

Managing high-level waste in the USA

Progress in implementing the Nuclear Waste Policy Act of 1982

by Ben C. Rusche

The safe disposal of spent nuclear fuel and high-level radioactive waste in the United States has been a matter of growing national concern since the first civilian nuclear reactor began generating electricity in 1957. The US Congress, recognizing the need for a co-ordinated programme for management of high-level waste and the need for a safe and environmentally acceptable method of permanent disposal, enacted the Nuclear Waste Policy Act (NWPA) of 1982 [the Act].

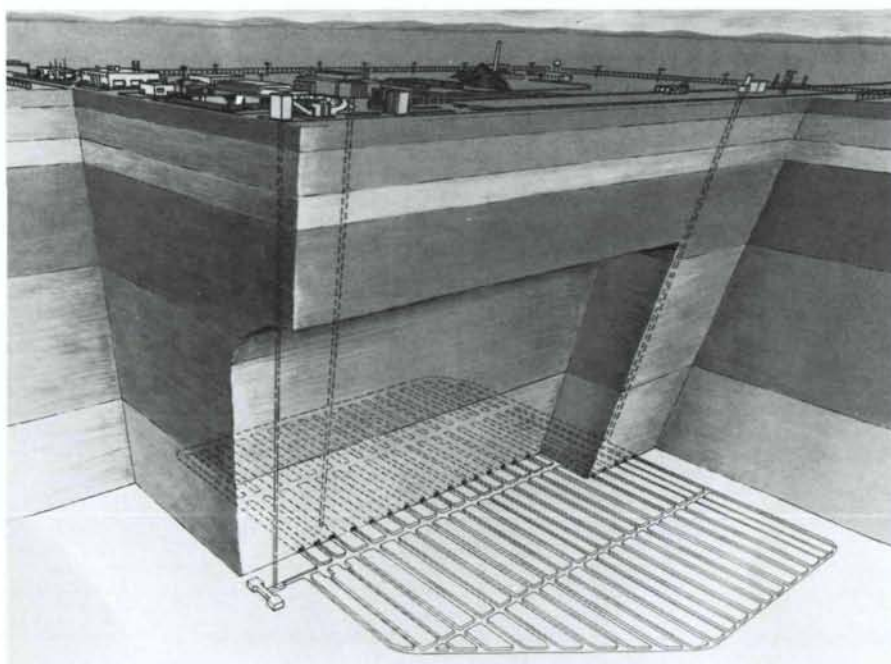
The Act established a schedule and a step-by-step process by which the President, the Congress, the states, affected Indian tribes, the Department of Energy (DOE) and other federal agencies must collaborate in the siting, design, construction, licensing, and operation of geologic repositories for disposal of high-level waste generated by civilian nuclear reactors. The Act provides for resources and, more importantly, mandates unprecedented interaction among the Federal Government, the states, and the public in order to identify and select sites for a repository, and if needed, for federal interim storage facilities.

Mr Rusche is the Director, Office of Civilian Radioactive Waste Management, US Department of Energy, Washington, D.C.

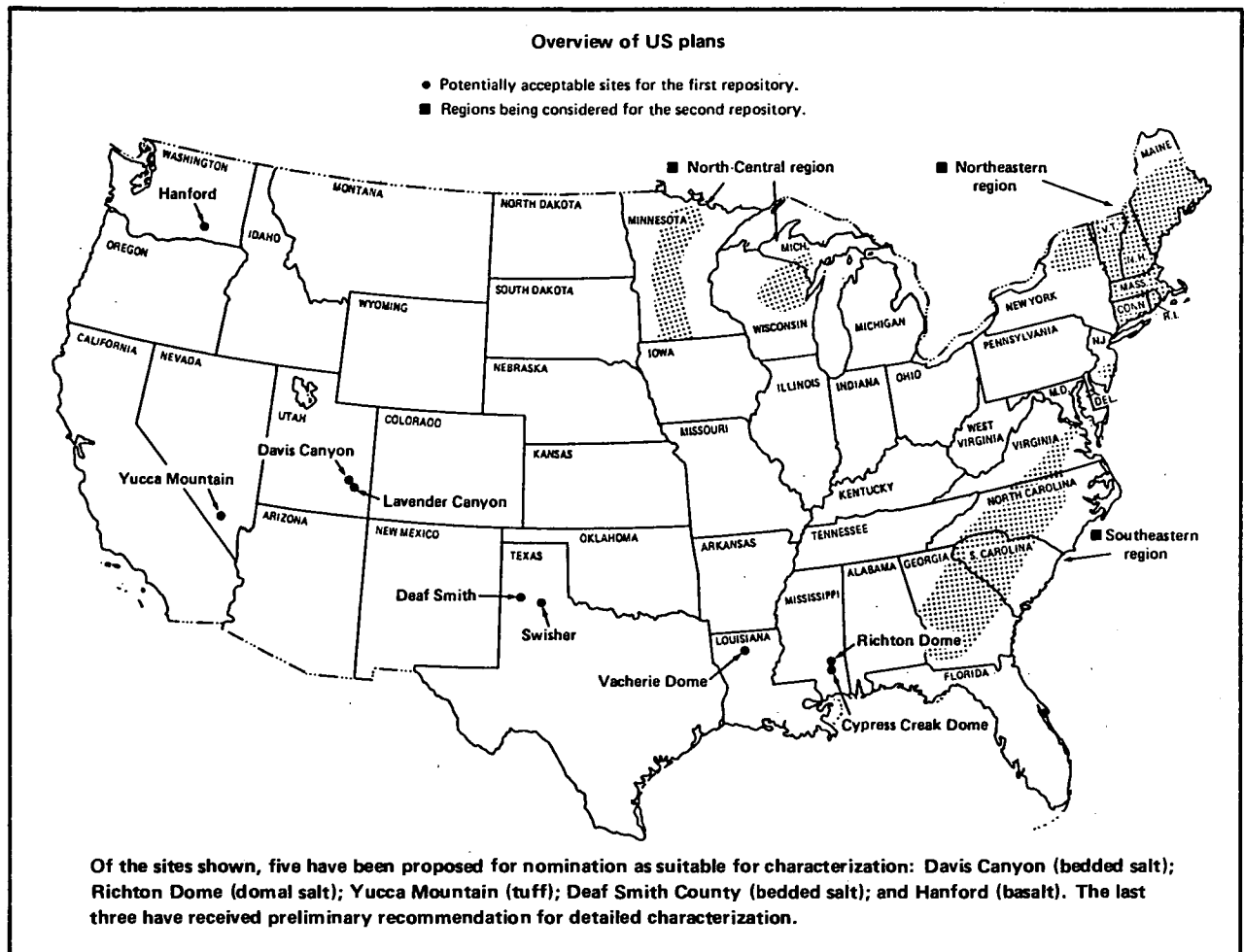
Included in the Act are five key provisions: (1) to site, license, construct, and operate repositories for the disposal of high-level radioactive waste by 1998; (2) to establish the Nuclear Waste Fund so that owners and generators of waste will pay the cost of the programme; (3) to establish co-operation between the Federal Government, states and Indian tribes; (4) to provide a limited amount of federal interim storage capability; and (5) to study the need for and feasibility of monitored retrievable storage.

The approach that the Department of Energy has taken to implement the Act evolves from the following goals:

- We must protect the public health and safety and the environment.
- The programme must be credible to the public by virtue of its integrity and technical excellence.
- The programme must neither subsidize nor penalize nuclear power as an energy source.
- The programme must be conducted in a cost-effective manner, with full cost recovery from the generators and owners of high-level waste and spent fuel.



Artist's conception of surface support buildings and underground facilities of a repository to contain high-level nuclear waste.
(Credit: US DOE)



The DOE programme objectives that evolved from these policy goals to implement the provisions of the Act include:

- To site, obtain a license for, construct, and operate deep geologic repositories, and ensure that the transportation of waste to repositories and the disposal of waste in repositories can be accomplished in a manner that is safe and environmentally acceptable
- To submit a proposal to Congress to develop one or more facilities for monitored retrievable storage
- To ensure the acceptance of waste for disposal by 1998, in accordance with the acceptance schedule provided for in DOE's standard disposal contracts with utilities and in conformance with the Act
- To assist utilities in providing adequate and safe at-reactor storage for spent fuel before transfer to DOE, and to provide limited federal interim storage for any utilities found by the Nuclear Regulatory Commission (NRC) to be eligible for such service.
- To manage the technical programme and the funds collected for disposal and storage services, or otherwise provided through appropriation, in an effective, integrated, and efficient manner.

Mission plan

The approach taken to implement the Act has been described in a comprehensive mission plan submitted to the US Congress in June 1985.

The mission plan includes, but is not limited to, a description of current programme objectives and strategy, and further provides a summary description of current programme plans for geologic repositories, a monitored retrievable storage facility, other storage options, transportation, and systems integration. The plan is viewed as a planning document subject to change and will be reviewed periodically for modifications on an as-needed basis.

Nuclear waste fund

The Act established the Nuclear Waste Fund (NWF) to finance the programme for disposal of high-level waste and spent fuel. The main source of revenue for the NWF is a one mill per kilowatt-hour (US\$0.001/kWh) fee charged to nuclear utilities for all electricity generated by civilian nuclear reactors beginning 7 April 1983. The Act provides for annual review and adjustment of the fee for nuclear-generated electricity to determine if the fee is sufficient to meet full cost recovery, as mandated. Our first three reviews have shown the fee to be adequate for currently anticipated costs. In addition to spent fuel generated since 7 April 1983, high-level radioactive waste and spent nuclear fuel generated prior to that date are subject to a fee equivalent to an average charge of one mill per kilowatt-hour.

First repository

In accordance with the Act, DOE developed and transmitted to the NRC for review and concurrence proposed guidelines to be used in the recommendation of sites for a repository. After a long review process, including several public hearings held around the country, and consultation with affected states, Indian tribes, and key federal agencies, the NRC concurred with the guidelines. These guidelines, published in the *Federal Register* on 6 December 1984, established the performance requirements for a geologic repository system, defined the technical and environmental qualifications that candidate sites must meet, and specified how DOE will carry out the site selection process.

On 20 December 1984, DOE issued draft environmental assessments (EAs) for nine potentially acceptable sites for the first repository. (See accompanying map.) It received over 20 000 comments on the draft EAs, which were addressed in comment-response documents and incorporated in the final EAs, as appropriate.

The EAs are expected to be published in the spring of 1986 after the National Academy of Science's Radioactive Waste Management Board completes a review of the methodology for site selection and the application of the methodology. The nomination for three sites will be submitted to the President for official recommendation of the three sites for the first repository.

Site characterization

Site characterization is geohydrological, geomechanical and geochemical exploration, investigation, and evaluation of a potential repository site. To collect the subsurface data, construction of exploratory shafts at each of the three sites recommended for characterization will be necessary. DOE plans to construct two shafts at each site. These shafts will be to the depth of a proposed repository, about 300 to 1200 meters deep. Shaft construction at the three sites will take approximately 2 years and will be followed by *in-situ* tests planned for late 1987 through mid-1990.

Before proceeding to construct shafts at sites approved for characterization, the Act requires that DOE prepare a site characterization plan for each of the three sites. These plans will be submitted to the NRC and the affected states and Indian tribes for review and comment, and will be made available to the public. Public hearings will be held in the vicinity of each candidate site to inform the area residents about the plan and to receive their comments.

In about 1991, based on site characterization, DOE will evaluate each site and recommend one site to the President for development as the first repository. This recommendation will be accompanied by an environmental impact statement which will have been prepared in accordance with the Act and the National Environmental Policy Act requirements, which include public review, comments, and hearings. With this schedule we will be in a position to begin receiving waste for disposal by 1998.

Second repository

Although the Act does not authorize the construction of a second repository, it does require DOE to carry out the siting and development activities essential to preparation of such a facility. National surveys identified for further study near-surface and exposed crystalline rock formations in 17 states divided into three regions. (See accompanying map.) Regional characterization reports (RCRs) were issued in September 1985. The RCRs summarize available geologic and environmental information and were developed in consultation with the 17 states.

DOE will release in early 1986 drafts of area recommendation reports, which used the results of limited field studies, the RCRs, and the Region-to-Area Screening Methodology (issued in April 1985 and developed in consultation with the states) to identify and document the selection of areas in several states for further field testing and study.

Financial assistance

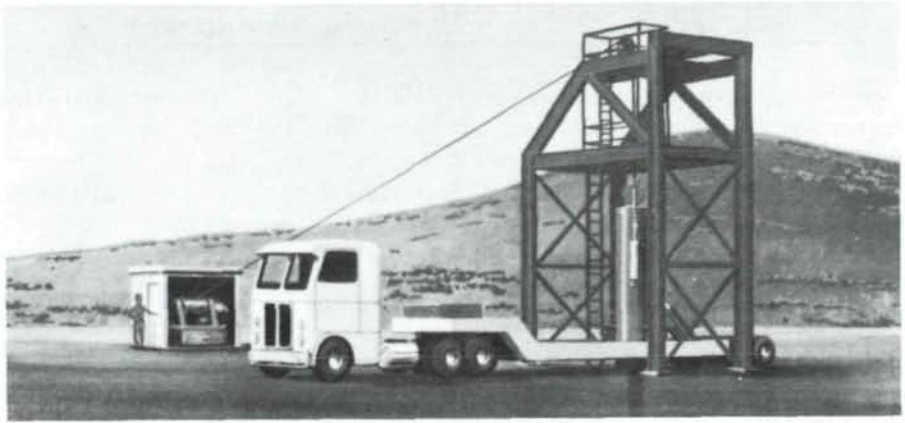
By the end of 1985, the DOE had awarded more than US\$20 million to affected states and Indian tribes for participation in activities associated with the first and second repository programmes. Grants have been awarded to all the first repository states and Indian tribes, as well as to 16 states included in the regions being considered for the second repository project.

Monitored retrievable storage

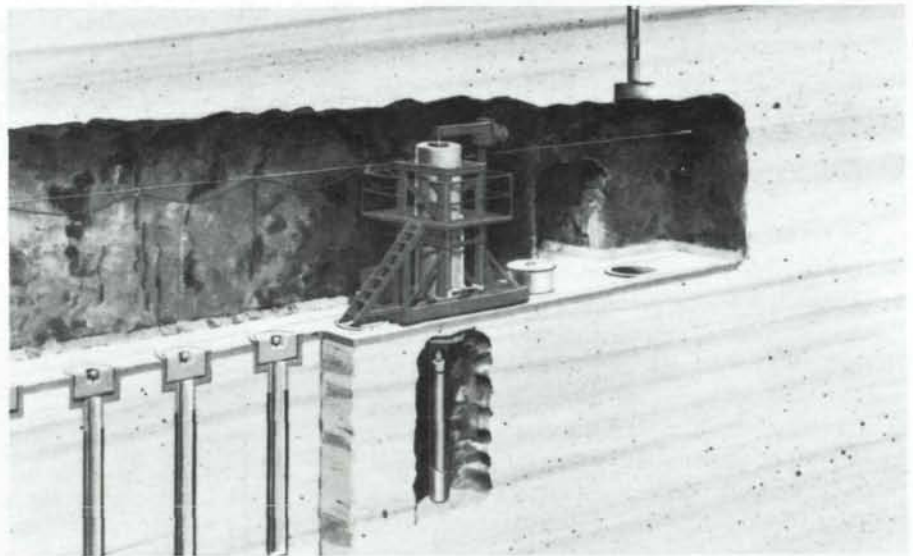
In accordance with the Act, the DOE will deliver a proposal to Congress in early 1986 for the development of monitored retrievable storage (MRS). Initially, MRS designs and plans were developed with the concept of the MRS as a back-up to the repository in the event of repository delays. Later analyses, however, indicated that an MRS facility would be more beneficial when operated as an integral component of the federal nuclear waste management system to receive, consolidate, package, and provide temporary storage for spent fuel prior to shipment to a repository. DOE chose to base its proposal for MRS construction on this role in the fall of 1984. In April 1985, three sites in Tennessee were identified for consideration for hosting an MRS facility. After the three sites were identified, the state received US\$1.4 million from the DOE to participate in and review MRS programme activities.

Transportation system

Development of the transportation system is integral to the development and siting of repositories and to carrying out other activities within the total waste disposal system. Planning for the transportation system will provide for development and acquisition of the appropriate types and quantities of equipment and services, as well as development of the appropriate institutional arrangements.



As part of US nuclear waste management efforts, the spent-fuel test "Climax" was conducted to evaluate the effects of storing spent reactor fuel in a crystalline rock formation 1400 feet below the surface of the Nevada Test Site. Transport vehicles carried waste packages to a hole drilled vertically into the floor of a tunnel carved out of solid granite, as illustrated here.
(Credit: US DOE, AIF)



In November 1985, a draft transportation business plan was published which set the context for business strategy decisions by providing background information and describing legislation and policies governing transportation under the NWP. Included in the draft business plan are strategies for procuring shipping casks and transportation support services. Additionally, in the spirit of the NWP, opportunities to utilize the private sector to the maximum extent possible are highlighted throughout the plan.

DOE expects to issue a transportation institutional plan in the spring of 1986. This plan defines processes

and schedules for working with potentially affected and interested groups in the implementation of the transportation aspects of the Act.

Other federal agencies

The Environmental Protection Agency (EPA) as required by the Act has issued "Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes" (40 CFR Part 191). The standards were developed as drafts with an extensive review and comment period and were issued on 19 September 1985.

In 1983, the Nuclear Regulatory Commission, as required by the Act, had issued "Rules and Regulations on Disposal of High-Level Radioactive Wastes in Geologic Repositories" (10 CRF 60). Both procedural and technical requirements were specified. NRC is currently reviewing its regulations to assure consistency with the more recent EPA standard.

The United States Geologic Survey of the Department of Interior is actively involved in developing and commenting on the Department's geologic activities. This expert assistance provides further confidence that our work is technically credible and sufficient for the licensing process with NRC.

To assure co-ordination of these and other federal agency actions, the DOE issued a draft project decision schedule for federal agency review and comment. The schedule lists actions required by each agency of the Federal Government.

Much accomplished, challenges ahead

The passage of the Nuclear Waste Policy Act in 1982 provided the mechanism required to focus the efforts of the US Government into operating a national programme for the permanent disposal of high-level radioactive waste and spent nuclear fuel. The Act established activities and schedules that must be followed to develop the technical means to dispose of high-level nuclear waste and spent fuel safely, and to involve states, Indian tribes, and local communities in the programmes. As described in the mission plan, we have adopted an optimistic approach in implementing the requirements set forth in the Act. We continue to meet and many times even exceed the high standards set by the Act.

If a schedule has been changed, it has been because we wanted to allow more time for increased public participation in the programme, or because we believed that more data were necessary to make a programme decision. We have continually said that we will not sacrifice an orderly and high quality process in order to meet interim schedules. It is important that each major step and its documentation be generally acceptable through a consultation and co-ordination process with the affected individuals and their local governments.

I want to emphasize my belief and respect for deep geologic disposal of nuclear waste disposal as a viable and environmentally acceptable method to assure long-term safety. However, the knowledge and trust that many of us have come to have is not yet translated into credible and understandable terms that many of our friends within the general public are willing to accept. The challenge then is not only to establish technical credibility but to provide information on what we intend to do in a way that the interested general public can test the credibility of the information and come to believe as we do. Emphasis on public outreach programmes is essential to the success of our efforts. We are continuing to respond to inquiries and concerns about the programme in the best way we know how and are always looking for better ways.

The programme has accomplished a great deal since the passage of the Act. Many more challenges remain. The work of site characterization has begun; we expect Congressional consideration of an MRS facility soon; and the narrowing of potential sites for the second repository is under way. Although we have a great deal ahead of us, I am confident the programme has the technical expertise and the talented staff to meet those challenges successfully by working together with federal agencies, state governments, Indian tribes, and the public.

Technical reading . . . and references

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- *Spent Fuel and Radioactive Waste Inventories, Projections and Characteristics*, DOE/RW-0006, Office of Civilian Radioactive Waste Management (October 1984).
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- *Cash Management Policies and Procedures, Nuclear Waste Fund*, DOE/S-0032 (November 1984).
- *Commercial Nuclear Power 1984, Perspective for the United States and the World*, DOE/EIA-0438 (84), Energy Information Administration (November 1984).
- *Nine Draft Environmental Assessments*, DOE/RW-0009 through 17, Office of Civilian Radioactive Waste Management (November 1984).
- *General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories; Final Siting Guidelines*, 10 CFR 960, Office of Civilian Radioactive Waste Management (December 1984).
- *Radioactive Waste Management System Project Decision Schedule*, DOE/RW-0018, preliminary draft, Office of Civilian Radioactive Waste Management (December 1984).
- *An Evaluation of Commercial Repository Capacity for the Disposal of Defense High-Level Waste*, DOE/DP-0020, Office of Defense Programs (January 1985).
- *Fee Adequacy Report*, DOE/RW-0020, Office of Civilian Radioactive Waste Management (February 1985).
- *Need for and Feasibility of Monitored Retrievable Storage — A Preliminary Analysis*, DOE/RW-0022, Office of Civilian Radioactive Waste Management (March 1985).
- *Screening and Identification of Sites for a Monitored Retrievable Storage Facility*, DOE/RW-0023, Office of Civilian Radioactive Waste Management (March 1985).
- *Analysis of the Total System Life Cycle Cost for the Civilian Radioactive Waste Management Program*, DOE/RW-0024, Office of Civilian Radioactive Waste Management (April 1985).
- *Analysis of the Total System Life Cycle Cost for the Civilian Radioactive Waste Management Program*, DOE/RW-0025, Office of Civilian Radioactive Waste Management (April 1985).
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