INTEGRATION OF LONG-RANGE PLANNING
FOR MANAGEMENT OF DEFENSE TRANSURANIC WASTE

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ABSTRACT

As described in The Defense Waste Management Plan, the defense TRU program goal is to achieve permanent disposal and to end interim storage. TRU waste is currently stored at six Department of Energy (DOE) sites, and new waste is generated at several more sites. The Waste Isolation Pilot Plant (WIPP) project is well-defined, and it has been necessary to integrate the activities of other parts of the TRU program in support of DOE Headquarters policy and the WIPP schedules and technical requirements. The strategy is described in the Defense Transuranic Waste Program Strategy Document. More detailed, quantitative plans have been developed through the use of several system models, with a Long-Range Master Plan for Defense Transuranic Waste Management as the focal point for coordination of proposed plans with all the parties involved.

BACKGROUND

Since 1970, defense transuranic (TRU) waste has been retrievably stored at six Department of Energy (DOE) sites, pending selection and development of permanent disposal methods. There are at present approximately 75,000 m^3 of retrievably stored contact-handled TRU waste, and new contact-handled waste is being generated at the rate of about 3700 m^3/yr. Additionally, there are approximately 1500 m^3 of remote-handled TRU waste in storage, with a projected generation rate of about 450 m^3/yr through the 1980s.

In January, 1981, the U.S. Department of Energy (DOE) Assistant Secretary for Defense Programs issued a Record of Decision for the Waste Isolation Pilot Plant (WIPP), stating that DOE would proceed with the WIPP on a phased basis, starting with site and design validation, then construction of permanent facilities for research and demonstration. In July, 1983, DOE announced its decision to proceed with construction of the full WIPP. Newly generated and stored TRU waste will be certified for compliance with the WIPP Waste Acceptance Criteria, after processing if necessary, then emplaced in the WIPP. In June, 1983, President Reagan submitted to Congress The Defense Waste Management Plan, describing reference plans for the permanent disposal of high-level and transuranic wastes from defense programs.

DISPOSAL

WIPP construction is underway, and hot operation is scheduled to begin in 1988, pending, of course, a formal DOE *decision to proceed*. Initially, WIPP will retrievably emplace contact-handled defense TRU waste; in about 1993 a decision will be made whether to convert WIPP to a permanent repository for this waste. A small quantity of remote-handled TRU waste will be received at WIPP in 1989, but routine receipts will not occur until 1994. WIPP will also conduct experiments with a limited quantity of high-level waste, but such waste will be removed before decommissioning WIPP.

CERTIFICATION

WIPP has established criteria for acceptable waste and container characteristics. Each site shipping waste to WIPP must verify, to the satisfaction of WIPP, that the waste meets WIPP criteria. This verification process is referred to as "certification." For newly generated TRU waste, certification will require procedural and administrative controls at the point of origin and may require some waste processing. Certification of stored waste will require records control and/or nondestructive examination (radiography), and may require waste processing. Because each storage and generator site is unique, but all must meet the same WIPP acceptance criteria, certification requires extensive coordination to ensure that certified waste will be ready in the quantities needed, and on the schedule needed, to support WIPP operation.

TRANSPORTATION

A new contact-handled TRU waste transportation system is being developed to replace the ones currently in use. The new system is called a Contact-Handled Transuranic Package Transporter (TRUPACT) and may be carried either by flatbed truck or flatbed rail car. A prototype TRUPACT unit is under construction and will be subjected to regulatory testing in 1984. Several TRUPACTs will then be built for operational testing, followed by construction of a fleet of TRUPACTs to support WIPP operation.

A simulation model of contact-handled waste inventory buildup and workoff is being developed. This model will provide the basis for projections of numbers of TRUPACTs required throughout the WIPP program to ensure that waste is moved in sufficient quantity and on schedule to support WIPP operation.

A WIPP-compatible canister for remote-handled TRU waste is under development. The remote-handled waste will be placed in this canister, and the canister will be shipped to WIPP in an appropriate shipping cask. The small number of initial shipments of remote-handled waste to WIPP will be made using existing shipping casks; design of a remote-handled cask is planned to begin in 1985.

PROGRAM OBJECTIVES

Major program objectives of the DOE lead organization for defense TRU waste management include:

- Achieve permanent disposal. This requires, as a first step, that DOE have certified waste at WIPP in quantities needed and on a schedule needed to support WIPP demonstration operations. To do this, DOE must:
  - Certify waste,
  - Transport waste, and
  - Develop and maintain an integrated plan
- End interim storage, including, if necessary, disposal of waste not shipped to WIPP.
- Continue safe management of buried waste by periodically reevaluating safety, and taking remedial action if required.
- Reduce waste generation.

The overall strategy is described in The Defense Waste Management Plan and in the Defense Transuranic Waste Program Strategy Document.

NEED FOR SYSTEM-WIDE COORDINATION

Implementation of the WIPP Record of Decision and The Defense Waste Management Plan will require coordinated action involving many generating and storage sites as well as the disposal site and a connecting transportation system. The DOE lead organization for defense transuranic waste management is developing and refining plans for a multi-site program to support WIPP objectives and schedules.

Long-range planning should lead the way to the efficient attainment of policy goals, and yet reserve for the policy-maker a realistic degree of flexibility. When addressing the near term, planning must be compatible with existing budget authorizations and with specific plans existing at each site. When addressing developments more than a few months away, planning can incorporate more flexibility to accommodate options for policy development or technology growth. Yet when there are common goals, there must be a single, integrating plan, placing activities at the several sites on a common schedule with uniform work loads and balanced total budget demands. Planning should address long-range requirements, showing the complete workoff of existing stored inventories and completion of the transition to permanent isolation.

A Long-Range Master Plan for Defense Transuranic Waste Management has been developed to meet this need and to provide a focus for the interface with WIPP. It documents a unified long-range strategy and provides a framework for detailed planning at each of the storage and generating sites. Schedules have been identified for design, construction, storage, retrieval, processing, and shipping activities over the period from 1984 to 2015, with particular emphasis on activities in the 1980s and early 1990s. The program has estimated volumes of waste at different points in the system throughout that period and has made preliminary estimates of capacity requirements for all facilities and transportation systems. Corresponding long-range budget estimates have also been made, consistent with budget guidelines of The Defense Waste Management Plan. Development of the Long-Range Master Plan has provided the vehicle for identification of program needs and resolution of inconsistencies between different sites. This will be a "living" document, updated frequently to reflect progress and evolving site plans, all within a reference framework.

TOOLS FOR INTEGRATED PLANNING

Models of the TRU waste management system have been developed to allow rapid computer analysis of the impacts of changing conditions and assumptions. These models address both the physical system (waste generation, sorting, certification, storage/retrieval, processing, and transportation) and cost projections associated with the anticipated physical system. A computer planning/scheduling system is being used to refine understanding of program logic, identify required activities and schedule conflicts, and quickly assess the schedule and resource impacts of changes in an evolving program. Following is a synopsis of TRU waste management models and tools currently in use:

- Program modeling is done on a mainframe computer project management code (Project/2), which takes input of activity durations, logic, and constraints (e.g., "not later than"), and then produces project schedules and identifies the critical path. This code will also tally resources (manpower, budget) and reschedule to meet resource limitations.

  The mainframe project management code is extremely effective and versatile, but it is also quite costly to use and turnaround is slow. Substantial cost savings and efficiency has been achieved by using an Apple Lisa to develop project logic and schedules, prior to final runs on the mainframe. The Lisa is very user-interactive and allows groups of engineers to update schedules directly on the screen as they observe the impact of changes on the total plan.

- Waste system modeling/simulation. Unlike project planning/scheduling, which allowed use of existing software, inventory workoff and transportation simulation modeling required software development "from the ground up." M-PLAN/TRUSIM is a combination FORTRAN/simulation code under development at Los Alamos National Laboratory which models site inventory buildups, workoffs, and shipment to WIPP. The size and sophistication of this code required development on a VAX mainframe computer, although the M-PLAN portion (inventory buildup and workoff) is presently also running on an IBM/PC. The next step will be to put the combined code on an IBM/PC, allowing greater access to the model.

- Cost modeling. System cost modeling can be performed at different levels, depending on whether one's system encompasses waste management at a single site, defense TRU waste management at a single site, nationwide defense TRU waste management, etc. The TRUCOST model, for example, is built around TRU waste storage, handling, and processing options at a single site, with the built-in assumption that TRU wastes will be transported to WIPP. Making assumptions about all the factors, one can calculate a total multi-year cost for a chosen scenario, and by comparing costs for different scenarios, perform impact studies.

SITE COORDINATION

Site data must continually be updated as new issues arise. An important part of the planning activity has been frequent coordination with the storage and generator generator sites to obtain more data, verify assumptions, inquire about proposed strategies and cost estimates, review draft plans, and test conclusions of impact studies. Sites are asked to report waste inventory and projections data annually, and recently they have been funded to prepare site inventory workoff plans--a next level of detail within the framework of the Long-Range Master Plan. Any issues thus identified form the basis for future discussions. An Interface Control Board established between the TRU Lead Organization and the WIPP Project Office provides a system for exchange of information, setting baselines for interface areas, and full cooperation in decisions affecting both organizations.

THE RESULTING PROGRAM

The defense TRU program goal is to achieve permanent disposal and end interim storage. The TRU waste management program now puts priority on the preparation of newly generated waste for WIPP, and on development of the necessary transportation capability to deliver that waste to the WIPP. There is little point in working off stored inventories through the front door while adding more waste to storage through the back door. A closely associated priority, however, is to work off the stored inventory at the Idaho National Engineering Laboratory. WIPP is scheduled to start receiving waste in October, 1988. Stored contact-handled TRU inventories can be worked off by 2006, with a WIPP throughput rate of only 7500 m^3/yr, and there is a possibility of reducing the transportation fleet requirements further if a longer workoff period is accepted. A small quantity of remote-handled waste would be emplaced within the first quarter of WIPP operations, and full-scale emplacement would be deferred until the end of the WIPP demonstration period. A remote-handled waste canister suitable for WIPP has already been designed, and a waste data records system to send information on proposed shipments ahead to the WIPP has been successfully tested. The first prototype instrumentation for nondestructive assay and examination as part of the certification process is now in operation. TRUPACT transportation package development has reached the fabrication stage, and both certification and processing facilities at the Idaho National Engineering Laboratory are scheduled to operate before the WIPP. Our long-range planning basis shows the subsequent workoff of stored inventories at all TRU storage sites, consistent with The Defense Waste Management Plan. Not all final decisions concerning these activities have been made, however. The decisions will depend on: completion of the National Environmental Policy Act process, authorization and appropriation of funds, agreements with states as appropriate, and in some cases, the results of pilot plant experiments and operational experience. In the case that decisions are made to proceed with WIPP emplacement of stored waste from other sites, activities now being planned will allow technology transfer, proper scheduling, and funding for economical workoff of those inventories also.

CONCLUSIONS

It has been possible to integrate the long-range planning of several TRU waste management sites, so that needs can be anticipated and activities at the several sites can be seen to be proceeding on a common schedule, with uniform work loads and balanced total budget demands, toward common objectives. This master plan then serves the sites by providing a framework for their more detailed planning. Several types of system modeling have been employed to address the range of system questions. Results are not final, however. Data, assumptions, and analyses must continually be updated, to keep pace with the progress made at each site and with evolving national and site-specific strategies.

PLANNING, DEVELOPING, AND FIELDING OF THERMAL/STRUCTURAL INTERACTIONS IN SITU TESTS FOR THE WASTE ISOLATION PILOT PLANT (WIPP)*

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ABSTRACT

Large-scale, well-instrumented underground tests to determine in situ thermal/structural response of bedded salt are being constructed in the (WIPP) facility in southeastern New Mexico. These tests are an essential component of a broad research and development program to resolve thermal/structural issues, to validate long-term prediction methods, and to develop a design basis for a future repository. They are the result of an extensive planning and evaluation procedure to determine the appropriate test configuration. All details of the tests, including background, decisions, design, site operations, and testing organization are explained. These procedures may be useful in development of other in situ tests.

INTRODUCTION

As a by-product of this nation's defense programs, remote and contact-handled transuranic and high-level radioactive reprocessing wastes exist at several locations around the country. Temporary, monitored storage of these wastes has been adequate, but a long-term solution for their permanent disposal is essential. Because these wastes represent a potential hazard to man, such disposal facilities must prevent access of the nuclides to the biosphere (and hence, man) for long periods of time.

The primary issues are the isolation characteristics of a repository site and the technical assurance that these characteristics are adequate. Resolution of the issues is obtainable through extensive research and development (R&D) to provide the technical basis for judging the merits of a given site or method. Such R&D is crucial because of the thermal and radiation conditions and the extended times required for decay of nuclides to safe levels of radioactivity. In this context, a highly integrated R&D program has evolved to provide the predictive and design technology base for future repositories of defense waste in salt. This program is encompassed under the Waste Isolation Pilot Plant (WIPP) Project, and the underground facility being constructed in southeastern New Mexico is the site for the in situ testing program (Fig. 1).

The WIPP Project is chartered by authorizing federal legislation (PL-96-164) for the "express purpose of providing a research and development facility to demonstrate the safe disposal of radioactive waste resulting from the defense activities and programs of the U.S. exempted from regulation by the Nuclear Regulatory Commission." The WIPP R&D Program provides the technical basis for systems design and safety and environmental assessments for future radioactive waste repositories for the defense programs. These designs and assessments are also applied to developing the WIPP full facility.

Two fundamental thermal/structural interaction (TSI) issues need to be resolved. First, stability of the repository during its operating life-time of 15 to 25 yr must be demonstrated. Second, it must be shown that the repository is sealed by creep closure of the openings in the long-term after decommissioning, and that movement of fluid toward, through, or away from the repository is unlikely. Proper resolution of these issues will provide confidence that the repository will not endanger public health and safety. To resolve these issues, Sandia National Laboratories has developed a comprehensive laboratory, computational, and in situ testing program.

This report is organized to give the necessary background for the TSI in situ tests by summarizing the general TSI R&D program, the approach to the TSI in situ tests, and the historical development of the tests. Specific in situ tests are then described in some detail. Finally, the organization and implementation of fielding the in situ tests is described and some relevant conclusions are drawn.

BACKGROUND

The WIPP project is a direct result of earlier work originating from National Academy of Sciences recommendations published in 1957 on disposing of radioactive waste in bedded-salt formations. Subsequent major studies include Project Salt Vault, which was a major program for demonstrating the emplacing, retrieving, and storing of radioactive waste.[1] At the conclusion of Project Salt Vault, further evaluations of salt basins in the US led to investigating bedded-salt deposits in southeastern New Mexico and eventually to development of a conceptual definition of the WIPP Project.

The Project has progressed through site characterization, design, and technology development leading to construction of the initial phase of the facility. Major portions of the characterization, design, and technology development are completed and have provided significant inputs to facility construction. Other activities will continue through the in situ testing and demonstration phases of the Project. Facility construction, now under way,

*Work supported by the United States Department of Energy (DOE) under contract number DE-AC04-76DP00789.