Sustainable Nuclear Power Initiative

Fact Sheet

Pacific Northwest NATIONAL LABORATORY

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Initiative Description

There are optimistic signs of a resurgent U.S. nuclear power industry following decades of stagnation. During the same period, the international industry has experienced steady growth. Because of stagnation, U.S. influence has waned in this strategic global industry. Increased use of nuclear power here at home could provide electricity needed to fuel sustainable economic growth while avoiding CO_2 emissions – as nuclear power is a key element in strategies to mitigate climate change. Nuclear power may also become a growing source of nearly carbon free electricity to revolutionize the transportation sector through "plug-in" hybrid and electric vehicles and process heat for production of alternative fuels. Reduction of dependence on imported oil and natural gas is a growing energy and national security concern for the United States and its friends and allies.

The necessity to reduce dependence on energy imports, increase electrical generation, and contain carbon emissions is prompting a fresh look at nuclear power by policy makers across the political spectrum. The utility industry is currently moving ahead with license applications to construct more than 30 Generation III nuclear power plants in the United States. The expansion of nuclear power globally requires the development of more effective and efficient safeguards and proliferation detection capability, as well as reform of the nuclear supply regime to maintain confidence that nuclear facilities are not misused to proliferate nuclear weapons. The steadily accelerating growth in global nuclear power demands that the United States re-engage as a technical leader to influence strategic energy, environmental, and national security policies and outcomes. Moving into the future, fourth generation nuclear power plant designs will feature increased safety margins, reduced lifecycle cost, reduced nuclear waste volume, and improvements in the safeguardability of nuclear facilities worldwide.

The 1,150-megawatt Columbia Generating Station, located in south-eastern Washington, produces enough electricity to power a city the size of Seattle.

SNPI R&D Capability Investments

SNPI is currently investing in a diversified R&D portfolio in four Focus Areas:

- Accelerated Fuel Qualification (AFQ)
- Safeguards and Proliferation Detection (SPD)
- Reactor Aging Management (RAM)
- Transuranic Recycle Technology (TRT)

In response to rapidly growing interest in nuclear power the technology community is engaging in new applied R&D efforts. The Sustainable Nuclear Power Initiative (SNPI) is building on the Pacific Northwest National Laboratory's (PNNL) core technical strengths in nuclear technology and national security R&D, developed over its long history of serving the Hanford mission, to establish new capabilities to address core technology needs at the heart of the nuclear renaissance.

Relevant PNNL Core Technical Strengths

- Safeguards and Proliferation Detection
- Safeguards & Security Technology
- Nonproliferation Policy
- Nuclear Regulatory Licensing Processes and Analysis
- International Nuclear Safety Upgrades
- Reactor Target Design, Fabrication and Testing
- Nuclear Fuel Performance Modeling
- Irradiated Material Science
- Radiochemical Process Development and Actinide Chemistry

Safeguards and Proliferation Detection

Safeguards and Proliferation Detection is developing next generation IAEA Safeguards and proliferation detection technology and policy analysis approaches. SPD research brings together PNNL's detection and measurement science experts with Safeguards and policy experts to produce technical advances that fit the most significant current and emerging verification problems. Technical solutions for enrichment, heavy water and graphite moderated reactors, spent fuel storage and transportation, and reprocessing and MOX fuel fabrication are critical features within this focus area.

The Sustainable Nuclear Power Initiative Supports national priorities for:

- Energy Security
- Carbon Management
- Nonproliferation
- Sustainability

Reactor Aging Management

Is developing technical solutions and analysis methods to help manage and extend the licenses of existing nuclear reactors. RAM research brings together PNNL's long-standing leadership in NRC licensing analysis and nuclear safety, with experts in irradiated material science and non-destructive evaluation technology. Maximizing the value of the enormous investment in the U.S. reactor fleet provides immediate financial returns to utility rate payers by reducing the lifecycle cost of both existing and new reactors. In concert, this path supports the minimization of carbon emissions from electrical generation by keeping U.S. reactors safely operating into the future. The potential savings to utility rate payers from 20 year reactor life extensions could reach half a trillion dollars while avoiding emissions of 12 billion tons of carbon.

PNNL's Radiochemical Processing Laboratory and other nuclear facilities provides an existing R&D infrastructure to support radiological work conducted by the SNPI Focus Areas.

Accelerated Fuel Qualification

Is developing new tools and techniques to reduce the time and expense of fuel qualification processes. It also explores advanced manufacturing and performance based testing methods. New fuel designs, while complex, are essential to meet safety and performance requirements in next-generation nuclear energy systems. PNNL is well positioned to support AFQ efforts with existing facilities that have supported DOE nuclear missions, such as with tritium and irradiated materials analysis. AFQ unites nuclear fuels and materials skill sets with technical strengths in advanced manufacturing and product testing methods development.

Transuranic Recycle Technology

Is developing a practical, small scale, state-of-the-art capability to study solvent extraction spent fuel recycle chemistry with a focus on recovery of minor actinides. It is also exploring novel concepts relevant to reducing the cost and environmental impact of spent fuel recycling. This R&D capability is critical to achieving long term fuel cycle sustainability by drastically reducing nuclear waste generation in a cost effective manner. Existing PNNL radiological facilities provide the necessary laboratory environment to support both bench and lab-scale work.

SNPI Leader is **Jon Phillips,**
jon.phillips@pnl.gov