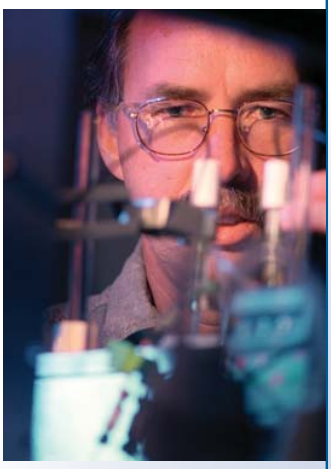
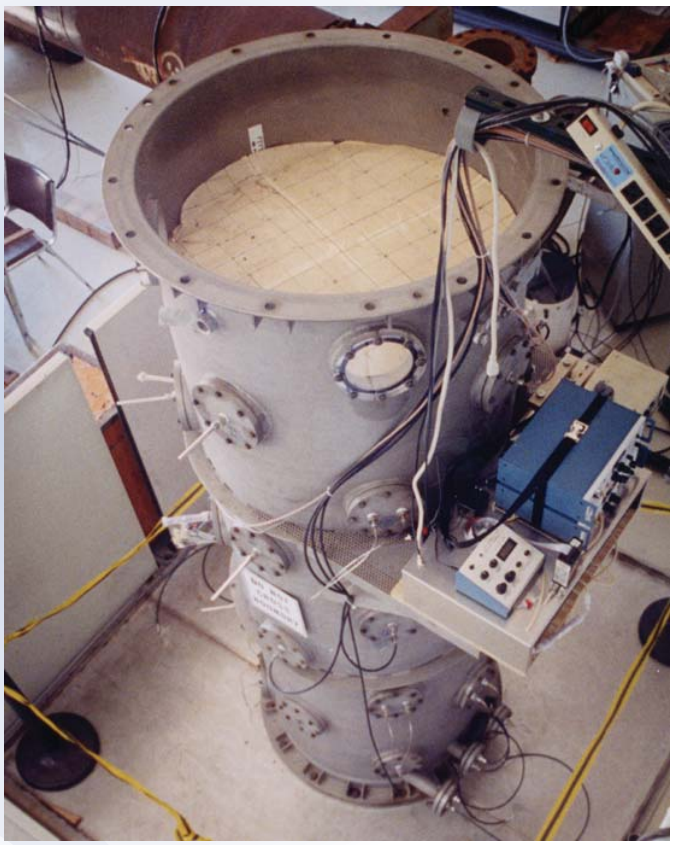
Geosciences Research



Meso-scale research column.

The Geosciences Research organization is improving our understanding of chemical, biological, and geophysical processes in the subsurface, and how these processes affect water and contaminant transport.



Researchers are designing better remediation approaches, improving vadose zone and groundwater monitoring technologies, and advancing modeling capabilities to provide more realistic environmental risk assessments. Emphasis is on highly cross-disciplinary, field-oriented, DOE mission-relevant research resulting in science and technology advances and peer-reviewed publications. The department operates a seismic network to monitor seismic activity on the INL site and throughout the Eastern Snake River Plain. The department also maintains several field research locations, as well as a mobile laboratory, and oversees a growing DOE complex-wide vadose zone monitoring network including a developing vadose zone research park. In addition, INL has established a Geocentrifuge Research Laboratory in Idaho Falls.

Geology and Geophysics

Researchers are analyzing the regional tectonic, volcanic, and sediment accumulation processes in the INL region to better understand the geologic hazards, both seismic and volcanic, to provide conceptual understanding of the subsurface hydrologic processes, and to develop better remedial strategies of subsurface contaminants. INL's seismic monitoring network is an important contributor to this work. Additional research is focused on hydrocarbon reservoir characterization, including borehole seismic tools and geophysical techniques for imaging geopressured reservoirs and basin modeling, and on enhancement of characterization and exploration techniques for geothermal resources.

Biogeochemical Processes

Research teams are studying the coupled geochemical and biological processes occurring in subsurface environments. The mobility of contaminants in groundwater depends on the chemical state of the system and on the presence of reactive minerals. The soil zone carbon cycle is central to this understanding as it links soil moisture, microbial

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Science

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activity, soil water pH buffering, and retardation of contaminants. Studies are under way to define constitutive and thermodynamic relationships among soil moisture, carbon dioxide, and contaminant transport. This improved understanding provides a higher level of confidence in predictions of the long-term fate of contaminants in the subsurface and supports technically sound remediation decisions. Such research advances DOE's long-term environmental stewardship mission.

Vadose Zone, Aquifer Monitoring and Characterization

Researchers are developing integrated instrument systems to characterize and monitor subsurface environments to better understand flow and transport in deep vadose and phreatic zones. Staff members are developing new instruments to measure the spatial and temporal distribution of physical and chemical parameters. Continuous subsurface monitoring systems are being deployed throughout the United States in cooperation with other research institutions and universities. Laboratory and field experimental studies are focused on measuring spatial and temporal distribution of chemical and soil physical parameters, evaluating subsurface microbial activities in unsaturated soil, integrating geophysical methodologies with soil physical measurements, and examining infiltration through high-contrast media. These advancements will lead to better quantitative prediction of contaminant transport through vadose zone and aquifer materials.

Geocentrifuge Investigations

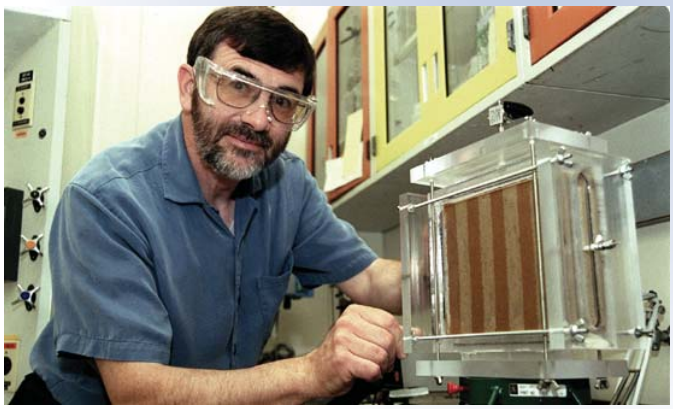
INL has established the Geocentrifuge Research Laboratory encompassing a 2-meter geocentrifuge user facility in Idaho Falls. Research conducted at this laboratory will enable more accurate modeling of a wide range of complex porous media and advance our understanding of subsurface contaminant transport. INL and visiting researchers use this laboratory to study fluid flow through samples made from soils, rock and other materials, and for traditional structural material testing. Using the 2-meter geocentrifuge to simulate an accelerated passage of time for a sample material, researchers can study in a few days or weeks the effects of tens of years of gravity-induced fluid movement. Test samples can include intact blocks and cores of geologic materials and fabricated models with idealized 2- and 3-D physical and chemical heterogeneities.

The Geosciences Research Department welcomes the opportunity to participate in collaborative research with scientists from universities, industry, and federal agencies. Other opportunities include post-doctoral fellowships, sabbaticals, and staff positions.

Crew at field-scale site.



Experiment at bench scale.



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