



**A Technical Resource
for Government and
Private Industry**



A product line for **Environmental Solutions**

Managers of federal sites and private industrial operations face significant environmental and resource management problems that can be solved only through innovative uses of science and technology. Water resource management, for example, involves the conflicting needs of commercial and agricultural development versus safeguarding endangered fish species. Cleanup of contaminated sites requires protecting the public and ecosystems while controlling remediation costs. Port and harbor deepening and military training must proceed without damaging fragile habitats.

Finding solutions to these and other environmental problems is the business of the Resource and Ecosystem Management (REM) product line at the Pacific Northwest National Laboratory. Our clients include the Department of Energy (particularly at Hanford), the Department of Defense (primarily the Army Corps of Engineers and Army Forces Command), other federal agencies, state and local governments, and the private sector.

We offer responsive, science-based approaches for solving complex, environmental problems.

The scope of our experience is extensive and diverse and is highlighted by

- 30 years of environmental monitoring at the Hanford site including groundwater, surface water, ecology, and cultural resources as well as technical leadership for Hanford's Groundwater/Vadose Zone program
- in-depth research and scientific studies for critical decisions related to fish passage and hydroelectric dam operations in the Pacific Northwest
- R&D 100 awards for our Six-Phase Heating and In-Situ Redox Manipulation groundwater cleanup technologies, which were recognized for improved effectiveness over current presumptive remedies and significant cost-savings.

For more information, contact:

Dr. Joseph L. Devary, Manager
(509) 376-8345

Resource & Ecosystems Management
Environmental Technology Division
PO Box 999
Richland WA 99352
joe.devary@pnl.gov
www.pnl.gov.2080

**Pacific Northwest
National Laboratory**
Operated by Battelle for the
U.S. Department of Energy



Restore Protect Sustain

Our high-value products and services focus on restoring, protecting and sustaining the environment.



Environmental Monitoring and Assessment

We provide critical information for site cleanup, risk management, and, ultimately, the long-term stewardship of contaminated sites. We collect and interpret contaminant and physical data from marine, freshwater, air, land, and geologic environments. We conduct comprehensive monitoring programs using sensors, non-intrusive characterization, and other techniques for RCRA, CERCLA and other regulations.

Environmental Fate and Transport of Contaminants

We specialize in numerical computer models that predict the fate and transport of contaminants in the air, marine, freshwater, and subsurface environments. Calibrated to laboratory and field-scale data, the models accurately simulate the dispersion, transport, transformation, and fate of contaminants in natural systems. Our predictive tools simulate various physical, chemical, and microbial processes that affect contaminant migration in the environment.

Management of Natural Resources

We offer in-depth knowledge for ecosystem management that balances operational demands with effective stewardship of natural resources. We equip managers with a framework of scientific data for evaluating ecosystem health, assessing land-use impacts, and enhancing ecological resources. We evaluate terrestrial and aquatic ecosystem response to natural and man-induced stresses through hydroacoustic monitoring, sonic tagging, hydrologic modeling, forecasting, watershed analysis, and integrated eco-assessments.

Ecological and Human Risk Assessment

Our advanced decision-support tools predict the levels, extent, and nature of risks to ecosystems and humans due to exposure to chemicals and radionuclides. We specialize in 1) groundwater and vadose zone contamination and 2) threats to natural resource systems. We use chemical/radionuclide risk assessment tools integrated with advanced geographic information systems (GIS) to manage spatial databases.

Measurement Technology and Assessment

Our highly defensible analytical and radiological chemistry studies support investigations at contaminated sites. We offer advanced analytical instrumentation and methods for determining chemical, physical, radiological, and biological properties in all types of media. We use specialized laboratories in Richland (radionuclides), Sequim (metals and arsenic), and Duxbury (organic compounds) for extremely accurate measurements of contaminants at trace concentration levels.

Environmental Remediation Systems

For soils and groundwater, our cleanup solutions offer significant cost savings compared to presumptive remedies such as pump-and-treat and excavation-and-removal. We offer active cleanup systems, such as six-phase heating, and passive systems that destroy or immobilize contaminants in place, such as in-situ redox manipulation (ISRM). We deploy barriers and isolation systems, and we develop and apply techniques to quantify and enhance the natural attenuation of contaminants in the subsurface environment.

Statistical Analysis and Design

Our statistical analysis and design products establish the protocols for collecting quality data in environmental studies. With our methods, decisions based on these data are scientifically defensible against public, legal and regulatory challenges. We offer statistical design, data assessment and data quality objectives (DQO) for monitoring and characterization activities.