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FALL 1995

OCRWM BULLETIN

A Report from the U.S. Department of Energy's Office of Civilian Radioactive Waste Management

REGULATORY DROP TESTS PLANNED FOR A MODEL TRANSPORTATION CASK

The Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) has been developing advanced-technology high-capacity legal-weight truck casks that will be used to transport spent nuclear fuel from commercial nuclear power reactor sites that cannot accommodate rail shipments. This fall, regulatory drop tests of a model cask will be performed at Maxwell Laboratories, Inc., in San Diego, California.

Workers assembling the GA-4 half-scale cask model

General Atomics (GA), under contract to OCRWM, is currently developing the GA-4 and GA-9 legal-weight truck spent nuclear fuel shipping casks. The total gross vehicle weight, that is, the weight of the loaded cask, tractor, and trailer, is less than 80,000 pounds, thereby avoiding the necessity of overweight permitting for highway transport.

The spent nuclear fuel casks, which are heavy thick-walled steel containers, are being designed to withstand severe thermal and impact loads typical of transport accidents. Some of the cask designs include lead or depleted uranium for radiation shielding. As part of the design process, the cask designer must submit a Safety Analysis Report (SAR) that justifies the structural, thermal, containment, criticality, and shielding integrity of the cask to the U.S. Nuclear Regulatory Commission (NRC). The NRC performs an independent evaluation of the cask design, and, based in part on the information in the SAR, certifies the design.

A series of rigorous hypothetical accident events was developed to demonstrate and verify the performance of the cask design (accident conditions are described in the Code of Federal Regulations, 10 CFR Part 71). To

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Published by the U.S. Department of Energy's (DOE) Office of Civilian Radioactive Waste Management (OCRWM). To be placed on the *Bulletin* mailing list, make address corrections, obtain information about the national program, or order copies of the *Bulletin* or the new publications listed in the *Bulletin*, please contact the OCRWM National Information Center, 600 Maryland Avenue, SW, Suite 760, Washington, DC 20024, 1-800-225-6972 or 202-488-6720 in Washington, DC. You may also write to DOE, OCRWM, Administration Division, RW-15, 1000 Independence Ave., SW, Washington, DC 20585, or access OCRWM electronically through its Home Page: http://www.rw.doe.gov.

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MASTER

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analyze the casks, General Atomics has been using sophisticated computer models to simulate loading conditions resulting from the hypothetical accident events. The results of computer models of the cask are compared with acceptance criteria, which are based on established design practices.

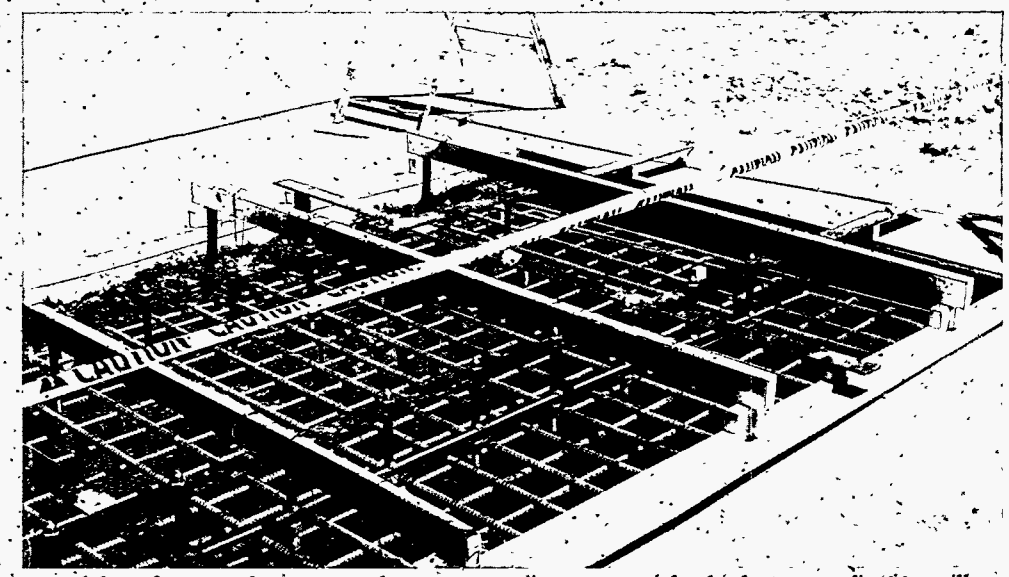
In addition to these mathematical models, engineers are preparing to perform drop tests at Maxwell Laboratories in San Diego using a scale model of the GA-4 cask design. A scale of one-half was selected for the model. Although a smaller one-quarter scale model would satisfy scaling laws, it would present significant fabrication challenges.

The GA-4 half-scale model replicates the following components: a cask body, a depleted uranium gamma shield, an inner liner, a fuel support structure, closure lid and seals, and aluminum honeycomb impact limiters. To simulate a fuel assembly, the model includes four dummy fuel assemblies comprised of steel and aluminum rods. The model weighs 3,120 kilograms (6,875 pounds), is approximately 3-meters (117-inches) long, and measures approximately 115-centimeters (45-inches) wide. While the model was being fabricated, valuable manufacturing experience with the advance technology cask was gained. Fabrication of the scale model and impact limiters will be completed during October 1995.

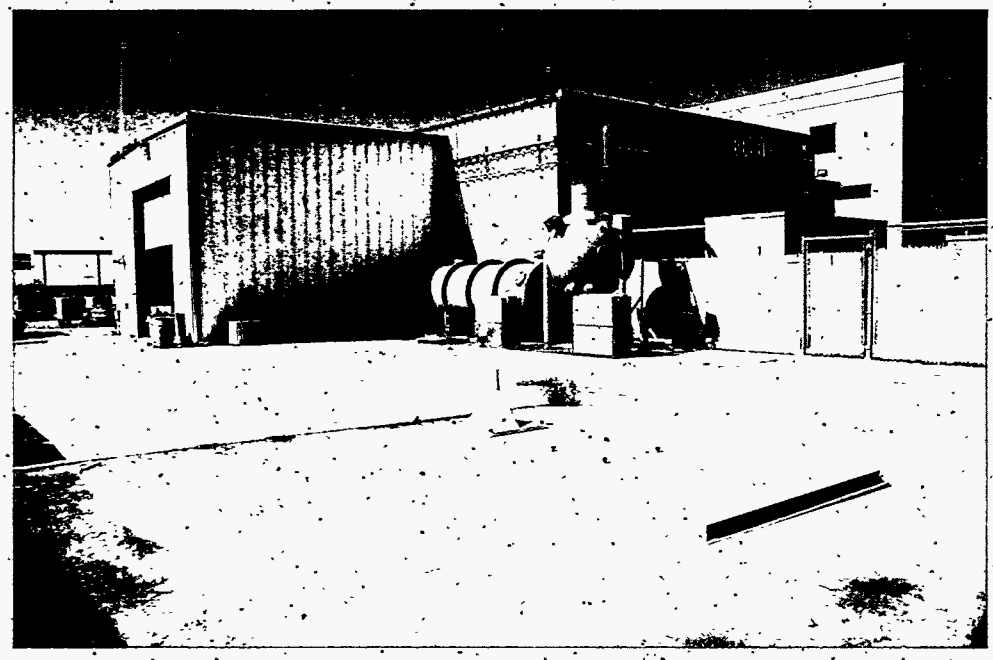
In preparation for the regulatory drop tests, a steel reinforced concrete drop pad was constructed at Maxwell's facilities. The weight of the pad is more than ten times the weight of the model. The pad provides an essentially unyielding surface for the regulatory tests. When the model strikes the essentially unyielding surface, all the energy of the impact is absorbed by the cask model.

At Maxwell, engineers will conduct several drop and puncture tests. The cask model will be dropped from 9 meters (30 feet) at various orientations onto the test pad, followed by a drop onto a steel rod from a 1-meter (40-inch) height. Deformation, strain, and acceleration data will be collected at various points on the cask. These data will be used to verify the cask design analyses. The results of these tests should generally demonstrate the conservatism of the analytical methods used to show that the cask design meets the NRC regulatory criteria. Although the casks are designed by analysis and structural tests are not required by NRC, the results will provide important information supporting prompt certification of GA-4 and GA-9 truck casks.

Scale-model testing is expected to reach completion in 1995. ■



Steel reinforcing rods are put in place prior to pouring concrete for the drop test pad at Maxwell Laboratories, Inc. The drop-test pad simulates an essentially unyielding surface.



Steel reinforced concrete drop-test pad

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Implementation Plan for the Environmental Impact Statement for a Multi-Purpose Canister System for Management of Civilian and Naval Spent Nuclear Fuel Issued

The U.S. Department of Energy's (DOE) Office of Civilian Radioactive Waste Management (OCRWM) is preparing an Environmental Impact Statement (EIS) for a proposal to develop a standardized container system for the storage, transportation, and disposal of spent nuclear fuel from commercial and naval reactors. The Notice of Availability for the Multi-Purpose Canister Environmental Impact Statement Implementation Plan, also known as the MPC EIS IP, was published in the *Federal Register* on August 30, 1995. The Implementation Plan records the results of the scoping process and serves as a plan for the preparation of the EIS. Copies of the Plan were distributed to approximately 1,200 stakeholders and 22 DOE Public Reading Rooms. Additional copies can be obtained by calling 1-800-672-3304.

An MPC is a metal container that can be loaded with spent nuclear fuel assemblies, sealed, and placed into a transportation cask for shipment and inside separate overpacks for storage and disposal. MPCs would be made available to nuclear utilities for commercial spent nuclear fuel and to the Idaho National Engineering Laboratory for naval spent nuclear fuel.

An EIS is an environmental document required to comply with the National Environmental Policy Act (NEPA), DOE's regulations implementing NEPA, and the Council of Environmental Quality's regulations for implementing NEPA. The NEPA process, as defined in these laws and regulations, requires preparation of an EIS for proposed Federal actions that may significantly affect the human environment. The NEPA review process provides opportunities for public participation in the scoping for, and review of, an EIS.

In late 1994, OCRWM held a series of public meetings to define the scope of the EIS for the MPC system. During the public scoping period, OCRWM received more than 2,800 comments from approximately 400 sources. The greatest number of comments focused on issues related to transportation, materials, manufacturing, regulatory requirements, and public health and safety. As a result of the comments received, three key changes were made in the scope of the EIS. The first two changes were adding two additional alternative systems to be considered in the EIS; the third was the expansion of the EIS to include naval spent nuclear fuel.

The MPC EIS IP consists of the following sections:

- Description of the scope of the EIS
- Discussion of other EISs and Environmental Assessments related to spent nuclear fuel and the Nevada Test Site
- Description of the purpose and need for action
- Summary of the scoping activities and public participation in the EIS scoping process
- Description of the proposed action and alternatives
- Identification of cooperating and consulting agencies

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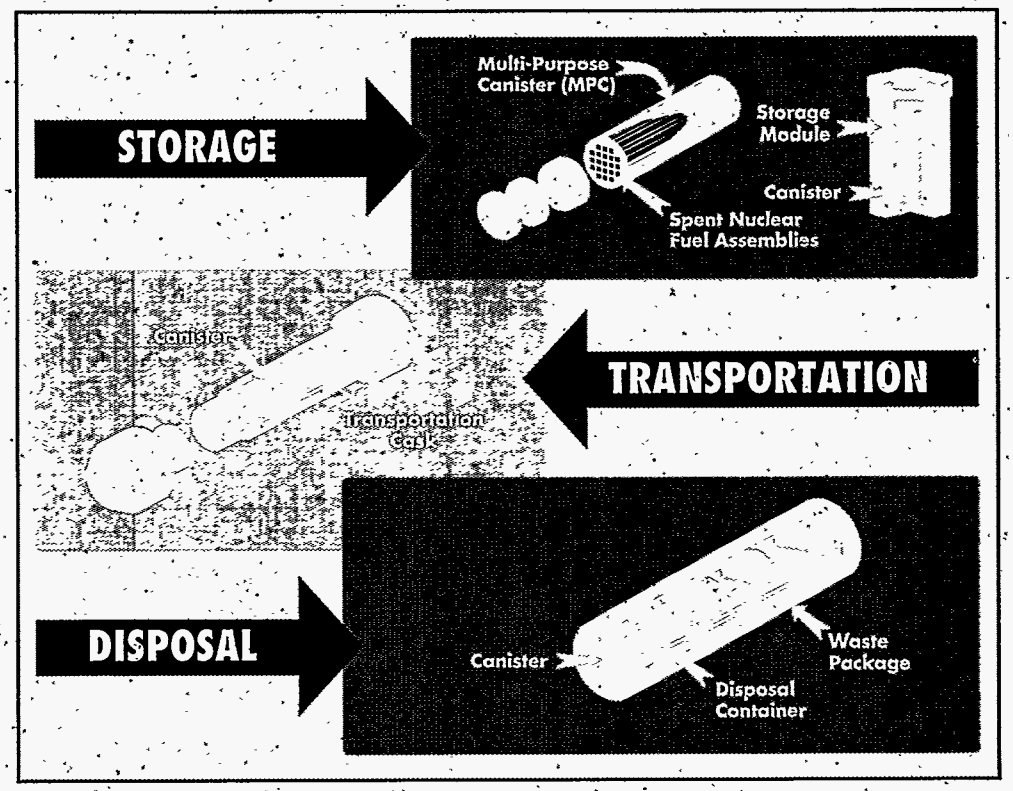

Conceptual Multi-Purpose Canister-Based System

Nuclear Waste Technical Review Board (NWTRB) Update

The most recent report from the Nuclear Waste Technical Review Board (the Board), issued on March 31, 1995, included 16 specific recommendations for the Civilian Radioactive Waste Management program. These recommendations addressed various aspects of the program, including the continued development and articulation of a waste isolation strategy, a repository thermal loading strategy, testing requirements prior to a site-suitability decision, the management and construction of an exploratory studies facility, repository requirements for defense waste, revised total system life cycle costs, and the use of total system performance assessments to guide site characterization and to set priorities. These recommendations, along with other comments and suggestions made by the Board, are being addressed by the Civilian Radioactive Waste Management program.

Since April 1995, the program has interacted with the Board in open public forums at two Full Board meetings and four Panel meetings. Topics discussed during these meetings included the status of the exploratory studies facility, repository operation and conceptual design, repository licensing, an independent management and financial review of the Yucca Mountain Project, fracture flow and transport in arid regions, system safety, human factors, transportation, engineered barrier systems, and perceived risk. During the April 19, 1995, Full Board meeting, Dr. Daniel Dreyfus, Director of the

The NWTRB

The Nuclear Waste Technical Review Board (the Board) was established as an independent Federal entity by the Nuclear Waste Policy Act of 1982, as amended. The Board is responsible for evaluating the technical and scientific validity of the activities undertaken by the Office of Civilian Radioactive Waste Management (OCRWM). It is required to report its findings, conclusions, and recommendations to Congress and the Secretary of Energy at least twice each year. To date, the Board has issued 11 reports that have included 143 specific recommendations. The Department responds formally to all of the Board's recommendations, and its responses are normally printed as an appendix in the Board's subsequent report.

To facilitate its review of OCRWM's diverse technical and scientific activities, the Board is organized into seven panels of two or more Board members. These panels and the Full Board meet periodically in an open forum to hear testimony from program participants and other parties, and to discuss various aspects of OCRWM's waste management and disposal program. The Board's meetings provide an opportunity for OCRWM to discuss its plans and receive comments and recommendations early in the decision-making process.

This past summer, the Board underwent several changes. Three new members were appointed by President Clinton on June 29, 1995: Jared L. Cohon, John W. Arendt, and Jeffrey J. Wong.

Dr. Jared L. Cohon of Connecticut is currently the Dean of the School of Forestry and Environmental Studies at Yale University. He is a national authority in the area of environmental systems analysis and water resources, and has previously served as Legislative Assistant for Energy and Environment to Senator Daniel Patrick Moynihan. Dr. Cohon has performed extensive research in the area of nuclear waste shipping and storage.

Mr. John W. Arendt of Tennessee is a private consultant with extensive experience in uranium processing, handling, accountability, shipping, and production. Previously, he worked with Union Carbide as a senior engineer for nearly 40 years. At Union Carbide, he provided technical and management assistance in the field of uranium enrichment operations, standards, waste management, reactor activities, quality assurance/quality control, uranium handling, shipping, and safeguards/accountability.

Dr. Jeffrey J. Wong of California is currently responsible for the Office of Scientific Affairs within the Department of Toxic Substances Control of the California Environmental Protection Agency. He has served as the Science Advisor to the Director of the Department of Toxic Substances Control, and has more than 16 years of experience in the area of toxicology, including assessment of risks associated with exposures at hazardous waste sites and facilities.

Other recent changes to the Board staff include the appointment on July 24, 1995, of Michael Carroll as Director for Administration, and the retirement—after 32 years of Federal service—of Dennis G. Condie, Deputy Executive Director, effective August 30, 1995. ■

Office of Civilian Radioactive Waste Management (OCRWM) discussed OCRWM's current plans and outlook. In his remarks, Dr. Dreyfus made the following key points.

Technical Issues

Dr. Dreyfus stated that OCRWM recognizes that many of the technical strategies to address complex issues facing the program are not fully developed. He noted that the Board's recent letters specifically highlighted two recurrent themes: (1) the need for a better articulated waste isolation strategy, and (2) a better definition of OCRWM's thermal loading strategy. A third issue, which has become more prominent as a result of the publicity it received in *The New York Times*, was criticality safety.

Dr. Dreyfus stated that OCRWM "must recognize that, in most cases, definitive positions on the crosscutting strategies have not yet been established. In our publications and briefings, we are still presenting working hypotheses, which are being refined or revised as greater understanding is gained. We expect that we will have to modify our current strategies as new data are obtained and analyzed."

Waste Isolation Strategy

With regard to OCRWM's waste isolation strategy, Dr. Dreyfus explained that OCRWM is defining its strategy to a level of detail that is sufficient enough to enable an educated observer to understand the rationale for decisions related to design and site characterization activities. OCRWM will use this strategy to focus site characterization activities on the key uncertainties it faces in evaluating the suitability of the site and designing the repository. The strategy will utilize a defense-in-depth philosophy consistent with the U.S. Nuclear Regulatory Commission's regulations. The capabilities of the natural system, as well as engineered systems, will be utilized. Dr. Dreyfus noted that OCRWM's goal is "to develop a waste package that will provide containment of the radionuclides for well in excess of 1,000 years with a high degree of confidence, and which will provide gradual release thereafter." He went on to say that "the greater integrity intended for the engineered system, which is consistent with the Board's recommendations, has led to some concern that we are de-emphasizing comprehension of the natural barriers. We are not. Engineering solutions are not likely to replace reliance upon the natural environment over the very long term."

Criticality Safety

On the topic of criticality safety, Dr. Dreyfus stated that the Los Alamos debate and the recent *New York Times* article raised the criticality issue to national visibility. "Criticality control, of course, has always been a consideration in our program. It is required by regulations for the entire waste management cycle: storage, transportation, and for disposal for the period of substantially complete containment in the waste package and longer-term after containment may be lost. The issue raised in the current debate—selective accumulation of fissile isotopes into a critical mass in a geologic repository setting—was the subject of studies as early as 1978 and 1981. It is not a newly discovered concept." Dr. Dreyfus went on to say that "certainly, the criticality issue must be resolved in the design of a repository."

OCRWM will closely follow the ongoing scientific debate, noted Dr. Dreyfus. The discussions thus far involve a variety of evaluations of the risk involved in the geologic disposal of weapons material. Dr. Dreyfus stated that OCRWM "intends to take seriously the possible risk of nuclear explosions in the proposed Yucca Mountain repository" and that the topic will be included in OCRWM's evaluation of long-term criticality control. OCRWM will conduct whatever technical work is needed in its program to resolve the issue. If it turns out that there is a non-negligible risk, OCRWM will evaluate it and act accordingly, to ensure protection of the public health and safety and the environment.

In concluding his remarks to the Board, Dr. Dreyfus stated that OCRWM is "charged with the first line responsibility of deciding if the Yucca Mountain site, and, indeed, the general concept is suitable for geologic storage, makes sense for the Nation. We must maintain a skeptical and objective viewpoint about all of the issues until we have satisfied ourselves. Then, if we are satisfied, we have a responsibility to design and propose the best project that we can conceive of, and to describe it as objectively and clearly as possible, so that the final judgment made in the political and regulatory arenas will be an informed judgment.

"The proper relationship between this program, its advisors and regulators, and the public, ought to be one of collaboration on the first determination that we must make—technical site suitability in 1998. The relationship ought not to be an adversarial one, in which we try to make it work and the oversight bodies try to prove us wrong. The public interest deserves the constructive input of all knowledgeable participants in an undertaking of this consequence."

Since Dr. Dreyfus' discussion with the Board at its April meeting, the repository thermal loading strategy has continued to evolve. The proposed strategy is to focus current design activities on a reference design thermal load that will permit emplacement of at least the statutory maximum within the primary repository area and will produce dry conditions around the waste packages. The current working hypothesis is that an areal mass loading of 80-100 metric tons of uranium per acre will satisfy both repository loading and

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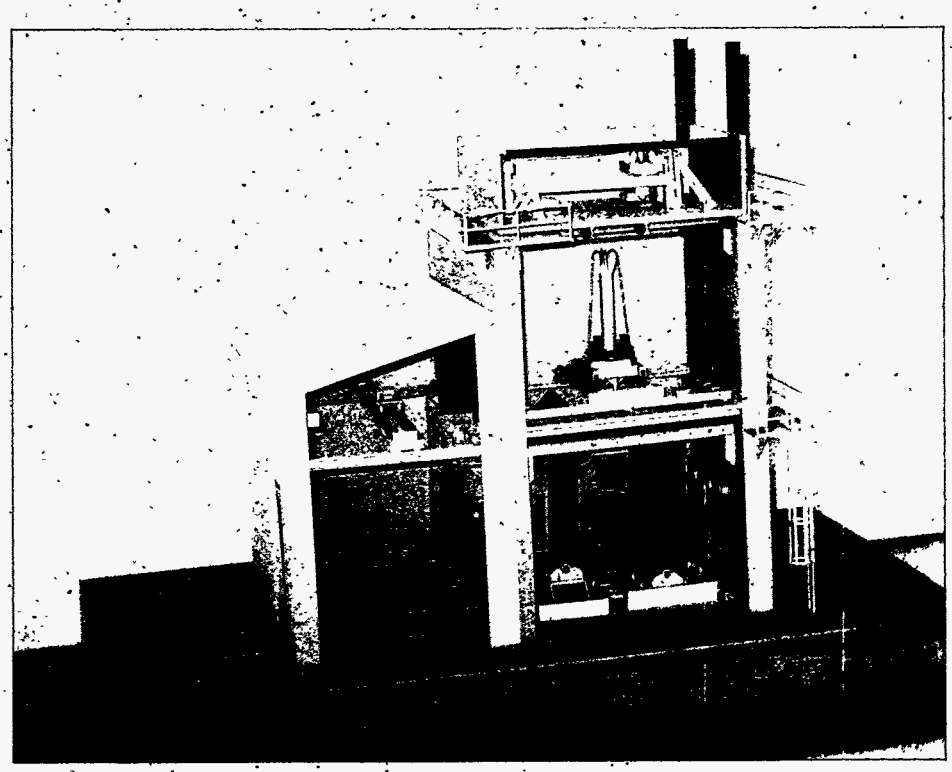
Dry Transfer System Design Under Way

The U.S. Department of Energy's (DOE) Office of Civilian Radioactive Waste (OCRWM) is currently engaged in a cooperative agreement with the Electric Power Research Institute (EPRI) to design a spent nuclear fuel dry transfer system. The design for this system is being developed by Transnuclear, Inc., under a subcontract from EPRI. The system will enable the transfer of individual spent nuclear fuel assemblies from a conventional top loading transfer cask to a multi-purpose canister (MPC) in a shielded overpack, or accommodate spent nuclear fuel transfers between two conventional casks.



OCRWM/EPRI Dry Transfer System

A dry transfer system has several significant applications and could benefit the Federal waste management system and utilities in a number of ways. It has the potential to:

- Allow recovery operations at shut-down reactor sites with independent spent nuclear fuel storage installations
- Provide a means for utilities that can presently handle only a truck cask to utilize a rail cask
- Permit the deployment of the larger capacity 125-ton MPC at reactor sites that would otherwise be limited to the 75-ton MPC
- Allow transfers of spent nuclear fuel from existing utility on-site storage casks/canisters into MPCs without returning to the reactor storage pool
- Support existing or future DOE and OCRWM spent nuclear fuel management activities.

On July 14, 1995, OCRWM published a *Federal Register* Notice titled "Notice of Prototype Spent Nuclear Fuel Dry Transfer System Project" (60 FR 36267). That notice invited letters of interest in participating with DOE in the cooperative project for prototype fabrication, demonstration, and/or licensing of a spent nuclear fuel dry transfer system currently being designed under the cooperative agreement between DOE and EPRI. Although the due date for letters of interest was September 22, 1995 (extended from August 30, 1995, through a second *Federal Register* Notice, 60 FR 45710), information on the prototype project can still be obtained by contacting Michelle Miskinis, Headquarters Procurement Operations, at the U.S. Department of Energy, 1000 Independence Avenue, SW, Washington, D.C. 20585, Attention HR 561.21. Ms. Miskinis can also be reached at (202) 634-4413. To receive a copy of either of the *Federal Register* Notices listed above, contact the OCRWM National Information Center at 1-800-225-6972 (in Washington, D.C., 488-6720) or in writing at 600 Maryland Avenue, SW, Suite 760, Washington, D.C. 20024. The notices may also be obtained through the Internet via OCRWM's Home Page at http://www.rw.doe.gov. ■

Second Edition of the OCRWM Resource Curriculum Now Available

The Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) recently released the second edition of *Science, Society, and America's Nuclear Waste*, a four-unit resource curriculum designed primarily for secondary students and their educators.

For the new school year, a revised and updated version of the curriculum's Teacher Guide is now available. When revising the curriculum, the statistical information was updated to make it current through July 1995. Both the new Teacher Guide and Student Readers are available to all requestors free of charge.

"*Science, Society, and America's Nuclear Waste* applies science to real-world events," said science teacher Pat DeRoos of Oak Ridge, Tennessee. "It's not just theory, or pie-in-the-sky, it's reality. These materials are relevant. They allow students to consider the politics of science in everyday life."

The curriculum and its supporting classroom activities and teaching materials encourage discussion and thought on a number of topics, such as the following:

- Energy and electricity generation, including electricity produced by nuclear powerplants
- Information on sources, amounts, locations, and characteristics of spent nuclear fuel and high-level radioactive waste
- Sources, types, and effects of radiation
- U.S. policy for managing and disposing of spent nuclear fuel and high-level radioactive waste and what other countries are doing
- Components of the nuclear waste management system.

"I teach eighth-grade science, and we discuss environmental issues," said Kathy Timms of Winneboro, South Carolina. "Nuclear waste management is becoming one of our top environmental issues. The students we teach are becoming consumers; they are going to be voters one day. They need to know the scientific background, the implications of what nuclear energy is, and the waste it produces."

The four units of *Science, Society and America's Nuclear Waste* can be used in their entirety or selectively, depending on student background, ability,

"Curriculum" continued on page 12

New Publications

To order any of the publications listed below, free of charge, contact the OCRWM National Information Center at 1-800-225-6972 or, in Washington, D.C., (202) 488-6720. In writing, send requests to the Center at 600 Maryland Avenue, SW, Suite 760, Washington, D.C. 20024.

Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program, U.S. Department of Energy, DOE/RW-0479, September 1995. This report documents the total system life cycle cost estimate of one concept for the Civilian Radioactive Waste Management System. The concept examined was a surrogate single repository system using multi-purpose canisters without interim storage.

Implementation Plan for the Environmental Impact Statement for a Multi-Purpose Canister System for Management of Civilian and Naval Spent Nuclear Fuel, U.S. Department of Energy, DOE/RW-0475, August 1995. The *Implementation Plan* is the Department of Energy's proposal to develop a multi-purpose canister for storage, transportation, and disposal of spent nuclear fuel from commercial and naval reactors (see related article in this issue for more information).

Program Funding (fact sheet), U.S. Department of Energy, DOE/RW-330P, Rev.1, July 1995. This two-sided fact sheet describes the three sources of OCRWM program funding and notes the program's accrued revenues as of September 30, 1994.

Spent Fuel Storage Requirements 1994-2042, U.S. Department of Energy, DOE/RW-0431, Rev. 1, June 1995. In this document, historical inventories of spent nuclear fuel are combined with U.S. Department of Energy projections of future discharges from commercial nuclear reactors in the United States to provide estimates of spent nuclear fuel storage requirements through the year 2042. Existing and future dry storage facilities are also discussed.

New Videotapes

Yucca Mountain Project: Why Study Yucca Mountain? To Solve an Environmental Problem, U.S. Department of Energy, May 1995 (playing time: 13:00). This videotape seeks to answer commonly asked questions concerning the Yucca Mountain Project, and explains the measures being taken to discover whether high-level radioactive waste could be stored safely at the potential site for the Nation's first repository. ■

Science, Society, and America's Nuclear Waste

SECOND EDITION
RESOURCE CURRICULUM

The U.S. Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) curriculum addresses scientific and social issues related to the safe management of spent nuclear fuel and high-level radioactive waste. For more information, call 1.800.225.6972 (in Washington, DC, 202.488.6720) or write to the:

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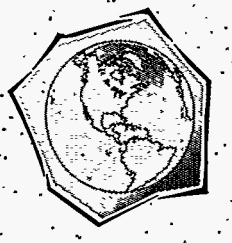


OCRWM PARTICIPATES IN GLOBAL '95 INTERNATIONAL CONFERENCE

Susan Smith, Special Assistant to the Director of the Office of Civilian Radioactive Waste Management (OCRWM), spoke on the topic of nuclear waste disposal in the United States at the Global '95 International Conference held in France on September 13. The purpose of the conference was to provide an international technical forum for a global view and assessment of options regarding the back-end of the fuel cycle of future nuclear systems. Speakers from Sweden, Japan, and Switzerland, as well as France, participated in a panel discussion.

During her presentation, Ms. Smith addressed the storage, transportation, and disposal of high-level radioactive waste in the United States; provided an overview of the United States' radioactive waste management program; and outlined the challenges facing the program and the Department of Energy's new approach to meeting them. She also included a brief discussion on the technological advances OCRWM is making in the areas of waste acceptance and storage, and in evaluating the scientific and technical suitability of the Yucca Mountain, Nevada, site for a geologic repository. Ms. Smith concluded her presentation by addressing legislative initiatives pending in the United States Congress.

To receive a copy of the paper Ms. Smith presented, titled "Nuclear Waste Disposal in the United States," contact the OCRWM National Information Center at 1-800-225-6972 (202-488-6720 in Washington, D.C.). ■

"SECTION 180(C)" INFORMATION AVAILABLE

In a continuing effort to include stakeholders in pre-decisional discussions while carrying out its requirements to provide technical assistance and funding for training, under Section 180(c) of the Nuclear Waste Policy Act, the Office of Civilian Radioactive Waste Management (OCRWM) announced to the public, via the *Federal Register* on July 18, 1995, supplemental information on options for policy and procedures to implement Section 180(c). A previous notice issued on January 3, 1995, briefly described these options for establishing Section 180(c) policy and procedures.

The purpose of Section 180(c) is to implement a program of technical assistance and funding to States for training for public safety officials of appropriate units of local government and Indian Tribes, through whose jurisdictions OCRWM plans to transport spent nuclear fuel or high-level radioactive waste. The training would cover both safe routine transportation and emergency response procedures. After public comments in response to the July 18, 1995, *Federal Register* notice are received (the deadline for submitting comments was September 30, 1995), OCRWM intends to prepare a Notice of Proposed Policy and Procedures for the Section 180(c) program. The publication of this notice is scheduled for early 1996.

Any questions concerning the *Federal Register* notice should be directed to Corinne Macaluso, OCRWM, at (202) 586-2837. To receive an information packet related to Section 180(c), contact the OCRWM National Information Center at 1-800-225-6972 (202-488-6720 in Washington, D.C.). Written requests may be addressed to the Center at 600 Maryland Avenue, SW, Suite 760, Washington, D.C., 20024, or through the Internet at http://www.rw.doe.gov. ■

Workshop on Routing Shipments of Spent Nuclear Fuel To Be Held In November

In Charlotte, North Carolina, on November 15, 1995, the Council of State Governments' Midwestern High-Level Radioactive Waste Committee and the Southern States Energy Board Advisory Committee on Radioactive Materials Transportation will convene a 1-day workshop on the routing of shipments of spent nuclear fuel.

The workshop will feature speakers from the U.S. Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM), the U.S. Department of Transportation, and State agencies involved in routing. In addition, workshop attendees will participate in a routing exercise designed to familiarize State agency officials with the process of selecting national highway and rail routes for shipments of spent nuclear fuel.

The committees will meet separately on Thursday, November 16, to discuss regional issues regarding radioactive waste transportation. Representatives of OCRWM will brief the committees on recent developments in the Federal waste management program.

For more information on the workshop or regional cooperative agreement group meetings, please contact Markus Popa, OCRWM, at (202) 586-5330. ■

"Review Board" continued from page 5

dry condition criteria. As a working hypothesis, the strategy will maintain prudent levels of flexibility by including alternative areal mass loadings through design options and variations in operational parameters. As laboratory and field test data become available and more refined analyses are performed, a preferred thermal load ultimately will be selected.

The preferred thermal loading ultimately will be selected based upon evaluations of the reference design thermal load and alternative thermal loads. System studies will provide the technical basis for the thermal loading decision through evaluations that consider performance, cost, schedule, and operability. Contingency planning and risk assessment will be evaluated.

To inquire about other or upcoming interactions with the Nuclear Waste Technical Review Board, contact the OCRWM National Information Center at 1-800-225-6972. In Washington, D.C., call (202) 488-6720. ■

New General Manager of OCRWM's Management and Operating Contractor Appointed

On August 1, 1995, Dr. Robert L. Strickler became the new President and General Manager of TRW Environmental Safety Systems Inc., the Office of Civilian Radioactive Waste Management's management and operating (M&O) contractor. Dr. Strickler has more than 25 years of expertise in the management of large, complex systems and engineering projects.

Prior to his appointment, Dr. Strickler was the M&O's Vice President and Deputy General Manager. Before joining the M&O, he was the Vice President and General Manager of TRW's Ballistic Missiles Division (BMD) in San Bernadino, California, where he was responsible for TRW's largest systems engineering project, the Intercontinental Ballistic Missile program. Among Dr. Strickler's assignments at BMD was the study and development of deep underground missile basing concepts, including the design, demonstration, and construction of rapid egress missile launch tunnels with tunnel boring machines at the Nevada Test Site. ■

1995

Information listed here is obtained from internal and external sources that are considered reliable, but accuracy is not guaranteed. This information is current as of September 29, 1995. For most current information, call (202) 488-6720.

OCTOBER

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
30	1	2	3	4 DOE Fall Headquarters/ Field Joint Indian Issues Points-of-Contact Meeting Denver, CO →	5 OCRWM Public Scoping Meeting on Repository EIS Salt Lake City, UT (O) →	6 →
7	8	9 *Columbus Day Holiday*	10 DOE/NRC Disposal Criticality Technical Exchange Rockville, MD	11 OCRWM Public Scoping Meeting on Repository EIS Baltimore, MD (O)	12 National Academy of Science/ National Research Council Commission on Geosciences, Environment, and Resources Washington, DC [Speaker - Dreyfus]	13 OCRWM Public Scoping Meeting on Repository EIS Albany, NY (O)
14	15	16	17 NWTRB Full Board Meeting, Arlington, VA [Speaker - Dreyfus] → OCRWM Public Scoping Mtg. on Repository EIS, Atlanta, GA (O) Natl. Acad. of Science (NAS) Board on Radioactive Waste Mgmt., Washington, DC [Speaker - Dreyfus]	18 →	19	20 OCRWM Public Scoping Meeting on Repository EIS Kansas City, MO (O) Council of State Govts. Eastern Regional Conference Northeast HLRW Committee Boston, MA
21 Open House, Yucca Mountain Las Vegas, NV	22	23	24 OCRWM Public Scoping Meeting on Repository EIS Tonopah, NV (O) Public Meeting on Nuclear Power Safety Oak Harbor, OH DOE/NRC Advisory Committee on Nuclear Waste Meeting Las Vegas, NV →	25 →	26 OCRWM Director's Program Review Washington, DC/Las Vegas, NV/ Dunn Loring, VA (O) *(Videoconference)* →	27
28	29 NCAI Annual Convention San Diego, CA → American Nuclear Society Winter Meeting San Francisco, CA [Speaker - Saltzman, October 30] →	30	31	1 DOE/NRC Quality Assurance Washington, DC/Las Vegas, NV *(Videoconference)*	2 →	3 →

OCRWM-sponsored meeting codes: (P) Public Participation Meeting (O) Open to the Public [Name]- OCRWM Speaker

1995 NOVEMBER

Information listed here is obtained from internal and external sources that are considered reliable, but accuracy is not guaranteed. This information is current as of September 29, 1995. For most current information, call (202) 488-6720.

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
28	29 NCAI Annual Convention San Diego, CA American Nuclear Society Winter Meeting San Francisco, CA	30	31	1 DOE/NRC Quality Assurance Washington, DC/Las Vegas, NV *(Videoconference)*	2	3
4	5	6 MIT University ANS Informal Seminar Cambridge, MA **[Speaker - Dreyfus]**	7 Western Interstate Energy Board (WIEB) Advisory Committee on Radioactive Materials Transportation Meeting, Las Vegas, NV DOE/NRC Technical Exchange Key Technical Uncertainties/Issues, Location: TBD (tentative)	8 DOE/NRC Bi-Monthly Exploratory Studies Facility (ESF) Technical Meeting Washington, DC/Las Vegas, NV *(Videoconference)*	9	10 *Veteran's Day Holiday Observed*
11 NARUC Nuclear Waste Workshop New Orleans, LA **[Speaker - Dreyfus]**	12 NARUC Annual Conference New Orleans, LA **[Speaker - Barrett, November 15]**	13	14 DOE/NRC Geophysics & Tectonics Models Technical Exchange, Rockville, MD (Tent.)	15 DOE/NRC Advisory Committee on Nuclear Waste Rockville, MD SSEB/CSG Midwest Advisory Committees on Radioactive Materials Transportation Mtg. Charlotte, NC	16	17
18	19	20	21	22	23 *Thanksgiving Day Holiday*	24
25	26	27	28	29	30	1

OCRWM-sponsored meeting codes: **(P)** Public Participation Meeting **(O)** Open to the Public [Name] OCRWM Speaker

"Canister" continued from page 3

- Identification of organizations preparing the EIS
- Proposed outline of the EIS
- Target schedule for development of the EIS.

Three primary appendices are also incorporated into the MPC EIS IP:

- A summary of public comments received during scoping and the relationship of comments to the scope of the EIS
- A discussion of technical approaches to be used in the impact assessment
- A copy of the Notice of Intent, with a list of reading rooms and information centers on the EIS.

The MPC EIS IP will serve as an important tool in helping the public follow the NEPA process. OCRWM's next steps will be to release a draft MPC EIS in December 1995 for public comment, conduct public hearings on the draft MPC EIS in January and February 1996, and issue the final MPC EIS and Record of Decision in the fall of 1996.

To receive a folder of 11 fact sheets related to the MPC EIS, contact the OCRWM National Information Center at 1-800-225-6972 (202-488-6720 in Washington, D.C.). Written requests may be addressed to the OCRWM National Information Center at 600 Maryland Avenue, SW, Suite 760, Washington, D.C., 20024 or sent electronically to http://www.rw.doe.gov (OCRWM's Home Page). ■

"Curriculum" continued from page 7

interest, and time. Unit 1, *Nuclear Waste*, helps establish the relevance of nuclear waste to students' everyday lives and activities. In Unit 2, *Ionizing Radiation*, students experiment and learn about the various sources of radiation (both natural and manmade sources). Unit 3, *Nuclear Waste Policy Act* (NWPA), presents our Nation's nuclear waste management situation and introduces the NWPA. Unit 4, *Waste Management System*, explains how elements of the high-level radioactive waste management system will work together to protect people and the environment. Elements of the management system include storage, transportation, and disposal in a geologic repository.

One new lesson, *The Role of the Multipurpose Canister in the Waste Management System*, has been added to Unit 4. This new lesson includes a complete lesson plan, a reading lesson, and two activities. One activity guides students through a review of the reading lesson. In the other activity, students role-play and assume the roles of stakeholders and other interested parties involved in a community-wide decision about the use of multi-purpose canisters—a concept currently being explored by OCRWM.

To order copies or to find out more about the curriculum, contact the OCRWM National Information Center at 1-800-225-6972. In Washington, D.C., call (202) 488-6720. ■

Reader Response Card

A reader response card is included in every *OCRWM Bulletin*.
The purpose of this card is to encourage communication between readers of the *OCRWM Bulletin* and OCRWM.
Your views, comments, and suggestions are appreciated.

Comments: _____

_____

Name: _____

Address: _____

City: _____ State: _____ Zip: _____ - _____

Affiliation: _____

Please detach this card and mail to:

Harold H. Brandt, Director, Administration Division • Office of Civilian Radioactive Waste Management •
U.S. Department of Energy • 1000 Independence Avenue, SW • Mail Stop RW-15 • Washington, DC 20585

Of Mountains & Science

YUCCA MOUNTAIN PROJECT Studies

Fall 1995

DOE starts work on Repository Environmental Impact Statement

The U.S. Department of Energy has announced its intent to prepare an environmental impact statement for a geologic repository at Yucca Mountain, Nye County, Nevada, for the disposal of spent nuclear fuel and high-level radioactive waste.

Construction would begin if the Nuclear Regulatory Commission authorizes construction of the repository. Surface facilities would be designed and constructed to receive, and prepare for disposal, spent nuclear fuel and high-level radioactive waste that would arrive in transportation casks by highway and by rail. Capability to treat or package the secondary wastes generated during disposal operations would also be provided. Subsurface facilities would be designed and constructed for emplacement of spent nuclear fuel and high-level radioactive waste in disposal tunnels. Subsurface facilities would primarily include access ramps, ventilation systems, disposal tunnels, and equipment alcoves.

Continued on page 114

Editor's note

The Department of Energy (DOE) is preparing an environmental impact statement for a potential repository at Yucca Mountain. This issue of the newsletter looks at that process, and offers a glimpse into DOE's latest thinking on how such a repository might function.

Preparation of an environmental impact statement requires DOE to consider alternatives based upon reasonable assumptions or projections that may strike readers of this newsletter as quite different from those that underlie the characterization of Yucca Mountain.

In reality, Yucca Mountain remains under study, and no decision has been made as to its suitability. The environmental impact statement, however, must evaluate potential environmental impacts assuming that a repository *will* be built, operated and ultimately closed at Yucca Mountain. It must do this not to predetermine the outcome of studies now underway, but to successfully consider how a repository might, under various designs and configurations, affect the environment and the public.

Because of this underlying assumption, the language of the *"Notice of Intent"* (reproduced here in part, beginning on the left) and related articles may strike some readers as less conditional and tentative than the reality of site characterization would justify. The language is a function of the environmental impact statement process. It does not in any way imply that any decision on the suitability of the site has been made.

At a Glance

- How do the site characterization and the environmental impact statement processes differ? *See page 121.*
- A look at options for transporting spent fuel. *See page 124.*

How to have input to the environmental impact statement

Your comments are important! The U.S. Department of Energy is preparing an environmental impact statement to explore the potential environmental effects of constructing, operating, and closing a repository at Yucca Mountain for the permanent disposal of spent nuclear fuel and high-level radioactive waste. This information will assist in making a decision on the repository at Yucca Mountain. A large part of this effort includes public input.

The National Environmental Policy Act specifies a series of steps for federal agencies to follow when developing an environmental impact statement, including opportunities for public comment.

Continued on page 119

Continued from page 113

Environmental impact statement

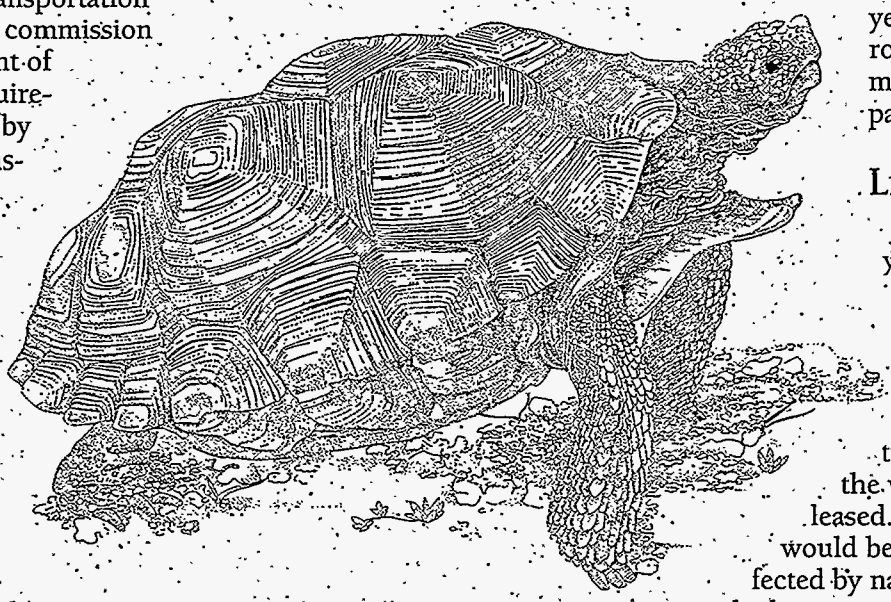
Starting disposal

Disposal operations would begin once the Nuclear Regulatory Commission issues a license allowing receipt of spent nuclear fuel and high-level radioactive waste. Disposal operations would be expected to last up to 40 years, depending on shipment schedules. Disposal tunnels would continue to be constructed during this time period as necessary. Spent nuclear fuel assemblies,[1] and canisters containing assemblies[2] or vitrified (i.e., solidified) high-level radioactive waste[3] would be shipped to the repository in transportation casks that meet the commission and U.S. Department of Transportation requirements for shipping by truck or rail[4]. The assemblies would be removed from the transportation casks, which would be placed back into service after decontamination and maintenance or after necessary repairs were completed. Canisters and assemblies would be transferred to a "hot" cell – a room where remotely-controlled equipment would be used to place the material in disposal containers. These waste packages (i.e., assemblies and canisters in disposal containers) would be transported underground in a transportation vehicle having radiation shielding for worker protection. Monitoring equipment, which would either be placed in selected tunnels or would be mobile remote-sensing devices, would monitor performance of waste packages and aspects of the local repository geology.

Closing a repository

The closure/post-closure period would begin after the commission amends the license to authorize permanent closure. Underground equipment would be removed, repository openings would be backfilled and sealed, and the surface facilities would be decontaminated, decommissioned, and dismantled or converted to other uses. Institutional controls, such as permanent markers and monuments, would be designed and constructed to last thousands of years and discourage human activities that could compromise the waste isolation capabilities of the repository.

The disposal and closure/post-closure activities would be designed and implemented so that the combination of engineered (i.e., waste package and any backfill) and natural (geologic system) barriers would isolate the spent nuclear fuel and high-level radioactive waste. The combination of barriers would meet a standard to be specified by the Environmental Protection Agency, which has been entrusted to develop a radiation release standard pursuant to Section 801 of the Energy Policy Act of 1992 (42 U.S.C. §10141 note); individual barriers would perform according to commission requirements, including its performance objectives at 10 CFR 60.113. The engineered barrier must provide substantially complete containment of spent nuclear fuel and high-level radioactive waste for between 300 and 1,000 years by using corrosion resistant materials in the waste package.



Limiting features

Beyond 1,000 years, continued isolation would be assisted by features that would limit the rate at which radioactive components of the waste would be released. The rate of release would be substantially affected by natural conditions, the heat generation rate of spent nuclear fuel and high-level radioactive waste (i.e., thermal load), and its rate of heat dissipation. First, different thermal loads would affect directly the internal and external waste package temperatures, thereby affecting the corrosion rate and integrity of the waste package. Second, the heat would affect the geochemistry, hydrology, and mechanical stability of the disposal tunnels, which in turn would influence the flow of groundwater and the transport of radionuclides[5] from the engineered and natural barrier systems to the.

Continued on page 115

Footnotes 1, 2, 3, 4 on page 118

[5]*Radionuclides: atoms that emit radiation.*

environment. Therefore, the long-term performance of the repository would be managed by appropriately spacing the waste packages within disposal tunnels and the distances between disposal tunnels, and by selectively placing spent nuclear fuel and high-level radioactive waste packages to account for their individual heat generation rates.

Alternatives

The department has preliminarily identified for analysis in the environmental impact statement a full range of reasonable implementation alternatives for the construction, operation, and closure/post-closure of a repository at Yucca Mountain. These implementation alternatives are based on thermal load objectives and include *high-thermal load, intermediate-thermal load,* and *low-thermal load* alternatives.

Under each implementation alternative, the department will evaluate different spent nuclear fuel and high-level radioactive waste packaging and transportation options. The department anticipates that these options would produce the broadest range of potential configurations for both surface facilities and possible operational and disposal conditions at the repository. Evaluation of these options will identify the full range of reasonably foreseeable impacts to human health and the environment associated with each implementation alternative.

High-thermal load alternative

Under the high-thermal load implementation alternative, spent nuclear fuel and high-level radioactive waste would be disposed in an underground configuration that would generate the upper range of repository temperatures while meeting performance objectives to isolate the material in compliance with agency standards and commission requirements. Under this alternative, the emplacement density would likely be greater than 80 metric tons heavy metal[6] per acre. This alternative would represent the highest repository thermal loading based on available information and expected test results.

Intermediate-thermal load alternative

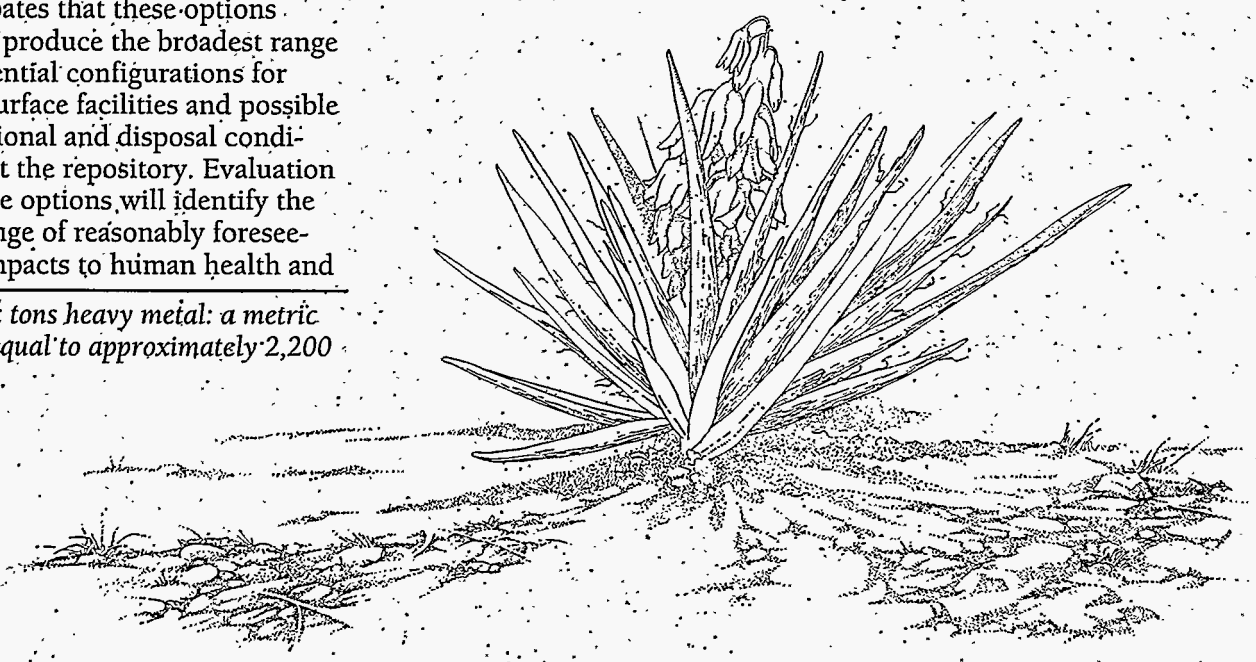
Under the intermediate-thermal load implementation alternative, spent nuclear fuel and high-level radioactive waste would be disposed in an underground configuration that would generate an intermediate range of repository temperatures (compared to the high- and low-thermal load alternatives) while meeting performance objectives to isolate the material in compliance with agency standards and commission requirements. Under this alternative, the disposal density would likely range between 40 to 80 metric tons heavy metal per acre.

Low-thermal load alternative

Under the low-thermal load implementation alternative, spent nuclear fuel and high-level radioactive waste would be disposed in an underground configuration that would provide the lowest potential repository thermal loading (based on available information and expected test results) while meeting performance objectives to isolate the material in compliance with agency standards and commission requirements. Under this alternative, the disposal density would likely be less than 40 metrics tons heavy metal per acre.

Continued on page 116

[6]*Metric tons heavy metal: a metric ton is equal to approximately 2,200 pounds.*



Continued from page 115

Environmental impact statement

Packaging options

As part of each implementation alternative, two packaging options would be evaluated. Under option 1, spent nuclear fuel assemblies would be packaged and sealed in multi-purpose canisters at the generator sites prior to being transported to the repository in commission-certified casks. High-level radioactive waste also would be packaged and sealed in canisters prior to shipment in similar casks. Under option 2, spent nuclear fuel assemblies (without canisters) and sealed canisters of high-level radioactive waste would be transported to the repository in commission-certified casks. Under both options, assemblies and canisters with intact seals would be removed from the casks and placed in disposal containers at the repository.

The department recognizes that it is likely that a mix of spent nuclear fuel assemblies and canisters (and canister systems) of spent nuclear fuel and vitrified high-level radioactive waste would arrive at the repository during disposal operations. However, since the specific mix is speculative, the above packaging options were chosen to produce the broadest range of potential configurations for both surface facilities and possible operational and disposal conditions at the repository. These options were also selected to reflect the potential range of exposures to workers and the public at the generator sites, along transportation routes, and at the repository from the packaging, transport, and disposal of spent nuclear fuel and high-level radioactive waste.

Scoping meeting schedule and locations

Soon to be held:	Date/Times
Penn Valley Community College, 3201 S.W. Trafficway, Kansas City, MO 64111	Fri., Oct. 20, 1995 Afternoon/evening sessions
Tonopah Convention Center, 301 Brougher, Tonopah, NV 89049	Tues., Oct. 24, 1995 Morning/evening sessions
Already held:	
Pahrump, NV	Tues., Aug. 29, 1995
Boise, ID	Wed., Sept. 6, 1995
Reno, NV	Fri., Sept. 8, 1995
Chicago, IL	Tues., Sept. 12, 1995
Las Vegas, NV	Fri., Sept. 15, 1995
Denver, CO	Tues., Sept. 19, 1995
Sacramento, CA	Thurs., Sept. 21, 1995
Dallas, TX	Tues., Sept. 26, 1995
Caliente, NV	Thurs., Sept. 28, 1995
Salt Lake City, UT	Thurs., Oct. 5, 1995
Linthicum (near Baltimore), MD	Wed., Oct. 11, 1995
Troy (Albany), NY	Fri., Oct. 13, 1995
College Park (Atlanta), GA	Tues., Oct. 17, 1995

Session times are as follows: morning (8:30 a.m.-12:30 p.m.), afternoon (12 p.m.-4 p.m.), evening 6 p.m.-10 p.m.)

Transportation

As part of each implementation alternative, two national transportation options and three regional (i.e., within the state of Nevada) transportation options would be evaluated. These options would be expected to result in the broadest range of operating conditions relevant to potential impacts to human health and the environment.

In a national context, the first option would consist of shipping all spent nuclear fuel and high-level radioactive waste by truck, from the generator site to the repository.

The second national option would consist of shipment by rail, except from those generator sites (as many as 19) that may not have existing capabilities to load and ship rail casks. For such sites, the spent nuclear fuel would be transported by truck to the repository,

Continued on page 117

or to a facility near the nuclear power plant where it would be transferred to rail cars for shipment to the repository.

In a regional context, there are three transportation options: two of these options apply to shipments that would arrive in Nevada by rail, and the third applies to shipments that would arrive in Nevada by legal-weight truck.[7]

The first regional transportation option would consist of several rail corridors to the repository. The rail corridor option would involve identifying and applying siting criteria, based on engineering considerations (e.g., topography and soils), potential land use restrictions (e.g., wilderness areas and existing conflicting uses), and any other factors identified from the scoping process.

The second regional transportation option would involve the use of heavy-haul truck[8] routes to the repository. The heavy-haul option would include the construction and use of an intermodal transfer facility to receive shipments that would arrive in Nevada by rail; the intermodal transfer facility would be located at the beginning of the heavy-haul route. The heavy-haul option would include any need to improve the local transportation infrastructure.

The third regional transportation option would involve legal-weight truck shipments directly to the repository. Under this option, a transfer facility would not be required.

No action

The no-action alternative would evaluate termination of site characterization activities at Yucca Mountain and the continued accumulation of spent nuclear fuel and high-level radioactive waste at commercial storage sites and department facilities. Spent nuclear fuel and high-level radioactive waste would continue to be managed for the foreseeable future at existing commercial storage sites and department facilities located in 34 States. The no-action alternative, although contrary to the congressional desire to provide a permanent solution for isolation of the nation's spent nuclear fuel and high-level radioactive waste, provides a baseline against which the implementation alternatives can be compared.

At the Yucca Mountain site, the surface facilities, excavation equipment, and other support facilities would be dismantled and removed for reuse or recycling, or would be disposed of in solid waste landfills. Disturbed surface areas would be reclaimed and excavated openings to the subsurface would be sealed and backfilled.

At commercial reactors, spent nuclear fuel would continue to be generated and stored in either water pools or in canisters, until storage space at individual reactors becomes inadequate, at which time reactor operations would cease. Department-owned spent nuclear fuel and high-level radioactive waste would continue to be managed at three primary sites – the Hanford Reservation, Savannah River Site, and the Idaho National Engineering Laboratory.

Environmental issues to be examined

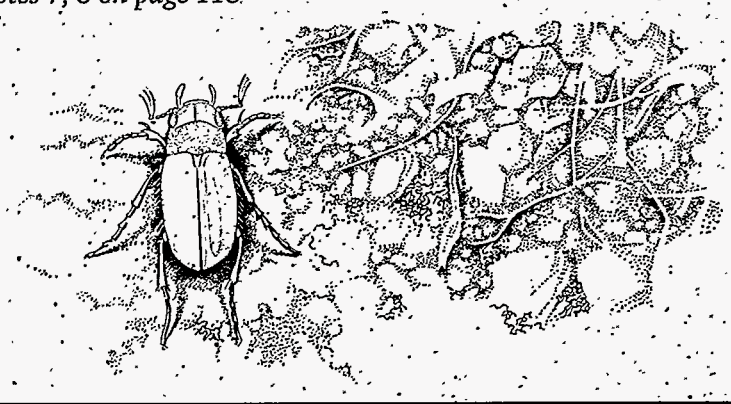
This environmental impact statement will examine the site-specific environmental impacts from construction, operation, and eventual closure of a repository for spent nuclear fuel and high-level radioactive waste disposal at Yucca Mountain, Nevada. Transportation-related impacts of the alternatives will also be analyzed. Through internal discussion and outreach programs with the public, the department is aware of many environmental issues related to the construction, operation, and closure/post-closure phases of such a repository. The issues identified here are intended to facilitate public scoping. The list is not intended to be all-inclusive or to predetermine the scope of the environmental impact statement, but should be used as a starting point from which the public can help the department define the scope of the environmental impact statement.

• *Radiological and non-radiological releases.* The potential effects to the public and on-site workers from radiological and non-radiological releases;

• *Public and worker safety and health.* Potential health and safety impacts (e.g., injuries) to on-site workers during the unloading, temporary surface storage, and

Continued on page 118

Footnotes 7, 8 on page 118



Continued from page 117

Environmental impact statement

underground emplacement of waste packages at Yucca Mountain;

• *Transportation.* The potential impacts associated with national and regional shipments of spent nuclear fuel and high-level radioactive waste from reactor sites and the department facilities to the Yucca Mountain site will be assessed. Regional transportation issues include: (a) technical feasibility, (b) socioeconomic impacts, (c) land use and access impacts, and (d) impacts of constructing and operating a rail spur, a heavy-haul route, and/or a transfer facility;

• *Accidents.* The potential impacts from reasonably foreseeable accidents, including any accidents with low probability but high potential consequences;

• *Criticality.* The likelihood that a self-sustaining nuclear chain reaction could occur and its potential consequences;

• *Waste isolation.* Potential impacts associated with the long-term performance of the repository;

• *Socioeconomic conditions.* Potential regional (i.e., in Nevada) socioeconomic impacts to the surrounding communities, including impacts on employment, tax base, and public services;

• *Environmental-justice.* Potential for disproportionately high and adverse impacts on minority or low-income populations;

• *Pollution prevention.* Appropriate and innovative pollution prevention, waste minimization, and energy and water use reduction technologies to eliminate or significantly reduce use of energy, water, hazardous substances, and to minimize environmental impacts;

• *Soil, water, and air resources.* Potential impacts to soil, water quality, and air quality;

• *Biological resources.* Potential impacts to plants, animals, and habitat, including impacts to wetlands, and threatened and endangered species;

• *Cultural resources.* Potential impacts to archaeological/historical sites, Native American resources, and other cultural resources;

• Cumulative impacts from the proposed action and implementing alternatives and other past, present, and reasonably foreseeable future actions;

• Potential irreversible and irretrievable commitment of resources.

Under the no-action alternative, potential environmental effects associated with the shutdown of site characterization activities at Yucca Mountain will be estimated. Potential environmental effects from the continued accumulation of spent nuclear fuel and high-level radioactive waste at commercial reactors and the department sites will be addressed by summarizing previous relevant environmental analyses and by performing new analyses of representative sites, as appropriate. At the Yucca Mountain site, the potential environmental consequences from the reclamation of disturbed surface areas, and the sealing of excavated openings following the dismantlement and removal of facilities and equipment, will be quantified. These analyses would be similar in level of detail to the analyses of the implementing alternatives. At the commercial reactor and the department sites, the potential environmental consequences will be addressed in terms of risk to the environment and the public from long-term management of spent nuclear fuel and high-level radioactive waste. In addition, the loss of storage capacity, the need for additional capacity, and their potential consequences to continued reactor operations, will be described. ■

Footnote explanations

[1] A fuel assembly is made up of fuel rods held together by plates and separated by spacers attached to the fuel cladding.

[2] Under one scenario, spent nuclear fuel assemblies would be sealed in a multi-purpose canister that would then be inserted into separate casks/containers for storage, transportation, and disposal. Other canisters are available and include single-purpose systems, which require transferring of individual assemblies from one cask/container to another for storage, transport, and disposal. Another option would be dual-purpose systems which require storing and transporting individual assemblies in one cask and disposing of them in another container.

[3] Vitrified (solidified as glass logs) high-level radioactive waste would be sealed in canisters suitable for transport in a truck or train cask.

[4] Barges also may be used for intermodal shipments of spent nuclear fuel and high-level radioactive waste from generator sites to nearby locations for transfer to truck and rail.

[7] A legal-weight truck consists of a tractor, semi-trailer, and loaded cask, with a maximum gross weight of 80,000.

[8] A heavy-haul truck consists of a tractor, semi-trailer, and loaded cask, with a gross weight in excess of 129,000.

"Of Mountains and Science" p. 118

Continued from page 113

How to be involved

Some of those opportunities include regional public scoping meetings, toll-free information lines, fax, and electronic mail (e-mail).

This environmental impact statement will evaluate the environmental effects of several alternatives for how spent nuclear fuel and high-level radioactive waste would be placed in the repository and a *no-action* alternative, which will evaluate the potential environmental impacts of *not* developing a repository at Yucca Mountain.

How to get involved

The National Environmental Policy Act was enacted in 1969 to guide federal agencies toward informed decisions when proposing major projects. The process outlined by the act emphasizes public involvement early on and then periodically throughout the preparation of an environmental impact statement.

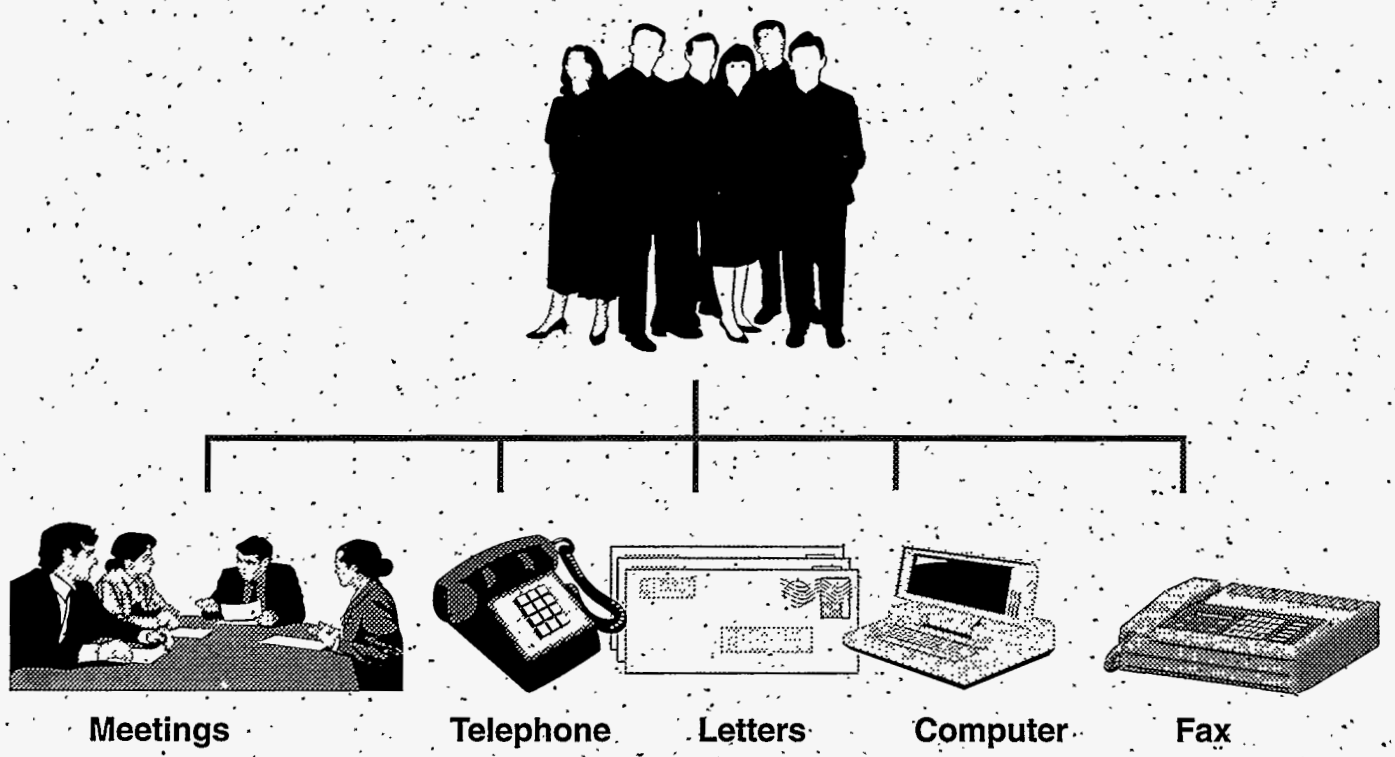
Federal and state agencies, Native American tribes, and the general public are first consulted in a phase of the process called *scoping*.

For the Repository Environmental Impact Statement, regional scoping meetings are being held at several locations across the nation. The meetings are open to anyone interested in attending and comments will be taken for the record. These comments will be used to help better define the issues that will be addressed in the environmental impact statement. You will be able to obtain details about these meetings in the *Federal Register*, a daily publication of announcements by federal agencies, and local and regional newspapers.

If you are unable to attend these regional meetings, there are several other ways to provide your input. You may send your comment in a

Continued on page 120

> *"The National Environmental Policy Act (NEPA) is our basic national charter for protection of the environment. The act ensures that environmental information is available to public officials and citizens before decisions are made and before actions are taken."* taken from Title 40, Code of Federal Regulations, Part 1500.



The process outlined by the National Environmental Policy Act emphasizes public involvement early on and then periodically throughout the preparation of an envi-ronmental impact statement. Involvement may be accomplished by commenting at public meetings or via any of the avenues of communication available.

Continued from page 119

How to be involved

letter. A toll-free phone line and a computer e-mail address have been set up to keep people up-to-date and accept comments during public comment periods.

Comments and concerns collected during the scoping pocess will be addressed in an implementation plan written by the department that describes what will be included in the environmental impact statement. After a draft environmental impact statement is prepared, another public comment period with public meetings is held. All comments received in this period will be addressed in the final environmental impact statement, along with the department's responses. A *record of decision* would be issued after a 30-day minimum period following publication of the final environmental impact statement.

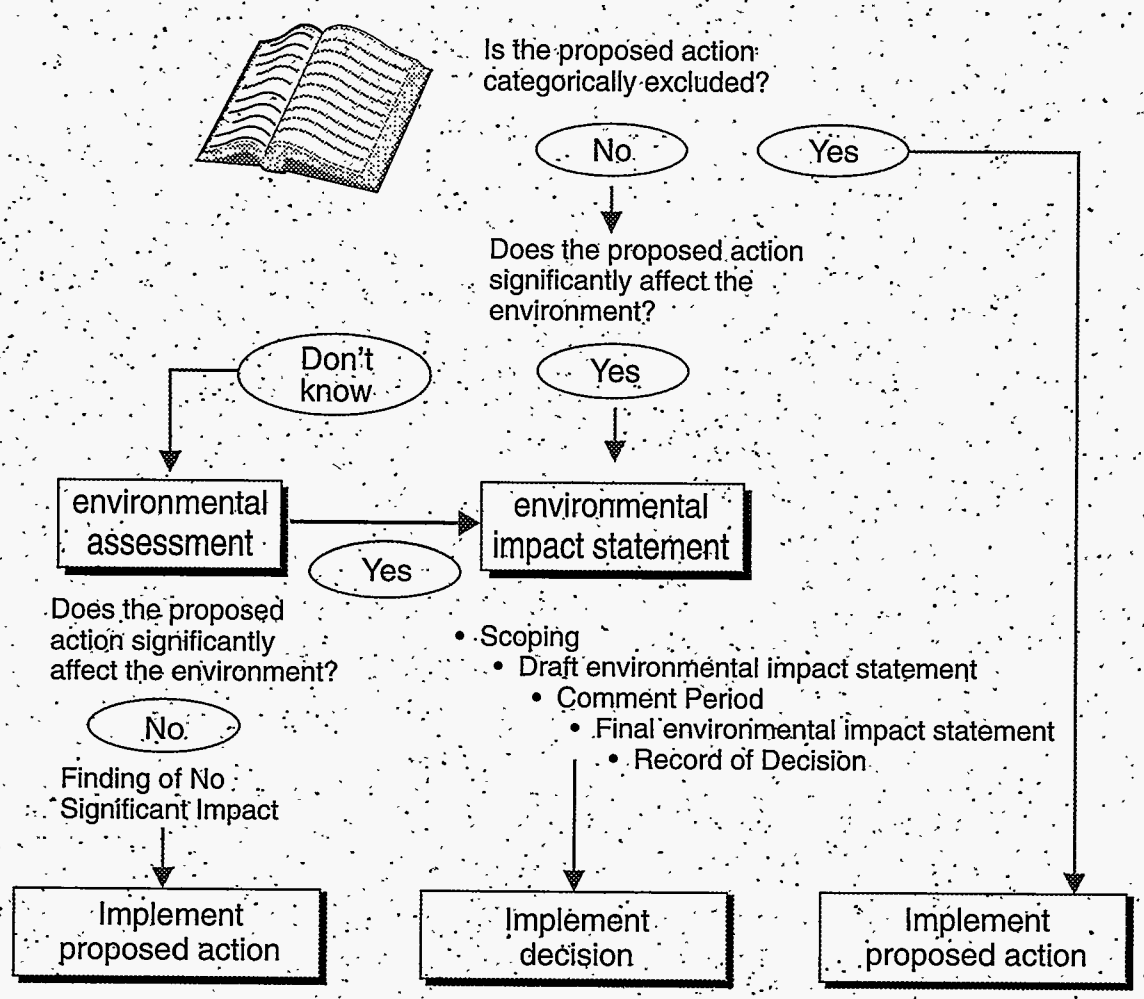
How may I most effectively present my concern?

Whether your comment is spoken at a public meeting, e-mailed, faxed, phoned, or mailed in, it ends up in the same system and is treated equally to all other comments. Each comment document (including transcripts of verbal comments) will be read by department staff. The key to maximizing the impact of your comment lies in understanding the comment process and your role in that process. To increase the impact of your comment:

- Define your goals and what you want your comment to accomplish.
- Focus on the issues and actions addressed in the environmental impact statement. The department must follow National Environmental Policy Act guidelines and confine its analyses to

Continued on page 123

National Environmental Policy Act process flow chart



How site characterization and environmental impact statement processes differ

Site characterization investigates for suitability

The studies underway at Yucca Mountain to determine the suitability of the site for a spent nuclear fuel and high-level radioactive waste repository are known as *site characterization*.

Scientists are studying the structural, mechanical, chemical, and hydrological characteristics of Yucca Mountain. These studies include surface-based studies, underground studies in the Exploratory Studies Facility, laboratory tests, and computer modeling. As examples, experts are investigating how groundwater moves within and around the site, and the potential for earthquakes, volcanism, and climate change. These studies, among others, are designed to provide a credible basis for scientific decisions about the suitability of the site. The studies are not complete and more information and testing still are needed.

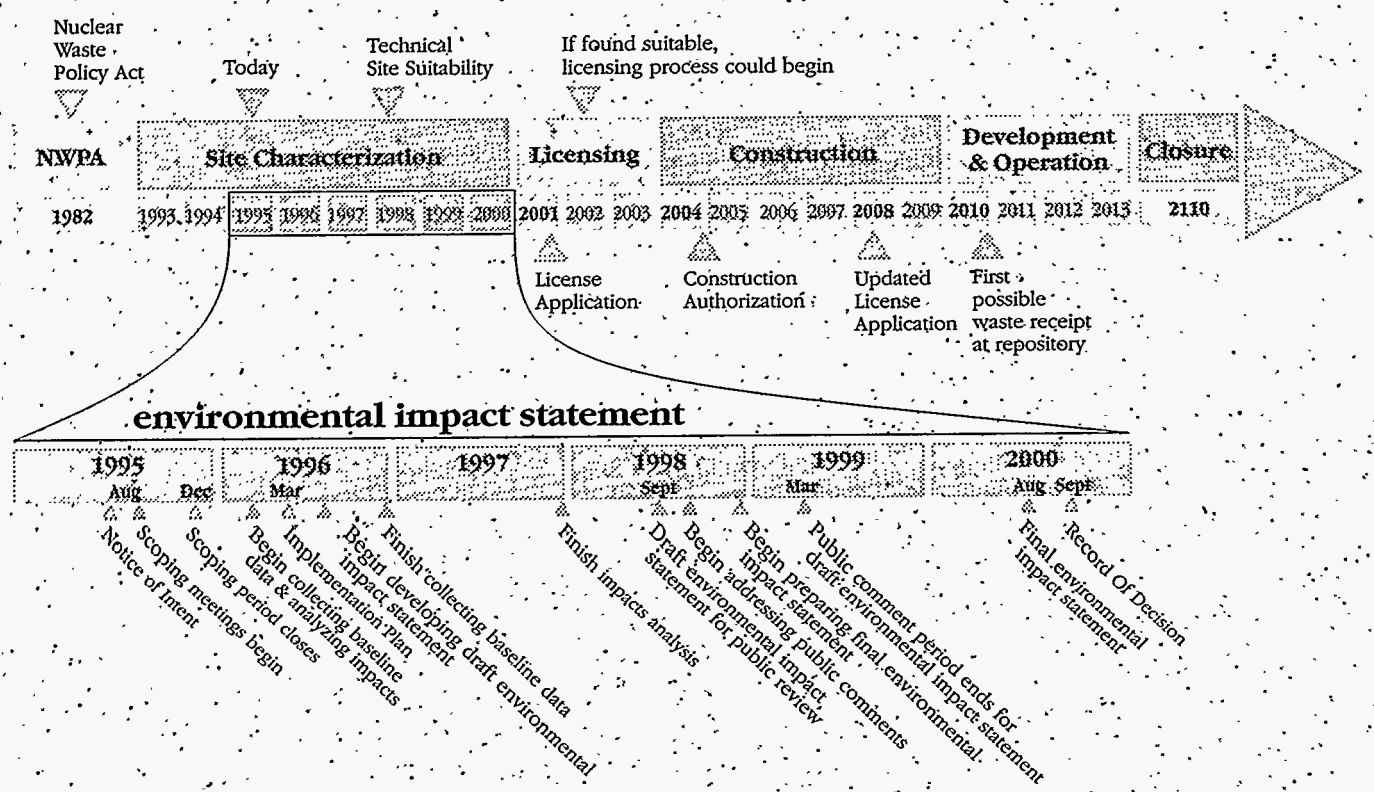
The Nuclear Waste Policy Act, as amended, directs the department to characterize Yucca Mountain. The act also states that if at any time during the course of scientific investigations the department finds the site to be unsuitable, the studies will be stopped and new direction sought from Congress.

Examines potentially significant environmental impacts

In the Nuclear Waste Policy Act, Congress directed that a recommendation to the president of the United States to develop a repository at Yucca Mountain must be accompanied by an environmental impact statement. The development of an environmental impact statement is a legal process based on the National Environmental Policy Act. The repository process is unique in that the Nuclear Waste Policy Act, enacted by Congress *after* the passage of the National Environmental Policy Act, altered the scope and extent of the evaluation of potential environmental impacts normally required in an environmental impact statement. The Nuclear Waste Policy Act directs that an environmental impact statement prepared for the repository does not need to consider:

Continued on page 121

Site characterization and environmental impact statement timelines



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How the processes differ

- the need for a repository;
- the time of initial availability of the repository;
- alternative sites to the Yucca Mountain, Nevada site; or
- alternatives to geologic disposal of spent nuclear fuel and high-level radioactive waste.

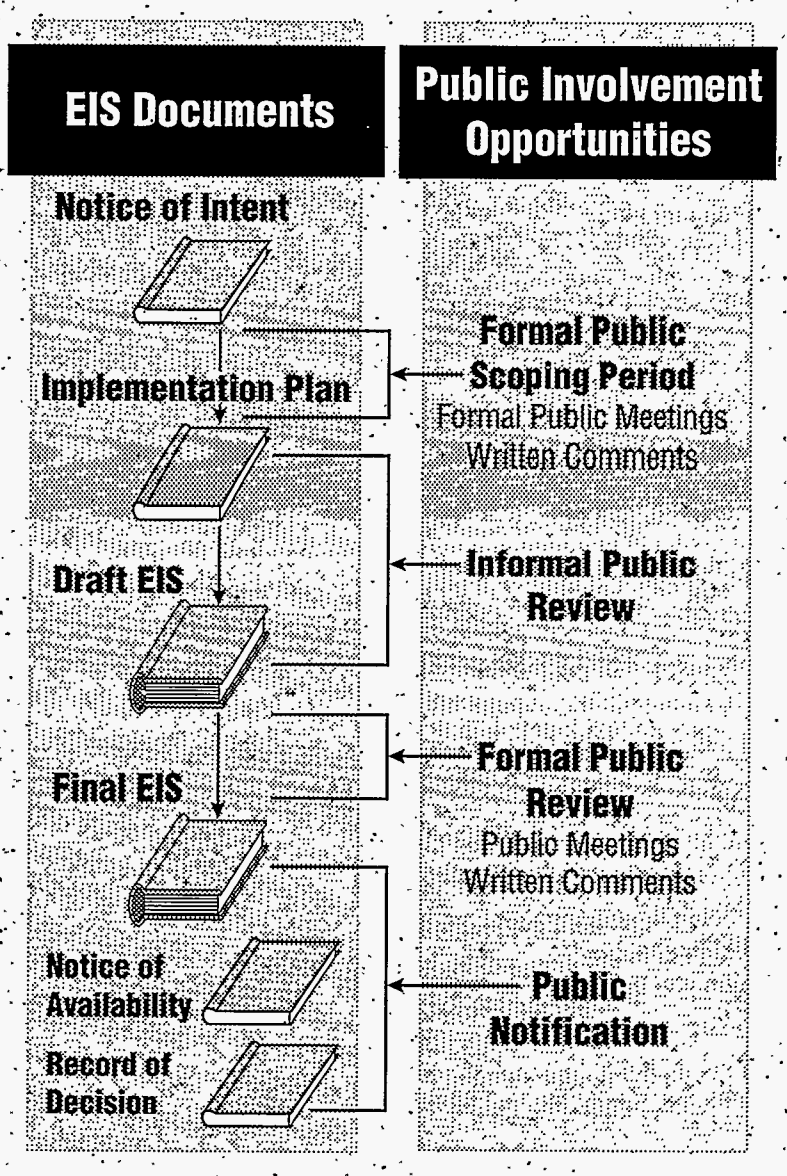
This means the Repository Environmental Impact Statement will be written to evaluate only whether any potentially significant environmental impacts would occur if a repository were constructed, operated, and eventually closed at Yucca Mountain.

How do these two processes differ?

Site characterization studies focus on whether the site is suitable based upon numerous levels of testing and analysis, including whether adverse conditions exist that may disqualify the site. These in-depth studies also provide information used in the licensing process for a repository, determining whether Yucca Mountain can be approved and licensed for construction and operation of a repository.

The environmental impact statement process examines Yucca Mountain from the perspective: *if* a repository were to be constructed, operated, and eventually closed, what would be the significant potential environmental impacts?

To support this evaluation, the department will draw from the extensive body of data and analysis already accumulated for the site characterization program. The public also is provided the opportunity to review and comment on the department's evaluation in the Repository Environmental Impact Statement.



The above outline illustrates the many opportunities for public involvement in the environmental impact statement process.

The purpose of the National Environmental Policy Act and the environmental impact statement documentation process is to ensure that necessary and accurate environmental impact studies are done. And further, that the studies are done with public involvement, and that public officials make decisions based on an understanding of environmental consequences.

They are separate but parallel processes

While these two separate processes, site characterization and the Repository Environmental Impact Statement, have different purposes, they also have a few things in common. The Repository Environmental Impact Statement schedule has been developed in recognition of the

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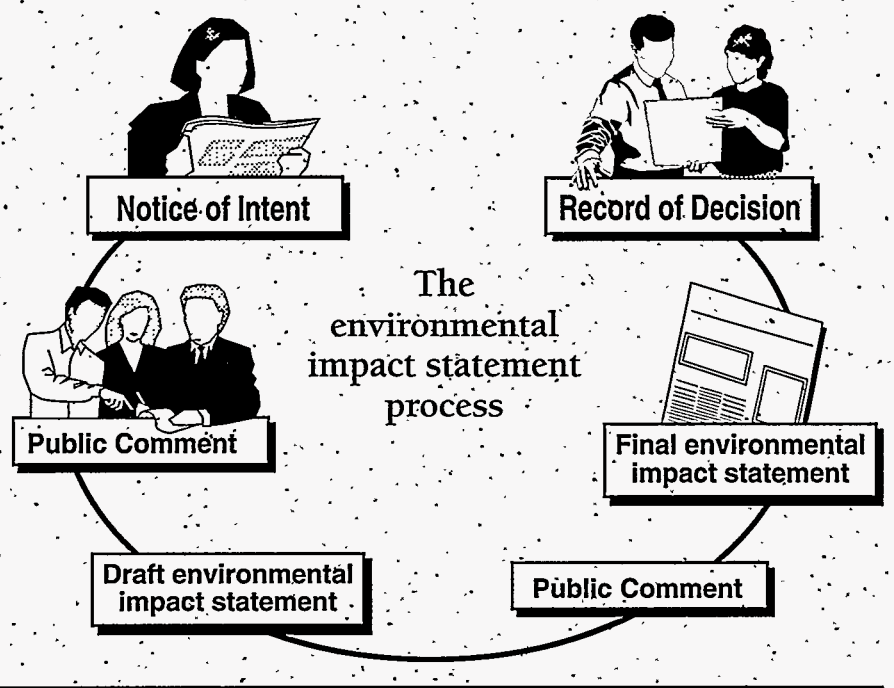
How the processes differ

complexity of the site characterization program, and to ensure close coordination with site characterization activities.

The environmental impact statement will be prepared over approximately a five-year period, beginning in 1995. This is necessary to allow it to draw upon the site characterization information that is being generated to support the department's evaluation of Yucca Mountain's suitability to become a high-level radioactive waste repository, and any subsequent license application to the U.S. Nuclear Regulatory Commission. ■



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How to be involved

the scope of the specific environmental impact statement. For example, the Repository Environmental Impact Statement will focus on the potential environmental impacts of constructing, operating, and closing a repository at Yucca Mountain. It will not address whether another site is more suitable. Therefore, a suggestion to move the project to another state would not address the subject matter of this environmental impact statement.

• Use available agency resources to get the information you need.

The Department of Energy wants your input. Meaningful and clear comments help the department and the commentor fulfill the goals of the National Environmental Policy Act.

To get more information

The department has established various ways to make it easier for you to get information and make your opinions known. Public scoping meetings and public hearings are announced in the *Federal Register* and area newspapers. A toll-free telephone line 1-800-967-3477) is available for you to call with questions about the process, schedules, to get on the mailing list, and to request additional information. Comments may be mailed (see below) or faxed (1-800-967-0739) to the department. You may review technical documents, request information, and provide comments via the INTERNET World Wide Web at the following Uniform Resource Locator address: http:/www.ymp.gov. The Repository Environmental Impact Statement is indexed as *Environmental Impact Statement* on the Yucca Mountain Project Home Page. Comments and information requests can be submitted by electronic mail at: ymp_eisr@notes.ymp.gov.

The mailing address is: Wendy R. Dixon, EIS Project Manager, Yucca Mountain Site Characterization Office, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 101 Convention Center Drive, Suite P-110, M/S 010, Las Vegas, Nevada 89109. ■

> *"Comments on an environmental impact statement on a proposed action shall be as specific as possible and may address either the adequacy of the statement or the merits of the alternatives discussed or both"* CEQ Regulation: 40 CFR 1503.3(a)

Transportation to a repository

If a repository is built at Yucca Mountain, Nevada, how would spent nuclear fuel and high-level radioactive waste get there? That question concerns people across the nation and the U.S. Department of Energy. Because transportation is such an important part of the Yucca Mountain Project, the environmental impact statement (EIS) for the repository at Yucca Mountain will look at the potential impacts of shipping spent nuclear fuel and high-level radioactive waste to the repository.

Various kinds of radioactive materials have been moved around our country for decades. Shipments of spent nuclear fuel regularly go to or from nuclear power plants, government research facilities, industrial complexes, and other facilities. After more than 25 years — and more than 2,500 shipments of spent nuclear fuel — there has not been a single death or injury because of the radioactive nature of the cargo.

Casks designed to shield radiation and withstand severe accidents

Spent nuclear fuel and high-level radioactive wastes are solid material shipped dry in large, heavy, metal containers called casks, which are designed to shield radiation and withstand severe accidents without releasing their radioactive contents. Spent nuclear fuel is usually transported by truck or rail, and different-sized casks are used for each. All types of transportation casks have several layers of walls to reduce the radiation dose outside the cask and to contain the radioactive material within.

Rail casks for shipping commercial spent nuclear fuel and high-level radioactive waste have layered walls up to 36 centimeters (14 inches) thick, can be five meters (17 feet) long, and can weigh as much as 170 metric tons (187.5 tons). Use of the large rail casks would allow more spent nuclear fuel to be loaded into one container, reducing the number of shipments and the chance for transportation accidents.

The smaller casks used for truck shipments can weigh up to 23 metric tons (about 26 tons) and measure some seven meters (20 feet) in length.

Transportation casks effectively shield radiation. If a person stood for about an hour about two meters (six feet) from a cask filled to maximum permissible load, the dose of radiation received would be about 10 millirem, roughly the same as from one chest X-ray. A person would receive about 10,000 times less radiation than a chest X-ray if he or she were standing 30 meters from a road when a loaded cask truck traveling 40 kilometers per hour passed by. That would be about 100 feet at 24 miles per hour.

NRC must certify all casks

The U.S. Nuclear Regulatory Commission must certify all casks that would be used for shipping commercial spent nuclear fuel and high-level radioactive waste. The stringent standards established by the commission ensure that casks will withstand very severe transportation accidents with minimal chance of a radiation release.

For example, commission standards require that casks be able to withstand, in sequence:

- a nine-meter (30-foot) drop on an unyielding surface;
- a puncture test involving a one-meter (40-inch) drop onto a pin with a diameter of 15 centimeters (six inches);
- a 30-minute, all-engulfing fire at 802 degrees Celsius (1,475 degrees Fahrenheit); and
- an eight-hour immersion under 0.9 meter (three feet) of water. An undamaged cask also is required to withstand an eight-

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Terms used in this article

Cask: A large, heavily shielded container for storing or transporting spent nuclear fuel and high-level radioactive waste.

Canister: The primary or sealed container for spent nuclear fuel and high-level radioactive waste.

Disposal container: The container in which the spent nuclear fuel and high-level radioactive waste is sealed prior to placement underground.

Overpack: A secondary (or additional) external container for spent nuclear fuel and high-level radioactive waste.

Heavy-haul: A transportation term to describe trucks and cargo above a certain weight (e.g., in Nevada, a loaded truck weighing above 129,000 pounds).

hour immersion test in 15 meters (50 feet) of water.

Scientists use a combination of methods including calculational, computer modeling, and scale-model testing to make sure casks can pass all the tests.

Are all shipping casks alike?

Over the years, the department has considered several different systems for storage, transportation, and disposal of spent nuclear fuel and high-level radioactive waste. A system could be designed for a single purpose, such as for storage, or transport, or disposal; it could be designed for dual purposes, such as both storage and transport; or it could be designed to be used for all three functions.

The single-purpose system requires transferring the spent nuclear fuel assemblies from one cask to another for storage, transport and disposal. The assemblies are either stored in pools or in dry containers. They are then removed from storage and placed in a transportation cask for shipment. Then, at the repository, the assemblies are unloaded from the transportation cask and placed in a cask designed for disposal.

The dual-purpose system involves storing and transporting spent nuclear fuel in one cask and disposing of it in another. When the cask arrives at the repository, the spent nuclear fuel assemblies would be removed and placed in a waste package designed for disposal.

A third type, called a multi-purpose canister, could be used for all three stages of the waste management system. In the multi-purpose system, spent nuclear fuel would be sealed inside a canister that is not intended to be reopened. The canister then would be placed into a different cask or canister at each stage, but the canister itself would not need to be reopened.

The department is currently evaluating the potential environmental impacts of fabricating and deploying one of these systems in a separate EIS. The Repository EIS will evaluate the potential environmental impacts

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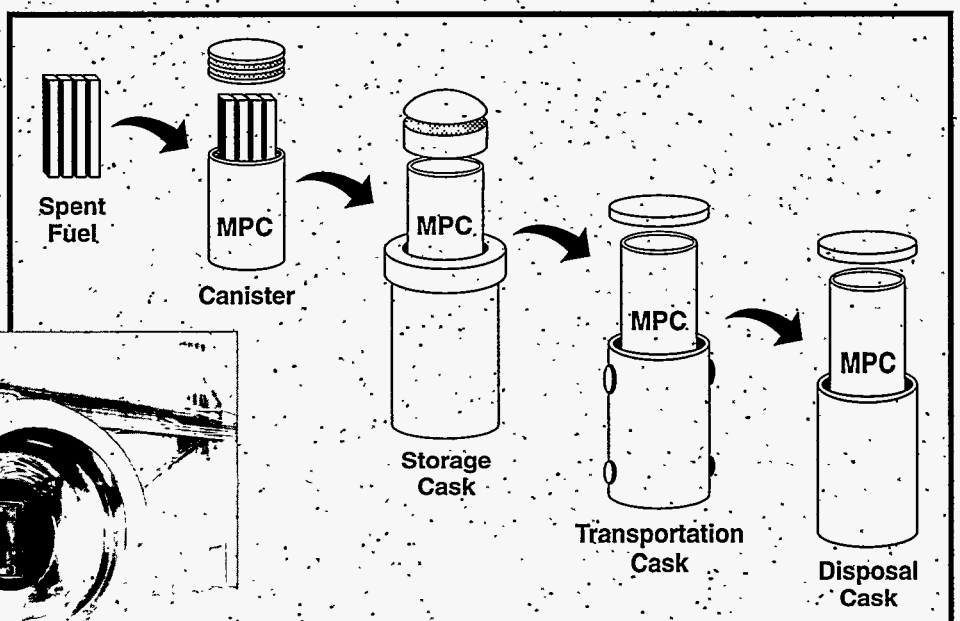
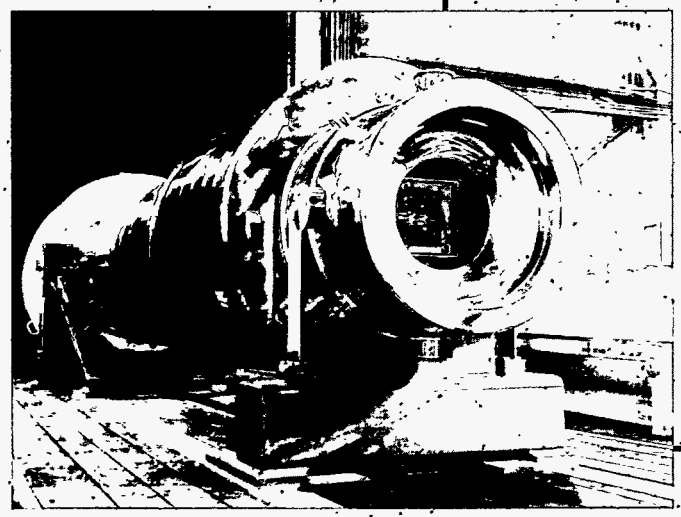


Once loaded with spent nuclear fuel assemblies, a multi-purpose canister (MPC) will be sealed and loaded into a cask for storage, and transport and into a separate container for disposal.



Single-purpose shipping cask containing a mock spent fuel assembly.

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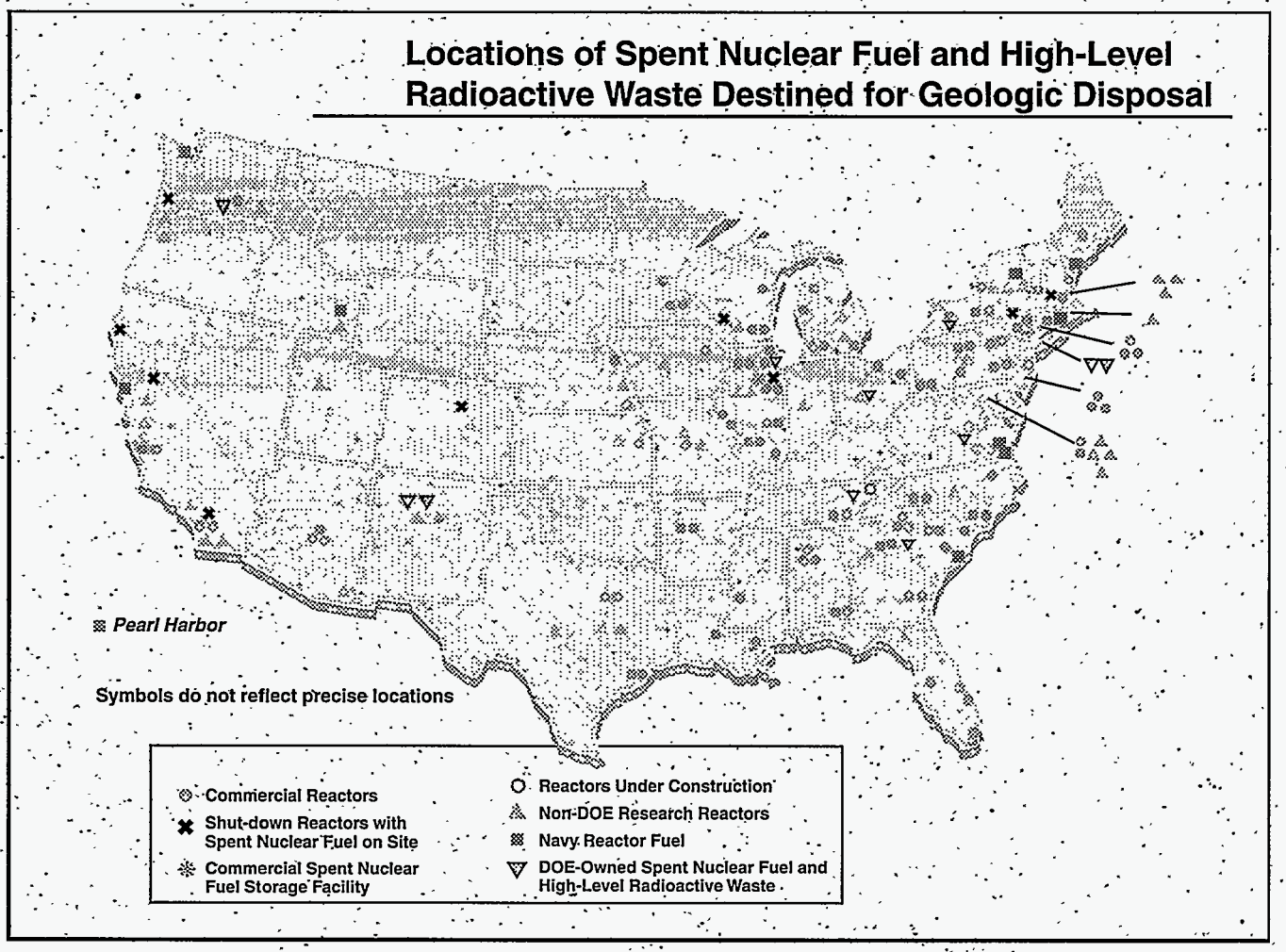
Transportation



of actually emplacing these types of disposal containers in the repository.

Regulations governing shipments

The U.S. Department of Transportation and the commission have developed regulations that provide a safe and effective transportation system. Federal and state regulations control virtually every aspect of spent nuclear fuel and high-level radioactive waste transportation. These regulations are rigorously enforced. While the commission is responsible for approving container designs, the Department of Transportation has regulations for loading, unloading, and handling shipping casks; labeling casks and attaching placards to transport vehicles for identification purposes; driver training and certification; and highway routing.

How would spent fuel be transported to the repository?

Shipments of spent nuclear fuel and high-level radioactive waste could come to Yucca Mountain by truck or railroad. Existing federal regulations specify that, whenever possible, trucks carrying spent nuclear fuel and high-level radioactive waste should use interstate highways and travel beltways around urban areas.

The regulations also allow states to recommend alternate routes for such shipments. Additionally, states will be notified in advance of spent nuclear fuel or high-level radioactive waste shipments. Current commission regulations do not provide for notifying Native American tribes. However, the department is working on a tribal-notification policy.

What if there is an accident?

Federal, state, and many local and tribal personnel will be

Continued on page 127

trained in emergency procedures. Local authorities would be the first to respond to a transportation accident involving spent nuclear fuel or high-level radioactive waste. The federal government would respond at the request of a state. In the event of an accident, various federal, state, local, and tribal agencies would coordinate emergency response activities as necessary.

The department is prepared to send trained personnel and special equipment to the accident area, rapidly responding from one of its eight regional centers. Before the department could ship spent nuclear fuel and high-level radioactive waste, states and Native American tribes along the routes would receive funding and technical assistance for the emergency response training of public safety officials. Funding and technical assistance have been scheduled to begin three to five years before shipments would start.

Information from other environmental impact statements will be used

National Environmental Policy Act regulations direct agencies to use existing documentation where appropriate, rather than "reinventing the wheel." Transportation of spent nuclear fuel has been, or is being, studied in a number of other environmental impact statement documents. Whenever possible, the Repository Environmental Impact Statement will refer to those other documents to support discussion of transportation issues.

Each alternative evaluated in the Repository Environmental Impact Statement will include analysis of both national and regional (within Nevada) transportation options: truck, train, or a combination of both. The national-level transportation analysis also will include an evaluation of potential use of barges for the few situations where that is a possibility. Currently, the department expects that shipments to the repository would not begin until the year 2010.

National transportation options

One national transportation option would examine potential impacts of transporting all the spent nuclear fuel and high-level radioactive waste to Nevada by legal-weight truck. The environmental impact statement will evaluate representative national routes currently available or previously approved for transporting radioactive material to the Nevada border, and will explore potential impacts to human health and the environment from the maximum reasonably foreseeable accident scenarios. Specific national routes would be determined and approved by the Department of Transportation and the commission prior to actual shipments.

The other national transportation option would involve maximum use of rail transportation with use of heavy-haul trucks to transport casks from facilities that do not have direct access to railroads. Casks would be driven to the closest rail spur, where they would be transferred to a rail car and shipped to Yucca Mountain.

Regional transportation options

For transportation within Nevada, three options will be evaluated:

- (1) construction and use of a rail corridor from existing mainline railroads to Yucca Mountain;
- (2) transfer of spent nuclear fuel and high-level radioactive waste from existing rail lines to heavy-haul trucks which would complete the journey to Yucca Mountain on existing, new, or improved roads; and
- (3) use of legal-weight truck shipments directly to the repository.

The rail corridor option will identify and apply siting criteria, based on engineering considerations (for example, topography and soils). Other criteria would include potential land-use restrictions (such as wilderness areas and existing conflicting uses) and other concerns identified during the scoping process.

The heavy-haul truck option also will evaluate construction and of an intermodal transfer facility to receive shipments arriving at the Nevada border by rail. It will look at the need to improve existing roadways or possibly construct new ones.

The legal-weight-truck option would not involve a transfer facility, since the shipments would arrive at the Nevada border and continue directly to the repository.

We invite you to participate

The department will continue efforts to improve container design, enhance emergency response capabilities, and strengthen lines of communication. To that end, the public from across the nation is invited to participate in this environmental impact statement process by asking questions, sharing concerns, and offering suggestions about transportation issues relevant to the Repository Environmental Impact Statement. ■

DOE completes one mile of ESF tunnel

The Yucca Mountain Site Characterization Project (YMP) has completed 1,609.76 meters (one mile) of tunnel in the excavation of the Exploratory Studies Facility (ESF) at Yucca Mountain. The YMP is using a Tunnel Boring Machine (TBM) to excavate the ESF.

The ESF serves as an underground laboratory for engineers and scientists to help determine if Yucca Mountain is suitable for the geologic disposal of commercial spent nuclear fuel and high-level radioactive waste. Tests to be conducted in the ESF include: geomechanical testing to measure rock's response to pressure; radial borehole tests to measure water and vapor movement through rock; thermal testing to measure the effect of heat on rock, and testing of the potential movement of radioactive particles through rock.

These underground tests in the ESF are just part of the testing being conducted for site characterization. Other tests are being conducted in boreholes to understand how water moves through the mountain. The systematic drilling program is progressing as borehole SD-7 is at a depth of 1,897.1 feet, and is used to gather rock quality and stratigraphic data. Work also continues in shallow trenches and through monitoring of extensive instrument networks to understand seismic hazards.

The completion of the one-mile mark at Yucca Mountain represents significant progress in the excavation of the ESF. The ESF was initially scheduled to be excavated to a milestone distance of 1,280 meters (4,200 feet) by September 30, 1995. The current excavation of the tunnel beyond one mile places construction of the ESF approximately 330 meters (1,090 feet) ahead of the scheduled excavation progress.

The TBM and its systems have been operating as anticipated. On June 28, 1995, excavation was temporarily halted for a required maintenance on the TBM. During this outage, workers inspected the entire TBM and its numerous systems, performed a routine service inspection of the power distribution system, and made several modifications that increased overall operating efficiency.

The installation of a new conveyor system was also completed during the maintenance outage. This system allows muck, or waste rock, to be carried from the ESF on a continuous basis as the TBM advances. During previous operations, muck was removed with rail cars and small electric locomotives.

Presently, the veteran TBM crews are achieving Project record production days during ESF construction at Yucca Mountain. On September 1, 1995 the TBM excavated a one-day record of 46 meters (150 feet) of tunnel. The following two days of ESF excavation produced advance rates of 37 meters (121 feet) and 44 meters (145 feet) per day. ■

Tour of Yucca Mountain - Saturday, Nov. 11

The U.S. Department of Energy's Yucca Mountain Project invites you to tour the Yucca Mountain area and talk to scientists and staff members about ongoing studies.

Reservations should be made by calling (702) 794-7104 during business hours. Tours will be filled on a first-come, first-served basis. ■

1995 Yucca Mountain exhibit schedule

Nov. 6-9 Geological Society of America, New Orleans, LA, Sun. 5 p.m.-8 p.m. • Mon. 9a.m.-5 p.m. • Wed. 9 a.m.-4 p.m.

"Great things are done when men and mountains meet."

– William Blake

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

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