

## Enabling a Sustainable Nuclear Energy Future

Since its inception, Argonne R&D has supported U.S. Department of Energy nuclear programs and initiatives, including today's Advanced Fuel Cycle Initiative, Generation IV Nuclear Energy Systems program (Gen IV), and the Global Nuclear Energy Partnership (GNEP).

**Advanced Separations Technologies:** Argonne chemists and engineers have developed processes to reduce nuclear waste volumes and recover valuable elements from spent nuclear fuel. These techniques allow portions of the spent fuel to be reused. Both aqueous and nonaqueous (electrometallurgical) methods have been developed to separate and reduce the waste created from nuclear energy. Current work aims to reduce the amount of the nation's nuclear waste, enable recycling in advanced nuclear reactors, and extend the capacity of the Yucca Mountain repository.

**Advanced Fast Spectrum Reactor Plants:** Argonne pioneered the technology of fast-spectrum reactors and has internationally recognized expertise to advance their economic attractiveness and safety, as well as to tailor their design to take advantage of the unique ability of fast reactors to manage stocks of transuranic actinides to maintain a safe and secure nuclear fuel cycle.

**Advanced Modeling and Simulation for Nuclear Applications:** Argonne's extensive, world-class capabilities in advanced modeling and simulation are being applied to improve nuclear reactor plant and overall fuel cycle analysis and development.

**Nuclear Waste Management:** Argonne's extensive capabilities in risk assessment, simulation, materials science and engineering, and source term science can be applied to a broad range of needs for the geologic repository system, from transportation of radioactive waste to its permanent disposal.

**Nuclear Nonproliferation:** Argonne has a distinguished history of advancing the nation's nonproliferation goals. Since 1978 the Laboratory has led the effort to convert research and test reactors worldwide from high-enriched uranium fuel to low-enriched uranium. We also lead the development of proliferation-resistant technologies for recycle of spent



*An Argonne researcher tests a nuclear fuel treatment process.*

reactor fuels and the incorporation of effective safeguards in the design of future nuclear energy systems.

**Materials Development for Nuclear Energy:** Future nuclear power plants are likely to operate at higher temperatures and have unique corrosion environments, so advanced structural materials will be necessary. Argonne has world-class expertise in experimental and modeling approaches to further fundamental understanding of materials durability in high-temperature and high-radiation environments.

**Environmental Assessment:** Argonne conducted the first nuclear power plant environmental impact analyses in the nation, and we are recognized as the preeminent national laboratory for this activity.

October 2006

