



# Characterization and Monitoring Branch

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The following information represents projects that are currently being undertaken by CMB. In addition to the tasks assigned to the team members, we also provide support to other scientists with peer review of documents, and work cross functionally with groups both internal and external. Team members also provide technical support to several different agencies and clients on an as needed basis.

The Characterization and Monitoring Branch (CMB) consists of a diversified group of scientists and support personnel. CMB supports the EPA's mission by providing research, development, and the expertise across a wide range of disciplines focusing on technologies (equipment and techniques) that contribute to cost-effective environmental data acquisition and interpretation required to address environmental issues. The broad scope of this mission encompasses all stages of the experimental and measurement process.

This includes:

- Sampling design optimization.
- Sampling and subsampling equipment and techniques.
- Field and laboratory analytical methods.
- Quality assurance and control procedures.
- Statistical data analysis and estimation methods.
- Optimal decision-making procedures.
- Geophysical analysis.

These efforts focus on the measurement and evaluation of contamination in various media, with current emphasis on soils, sediments, and ground water.

In addition to the basic and applied research programs described above, CMB, under the Superfund Innovative Technology Evaluation (SITE) program, actively seeks out new technologies to evaluate their performance under the most realistic conditions possible with the goal of providing a non-biased assessment of each technology's capability. CMB also provides Superfund support to EPA's Remedial Project Managers (RPMs) and On-Scene Coordinators (OSCs) through the Superfund Technical Support Center (TSC) for Monitoring and Site Characterization. The diversity of expertise available through our TSC allows us to work with the RPMs and OSCs throughout a site characterization event from planning and design through analysis and data interpretation.



Soil sampling at Boarhead Superfund site

For more information on current and past projects of CMB, visit our website at

<http://www.epa.gov/esd/cmb/default.htm>

Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.

## Site Characterization Library

In order to assist site characterization field teams, the U.S. Environmental Protection Agency (EPA), through the Office of Research and Development (ORD), released a CD-ROM entitled "Site Characterization Library 2.5." This CD-ROM was designed to allow those in the field to have instant access to documents and software programs without having to access the Internet or carry a large amount of reports to the site. An updated version of the CD is currently under development with enhanced new features.

Documents were grouped into categories for easy access to the different stages of site characterization. Below is a listing of the categories.

- Project Planning and Data Quality
- RCRA (Resource Conservation and Recovery Act)/Superfund Site Assessment Guidance
- Field Operations and Standard Operating Procedures
- General Site Assessment Guidance
- Other Site Assessment Topics: Geophysics, NAPLs (non-aqueous phase liquids), Karst, and Ecological Assessment
- Soil, Vadose Zone, Sediment, and Hazardous Waste Sampling/Monitoring
- Ground-Water Sampling and Monitoring
- Risk Assessment
- Data Analysis
- Software

The CD-ROM can be ordered by visiting the CMB website.

## Statistical Sampling and Data Analysis

Research is being conducted to evaluate and develop new approaches designed to improve soil and sediment sampling techniques, measurement design, and data analysis using chemometric and robust statistical methods. Improvements in sampling soil or other heterogeneous particulate solids are being investigated in order to obtain more representative subsamples and to reduce errors that commonly occur during sample collection and handling. The sampling research will evaluate the Pierre Gy particulate sampling theory for both laboratory and field subsampling practices. Robust statistical methods are being developed to better analyze and interpret data, and to reduce data uncertainty.

The overall objective of the program is to examine and evaluate the statistical procedures and methods used in the measurement process (sampling design, sampling, experimental design, quality control, data collection, data analysis, validation, and decision analysis). These procedures and methods will then be improved by investigating, developing, and evaluating statistical methods and software in order to reduce data uncertainty and to assure that scientifically defensible decisions for assessing and characterizing risks to human health and the environment can be made.

## Ground-Water Sampling and Geophysical Methods Development and Evaluation

Inadequate site characterization and a lack of knowledge of subsurface contaminant distributions, particularly of non-aqueous phase liquids (NAPLs), hinder our ability to make good decisions on remediation options and to conduct adequate cleanup efforts at contaminated sites. Research is being conducted by CMB to improve and evaluate the resolution of a variety of geophysical methods including: complex resistivity (CR), natural potential (NP), electromagnetic (EM), seismic, and ground penetrating radar (GPR) for the detection of subsurface NAPLs.



Running lab tests at Las Vegas Facility

To conduct this research, a small 8-foot diameter spill testing tank was installed in Richmond, CA. The first dense non-aqueous phase liquid (DNAPL) spill simulation experiment has been conducted in this tank, with personnel from the EPA, the U.S. Geological Survey, and the Lawrence Berkeley National Laboratory of the Department of Energy. Testing will evaluate geophysical methods before, during, and after the DNAPL injection. Current research is evaluating the use of geophysical methods for monitoring the remediation of the DNAPL.

A site for a second larger characterization test cell (CTC) (30' by 40' by 10' deep) with the ability to simulate ground water flow has been identified at Naval Base Ventura County in Port Hueneme, CA. A Memorandum of Understanding between the Navy and EPA, along with an Interagency Agreement, are being put in place to proceed with the constructing of this cell. The CTC will be constructed to allow for research on ground water sampling and characterization, soil sampling for DNAPLs, and large-scale evaluation of geophysical techniques, before, during, and after the DNAPL injection and remediation efforts.

In addition to the DNAPL spill experiments, efforts are underway to evaluate a relatively new surface geophysical technique, the proton resonance sounding (PRS) method, for determining subsurface water content and permeability. This technique will be evaluated by conducting a field test in Southern Nevada and comparing the results to borehole cores, geophysical logging, and standard borehole aquifer permeability measurements. These results will provide a better understanding of the capabilities and limitation of the PRS method for subsurface site characterization.

# CMB is Also Responsible for Managing the following Programs

## Technical Support Center (TSC)

There are five Technical Support Centers (TSC), in five laboratories, operated by ORD and funded by the Office of Superfund Remediation and Technology Innovation and the Technical Support Project (TSP). Each TSC is dedicated to serving the EPA by supplying high-quality, quick-response technical support services when the scope of work is beyond that which is available to the Regions. The Environmental Sciences Division (ESD) in Las Vegas, NV, operates the Technical Support Center for Monitoring and Site Characterization.

The Las Vegas TSC began in 1987 and specialized in Superfund support to EPA's RPMs and OSCs. Since 1991, limited RCRA technical support has also been available. The diversity of expertise available through our TSC allows us to work with the RPMs and OSCs throughout a site characterization event, i.e., from planning and design to analysis and data interpretation.

Examples of the types of technical support provided are shown below.

- Analytical Chemistry – specialized chemical analysis, QA support, data audits.
- Statistical Analysis – consultation, UCL (upper confidence level), UTL (upper tolerance level), calculations, background vs. site concentrations, spatial analysis/mapping, sampling and sample design, multivariate analysis, ProUCL software.
- Groundwater/Subsurface Support – geophysics, bioremediation assessment/monitoring, contaminant pattern recognition/fingerprinting.
- Air Monitoring/Modeling.
- Document Reviews – RI/FS (Remedial Investigation/Feasibility Study), monitoring/sampling designs, statistical approaches, QAPPs (Quality Assurance Project Plans), characterization and measurement methods.

Visit the TSC website for more information at:

<http://www.epa.gov/esd/tsc/tsc.htm>

## SITE – Superfund Innovative Technology Evaluation

Performance verification of innovative environmental sampling, monitoring, and measurement technologies is an integral part of the regulatory and research mission of the U.S. Environmental Protection Agency.

To address this need, the Superfund Innovative Technology Evaluation (SITE) Program was established by EPA's Office of Solid Waste and Emergency Response and the Office of Research and Development. The overall goal of the Program is to conduct performance verification studies and to promote the acceptance of innovative technologies that may be used to achieve long-term protection of human health and the environment. The program is designed to meet three objectives: 1) to identify and remove obstacles to the development and commercial use of innovative technologies; 2) to demonstrate promising innovative technologies, and gather reliable performance and cost information; and 3) to develop procedures and policies that encourage the use of innovative technologies at Superfund and other hazardous waste sites.

Visit the SITE website for more information at:

<http://www.epa.gov/sitemmt.htm>



Sampling for PCBs in Lake Michigan

## Soil and Sediment Sampling

Sampling is perhaps the major source of error in the measurement process and, potentially, is an overwhelming source of error for heterogeneous particulate materials, such as soils and sediments. Current approaches and devices used to characterize volatile organic compounds (VOCs) in soils can result in the loss of 100% of the detectable VOCs present. Research is underway to improve sampling approaches and devices to reduce the loss of VOCs in soils during sampling events.

A new initiative is underway to address the vapor intrusion problem that occurs at many contaminated sites in which VOCs move from ground water through the soil and into homes.

Investigations are underway to look at the spatial and temporal variability influences on indoor air quality as well as exploring geostatistical approaches to vapor intrusion issues.

Disturbance of contaminated sediments during dredging or large storm events often leads to their resuspension and subsequent deposition downstream. Research to improve the collection of undisturbed surface sediments so that the effect of these recent events can be identified and quantified is being conducted.

## Current CMB Projects

The Order of the Addition of a Preservative/Extractant to a Soil Sample: Influence on Recovery of VOCs.

Effects of Soil Disturbance on VOC Emissions From Aged, Contaminated Soil.

Collection of Undisturbed Surface Sediment Samples.

Composite Sampling for Soil VOC Analysis.

Reevaluation of the Relationship Between Collocated Soil and Vapor Sample of VOC Concentrations.

Evaluation of an Innovative Soil Sampler.

In-Vial Preservation of Soil VOCs.

Site Characterization Library, Version 3.0.

Statistical Sampling and Data Analysis.

Ground-Water Sampling and Geophysical Methods Development and Evaluation.

Plan and Conduct a Field Demonstration of XRF Analyzers for the Determination of Target Elements in Soil and Sediment Samples.

Prepare Final Reports on the Performance Verification of Technologies for the Measurement of Dioxin and Dioxin-Like Compounds in Soil and Sediment.

RARE – Development of a Systematic Approach to Accurately Measure Trace Levels of VOCs in Soils.

RARE – Preliminary Evaluation of the Use of the High Volume Water Sampling Method for Dioxin Analysis During Site Characterization.

RMI – Reevaluation of Sample Holding Times.

## Recently Completed Projects

Technologies for the Determination of Mercury in Soil and Sediment. Metorex's S-MET<sup>®</sup>. (EPA/600/R-04/028). May 2004.

Technologies for the Determination of Mercury in Soil and Sediment. Milestone Inc.'s Direct Mercury Analyzer (DMA)-80. (EPA/600/R-04/012). May 2004.

Technologies for the Determination of Mercury in Soil and Sediment. MTI Inc.'s PDV 6000 Anodic Stripping Voltammetry. (EPA/600/R-04/028). May 2004.

Technologies for the Determination of Mercury in Soil and Sediment. NITON's Xli/XLt 700 Series X-Ray Fluorescence Analyzers. (EPA/600/R-03/148). May 2004.

Technologies for the Determination of Mercury in Soil and Sediment. Ohio Lumex's RA-915+/RP-91C Mercury Analyzer. (EPA/600/R-03/147). May 2004.

Literature Review and Report: Surface Sediment Sampler Database. (EPA/600/R-03/115). December 2003.

Guidance for Obtaining Representative Laboratory Analytical Subsamples from Particulate Laboratory Samples. (EPA/600/R-37/027). November 2003.

Potential Environmental Impacts of Dust Suppressants. Avoiding Another Times Beach. (EPA/600/R-04/031). May 2004.

Fingerprint Analysis of Contaminant Data: A Forensic Tool for Evaluating Environmental Contamination. (EPA/600/R-04/054). May 2004.

ProUCL Version 3.0 Software and Users Guide. (EPA/600/R-04/079). April 2004.

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