

# Performance Verification of Field Analytical Technologies that Can Assist in Site Characterization and Monitoring Activities

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# US EPA Environmental Technology Verification (ETV) Program

- Established by EPA in 1995 to verify the performance of innovative environmental technologies
- Accelerates acceptance and use of improved, cost-effective technologies
- Six Centers including the *Advanced Monitoring Technology*, Air Pollution Control, Greenhouse Gas, Drinking Water Systems, Water Protection, and Pollution Prevention, Recycling and Waste Treatment



# What does ETV Verification Mean?

- To establish the performance of a technology under specific, predetermined criteria or protocols and adequate data quality assurance procedures.
- Verification is NOT certification
- Responsibility rests with the technology user to correctly choose and apply technologies



# Important Principles

- A voluntary program for commercial-ready private sector technologies
- High-quality data and information; not an “approval” process
- Public-private partnerships to efficiently execute testing
- A “market-based” program through ongoing stakeholder participation
- Web-based publication of all products for speed and universal access
- Credibility, credibility, credibility



# ETV Values and Quality Criteria

- **Fairness**
  - Testing available to all vendors of commercial-ready technologies within defined categories
- **Credibility**
  - Objective third-party tester
  - Preexisting protocols/test plans, publicly available for independent testing
- **Transparency**
  - Public availability of methods and results
- **Quality**
  - Testing done under quality criteria to insure credible data and verification
- **Responsive**
  - Respond to industry, user, and vendor needs through stakeholder process



# ETV Statistics

## June 2001



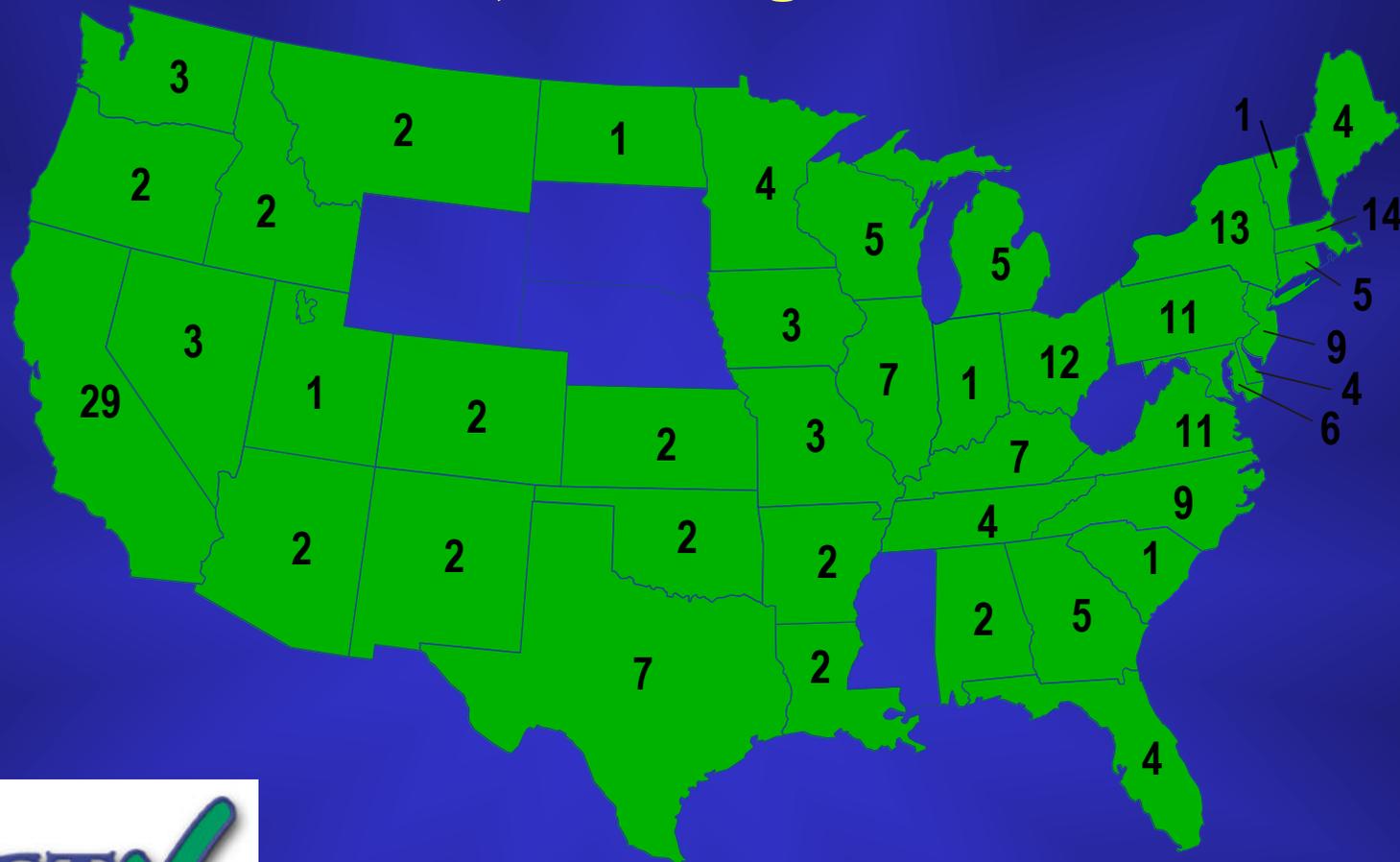
- 1,062 Stakeholders in 18 Groups; 89 Meetings held
- 60 Generic protocols; 84 Technology-specific test plans
- 138 Applications pending
- 111 Technologies in testing/evaluation process
- 118 Technologies verified



# Vendors, Vendors, Everywhere

June 2001

41 States, 8 Foreign Countries



# Advanced Monitoring Technology Center

- Goal is to increase the use of innovative monitoring technologies (air, water, soil)
  - Identify needs
  - Define a process for verifying technology performance
  - Verification testing
  - Information transfer
- Three verification organizations
  - Oak Ridge National Laboratory
  - Sandia National Laboratories
  - Battelle Memorial Institute



# Innovative Field Technologies

## faster...cheaper...better

### ■ **Faster...**

- Reduced sample “turnaround” time
- In-field decision-making
- Minimized crew and equipment deployment time

### ■ **Cheaper...**

- Reduced analytical costs
- Reduced field labor costs
- Faster time-to-completion

### ■ **Better...**

- Data quality as good as or better than fixed off-site lab
- Refined data analysis through onsite screening results
- Computer assisted decision making

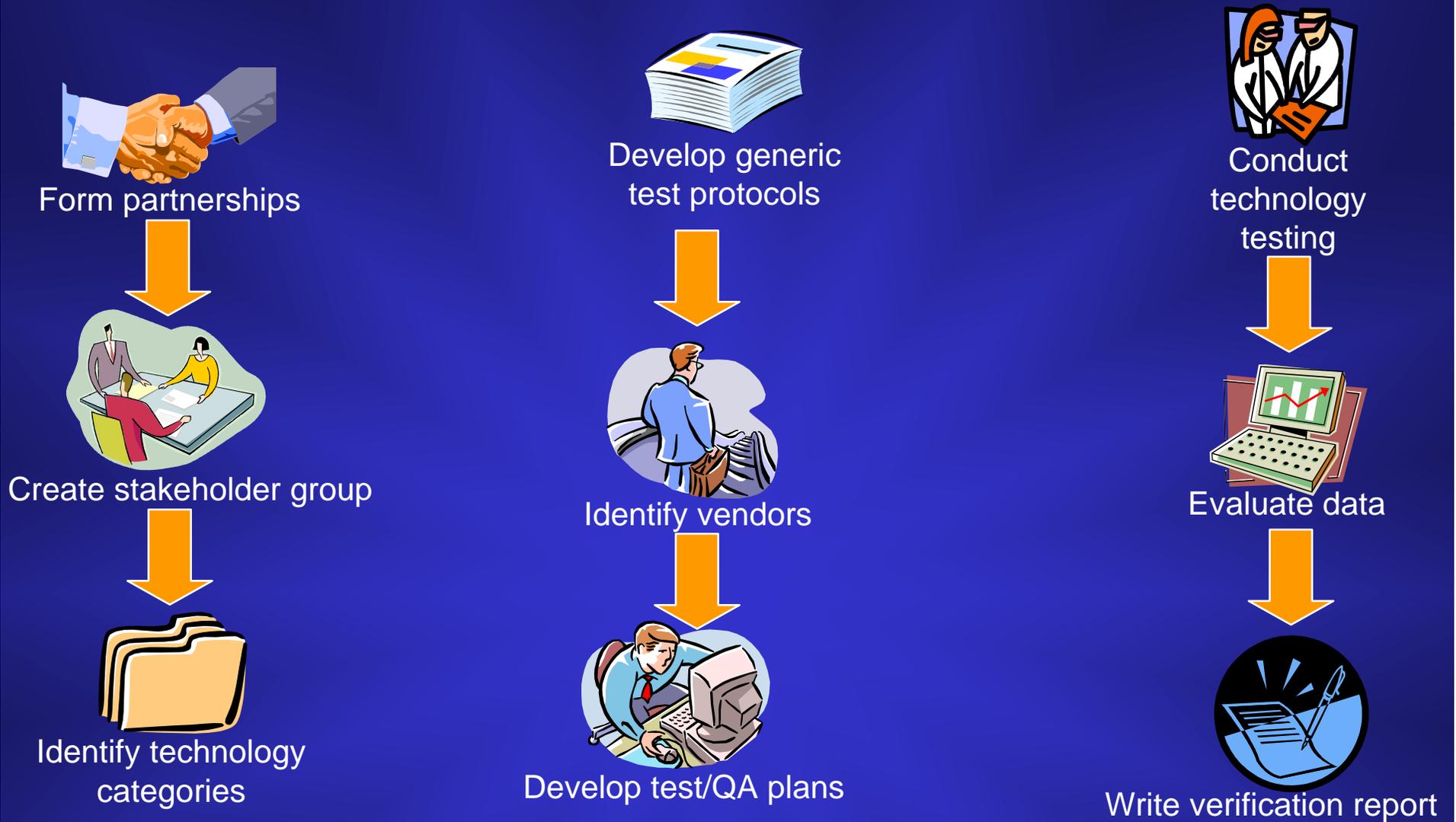


# Application Areas

- Public/private contaminated site characterization and monitoring
  - Brownfields
  - Superfund
- Source/process monitoring
- Insurance industry
- Emergency management/response
  - Chemical/biological hazards
  - Odor investigations
- Air, water, soil quality monitoring
- Plant monitoring
  - Fenceline monitors



# ETV Verification Process



ETV Outreach

[www.epa.gov/etv](http://www.epa.gov/etv)

# Examples of the Contamination Problem



# Multiple field analytical approaches to site characterization



Immunoassay



Ion-specific electrode



Mass spectrometry



Gas chromatography



Ion mobility spectrometry

# 85 Technologies Tested

## *Advanced Monitoring Technology Center*

- **Field-portable X-ray Fluorescence Analyzers**
- **Soil/Soil Gas, Sediment, and Groundwater Samplers**
- **Subsurface TPH via Cone-penetrator/LIF**
- **Field-portable Kits/Instrumentation for PCBs in Soil**
- **Field portable GC & GC/MS**
- **On-board vehicle emission monitor**
- **Decision Support Software**
- **Field-portable instrumentation for Explosives in Soil/Water**
- **NO/NO<sub>x</sub> Emission Monitors**
- **Turbidimeters**
- **Optical Open-Path Monitors**
- **Mercury continuous emission monitors**
- **Ambient fine particle monitors**

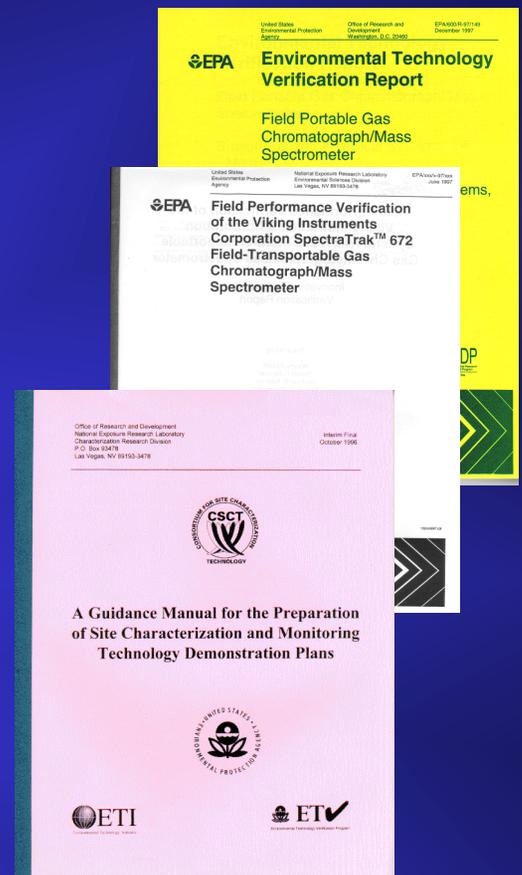


# Reporting the Data



# Technology Verification Report Contents

- Verification Statement
- Technology Description
- Site and Test Design Description
- Reference Laboratory Data Validation
- Technology Verification Results
- Field Observations and Cost Summary
- Technology Update



# Performance Information

- Accuracy
- Precision
- Comparability with standard method
- False positive/negative rate
- Instrument Drift
- Logistical requirements
- Ease of use
- Portability/Ruggedness
- Cost
- Sample Throughput



# PCB Field Technology Test



9 technologies tested

# PCBs in Soil/Extracts: Field Verification Test Plan

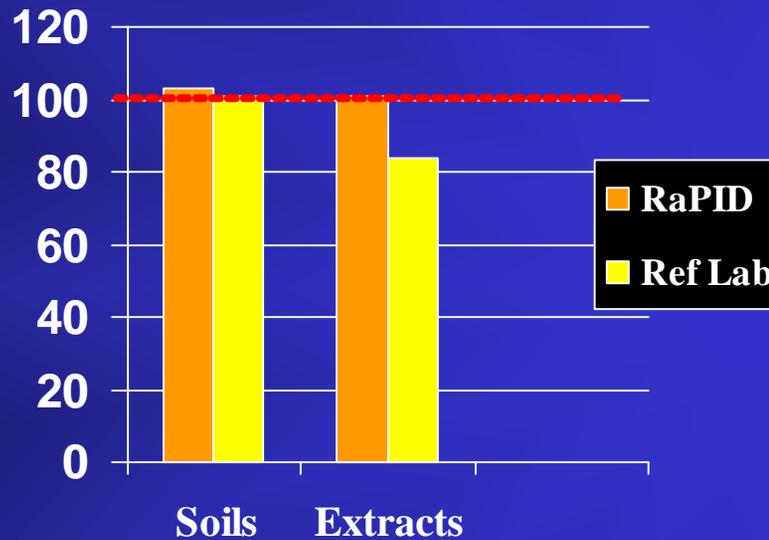
- Different Environmental Conditions
  - Outdoors, naturally variable temperature and relative humidity
  - Controlled environmental chamber, constant temperature and relative humidity
- Varied Samples
  - Performance evaluation (PE) soil (n=72)
  - Environmental soil (n=136)
  - Simulated extract (n=24)
- Wide Concentration Range
  - PE Soil: 0 to 50 parts per million (ppm)
  - Environmental Soil: 0.1 to 700 ppm
  - Simulated extract: 0 to 100  $\mu\text{g/mL}$   
(simulated wipe concentration:  $\mu\text{g}/100\text{cm}^2$ )



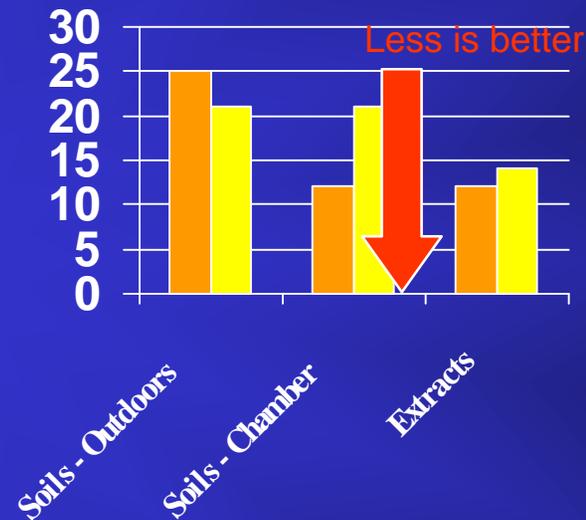
# SDI RaPID Assay System for PCB's in Soil and Solvent Extracts



Accuracy, %



Precision, RSD, %



# PCB: Field Verification Test Plan

*transformer oils*

- Varied Samples
  - 20 blank transformer oil
  - 32 spiked reference oils
  - 100 samples from active and inactive transformers
- Blind, randomly distributed
- Single Aroclor and Multi-Aroclor mixtures evaluated



# PCB Verification Test Results: Dexsil L2000DX



Accuracy, % recovery



Precision, % RSD



# VOCs in Groundwater: Verification Test Plan

- 65 environmental groundwater samples from at two sites
- 84 performance evaluation (PE) water samples mixed and distributed onsite
- 16 blank samples
- ~160 samples analyzed per technology at two sites (1 week per site)
- Onsite sample preparation and QA audits



# VOC Measurement Technology

## Inficon HAPSITE

Detection Limits: 5-10 ug/L

Precision: 12% RSD (median)

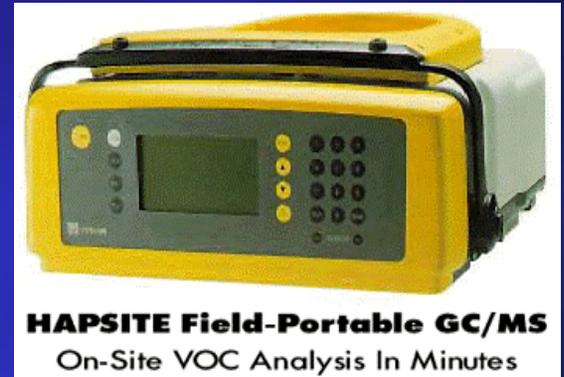
Accuracy: 8% absolute difference

Throughput: 2-3 sample/hr

Weight: 50 lbs

Cost: \$ 75-95K

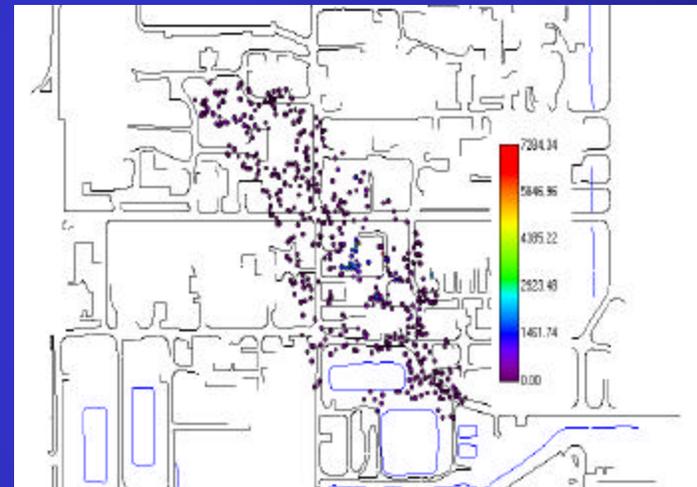
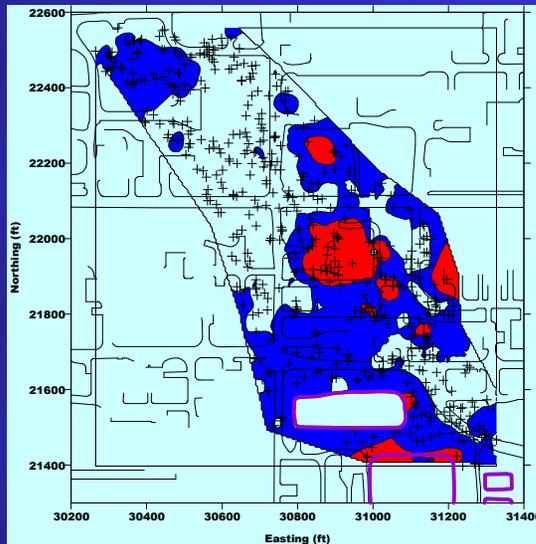
Setup Time: 30 min



# Decision Support Software Evaluation

Sample locations and arsenic concentrations (mg/kg) generated by Surfer (baseline) and SADA for the Site N cost-benefit problem.

Baseline Analysis Using SURFER Test Analysis Using SADA



# Future Technology Categories

## In-Progress:

- Multi-parameter water probes
- Portable water quality analyzers
  - Nitrate
  - Arsenic
- Ground Water Sampling – small diameter (< 2")
- Field portable technologies for detecting lead in housedust

## Pending:

- Organic stack vapor monitoring
- Water detectors for biological contaminants
- MTBE monitors
- Assessment tools for monitored natural attenuation
- Leak detectors for fugitive emissions from valves and flanges
- Geophysical characterization technologies

# For More Information....



[www.epa.gov/etv](http://www.epa.gov/etv)  
[www.ornl.gov/etv](http://www.ornl.gov/etv)

Web sites contain:

Technology categories

Test plans

Complete reports

Test schedules

Report summaries

Center news