Pacific Northwest NATIONAL LABORATORY

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Environmental Sciences Laboratory

Scientific Expertise: Need to find out the chemical and physical composition and properties of a sample? The Environmental Sciences Laboratory, located in the 331 Building in the 300 Area, has an expert staff of geochemists, chemists, and geologists. These scientists are translating strategy into action by teaming with colleagues across the laboratory to conduct environmental research—from conceptual design to data analysis and reporting—to develop effective, science-based solutions to solve complex environmental and climate challenges.

Projects: Environmental Sciences Laboratory scientists work on diverse projects such as investigating radiological or chemically contaminated soil and liquid samples; assessing the performance of advanced waste forms; studying the fate and transport of contaminants in the deep vadose zone; using sophisticated isotopic analyses to determine contaminant source terms; and developing conceptual models depicting contaminant release and transport. These studies help researchers better understand and predict environmental impacts; conduct groundwater and deep vadose zone treatability studies; and advance understanding of subsurface science for environmental remediation.

Analytical Equipment: The Environmental Sciences Laboratory houses a full suite of scientific instrumentation and technologies designed to analyze various types of organic and inorganic samples in liquid and solid forms. These analytical instruments provide valuable characterization data that help researchers advance their capability to deliver science and technology solutions.

Instrument Information and Sample Scheduling

Trained technicians are available to operate the instruments and process samples collected onsite or offsite. To schedule a sampling activity, or if you have questions regarding instrument capabilities, please contact Michelle Valenta or Keith Geiszler from the Geosciences Group:

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Inductively Coupled Plasma-Optical Emission Spectrometry

This instrument (shown left) can be used to analyze a multitude of samples including waters, biological materials, inorganic materials, and environmental and geological samples. Detection capabilities span the periodic table of elements, with detection limits in the low to mid parts per billion (ppb) range.

U.S. DEPARTMENT OF ENERGY

Inductively Coupled Plasma-Mass Spectrometry

This highly sensitive instrument is capable of detecting a range of trace elements at the low to sub parts per trillion (ppt) range in a multitude of matrices. The unit's Dynamic Reaction Cell™ uses chemical resolution to eliminate plasma-based polyatomic species and improve detection limits for difficult elements such as iron, calcium, potassium, magnesium, arsenic, selenium, chromium, and vanadium.

Inductively Coupled Plasma-Mass Spectrometry

Ion Chromatograph/ Mass Spectrometry

This instrument can be used to measure anions and cations, carbohydrates, organic acids, amino acids, proteins, peptides, oxyhalides, carboxylates, polyphosphates, fatty acids, metals, and phenols in a variety of matrices. Typical detection limits span the ppb to ppm range.

Ion Chromatograph/Mass Spectrometry

X-Ray Fluorescence

This instrument identifies total elements of composition in solid materials, both organic and inorganic. Several elements may be analyzed simultaneously by measuring the characteristic fluorescence X-rays emitted by a sample. This instrument also measures the scatter X-rays emitted by the sample during each measurement to determine the approximate density and percentage of the light elements in the sample.

X-Ray Fluorescence

Radiological Analysis

A full suite of instruments is available to support radiological analyses. Gamma ray spectrometers are used to quantify the activity of gamma-emitting nuclides (such as cesium-137) in solid or liquid samples.

The liquid scintillation counter is used to quantify the alpha- and beta-emitting nuclides in liquid samples using ultraviolet light detection.

X-Ray Diffraction

This instrument, housed in the 325 Building in the 300 Area, is used to determine the crystallographic structure, texture analysis, and preferred orientation in polycrystalline or powdered solid samples. The unit's high temperature stage enables in situ analysis of phase alteration, crystal growth and thermal expansion.

X-Ray Diffraction

Pressurized Unsaturated Flow

This instrument has the capability to measure contaminant retardation with flow-through columns operating at unsaturated water conditions. The PNNL patented device is designed to vary the volumetric water content from saturation down to 20% of saturation; minimize the flow rate to increase liquid residence time; and operate at a maximum temperature of 90°C.

Pressurized Unsaturated Flow Instrument

Geosciences Group

The Geosciences Group's primary goal is to solve complex environmental challenges with earth-science solutions. Our fundamental approach is to apply our technical expertise in geosciences to develop, deliver, and deploy transformational science and technology solutions for our clients.

To learn more about the Geosciences Group, please contact **Chris Brown**, Geosciences Group Manager, at (509) 371-7389 or visit our website at http://geosciences.pnnl.gov/.

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PNNL-SA-82960