Sandia National Laboratories

Waste Isolation Pilot Plant Project

Description

Waste Isolation Pilot Plant

The Waste Isolation Pilot Plant (WIPP) is an operational facility for permanent disposal of transuranic (TRU) waste generated by defense programs of the United States of America. Sandia National Laboratories has played a primary role in the development of the WIPP and its eventual permitting by the Environmental Protection Agency (EPA). Principal responsibilities delegated by DOE to Sandia, the WIPP's Scientific Advisor, are 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. All these activities were conducted under the Quality Assurance program developed by Sandia to meet the strict requirements of the EPA and yet be practical and efficacious in its application. Since WIPP has become operational, Sandia is focusing more effort, through its National Transuranic Program (NTP), on helping DOE meet its disposal goals and optimization of the transuranic waste system logistics. The following paragraphy represent areas of Sandia expertise in repository science.

Site Selection and Characterization

Sandia selected and characterized the site for WIPP prior to the existence of any regulatory guidance. To accomplish this, Sandia developed its own criteria for a repository site based on assuring safety under all plausible released scenarios and for time frames as long as 250,000 years into the future. This required an understanding of geologic and hydrologic processes operating at the site and an ability to apply geotechnical tools to obtain the necessary information. Conservative, but realistic, interpretation and analysis were essential to this undertaking.

Sandia is a multiprogram laboratory operated by Sandia corporation, a Lockheed Martin Company, for the United States Department of Energy under contract DE-AC04-94AL85000.
SAND2001-1235P

Sandia National Laboratories

Experimental Studies

Rock Mechanics

To adequately understand the physical and chemical processes important to safe isolation of TRU wastes in salt beds, Sandia carried out a multitude of laboratory and *in situ* experiments. Rock mechanics testing in the laboratory and underground at WIPP were capabilities essential to development of realistic models for predicting salt creep over the long periods (100+ years) of time necessary for room closure and shaft seal performance. Studies at both ambient and elevated temperatures were conducted to evaluate repository behaviors for both TRU and defense high-level wastes.

Chemical Studies

Laboratory experiments to determine the behavior of TRU wastes in a salt host rock were extensive. Through the WIPP project, Sandia has developed unique expertise for evaluation of waste form degradation (e.g. metal corrosion, cement degradation) in high- ionic strength media, which is particularly valuable for the design of a nuclear waste repository in a salt formation or in an environment with saline groundwater. Solubility and colloid potential for actinides under a range of possible chemistries provided data to do realistic transport modeling and to allow development of engineered backfills to minimize the concentration of actinides in WIPP brines. Another major program where Sandia pioneered was in the assessment of gas generation from decomposition of organics and from the anoxic corrosion of iron and aluminum in the repository. WIPP takes advantage of the strength of Sandia in materials research and science and collaborates with other organizations of the lab as well as universities to develop various functional materials to meet various needs of nuclear waste management. The first fabrication technology of Synroc, a durable ceramic waste form proposed for disposal of surplus weapons-usable plutonium, was developed at Sandia.

Room Q in the WIPP Underground

Hydrologic Studies

Sandia has been at the forefront of hydrologic testing and transport modeling. Realistic laboratory simulations using actual actinides and surrogates have investigated transport and retardation through various geologic media. Large scale field tests have examined the transport characteristics of the aquifer at the WIPP site. Non-sorbing tracers were used over distances of several tens of feet to establish the appropriate hydraulic flow model and choose between single and dual porosity flow. Large scale pump tests, lasting a month or more, have established average transmissivities over several thousand feet between the observation well and pump location.

Performance Assessment

Predication of repository performance over very long (+10,000 years) periods of time requires realistic models of the physical processes as well as appropriate input data to the models. The probabilistic modeling required by the EPA demands a large number of calculations which sample input parameters over their range of uncertainty. To realistically conduct the large number of calculations requires a simplification of the more complex, time consuming

mechanistic models. Thus, the performance assessment models could be carried out more rapidly and used for prediction but only after making corrections with the more mechanistic models to be sure the results were representative.

Quality Assurance

Quality assurance is not only a part of good scientific research, it is absolutely essential in a regulatory environment. The processes used in experiments and model development must be documented well enough to allow independent reviewers to make their own assessment of the appropriateness and rigor of the activities being examined. Traceability from inception to conclusion of an activity is provided. To this end, a process of data management and retrieval is critical so that reviewers and auditors questions can be rapidly addressed.

Regulatory and Stakeholder Interfaces

Sandia has been successful in implementing its repository responsibilities because the importance of establishing good communication with oversight organizations and regulators has been recognized. Good science is necessary but is not enough. Responsiveness to technical oversight reviews and utilization of technical peer review panels not only enhances the scientific programs, but also improves technical and public credibility. Sandia has shown it can balance these needs with the degree of a technical understanding required to achieve acceptance of repository performance.

Wendell Weart inside the WIPP

The Compliance Certification Application

March 26, 1999 Transportation of Transuranic Waste

"...moving from science to compliance."

Contact

Paul Shoemaker
Carlsbad Operations Department
4100 National Parks Highway
Carlsbad, NM 88220
Phone: (505) 234-0063
Fax: (505) 234-0123
Email: peshoem@sandia.gov