



THE LEADER IN ENVIRONMENTAL TESTING

Incremental Sampling Methodology – Status Report on ITRC Guidance

Mark Bruce, Ph. D.

Michael Stroh - Missouri DNR

Kelly Black - Neptune & Co.

Report Documentation Page

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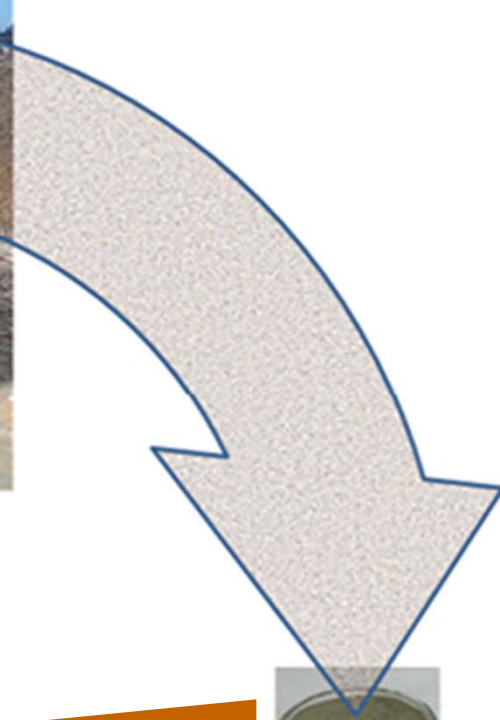
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Chasing Uncertainty Sources

- Instrumental analysis
- Sample preparation
- Laboratory sub-sampling
- Field sample collection



Does the decision unit fit in the sample jar?

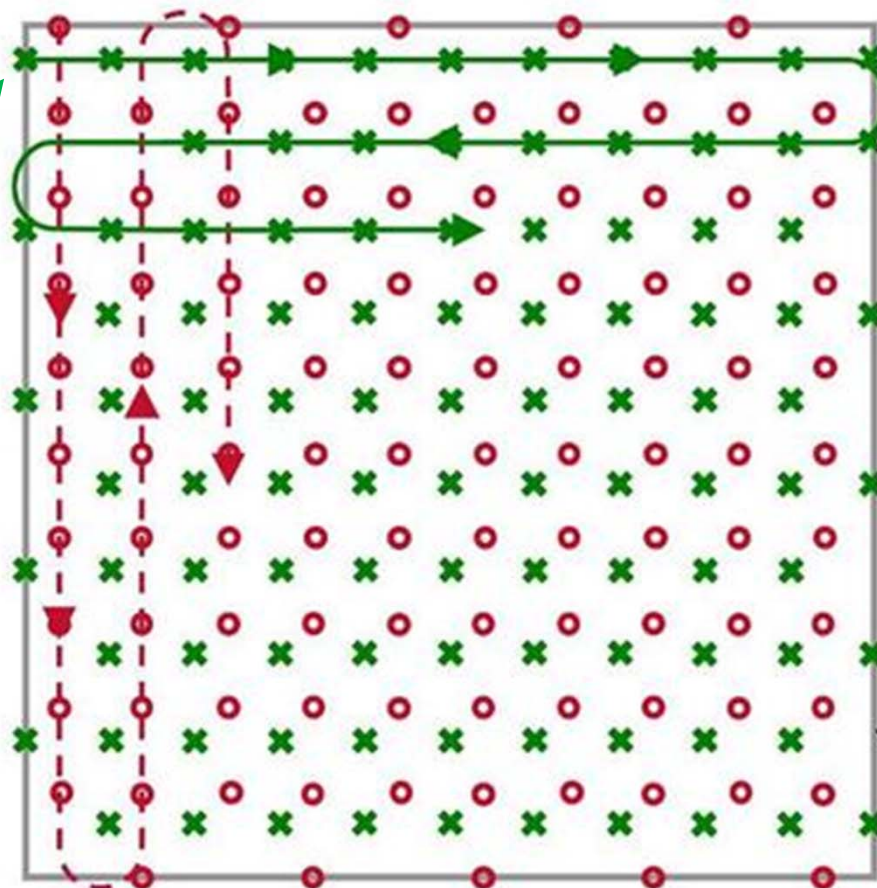


Representative subsampling



- Systematic Random Design

Random starting locations in first grid



→ Path of travel
○ X Sample collection point

Area Sampled



- **Incremental Sampling Methodology Team**

- ~ www.itrcweb.org/teampublic_MIS.asp

- ~ Formed Jan. 2009

Disclaimer: Most of the material in this presentation has been derived from the Feb. 2011 draft guidance developed by the ITRC ISM team. ITRC does not endorse the use of specific vendors or technologies. This presentation is not official ITRC sanctioned training material. It has been reviewed by ITRC for compliance with the ITRC usage policy.



INTERSTATE TECHNOLOGY & REGULATORY COUNCIL

Advancing Environmental Solutions

Introduction

ISM Principles

Systematic Planning

Statistical ISM Design

Field Implementation

Laboratory Process

Making Decisions

Regulatory Concerns

Case Studies

Stakeholder Input

- ISM for Environmental Sampling
- Limitations of Traditional Approaches
- ISM for Site Characterization
- Comparing ISM to Compositing
- Purpose
- Document Organization



- Introduction
- Foundation Concepts of Sampling
- Soil is Heterogeneous
- Types of Heterogeneity
- Gy Theory and the Source of Sampling Error
- Sampling Approaches
 - ~ (Discrete, Composite, Incremental)

**Nature of Soil
&
Interaction of
Contaminants With Soil**

Results In

ISM Principles

Heterogeneity

Sampling w/o addressing leads to

Sampling Errors

Manifested (observed) in

ISM Principles

**Unknown
Data Variability**

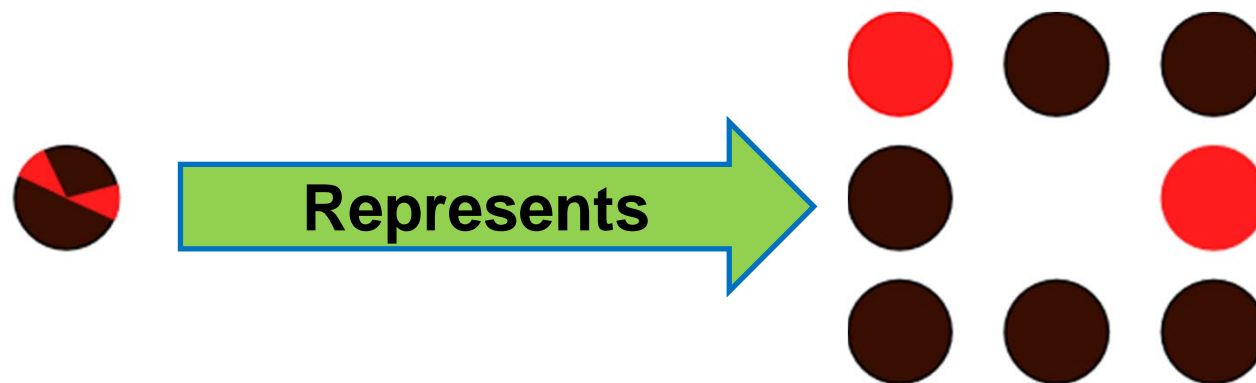
which can lead to

Decision Errors



Representative Sample

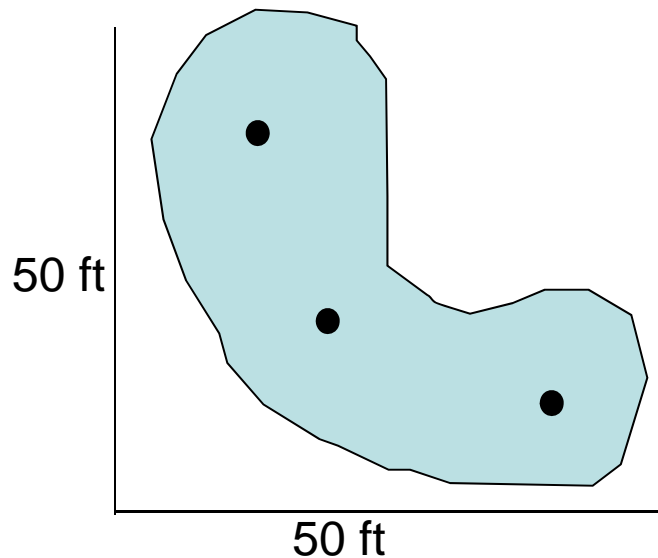
A representative sample is one that contains a subset of all the constituents of a population in exactly the same proportion that they are present in the target population.



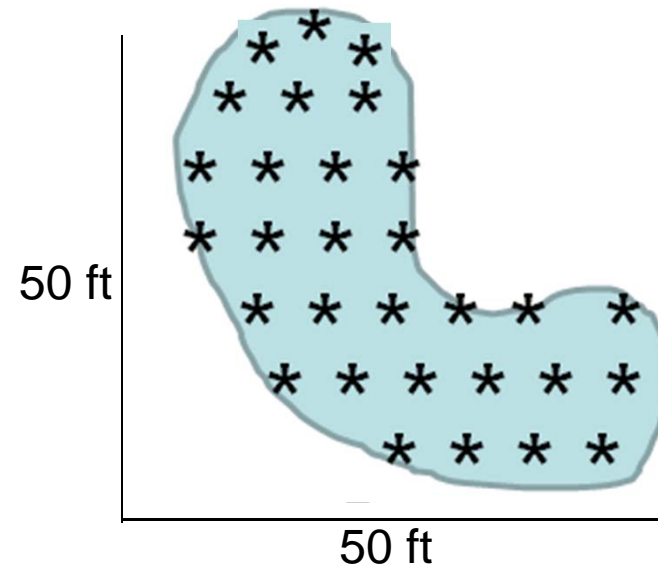
Representativeness

Which is more likely to represent the true mean?

Average (or UCL) from
3 discrete samples

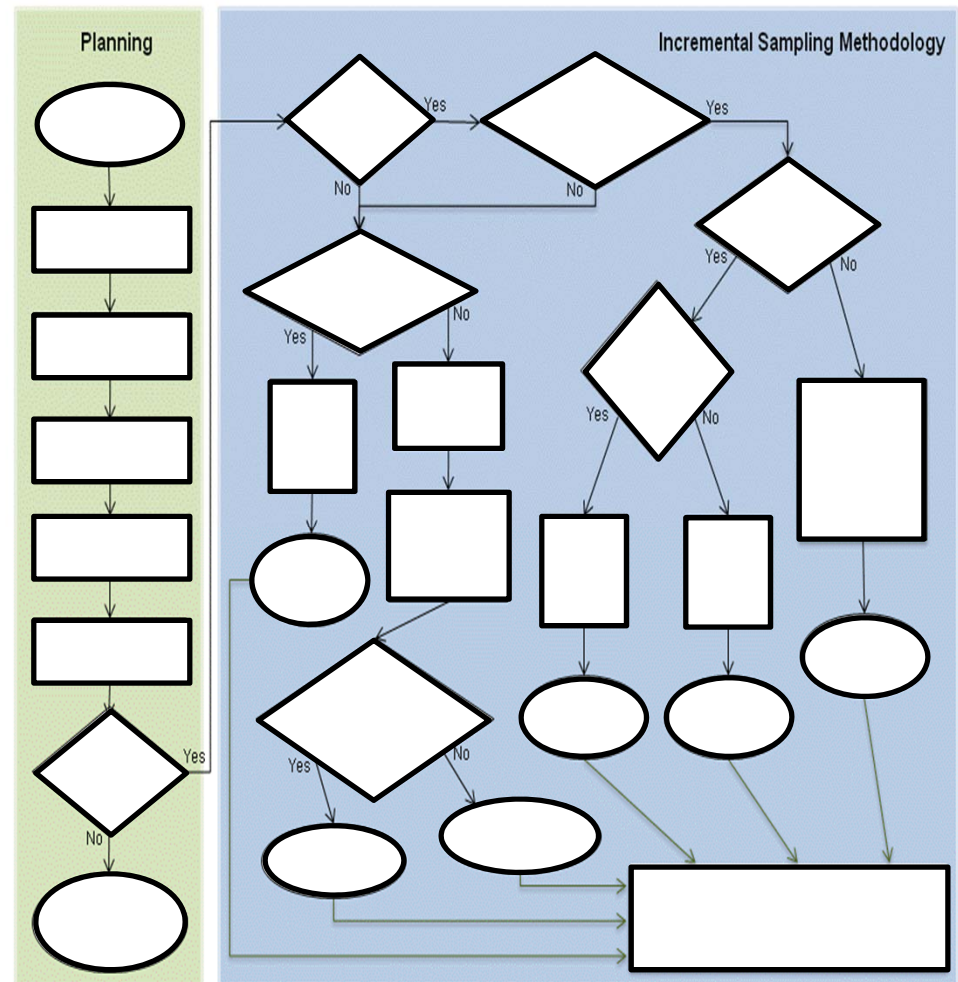


One 30-increment sample



Systematic Planning Approach

- Introduction
- Conceptual Site Models
- Investigation Objectives
- Identify Data Needs
- Decision Units (DU)



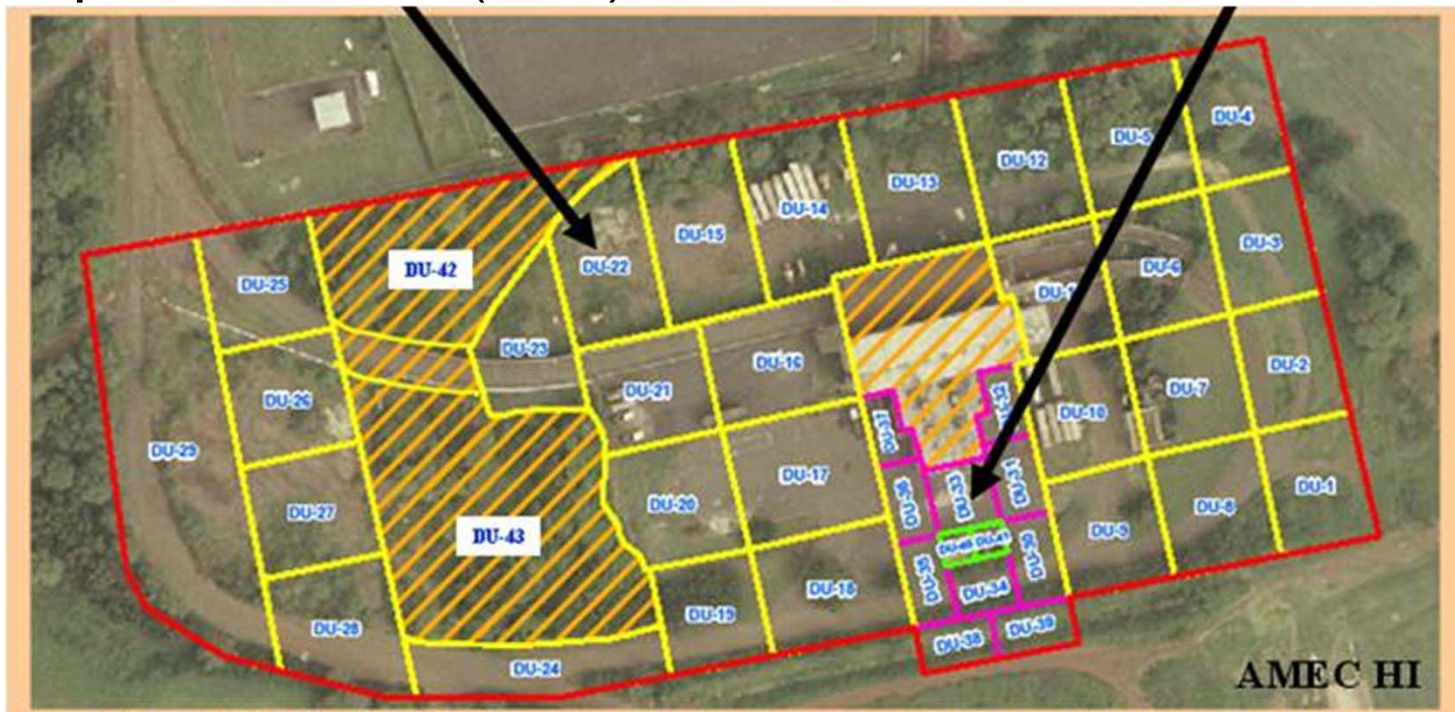
The Decision Unit: A Key Concept for ISM

- **Decision Unit (DU)** – smallest volume of soil (or other media) for which a decision will be made based upon ISM sampling. A DU may consist of one or more Sampling Units (SUs).

Combined DUs

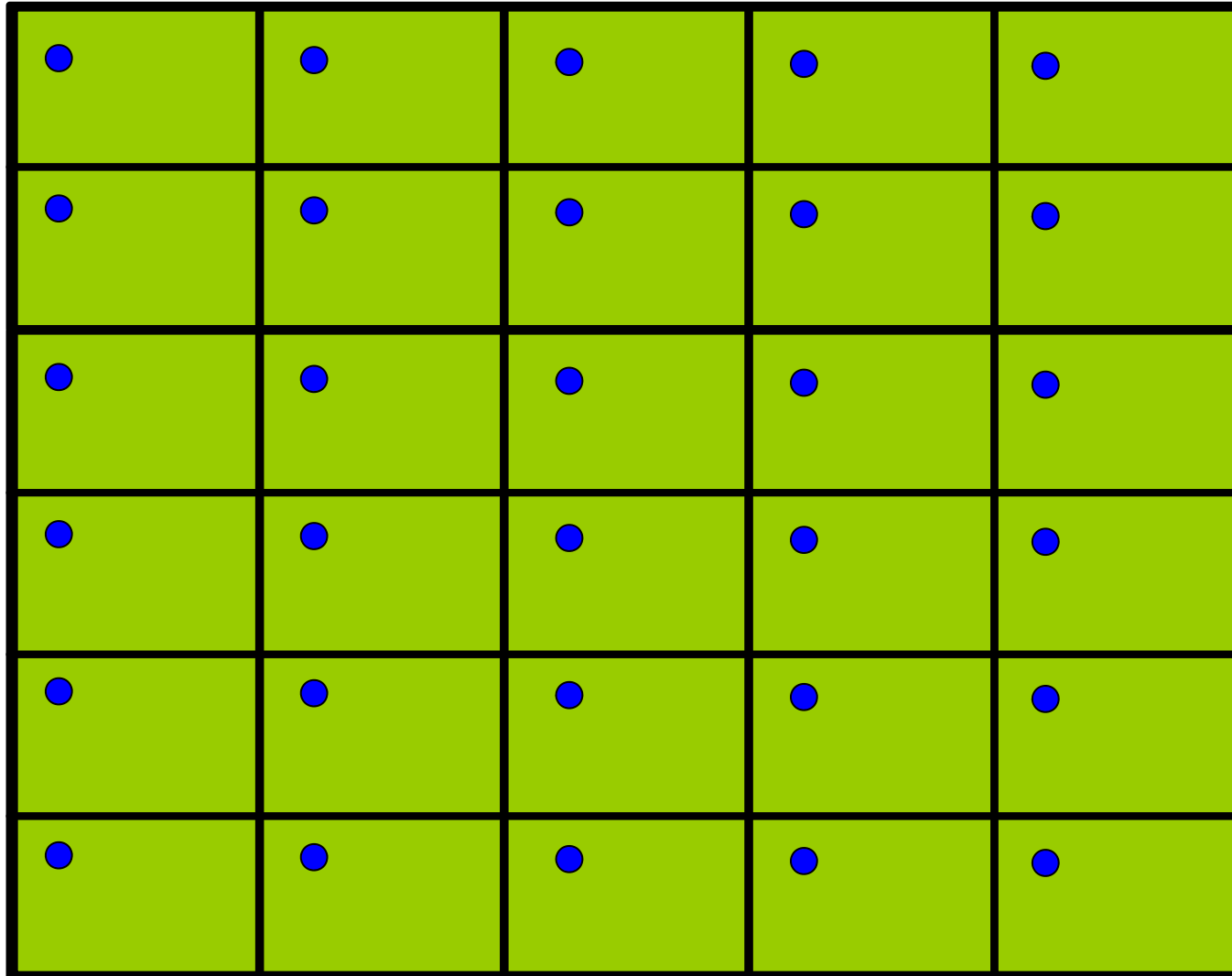
Future residential lots,
DUs sized as
exposure areas (EUs)

Pesticide mixing area,
DUs sized to assist
remediation



- Estimating the Mean Concentration
- Uncertainty in Estimates of the Mean
- Evaluating the Performance of Sampling Approaches
- Areas for Further Study

Systematic Random Sampling



Field Implementation

- Introduction
- Sampling Tools
- Field Collection
- Field Processing Options



Sampling Tools



Surface Samples



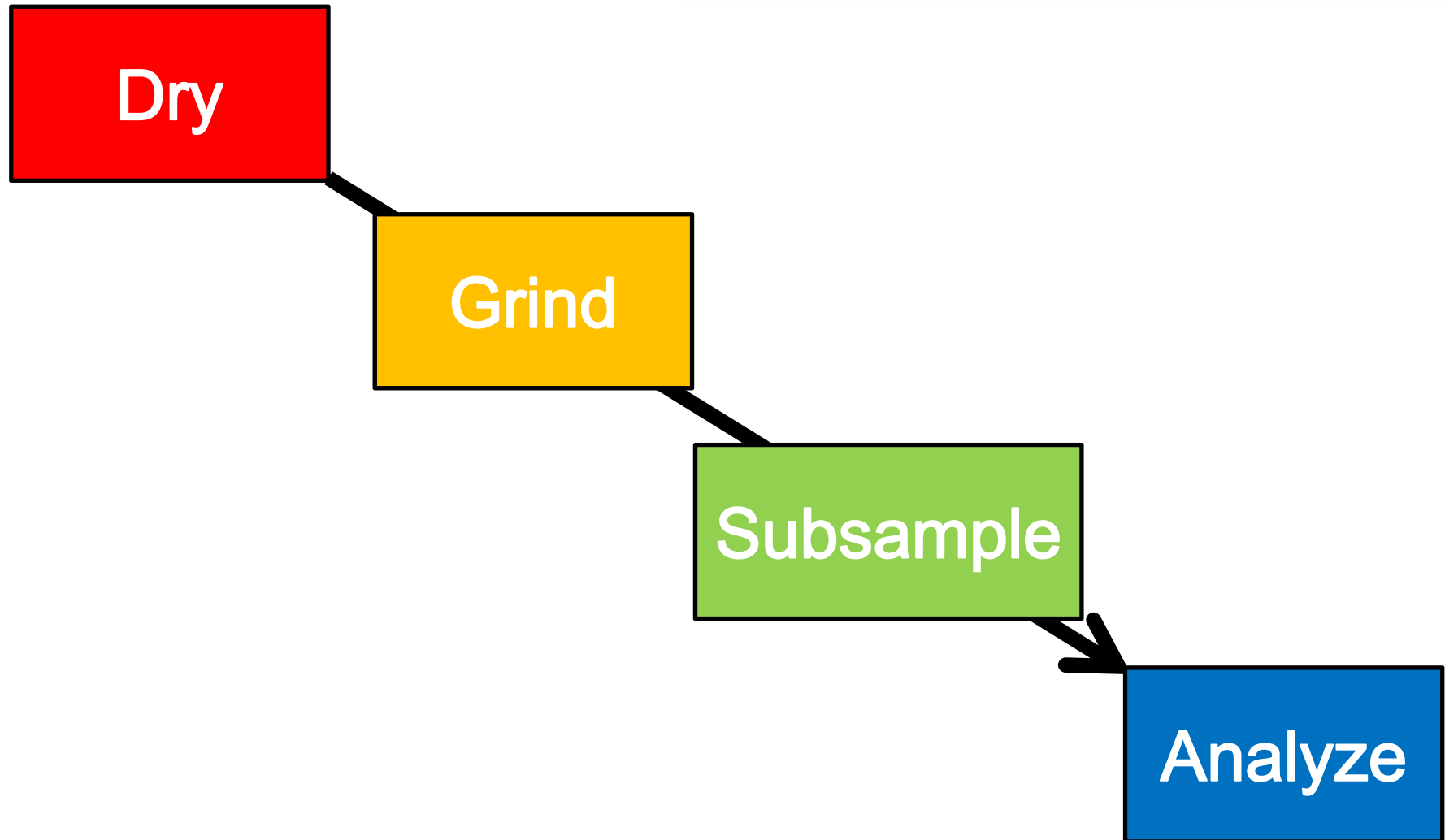
Volatile Organic Compound Sampling



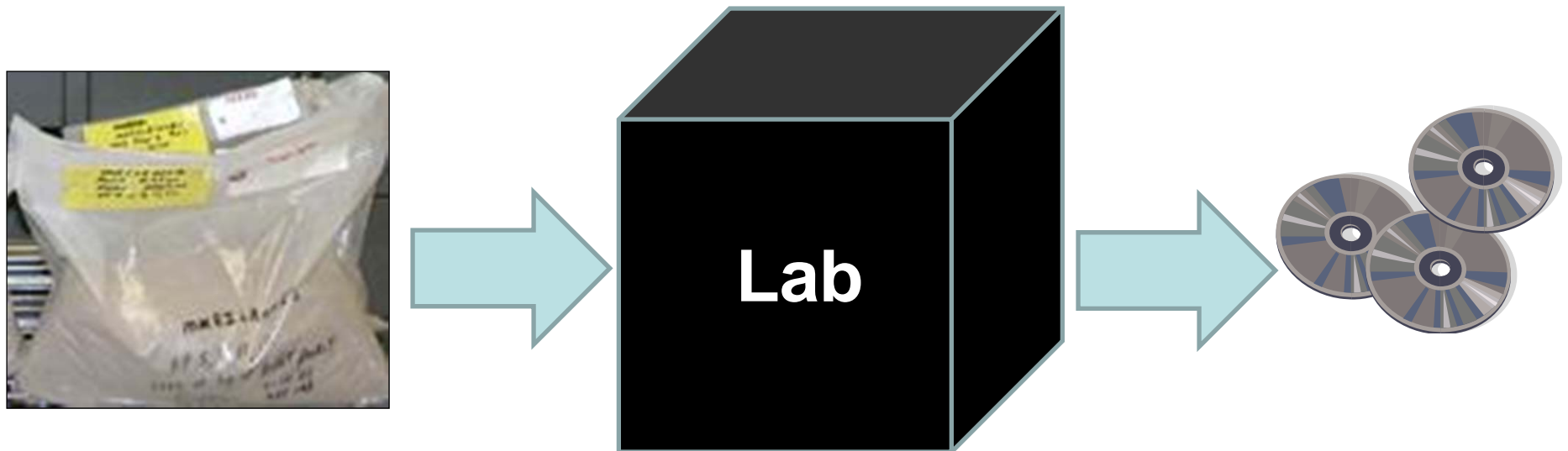
- Introduction
- Laboratory Processing
- Laboratory Analysis
- Quality Assurance



No Universal Lab Sample Processing



Include Lab Processing in Project Planning



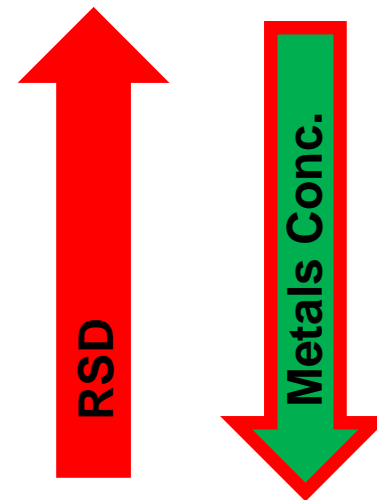
- Air drying
 - ~ Room temperature - most common
 - ~ Ventilation hood
 - ↓ ~ Consider volatilization losses
 - Boiling point
 - Binding to soil particles (lower conc. > higher binding > lower losses)
 - Loss risk table
 - ↓ — naphthalene
 - ↓ — 2-methylnaphthalene
 - ↓ — acenaphthene
 - ↓ — dibenzofuran
 - Loss risk test
 - ~ Goal: Crushable agglomerates



- Grinding:
 - ~ Generic term for soil disaggregation or milling. The grinding type or equipment must be specified to select a particular laboratory process.

Defining Terms

- Disaggregating:
 - ~ Breaking the soil clumps into individual small particles, but keeping the small pebbles and hard crystalline particles intact.

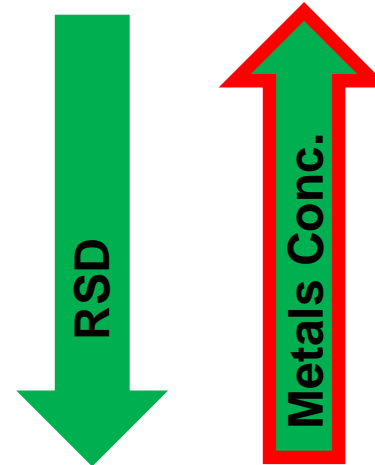


Compared to milling

- Milling:
 - ~ Complete particle size reduction of all soil components including hard crystalline materials to a defined maximum particle size (e.g. $< 250 \text{ um}$ or $< 75 \text{ um}$).



Picture from USACE-Alan Hewitt



Compared to disaggregating

Sub-sampling Options

- 2-Dimensional Japanese Slabcake



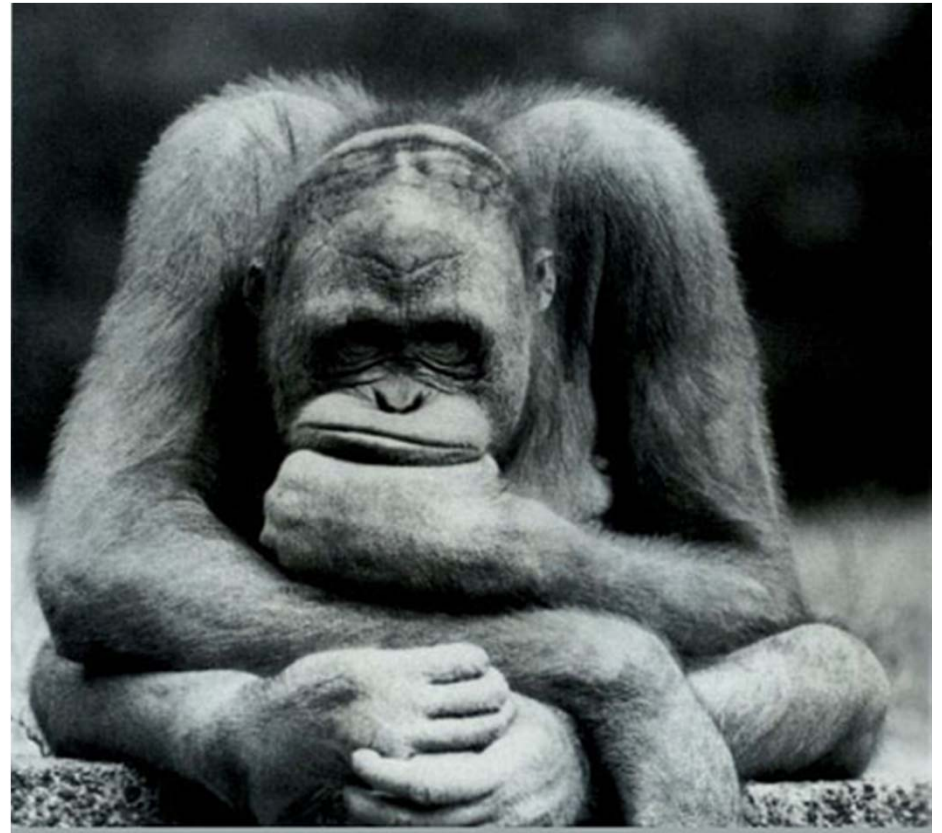
Dry



Wet

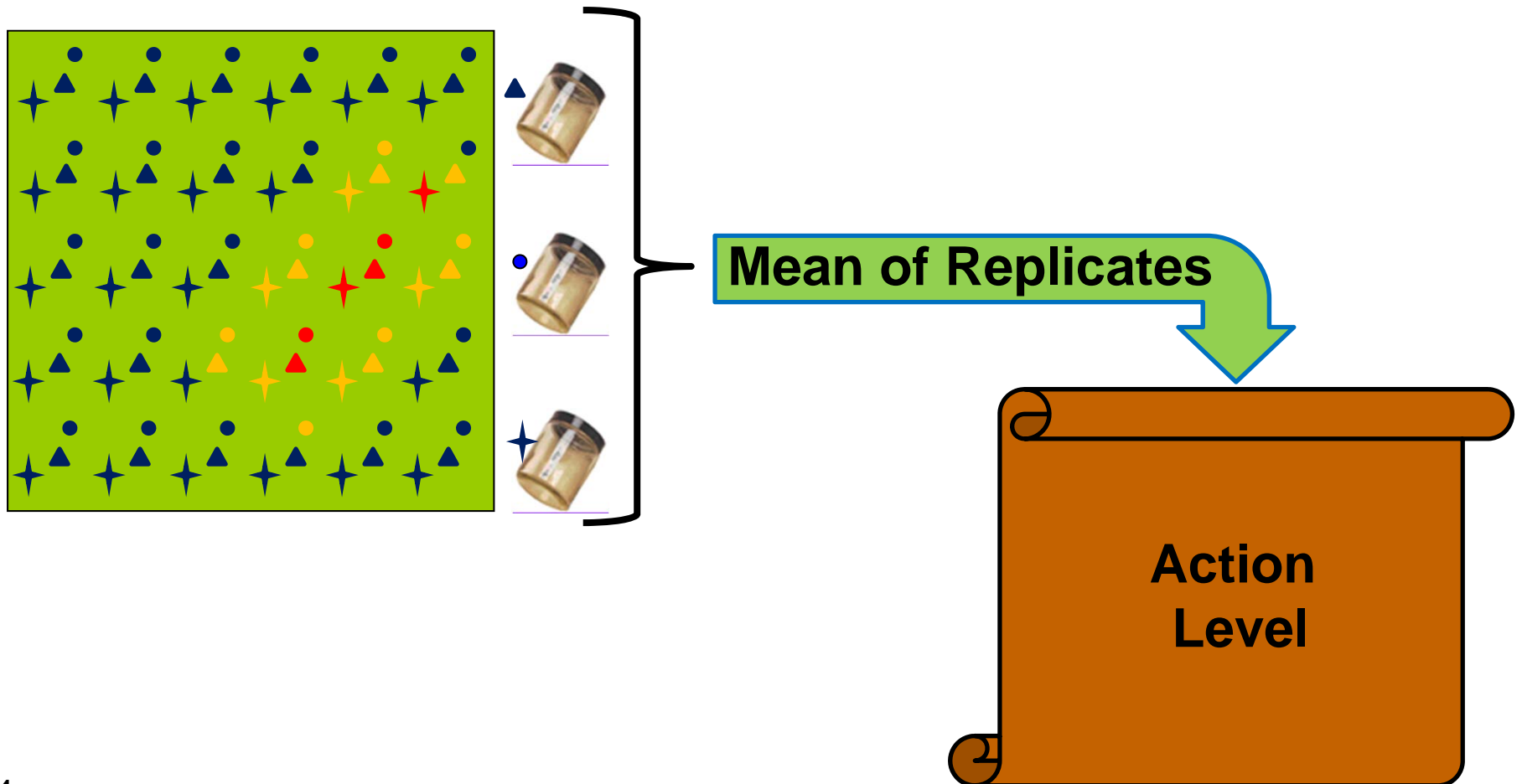
Making Decisions

- Introduction
- Options
- Error Assessment



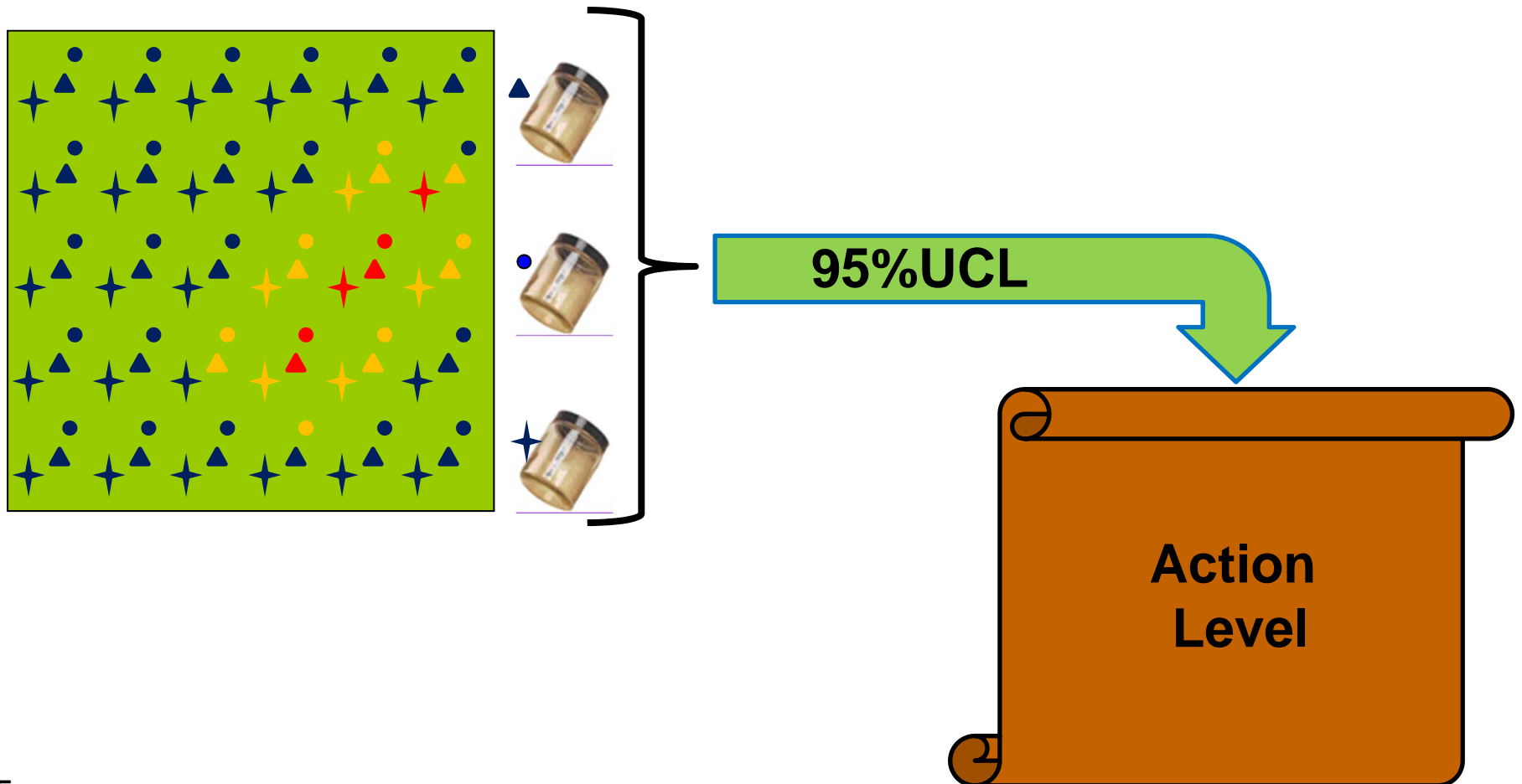
Compare Average ISM Result to Action Level

Decision Unit



Compare 95% Upper Confidence Limit to Action Level

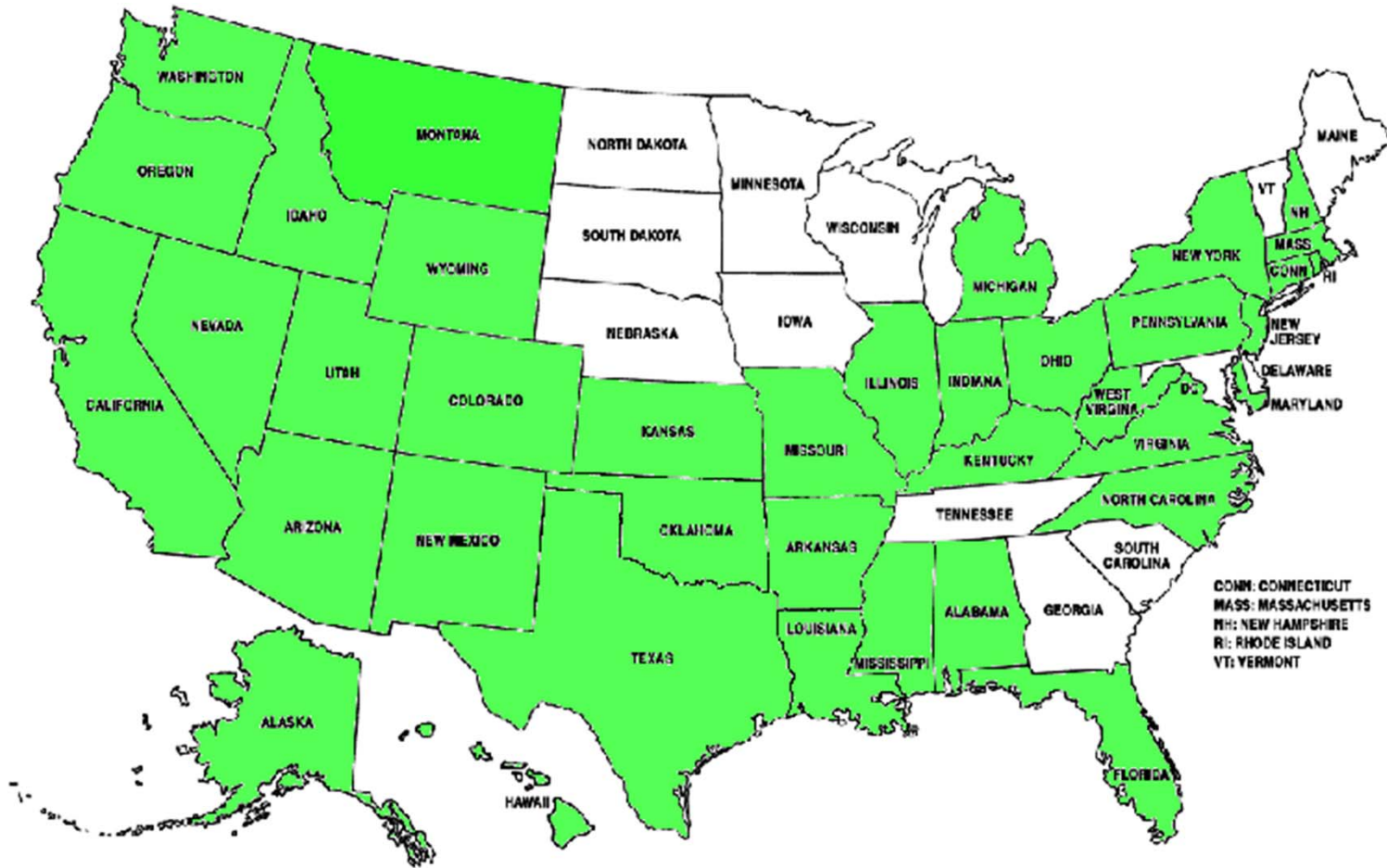
Decision Unit



Regulatory Concerns

- Introduction
- Perception Issues
- Regulatory Challenges
- State of Knowledge, Experience and Training
- Implementation Issues

States with Incremental Sampling Projects



Use of ISM does not constitute state regulatory acceptance. Results based on ITRC ISM survey 2009

- PCB Contaminated Landfill
- TCE Vadose Zone Investigations
- Petroleum Contaminated Soil Stockpile
- Uranium Enrichment Facility
- Former Golf Course Field Demonstration
- Hawaiian Homelands Development

Guidance Document Projected Schedule

- Full ITRC (non-DoD) review – April 15, 2011
- DoD & EPA review – June 1, 2011
- Final to ITRC communications – Oct. 2011
- Web based guidance testing – Jan. 2012
- Tech. Reg. Publically Available – Feb. 2012

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Kelly Black

Contact Information

Mark L. Bruce Ph.D.
Technical Director

TestAmerica
4101 Shuffel St. NW
North Canton, OH 44720
Tel: 330-966-7267

Email: mark.bruce@testamericainc.com
www.testamericainc.com