Pacific Northwest
NATIONAL LABORATORY

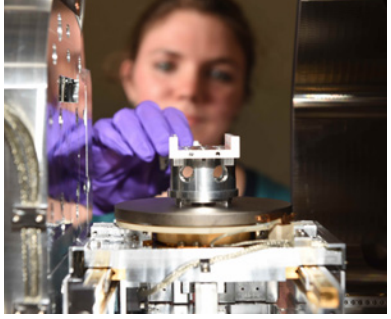
PNNL'S NUCLEAR ENERGY EXPERTISE AND CAPABILITIES

> Pacific Northwest National Laboratory has a long heritage supporting our nation's nuclear energy programs by facilitating the regulatory licensing, design, and analysis of conventional and advanced reactors; safely extending the operational lives of the existing fleet; and developing and implementing processes for recycling, storage, transportation, and disposal of spent nuclear fuel.

With more than 250 staff committed to the nuclear energy mission space, complemented by state-of-the-art nuclear facilities—such as the Radiochemical Processing Laboratory (RPL), a Hazard Category II Non-Reactor Nuclear Facility—our diverse expertise and innovative solutions are enabling both federal and commercial partners to achieve a reliable, safe, and secure energy future.

PNNL's capabilities in support of the nuclear energy industry include:

- **Advanced Fuel Concepts:** Developing accident-tolerant fuel concepts and state-of-the-art extrusion methods for metal fuel fabrication that will serve the next generation of nuclear reactors.
- **Advanced Modeling and Simulation:** Establishing the technical basis for next-generation fuels and reactors through modeling and simulation—down to the molecular level of materials—to augment experimental tests.
- **Cyber Security:** Focusing our national security computing program on infrastructure development, analytics, decision support, and training. Our team represents a rare combination of expertise in cyber security and nuclear power plant operations, including policy development, innovative research, assessments and inspections, and capacity development.



- **Materials Science:** Developing robust materials for advanced reactors and helping sustain the existing fleet. This research is leading to and supporting the development of advanced alloys and materials for use in the harsh environment of the next generation of reactors, and a deep capability in the science of stress corrosion crack (SCC) initiation and growth. Our SCC test facilities are used by federal, commercial, and international sponsors.
- **Nondestructive Examination (NDE):** Developing methods for the reliable detection of materials degradation for a variety of industries, including conventional and advanced nuclear reactors, the petro-chemical industry, and nuclear waste materials.
- **Post-Irradiation Examination (PIE):** Conducting a wide range of radiological work, including PIE of nuclear fuels across the fuel cycle and the mechanical testing of irradiated alloys. With our RPL research facility, we have the capability to receive materials in shipping containers as large as spent fuel casks or as small as radioisotope vials.
- **Probabilistic Risk Assessment (PRA):** Drawing upon a broad base of PRA expertise, materials science, and knowledge of reactor operations, we further develop risk assessment methods—making PRA a more relevant tool to regulatory streamlining and commercial decision-making for cyber security, spent fuel storage and transportation, and event-driven mechanisms (such as flooding and seismic events).
- **Radiological Risks and Hazards Assessment:** Supporting the modification of U.S. safety requirements in response to the 2011 accident at the Fukushima nuclear power plant, we also have been working with Japanese organizations in clean-up and decommissioning, with an emphasis on risk-informing the priorities of activities.
- **Reactor Decommissioning:** Providing technical support for more than 40 years to the U.S. Nuclear Regulatory Commission (NRC) and to international organizations in safely and efficiently decommissioning aging reactors, from radiological characterization to cost estimates.
- **Reactor Regulation and Licensing:** Engaging in large multi-year, multi-task projects for the NRC to support the licensing and operations of our Nation's nuclear fleet, including first-of-a-kind small modular nuclear reactors and new non-conventional reactors.
- **Risk-Informed License Amendment Reviews:** Serving as the principal organization supporting the NRC in the technical review of license amendment requests, risk-informed technical specifications, and fire protection programs.
- **Seawater-based Critical Materials:** Utilizing DOE's only Marine Sciences Laboratory (operated by PNNL in Sequim, Wash.), researchers are discovering effective methods to extract critical materials and high-value energy elements from seawater, such as uranium, magnesium, and lithium.
- **Spent Fuel Recycling:** Developing processes for the proliferation-resistant recycling of commercial spent nuclear fuel, employing our world-renowned expertise in online monitoring and analysis techniques—and leveraging the research capabilities in RPL.
- **Spent Fuel Storage and Transportation:** Understanding the science and technology—as well as developing the logistics—for the safe transportation, storage, and disposal of spent nuclear fuel. Our international transportation demonstration project with Sandia NationaLaboratories was recognized with a 2018 Secretary of Energy Achievement Award.

PNNL Points of Contact:

Mark Nutt, Ph.D.
Nuclear Sector Manager
mark.nutt@pnnl.gov | 509-375-3880

Kim M. Fowler, LEED AP
Energy for National Security Sub-Sector Manager
kim.fowler@pnnl.gov | 509-372-4233

Tara O'Neil
Nuclear Regulatory Sub-Sector Manager
tara.oneil@pnnl.gov | 541-738-0362

Bruce McDowell
Advanced Reactors Program Manager
bruce.mcdowell@pnnl.gov | 509-375-666

nuclearenergy.pnnl.gov

PNNL-SA-140515 | January 2019

U.S. DEPARTMENT OF ENERGY

Pacific Northwest National Laboratory is managed and operated by Battelle for the U.S. Department of Energy.