

The Marine Sciences Laboratory has 6,000 square feet of analytical and general purpose laboratories and 7,700 square feet of wet or support laboratories supplied with heated and cooled freshwater and seawater. The Marine Sciences laboratory also has a state-of-the-art waste seawater treatment system; a 28-foot research vessel, the "Strait Science," equipped with the latest electronic equipment; a specialized scientific diving boat; and a full scientific scuba dive capacity with six certified divers.

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## Process Science and Engineering Division

One of the more laboratory-intensive divisions at the Pacific Northwest National Laboratory, the Process Science and Engineering Division is helping clients gain a better understanding of chemical, radiochemical, and biological phenomena that underlie environmental systems:

- **Advanced Processing** — novel processes, materials, and applications for advanced processing projects, including glass science and engineering
- **Chemical and Biological Process Development** — chemical and biological processes used in bioprocessing, microchemical systems, separations, and catalysis reaction and engineering



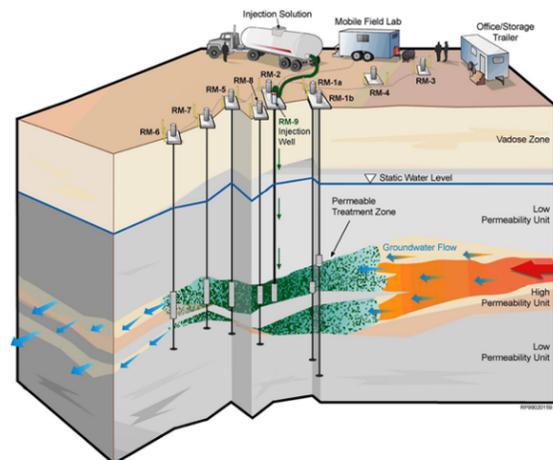
*PNNL researchers are studying fungi to discover novel isolates and to find new biomass degrading enzyme systems.*

- **Fluid and Computational Engineering** — fluid dynamics, heat transfer, related transport phenomena, and liquid-solid systems for fluid and computational engineering projects
- **Radiochemical Science and Engineering** — nuclear process engineering, radiomaterials characterization, and radiochemical separations and processing with linkages to process modeling, inorganic materials, and chemical separations for radiochemical science and engineering projects.

The Process Science and Engineering Division manages the Radiochemical Processing Laboratory, a Category 2 nuclear research and development facility with hot cell, radioanalytical and support services infrastructure. It also is home to the Applied Process Engineering Laboratory, a user facility for state-of-the-art engineering testing and demonstration.

The Process Science and Engineering Division generates the greatest amount of intellectual property revenues at the Pacific Northwest National Laboratory.

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*The field tests on In Situ Redox Manipulation show it can remove toxic chromate from the groundwater to levels below drinking water standards and water quality standards for aquatic life. This technology, developed by Pacific Northwest National Laboratory, won an R&D 100 award in 1998.*

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# Environmental Technology Directorate

The Environmental Technology Directorate is the steward of the Pacific Northwest National Laboratory's environmental quality goal — to be the leading lab for expedited cleanup and sustainable production. Our stewardship provides the basis for missions to:

- restore the environment by cleaning up the legacy of nuclear weapons production, and military and industrial activities
- protect ecological and human health through our safety work, our stewardship activities, and our focus on major threatening problems, and
- sustain the environment by providing methods to effectively manage our natural resources and technologies that are economic and enhance the quality of life supporting a healthy global environment.

Our 772 staff members work in four divisions serving clients from the Department of Energy, other government agencies, and industry.

## Health Effects and Risk Sciences

The Health Effects and Risk Sciences Division supplies science-based solutions to complex environmental health and cleanup issues. Health Effects and Risk Sciences integrates solutions from the following capabilities:

- **Health Physics** – experimental and modeling expertise for assessing human health consequences of radiological exposure, internationally recognized in radiation dose reconstruction, development of thermoluminescent and optically-stimulated luminescent dosimetry
- **Chemical Toxicology** – inhalation, developmental, and reproductive toxicology; chemical toxicology screening and analysis; toxicity and exposure kinetic assessment
- **Hazard and Exposure Assessment** – assessment of radiological and chemical hazards and exposure for facilities, wastes, and nuclear materials through atmospheric fate and transport modeling and model development, and chemical degradation and characterization studies; meteorological forecasting of hazardous conditions; and non-destructive analyses
- **Integrated Modeling and Analysis** – process-based models of complex environmental and biological systems are combined to perform risk analysis, decision analysis, and systems engineering; modeling incorporates optimization and visualization tools and can be used in science and technology road mapping and strategic planning



*The state-of-the-art thermogravimetric analysis/differential scanning calorimeter/mass spectrometer system, housed at the Radiochemistry Processing Laboratory, is used to analyze macroscopic samples to study mechanisms and kinetics of material reactions in varied atmospheres including static and dynamic conditions.*

- **Project Engineering and Technology Deployment**— program integration, systems engineering, project management, and planning to allow successful deployment of complex, high-risk technology solutions.

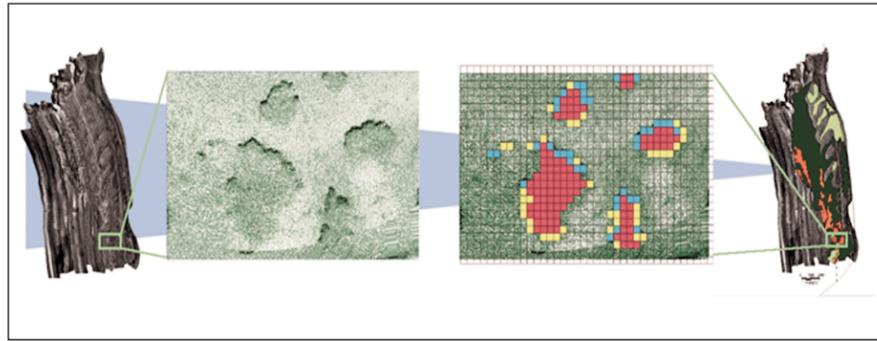
This combination of capabilities is increasingly being used for planning and analysis of emergency response and emergency preparedness.

The Health Effects and Risk Sciences Division offers a state-of-the-art Chemical Testing Chamber for trace detection of semi-volatile chemicals and their degradation products. The division also houses an Environmental Testing Laboratory, offering a full range of instrument performance testing and calibration. Several programs within the division's Radiological Calibrations Laboratory have nationally recognized accreditations by the National Voluntary Laboratory Accreditation Program (NVLAP) and the Department of Energy Laboratory Accreditation Program (DOELAP).

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*The information provided by the Chemical Testing Chamber can provide analyses for a wide range of issues, including environmental contaminants, indoor air concerns, industrial emissions monitoring and control, and sensor testing for homeland security applications.*

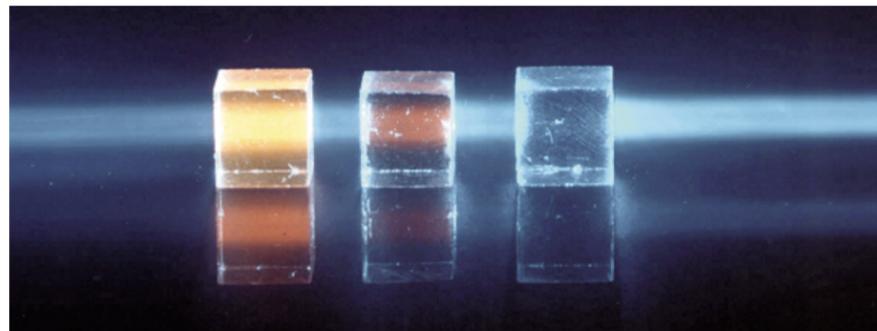


*Researchers successfully characterized a 14-mile section of Puget Sound shoreline using a combination of side-scan sonar and underwater videography to assist the King County Department of Natural Resources in determining the location for its new wastewater treatment plant outfall.*

## Natural Resources Division

Projects conducted in the Natural Resources Division enable clients to achieve a balance between planned activities and resource stewardship for issues ranging from environmental restoration to fish and wildlife studies. Natural Resources capabilities include:

- **Applied Geology and Geochemistry** — development and testing of practical soil and water remediation technologies and development of geophysical methods to monitor field-scale and regional phenomena through contaminant transport modeling, regional seismic monitoring, and spatial and temporal data analyses
- **Ecology** — identification and remediation of the impact of client operations on the environment through evaluations of ecosystem health; assessments of land-use impacts; and in-depth studies, some
- **Environmental Characterization and Risk Management** — comprehensive environmental monitoring programs that provide data to demonstrate compliance with ongoing operations and support environmental restoration activities and stewardship of natural resources using expertise in environmental characterization, monitoring, and remediation design, as well as cultural and historical resource management and risk assessment
- **Field Hydrology and Chemistry** — research and technologies that characterize, monitor, and control the migration of contaminants in the subsurface environment using experience in dealing with soils and groundwater contaminated with radioactive and non-radioactive hazardous materials



*Optically stimulated luminescence, a technology developed to measure a radiation worker's exposure, may also be used for high-density data storage, detecting defects in materials, planning and testing radiation treatment for cancer, quality assurance in food irradiation, and medical imaging.*

- **Hydrology** — problem-solving that involves the movement and quality of water as it cycles through the environment, including watershed responses to land use and climate change, long-term landfill covers, vadose zone and groundwater flow and reactive transport predictions, performance and risk assessments, river flow and transport predictions, and river hydraulic effects near dams and other structures.

The Natural Resources Division manages a number of specialized facilities for Pacific Northwest National Laboratory, including aquatic laboratories for rearing fish and other aquatic organisms; a state-of-the-art Multifluid Research Laboratory for nonintrusive and nondestructive measurements of fluid saturations, salt concentrations, and porous media densities; and a closed-loop wind tunnel for aerosol studies.

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## Marine Sciences Division

The Marine Sciences Division, located at the Marine Sciences Laboratory in Sequim on Washington State's Olympic Peninsula is the Department of Energy's only marine research laboratory. The Marine Sciences Laboratory helps clients understand the effects of pollutants on marine and freshwater organisms; measure trace substances in the marine environment and develop tests to determine safe levels of the substances; assess and restore marine and coastal habitats; and use satellite information and other remote sensing techniques to map, measure, and model what happens in the ocean. Marine Sciences capabilities include:

- **Ecotoxicology** — toxicity tests at different temperatures, salinity, and flow regimes on over 30 different marine and freshwater organisms using a large-capacity, wet-laboratory facility



*The culvert testbed will help scientists understand the movement of juvenile salmon through culverts, which may be blocking them from reaching thousands of miles of habitat.*

- **Chemistry** — risk-based measurement of trace organics and metals in the environment, with targeted expertise in petroleum hydrocarbon fingerprinting and ultra-low trace-level analysis of contaminants in tissues, sediments, soil, water, and air
- **Biotechnology** — remediation of soils and sediment contaminated with petroleum compounds, bacteria, and other toxic or hazardous wastes and development of enzyme applications and beneficial use of byproducts.
- **Coastal and Marine Resources** — identification and understanding of coastal processes, particularly the responses of fisheries and wildlife to coastal habitat restoration; wetlands ecology; environmental resource assessment; habitat mapping; dive surveys; and benthic community analysis
- **Ocean Processes** — remote sensing; GIS; side-scan sonar; ocean circulation modeling; sediment and contaminant transport; ocean data analysis; instrument development; and marine geology for coastal and open-ocean applications in environmental cleanup, natural resource surveys, national security, and emergency response.



*The sensor-packed synthetic salmon making their way through turbines at hydroelectric dams measure the conditions that real fish encounter as they pass through the turbines on their way to the ocean.*