

CURRENT ACTIVITIES OF THE NATIONAL RESEARCH COUNCIL WIPP COMMITTEE

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ABSTRACT

The National Research Council (NRC) of the National Academy of Sciences (NAS), National Academy of Engineering (NAE), and Institute of Medicine (IOM) has conducted a committee study of the U.S. Department of Energy's (DOE's) Waste Isolation Pilot Plant (WIPP) since 1978. The WIPP Committee has issued two major reports in 1984 and 1996 and eight shorter reports between 1979 and 1992, all commenting on site characterization, research, testing, and modeling efforts undertaken during those years to gain understanding of the viability and long-term performance of a WIPP repository. After the 1996 report, the technical issues for this committee to most effectively address in future reports was expanded, resulting in the current task statement and composition of committee membership. The WIPP Committee is currently gathering information in support of its future report(s) on (1) meritorious geotechnical research activities to continue during an operational disposal phase of a WIPP repository, and (2) improvements to the National TRU Program, which is the engineering system to manage WIPP-bound transuranic (TRU) wastes.

INTRODUCTION

The WIPP repository is a series of excavations in a Permian-age bedded salt formation that is proposed as a disposal site for DOE TRU waste. The National Research Council (NRC) of the National Academy of Sciences (NAS), National Academy of Engineering (NAE), and Institute of Medicine (IOM), a collection of institutions often referred to as the "Academy," began a WIPP Committee study in 1978 that has continued to the present. Membership on the committee has changed over time, to reflect expertise in technical disciplines most relevant to topics of active investigation in the WIPP project.

Past committees authored two major reports in 1984 and 1996 and eight shorter letter reports between 1979 and 1992. These reports dealt with technical issues that arose during the WIPP project's history, including

1. surface-based characterization studies in early years, prior to access to the underground in the early 1980s;
2. research and testing conducted since the early 1980s, when tunnels were excavated in the host salt and in situ experimentation was possible; and
3. modeling efforts, particularly in performance assessment (PA), that were conducted over many years but which became important in the mid-1990s to support the 1996 DOE application for a certificate of compliance to its external regulator, the U.S. Environmental Protection Agency (EPA).

CONTEXT PROVIDED BY THE RECENT PAST

The 1996 report concluded that a WIPP repository adequately sealed and undisturbed by future human activity would not result in any probable radionuclide releases. For a repository disturbed by future human activity, confidence in its performance could be improved by a re-evaluation of speculative scenarios, results of future experimentation, and/or the use of engineering options to make the repository design more robust against hypothetical scenarios that would cause radionuclide releases. This report was published prior to the period of time in which EPA reviewed the 1996 DOE compliance certification application (CCA).

This CCA contained a model of WIPP's long-term performance, based on PA calculations that considered scenarios of events that might release radionuclides from WIPP through some disturbance of the natural geologic setting. One hypothesized release mechanism is for plutonium to be entrained in drill cuttings brought to the surface by a future drilling operation in which a well is drilled through the repository. Another hypothesized scenario is that of pressurized brine entering the repository, dissolving plutonium, and exiting the repository, with flow paths provided by cracks in anhydrite interbeds within the bedded salt formation or by poorly sealed wells in the area.

These issues were among those that EPA considered in assessing whether WIPP's modeled performance was adequate to comply with applicable EPA regulations. Since May 1998, when EPA concluded its review and granted DOE a certificate of compliance, DOE has been making preparations to open and operate WIPP. A significant outstanding issue at present is the set of regulatory requirements that the state of New Mexico would impose in its Resource, Conservation, and Recovery Act (RCRA) Part B permit for mixed waste operations and characterization activities.

MISSION OF THE FUTURE COMMITTEE STUDY

The developments mentioned above provide the context within which representatives of DOE and the Academy interacted to explore what technical assistance the WIPP program could benefit from and how the Academy might best be used for this purpose. The result of these interactions was a proposed mission for a further Academy committee study on WIPP, which was subsequently approved by the NRC Chairman (i.e., the NAS President) to be conducted under the auspices of the Academy. This mission is shown below, expressed as a "statement of task" to the committee to use in writing its reports. As is evident, two avenues of further work are designated. To paraphrase the statement of task, the committee study would identify the limiting technical components of the WIPP program, to

- improve understanding of long-term repository performance by identifying research areas to reduce important uncertainties, and
- identify options for improvement in TRU waste handling operations (i.e., the National TRU Program, the waste management system encompassing waste characterization, treatment, packaging, and transportation).

Statement of Task

The purpose of this study is to identify the limiting technical components of the WIPP program, with a two-fold goal of (i) improving the understanding of long-term performance of the repository and (ii) identifying technical options for improvements to the National TRU Program (i.e., the engineering system that defines TRU waste handling operations that are needed for these wastes to go from their current storage locations to the final repository destination) without compromising safety.

To accomplish this goal, the study will address two major issues.

1. The first is to identify research activities that would enhance the assessment of long-term repository performance. This study would examine the performance assessment models used to calculate hypothetical long-term releases of radioactivity, and would suggest future scientific and technical work that could reduce uncertainties.
2. The second is to identify areas for improvement in the TRU waste management system that may increase system throughput, efficiency, cost effectiveness, or safety to workers and the public. This study will examine, among other inputs, the current plans for TRU waste handling, characterization, treatment, packaging, and transportation.

The first major issue of the statement of task is undertaken with the guiding thought that the time in which the repository is operational (i.e., during which waste is emplaced in rooms excavated in the salt) provides an opportunity to conduct experiments to probe uncertainties in the model predictions of WIPP's long-term behavior. Such uncertainties include not just parameter values, but also the validity of conceptual models. The geotechnical topics involved (e.g., in mining engineering, actinide geochemistry, hydrogeology, and rock mechanics) have traditionally been studied by the WIPP project and by past Academy WIPP Committees.

The second major issue of the statement of task is to examine the technical components of the National TRU Program, which is the engineering system of surface-based waste management operations to retrieve transuranic waste containers from current storage, characterize and repackage their waste contents, transport the containers, and emplace them in WIPP. This program is designed to account for many technical, regulatory, and legal requirements on surface-based operations of waste handling, characterization, packaging, and transportation. This system as currently configured has the potential to be costly and to meet a host of regulatory requirements in a manner that does not optimally reduce risk (here risk includes not only radiation exposure, but also operational hazards of routine work procedures that also have the potential to cause harm to workers or the public).

MEMBERSHIP AND CURRENT ACTIVITIES

The approach of the current Academy WIPP Committee in addressing its two-fold statement of task is to divide itself into two subcommittees, each to perform the in-depth work of gathering information on one major issue. Following standard Academy procedure, each committee member (i.e., not just those of a subcommittee) must approve the language of any report; therefore, all reports come from the full committee as the proper authoring body. The Chair of the WIPP Committee is B. John Garrick, retired from a long career with PLG, Inc. in conducting risk, safety, and performance assessments of a variety of technical operations, particularly nuclear power plants.

The Geotechnical Subcommittee is chaired by Professor Emeritus Ching Yew of the University of Texas at Austin. This subcommittee has to date met with representatives of DOE and Sandia National Laboratories to consider the geotechnical setting of WIPP in order to address the first issue of the statement of task, that of identifying meritorious research activities. Relevant topics for this subcommittee to consider include:

- the impact on the repository of any future activities to extract natural resources (i.e., potash in formations above the repository and petroleum reserves in formations below the repository) in areas adjacent to WIPP;
- the evolution of the sealed repository, as the salt plastically deforms to creep closed to encase the waste and restore a low permeability barrier around it; and
- underground operations such as the use of backfill that impact the time-dependent restoration of low permeability.

The TRU Program Subcommittee is chaired by Milton Levenson, retired from the Electric Power Research Institute. This subcommittee has met with representatives of the National TRU Program, administered from the Carlsbad Area Office of DOE, and has to date visited one TRU waste generator and storage site, the Los Alamos National Laboratory, to gather information relevant to the second major issue of the statement of task. Relevant topics for this subcommittee to consider include:

- various characterization requirements imposed on WIPP-bound wastes, and their rationales;
- stringent limits on transuranic isotopes within each drum and each shipping container that are imposed by a gas generation model, to ensure that organic material co-disposed with alpha-emitting actinides does not result in radiolytically generated gases (chiefly hydrogen and methane) that would constitute a flammability hazard during transportation from a generator site to WIPP; and
- other transportation and handling safety issues.

Subcommittee membership, and the field of expertise of each member, are shown below. A one-paragraph biography of each member is posted on the Academy's homepage (<http://www.nas.edu>), under the name of the project (i.e., Committee on the Waste Isolation Pilot Plant).

Geotechnical Subcommittee

<i>Member</i>	<i>Expertise</i>
Ching Yew	fracture mechanics and borehole engineering
Michael Hardy	ining engineering
John Lee	petroleum engineering
John Sharp	hydrogeology
Martha Scott	actinide geochemistry
Paul Shewmon	aterials science and engineering
Stanley Kaplan	performance assessment

TRU Program Subcommittee

<i>Member</i>	<i>Expertise</i>
Milton Levenson	nuclear engineering
James Watson	health physics
Kimberly Ogden	chemical and environmental engineering
Mark Abkowitz	transportation systems engineering
Al Grella	transportation packaging
H. M. Kingston	analytical chemistry of inorganics and plutonium
Paul Shewmon	materials science and engineering
Stanley Kaplan	performance assessment

This committee first met in May 1998 to begin a study lasting three years. The product(s) will be one or more reports responsive to the statement of task. Following Academy practice, these reports are consensus products, garnering the approval of each committee member and undergoing a rigorous internal review prior to their publication. The reports are disseminated in the public domain in addition to being made available to the sponsor (here, DOE) of the study.

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