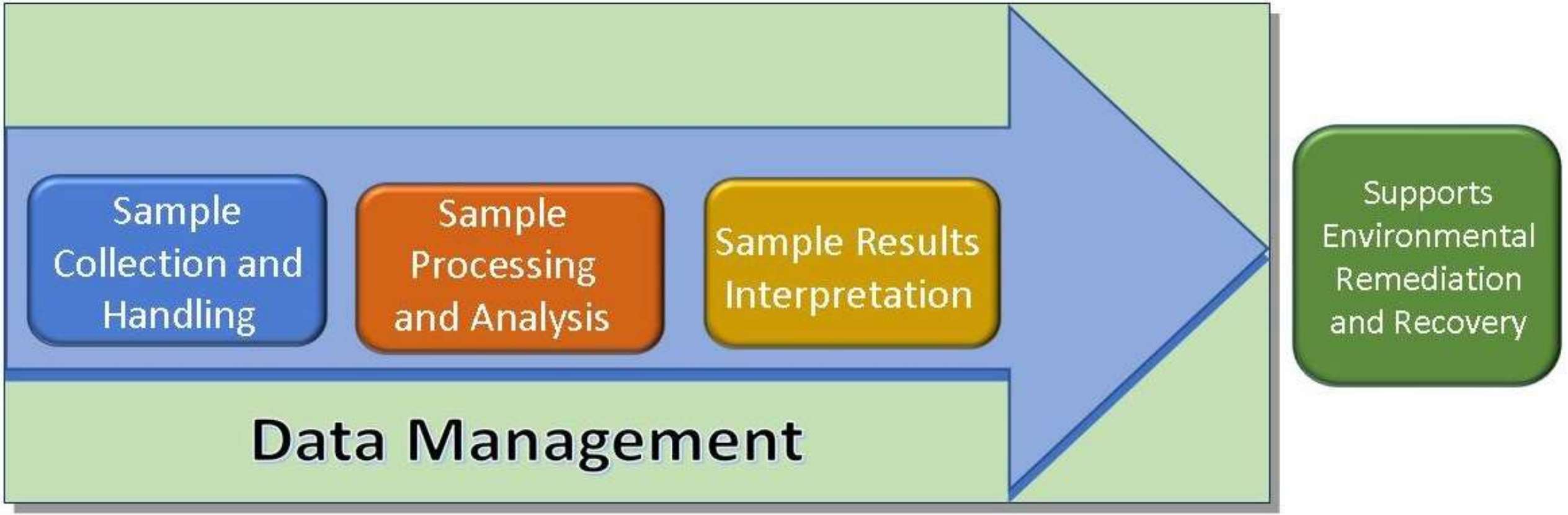
- *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA (Method 1623)
- *Salmonella* in Sewage Sludge (Biosolids) by Modified Semisolid Rappaport-Vassiliadis (MSRV) Medium (Method 1682)
- Quality Assurance/Quality Control Guidance for Laboratories Performing PCR Analyses on Environmental Samples (QA guidance lab PCR)



BIOTOXIN Methods:

- *Clostridium botulinum* (FDA method Ch 17-2001 Bacteriological Analytical Manual Online: Chapter 17)
- Detection and Enumeration of *Listeria monocytogenes* in Foods (FDA method Ch 10-2003)
- Bacteriological Analytical Manual Online, Rapid Methods for Detecting Foodborne Pathogens (FDA online method Appendix 1, 2001)

DEMO of ESAM



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