

- supporting NRC’s development of regulatory infrastructure for advanced non-LWR reactor designs, including advanced health physics computer codes.
- leading, participating in, and reviewing an array of Probabilistic Risk Assessments (PRAs) for the NRC on U.S. and international nuclear reactors.

A PROVEN TRACK RECORD FOR YOUR PROJECT

PNNL’s many years of experience in the nuclear industry have culminated in a proven track record in supporting nuclear power regulation and operations using disciplined project management and controls. PNNL’s professional staff can understand and adapt to the unique requirements of any given project, cultures, and contract specifications for developing nuclear regulatory programs both domestically and internationally. PNNL staff members have years of experience in participating in mandatory and contested nuclear licensing hearings in front of a board of licensing judges. PNNL understands this work well and can quickly mobilize a highly qualified team to support any aggressive commercial nuclear program schedule.



ABOUT PNNL

Interdisciplinary teams at PNNL address many of America’s most pressing issues in energy, the environment, and national security through advances in basic and applied science. Founded in 1965, PNNL employs 4,400 staff and has an annual budget of nearly \$1 billion. It is managed by Battelle for the U.S. Department of Energy’s Office of Science. As the single largest supporter of basic research in the physical sciences in the United States, the Office of Science is working to address some of the most pressing challenges of our time. For more information on PNNL, visit PNNL’s News Center. Follow us on Facebook, Google+, Instagram, LinkedIn and Twitter.

PNNL is part of a thriving and respected science community along the picturesque Columbia River and in the heart of Washington wine country. Richland and the greater Tri-Cities area have one of the lowest costs of living in the state and offer more than 300 days of sunshine a year, making it easy to enjoy all kinds of outdoor activities.



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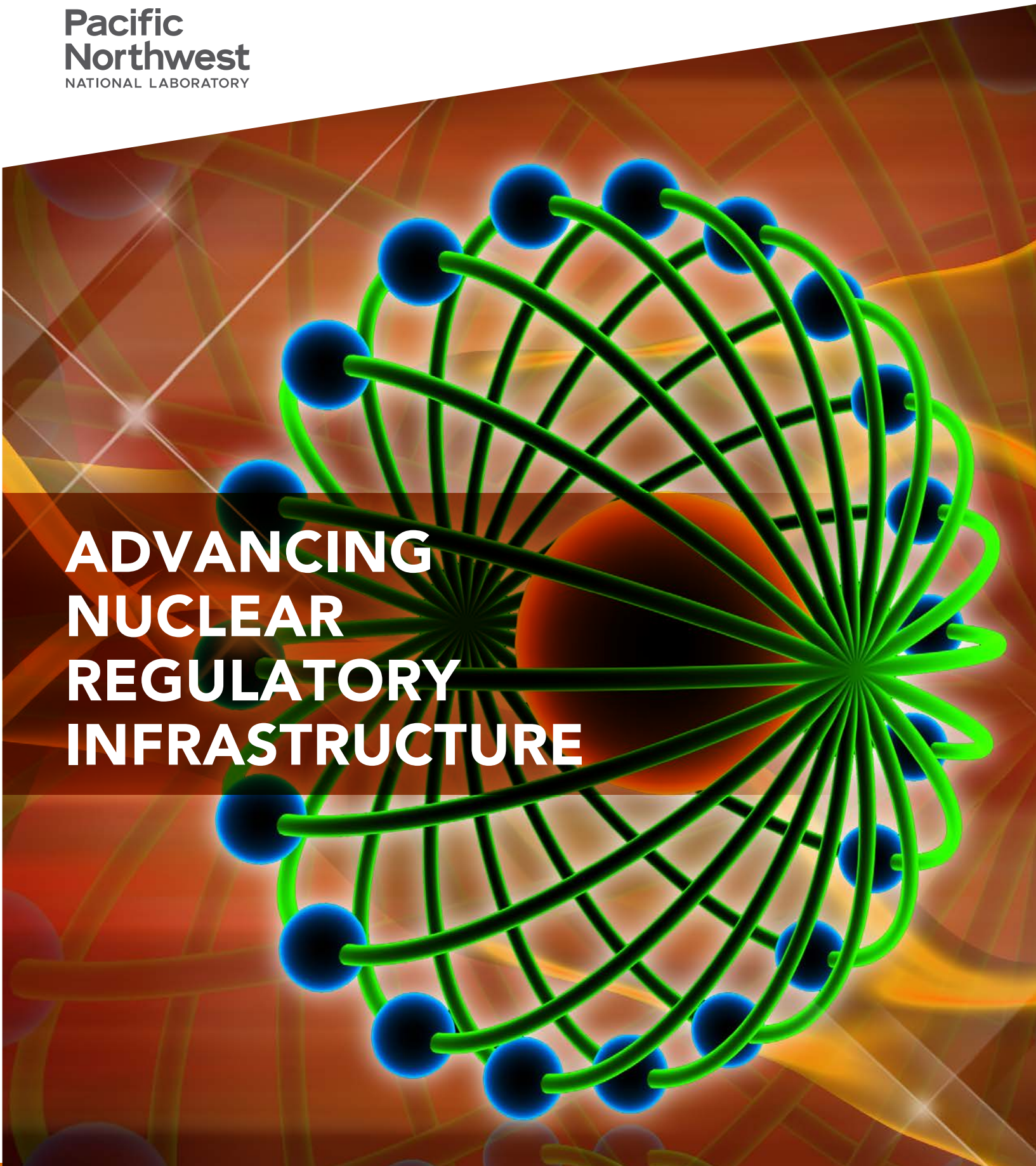
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ADVANCING NUCLEAR REGULATORY INFRASTRUCTURE



A comprehensive and effective regulatory program serves as the cornerstone of an environmentally safe and secure domestic nuclear power industry. But establishing a regulatory infrastructure that supports a nuclear power program across its lifecycle can be very challenging, especially for countries just embarking on the development of nuclear energy.

Pacific Northwest National Laboratory (PNNL) is a U.S. Department of Energy (DOE) Office of Science laboratory. PNNL, through its longstanding support to the U.S. Nuclear Regulatory Commission, has established a reputation as a first-class provider of integrated nuclear regulatory capabilities. PNNL offers a range of integrated regulatory services that span every aspect of a nuclear power program, from initial siting and construction to operations and decommissioning. PNNL's team of scientists, engineers, regulatory and operations specialists represent more than five decades of regulatory experience, having provided technical expertise to the U.S. Nuclear Regulatory Commission, the U.S. Department of Energy, and countries around the world interested in strengthening their regulatory infrastructures.

PNNL: HOW WE MEET YOUR NEEDS

We believe that an effective regulatory infrastructure is the foundation of responsible stewardship of nuclear power and technology and is essential to risk reduction and confidence-building with domestic and international stakeholders. Our team will work closely with your staff, transferring expertise through mentoring, to develop an infrastructure tailored to your country's specific needs and cultural environment. Our end goal is to ensure a regulatory infrastructure that is comprehensive, effective, and self-sustaining.

PNNL'S INTERNATIONAL PERSPECTIVE AND EXPERIENCE

Through a process of orientation, mentoring, and technology transfer, PNNL has assisted nations with establishing, maintaining, and improving their nuclear regulatory infrastructure and improving the operational safety and security of their nuclear power plants. PNNL has managed DOE's International Nuclear Safety Program (INSP) for nearly 20 years, coordinating with the International Atomic Energy Agency's efforts to ensure safe operation and security of nuclear facilities in the former Soviet Union. The INSP philosophy, which PNNL embraces, is to transfer the knowledge and experience of the international community, while maintaining the highest respect for host country cultures and the needs of its people.

Specifically, PNNL's international assistance has focused on improving such operational safety areas as conduct of operations, operator and maintenance training, full-scope simulators, severe accident mitigation guidelines, emergency operating and shutdown procedures, normal operational procedures, administrative guidelines, emergency response guidelines, and physical security evaluation and implementation.



PNNL regulatory and nuclear capabilities

- Emergency Planning, Preparedness, and Evaluation
- Physical and Cyber Security
- Health Physics
- Radiological Environmental Monitoring
- Surface and Groundwater Hydrology
- Aquatic and Terrestrial Ecology
- Meteorology and Air Quality
- Accidental Release Analysis
- Probabilistic Risk/Safety Assessment
- Socioeconomic and Environmental Justice
- Cultural and Historic Resources
- Environmental Effects of Transportation of Fuel and Waste
- Benefit and Cost Analysis
- Alternative Energy Sources and Sites
- Reactor Core Design and Analyses
- Nuclear Fuel and Materials Performance
- Nondestructive Evaluation and Materials Reliability
- Occupational/Environmental Health Physics, Safety, and Risk Assessment
- Reactor Dosimetry
- Fate, Pathway, and Exposure Modeling
- Risk-Informed Decision Making and Management, Systems Engineering and Analysis
- Nuclear Plant Aging and Maintenance Analysis
- Nuclear Facility Maintenance
- Safeguards and Security Inventory and Accountability Systems
- Nuclear Plant Fire Protection
- Evaluation of Spent Fuel Storage (Spent Fuel Pools and Dry Cask Storage)
- Nuclear Cyber Security
- USNRC-licensed Reactor Operator Examinations
- Human Factors and Human-Machine Interface
- Stakeholder and Public Outreach

BENEFITS

PNNL can quickly form and commit project teams consisting of knowledgeable and experienced nuclear specialists, nuclear operations and licensing specialists, and nationally and internationally recognized subject matter experts. These teams provide the range and depth of services necessary for the successful development of regulatory guidance and the evaluation, development, and implementation of a domestic nuclear power program. We have the resources to meet and exceed a client's expectations for quality, timeliness, and value. PNNL will help your country:

- establish a knowledgeable regulatory authority that is educated in the international principles of nuclear management and oversight and can apply judgment based on the experiences of other top performing international nuclear programs
- efficiently create a regulatory framework based on industry good practices, specifically tailored to unique circumstances and providing flexibility for future growth
- promptly access international reference material and technical resources that enable the quick, effective establishment of a functional regulatory authority
- create a method for knowledge management and communication within and across multidisciplinary teams
- develop a coherent, detailed set of laws, regulations, procedures, and implementing guidelines based on industry good practices that will ensure the health and safety of the public
- access experts with extensive experience working with the U.S. Nuclear Regulatory Commission, U.S. Department of Energy and IAEA to support the development of regulations and develop regulatory guidance based on technical requirements
- tap the experience of international experts knowledgeable in setting up project infrastructure and processes to expedite regulatory development and site application reviews using proven knowledge management tools
- train inspector and oversight organizations to use modern techniques and institutionalize principles of nuclear safety, security, and safeguards
- evaluate safety and environmental aspects of nuclear power plant proposals and recommend reasonable alternatives should issues arise
- access experience in managing multidisciplinary programs and projects in environmental reviews, emergency planning and preparedness, waste management, energy, transportation, and regulatory compliance
- expedite development of a safe, efficient, profitable domestic energy program.

OUR EXPERTS AND RELATIONSHIPS MAKE A DIFFERENCE

The PNNL team of experts includes former nuclear power plant specialists and more than 100 staff in multiple technical disciplines, some with more than 35 years of industry experience. PNNL is set apart from other national support programs in that we provide the critical mentoring necessary for building the indigenous nuclear expertise to operate a nuclear regulatory program to high international standards.

We have developed a network of experts and supporting contractors in countries such as Russia, Ukraine, Bulgaria, and Armenia who possess experience specific to the operation and support of VVER designed reactor facilities. Additionally, we have established strong relationships with domestic and international consulting companies, the Institute of Nuclear Power Operations (INPO), World Association of Nuclear Operations (WANO), U.S. commercial nuclear power plant facilities, and other DOE national laboratories. These relationships provide the most current industry expectations and enable selection of the most appropriate expertise for a given project and site.

PNNL IS ADVANCING RESEARCH AND DEVELOPMENT OF GEN IV REACTOR DESIGNS

This next generation of nuclear power reactors will be even safer, will minimize waste, and will operate with improved economics—which is why PNNL is committed to bringing Gen IV designs to commercialization.

PNNL's support for DOE and for commercial sponsors includes:

- teaming with Flibe Energy on a DOE-NE molten salt processing opportunity to examine the use of nitrogen trifluoride as an agent to remove uranium from a molten-salt fuel mixture as a preliminary step for the removal of fission products.
- participating in DOE's Gateway for Accelerated Innovation in Nuclear (GAIN) Program. PNNL and the Columbia Basin Consulting Group conducted a regulatory gap analysis for their Lead-Bismuth SMR design and are currently evaluating functional containment requirements.
- under the auspices of DOE-NE, supporting TerraPower nuclear fuel development programs, including hot cell research into the mechanical properties of irradiated cladding.
- under the DOE-NE Advanced Technology Program, supporting advanced Instrumentation and Controls (I&C) development, advanced materials and cladding development, accident tolerant fuel and transmutation fuel technology, and metal fuel extrusion technology.