Argonne NATIONAL LABORATORY

Nuclear Engineering Division

Great missions seeking great minds

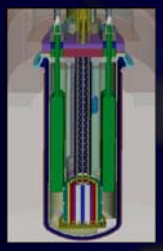
Nuclear Energy Mission

Argonne's history is rooted in the birth of nuclear energy. Argonne-led research is the basis for reactors in operation worldwide. Today, Argonne continues to have a key role advancing technologies needed to meet future demand for a reliable, environmentally safe and sustainable energy supply. In addition, we apply our nuclear-energy-related expertise to support U.S. programs in national security and non-proliferation around the world.

The NE Division participates in key Department of Energy programs such as the Advanced Fuel Cycle Initiative, the Generation IV Initiative, and the Nuclear Hydrogen Initiative. We also have major roles in national security and non-proliferation programs conducted by the National Nuclear Security Administration (NNSA) and other agencies.

Division personnel contribute to improving the operation of existing nuclear energy systems and to resolving issues related to their performance and safety. Moreover, we have a key role in advancing major Laboratory initiatives in such diverse areas as transportation, hydrogen generation and computational science. Finally, we contribute engineering expertise to the design, operation and decommissioning of major nuclear facilities at Argonne and elsewhere.

Generation IV Initiative



Generation IV is a U.S.-led international effort to develop advanced next-generation energy systems (both reactor and fuel cycle) for meeting challenges of safety, economics, waste, and proliferation resistance. The Nuclear Engineering Division is actively participating in the development of Gen IV systems and underlying technologies. Key areas of contribution include reactor physics, thermal-hydraulics, structural mechanics, safety, and fuel cycle technologies. Argonne and the Idaho National Laboratory (INL) provide technical leadership and coordination of the Gen IV initiative for the Energy Department.

Advanced Fuel Cycle Initiative

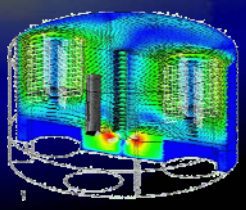
Argonne has been working with the international research community to explore advanced nuclear technologies that can significantly reduce the difficulty of disposing of spent nuclear fuel from power plants. Extensive work pioneered at Argonne has provided a framework for an advanced nuclear fuel cycle that will reclaim energy contained in spent fuel, provide fuel for future generation reactors, reduce the volume and toxicity of nuclear waste, reduce the proliferation threat posed by plutonium in spent fuel, better utilize geologic repositories, and do so in a safe, cost-effective, environmentally-friendly and proliferation-resistant manner.

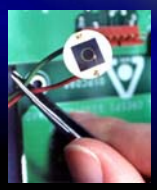
Decontamination & Decommissioning

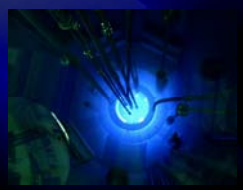
We perform D&D of research reactors and surplus contaminated facilities, develop technology to enhance D&D safety and efficiency, and share our expertise with the international community through training and technical exchanges.

Experimental and computational facilities

We have developed a number of large-scale computer codes for scientific and engineering applications, have advanced state-of-the-art computing facilities for modeling and analysis, and have unique experimental facilities and labs to support our R&D work.







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National security and non-proliferation

Reduced Enrichment for Research and Test Reactors

The Reduced Enrichment for Research and Test Reactors (RERTR) program develops technology to minimize and, to the extent possible, eventually eliminate the use of highly enriched uranium (HEU) in civilian nuclear applications worldwide. There are more than 150 research reactors around the world that still use HEU fuel.

Initiated in 1978, the RERTR program has long relied on Argonne's skills as a world leader in designing reactors and developing nuclear fuel to convert research and test reactors across the globe to low enriched uranium (LEU) fuel – a material that cannot be diverted for direct use in nuclear weapons.

43 HEU reactors in 23 countries from Argentina to Turkey have been modified to run reduced enrichment fuel, and 66 additional reactors are prime candidates for conversion.

RERTR is a key element of the nation's efforts to reduce the spread of nuclear weapons.

Export Control

This activity involves assessments of proliferation risks associated with proposed transfers of proliferation sensitive materials, equipment, software and technology. We also participate in projects to strengthen multilateral export control regimes and to analyze risks presented by emerging technologies. Furthermore, we participate in DOE's international programs designed to mitigate these risks, such as technical cooperation on export controls with the Former Soviet Union, and engage in projects to assure technology security within the DOE complex. Finally, we develop information and decision support systems.

Safeguards

This program focuses on safeguarding nuclear material in Russia and the Newly Independent States (NIS) and reducing the nuclear threat from proliferation through protection, control, and accounting of highly enriched uranium and plutonium, and establishing a sustainable infrastructure to maintain the safeguards at facilities around the world.

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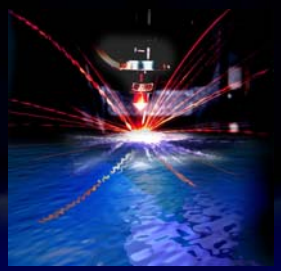
Applied technology initiatives

Laser applications

The Laser Applications Laboratory (LAL) houses two high-power laser systems, complete with diagnostics for materials-processing functions – a 6 kW CO2 laser and a 1.6 kW pulsed Nd:YAG laser. This activity performs research and development on laser-based applications for materials processing and aerosol or spray characterization. Collaborative research and development activities with industrial partners are a key activity. One of our projects is examining the feasibility of adapting high-power laser technology to drilling for gas and oil to establish a scientific basis for developing a commercial laser drilling system. If drilling with lasers ultimately proves viable, it could be the most radical change in drilling technology in the last century.



System technologies & diagnostics

This activity performs research and development related to instruments and NDE techniques for characterization of materials and determination of system parameters related to different energy systems (including fossil, transportation, and nuclear). We also develop sensors and technologies for applications such as homeland security and biomedical engineering. One such project investigates the potential of passive mm-wave imaging for detection of concealed devices. Radiometry in the millimeter wavelengths has been used for remote sensing of the earth and atmosphere. Earth resources such as vegetation, soil moisture, and snow cover, as well as weather patterns and military targets, have been imaged with this technology.

Robotics

The Robotics Laboratory (RL) houses various remote manipulator systems, including the Dual Arm Work Platform, to support enhancements to teleoperation of remote systems for nuclear and for national security applications.