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NUCLEAR WASTE ISOLATION Activities Report

MASTER

December 1980

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U.S. Department of Energy's
Nuclear Waste Management Program

OFFICE OF WASTE ISOLATION
Washington, D.C. 20545

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REPORT FROM THE DEPUTY ASSISTANT SECRETARY

Significant progress has been made in the last few months in each program area. Under the Office of Waste Operations and Technology, in the long-term waste treatment technology area, increased attention has been given to the development and evaluation of alternative waste forms for the immobilization of high-level and transuranic wastes. The Materials Characterization Center at Pacific Northwest Laboratories has formulated the first waste form test procedure for approval as a standard. It is now being evaluated in leach tests on standard samples in fifteen different laboratories.

A draft low-level waste strategy document, prepared by a task force of federal and nonfederal persons with diverse qualifications, is being widely disseminated, and regional meetings are being planned to obtain a broad spectrum of public input.

In the interim waste operations area, emphasis has been placed on completing the construction of new double-shelled high-level liquid waste tanks at the DOE Savannah River and Hanford sites. At Hanford, all of the 149 old single-shelled tanks have been taken out of active liquid service, leaving them with only a damp salt cake. At both sites only the new double-shelled tanks will be used to hold liquids. Construction nears completion on a new facility in Idaho to process the liquid high-level waste into a calcined solid.

A new DOE activity under this Office was initiated October 1, 1980, when President Carter signed legislation to provide the Department of Energy authority to carry out a high-level liquid nuclear waste management demonstration project at the Western New York Nuclear Service Center in

NOTE TO READERS

The first *Activities Report* (November, 1979) provided a general description of the Department of Energy's various nuclear waste management programs with particular emphasis on the program for disposal of highly radioactive wastes. Several organizational changes have occurred since then, and that report is out of print, but demand for it has persisted. Therefore, this report not only describes important new activities not mentioned in either the November, 1979, or May, 1980, reports, but also repeats (updated) background information from the November, 1979, report in the last section.

West Valley, New York. A public scoping meeting for preparation of an environmental impact statement (EIS) to assess the environmental implications of immobilizing the high-level liquid waste was held on February 2, 1980, at West Valley, New York. Distribution of a draft EIS for public comment is planned for mid-1981, and planning and conceptual design for the solidification project is now under way.

Under the Office of Waste Isolation, progress has been made in several areas as will be described in this *Report*. Particularly noteworthy are initial gains made in expanding and diversifying the siting program. Following procedural recommendations offered by the State Planning Council, letters were sent to each of the fifty states and heads of Tribal governments explaining policy and program needs, proposing a general plan for intergovernmental interaction, and asking for their thoughts. Discussions have since been initiated with several states in regions of granite and granite-like formations of potential interest.

Under the Office of Transportation and Fuel Storage, recent work includes explosive testing of a spent fuel container to characterize and quantify release fractions of radioactive materials from hypothetical sabotage attempts. Scale-model testing was completed for a new modular Type A container for contact-handled TRU and defense low-level waste, and scale-model testing was initiated for the new Type B TRU package transporter (TRUPACT) currently being developed.

In the spent fuel storage area, the Department of Energy issued in July the Record of Decision on the Final Environmental Impact Statement on the proposed U.S. Spent Fuel Policy. The decision was formally made to implement the policy for storing spent fuel and charging a fee to recover the costs of those services. Actual implementation of the policy will require congressional passage of appropriate legislation. In August DOE issued a Notice of Intent to prepare an environmental impact statement on the Near-Term Acquisition of Away-From-Reactor (AFR) Spent Fuel Storage Facilities. A report on the fee for spent nuclear fuel storage and disposal services was prepared and sent to Congress in November. The report (DOE/SR-0006) estimates the charge for disposal and storage at \$371 per kilogram of uranium. The charge for disposal only is estimated at \$234 per kilogram of uranium.

Progress under the Remedial Actions Program was particularly evident at sites in Jersey City, New Jersey, and Middlesex, New Jersey. Engineering and environmental studies on eleven other sites were also initiated. At Jersey City, a thorough subsurface radiological survey involving excavation of trenches and surveying by gamma ray measurements and analysis of soil

samples is under way. At Middlesex, the decontamination of the two properties was completed; 28 additional properties are scheduled to be decontaminated during 1981. The low-level contaminated soil is being stored temporarily at the Government-owned former sampling Plant at Middlesex in a storage facility designed to prevent any transport of contamination off site.

Finally, I am pleased to report several developments in the areas of international cooperation: a bilateral agreement for four more years of cooperation with Sweden was signed in September; an agreement for cooperation with Canada has been renewed; and initial agreement was reached with Japan regarding coverage of waste management under fuel cycle aspects of the existing Fast Reactor Exchange Agreement. Agreement was also reached with Japan on the Pacific Basin Spent Fuel Study. The agreement calls for a joint two-year study of the feasibility of interim storage of spent power reactor fuel on an island in the western Pacific.

Sheldon Meyers
Deputy Assistant Secretary
for Nuclear Waste Management
Office of Nuclear Energy

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ABOUT RECENT EVENTS

National Waste Terminal Storage Program Office (NPO)

In order to provide more centralized direction and coordination to the National Waste Terminal Storage Program, the Deputy Secretary of Energy has established a central program office in Columbus, Ohio. The National Waste Terminal Storage Program Office (NPO) reports to the Deputy Assistant Secretary for Nuclear Waste Management through the Office of Waste Isolation. The organizational change took effect on October 1, 1980, the beginning of the new fiscal year.

The NWTS Program Office is responsible for coordinating all work currently being carried out by the Basalt Waste Isolation Project (BWIP) at the Hanford Site, the Nevada Nuclear Waste Storage Investigations (NNWSI) at the Nevada Test Site, the Office of Nuclear Waste Isolation (ONWI) investigations on characterizing sites on non-Department of Energy lands, and all activities related to development of technology. The detailed activities and actions needed for this coordination are implemented by the Office of Nuclear Waste Isolation of Battelle.

See the closing chapter for additional information, including an organizational chart showing the structure of the NWTS program.

Interface Control Boards (ICBs)

To coordinate the interfaces between elements of the DOE Nuclear Waste Management Program, the Department of Energy has established four Interface Control Boards (ICBs), as summarized below.

INTERFACE CONTROL BOARDS, DECEMBER, 1980

Area of Responsibility	Abbreviated ICB Name
Waste Isolation Program	I-ICB
Transportation	Transportation-ICB
Waste Materials:	
High-Level Waste	HLW-ICB
Transuranic Waste	TRU-ICB

The isolation-ICB has, in addition, been chartered by DOE's NWTS Program Office (NPO) to make recommendations on the management of interfaces between the various waste isolation projects which comprise the NWTS Program, i.e., the Office of Nuclear Waste Isolation (ONWI), the Basalt Waste Isolation Project (BWIP), the Nevada Nuclear Waste Storage Investigations (NNWSI) and the Subseabed Disposal Program.

Expansion of Site Exploration Program

The Department of Energy has written to state governors and heads of tribal governments seeking close cooperation in an expanded program to study and identify suitable geology and sites for possible disposal of radioactive wastes. The action follows a recommendation by the State Planning Council, established by President Carter and headed by South Carolina Governor Richard Riley, that the expansion program begin with letters describing the overall process. The Council includes other governors, Cabinet officers, local government officials, and an Indian nation representative.

DOE already is investigating geologic systems underlying seven states: Washington, Utah, New Mexico, Nevada, Texas, Louisiana, and Mississippi.

In the letter to governors and heads of tribal governments, July 3, 1980, DOE Assistant Secretary George W. Cunningham said the new studies are designed to help meet President Carter's objective of identifying alternative disposal sites for high-level radioactive wastes from among diverse geologic environments that qualify in various parts of the country.

Initial recommendations of new regions that should be examined are currently being developed by DOE and the U.S. Geological Survey. Based on the recommendations, DOE will consult with individual states and Indian nations to establish cooperative arrangements for the investigations.

"At each step of the way," Cunningham wrote, "we will work closely with state authorities and Indian representatives to gain an understanding of the data being developed and the issues of concern to each party."

Steps leading to identification and selection of suitable sites include:

- A broad national survey of various geologic media by DOE and of geohydrological provinces identified by the U.S. Geological Survey (USGS). This phase is generally conducted through literature studies and review of available geologic and hydrologic maps.
- Regions of interest (usually spanning several states) that have been identified are further screened through more detailed review and field mapping to select areas where more specific data collection, including core drilling, might be undertaken following the consultation and concurrence process.
- Data taken in area studies are evaluated to recommend specific locations which then require very detailed geophysical tests to assess their suitability as potential sites for future selection. These data are provided to the states and Indian tribes for analysis.

Cunningham said that the investigations should provide important geologic and hydrological data of interest to environmental and nonnuclear programs which are of interest to the state and local governments.

When a program expansion involves a specific state, group of states, or an Indian nation, DOE representatives will contact governors or Indian tribal officials and any other officials designated by these leaders.

In the first meeting, DOE will seek to establish appropriate consultation and concurrence procedures which also may include studies involving scientists representing all parties.

DOE hopes to consult with several states and Indian nations concurrently when broad regional investigations are proposed.

Cunningham requested that the governors and Indian leaders submit any comments on the proposed procedures so that their views can be considered in the final planning process.

Following these letters, DOE announced plans to study granitic rocks of the southern extension of the Canadian shield in a public meeting in Madison, Wisconsin, before Governor Lee Dreyfus and representatives of the Governors of Minnesota and Michigan. These state and federal officials discussed the general purpose and course of proposed studies. Later, on October 6, 1980, George W. Cunningham, Assistant Secretary for Nuclear Energy, wrote letters to the governors or designated representatives of 13 Appalachian states from Maine to Georgia announcing the inclusion of granitic rocks of the Appalachian system within the plans for early studies of these rock types. It will take some time to conclude discussions at operating levels of government before initiating a one-year phase of studies of existing literatures on these rock systems. The next phase would be certain field investigations focused on more promising areas within the large Appalachian and Lake Superior regions.

Confidence Rulemaking

Another major event in this program area has been DOE's filing of its Cross-Statement for the Confidence Rulemaking on the Storage and Disposal of Nuclear Waste (DOE/NE-007, Supplement I). The Rulemaking is being conducted by the U.S. Nuclear Regulatory Commission (NRC) to assess the degree of assurance now available that radioactive waste can be safely disposed of, to determine when such disposal or off-site storage will be available, and to determine whether radioactive wastes can be safely stored on-site past the expiration of existing facility licenses until off-site disposal or storage is available. DOE had earlier filed its Statement of Position on these matters along with 31 other participants. Participants then filed Cross-Statements in response to the positions taken by the other participants.

Environmental Impact Statement

The Environmental Impact Statement (EIS) for the Management of Commercially Generated Radioactive Waste, DOE/EIS-0046F, has been prepared and finalized by the U.S. Department of Energy in compliance with the National Environmental Policy Act (NEPA) to analyze the significant environmental impacts that could occur if various technologies for management and disposal of high-level and transuranic wastes from commercial nuclear power reactors were to be developed and implemented. The

final EIS will serve as the environmental input for the decision on which technology, or technologies, will be emphasized in further research and development activities in the commercial waste management program.

Specifically, the action proposed in the final EIS is to (1) adopt a national strategy to develop mined geologic repositories for disposal of commercially generated high-level and transuranic radioactive waste (while continuing to examine subseabed and very deep hole disposal as potential backup technologies) and (2) conduct an R&D program to develop such facilities and the necessary technology to ensure the safe long-term containment and isolation of these wastes.

The environmental impacts analyzed in the EIS include exposure to radiation and to nonradioactive effluents; consumption or preemption of natural resources; and socioeconomic impacts. Both routine operations and accidents are considered.

Public hearings were held on the draft EIS during the summer of 1979, and comments received by DOE. These comments have been addressed in the final EIS which was issued in October, 1980.

The analyses of environmental impacts contained in the EIS are applicable to the technical strategies examined by the IRG and provide the required analysis of environmental impacts for consideration in selecting a National strategy for the disposal of high-level and transuranic wastes from the commercial fuel cycle.

Inquiries for copies of the EIS should be addressed to:

ONWI Library
505 King Avenue
Columbus, Ohio 43201

State Planning Council Events

On February 12, 1980, President Carter announced the formation of a State Planning Council on Radioactive Waste Management to advise the Executive Branch and to work with the Congress on key radioactive waste management issues. Establishment of the Council was one of several actions taken by the President to strengthen intergovernmental relationships and assure state and local governments an effective role in the development and implementation of a national waste program. The eighteen-member body is composed of eight governors; five other elected state and local government

officials; one Tribal government representative; the Secretaries of Energy, Interior, and Transportation; and the Administrator of the U.S. Environmental Protection Agency. Governor Richard Riley of South Carolina is the chairman of the Council. Specifically, the Council is to:

- Recommend procedural mechanisms for reviewing radioactive waste management plans and programs, including the consultation and concurrence process
- Ensure that radioactive waste management plans adequately address the needs of affected states and local areas
- Advise on all aspects of siting and licensing of facilities for storage and disposal of radioactive wastes
- Advise on proposed federal regulations, standards, and criteria related to radioactive waste
- Advise on proposed federal regulations, standards, and criteria related to radioactive waste management programs
- Identify and make recommendations on other matters related to the transportation, storage, and disposal of radioactive wastes that the Council believes are important.

In the four meetings held to date, the Council has been active in the areas of low-level waste; legislation to make the Council permanent; the Department of Transportation's rulemaking on the highway routing of radioactive materials; relationships among federal, state, local, and Tribal governments for different types of wastes (including advice to DOE on procedures for expanding high-level waste repository siting studies into additional states); procedural aspects of NRC's proposed 10 CFR 60 regulations concerning disposal of high-level wastes; and the National Plan. Its fifth meeting is planned for January 8-9, 1981, in Phoenix, Arizona.

The Council, supported by a technical and administrative staff, reports to the President and Secretary of Energy following each meeting and is to provide a final report to the President in August, 1981, when its term expires. Additional information on the Council may be obtained by writing to:

State Planning Council
1900 L. Street, NW, Suite 605
Washington, D.C. 20036
(202) 785-2901

Dr. John Stucker is serving as Executive Director.

NEW LITERATURE

Copies of reports listed here are generally available from the National Technical Information Service in Springfield, Virginia. Titles of current publications pertinent to nuclear waste isolation may be submitted to the following address for inclusion in future lists: The Ecological Sciences Information Center, Building 2029, P.O. Box X, Oak Ridge, Tennessee 37830.

- Bradley, D. J., et al. WRIT. *Leach Test Methodology for the Waste/Rock Interactions Technology Program*. PNL -3326 (May 1980).
- Burkholder, H. *Waste Isolation Performance Assessment—A Status Report*. ONWI-60 (1980).
- Jenks, G. H. *Review of Information on the Radiation Chemistry of Materials Around Waste Canisters in Salt and Assessment of the Need for Additional Experimental Information*. ORNL-5607 (March 1980).
- Merrell, H. W. *Mineral Resources Inventory of the Paradox Salt Basin, Utah and Colorado*. Utah Geological and Mineral Survey. Report of Investigation No. 143 (October 1979).
- McDaniel, E. W. *Cement Technology for Borehole Plugging: Permeability of Cementitious Solids*. ORNL-TM-7092 (January 1980).
- Moore, J. *Cement Technology for Borehole Plugging: Interim Report on the Effects of Flyash and Salt on the Physical Properties of Cementitious Solids*. ORNL-TM-7106 (March 1980).
- Morgan, M. T. *Thermal Conductivity of the Rocks in the Bureau of Mines Standard Rock Suite*. ORNL-TM-7052 (January 1980).
- Nelson, R. W., and Schur, J. A. AEGIS. *PATHS Groundwater Hydrologic Model*. PNL-3162 (April 1980).
- Office of Nuclear Waste Isolation. *National Waste Terminal Storage Program: Office of Nuclear Waste Isolation Technical Program Plan*. ONWI-19 (Rev. 1) (December 1979).
- Office of Nuclear Waste Isolation. *Proposed Assumptions and Ground Rules to be Used in Nuclear Waste Projections and Source-Term Data*. ONWI-24 (1980).
- Office of Nuclear Waste Isolation. *An Assessment of LWR Spent Fuel Disposal Options*. ONWI-39 (1980).
- Office of Nuclear Waste Isolation. *The Isolation of Spent Fuel*. ONWI-59 (1980).
- Office of Nuclear Waste Isolation. *NWTS Repositories 1 & 2: Cost Estimate Reconciliation Study*. Volume 1. ONWI-69 (1980).
- Office of Nuclear Waste Isolation. *Status Report on the Importance of Natural Organic Compounds in Groundwater as Radionuclide Mobilizing Agents*. ONWI-84 (1980).
- Office of Nuclear Waste Isolation. *Thermal Gradient Brine Inclusion Migration in Salt Study: Gas-Liquid Inclusions—Preliminary Model*. ONWI-85 (1980).

Office of Nuclear Waste Isolation. *Proceedings of the US/FRG Bilateral Workshop on Waste Isolation Performance Assessment and In-Situ Testing*. ONWI-88 (1980).

Office of Nuclear Waste Isolation. *Proceedings of a Workshop on Thermomechanical Modeling for a Hard Rock Waste Repository*. ONWI-98 (1980).

Raymond, J. R., et al. *Test Case Release Consequence Analysis for a Spent Fuel Repository in Bedded Salt*. PNL-2782 (January 1980).

U.S. Department of Energy/U.S. Department of the Interior. *Earth Science Technical Plan for Disposal of Radioactive Waste in a Mined Repository*. DOE/TIC-11033 (draft) (April 1980).

U.S. Department of Energy. *In the Matter of Proposed Rulemaking on the Storage and Disposal of Nuclear Waste*. Statement of Position of the United States Department of Energy (to the Nuclear Regulatory Commission), DOE/NE-0007 (15 April 1980).

U.S. Department of Energy/National Aeronautics and Space Administration. *Analysis of Waste Disposal in Space—Phase III* (1980).

U.S. Department of Energy. *Report on Geologic Exploration Activities*. DOE-RL-C-14 (1980).

UPCOMING WASTE MANAGEMENT MEETINGS

Waste Management '81, American Nuclear Society Topical Meeting, Tucson, Arizona, **February 22-26, 1981**. Sponsored by American Nuclear Society, La Grange Park, Illinois. Contact: General Chairman Roy G. Post or Program Chairman Morton E. Wacks, University of Arizona, Department of Nuclear Engineering, Tucson, Arizona 85721.

Rapid Excavation and Tunneling Conference, San Francisco, California, **May 3-7, 1981**. Sponsored by the Society of Mining Engineers of AIME. Contact: Meetings Dept., Society of Mining Engineers of AIME, Caller No. D, Littleton, Colorado 80127.

ANS Nuclear Power Exhibit, Bal Harbour, Florida, **June 7-10, 1981**. Contact: ANS Nuclear Power Exhibit, 555 North Kensington Ave., LaGrange Park, Illinois 60525 (312/352-6611).

National Underground Space Conference, Kansas City, Kansas, **June 8-10, 1981**. Sponsored by American Underground Space Association. Contact: AUA:USCE, c/o TLH Associates, Inc., Suite 900, Minnesota Bldg., St. Paul, Minnesota 55101 (612/376-5580).

American Nuclear Society, San Francisco, California, **November 29-December 4, 1981**.

BACKGROUND INFORMATION ON DOE'S NUCLEAR WASTE MANAGEMENT PROGRAMS

The Department of Energy (DOE) is responsible for providing the technology and facilities for permanent disposal of certain radioactive wastes. Within DOE, the Deputy Assistant Secretary for Nuclear Waste Management under the Assistant Secretary for Nuclear Energy is responsible for managing the Offices and Programs concerned with nuclear waste management.

OFFICE OF WASTE OPERATIONS AND TECHNOLOGY

Programs under this office are primarily responsible for the management of radioactive waste materials, which have been accumulating for over 30 years, generated in the U.S. weapons program. These include high-level (HLW), transuranic (TRU), and low-level wastes (LLW). These programs provide for the interim storage of these materials until they can be adequately disposed of, in deep (about one-half mile) geological repositories

The Department of Energy nuclear waste management programs as of December, 1980, are shown above.

(HLW and TRU), and by burial 10 to 20 feet below grade in stabilized trenches (LLW).

High-level wastes are currently maintained, both as solids and liquids, in tanks at DOE sites (primarily at the Hanford site in Washington, Idaho National Engineering Lab, and the Savannah River Plant in South Carolina). The program provides for the eventual immobilization (solidification) of these wastes into a form suitable for final disposal in a Federal repository. TRU wastes are maintained in retrievable storage at DOE sites awaiting final disposition.

The strategy for defense low-level waste operations is to continue upgrading present DOE sites and to develop alternatives to current shallow land burial practices.

OFFICE OF WASTE ISOLATION

The DOE program for commercial waste management (and the focus of the *Activities Report*) is the NWTS program, which is described in more detail later. The objectives of this program are to build and operate facilities for the safe, permanent isolation of high-level and transuranic radioactive wastes originating from the commercial uses of nuclear energy (primarily electric power generation). The major elements of the program are (1) to develop isolation technology, (2) to recommend repository sites, (3) to design and develop the repository, and (4) to develop technology for the prerequisite treatment and packaging of waste. These same repositories or similar future ones may be used also for the permanent disposal of defense wastes once they are in a suitable solid form.

OFFICE OF TRANSPORTATION AND FUEL STORAGE

The Spent Fuel Storage Program is responsible for the storage of commercial spent nuclear fuel prior to its final disposal in keeping with the U.S. policy of deferral of reprocessing of this material. Storage requirements,

at-reactor storage capabilities, and options for existing away-from-reactor facilities are being determined.

The Transportation program was established to deal with the increasing demands and complexities of transporting nuclear materials, especially radioactive waste and spent fuel. Safe, reliable transportation equipment and facilities are needed on a schedule consistent with the schedules of the repository development program, the spent fuel storage program, and international spent fuel shipments. A systems approach will be used to evaluate technology, operational, and acceptability issues for both defense and commercial waste transportation. In the commercial sector, consistent with National policy, the availability of transportation equipment is to be sought through industry action and Government oversight.

Sandia Laboratories, designated as the lead center for DOE nuclear materials transportation activities, has set up the Transportation Technology Center (TTC) to accomplish its program objectives.

REMEDIAL ACTIONS

Piles of mill tailings (wastes remaining from the mining and processing of uranium ore) have in the past received inadequate attention with respect to disposal. Residual levels of uranium decay products, such as radioactive radon gas, have been measured in these piles in excess of federal criteria. In addition, low levels of radioactive contamination exist in old facilities involved in nuclear research or energy production. This DOE remedial actions program has been established to meet both newly acquired and inherited responsibilities related to the above situations. Specifically, the program involves: remedial actions at about 30 radioactively contaminated, formerly utilized Manhattan Engineer District and Atomic Energy Commission (MED/AEC) sites; continued remedial actions at Grand Junction, Colorado, to remove uranium mill tailings from the premises of about 800 structures where radon exposures exceed the Surgeon General's guidelines; remedial actions at 22 inactive uranium mill tailings sites to eliminate potential health hazards caused by residual levels of uranium decay products that exceed EPA criteria; and decontamination and decommissioning (D&D) of radioactively contaminated surplus DOE facilities.

This artist's perspective of a proposed nuclear waste isolation facility in salt shows surface structures (buildings, salt storage area, roads, railway track) and underground facilities (shafts, tunnels, storage rooms). **The inset** illustrates that in conventional geologic disposal, the waste package will consist of waste in a canister, buried in a hole, surrounded by overpack, filled with backfill; that the repository housing the package will lie between impervious geologic strata; and that the repository will be 2,000 feet below the surface.

- UNIFOLD DRIFTS
- MIN ENTRIES
- INE STORAGE ROOM (TYPICAL)
- INE OPERATIONS AREA
- MINER SHOPS
- MINER PARTS STORAGE
- MINER TRAVELING FACILITIES
- MINER DISTRIBUTION
- MINER OFFICES
- MINER WATCH
- MINER REST AID

National Waste Terminal Storage (NWTs) Program Structure

The Director of the Office of Waste Isolation is responsible for overall direction of the NWTs Program. This Office implements the objectives of the NWTs Program by directing and controlling activities, including budgetary allocations, of various DOE field offices and contractors.

DOE field office personnel, supported by more than 2,000 professional employees of contractors, are responsible for implementing the NWTs Program. This arrangement provides the program with experience of a broad spectrum of professionals ranging from geoscientists and mechanical engineers to sociologists and political scientists. The organizational chart shows that technology development and characterization of sites are performed by contractors who report to field operations offices.

There are three NWTs projects: the Office of Nuclear Waste Isolation (ONWI), the Basalt Waste Isolation Project (BWIP), and the Nevada Nuclear Waste Storage Investigations (NNWSI). The interrelationship of these projects is shown in the chart with their respective supporting organizations: Battelle Memorial Institute; Rockwell International; and at the Nevada Test Site (NTS), Sandia National Laboratory, Los Alamos National Laboratory, Lawrence Livermore Laboratory, and the U.S. Geological Survey. All three projects conduct independent site characterization and evaluation, leading to recommendations of preferred sites within their respective programs; they also share data and information of mutual benefit. In addition to project responsibilities, the NWTs Program Office (NPO), located in Columbus, Ohio, oversees the ONWI responsibility for generic technology direction and coordination of site investigations in the NWTs Program.

Also shown in the chart is an Interagency Working Committee on Radioactive Waste Management chaired by the Deputy Assistant Secretary for Nuclear Waste Management.

Critical events in the NWTs program are outlined in the two-page table of key dates. Two maps of the United States show regions being investigated for terminal storage of radioactive wastes and the locations of additional rock formations of interest.

The Office of Nuclear Waste Isolation (ONWI) in Columbus, Ohio, has lead responsibility in the NWTs Program structure for coordinating all

The Department of Energy nuclear waste management programs as of December, 1980, are shown above.

projects, for developing general waste disposal technology, and for conducting geologic exploration and environmental studies on land not controlled by the Department of Energy. ONWI's responsibilities include making recommendations to DOE concerning site qualification criteria, safety assessment methodologies, licensing strategies, and the collection and evaluation of data for site and repository suitability assessment. For example, the criteria which will be used for site selection, which have been circulated for public review and comment, were developed by ONWI and agreed upon by all three NWTs projects and by DOE's Office of Waste Isolation.* ONWI also plans programs and coordinates the examination of alternate disposal concepts. ONWI's work is supervised by DOE's NWTs Program Office (NPO) in Columbus.

Further details about the three main NWTs Projects appear in the following sections.

Office of Nuclear Waste Isolation (ONWI)

At the present time, the feasibility of locating repositories in various geologic formations throughout the continental United States is being evaluated under the direction of the Office of Nuclear Waste Isolation. This evaluation conforms with the President's statement of 12 February 1980: "Immediate attention will focus . . . on locating and characterizing a number of potential repository sites, in a variety of different geologic environments with diverse rock types."**

The contractors whose work is coordinated by ONWI are listed in tabular form at the end of this chapter.

Basalt Waste Isolation Project (BWIP)

The Basalt Waste Isolation Project focuses on investigating the suitability of basalt formations for waste disposal and the use of DOE's Hanford Site as a potential site for waste disposal. DOE's Richland Operations Office directs the management, quality assurance, contract administration, and

*Office of Nuclear Waste Isolation, *NWTs Program Criteria for Geologic Disposal of Nuclear Waste—Site Qualification Criteria*, ONWI-33(2), Battelle Memorial Institute, Columbus, Ohio, January, 1980.

**Presidential Message to the Congress, February 12, 1980, "Comprehensive Radioactive Waste Management Program", *Weekly Compilation of Presidential Documents*, 1980, Vol. 16, No. 7.

ABOVE.

The shaded regions above overlie geologic formations under investigation by the National Waste Terminal Storage Program.

BELOW.

The map below shows regional occurrences of major formations of additional potential interest to the National Waste Terminal Storage Program.

SITE CHARACTERIZATION

National Environmental Policy Act Actions	Hanford Site	Salt Domes	Bedded Salt	Nevada Site	Hard Rock Site	Site Characterization Actions
Environmental Assessment/ Site Characterization Plan	5/81	1/81	8/82	6/82	5/83	Completion of area studies, identify preferred locations
Draft Environmental Impact Statement (for banking*)	3/83	10/82	12/83	2/84	9/84	Completion of location studies, identify preferred sites
Detailed Site Characterization Plan; Final Environmental Impact Statement (for banking*)	2/84	7/83	9/84	11/84	6/85	Bank sites*
Detailed Site Characterization Report	3/85	9/83	4/85	6/85	12/85	Completion of site characterization work

*A site is "banked" when participants in the siting process reach a consensus on its technical, environmental, and institutional adequacy relative to established criteria and procedures have been instituted by the Department of Energy to maintain the integrity of the site through the remainder of the selection process.

SITE SELECTION**Draft Environmental Impact****Statement/Site Recommendation**

Report 12/85

Final Environmental Impact

Statement (for selection) 7/86

Site Selection 3/87

SITE ACQUISITION

Site Acquisition 9, 87

**REPOSITORY LICENSING,
CONSTRUCTION, AND OPERATION****Repository License Application to**

Nuclear Regulatory Commission 9/87

Construction Authorization from

Nuclear Regulatory Commission 9/91

Earliest Repository in Operation 7/97

Key dates in the National Waste Terminal Storage (NWTs) program (as of December, 1980) include the critical events listed on these two pages. Site characterization is followed by site selection, site acquisition, and repository licensing, construction, and operation. (Adapted from DOE/NE-0007, Proposed Rulemaking on the Storage and Disposal of Nuclear Waste-Waste Confidence Rulemaking—Statement of Position of the U.S. Department of Energy, April 15, 1980.)

data collection and evaluation of the project, with technical assistance provided by the Rockwell International Corporation. The Hanford Site, located in the Columbia Plateau of southeastern Washington, is underlain by thick basalt formations. This site was selected for study because of its present commitment to nuclear activities, the possible continued dedication of Hanford to this purpose, and the potential of basalt as an acceptable isolation medium. Technology development studies, including the evaluation of engineered and natural barriers to waste migration, also are under way. A Near-Surface Test Facility has been constructed in a basalt outcropping at Hanford to carry out in situ tests, including tests with placement of spent fuel. These tests will determine how nuclear wastes will interact with the host rock by studying the thermal, mechanical, and radiation effects on basalt, and provide engineering data to support the design and construction of a repository.

Nevada Nuclear Waste Storage Investigations (NNWSI)

The Nevada Nuclear Waste Storage Investigations project is being conducted at the Department of Energy's Nevada Test Site (NTS) in southern Nevada. The NTS provides a variety of geologic media such as granite, argillite (a compact clay rock), and tuff (a heat-fused volcanic ash). This site was selected for study because of its present commitment to nuclear activities and its geohydrologic characteristics.

NNWSI's tasks include evaluating the area's possible use for a waste repository, identifying a preferred site in a suitable geologic medium for a repository, and performing in situ testing of thermal and radiation effects of encapsulated spent fuel placed underground in a granite formation. Other studies are evaluating the effectiveness of shale, granite, and tuff as host media and the impact, if any, of ground motion from weapons testing on repository design. This work is managed by DOE's Nevada Operations Office with technical participation provided by Sandia National Laboratory, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, the U.S. Geological Survey, the Reynolds Electrical and Engineering Company, Westinghouse Electric Corp. Advanced Energy Systems Division, and NV's prime A-E support contractors, Fenix and Scisson and Holmes and Narver.

Subseabed Disposal Program

Sandia Laboratories manages the Subseabed Disposal Program under the direction of DOE's Albuquerque Operations office. The primary objective of the program is to assess the technical, environmental, and engineering feasibility of disposing of processed and packaged high-level nuclear waste and/or repackaged spent reactor fuel in geologic formations beneath the world's oceans. A secondary objective is to develop and maintain a capability to assess the seabed nuclear waste disposal programs of other nations. The program will be accomplished in four phases:

- Phase 1: Determination of technical and environmental feasibility on the basis of historical data.
- Phase 2: Determination of technical and environmental feasibility from newly acquired oceanographic and effects data.
- Phase 3: Determination of engineering feasibility
- Phase 4: Demonstration of capability.

The program has just entered Phase 2.

Management

A Program Plan is prepared annually by each NWTs component and, when approved by DOE, is a basis for each fiscal year's program. These Program Plans describe objectives, work category structures, schedules, budgets, and organizational accountabilities within the NWTs Program. Field office directives provide continuous direction or redirection, if required, to the lead contractor, supplementing his initial contractual requirements. Integration of the projects is accomplished by periodic meetings of the field office project managers and the Director of the Office of Waste Isolation. The DOE field office manager exercises direct project control through routine meetings with contractor personnel. Additional management and administrative processes, e.g., peer review and technical consultation, planning and control techniques, quality assurance procedures, configuration and data management approaches, and reporting and information control methods, are routinely used in the NWTs Program.

Where to Get Information on Nuclear Waste Isolation

In February, 1980, the President established the first comprehensive radioactive waste management program.* In keeping with the President's policy statement, an active public information program is under way to provide technical and nontechnical information to the scientific and lay publics. The purpose of this public information program is to encourage the fullest possible participation by the general public, by state and local governments, and by the scientific community, in policy or program decisions concerning the management and disposal of nuclear wastes from U.S. commercial power plants.

GENERAL INFORMATION

The Office of Nuclear Waste Isolation (ONWI) prepares and distributes printed and audiovisual materials designed for nontechnical audiences. The content and format are oriented toward governmental groups, students, the general public, and media representatives. ONWI provides staffed displays and exhibits at meetings for the general public (such as the Texas Energy Independence Fair), and at local, state, and national technical meetings of professional groups (such as the American Library Association, the American Institute of Chemical Engineers, and the American Nuclear Society). In addition, upon request, ONWI provides consultation to publications planning to publish articles about the National Waste Terminal Storage program. ONWI is maintaining media contacts by means of news releases, press facilities, briefings, and interview coordination. The ONWI speakers' bureau provides knowledgeable speakers on the subject of waste isolation.

Materials such as the following are available:

- Booklets, brochures, fact sheets, and pamphlets
- Reprints of technical papers, speeches, and articles
- Briefing books and other materials useful to officials

*Excerpts from the policy statement presented to Congress appear in the *Nuclear Waste Isolation Activities Report* for May, 1980 (pp. 1-3). The full Presidential Message to the Congress, February 12, 1980, "Comprehensive Radioactive Waste Management Program," appears in *Weekly Compilation of Presidential Documents*, 1980, Vol. 16, No. 7. To obtain a copy of the statement, contact ONWI Communications, 505 King Avenue, Columbus, Ohio 43201, phone (614) 424-4718.

- Audiovisual presentations on loan (slide shows, video tapes, motion pictures)
- Table top exhibit.

To borrow audiovisual materials, obtain a speaker, arrange for an exhibit, or obtain booklets and reprints, contact:

ONWI Communications
505 King Avenue
Columbus, Ohio 43201
(614) 424-4718

TECHNICAL INFORMATION

In addition to general information, the Office of Nuclear Waste Isolation publishes technical reports on nuclear waste isolation which result from scientific and technical investigations conducted by more than 100 subcontracting organizations. A Technical Progress Report is issued quarterly to summarize progress by these subcontracting organizations. The reports cover the subject areas of geology, hydrology, drilling, rock mechanics, and socioeconomics and licensing, among others. Reports are distributed to the public, government agencies, universities, and libraries, and are available in limited numbers to interested individuals. Readers who would like to receive the *ONWI Library Reports List* or other technical publications are invited to write or call:

ONWI Library
505 King Avenue
Columbus, Ohio 43201
(614) 424-7697

The ONWI Library is open to the public from 8 a.m. to 5 p.m., Monday through Friday. Interested users may arrange to visit the Library during these hours by contacting the Library at the above address.

LIST OF NWTS CONTRACTORS, DECEMBER, 1980

Contractor	Activity
Acres American	Nuclide transport
A. D. Little	Waste Package performance measures
Allied-General Nuclear Services (AGNS)	Security and safeguards systems; spent fuel transportation and handling studies; reprocessing studies
Argonne National Laboratory	Ceramic waste forms; brittle fracture studies
Battelle Columbus Laboratories (BCL)	Waste issues; waste acceptance criteria
Bechtel, Inc.	Regulatory Program Manager, environmental studies
Brookhaven National Laboratory	Radiation damage
Catholic University	Porous glass matrix development
Colorado School of Mines	Mining technology development
Dames & Moore	Environmental impact studies; geological and technical studies
D'Appolonia	Borehole plugging and field testing
Envirosphere	Alternate concepts; human aspects
Exxon Nuclear Idaho Co.	Alternative waste form application
Fenix and Scisson	Boreholes, tunnel and mine design
Fiber Materials	Thermal properties measurement
General Atomics	Reliability-maintainability analysis
Georgia Institute of Technology	Geothermometry
Gruy Federal	Core drilling management
Holmes and Narver	Facility design and construction
Human Affairs Research Centers (HARC)—Battelle, Seattle	Transportation impacts
IRT, Corp.	Borehole instrumentation
Intera	Performance assessment
Kaiser Engineers	Conceptual designs; retrieval analysis; cost estimate reconciliation

**LIST OF NWTs CONTRACTORS
(Continued)**

Contractor	Activity
Law Engineering and Testing Co.	Geologic Program Manager, Gulf Coast Salt Domes
Lawrence Berkeley Laboratory	Hydrology; thermodynamic properties in chemical species/waste; migration/radionuclides in geologic media; crystalline rock site search
Lawrence Livermore Laboratory	Thermal properties; fracture permeability
Lehigh University	Engineered barriers
Los Alamos Scientific Laboratory	Oklo; U-oxide mobility
Los Alamos Technical Associates	Engineering design criteria
Louisiana State University	Gulf Coast Salt Domes; geomechanics; geohydrology; exploratory drilling
National Aeronautics and Space Administration (NASA)	Space disposal
National Bureau of Standards	Properties Handbook
New York University Medical Center	Natural reactors
North Carolina State University	SYNROC investigations
NUS Corp.	Regulatory Program Manager, bedded salt; waste inventory study; environmental assessment services
Oak Ridge National Laboratory (ORNL)	Effect of water in salt repository; borehole plugging; thermal properties measurement; administrative services
Ohio State University	Instrumentation in situ tests; convective heat transfer
Oregon State University	Subseabed waste package
Pacific Northwest Laboratory	Safety assessment; materials characterization center
Parsons, Brinckerhoff, Quade & Douglas (PBQ&D)	Environmental impact studies; design services for mining and underground excavation
Pennsylvania State University	Materials studies; near-field interactions
Princeton University	Socioeconomic studies
RE/SPEC, Inc.	In situ salt tests

LIST OF NWTs CONTRACTORS (Continued)

Contractor	Activity
Reynolds Electrical & Engineering Co.	Manpower supplies
R. M. Parsons	Engineering and design services for electrical, mechanical, and stress analysis
Rockwell Energy Systems	Ceramics waste form
Rockwell-Hanford Operations	Spent fuel handling and packaging
Rocky Flats Plant	Waste immobilization
Sandia Labs	Borehole plugging; canister studies
Savannah River Laboratory	Southeastern site studies; earthquake studies; alternative waste form assessment
Science Applications, Inc. (SAI)	Thermomechanical model; engineered barriers; horizontal emplacement; issues studies; retrieval period rationale
Southern Science Applications	Regional repositories; GEIS Revision
South Dakota School of Mines	Bench scale creep testing
Stanford Research Institute	Very deep hole
Stearns-Roger	Salt dome assessment
Stone & Webster	Geologic Program Manager, Salina Basin
Syracuse University	Computer analysis/porosity of rock strata
Terra Tek	Flatjack tests
Texas A & M	Transient creep in rock salt
Texas Bureau of Economic Geology	Permian Basin; East Texas Salt Domes; salt test facility feasibility
The Analytic Science Corp.	System safety and risk analysis
TRW, Inc.	Cost data analysis; NWTs Program Plan; alternate concepts; spent fuel charge calculation
University of Arizona	Chlorine dating
University of California	Institution design regulation concept; brine migration model

LIST OF NWTS CONTRACTORS
(Continued)

Contractor	Activity
University of Florida	Waste form deterioration
University of Minnesota	Displacement/discontinuities; rock mechanics models
U.S. Army Corps. of Engineers	Evaluation/survey of geologic systems
U.S. Department of Agriculture	Site specific socioeconomic impacts
U.S. Geological Survey	Borehole geophysics; hydrology; mineral characteristics; geochemical; thermal properties; exploration of candidate geologic system
Utah Geologic and Mineral Survey	Exploratory/survey of candidate geologic systems
Westinghouse	Waste package design
Woods Hole Oceanographic Institute	Characterization of subscaled sites
Woodward-Clyde	Geologic Program Manager, Paradox Basin; national screening for repository

NUCLEAR WASTE ISOLATION **Activities Report**

The *Nuclear Waste Isolation Activities Report* is prepared for the Department of Energy by the Office of Nuclear Waste Isolation, which is managed for DOE by the Battelle Memorial Institute in Columbus, Ohio. The *Report* provides information about DOE's National Waste Terminal Storage program to researchers, decision makers, NWTS program participants, and the general public. The *Report* contains current information on such topics as ongoing research, organizational changes, new technological developments, upcoming meetings, current literature on nuclear waste management, translations of foreign literature, and developments related to NWTS program activities. The *Report* is not a newsletter or periodical issued on a scheduled basis, but rather is issued as warranted by events. Previous reports in the series, described below, are available while the supply lasts from the address at the bottom of the page:

Date of Issue**Report Topic**

May, 1980

Technical Activities of the NWTS
Program, 31 pp.

Send comments and requests for copies to:

Beverly A. Rawles, Editor
Nuclear Waste Isolation Activities Report
Office of Nuclear Waste Isolation
505 King Avenue
Columbus, Ohio 43201