



US Army Corps  
of Engineers®

Engineer Research and  
Development Center

Service

# Chemical Analysis of Environmental Samples

## Description

The Environmental Chemistry Laboratory (ECL) at the Construction Engineering Research Laboratory (CERL) provides CERL researchers and External Army customers with analytical support to evaluate samples taken at field locations, or those generated in bench, pilot, and demonstration scale experiments. These samples may contain combinations of solids, liquids, and organic and inorganic gases. Often, the sample's composition is unknown. Based on project requirements, the ECL designs experiments, develops methods, and provides research direction to best analyze and answer research questions.

## Capabilities

The ECL provides special services that outside contract laboratories cannot typically provide because contract documents must specify which methods to use, which compounds to identify, and the required detection limit. The analysis of unknown samples makes special demands on the researcher, who at times must develop the applicable method, identify the compounds in a sample, and then identify the detection limit for the compound.

The ECL is specially suited to meeting the needs of customers with unique needs. The types of environmental samples that come to the ECL often contain many background interferences that must be removed by special preparatory steps (e.g., immiscible liquid extraction) before analysis. The ECL performs its specialized functions while providing quick analytical support turnaround time—a crucial aspect when sample analysis is being used to determine and refine experimental operating conditions.

## Supporting Technology

Analytical support requires a variety of instrumentation, depending on the material composition (organic or inorganic; solid, liquid or gas) and concentration (required detection limits). Analysis can be non-specific when measuring groups of similar compounds (e.g., Total Organic Carbon, or Oil and Grease), or highly specific for the analysis of individual compounds. The ECL at CERL currently has the following analytical instrumentation:

- Tools for Organic Analysis:
  - Gas Chromatograph/Mass Spectrometer
  - Mass Spectrometer (GC/MS/MS)
  - Portable Gas Chromatograph/Mass Spectrometer (GC/MS)
  - Portable Gas Chromatograph
  - Liquid Chromatograph/Mass Spectrometer (LC/MS)
  - High-Pressure Liquid Chromatograph with Photodiode Array (PDA) Detector
  - Fourier Transform Infrared Spec-



**Environmental samples may contain combinations of solids, liquids, and organic and inorganic gases.**

- trometer (FTIR)
- LC/IR
- Pyrolysis Instrument
- Tools for Inorganic Analysis:
  - Flame & Graphite Furnace Atomic Absorption Spectrometer (AA)
  - Ion Chromatograph (IC)
  - Electrochemical Analysis
  - Orion Auto-Titrator.

### **Benefits**

The ECL's customers benefit from the broad range of environmental analytical services not commonly available at commercial, contract laboratories. The ECL does timely analyses of crucial samples, and performs exploratory analyses of materials of unknown composition. The ECL's in-house experts can help develop specialized sample preparation techniques as required by specific projects. The ECL is the sole analytical support base for some U.S. Army projects and for those situations where analysis at an outside laboratory under contract would be prohibitively expensive due to the complexity of analysis or the number of samples. In instances where ECL may not have the equipment, expertise, or time to analyze samples, the laboratory has developed a working relationship with the nearby University of Illinois' Waste Management and Research Center.

### **Success Stories**

Some representative projects that the ECL has successfully undertaken include:

- Identification of by-products from advanced oxidation processes
- Analysis of wastewater runoff from aircraft wash facilities
- Grease/oil and particle size analysis of water and soil
- Analysis of industrial wastewater
- Analysis of heavy metals leaching from antifoulant coatings for zebra mussels
- Identification of corrosion products in drinking water and paint strippers
- Toxicity Characteristic Leaching Procedure (TCLP) analysis of paint blast media residue
- Onsite environmental assessment of energetic contamination of soil and water
- Collection and analysis of hazardous waste incinerator emissions.

### **ERDC POC**

Construction Engineering Research Laboratory (CERL)  
 Environmental Processes Branch (CEERD-CN-E)  
 tel.: (217)352-6511  
 Fax: (217)373-7222.