Sandia National Laboratories

SAND2008-3261P

SANDIA NATIONAL LABORATORIES

Nuclear Energy Program

REPOSITORY SCIENCE

Yucca Mountain Project [YMP]

The Yucca Mountain Site in southern Nevada is currently being studied to determine whether it is suitable for the permanent disposal of spent nuclear fuel and higher-level radioactive waste. In 2007 the Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) designated Sandia National Laboratories as its lead laboratory to integrate repository science work for the YMP. Sandia has been a key participant in the YMP since its inception. Sandia's expertise that has contributed to the success of YMP includes performance assessment, numerical modeling, field and laboratory testing, transparency, and quality assurance.

Waste Isolation Pilot Plant (WIPP)

Sandia has played a primary role in the development of the WIPP and its permitting by the Environmental Protection Agency (EPA). Sandia's principal responsibilities for WIPP include: Primary Scientific Advisor, site selection and characterization, experimental studies to understand the interaction of TRU waste and the disposal environment, transport of radioactive actinides, and performance assessment modeling of the repository for the 10,000-year regulatory time frame.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Adminstration under contract DE-AC04-94AL8500.

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Nuclear Energy Program

NUCLEAR ENERGY SAFETY AND SECURITY TECHNOLOGIES

Probabilistic Risk Assessment (PRA) & Human Reliability Assessment (HRA)

Sandia has supported the NRC in most of the benchmark PRA studies performed to determine the level of safety for the existing fleet of nuclear power plants and has been a major developer of PRA-related licensing tools to include establishment of new, risk-informed regulatory frameworks for licensing new reactors. Sandia develops human reliability assessment (HRA) programs in support of the NRC, the nuclear weapons program, and other federal agencies. The results from the HRAs are often used for input into PRAs to determine how people will respond to certain situations, often in severe accident scenarios.

Transportation

Sandia develops innovative technologies and methodologies to solve transportation and packaging problems for DOE and other federal agencies. These solutions range from new package design to package testing and from regulatory standard development to transportation risk/safety assessments.

Severe Accident Modeling - MELCOR & MACCS

MELCOR, developed at Sandia, is a fully integrated, engineering-level computer code that models the progression of severe accidents in light water reactor nuclear power plants and is used to analyze design basis accidents for advanced power plant applications. MELCOR is fully integrated with the MACCS2 code (also developed at Sandia) which calculates atmospheric dispersion of radioactive materials and analyzes both health and economic consequences.

Fire Research

Sandia has been the lead laboratory for NRC-sponsored fire safety research since 1975. Sandia develops fire simulation and analysis codes, runs multi-scale fire tests and utilizes the Thermal Test Complex, a state-of-the-art test facility.

Containment Integrity/Structural Analysis

Sandia performs complex systems analysis, structural/mechanical analysis and design in support of safety and security assessments of commercial nuclear power generation plants and fuel cycle facilities. We have planned and conducted large scale structural tests and complex structural analyses using both commercial and Sandia codes.

Mars Science Laboratory (MSL)

Sandia has been tasked by DOE to perform the safety analysis for the launch of radioisotope power systems into space. The MSL is the next such launch and includes a rover that is powered by a newly developed radioisotope power system. Sandia is performing the launch safety analysis for this mission and is developing a Safety Analysis Report (SAR).

New Reactor Licensee Application Reviews

In a new role with NRC, Sandia is part of an extended team of national labs and private-sector contractors directly involved with NRC's Office of New Reactors (NRO) certifying new nuclear power plant designs and reviewing license applications for construction and operation.

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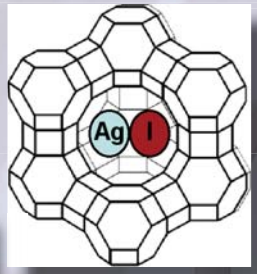
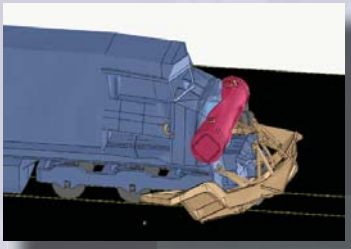
ADVANCED NUCLEAR ENERGY TECHNOLOGIES



Ag-I-Zeolite for 129I capture

Analysis



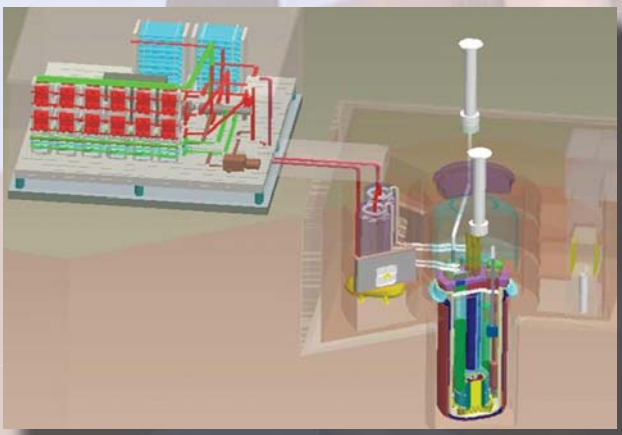
Testing

GNEP (Global Nuclear Energy Program)

Nuclear Fuel Cycle Science Solutions are developed at Sandia under the GNEP. Two examples of Sandia's work include; first, in Advanced Waste Form development, we are pursuing research for the sequestration and storage of radioactive Iodine, including the selectivity of silver-loaded zeolites for Iodine gas and their miscibility in encapsulation materials for long term storage. Second, in Systems Analysis, we are destigmatizing radioactive transportation issues by using a wide range of engineering disciplines for the evaluation of cask response to severe mechanical and thermal accident environments. Capability sets supporting these engineering disciplines include analyses, testing, and risk assessment.

Nuclear Hydrogen - Nuclear Solar Hydrogen - MELCOR Hydrogen

A hydrogen economy will require new methods of hydrogen generation; nuclear is an attractive option. MELCOR-H2 is the world's first fully-dynamic, fully-coupled nuclear reactor/hydrogen production simulation tool. It is the only tool capable of successfully modeling the transient chemistry required to produce large-scale quantities of hydrogen with no CO2 emissions. MELCOR-H2 brings the US one step closer to achieving the goal of energy independence for the impending hydrogen economy.



Schematic of Underground RSR

Right-Sized Reactor (RSR)

An RSR is a marketable nuclear system that can meet societal needs of the 21st century. Over the last 15 years, increasing demand in the U.S. has been met by 290 GWe of right-sized gas systems (100-300 MWe). 80% of countries can only absorb 100-300 MWe power plants. Sandia's RSR concept include the following features: will be factory made and can be placed in service within 2 years, can operate twenty years without refueling, could be deployed anywhere in the world, and is completely sustainable.

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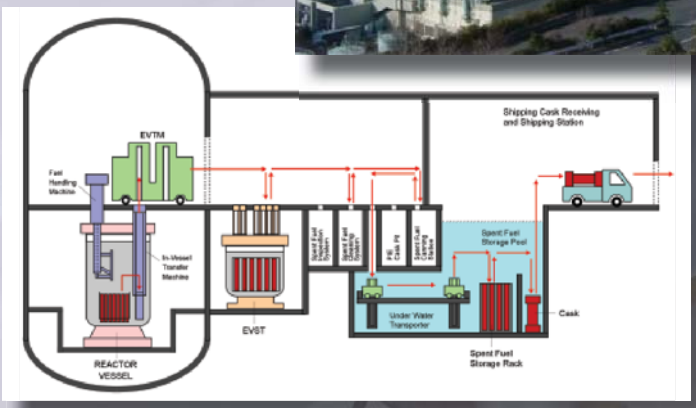
Nuclear Energy Program

INTERNATIONAL-IN PARTNERSHIP WITH THE GLOBAL SECURITY PROGRAM

Monju Nuclear Power Plant



Transparency

Transparency in the nuclear fuel cycle is the cooperative process of providing outside parties with access to information so they can independently evaluate the safety, security, and legitimate management of nuclear materials. Sandia is a facilitator in the transparency process by offering comprehensive services in the usage, storage, and disposal of nuclear materials that enables countries to implement monitoring activities during all stages of the nuclear fuel cycle.

International Fuel Return Demonstration

Discouraging the spread of used nuclear fuel reprocessing technology is a critical nonproliferation and security goal. Realizing this goal will require overcoming a variety of challenges that currently inhibit international used fuel management approaches. Sandia's work is directed at identifying key areas in which technical solutions can facilitate such a system. Currently, conflicting international standards for safety and security, as well as disparate approaches to meeting those standards, make spent fuel "return" efforts prohibitively expensive or unacceptable to stakeholders.

First East Asia Forum on Radioactive Waste Management in Taipei, Taiwan

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