

NUCLEAR ENERGY SECTOR

*Applying and leveraging our expertise,
built over nearly six decades, to help
advance nuclear energy for a reliable,
safe, and secure energy future.*



PRIORITIES

Sustaining and extending the lifetime of the current fleet of commercial nuclear reactors

Accelerating the domestic development of advanced reactors and innovative nuclear technology

Enabling safe storage, transportation, and disposal of spent nuclear fuel

Identifying and evaluating opportunities for carbon-free nuclear energy in the 21st century electric grid

Maximizing the sustainability of nuclear energy through recycling of fissile material

Enhancing U.S. nuclear industry global competitiveness



MISSION

Utilize our deep multi-disciplinary capabilities in engineering, chemistry, materials science, Earth sciences, data analytics, and more to advance sustainable, carbon-free nuclear energy, now and into the future.



WHAT WE DO

PNNL 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, a Hazard Category 2 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.

KEY PROJECTS

- Radiological Materials and Wasteform Development
- Nuclear Chemistry and Engineering
- Reactor Materials and Mechanical Design
- Irradiation Sciences and Radiation Measurement
- Operational Systems Engineering
- Risk and Environmental Assessment
- Environmental Subsurface Science
- Applied Materials & Manufacturing
- Nuclear Engineering and Analysis
- Integrated Waste Management
- Spent Nuclear Fuel Storage and Transportation

FACILITIES & EQUIPMENT

Radiochemical
Processing Laboratory

Wasteform Development
Laboratory

Solid Phase Processing
Demonstration Facility

Materials Science &
Technology Building

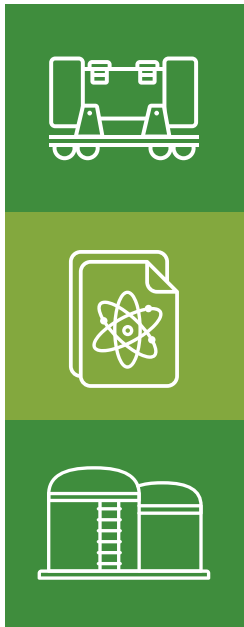
Radiological Exposures
and Metrology Laboratory

Nondestructive
Evaluation Laboratory

Metal Organic
Framework Laboratory

Multi-Purpose Hot Cells
and Glove Boxes

Institutional
Microscopy



Nuclear Energy

- Advanced Reactor Technology Development
- Advanced Fuel Cycles
- Spent Nuclear Fuel Management

Nuclear Regulatory Commission

- Environmental Reviews
- Radiation Protection and Risk Assessment
- Materials and Component Integrity

Commercial Nuclear Industry

- Molten Salt Reactor Chemistry
- Techno-economic Assessments
- Off-Gas Capture and Immobilization



ACCOMPLISHMENTS



Post-Irradiation Examination of Spent Nuclear Fuel

High-burnup nuclear fuel rods have been and continue to be examined in PNNL's Radiochemical Processing Laboratory to establish the technical bases for the extended storage and subsequent transportation of high-burnup spent nuclear fuel.



Streamlining Environmental Reviews

Worked with the Nuclear Regulatory Commission (NRC) to streamline the environmental impact statement process for siting a small modular nuclear at Clinch River, Tennessee, in under two years; supporting the NRC on the Advanced Reactor Generic Environmental Impact Statement and the License Renewal Generic Environmental Impact Statement.



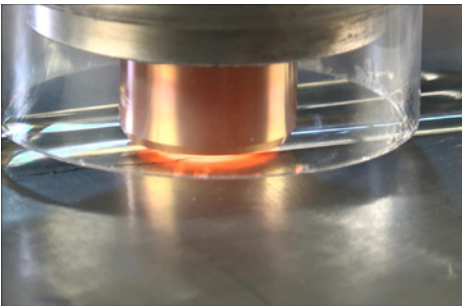
Assessing the Techno-economics of Nuclear Energy

Assessed how new nuclear power reactors could satisfy the Pacific Northwest's dynamic electricity demand and explored the viability of deploying the reactors at three locations in Washington state.



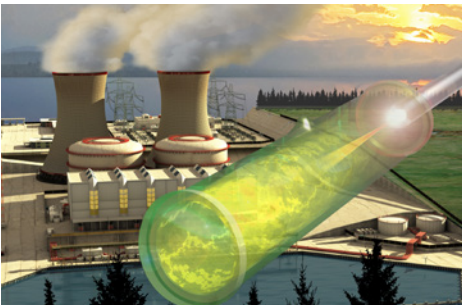
Applying Environmental Justice Principles

Providing ongoing environmental justice support to the NRC National Environmental Policy Act evaluations; providing subject matter expertise to the DOE Office of Nuclear Energy's consent-based siting process for consolidated interim storage and supporting NRC efforts in assessing environmental justice in NRC programs, policies, and activities as directed by the Commission.



Solid Phase Processing Technologies

Developing tools and techniques—friction stir welding, cold spray, and Shear Assisted Processing & Extrusion (ShAPE)[™]—for lightweight and corrosion-resistant metal components, leading to improved performance in nuclear systems.



Improved Understanding of Molten Salt Chemistry

Established capabilities to improve understanding of molten salt under reactor conditions, as well as actinide and radionuclide behavior, to support the demonstration and deployment of molten salt reactors.



Evaluating the Transportation of Spent Nuclear Fuel

Investigated potential risks to spent nuclear fuel during normal transport, including measuring the stresses and vibrations a cask might experience. Developed a framework for off-site transportation probabilistic risk assessment to help enable the safe and secure transportation, management, and disposition of advanced microreactor technologies.

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ABOUT PNNL

Pacific Northwest National Laboratory advances the frontiers of knowledge, taking on some of the world's greatest science and technology challenges. Distinctive strengths in chemistry, Earth sciences, biology, and data science are central to our scientific discovery mission. PNNL's research lays a foundation for innovations that advance sustainable energy through decarbonization and energy storage and enhance national security through nuclear materials and threat analyses.