

IMPLEMENTATION OF DOE'S MRS PLAN: A MID-TERM REPORT

R. J. Hall
D. K. Kreid
Pacific Northwest Laboratory
Richland, Washington 99352

ABSTRACT

The Nuclear Waste Policy Act (NWPA) of 1982 identifies Monitored Retrievable Storage (MRS) as an option for providing safe and reliable management of high-level radioactive waste or spent fuel. The Act requires the Department of Energy (DOE) to complete by June 1, 1985, a study of the need for and feasibility of MRS facilities for interim storage of nuclear wastes and to submit to Congress a proposal for the development of such facilities. This paper describes the status of the program established by DOE to comply with the MRS provisions of the Act.

INTRODUCTION

The Nuclear Waste Policy Act (NWPA) of 1982 defines the Federal Policy for management of radioactive waste from commercial nuclear power generation. This policy is based on the provision of mined geologic repositories for the ultimate disposal of radioactive waste beginning no later than 1998. However, the Act also defines requirements for a study of Monitored Retrievable Storage (MRS) which the Department of Energy (DOE) is to complete by June 1, 1985. This paper describes the program established by DOE to comply with the MRS provisions of the Act.

The major requirements of the NWPA with respect to MRS are briefly summarized below:

- The NWPA requires that DOE: 1) conduct a detailed study of the need for and feasibility of MRS (to be completed by June 1, 1985); 2) submit to Congress by July 7, 1983, a report on the research and development (R&D) activities necessary to prepare an MRS proposal; and 3) submit to Congress by June 1, 1985, a proposal for the construction of one or more MRS facilities for high-level wastes and spent fuel.
- The proposal is to include: 1) plans for the establishment of a program for siting, development, construction and operation of licensed MRS facilities; 2) a plan for MRS facility funding with cost to be borne by the generators and owners of the materials to be stored; 3) site specific designs and other information sufficient to enable completion and operation of an MRS facility as soon as possible after authorization; 4) a plan for integrating MRS facilities with other storage and disposal facilities authorized in the NWPA. Finally, DOE is to prepare and submit to Congress an Environmental Assessment relative to the MRS proposal.

BACKGROUND

The NWPA, which was signed into law in January 1983, represents the first legislative requirements for MRS. However, dry storage of spent fuel and/or high-level waste (HLW) has been actively investigated in the United States and abroad since the early 1970s; first under the Atomic Energy Commission, then the Energy

Research and Development Administration (ERDA), and finally the Department of Energy (DOE).

A 1975 study by the National Academy of Sciences (NAS)⁽¹⁾ was a cornerstone in developing MRS. The principal findings of this study were that "... retrievable surface storage is an acceptable interim storage stage in a comprehensive system for managing high level radioactive wastes." The study further found that "... in principle, high level radioactive wastes can be stored safely and economically in sealed storage casks, in a water basin or in an air cooled vault. However, [the study] recommends an optimized version of the sealed storage cask concept."

In the subsequent years, ERDA and then DOE supported a number of analyses and tests of dry storage concepts. One of the more visible early programs in this area was the Retrievable Surface Storage Facility. These programs, which had a combined funding of close to \$20M, developed a broad technology base for MRS. Several of the concepts progressed to the hardware stage and underwent demonstration testing for design confirmation.

In 1981, DOE published the findings of a study⁽²⁾ of dry storage concepts for MRS applications. This study provided a preliminary screening of the principal dry storage technologies relative to several criteria pertinent to MRS and analyzed the impacts of MRS on the overall waste management system. The results of this screening and a follow-up study⁽³⁾ identified eight dry storage concepts considered technically and economically feasible for MRS applications, including those cited in the NAS study.

The principal features that distinguish dry passive storage concepts from the water pool technology currently used for at-reactor fuel storage are:

- The decay heat is transmitted by natural passive means directly into the surroundings without dependence on a secondary heat transfer fluid.
- Once the wastes are emplaced, dry storage systems can safely function essentially unattended without reliance on fans, pumps, filters or external sources of power.

These features are the primary reasons that dry storage has consistently been found to be advantageous for MRS applications.

MRS PROGRAM DEVELOPMENTS

MRS activities continued at a relatively low level of effort until the passage of the Act in January 1983. In January, concentrated planning was undertaken to re-direct the existing MRS program to the more specific MRS requirements of the Act. In examining the Act requirements, it was apparent that significant effort would be needed to develop five or more advanced designs for at least two MRS concepts and that little time was available for selecting the concepts, obtaining the services of an A-E, and developing the designs. Therefore, two of the main considerations in establishing the MRS program were: 1) meeting the schedule requirements in the Act with a quality product, and 2) using existing technology to the degree possible and solicitation of input from private industry to avoid unnecessary "reinventing of the wheel".

As indicated above, previous designs had already been developed for a number of MRS concepts. However, these earlier designs were based upon widely varying assumptions which made comparison difficult. Some designs were developed for the storage of spent fuel, some for the storage of high-level waste, and some for both. The capacities of the systems also varied considerably. Some were designed for very limited facilities of several thousand metric tons capacity and some were designed for facilities of up to nearly 50 thousand metric tons capacity.

To select specific concepts for evaluation in the proposal, it was necessary to narrow the field of alternatives to a workable number. It was first determined that two concepts would be evaluated in the proposal based on the requirement in the Act for development of at least five designs for at least three sites. It was further determined that these two concepts would be selected from the eight dry storage concepts identified in the DOE studies^(2,3) as being the most likely candidates for MRS. These were: field drywells, tunnel drywells, open-cycle vaults, closed-cycle vaults, tunnel racks, concrete sealed storage casks, concrete casks-in-trench, and metal casks (both stationary and transportable).

The selection of the two concepts required the development of a consistent basis for comparison of the previously proposed concepts. To make a sound comparison: 1) normalized designs needed to be developed according to consistent assumptions, and 2) criteria were needed to compare the normalized design information. However, in order to normalize the designs, it was first necessary to establish the facility requirements or mission.

In April 1983, the basic MRS facility mission was defined to be that of storage backup in case of repository program delay. The corresponding assumption for facility size was that the facility should be able to store sufficient material to accommodate a five-year delay in the repository program. At the time the study was initiated, the repository program planning was based on an acceptance rate for an individual repository of 1800 metric tons for the first five years of repository operation, increasing to 3000 metric tons per year thereafter. The second repository with the same receipt rate schedule was to become operational four years after the first. Using this information, it was decided that an MRS facility capacity of 15,000 metric tons and a receipt rate of 1800 metric tons per year for the first five years expandable to 3000 metric tons thereafter was a good baseline size for an MRS facility. At that time, it was also determined that the MRS facility should have the capability of expanded storage up to a total of 70,000 metric tons in case of longer delays in the repository program.

Concept Normalization

The above requirements were key factors in defining the bases needed in the development of a conceptual design analysis for each concept. These analyses were performed by contractors having extensive previous experience in the development and evaluation of systems for storage of radioactive materials. To the extent possible, the firms were assigned concepts for evaluation that were most closely related to their past experience, to take maximum advantage of that knowledge base. The concept assignments were:

- Boeing Engineering Company (concrete sealed storage cask, concrete cask-in-trench, open-cycle vault)
- GA Technologies, Inc. (close-cycle vault, tunnel-rack vault)
- Westinghouse Electric Corporation (metal cask, field drywell, tunnel drywell).

Kaiser Engineers Hanford Company was assigned the task of providing a conceptual generic Receiving and Handling (R&H) facility. This generic facility design was incorporated into each of the storage concept evaluations to assure that differences between storage concepts were not masked by differences between individually conceived R&H facility designs. The results of the design studies, which were completed in August 1983, were presented in the form of independent design reports for each of the eight concepts.

Concept Ranking

While the MRS concepts were being normalized to a common basis, a parallel activity was establishing a basis for comparison of the normalized data. It was determined that the concepts should be compared on the basis of seven factors: safety/licensing, cost, concept maturity, environmental impact, flexibility, socioeconomic impacts, and siting requirements. Upon completion and evaluation of the designs, the ranking was performed and two concepts were selected for additional design.

The sealed storage cask (silo) was selected as the primary concept which would be taken to the stage of advanced conceptual design. Field drywells were selected as the alternate concept which would be taken through the conceptual design stage. It was determined that for added flexibility each concept design must also be capable of accepting and storing dual purpose transport-storage casks in case such casks are used by utilities for at-reactor storage and it is demonstrated that they could continue to provide safe storage at the MRS facility.

MRS Facility Descriptions

The essential features of an MRS facility based on the sealed storage cask concept are illustrated in Fig. 1 and 2. The overall facility, illustrated in Fig. 1, consists of a central R&H facility and an open storage yard surrounded by appropriate security fences.

Fuel and HLW arriving at the R&H facility in conventional truck and rail transport casks will be unloaded, inspected, and sealed in metal canisters. The canisters will be cleaned and loaded into concrete casks, which will be sealed for storage. The sealed casks will then be loaded onto a truck and transported to the storage yard where they will be emplaced on concrete pads as shown in Fig. 2. If dual purpose metal casks are received at the MRS facility, they can be

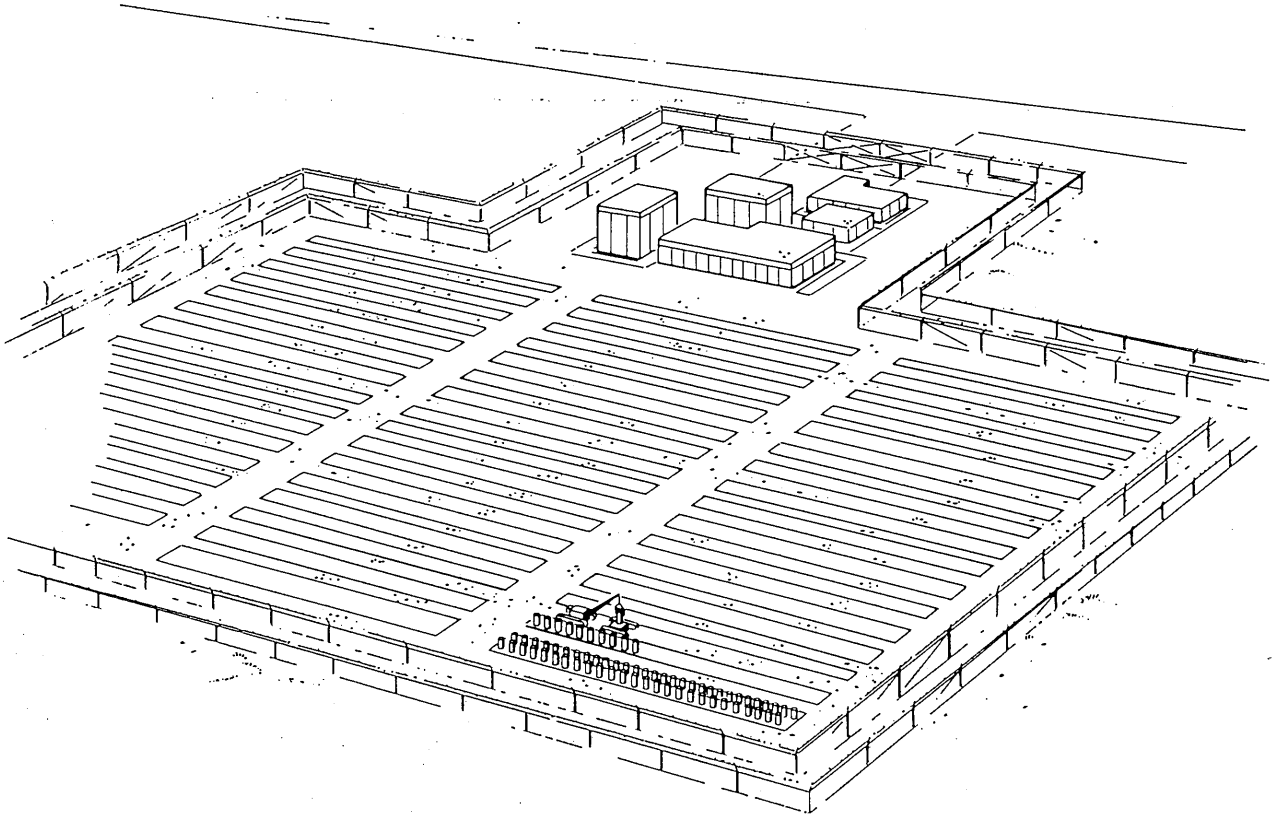


Fig. 1. Overview of a Sealed Storage Cask MRS Facility.

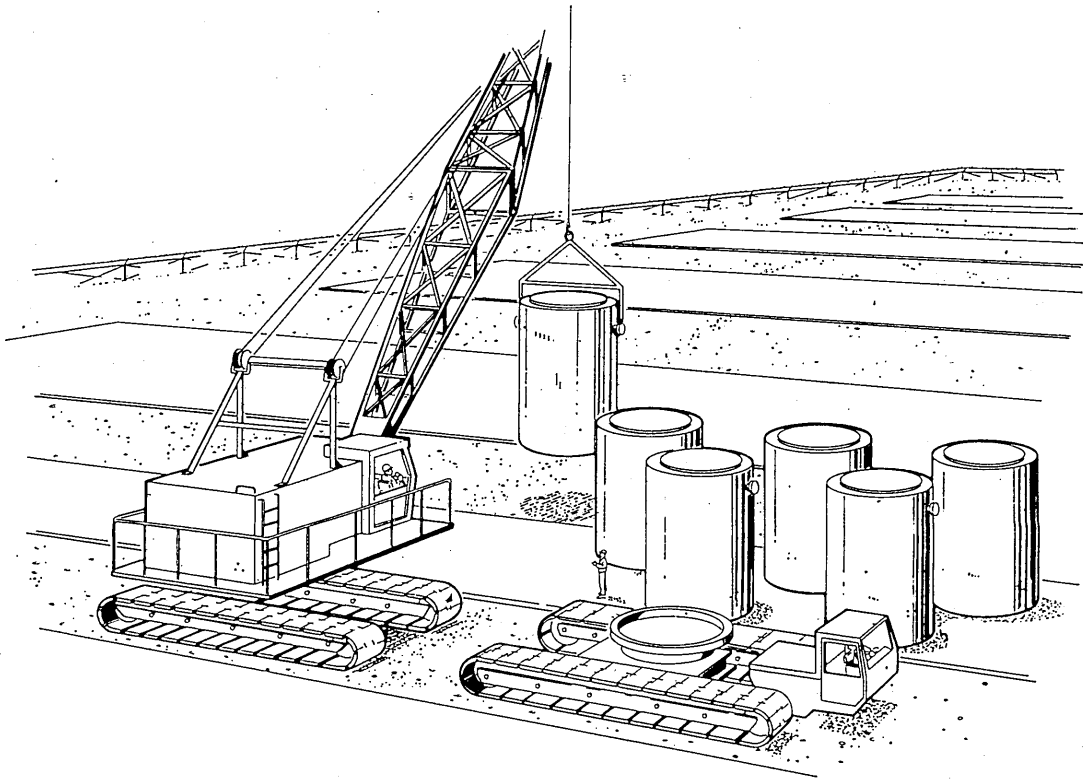


Fig. 2. Emplacement of Casks in the Storage Yard.

directly emplaced and stored in a similar manner, bypassing most of the R&H operations.

An MRS facility based on the field drywell concept will differ in several respects from that described for the sealed storage cask. The R&H operations will be the same through the fuel receipt and canistering process. The canisters will then be loaded individually into a shielded transporter which will transport them to the storage yard and emplace them in drywells as shown in Fig. 3. Because of the low thermal conductivity of soil, the spacing of the drywells, and thus the size of the needed storage yard, will be substantially larger than are needed for the concrete cask facility.

Other Program Developments

During the concept normalization/selection process, DOE procured an architect-engineer to provide the designs needed for the proposal. Ralph M. Parsons Company, in association with Westinghouse Electric Corporation and Golder Associates, was selected in late summer of 1983 to provide the needed MRS design work and to provide support for other proposal preparation activities. Functional design criteria for the MRS facility have been developed and are being used to direct the Parsons design activity.

In June of 1983, in accordance with requirements of the NWPA, DOE submitted a report to Congress on the research and development needed to prepare the MRS proposal.⁽⁴⁾ This report summarizes the findings of several independent assessments of the R&D that might be needed to provide the designs called for in the MRS proposal. Assessments were provided for each of the eight concepts described above by the same contractors that subsequently provided the normalized concept evaluations. The conclusion of the report was that, because of the significant earlier work and because of ongoing work in other programs, there was no significant additional R&D needed to prepare the proposal to Congress. However, it was noted that some work may be needed for design optimization studies and to develop a licensing data base for MRS. DOE is still evaluating potential needs in this area.

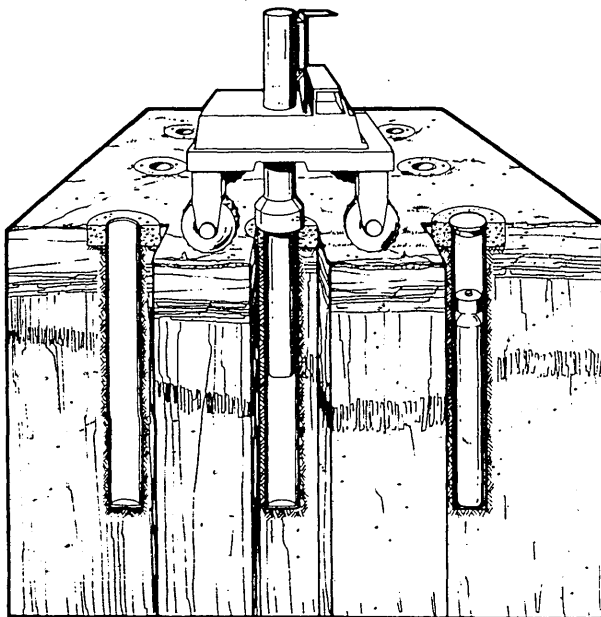


Fig. 3. The Field Drywell MRS Concept.

Siting criteria for MRS facilities have been developed and are currently undergoing internal review. It is expected that these criteria will be released by DOE for comment within the next couple of months. Because the MRS is an engineered facility, it appears that from a technical standpoint it is likely that MRS sites could be found in almost any of the 48 contiguous states.

ONGOING AND PLANNED ACTIVITIES

A number of additional key studies and activities are underway in the MRS program. A study of the need for and feasibility of MRS is proceeding. This study is examining the need for spent fuel and waste storage and evaluating MRS as a means for satisfying this need. This study supports several other activities and it will continue throughout the duration of the MRS program.

A number of provisions have been made to broaden participation in the proposal development. Independent peer reviewers reporting to DOE provide an overview of all aspects of the MRS program. The peer reviewers represent a broad spectrum of industry, government and public sector perspectives. As noted above, opportunities for direct public input are also being provided in development of the MRS siting criteria and plan.

Mechanisms for frequent interactions with the Nuclear Regulatory Commission (NRC) and the Environmental Protection Agency (EPA) are being established to facilitate development of a sound proposal which can be implemented as soon as possible after congressional authorization. DOE will comment on the regulations that the NRC will propose for MRS facilities when they are available. These regulations are currently expected in the summer of 1984. Work on the Environmental Assessment, which is to accompany the proposal, is underway, as is work on the funding and integration plans which were called for by the Act. Fig. 4 shows some of the key milestones in the MRS program.

The funding requirements for the MRS program for fiscal year 1984 are twelve million dollars. It is expected that funding needs will decrease somewhat in fiscal year 1985 as work culminates in the submittal of the proposal to Congress in June 1985.

SUMMARY

The status of the MRS program can be summarized as follows:

1. The schedule is tight and is success oriented; however, it is achievable.
2. The program continues to be essentially on schedule.
3. Two concepts have been selected for further design.
4. Design for the two MRS concepts is under way and is expected to be thirty percent complete in early summer of 1984.
5. Peer review mechanisms have been established to insure valuable and timely input from industry, the academic community, and other agencies.
6. From a constructability standpoint, siting requirements are so general that an MRS facility could be constructed literally in any of the contiguous United States.

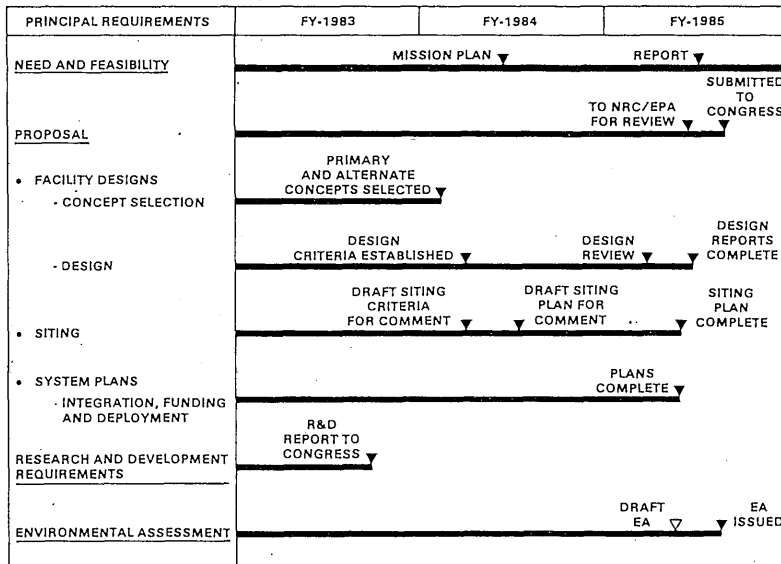


Fig. 4. MRS Program - Principal Timelines.

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