



**US Army Corps  
of Engineers®**

Engineer Research and  
Development Center

# Environmental Chemistry, Research, and Analytical Services

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## Description

The Environmental Chemistry Branch (ECB) of the ERDC Environmental Laboratory (EL) provides critical infrastructure and expertise for solving environmental problems and challenges. The ECB laboratories are fully staffed and well equipped. A staff of 23 well-trained and experienced employees, including 9 Ph.D.'s and 3 M.S.'s, use 10,000 ft<sup>2</sup> of laboratory space to provide technical services and method development for environmental research, assessment, monitoring, water quality, and dredged material characterization. Methods are developed to solve the analytical problems that are faced every day in the successful completion of ECB's mission. The ECB is also responsible for direct-funded basic and applied research in metals geochemistry, field-deployable instrumentation, and computational chemistry. A wide variety of projects include experimental and computational components within the same research effort.

## Capabilities

Method Development and Experimental Research. The research staff has developed methodologies for the study of contaminants and the geochemical processes they undergo. A combination method using HPLC and ICP-MS has been developed to study metal speciation in complex media. In addition, FFF (Field Flow Fractionation), a separation technique, is coupled to ICP-MS to study metal nanoparticles by size and composition. ESI-MS<sup>n</sup> is used to study carbon nanoparticles, degradation reactions of munitions constituents and other emerging contaminants. Traditional organic and inorganic analytical techniques have also been modified to achieve lower detection limits and higher quality data.

Computational Capabilities. The research staff utilizes the DoD's high performance computing (HPC) resources, including those available at the ERDC Major Shared Resource Center, to investigate the environmental fate of emerging contaminants using ab initio quantum chemical and molecular dynamics approaches.

The ECB is also capable of providing the following services to our customers:

- Environmental chemistry research.
- Quality assurance sample analysis.
- Water quality analysis.
- Analytical chemistry in support of research.
- Site investigations.
- Sample analysis for Department of Defense research and all major environmental analytical programs of the Environmental Protection Agency (EPA).
- Analysis of water, soil, sediment, and tissue samples for explosives, volatile and semi-volatile organics; metals, aroclors and PCB congeners, pesticides, herbicides, nutrients, and numerous other environmental contaminants.

- Methylmercury analysis and metal speciation.
- Data review and assessment, and data validation following functional guidelines.
- Laboratory inspection/validation.
- Performance evaluation sample preparation.
- Audits of contractor laboratory data.
- Electronic data deliverables.
- Chemical quality assurance reports.
- Expert witness testimony.
- Establishing and maintaining chain of custody for all samples.

## Supporting Technology

The ECB is equipped with state-of-the-art instrumentation, including:

- Several gas chromatographs with a variety of detectors, including GC-MS.
- FT-IR, and Raman.
- Total organic/inorganic carbon analyzers.
- Liquid chromatography equipment, including HPLC-MS (HPLC-ESI-MS<sup>n</sup>).
- Radiological analysis counting system.
- ICP instrumentation, including ICP-MS.
- Ion chromatography instrumentation.
- Sample preparation equipment.
- NMR (coming soon).
- Access to DoD supercomputer facilities.

The ECB laboratory utilizes a Laboratory Information Management System (LIMS) to assemble and report data. In addition to the standard report, ADR and custom EDDs can be generated with the associated QC data.

## Benefits

The ECB provides a means for researchers and other environmental quality personnel to analyze samples with high accuracy. Developments in the ability to analyze samples in complex matrices have expanded the possibilities and removed limitations. These types of developments have put the ECB on the forefront of environmental quality research and analysis. The extensive experience of personnel, combined with the state-of-the-art facilities and equipment, provide a unique analytical chemistry resource for engineers and scientists to bring success to environmental projects, including analytical chemistry support for research, hazardous and toxic waste site investigations, and site remediation. The ECB also adds to the knowledge base of contaminant longevity by producing highly accurate mechanisms of degradation pathways. Parameters produced in these calculations can be used by other environmental modelers to refine their results in such areas as toxicity prediction modeling and water quality modeling. The ECB has a strong publication record in peer-reviewed journals, and is a visible presence at many meetings and conferences.

**Success Stories**

ERDC has had much success with and contributed significantly to research and environmental programs, primarily with Corps Districts. A major success resulting from the split sample analysis program was Drake Chemical Superfund Site, working with the Baltimore District. With significant savings to the project, ERDC completed critical analytical chemistry development and analysis to keep the project on schedule after the contract laboratory's capabilities came into question. In support of the San Francisco District, ERDC developed the capability to complete parts-per-trillion analysis of methylmercury and applied the technique to a key wetlands project. For the Philadelphia District and the Vineland Chemical Superfund Project, ERDC developed an efficient and effective method for arsenic speciation. The method continues to be used for this project. ERDC has developed techniques for analysis of numerous special explosives and provides analysis services for a wide range of customers. ERDC is a team player for many environmental projects and continues to provide commendable analytical chemistry services to the Corps, which results in savings of time and money.

**Point of Contact**

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