# A POSTER GIVING A GENERAL WIPP OVERVIEW AND PROVIDING SOME DETAIL ON SALT CREEP, SHAFT SEALING, FLUID FLOW, AND TRANSPORT

Prepared for SMRI by Sandia WIPP Principal Investigators
(Assembled by Allan R. Sattler in Consultation with Peter N. Swift)

**Sandia National Laboratories, Albuquerque NM**

for

Solution Mining Research Institute

1997 Fall Meeting
El Paso, Texas

## ABSTRACT

The Waste Isolation Pilot Plant (WIPP) is a geologic repository for Defense-Program generated transuranic (TRU) waste. The repository is excavated at a depth of 2150 feet in the Salado Formation in Southeast New Mexico, about 26 miles east of the town of Carlsbad. Geotechnical and other scientific studies, conducted since 1975, have confirmed the suitability of the WIPP Site.

The Department of Energy's WIPP Project submitted its application for compliance certification to the U. S. Environmental Protection Agency in October, 1996. A critical part of the application is the 10,000 year probabilistic assessment of compliance with EPA's numerical standards governing permissible release of radionuclides. This assessment shows WIPP to be a "robust" repository in the sense that any releases of radionuclides due to natural processes is extremely unlikely. For example, shaft seal designs have been developed which preclude these features as significant release paths to the accessible environment as long as the salt itself remains, far beyond the 10,000 years. WIPP is also robust in the sense that release of radioactivity due to inadvertent human intrusion (say, from drilling) will fall below the limits allowed by EPA standards over these 10,000 years. The confidence in the repository comes from these studies carried out over the 22+ years.

A few issues and processes related to inadvertent human intrusion stand out as being the most critical for the compliance of the WIPP, and recent studies have concentrated on such issues. For example, experiments and modeling have shown that for release scenarios envisioned, the Culebra (see below) is a robust geologic barrier to prevent radioactivity from reaching the accessible environment in groundwater because of the physical and chemical retardation of radionuclides in the Culebra. The issues above and

related issues are described in this Poster which also gives a general overview of the repository.

The overview of the WIPP Poster consists of a **mission statement, location of repository and sources of radioactive waste, terrain, facility views, anticipated typical TRU waste illustrations, key WIPP processes, site studies, summary, geologic cross section, regulatory requirements, major WIPP events, overall results, and conclusions** from the extensive studies which have been undertaken for the WIPP.

In addition, the poster describes certain issues in some greater detail:

- Disposal room/salt properties/room closure--The disposal room conditions will ultimately be determined by interaction of room closure (salt creep), brine seepage, gas generation resulting from microbial waste decomposition, and anoxic iron corrosion. **The poster focuses on salt creep, the salt constitutive model, and room closure.**

- Shaft seals/compacting of the crushed salt seal component--Sealing concepts for the WIPP have previously relied upon reconsolidation of crushed salt to form a highly impermeable barrier in the lower portion of the WIPP shafts. Current designs implement two improvements over the earlier concepts; (1) tamping the salt to reach 90% of the intact salt density on emplacement, thus reducing the time required for salt to reach the compaction that is required for very low permeability; and (2) placement of asphalt water stops and compacted clay columns to assure that possible entry points for water are isolated from the lower compacted salt column where final compacting and ultimate sealing occurs. **The poster displays the present shaft seal design, a cutaway of the mine showing the shaft seals, the proposed multi-deck stage for compacting the crushed salt, a panorama of the dynamic (crushed salt) test compacting area, and microscopic views of crushed, tamped, and reconsolidated salt.**

- Fluid flow and transport of nuclides--A repository disposal room intersected by a drill hole may be initially brine saturated and pressurized; or the repository may be connected by the borehole to an underlying pressurized brine reservoir. In either case, the flows of brine (and gas) up the borehole have the potential of reaching the accessible environment. (Due to the nature of WIPP waste any gasses which may be present are not of regulatory concern.) Groundwater flow of the Culebra Member of the Rustler Formation, above the waste horizon, has been identified as the most likely geologic pathway of radionuclides to the accessible environment in case of a breach of the repository. **The poster highlights an extensive hydrologic and tracer testing program to further characterize the Culebra. The poster also describes a frustrating and not uncommon (Culebra) brine disposal problem and its solution.**

During the course of the SMRI fall meeting, some WIPP investigators and project personnel will be available to answer questions and provide more detail. The

accompanying paper, which would go in the SMRI proceedings, would give a detailed list of all the panels on the poster with additional descriptive statements where appropriate. In addition, a recent WIPP overview paper, W. D. Weart and Margaret S. Y. Chu, "*Critical Scientific Issues of WIPP Compliance with EPA Repository Standards*," Proceedings of Waste Management 97 Symposium, Tucson, March 1997, will be available as handouts. Other handouts of particular interest to the membership will be made available, for example, further details of shaft sealing. Both this abstract and the poster draw upon the Weart and Chu publication among many other sources.

This work was supported by U. S. DOE under contract DE-AL04-94AL8500.