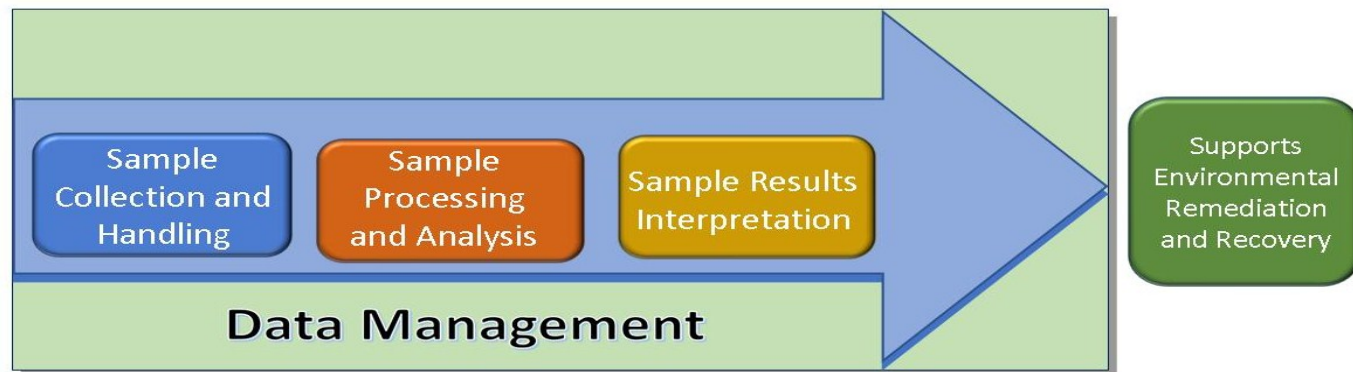


US EPA Office of Research and Development
Homeland Security Research Program

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



**National Environmental Monitoring Conference
August, 2018**

Erin Silvestri
U.S. Environmental Protection Agency



Overview

- Background
- Environmental Sampling and Analytical Methods (ESAM) Program
- Sample Collection and Analysis
- Selected Analytical Methods (SAM)
- SAM Statistics
- ESAM Website





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

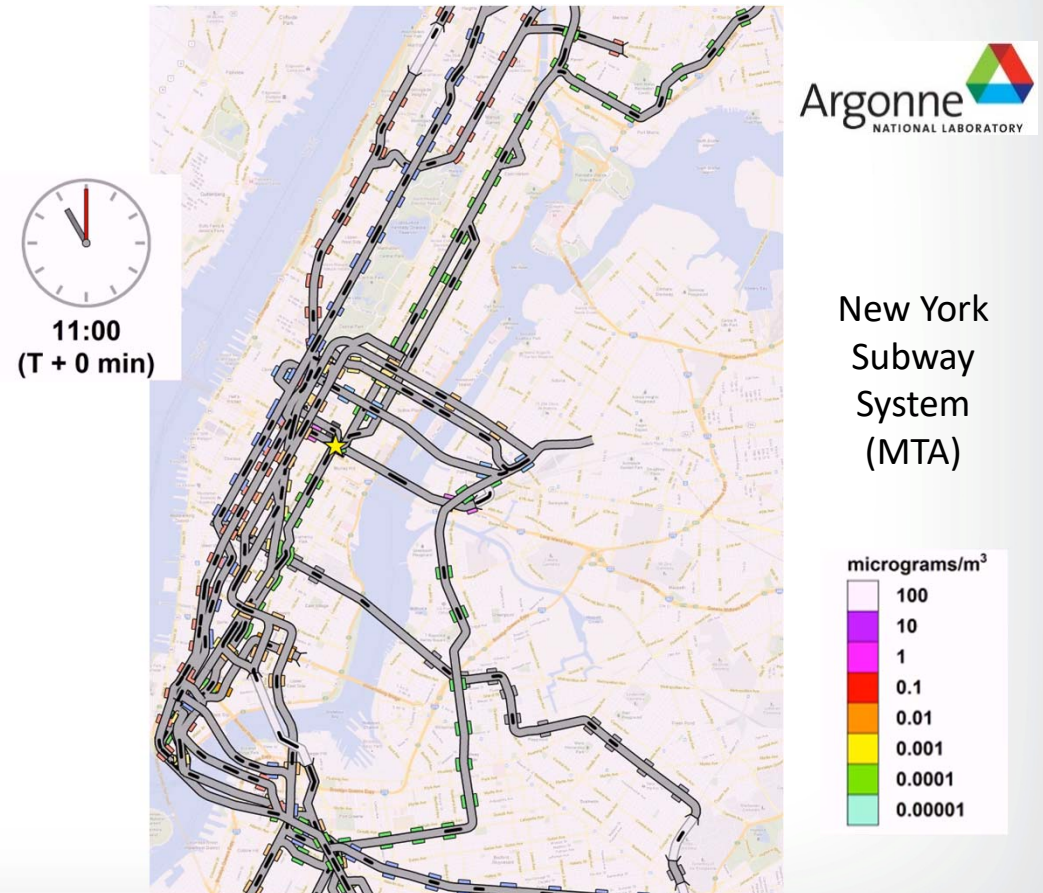




Why should you care about EPA's Environmental Sampling and Analytical Methods (ESAM)?

- Problem:

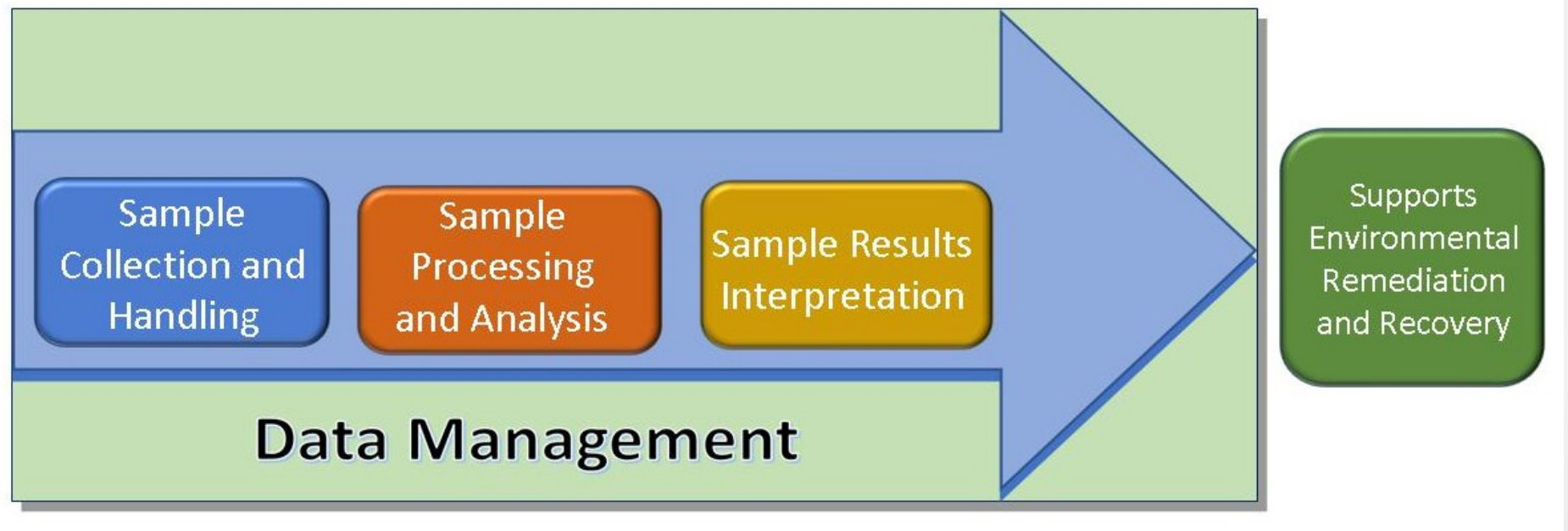
- A future wide area incident is still a major concern!
- **State, local and tribal public health and environmental agencies need to know what resources they have available**





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.



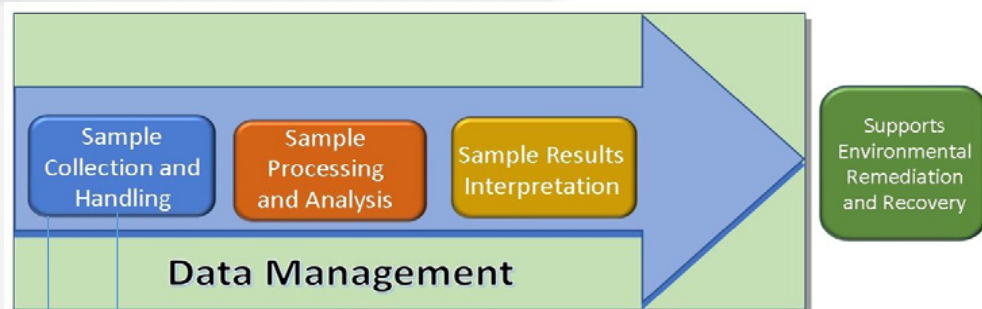


What types of contaminants and sample types?

Chemicals	Radiochemicals	Pathogens	Biotoxins
<ul style="list-style-type: none"> • <u>145 analytes</u> <ul style="list-style-type: none"> • Chlorine • Fentanyl • VX • <u>5 sample types</u> <ul style="list-style-type: none"> • Solids • Non-drinking water • Drinking water • Air • Wipes 	<ul style="list-style-type: none"> • <u>36 analytes</u> <ul style="list-style-type: none"> • Cesium-137 • Plutonium-238/239 • Strontium-90 • <u>10 sample types</u> <ul style="list-style-type: none"> • Drinking water • Aqueous & liquid phase • Soil & sediment • Surface wipes • Air filters • Vegetation • Brick • Concrete • Asphalt matrices • Asphalt shingles 	<ul style="list-style-type: none"> • <u>33 analytes</u> <ul style="list-style-type: none"> • <i>Bacillus anthracis</i> • <i>Legionella</i> • <i>Cryptosporidium</i> • <i>Noroviruses</i> • <u>5 sample types</u> <ul style="list-style-type: none"> • Aerosol • Particulate • Soil • Drinking water • Post decontamination waste water 	<ul style="list-style-type: none"> • <u>17 analytes</u> <ul style="list-style-type: none"> • Ricin • Microcystins • Botulinum neurotoxins • <u>5 sample types</u> <ul style="list-style-type: none"> • Aerosol • Solid • Particulate • Non-drinking water • Drinking water



ESAM Sample Collection Protocols, Procedures, and Information



Sample Collection Protocols & Procedures

- Readily available protocols and procedures for use in the field by sample collectors

Sample Collection Information Document (SCID)

- Online resource to facilitate field sample collection and laboratory requirements for large numbers of samples



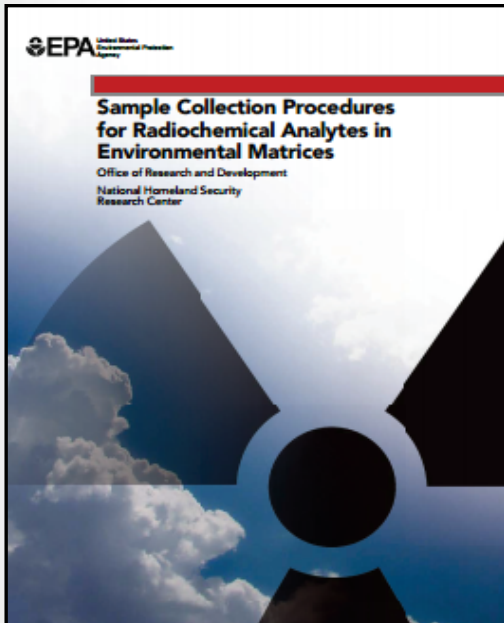
Sample Collection Information Document (SCID)

- 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

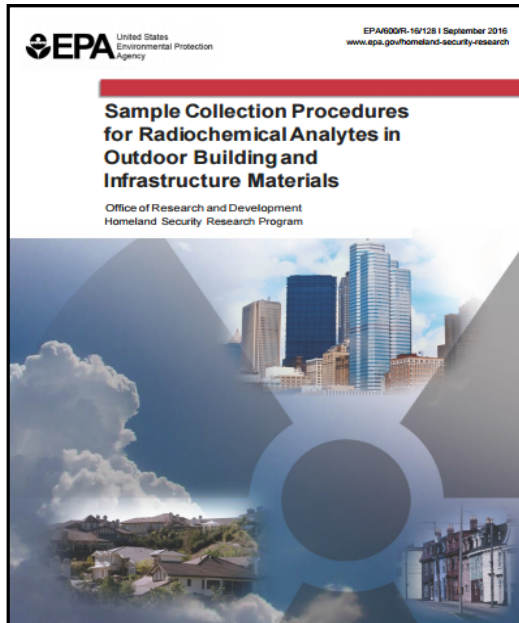




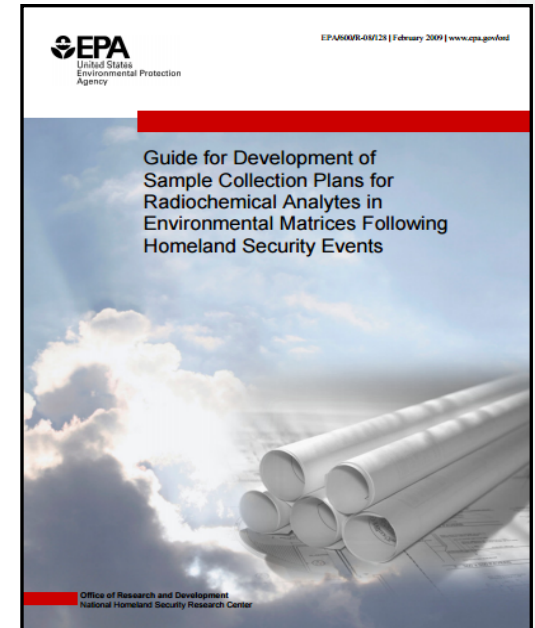
Example: Radiological Sample Collection



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



Activity-based sampling



Wet vacuum



Robotic cleaner



Native air filters (e.g. HVAC)



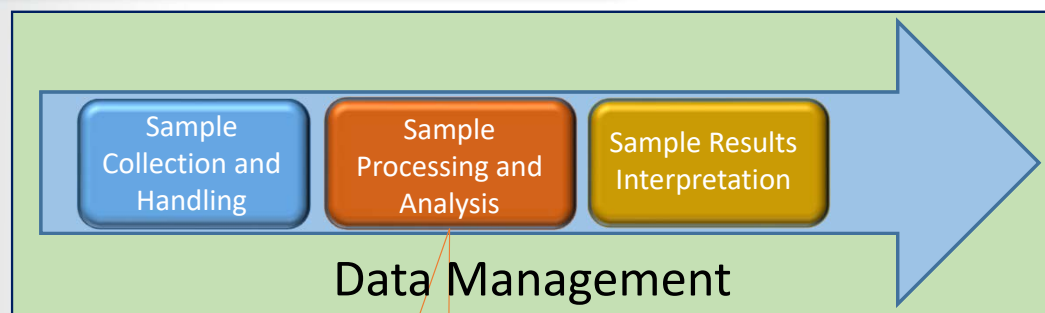
Burkholderia pseudomallei incident at Tulane

- Primates infected with *B. pseudomallei* at Tulane National Primate Center
- Developed sample collection methods and sampling plans for outdoor facilities





ESAM Sample Processing and Analysis



Supports
Environmental
Remediation
and Recovery



Sample Processing and Analytical Protocols & Methods

- Readily available protocols and methods for use in the laboratories

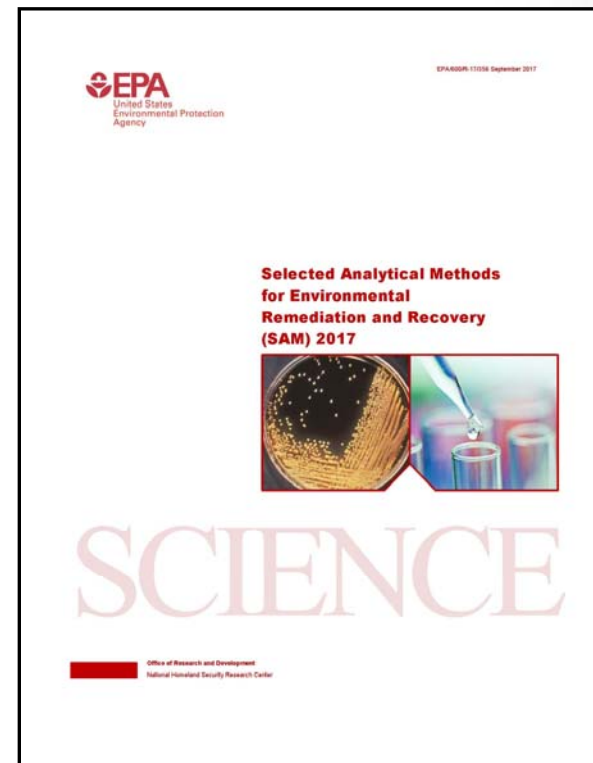
Selected Analytical Methods (SAM)

- Online resource identifying best available analytical method to be used by multiple laboratories during a large homeland security incident



Selected Analytical Methods for Environmental Remediation and Recovery (SAM)

- Identifies a single, selected method for each analyte/sample type in a specific matrix (e.g. soil, water, air)
 - To be used by laboratories performing analyses of environmental and building material samples following a contamination incident.
 - Permits sharing of sample load between laboratories
 - Increases the speed of analysis
 - Improves data comparability
 - Simplifies potential outsourcing analytical support



Searchable online at <https://www.epa.gov/homeland-security-research/sam>



Who helped develop SAM?





How are SAM Methods Chosen?

- 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?





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:

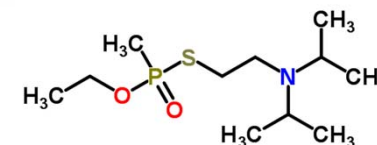
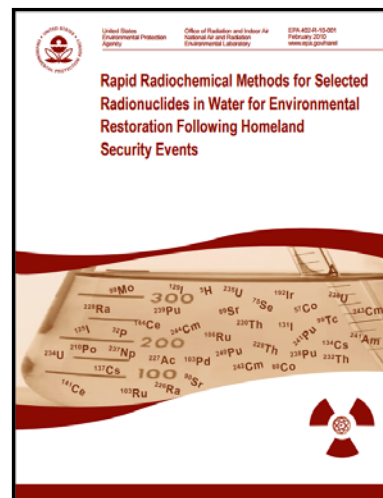
- *Yersinia pestis*
- *Francisella tularensis*
- Ricin

Chemical:

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

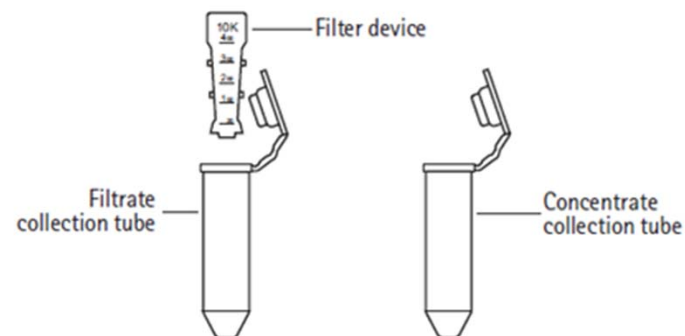
Radiochemical:

- 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



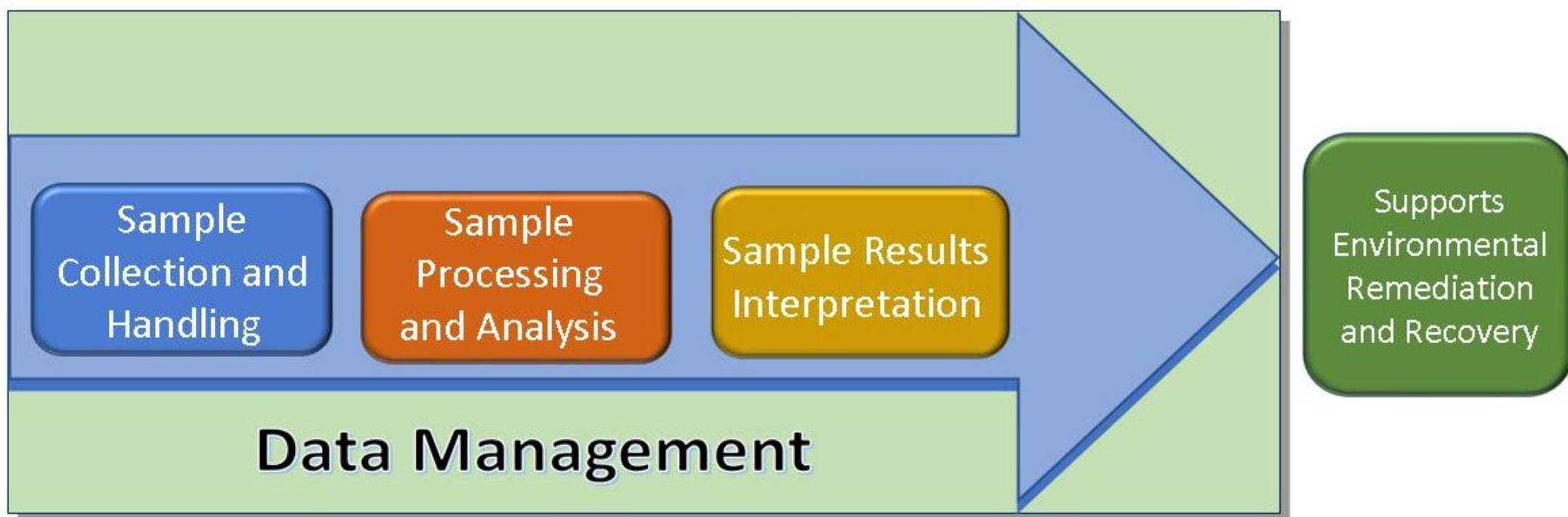
Arsenic Incident near Louisville, KY

- 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





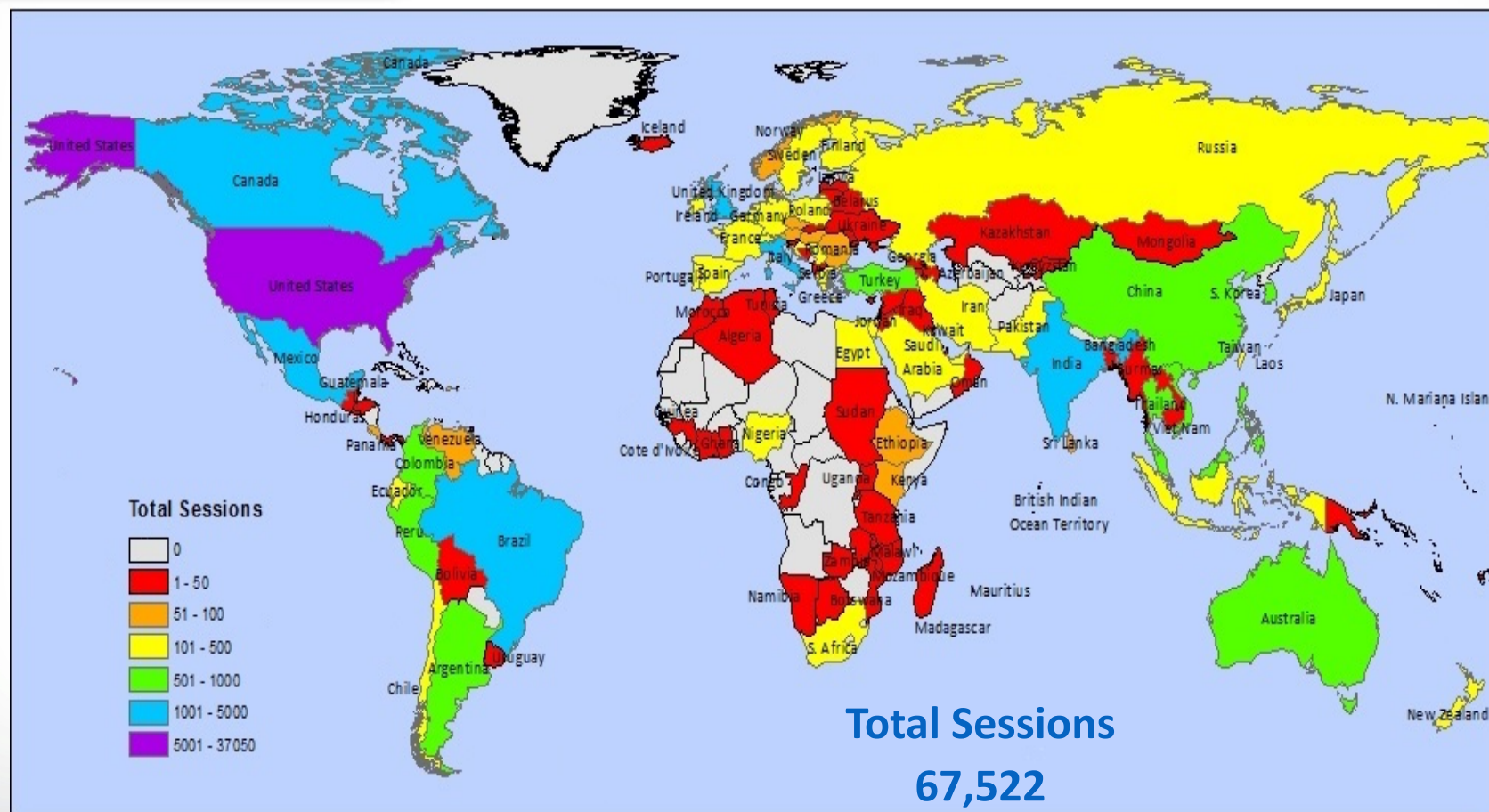
ESAM- Additional Components



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



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)

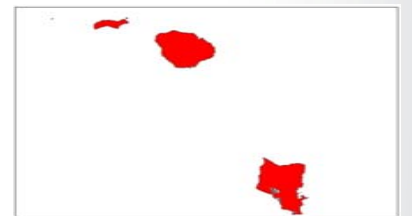
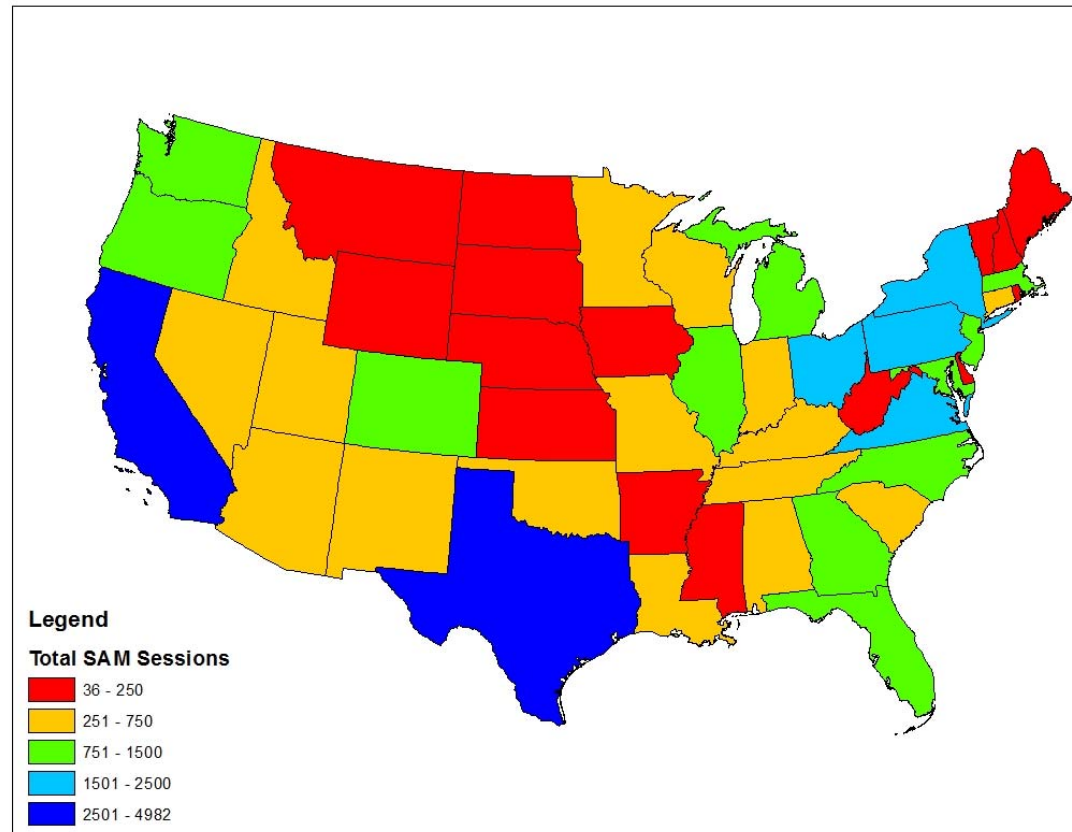
Virginia (1,728)

New Jersey (1,408)

North Carolina (1,355)

Washington (1,314)

Colorado (1,286)





Sampling Design Planning - MicroSAP

EPA | MicroSAP

HELP RESOURCES

0 COVER PAGE

A APPROVALS

B DISCLAIMER

C ACRONYMS

1 INTRODUCTION

2 EVENT MANAGEMENT

3 BOUNDARIES OF THE EVENT

4 PHASE-BASED PROJECT PLANNING

5 SAMPLING DESIGN

6 ANALYTICAL DATA DISPLAY AND ANALYTICAL STATISTICAL APPROACH FOR RESULTS

7 QUALITY CONTROL ACTIVITIES

SAMPLE TRANSPORTATION

Sample Plan

Created On: Thu, 01/11/2018 - 08:24 By: silvestri.erin Status: Draft

To Dos(0) Log Export Duplicate Privacy: Public

SILVESTRI.ERIN, you are the owner of this SAP.

Cover Page

Characterization Sampling and Analysis Plan

SAP
Sample Plan

EVENT TYPE
- None -

FIRST NAME LAST NAME AFFILIATION

STREET ADDRESS CITY ZIP CODE STATE
- None -

DATE
1/11/2018

Save Submit

EPA | MicroSAP

HELP RESOURCES

Search for an existing SAP

☐ ONLY VIEW MY SAPS

Create A New Plan

SEARCH:

Showing 1 to 2 of 2 entries

	ID	EVENT NAME	EVENT TYPE	PATHOGEN	MATRIX	CREATED BY	STATUS
+	2	Sample Plan	Incident	Bacillus anthracis	n/a	silvestri.erin	Draft
+	1	Sample Exercise	Exercise	Francisella tularensis	n/a	sapadmin	Draft

Previous 1 Next

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, waste characterization, and post-decontamination sampling stages of a microbiological contamination incident.



DEMO of ESAM

Sample
Collection and
Handling

Sample
Processing
and Analysis

Sample Results
Interpretation

Data Management

Supports
Environmental
Remediation
and Recovery

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



ESAM Website



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

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Environmental Sampling & Analytical Methods (ESAM) Program - Home

EPA's Environmental Sampling & Analytical Methods (ESAM) is a comprehensive program to facilitate a coordinated response to a chemical, radiological, biological or pathogen contamination incident. The program is comprised of documents and information supporting field and laboratory efforts for site characterization, remediation and release.

Sample Collection Information Documents (SCIDs)

The information in the Sample Collection Information Document for Chemicals, Radiologicals and Biologicals and in the Sample Collection Information Document for Pathogens (see general information for use by EPA and its contractors when collecting samples following a contamination incident).

[Sample Collection Information Documents \(SCIDs\)](#)

Sample Collection Procedures & Strategies

The sampling procedures guide collection of samples specifically intended for analysis using the methods in EPA's Selected Analytical Methods for Environmental Remediation and Recovery (SAM) following a contamination incident. The sampling strategies provide a framework to assist decision-makers in developing and implementing an approach for sample collection. The documents focus on site characterization, remediation and release.

[Sample Collection Procedures & Strategies](#)

SAM 2017

EPA SAM identifies analytical methods to be used by laboratories performing analysis of environmental and building material samples in support of site characterization, remediation and release following a contamination incident.

[Selected Analytical Methods for Environmental Remediation and Recovery \(SAM\) 2017](#)

HSRP and HSRP Partner Analytical Methods and Protocols

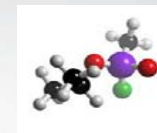
HSRP has verified with partnering laboratories and agencies to develop a series of analytical methods and protocols to address target chemical, radiological, biological and pathogen contaminants of concern in environmental samples, as well as outdoor infrastructure and building materials. These methods are a subset of the methods included in EPA's Selected Analytical Methods for Environmental Remediation and Recovery (SAM) 2017 and can be accessed here for convenience.

[Analytical Methods and Protocols](#)

[Contact us](#) to ask a question, provide feedback, or report a problem.



SAM Chemical Analyte Query Results



Chemical Analyte Query Results

(For definitions of abbreviated column headings, hold the cursor over the abbreviation.)

Ammonia 7664-41-7	Technique	Method	Prep	Det	Sol	NDW	DW	Air	Wipe
	Distillation	Standard Method 4500-NH3 B	✓			✓			
	Visible Spectrophotometry	350.1 (EPA OW)	✓	✓			✓		
	Visible Spectrophotometry	NIOSH Method 6015	✓	✓				✓	
	Visible Spectrophotometry	Standard Method 4500-NH3 G		✓		✓			
End of Query Results									

Query the Selected Analytical Methods Now!

Due to the complexity of some tables and graphics, some of our information is not amenable to a screen reader. If you have trouble accessing information contact [Kathleen Nickel](#) and accommodations will be made.

Select your type of analyte to begin your query:

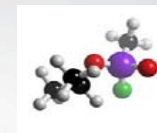
- [Chemical Methods Query](#)
- [Radiochemical Methods Query](#)
- [Pathogen Methods Query](#)
- [Biotoxin Methods Query](#)



<http://www.epa.gov/homeland-security-research/sam/>



SAM Chemical Method Query Results



Chemical Method Query Results

(For definitions of abbreviated column headings, hold the cursor over the abbreviation.)

Technique	Method	Prep	Det	Sol	NDW	DW	Air	Wipe
LC-MS-MS	EPA/600/R-15/258	✓	✓	☑	☑	☑		☑

CAS RN	Analyte
64038-44-4	2-Chlorovinylarsonic acid (CVAOA) (degradation product of Lewisite)
85090-33-1	2-Chlorovinylarsonous acid (CVAA) (degradation product of Lewisite)
541-25-3	Lewisite 1 (L-1) [2-chlorovinylchloroarsine]
40334-69-8	Lewisite 2 (L-2) [bis(2-chlorovinyl)chloroarsine]
40334-70-1	Lewisite 3 (L-3) [tris(2-chlorovinyl)arsine]
1306-02-1	Lewisite oxide (degradation product of Lewisite)

End of Query Results

Query the Selected Analytical Methods Now!

Due to the complexity of some tables and graphics, some of our information is not amenable to a screen reader. If you have trouble accessing information contact [Kathleen Nickel](#) and accommodations will be made.

Select your type of analyte to begin your query:

- [Chemical Methods Query](#)
- [Radiochemical Methods Query](#)
- [Pathogen Methods Query](#)
- [Biotxin Methods Query](#)



<http://www.epa.gov/homeland-security-research/sam/>



SCID Webpage & Query Search

Step 1. Select an Analyte

Abrin and Abrin (abrin marker)
Aflatoxins (B1, B2, G1, G2)
Anatoxin-a
Botulinum neurotoxins (Serotypes A - G)
Brevetoxins (A and B Forms)
Cylindrospermopsin
Diacetoxyscirpenol (DAS)
Domoic Acid (DA)
Microcystins (LA, LF, LR, LY, RR, YR)
Picrotoxin

Add

Remove

Add All Analytes

Remove All Analytes

Step 2. Select Parameters Display

Select All Information

Select All Sample Types

- ☐ Selected Analytical Methods - 2017
- ☐ Sample Type
- ☐ Sampling Device/Medium
- ☐ Sample Container Size
- ☐ Preservation
- ☐ Holding Time
- ☐ Packaging
- ☐ Shipping Label
- ☐ Notes

- ☐ Aerosol (filter/cassette, liquid impinger)
- ☐ Particulate (swabs, wipes, dust socks)
- ☐ Solid (soil, powder)
- ☐ Water (surface water, waste water, drinking water)

Step 3. Retrieve Results

[Click Here to Retrieve Results](#)

<https://www.epa.gov/homeland-security-research/sample-collection-information-documents-scids>



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Sample Collection Information Documents (SCIDs)

[ESAM - Home](#)

The information in the Sample Collection Information Documents (SCIDs) provides general information for use by EPA and its contractors when collecting samples during environmental remediation following an intentional or accidental homeland security-related contamination incident. The information is provided to support collection of samples to be analyzed using the specific methods and procedures listed in EPA's [Selected Analytical Methods for Environmental Remediation and Recovery](#) (EPA/600/R-17/356).

Query Sample Collection Information

Due to the complexity of some tables and graphics, some of our information is not amenable to a screen reader. If you have trouble accessing information, contact [Kathleen Nickel](#) and accommodations will be made. Select your type of analyte to begin your query.

[Chemicals](#)

[Biotoxins](#)

[Radiochemicals](#)

[Pathogens](#)



Sample Collection Information Document for Chemicals, Radiochemicals & Biotoxins



[Sample Collection Information Document for Chemicals, Radiochemicals and Biotoxins - Companion to Selected Analytical Methods for Environmental Remediation and Recovery \(SAM\) 2017](#)

Sample Collection Information Document for Pathogens



[Sample Collection Information Document for Pathogens - Companion to Selected Analytical Methods for Environmental Remediation and Recovery \(SAM\) 2017](#)

Resources

- [Acronyms and Abbreviations](#)

[Contact Us](#) to ask a question, provide feedback, or report a problem.



SCID Biotoxin Method Query Results



Biotoxin Sample Collection Information — Query Results

The Web page you are viewing requires JavaScript. Due to the complexity of some tables and graphics, some of our information is not amenable to a screen reader. If you have trouble accessing information contact [Kathleen Nickel](mailto:nickel.kathy@epa.gov) (nickel.kathy@epa.gov) and accommodations will be made.

General Notes:

1. Methods and tiers listed under *Selected Analytical Methods for Environmental Remediation and Recovery (SAM) 2017* can be located using the SAM website (<https://www.epa.gov/homeland-security-research/sam>). Analytical technologies and methods addressing biotoxins continue to be developed and improved; the contact information on this website should be used for updates regarding analytical procedures.
2. Sample sizes are provided for guidance, and may vary depending on the specific contamination incident, data quality objectives and requirements, and laboratory needs. If requested by the laboratory, additional sample(s) must be collected for analyses using multiple methods, or for laboratory quality control analyses (e.g., duplicates, matrix spikes). It is also recommended that additional sample(s) be collected in cases where low concentrations are expected or in the case of an anticipated need for reanalysis due to sample spillage or unforeseen analytical difficulties.

Analyte:	Anatoxin-a
Sample Type:	Water (surface water, waste water, drinking water)
Sampling Device/Medium:	Sterile leak proof container - amber glass or amber PETG (or protect from light)
Sample Container Size:	100 mL
Preservation:	<ul style="list-style-type: none">• Immediately place on ice (e.g., ice packs, secure double-bagged ice). Target temperature $\leq 10^{\circ}\text{C}$.• Protect from light <p>NOTE: For treated water samples, add 1 g sodium bisulfate and 0.1 g ascorbic acid / 1-L sample.</p>

Query Sample Collection Information

Due to the complexity of some tables and graphics, some of our information is not amenable to a screen reader. If you have trouble accessing information, contact [Kathleen Nickel](mailto:nickel.kathy@epa.gov) and accommodations will be made. Select your type of analyte to begin your query:

[Chemicals](#)[Biotoxins](#)[Radiochemicals](#)[Pathogens](#)

<https://www.epa.gov/homeland-security-research/sample-collection-information-documents-scids>



Homeland Security Research Program

For more information:

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

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Mission: to conduct research and develop scientific products that improve the capability of the Agency to carry out its homeland security responsibilities

**ADVANCING
OUR NATION'S
SECURITY
THROUGH
SCIENCE**

