



For more information about our Enhanced Environmental Capabilities in Support of the Decommissioning of Nuclear Facilities, contact:

Tara O'Neil  
Nuclear Regulatory  
Sub-Sector Manager  
(541) 738-0362  
Tara.Oneil@pnnl.gov

Or

Amoret Bunn  
Senior Environmental Scientist  
(509) 372-4782  
Amoret.Bunn@pnnl.gov

Pacific Northwest National  
Laboratory  
P.O. Box 999  
Richland, WA 99352

## ENHANCED ENVIRONMENTAL CAPABILITIES IN SUPPORT OF THE DECOMMISSIONING OF NUCLEAR FACILITIES

**Environmental Framework** – Pacific Northwest National Laboratory (PNNL) has provided technical support to the U.S. Nuclear Regulatory Commission (NRC) for more than 40 years. With over 240 scientists, engineers, and professional staff supporting a comprehensive suite of scientific- and risk-based environmental capabilities, PNNL is committed to resolving challenges associated with the decommissioning of nuclear facilities, including safe removal of a facility or site from service, the termination of the NRC license, and the release of property for restricted or unrestricted use. In support of those decommissioning activities, PNNL can provide:

- ▶ the scientific basis to establish compliance with regulatory requirements under Title 10 of the *Code of Federal Regulations* (CFR) 20 Subpart E: Radiological Criteria for License Termination;
- ▶ the establishment of, and adherence to, a structured, integrated environmental framework for decommissioning activities and site closure objectives;
- ▶ the satisfaction of requirements for independent verification as applied to the process of releasing, or accounting for the release of, facilities or properties under radiological controls; and
- ▶ the active management of real or perceived organizational conflicts of interest through established and vetted processes in the delivery of impartial, technically sound, and objective performance requirements.

**Technical Guidance and Program Development** – PNNL has a legacy of understanding the potential impacts of contaminants of concern on human health and the environment. Working in collaboration with federal clients and regulators, PNNL has developed and implemented processes and programs specifically for the sampling, characterization, and remediation of soils and sediments; surface water and groundwater; air and dispersive contaminants; facilities; and construction materials, including:

- ▶ technical guidance, methodologies, standards, and templates;
- ▶ program planning, data sufficiency, and data-quality objective process evaluations;
- ▶ sampling and characterization of contaminants;
- ▶ modeling and decision support including predictive and remedial analytics;
- ▶ records management for administrative record and document control; and
- ▶ quality assurance compliance through DOE Order 414.1D and ASME NQA-1-2012.



Environmental sampling and analysis by researchers at PNNL supports the International Atomic Energy Agency (IAEA) and United Nations Special Commission (UNSCOM) non-proliferation objectives.

**Sampling and Analysis** – PNNL maintains and operates state-of-the-art facilities that enable integrated, cross-disciplinary characterization, remediation, and containment of contaminants across all environmental matrices. With expertise in metals and radionuclide analysis, biogeochemical interactions, and co-contaminated complexes, PNNL’s analytic capabilities are exemplified as follows:

- ▶ established proficiencies in environmental sampling and analysis of soils and sediments, surface water and groundwater, air, biota, vegetation, and materials of construction (e.g., concrete, asphalt, and sheetrock);
- ▶ field and fixed laboratory equipment covering the range of radiological conditions, detectable activity and sensitivities, and matrices;
- ▶ alpha, beta, and gamma detectors, isotopic analysis, ICP-mass spectrometry, x-ray fluorescence, and x-ray diffraction;
- ▶ participant in DOE’s Analytic Services Program and MAPEP qualified; and
- ▶ compliance with laboratory quality assurance and quality control programs for traceability, procedure and methods development, and analysis.

**Modeling and Decision-Support Toolbox** – Complemented by dedicated institutional computing resources, PNNL’s modeling and predictive analytic capabilities enable risk, safety, and human-health informed decision-making in the design, evaluation, and implementation of environmental sampling, analysis, and remediation plans. Modeling and decision-support tools include the following:

- ▶ Visual Sample Plan (VSP): Developed by PNNL, VSP couples site, building, and sample location visualization capabilities with MARSSIM-specific strategies for optimal sampling design and statistical analysis (<https://vsp.pnnl.gov/>).
- ▶ Radiation Protection Computer Code Analysis and Maintenance Program (RAMP): Supported by PNNL, RAMP is comprised of a suite of NRC-sponsored radiation protection and dose assessment codes, such as GENII, that can address source term, surface water and atmospheric transport, exposure pathways, receptors, and dose/consequence assessments (<https://www.usnrc-ramp.com/>).
- ▶ Subsurface Transport Over Multiple Phases (STOMP): STOMP is a computational tool for simulating groundwater flow and contaminant transport phenomena for multidimensional analysis of sites with radioactive and other contaminants (<https://stomp.pnnl.gov/>).
- ▶ Advanced Simulation Capability for Environmental Management (ASCEM): ASCEM is a modular and open source high-performance computing tool informing integrated approaches to modeling and site characterization for standardized assessments of performance and risk for site cleanup and closure activities.

- ▶ E4D: E4D is a geophysical assessment and computation geophysics modeling tool used to describe spatially relevant subsurface information, improve geophysical characterization of subsurface features and contaminant transport, and monitor and predict temporal changes (<https://e4d.pnnl.gov>).

**Integrated Program Execution** – PNNL has actively participated in the development of more than 70 NUREGs/RGs/CRs addressing safety, cost, environmental, and radiological characterization requirements for the decommissioning of nuclear facilities. Our capabilities have been, or may be used, to develop or support the following:

- ▶ provide subject matter expertise in the development and execution of regulations and guidance for decommissioning activities;
- ▶ conduct research to develop data, techniques, and models to assess human/environmental health risks associated with site closure activities;
- ▶ review applications for license termination, license termination plans, and license amendment requests in accordance with NRC regulations and requirements;
- ▶ participate in inspections, audits, and review of site survey reports;
- ▶ conduct independent confirmatory analyses of site surveys including sampling, analysis, and monitoring methodologies and results;
- ▶ develop environmental assessments and environmental impact statements in support of NRC decommissioning activities; and
- ▶ organize and support public meetings and manage public comments.



Trojan reactor core nearing placement for final disposition at Hanford, WA.