



# OCRWM BULLETIN

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

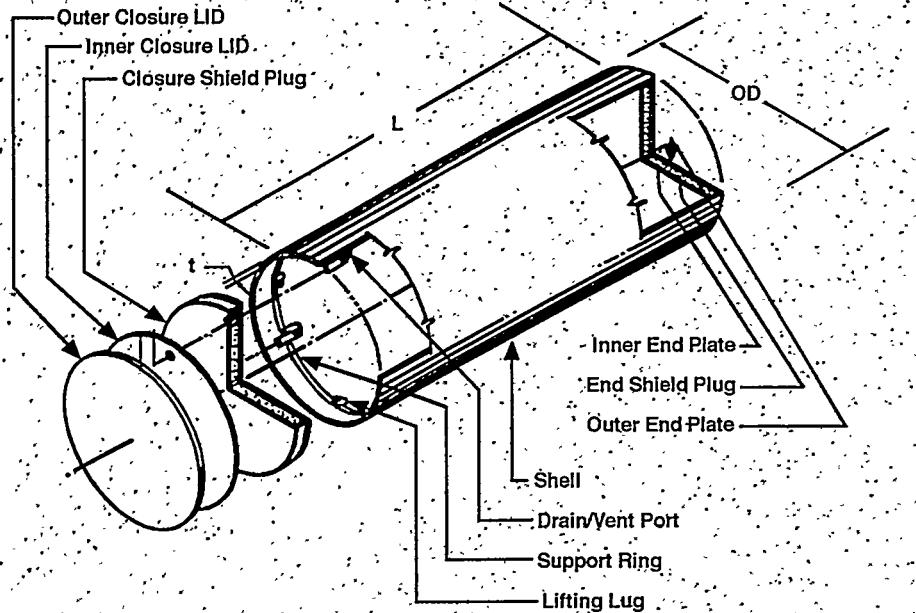
## WESTINGHOUSE BEGINS DESIGNING MULTI-PURPOSE CANISTER

The Secretary of Energy is currently exploring the use of a multi-purpose canister (MPC)-based system for the storage, transport, and disposal of commercial spent nuclear fuel through a phased approach, as discussed later in this article. The Westinghouse Electric Corporation is proceeding with preliminary design and safety analysis reports for what would be the world's first container system of this sort.

As a major Federal action, this initiative requires preparation of an environmental impact statement (EIS).

under the National Environmental Policy Act. The findings in the statement will contribute to the Department's final decision, scheduled for 1996, on whether to procure and deploy the MPC system. If the system is deployed, the design of its components would have to be certified by the U.S. Nuclear Regulatory Commission (NRC) as meeting all requirements for storage and transportation. The Department also would have to obtain a license from the Commission to use the canisters and associated equipment. No decision

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Westinghouse Multi-Purpose Canister Design Concept

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sion to fabricate or deploy the MPC system would be made until the Commission reviews designs and an EIS is completed.

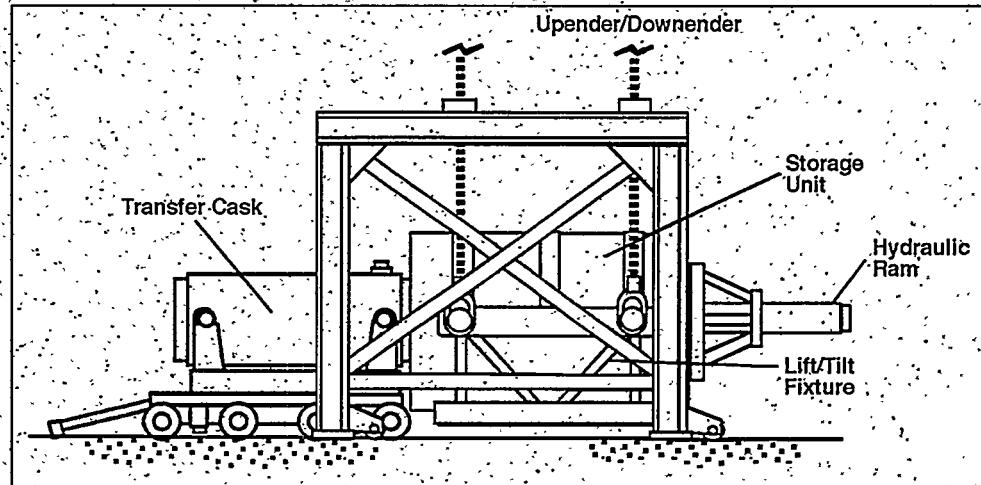
The NRC has already certified several casks for either storing or transporting spent nuclear fuel, and a number of companies are designing container systems for both storage and transport of spent fuel. The MPC system, however, would be designed not only for the storage and transportation of spent fuel, but also for its potential disposal in a geologic repository.

TRW Environmental Safety Systems, the management and operating contractor for the U.S. Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM), awarded the contract to Westinghouse on April 20, 1995. Although OCRWM is not a party to this contract, it will own the NRC-issued certificates of compliance for the MPC system.

"The awarding of this contract is a major step toward establishing an integrated Federal waste-management system, a system with compatible elements at every step," commented Jeff Williams, Director of OCRWM's Engineering Division.

The MPC-based system would require sealing spent nuclear fuel inside a metal canister. The sealed canister would be placed into a transportation cask for shipment and inside separate overpacks for storage and disposal. The intent would be to not reopen the canister once sealed. This reduces the need to handle individual fuel assemblies. In addition, a multi-purpose canister system could also help:

- Utilities meet their storage needs. Today, utilities store most of their spent nuclear fuel in special water-filled pools at their powerplants. By the year 2000, about



Westinghouse Transfer System Design Concept

30 civilian power reactors will not have adequate storage space in their pools. By 2010—the earliest date for commencement of repository operation—more than 75 civilian power reactors will not have adequate pool-storage capacity. The MPC system could be used for dry storage, either at the reactor sites or at a Federal interim storage facility.

- Standardize spent-fuel management in the United States. Utilities currently use dry storage at seven nuclear powerplants, and plans for dry storage at seven other plants by 1998 have been announced. These dry-storage facilities were not designed for use of the MPC or for compatibility with the Federal waste-management system but, by using MPCs for future storage, utilities could increase standardization and, in the long run, reduce the Nation's spent fuel management costs.
- Utilities decommission their reactors. Nine civilian reactors have shut down but still have spent fuel in pool storage. More reactors will shut down as they reach the end of their operating lives. The MPC system would be designed to allow removal of spent fuel from pool storage, shipment off site, and completion of the decommissioning process.

Another advantage of the MPC system would be the canister's large capacity. Designed for rail transport, the MPC can hold more fuel assemblies than a cask designed for truck transport. The larger capacity means fewer shipments, reduced time in transit, and reduced risk of accidents.

#### *The MPC System*

Systems engineers describe the MPC system as a "subsystem" of the Civilian Radioactive Waste Management System. The major functions of the waste-management system are to accept spent nuclear fuel or high-level radioactive waste from current owners and to transport it to an interim storage facility, or a Federal repository for permanent disposal. The waste accepted into this system will include spent nuclear fuel from commercial power reactors and high-level radioactive waste resulting from atomic energy defense activities. For each of its three uses—storage, transportation, and disposal—the MPC system would require approval from the NRC. The Federal regulations that govern these approvals are contained in the Commission's regulations in 10 CFR Part 72 (storage), 10 CFR Part 71 (transportation), and 10 CFR Part 60 (disposal).

The repository and "waste package" that, under this scenario, would include the MPC are still in the early

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stages of design. It will be years before a repository site is licensed and the repository and waste-package designs are complete. Because of this, the initial thrust would be to certify the MPC system for storage and transportation. Meanwhile, Westinghouse will design the MPC so that it is compatible with known requirements for disposal.

The canisters in the MPC system would come in two sizes, 125 tons and 75 tons, so that they can be used at as many reactor sites as possible. The weight refers to the nominal weight of a transport cask containing an MPC filled with spent fuel—the heaviest load a crane would have to lift at the reactor site.

Each of the two sizes will have two basket designs. The "basket" is the structure that will support the fuel assemblies inside the canister. (It also will absorb neutrons emitted by the spent fuel.) One basket design will be for fuel from a pressurized water reactor (PWR). The other will be for fuel from a boiling-water reactor (BWR). The 125-ton MPC will be able to hold 21 PWR or 44 BWR assemblies. The capacity of the 75-ton MPC will be 12 PWR or 24 BWR assemblies.

The MPC system must meet five major design criteria, derived from NRC standards:

- **Thermal.** The canister and overpacks must keep the spent fuel within the NRC's temperature limits to prevent fuel-cladding deterioration during long-term storage.
- **Containment.** The container must contain radioactive material during storage. Overpacks must limit any release of materials during transport and the period of substantially complete containment during disposal.
- **Criticality.** The canister must

keep the spent fuel from "going critical"—undergoing a self-sustaining nuclear chain reaction—during storage, transport, and disposal.

■ **Shielding.** The canister's shield plug must protect workers from penetrating gamma radiation during handling operations. The overpacks must shield people from this radiation during storage and transportation.

■ **Structural.** The canister and transportation cask must be able to withstand the hypothetical accident conditions outlined in the NRC's regulations.

The MPC system would have seven major components:

- Canisters (in two sizes, each with PWR or BWR baskets)
- Automatic welding equipment (used to seal the canister)
- Transportation casks (in two sizes, for the two canister sizes)
- Rail cars (a six-axle rail car designed to transport either size MPC and transportation cask)
- Storage units (concrete overpacks—in two sizes—for storing canisters loaded with spent fuel)
- Transfer casks (in two sizes, to be used at the reactor site to transfer spent fuel loaded into MPCs from the storage pool to the storage units and to transfer loaded MPCs from the storage units to transportation casks)
- Transporters (used to move loaded casks at reactor sites)

Westinghouse also will design the auxiliary equipment needed to support the use of MPCs at utility sites.

#### *The MPC Procurement*

Should the Department of Energy decide to go forward with deploy-

ment of MPCs, the procurement would be carried out in three phases. During each of the first two phases, OCRWM must decide whether to continue to the next phase. The three phases are:

- Phase 1—develop designs and prepare safety analysis reports.
- Phase 2—submit the safety analysis reports to the NRC for certification and construct prototypes.
- Phase 3—fabricate up to 2 years' supply of canisters (enough to store 400 metric tons of spent fuel in 1998 and 600 additional metric tons in 1999).

The Westinghouse contract covers the first phase. During this phase, Westinghouse will develop designs and prepare safety analysis reports for the MPC system, and will study ways to handle unique spent fuel designs—such as highly enriched fuel, exceptionally long fuel, and fuel clad with stainless steel. The company also may order some materials requiring a long lead time for the next phase of work.

Westinghouse has 9 months to complete the designs and 3 months after that to complete the safety analysis reports. (The start date for Westinghouse was April 25, 1995.) After the designs are complete, Westinghouse may be directed to submit its proposal for phase 2.

For its work on phase 1, the Westinghouse team will receive a fixed price of \$14,049,233. The Westinghouse team includes several Westinghouse divisions (Marine Division in Sunnyvale, California; Energy Systems in Pittsburgh, Pennsylvania; and the Scientific Ecology Group in Oak Ridge, Tennessee) and three key subcontractors: Packaging Technology (PacTec) of Tacoma, Washington; Chem-Nuclear Systems of Columbia, South Carolina; and E.J. Bentz Associates in Springfield, Virginia.

*"Canister" continued on page 15*

## FINAL INTERPRETATION OF NUCLEAR WASTE ACCEPTANCE ISSUES PUBLISHED

The Department of Energy (DOE) published a "Final Interpretation of Nuclear Waste Acceptance Issues" in the *Federal Register* on May 3, 1995. The "Final Interpretation" sets forth the Department's conclusions concerning the legal issues raised in the Notice of Inquiry (NOI) on Waste Acceptance Issues published in the *Federal Register* on May 25, 1994.

The Department's final interpretation of its obligations under Section 302 (a)(5) of the Nuclear Waste Policy Act of 1982, as amended (the Act), concluded that the Department has no legal obligation to begin accepting high-level waste and spent nuclear fuel in 1998 in the absence of a repository or other facility constructed under the Act. DOE has also concluded that it has no authority under the Act to provide interim storage. Additionally, the "Final Interpretation" addresses potential contractual remedies for utilities and the availability of contractual dispute resolution procedures to discuss financial or other assistance that may be appropriate in light of the Department's inability to begin providing disposal services in 1998.

The Department's "Final Interpretation of Nuclear Waste Acceptance Issues" provides supplementary information outlining the Department's arguments in support of its decision. To receive this "Final Interpretation," contact the OCRWM National Information Center at 1-800-225-NWPA (6972) (In Washington, D.C., 202-488-6720). To access it electronically through OCRWM's Home Page, select "Federal Register Notices" at <http://www.rw.doe.gov>.

## OCRWM DIRECTOR DISCUSSES NEED FOR INTERIM STORAGE

Dr. Daniel Dreyfus, Director of the Office of Civilian Radioactive Waste Management (OCRWM), appeared before the Subcommittee on Energy and Power of the U.S. House of Representatives on June 28, 1995, to discuss the interim storage of commercial spent nuclear fuel and high-level radioactive waste. Dr. Dreyfus outlined earlier efforts that had been made to address interim storage needs and the current storage situation, and discussed issues of safety, logistics, and costs for at-reactor storage, interim storage, transportation, and permanent geologic disposal of waste.

### Earlier Efforts to Address

#### Interim Storage Needs

Dr. Dreyfus stated that over the past two decades there have been several initiatives to provide Federal interim storage of spent fuel. The Nuclear Waste Policy Act of 1982 (the Act) directed the Department to select and propose a site for interim storage of spent nuclear fuel. However, the Department's proposal to locate a storage facility was annulled by the 1987 amendments to the Act. The 1987 amendments established the Office of the Nuclear Waste Negotiator for the purpose of finding a volunteer site for either a storage facility or a repository. The Negotiator was not able to develop a site proposal, and the Office's authority expired in January 1995.

### Current Storage Situation

Dr. Dreyfus noted that spent nuclear fuel inventories have been produced by 118 commercial reactors in 34 States, and that presently there are 7 nuclear powerplants that store approximately 600 metric tons of spent nuclear fuel in dry casks. By the year 2005, approximately 40 sites in 28 States will need additional dry storage capacity. It is estimated that by the year 2010, the timeframe in which the Department of Energy

expects to receive a license to emplace waste in the geologic repository, the figures will rise to about 55 sites in 30 States with storage capacity needed for over 11,000 MTUs.

### At-Reactor Storage

Dr. Dreyfus reiterated the Nuclear Regulatory Commission's "waste confidence" rulemaking in 1984, which found reasonable assurance that, if necessary, spent fuel generated at any reactor can be stored at the reactor safely and without significant environmental impacts for at least 30 years beyond the expiration of the reactor's operating license. However, he indicated that, although pool storage has been deemed safe, it is not, for institutional, economic, and technical reasons, a preferred long-term option. Dr. Dreyfus stated that "the long-term institutional responsibility for the integrity of spent fuel storage, especially at sites where reactors are no longer in operation, the probable proliferation of different spent fuel storage technologies over time, and the increasing complexity of transportation access to some sites as the demographics and transportation infrastructure change, promise to make the ultimate removal of spent fuel from the 70-plus sites increasingly costly and technically challenging."

### Transportation

Dr. Dreyfus stated that the Nuclear Waste Policy Act directs the Department to transport commercial spent nuclear fuel from reactor sites to a Federal waste management facility. He also said he was aware of the public's concerns about the choice of routes, the risk of accidents and possible threats to public health and safety and the environment, what emergency measures will be provided, the integrity of the shipping cask, and advance notification and inspection of the shipments. He indicated

that he is working with stakeholders and other programs within the Department to address these concerns. He stated that transportation planning cannot be completed and many key planning activities cannot proceed until a site is selected for storage or disposal.

#### **Permanent Geologic Disposal**

Dr. Dreyfus discussed the progress being made toward a determination of the suitability of Yucca Mountain as a permanent geologic repository. He stated that "over the last 2 years, the current Administration has taken action to bring the disposal program into better conformity with societal expectations of cost and schedule." Assuming appropriate funding is provided, by 1998 the program will have evaluated whether the Yucca Mountain site is technically suitable for radioactive waste isolation. The year 2010 remains the Department's target for emplacing waste in the repository.

#### **Consideration of Legislative Initiatives**

Dr. Dreyfus' testimony indicated that much has been learned over the past five decades about the realities of implementing academic nuclear waste management solutions. Recognizing the true complexities of the issue, Dr. Dreyfus emphasized four guidelines the Nation should use in any policy redirection:

- Continue to preserve human health and safety and protect the environment.
- With any new policy, provide funding commensurate with the objectives, recognizing the user-funded nature of the program.
- Continue to pursue geologic disposal by evaluating Yucca Mountain and the disposal concept itself (a key to keeping "interim" storage from becoming permanent).

- Any new policy should consider all high-level wastes, not just spent nuclear fuel.

Dr. Dreyfus concluded his statement by saying that "the Nation's policy for the interim management of spent fuel should recognize the systemic nature of the problem, including the needs for at-reactor storage, and interim centralized storage; the complexities of extensive nationwide transportation campaigns, and the technical and societal challenges of ultimate disposal."

*A copy of Dr. Dreyfus' complete Statement for the Record presented to the Subcommittee on Energy and Power of the U.S. House of Representatives on June 28, 1995, can be viewed on the OCRWM Home Page (<http://www.rw.doe.gov>) or obtained through the OCRWM National Information Center at 1-800-225-NWPA (6972) (in Washington, D.C., 202-488-6720).*

## **OCRWM DIRECTOR APPEARS BEFORE THE NUCLEAR REGULATORY COMMISSION**

On June 9, 1995, Dr. Daniel Dreyfus, Director of the Office of Civilian Radioactive Waste Management (OCRWM), appeared before the Nuclear Regulatory Commission (NRC). During this briefing, Dr. Dreyfus presented two Statements for the Record. The first presentation was a status report on the OCRWM program; the second updated the multi-purpose canister activities associated with the program.

During Dr. Dreyfus' first statement, he provided a general overview of the progress that has been made in activities across the program, reviewed the site investigations at Yucca Mountain, Nevada, that were

conducted during the first half of 1995, and addressed issues raised in a May 12, 1995, letter from the NRC relating to questions posed by the Commission during an April 25, 1995, NRC staff meeting. Dr. Dreyfus' opening comments during this statement included his recognition that the OCRWM program, in light of the ongoing debate regarding the program's future, needs Congressional guidance—and probably new authority—to define its role in the near-term management of commercial spent fuel.

Dr. Dreyfus' second statement provided background on the MPC concept, presented cost estimates for an MPC system, and discussed

OCRWM's current view of the MPC system, including the current status of its development and OCRWM's near-term plans for technology certification.

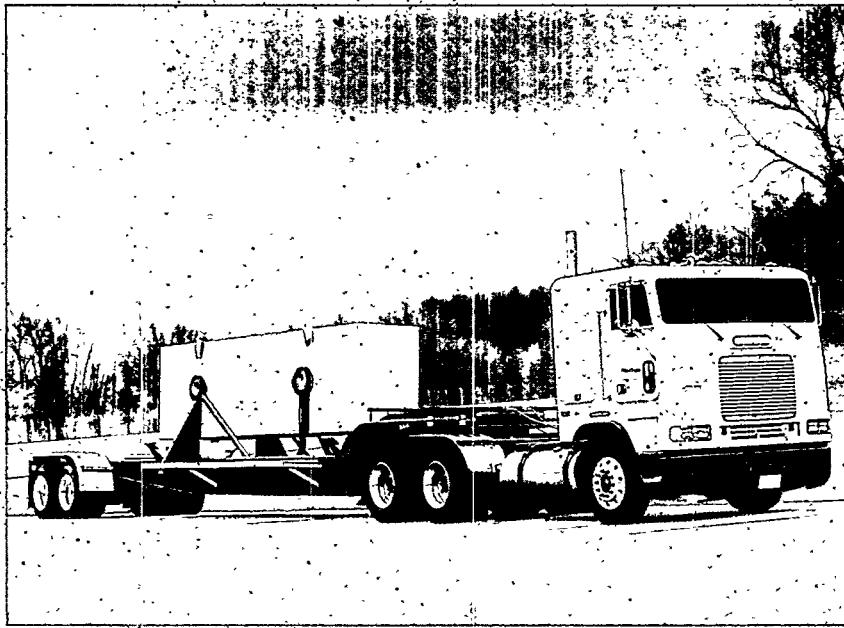
Dr. Dreyfus' two presentations are available on the OCRWM Home Page, accessible on the World Wide Web at <http://www.rw.doe.gov>. Copies may also be requested from the OCRWM National Information Center through its toll-free number, 1-800-225-NWPA (6972), or, in Washington, D.C., 488-6720. There is no charge for copies of the statements. To purchase a transcript of the June 9, 1995, NRC meeting, contact the NRC's Public Document Room at (202) 634-3273.

## DOE ACCEPTS GENERAL ATOMICS-9 ASSEMBLY TRANSPORTATION CASK TRAILER

The Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) has been aggressively developing a system for legal-weight highway transport of spent nuclear fuel to service utilities who cannot accommodate rail shipments. The legal-weight truck (LWT) transport system consists of a commercial-production cab-over-engine truck-tractor produced by Freightliner, Inc., and a lightweight semitrailer designed by General

Atomsics and fabricated by General Trailer. The LWT system is intended to support the requirements for highway transport of spent nuclear fuel loaded into the General Atomics-9 assembly transport cask (GA-9). To reduce the number of highway shipments of radioactive material over the Nation's highways, it will be necessary to carry as much spent nuclear fuel as possible per trip and still keep the total transport system weight under the 80,000-pound legal weight limit. Legal weight status is important, since it will eliminate the requirement to secure an overweight permit for each shipment. The LWT system is required to weigh less than 26,000 pounds while transporting the 54,000-pound (loaded) GA-9 cask.

General Atomics has designed a special trailer to transport its GA-9 spent nuclear fuel shipping casks. A similar type trailer will be designed for the GA-4 LWT cask. Upon completion of fabrication, the trailer was subjected to a series of performance tests. Prior to durability-testing, the trailer passed



Legal Weight Truck (LWT) transport system undergoing durability testing at the Allied Signal Automotive Proving Ground.

the Commercial Vehicle Safety Alliance Enhanced Inspection. To evaluate the trailer's durability, reliability, and performance, DOE has designed a durability and operational testing program targeted at augmenting current standard industry testing. The test is being performed in two phases. Phase one involved a durability evaluation of the trailer. Phase two will consist of an operational performance assessment of the entire LWT system.

Phase one of the durability-testing program was conducted at the Allied Signal Automotive Proving Ground in New-Carlisle, Indiana. As part of this demanding test, the GA-9 trailer experienced 7,489 durability-test track miles designed to simulate the stress and strain of 240,000 actual highway miles. During this time, frequent comprehensive structural inspections and design reviews were conducted to evaluate how the system would perform during actual operations, and to capture reliability data and maintenance experience

prior to extensive operation on public roads. As a result of the durability testing, completed in February 1995, minor modifications were made to further increase the structural durability of the trailer and to reduce its maintenance requirements. On April 26, 1995, OCRWM's Office of Waste Acceptance, Storage, and Transportation Division signed to accept possession of the GA-9 trailer for the Department.

The operational performance phase of the LWT system testing is currently in progress. During this demanding phase of the testing, the emphasis will shift from the durability of the GA-9 trailer to the operational performance of the entire LWT system. Testing events will be developed to measure how well the LWT system accelerates, brakes, and performs standard highway maneuvers such as changing lanes. Because driver performance and system safety are so essential to the program, human-factors information will also be collected and analyzed. The final phase of the testing will involve an assessment outside the test-track environment. This over-the-road operational assessment will involve 22 trips to 16 potential utility sites, located in 13 States and covering 17,200 miles. The purpose of this final phase of testing is to validate how well the LWT system performs in the real world. Full testing is expected to be completed by June 1996.

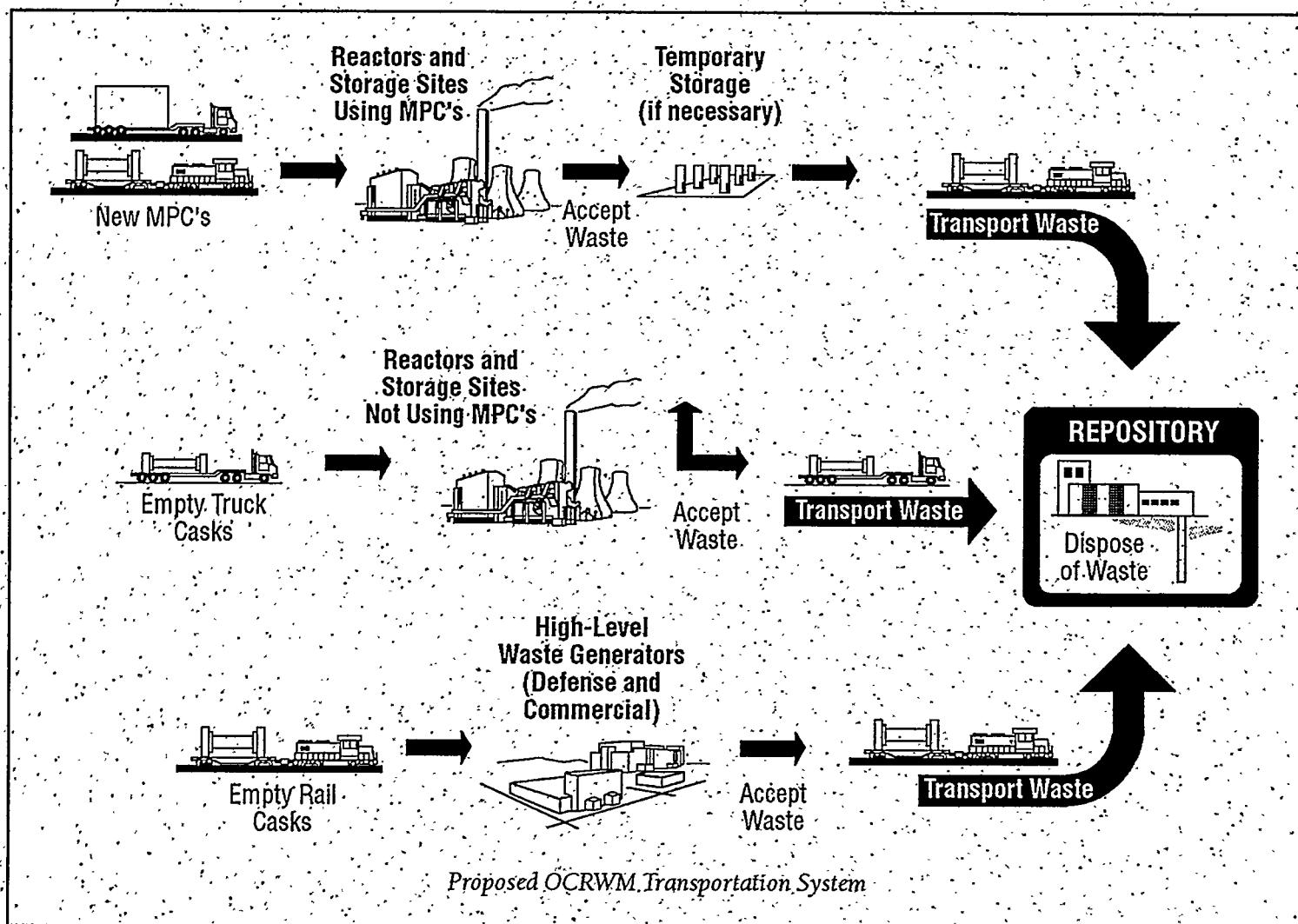
## TRANSPORTATION UPDATES PRESENTED IN BALTIMORE

The Office of Civilian Radioactive Waste Management (OCRWM) held its annual Transportation Coordination Group meeting in Baltimore, Maryland, June 6-7, 1995. Approximately 150 individuals from across the Nation attended the meeting. Lake Barrett, OCRWM's Deputy Director, opened the conference with an overview of the OCRWM Program. Linda Desell, Director of OCRWM's Environmental and Operational Activities Division, spoke on recent activities pertaining to the development of the transportation subsystem; contingency planning for the movement of spent nuclear fuel prior to the year 2010, if that becomes necessary;

necessary; institutional interactions; and the publication of the new OCRWM Transportation Report. Other OCRWM personnel updated meeting participants on the multi-purpose canister (MPC) system and associated procurement actions, and spoke on the status of the General Atomics legal-weight truck-casks, actions that have been taken to implement Section 180(c) of the Nuclear Waste Policy Act, and the latest efforts to produce a Department of Energy-wide routing guidance document. Waste acceptance issues and a preliminary OCRWM approach for transportation risk management were discussed, and brief updates from each of the Cooperative Agreement

groups sponsored by OCRWM were presented. A highlight of the meeting was a first-ever industry panel on rail issues, which reflected the growing recognition of rail transportation and its relationship to MPC initiatives.

Copies of presentations and reports distributed at the meeting are available through the OCRWM National Information Center at 1-800-225-NWPA (6972) or, in Washington, D.C., 202-488-6720. Meeting minutes were prepared and mailed to participants. For those parties unable to attend, meeting minutes are available through the OCRWM National Information Center.



## OCRWM'S HOME PAGE—UP AND RUNNING!

Looking for information on the Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) and the progress the civilian radioactive waste management program is making? You can now find much of that information on OCRWM's new Home Page. OCRWM program plans, current activities, resource materials, information services, a publications-ordering system, and a way to provide comments are all available through the Internet. New information is added every month, and outdated information is replaced when it is superseded. Cybersurfers can access OCRWM's Home Page via the World Wide Web at "http://www.rw.doe.gov," or through the Department of Energy's Home Page by selecting the Office of Civilian Radioactive Waste Management under the information systems category.

Within the first 4 days the Home Page was up and running, the database had been accessed 640 times. As of July 19, 1995, as this newsletter was going to print, the Home Page had been accessed 37,059 times.

Current Home Page users include education and government groups, private citizens, industry professionals, and many other parties throughout the United States. Many individuals in foreign countries, including Canada, Austria, Japan, France, Sweden, Italy, Turkey, Switzerland, and Finland also have managed to "web" their way to the OCRWM Home Page.

### What's on the OCRWM Home Page?

When viewers access the Home Page, they will find the following:

- Current program plans
- Announcements and an events calendar
- The current OCRWM Bulletin
- The current Annual Report to Congress
- Federal Register Notices



- Bilateral agreements with nuclear nations around the world (coming soon!).
- Cooperative agreements with groups working to help OCRWM achieve its mission.
- Reports on technical issues regarding the direction of the program
- Congressional activities
- Current budget information
- Fact sheets and brochures

- Educational material
- Answers to questions that are frequently asked about OCRWM's programs (coming soon!)
- OCRWM organization charts
- Speeches and testimonies (by OCRWM's Director and Deputy Director)

### How to Order Documents

In the near future, a publications-ordering system will allow users to search for and order specific documents using key words. Orders will be delivered directly from OCRWM's warehouse within 2 weeks of their order date. This ordering system is one of the features that is currently accessible through INFOLINK, OCRWM's present on-line system. The new, more user-friendly Home Page will eventually replace INFOLINK, which is a text-only interface for ordering publications, viewing the publication catalog, and perusing information.

Most of the information currently found on INFOLINK, which is scheduled to be phased out on August 15, will be available on Home Page.

### Yucca Mountain Information

Information about OCRWM's Yucca Mountain Project is also accessible from the OCRWM Home Page. On Yucca Mountain's Home Page, users can find the following information:

- Facts about site characterization
- On-line document search and ordering (coming soon!)



## OCRWM'S NEW HOME PAGE TO REPLACE INFOLINK

Because the advent of the World Wide Web service enables OCRWM to utilize the latest technology to deliver high-quality text and graphics to the public in a more timely and efficient manner, INFOLINK, OCRWM's electronic public information database, will no longer be maintained beginning August 15, 1995.

Information about the Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM) is now accessible on the World Wide Web at "http://www.rw.doe.gov," or when visiting the Department of Energy's Home Page by selecting the Office of Civilian Radioactive Waste Management under the information services category.

Additional information about the Home Page can be obtained from OCRWM's National Information Center at (202) 488-6720 (1-800-225-6972).

## CALL FOR PAPERS: 1996 INTERNATIONAL HIGH-LEVEL RADIOACTIVE WASTE MANAGEMENT CONFERENCE

A call for papers was recently issued for the 1996 International High-Level Radioactive Waste Management Conference, a forum for presenting and discussing scientific and technical information and issues related to radioactive waste. The conference, sponsored by the American Nuclear Society and the American Society of Civil Engineers, will be held April 29-May 3, 1996, in Las Vegas, Nevada. All submitted papers must be postmarked by November 8, 1995. Subject categories for the papers include natural, engineered, institutional, and integrated systems.

Papers, which are expected to contain descriptions of work that is new, significant, and relevant to

the conference purpose, may include research articles that contain new data and developments in a scientific area or a program of general interest; discuss a technique or a possible resolution for a problem of interdisciplinary significance; or include in-depth discussions of scientific issues related to policy questions. Criteria for selection will include originality and relevance of effort, validity of method, clarity of communication, and adherence to scientific method. As part of the acceptance requirements, authors must also comply with content and length guidelines. For more details on the guidelines and specific submission information, please contact Ellen Leitschuh at the American Nuclear Society, (708) 579-8253.

*"Home Page" continued from page 8*

- Schedule of tours and speaking engagements
- Announcements and an events calendar
- YMP educational programs
- Press releases related to the Yucca Mountain Project
- YMP's quarterly newsletter, *Of Mountains and Science*
- A virtual tour of Yucca Mountain (coming soon!)

### Comments Are Welcome!

Because the OCRWM Home Page is dynamic, always undergoing change, input from users is welcome. A mailbox is provided on the Home Page so that users can submit ideas about what they would like to see on the system, ask questions about the program, or request information, documents, or videotapes.

If you have any questions about how to access the system, or wish to learn more about the OCRWM Home Page, please contact the OCRWM National Information Center at (202) 488-6720 (1-800-225-6972).



## TRANSPORTATION EXTERNAL COORDINATION WORKING GROUP UPDATE

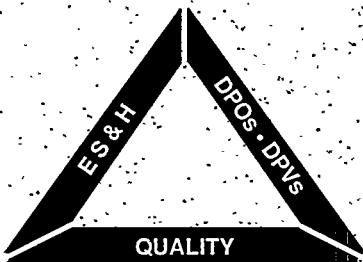
The Office of Civilian Radioactive Waste Management's (OCRWM) Transportation External Coordination Working Group met July 18 through 20 in Kansas City, Missouri. The topics of the three plenary sessions held on the 18th included (1) the status of the Department of Energy's Environmental Management transportation program; (2) a transportation program and activity update panel, which had discussions of the nitric acid shipments, a Waste

Isolation Pilot Plant update, a spent nuclear fuel update, and the latest status of the OCRWM transportation program; and (3) emergency management. Also on the 18th, three groups met during a breakout session to discuss transportation operations, general planning and public information and education, and Section 180(c) and routing.

The agenda for the 19th included four plenary sessions on the following topics: the national survey on public perceptions of transportation risks, the Commercial Vehicle Safety Alliance program, future

planning for the Department of Energy and local communities, and Department of Transportation-related activities. Breakout sessions on the 19th were expansions of the breakout session held on the 18th. The activities on the 20th included a plenary session devoted to reports on the breakout sessions and a tour of the Union Pacific railroad facilities in Kansas City.

For more detailed information on the meeting, please call Markus Popa at (202) 586-5330.



### OCRWM CONCERNS PROGRAM

The Office of Civilian Radioactive Waste Management is committed to Excellence in all its activities. If you have any concerns about the quality of work, Environmental Safety & Health, or any OCRWM issue . . .

**CALL THE OCRWM CONCERNS PROGRAM HOTLINE**

**TOLL FREE**

**1-800-874-5335**

**ALL CALLS ARE HANDLED CONFIDENTIALLY**

**➤ NOTE: If you wish confidentiality, please do not send concerns via e-mail.**

## NEW PUBLICATIONS

To order any of the publications listed below, free of charge, contact the OCRWM National Information Center (toll-free) at 1-800-225-NWPA (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. Internet users can access these publications on the OCRWM Home Page at <http://www.rw.doe.gov>.

*Office of Civilian Radioactive Waste Management: Fiscal Year 1994 Annual Report to Congress*, U.S. Department of Energy, DOE/RW-0464, May 1995. The FY 1994 Annual Report contains details of the Office of Civilian Radioactive Waste Management's activities and expenditures during fiscal year 1994 (October 1, 1993, through September 30, 1994), including audited financial statements.

*OCRWM Transportation Report*, Department of Energy, DOE/RW-0473, June 1995. This report, to be updated annually, reflects the status of transportation issues in the OCRWM program. Chapter 1 introduces the concept of nuclear waste management; Chapter 2 discusses the status of OCRWM's transportation system, and Chapter 3 addresses institutional issues related to the transportation of spent nuclear fuel and high-level radioactive waste. Appendix A contains OCRWM's responses to comments received on a preliminary draft Transportation Plan issued in June 1994. Appendix B identifies the current locations of spent nuclear fuel and high-level radioactive waste that will eventually require geologic disposal. Note: Comments and suggestions on this report, which will be reflected in future issues, should be directed to Corrine Macaluso, c/o Lois Smith, TRW Environmental Safety Systems, Inc., 2650 Park Tower Drive, Suite 800, Vienna, VA 22180.

*Publications (Brochure)*, Department of Energy, DOE/RW-0384, Rev. 1, 1995. This trifold brochure lists OCRWM publications that are available through the OCRWM National Information Center.

*OCRWM Home Page (Brochure)*, Department of Energy, DOE/RW-0383, Rev. 1, 1995. General information on what OCRWM's new Home Page database is, and how it can be accessed, is provided.

*Videos (Brochure)*, Department of Energy, DOE/RW-0386, Rev. 1, 1995. This trifold brochure lists the OCRWM-related videotapes currently available through the OCRWM National Information Center. An order form is included on the back.

*Resource Curriculum (Brochure)*, Department of Energy, DOE/RW-0385, Rev. 1, 1995. The four units of OCRWM's curriculum—*Science, Society, and America's Nuclear Waste*—are described.

*Exhibits (Brochure)*, Department of Energy, DOE/RW-0381, Rev. 1, 1995. OCRWM's traveling exhibits are described. Descriptions include subject matter and exhibit dimensions and weights.

## NEW VIDEOTAPES

The following new videotapes also are available, free of charge, through the OCRWM National Information Center.

*OCRWM Compilation Videotape*, Department of Energy, June 1995 (playing time: 97:06). Seven OCRWM program videotapes have been compiled onto this one tape, giving its audiences a wide perspective of the OCRWM program. Included are *OCRWM 1994 Program in Review*, *Multi-Purpose Canister System*, and *Yucca Mountain Project in Review 1994*.

*Yucca Mountain Site Characterization Project: May 1995 New Work Update*, Department of Energy, May 1995 (playing time: 6:30). This videotape on the Yucca Mountain Project describes the progress being made by the Tunnel Boring Machine; the Seismic Reflection Profiling Experiment; and independent borehole-drilling studies being conducted through Nye County's oversight program.

*Yucca Mountain Project: Cultural Resources Program—Preservation Through Cooperation*, Department of Energy, May 1995 (playing time: 9:00). This videotape describes Yucca Mountain's Cultural Resource Program, a cooperative effort between Project archaeologists and Native Americans to preserve the Native American tradition and its resources while making a careful scientific study of Yucca Mountain's long prehistoric past.

## AUGUST

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 July 27, 1995. For most current information, call (202) 488-6720.

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
29		30	31	1	2	3
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12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

Yucca Mountain Site Visit  
Las Vegas, NV

NAACH/DOE Scholars  
Summer Conference  
Washington, DC

DOE/NRC Bi-Monthly  
Management Meeting  
Rockville, MD

DOE/NRC Advisory  
Committee on Nuclear  
Waste Meeting  
Rockville, MD

OCRWM DPR  
Washington, DC/ Las Vegas, NV/  
Dunn Loring, VA (O)  
(Videoconference)  
NCSL HI RW Interim Storage  
Transportation Working  
Group Meeting  
Buffalo, NY

[Name], OCRWM Speaker

(O) Open to the Public

(P) Public Participation Meeting

OCRWM-sponsored meeting codes:

## SEPTEMBER

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 July 27, 1995. For most current information, call (202) 488-6720.

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
						1
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26	27	28	29	30	31	3
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1995

OCRWM-sponsored meeting codes:

(P) Public Participation Meeting

[Name] OCRWM Speaker

(O) Open to the Public



**"Canister" continued from page 3**

PacTec has the lead in designing and certifying the system for transportation; Chem-Nuclear has the lead in designing and certifying the system for storage; and E.J. Bentz is providing engineering support.

All team-member companies have extensive experience in designing packages for transporting and storing nuclear materials. Their products include the casks used to ship spent fuel from Shoreham, New York, to Limerick, Pennsylvania; core debris from Three Mile Island (Pennsylvania) to Idaho; and, in the future, transport of transuranic waste from defense facilities to the Waste Isolation Pilot Plant in New Mexico. Westinghouse also ranks among the world's leading suppliers of nuclear fuel, pressurized-water reactors, and other equipment used in nuclear powerplants.

TRW evaluated proposals to determine the overall best value to the U.S. Government and ratepayers based on business management, technical, and price factors. For phase 1, the "business and management" criteria included corporate experience, personnel, management plans, and facilities. The "technical" criteria focused on the system's design and how difficult it would be to certify, fabricate, and operate. The total fixed price for phase 1 plus the total estimated prices for phases 2 and 3 were also part of the evaluation.

Five qualified offerors—including the Westinghouse team—submitted proposals in response to TRW's request for proposals. Three of the unsuccessful offerors have protested the contract award to Westinghouse. The U.S. General Accounting Office is reviewing their protests and is due to report its findings to OCRWM by early fall.

**Technical Challenges**

"I don't expect any technical gremmils that would keep us from being

successful on this contract," said Jim Clark, MPC manager for OCRWM's management and operating contractor. "But the schedules are tight. It will be a major challenge to get the system certified and begin deployment by the fall of 1998."

Another challenge is resolving the issue of burnup credit—allowing for the loss in reactivity as fuel is used (or "burned") in a reactor. The NRC has not allowed burnup credit in the past, but has agreed to review how OCRWM plans to account for it. The first report in a planned series of topical and technical reports has been provided to the NRC. Initial comments from the NRC staff have been encouraging. Additional reports will be developed and submitted to the NRC over the next few years in an attempt to resolve the issue of burnup credit.

Keeping the MPC design consistent with the evolving designs for disposal will also be a major challenge. In April 1996, at the same time the safety analysis reports are submitted to the NRC for review, OCRWM intends to submit a report to the NRC on the MPC's consistency with disposal requirements. A positive response from the NRC would be a letter of "no objection" to proceeding with the MPC design.

"A preliminary design of the waste package is due in September 1997," said OCRWM nuclear engineer Dan Kane. "By then we should know a lot more about how the MPC would interact with the disposal package, natural environment, and repository operations. A letter of 'no objection' would tell us that the NRC sees no fatal flaws in our plans to use the MPC as part of the disposal package."

**NEPA Compliance**

Another major challenge is compliance with NEPA—the National

Environmental Policy Act. NEPA applies to major Federal actions, such as deciding whether to fabricate and deploy an MPC system. This law requires Federal agencies to consider how major Federal actions might affect human and natural environments.

To comply with NEPA, OCRWM will prepare an EIS and a Record of Decision. The EIS will present an analysis of the alternatives and their effects on the environment. The Record of Decision will report OCRWM's decision on whether to fabricate and deploy the MPC system.

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—which ended on January 6, 1995—OCRWM received 2,832 comments from 427 sources. The comments focused on transportation, materials, manufacturing, regulatory requirements, and public health and safety.

OCRWM expects to publish and distribute an Implementation Plan for the MPC EIS this summer. This implementation plan reports the results of the public scoping process, and provides the plan for the preparation of the EIS. OCRWM's next steps will be to release a draft EIS for public comment in December 1995, conduct public hearings in January 1996, publish the final EIS in August 1996, and issue the Record of Decision at least one month following publication of the final EIS.

"We still have much to do," said Jeff Williams, "and it will be a challenge to meet the milestones we have set for developing the MPC-based system. But with the awarding of the design contract, we are now on track to develop this key part of the Nation's spent-fuel management system."

# SUMMER 1995 OCRWM EXHIBIT SCHEDULE

American Chemical Society's Fall National Exposition  
August 21-23, Chicago, IL  
Exhibit: *National Program Exhibit*

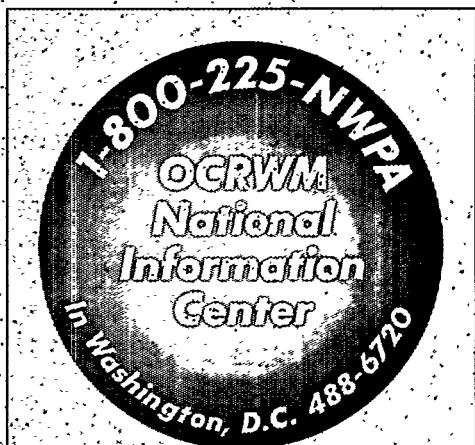
National Association of Towns and Townships  
September 6-8, Washington, DC  
Exhibit: *Multi-Purpose Canister Exhibit (anticipated)*

Emergency Nurses Association  
September 7-9, Nashville, TN  
Exhibit: *Transportation Exhibit (anticipated)*

National Association of Governors' Highway Safety  
Representatives Annual Meeting  
September 24-27, Anchorage, AK  
Exhibit: *Multi-Purpose Canister Exhibit (anticipated)*

## OCRWM WAREHOUSE RELOCATES

The OCRWM publications warehouse is moving from Oak Ridge, Tennessee, to Beatty, Nevada. During the transition period, July 28 through August 14, 1995, no documents will be distributed. However, OCRWM publications and videotapes can still be ordered through OCRWM's toll-free number, 1-800-225-NWPA (6972). Distribution of orders received during the transition will begin on August 15.



## OCRWM OUTREACH

The OCRWM National Information Center was established to provide easy access to information on program plans and activities. To contact the Information Center, please call 1-800-225-NWPA (6972) or 488-6720 (in Washington, D.C.).

## 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

Summer 1995

## Drillers find more perched water in Yucca Mountain's unsaturated zone

On March 7, drill rig operators encountered the latest in a series of "perched" water pockets in Yucca Mountain. They found the water at the south end of the po-

tential repository block, in a borehole drilled to a depth of about 487 meters (1,600 feet).

The water, which appears to be limited in quantity, was found be-

neath the potential repository block, and about 120-150 meters (400-500 feet) above the water table. Project geologists and hydrologists believe they must learn more about how perched water gathers at Yucca Mountain. They are particularly interested in whether the perched water zones that exist are interconnected. Studies of this perched water will help them determine whether it poses a problem for the construction or safe operation of a repository.

Similar pockets of perched water were found in 1993 and 1994 at similar depths in the Drillhole Wash area north of the potential repository site. Hydrologists found bodies of perched water that appear to be mixed with drilling fluids left in the ground during the

*Continued on page 106*



Drill rig operators recently encountered the latest in a series of water pockets in Yucca Mountain at the south end of the potential repository block.

## Erionite find at Yucca Mountain poses few worker safety risks

Last October, Yucca Mountain Project mineralogists discovered an occurrence of a white, fibrous mineral called erionite in a rock core sample removed from the UZ-14 borehole. Drillers had hit a rare two and a half meter (eight-foot)

layer of tuff containing erionite. The erionite layer, the only one of its kind and size found at Yucca Mountain to date, began at 415 meters (1,364 feet) underground. There was no erionite found in the

*Continued on page 102*

## At a Glance

- Project hydrologists find more perched water pockets at Yucca Mountain. But where does it come from? See cover story.
- Project workers take special measures after encountering erionite at Yucca Mountain. See page 101.
- A Las Vegas student and teacher have a close encounter with a volcano in Hawaii. See page 107.
- He's here, he's there, he's everywhere. Meet Lawrence Weekly, a Project Speakers Bureau coordinator and community activist. See page 110.



Printed with soy-based ink on recycled paper containing 100% postconsumer recovered fiber

Continued from page 101

## Erionite

rock layer above or below this location. This was not a trace amount, says Dave Bish, a mineralogist with the Los Alamos National Laboratory. The erionite occurred in substantial quantities.

Erionite is rare outside of Turkey, California and Oregon. Like asbestos, it is suspected to be hazardous to one's health if inhaled in quantities and for a long time. When Project scientists first encountered it in appreciable quantities, they had a hard time finding scientists in the United States who had ever studied the material extensively. This is due, in part, to its rarity and to there

being few known commercial uses for erionite. Refineries had once used the mineral to make gasoline, but eventually found something better, so they discontinued its use.

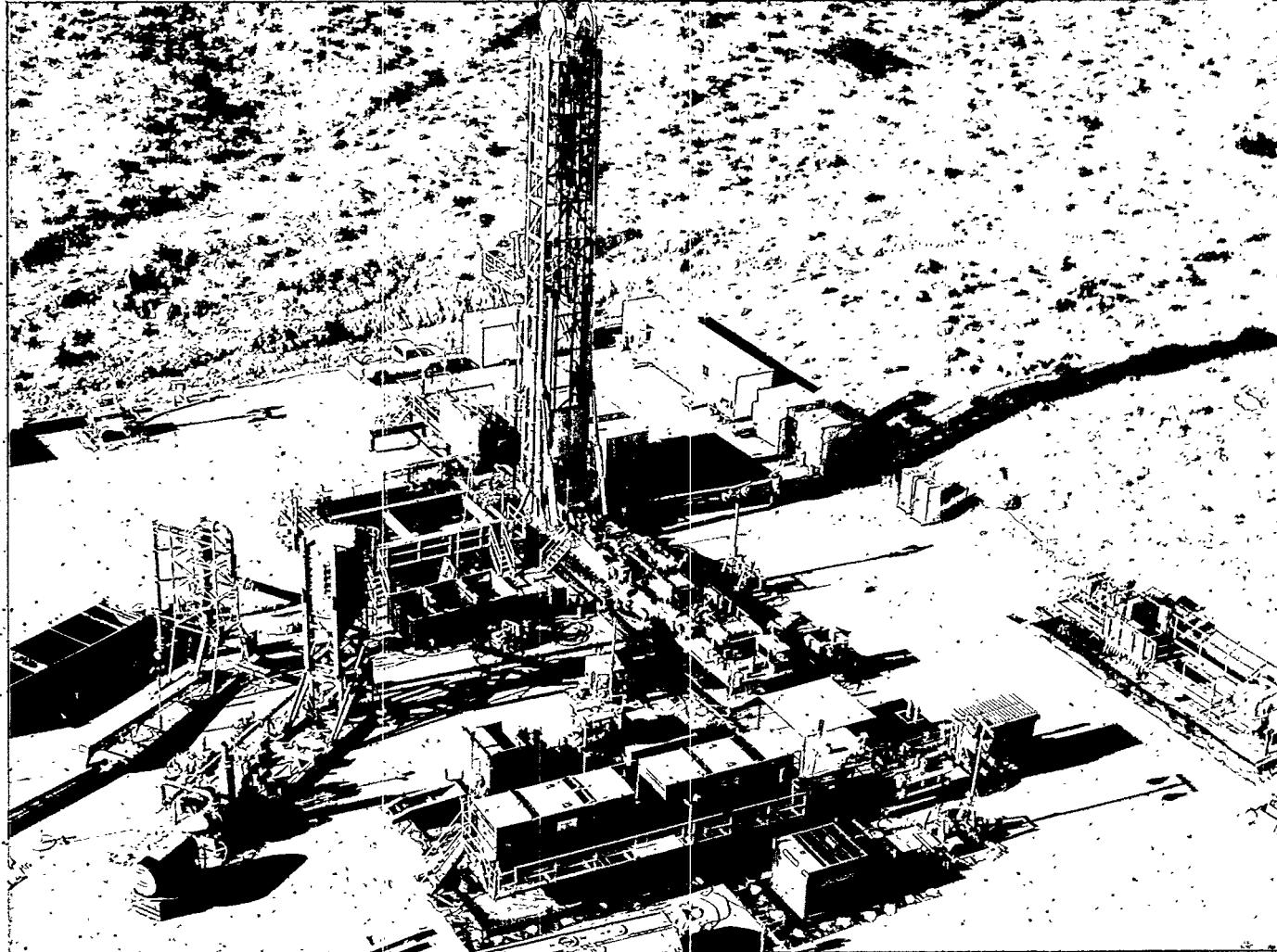
Project mineralogists certainly didn't expect to find quantities of erionite at Yucca Mountain. The mineral initially appeared to exist underground in trace amounts only, usually in places where water had somehow caused chemical alterations in the rock. There had been nothing to indicate a significant presence of erionite — nothing, that is, until a significant find occurred.

"To say we were surprised is an understatement," said Bish. "In fact, we were astonished."

### Early erionite traces

In 1987, scientists studying the mineral makeup of Yucca Mountain found their first, very small deposit of this extremely rare (for the area) fibrous mineral. They found it in a single location deep underground, in a one- to two-millimeter layer of rock directly above the lower vitrophyre rock layer. The vitrophyre is a glassy, densely welded unit of tuff that looks like obsidian and exists at

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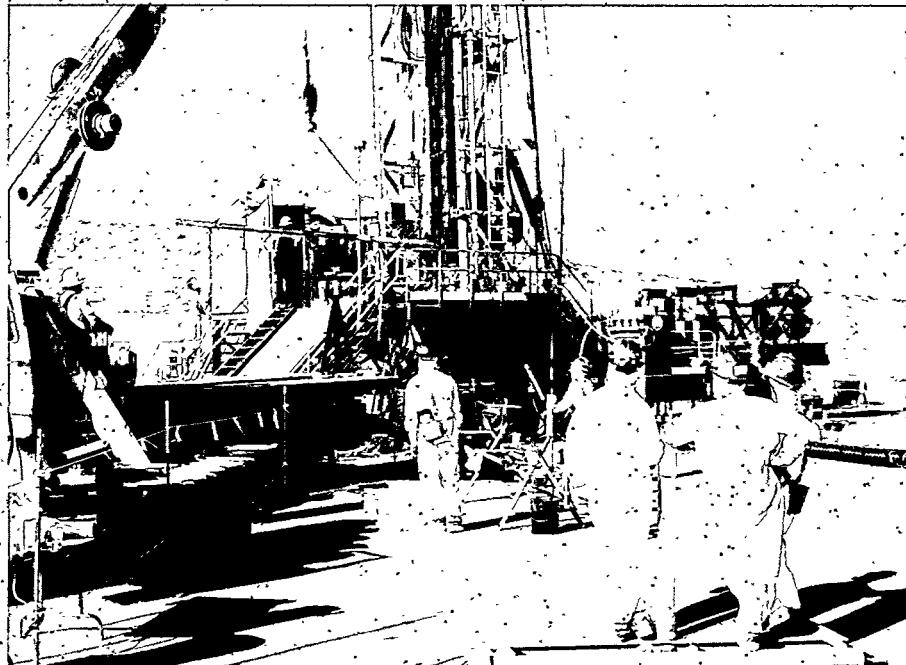


Aerial photo of the UZ-14 borehole, where drillers hit a rare two and a half meter (eight-foot) layer of tuff containing erionite.

the bottom of the Topopah Spring Member, or section, of the Paintbrush tuff. The fracture containing erionite was found well below the horizon of a potential repository. Only a tiny percentage of this fracture contained erionite.

This first encounter with erionite occurred at a depth of 395 meters (1,296 feet). Workers found it lining a rock fracture under Drillhole Wash. The fracture lining was small, but erionite made up 34 percent of its weight. Before the latest encounter, mineralogists had located extremely limited quantities of erionite in two other places.

All four incidents of erionite were deep underground, and occurred above the water table. In each instance, the erionite formed in clay and zeolite-rich zones at the top of vitrophyres, where water had forced mineralogical changes where one layer joined another. Three of these occurrences formed above the lower vitrophyres of the Topopah Spring Member.



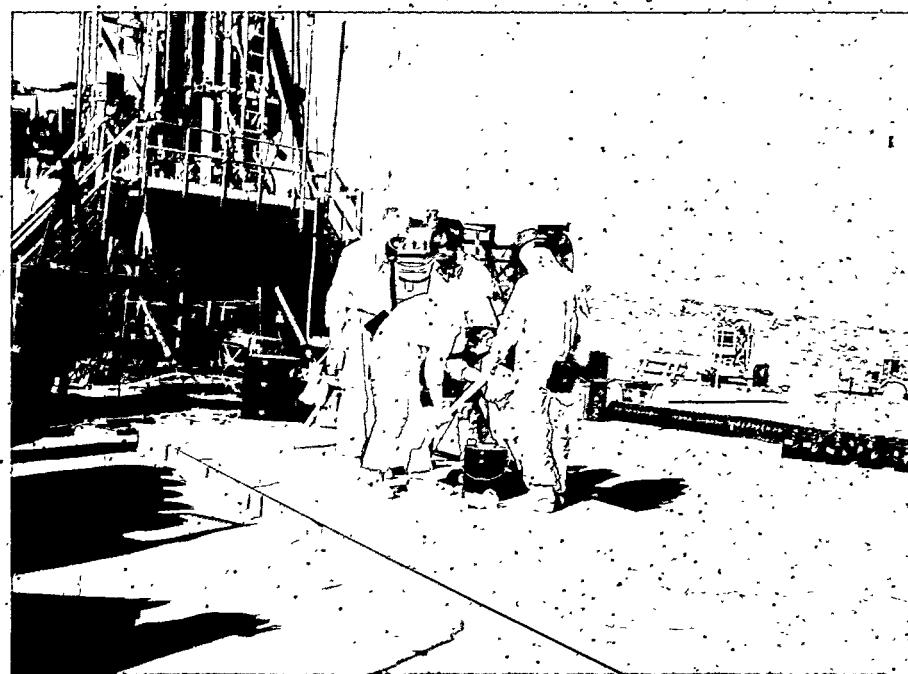
Workers wearing protective suits remove a rock core sample suspected of possibly containing the mineral erionite.

#### Possible health effects

By 1994, new information was becoming available about the biological effects of erionite. Research suggested more conclusively that large amounts of erionite inhaled

over long periods may pose significant health risks. Scientists believe that some kinds of erionite can cause lung cancers. Chief among these is pleural mesothelioma, a rare malignant tumor of the lung membrane. Such diseases are often caused by prolonged inhalation of various asbestos or silicates, which have carcinogenic effects upon the lungs.

Afflictions like mesothelioma are considered to be occupational diseases. They are caused by the inhalation of particles from industrial or natural substances that deposit themselves in the lungs in amounts substantial enough to overwhelm the body's defenses. At Yucca Mountain, fortunately, no worker exposure to erionite was detected by industrial hygienists. When UZ-14 was drilled, the erionite was found below a pocket of perched water. This water prevented the erionite fibers from becoming airborne.



Workers wearing protective suits prepare a rock core sample for transport.

Continued on page 104

Continued from page 103

## Erionite

Mineralogists and biologists had, in recent years, determined that erionite was probably a great deal more hazardous to humans than asbestos. They also believed it might pose dangers in less amounts when breathed in over less time than asbestos.

But no one actually knows how much exposure to erionite might create a health effect. Nor could anyone say how much erionite could be inhaled without overwhelming the body's natural defenses. Fortunately, nothing that was found at Yucca Mountain required immediate answers to these questions.

### Worker safety issues addressed

Although no one inhaled or ingested erionite, Project safety personnel realized in the wake of their latest find that they would have to re-examine erionite levels at the site. They also knew they would have to take precautions to safeguard workers and other members of the public from possible future encounters with the mineral. These precautions would remain in effect until the full extent of any risks became known. Conceivably, drillers could encounter erionite during those brief periods when their drill bits might strike an erionite-containing fracture or rock layer not enveloped in water. Sample management personnel could incur exposures when shipping or pulverizing rock samples for study at laboratories. Laboratory personnel might then risk exposure too.

The Project's Health and Safety Department moved quickly to protect on-site workers from possible health effects:

- The Sample Management Facility (SMF) at Yucca Mountain

was directed to close and seal core boxes containing core samples from depths where erionite could be present in all recently drilled boreholes, including UZ-14, UZ-16, SD-12 and SD-9.

- Industrial hygienists tested air and swipe samples of dust from the SMF for possible erionite contamination. They removed bulk samples of dust and particulate from drill rig dust containment bins for testing.

- Whenever drills approached within 15 meters (50 feet) of possible erionite-bearing rock, safety personnel limited access to the drill rig area.

- Safety officers required workers continuing to operate the rigs to wear high-efficiency particulate filter respirators. In some cases, they also donned protective suits.

- Safety personnel rotated workers wearing such gear frequently to prevent possible dehydration.

- Health and safety specialists were brought in to ensure that all possible safety measures and protocols have been complied with.

### Mineralogists take a second look for evidence of erionite

Puzzled by the size of last year's discovery of erionite, Project mineralogists began re-examining core samples from drilling sites. They looked mostly at samples they suspected might contain erionite in trace amounts overlooked by traditional rock analysis techniques. These researchers eventually developed new methods for detecting mineral traces in amounts previously invisible. This effort turned heads within the world mineralogical community. It also pointed to two other traces of erionite. One occurred relatively

far from Yucca Mountain. The other occurred deep underneath it.

Woolly in appearance, erionite is sometimes found in zeolite deposits. In the American West, it occurs most frequently in the tuff strata between Eureka and Elko, Nevada. Like other zeolites, erionite can take up metals and

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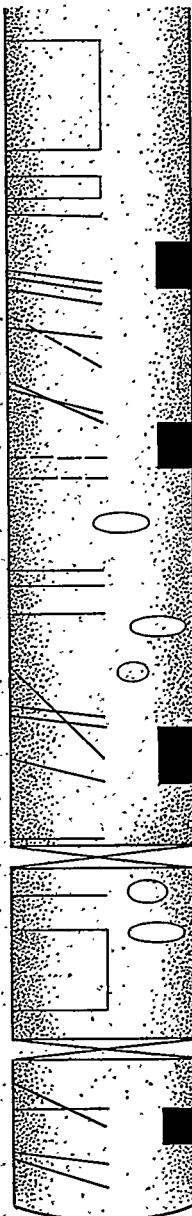


Illustration of the kind of core sample in which scientists found traces of erionite.

positively charged ions. But unlike the other zeolites found in the tuff at Yucca Mountain, it is dangerous when breathed over time.

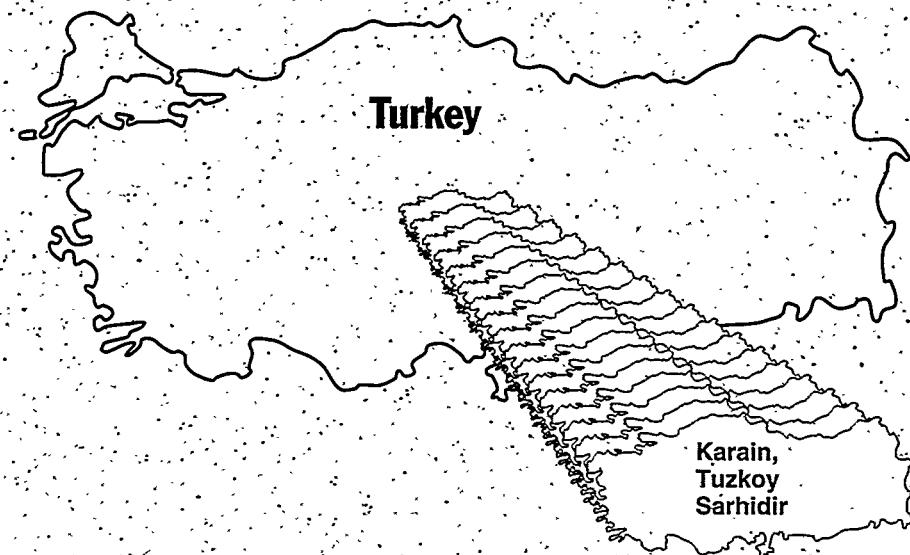
### Dangers of erionite first recognized

News that erionite might affect human health first emerged during the late 1970s. I. Baris, a researcher visiting several villages in a remote region of central Turkey, noticed something odd. The local population lived in rock huts and caves. And they were dying in unusual numbers from mesothelioma.

The chances of someone succumbing to this disease elsewhere in the world were about one-in-a-million. In the villages of Karain, Tuzkoy and Sarhidir, however, this cancer had become the single leading cause of death. It began in the linings of the lungs. And the researcher saw a distinct resemblance to the cancers caused by certain types of asbestos. The only problem was, there didn't seem to be enough asbestos in the region to create such a deadly epidemic.

The walls of peoples' homes, the researcher observed, were carved from tuff. Tuff is a sedimentary rock made up of particles of igneous rock from volcanic eruptions. Upon examining this tuff, he noticed that it contained large quantities of erionite.

Scientists in the United Kingdom took quick notice of the situation in Turkey. One British researcher, Chris Wagner, exposed large numbers of small animals to erionite. Often, he dabbed the pleura of their lungs with small amounts of erionite dust. He also exposed a control group of similar animals, mostly rats and hamsters, to asbestos. The results, says Bish, seemed to show that erionite was



Turkey

News that erionite might affect human health emerged in the late 1970s when it was discovered that the walls of peoples' homes in the villages of Karain, Tuzkoy and Sarhidir, located in a remote region of central Turkey, were carved from tuff containing large quantities of the white, fluffy, fibrous material.

considerably more carcinogenic than asbestos, silicates, and most other naturally occurring minerals. His findings were born out by subsequent research.

These findings led the World Health Organization's International Agency for Research in Cancer to list erionite as a known human cancer-producing agent. But other agencies have not yet done so. Medical researchers have not yet determined what quantities of erionite must be inhaled, and for how long, to affect human health. Nor have they developed specific health and safety standards for those who might find themselves exposed to it.

Air, dust samples at Yucca Mountain's surface show no Erionite

Mike Pochowski, a Project health and safety specialist, suggests that some comfort may be taken from the fact that most systematic efforts to find erionite at

the site have turned up little or none of the mineral. Air and dust samples taken regularly at the surface of the Yucca Mountain area have revealed no erionite signatures. Casual visitors to the site, therefore, do not appear to face any greater risk of erionite exposure than they might face almost anywhere else in the western United States.

Also, scientists do not expect erionite to pose a problem in the construction or operation of a high-level nuclear waste repository. The altered tuff where erionite has been found at Yucca Mountain exists below the potential repository horizon. Any excavation in that zone will be conducted with great caution. Workers engaged in such work will wear protective gear. The amount of erionite that might be liberated into the biosphere from any of their activities, scientists believe, would be too small to have any discernible effect. ■

Continued from page 101

## Perched water

early 1980s, before the present studies of Yucca Mountain began.

Samples have been taken from the most recently discovered water to determine whether the water contains traces of drilling fluid. But hydrologists would be very surprised if it does. If so, they would have to contend with the possibility of a much larger, interconnected body of underground perched water.

"The water is well below the elevation of the proposed repository, and shouldn't affect construction," says Robert Craig, chief of the U.S. Geological Survey's Nevada Operations Program. But Craig believes that a perched water situation would have to be assessed in scenarios depicting how waste might move out of a repository.

Craig says that scientists were not particularly surprised to find the water where they did. The water occurred in an area of changing conditions between one geological layer of rock and another. Such areas sometimes contain pockets of suspended water because one layer may be more or less permeable than another. Permeability refers to the degree to which a fluid can move through rock.

When water that is seeping slowly through relatively permeable rock reaches rock that isn't quite so permeable, that water may have limited places to go, and builds up. Alternatively, water can accumulate in less porous rock. Because the pores are narrow, any water contained in them drains slowly. Either way, over time, water can accumulate into sizable pockets.

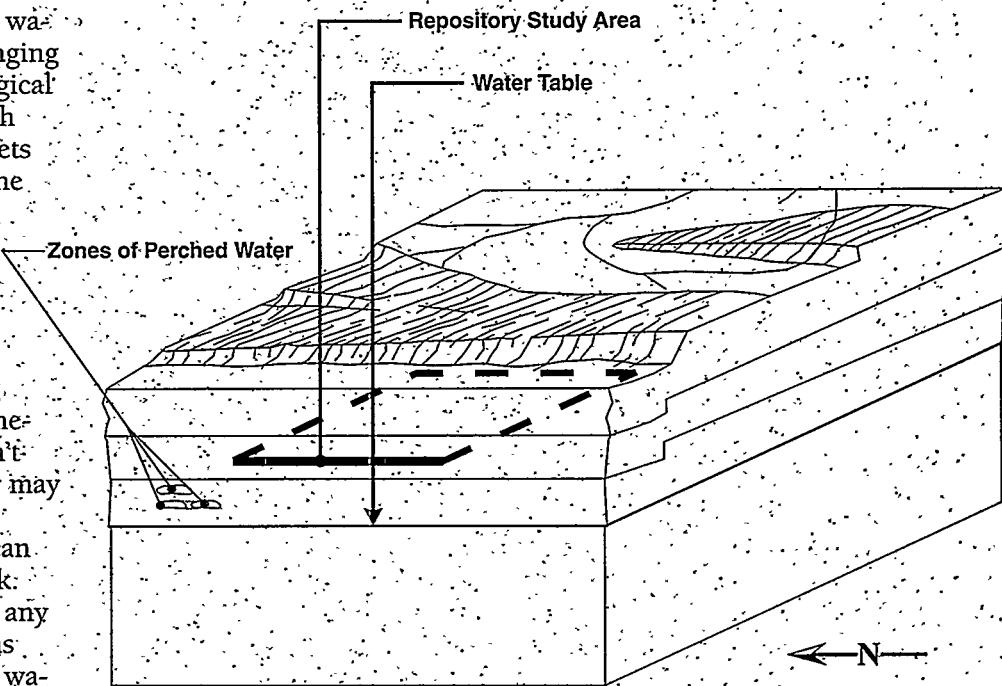
What remains unclear to scientists is whether the perched water recently found seeped down from

the surface or arrived along a dipping horizontal plane, perhaps from water flowing downward from the northeast. Possible sources of the water will be determined by a series of tests for analyzing and dating water samples. These tests may tell scientists if the waters found in different locations are from different sources or if they are interconnected.

Scientists suspect that there may not be a great deal of permeability near this latest perched water. Hydrologists pumped 35,580 liters (9,400 gallons) of water from the drillhole during one eight-hour test. During a subsequent test scheduled to take 120 hours to complete, water levels de-

creased by 2.2 meters (7.5 feet) in the first 30 hours, causing hydrologists to cancel pumping a quarter of the way through their test. Within a week, the water level rose only slightly, stabilizing at about two meters (six feet) below where it had first been. This suggests that water is not returning, in vast quantities, back to the perched water zone.

"That week-long period," said Craig, "implies that we de-watered part of that perched water body. More important to us than how much water we have there is how fast it's moving, if at all. It probably is moving, but is it moving fast enough over the next several thousand years for us to be concerned about?" ■



A cross-section of Yucca Mountain as seen from the west. The perched water pictured here occurs away from, and well below, the repository study area, yet also above the water table.

# The Argonauts take Hawaii

Over 3,000 years ago, hoping to regain possession of the kingdom that was rightfully his, the Greek mythological hero Jason set out in search of the woolly hide of a golden ram best known as the "Golden Fleece." Aboard a ship called the Argo, Jason and his "Argonauts" crossed uncharted waters, allegedly discovering fertile land along the Black Sea.

Dr. Robert Ballard, a senior scientist at the Woods Hole Oceanographic Institution, is a latter-day Jason who caused a stir in 1985 by discovering the location of the sunken Titanic. When news of this find broke, Ballard received thousands of letters from students fascinated by his endeavors. In response, Ballard created the JASON Foundation for Education, using it to launch the JASON Project. His aim? To rekindle within today's American students the sense of adventure personified by this mythical Greek figure.

## Students embark on a fantastic voyage

The JASON Project is one of

several educational endeavors supported by volunteers from the Yucca Mountain Project to point students toward a greater interest, and perhaps even a career, in science.

Jason has taken students via satellite on electronic field trips to the Mediterranean, the Galapagos Islands and Belize. Last February, Ballard and a select team of JASON scientists, students and

teacher Argonauts, set out for the Big Island of Hawaii.

They did not go there, though, to bag rays or catch a wave. High school students nationwide followed their exploits by way of telecasts at schools and facilities in and around Las Vegas and the United States. They gazed with wonder as the Jason team used

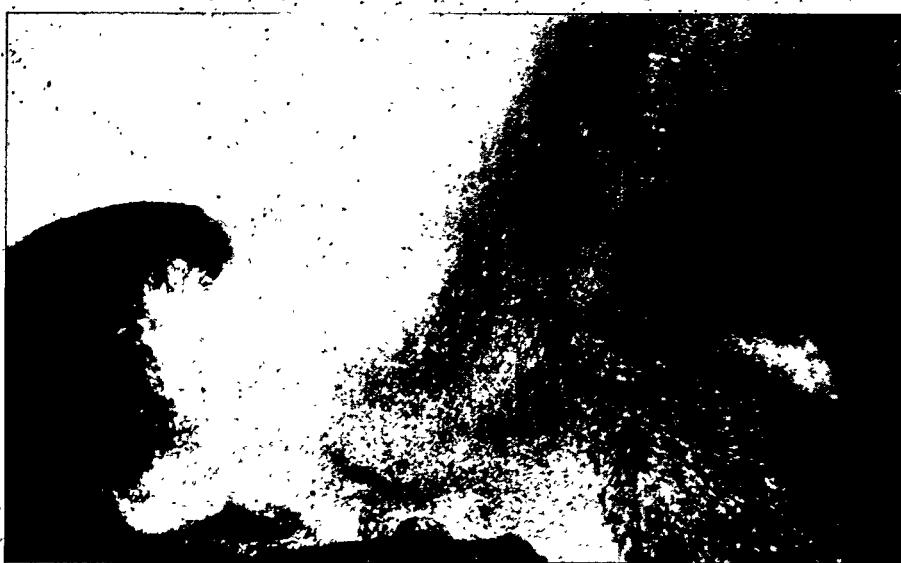


Dr. Robert Ballard confers with one of his Argonauts.

robotic vehicles to explore the eruption zone of the Kilauea volcano. Here, the Argonauts looked directly upon the forces that churn deep within the Earth.

Along on this dramatic encounter with the rages of nature were two Las Vegans: student Argonaut Angela Namba, a tenth grader at Durango High School; and Kathy Grimes, a teacher at Woolley Elementary School. Grimes is a member of the Yucca Mountain Project's Teacher Steering Committee, and an award-winning science teacher whose participation in the Project inspired her to promote experience-based learning.

Grimes says she found the Hawaii expedition both educational and daunting. "We were leaving the village one morning at 3 a.m.," she recalls, "and there was a glow in the sky I hadn't noticed on



"It was humbling to realize how little control we have over nature," says Argonaut Kathy Grimes.

Continued on page 108

Continued from page 107

# The Argonauts take Hawaii

previous mornings. It reminded me of the glow you see in Las Vegas from the outskirts of the city. But we weren't close to any city large enough for that to be the cause.

"As we approached our work site, it became apparent that the volcano had become very active overnight. Ribbons of lava were streaming from the caldera. During the day, it set the road on fire and threatened our home base. It was humbling to realize how little control we have over nature, and to experience such a tremendous force of nature as it creates new land."

Through the efforts of the JASON Foundation, and with some assistance from modern technology, students were able to share in Grimes' experiences. In this fashion, they became intimately acquainted with areas of science and culture once only available in a textbook.

The students and teachers studying the ecological and biological conditions found on the islands quickly noticed the degree to which the volcanoes dominate all aspects of existence there. Plant and wildlife found only in Hawaii took their present forms by adapt-

ing to their volcanic surroundings.

The isolation of the islands, for instance, led to such specialized creatures as a carnivorous caterpillar and the honeycreeper birds that originated in Asia. These birds developed specialized beaks to help them survive on the food that is available to them. The honey-

created the islands as she searched for a new home where she could tend her own sacred fires, an honor reserved for the men in her original homeland. Though her mortal body was destroyed along her journey, her spirit lingers on the island. Offerings are made daily at Kilauea and other volcanoes that threaten to erupt to appease the goddess' fiery temper.

## The JASON mentorship

Apart from learning about the cultural and scientific aspects of Hawaii, some Las Vegas students receive another added benefit of the JASON project through a mentoring program.

The Yucca Mountain Project sponsors a mentoring program that is designed not only to augment

the JASON experience for students, but to provide them with positive role models throughout the year. This year's program was implemented at both Woolley Elementary School and the Roy Martin Middle School.

The participating mentors are Yucca Mountain personnel and scientists. They meet weekly with their group of students, and participate in activities that relate to the JASON project, different areas



Students gather at a JASON Project transmission site to follow the exploits of their on-the-scene Argonauts.

creepers on the various islands of Hawaii have adapted so specifically to their surroundings that they no longer recognize ancestral species they evolved from, although some of these related species are found living on the other Hawaiian islands.

Volcanoes also have become a prevalent theme in the culture of the islands. Pele, the fire-goddess, is a creative and destructive spirit that plays a large role in local folklore. The myths hold that Pele

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# The Argonauts take Hawaii

of science, or just talk about topics they find of interest.

Marti Castillo, one of the mentors at Roy Martin Middle School, explains why she enjoyed being a mentor.

"I had a lot of fun because the kids were interested. They found out that science could be more fun than they expected."

Though the live broadcasts from Hawaii have ended, and this year's mentoring programs have come to a close, the expedition continues. Next year, Ballard journeys with his crew of Argonauts to the coast of Florida. Students will study the ecology of the Florida Keys, the everglades, and the coral reefs. They will look at species such as the endangered manatees and explore technologies aboard a nuclear submarine. Through the ongoing efforts of the JASON Foundation, students will continue to discover the wonders of science and exploration. ■

Jennifer Sizemore



A traditional Hawaiian ceremony and blessing is held at the start of this year's JASON broadcast.

Student attendees at the field-trip view a seismograph that is monitored by Community College of Southern Nevada.



EG&G Energy Measurements Inc. displays a remotely-operated vehicle that allows students to experience technology similar to the technology used on location for the JASON Project.

# In their own words...

## "Another Weekly, another mission"

Some people are lucky enough in their lifetime to develop a sense of mission. Although he is only 31, Lawrence Weekly has developed several. Each seeks to make the world better by doing. Each focuses on the things he can touch. Each seems to stem from a conscious attempt to overcome daunting personal obstacles, or to help others grapple with their own.

A native of Las Vegas who grew up under difficult circumstances, Weekly now helps young people navigate the rocky shoals of urban life toward personal success. Emerging from an environment in which books were at a premium, Weekly now battles illiteracy as a member of the Las Vegas-Clark County Library District Board of Trustees. A fierce believer in civil discourse, Weekly is the longtime host of a popular Las Vegas-based public radio community affairs talk show. A victim of occasionally bone-chilling stage fright, Weekly forces himself to accept offers from around the country to host beauty pageants and other public events.

During the last year, Weekly has put his knowledge of community and passion for self-betterment at the disposal of the Yucca Mountain Project. As a coordinator of its Speakers Bureau, his job is to connect those people who want to know what the latest word on the Project is with those people best equipped to give it. The community, he believes, has an obligation to find out as much as it can — for its own good.

We should note that Lawrence Weekly is now a new father to a baby boy. Another Weekly, another mission.

"When I was a student at Grambling State University (from 1983 to 1987), I started doing some freelance emceeing. I've been doing it for about 10 years. Most recently, I flew to Louisiana to emcee a Calendar Girl pageant, which is a preliminary to the Miss Louisiana Pageant. Locally I've done the Miss Black Teenage Nevada Pageant, and a lot of banquets."

"I suppose it kind of comes naturally, but no one really knows. I'm really frightened to death, although I think I like the adrenaline rush. You do get to meet interesting and influential people, and it helps you conquer one of humanity's worst fears — public speaking. It's not just the challenge though, or I would go out and play in a field of rattlesnakes. I majored in communications, and have not yet overcome the obstacle to being calm, cool and collected with an audience. I still get really nervous, although people say they don't sense it."



Lawrence Weekly

reer options. Their main thrust is academic achievement, career and college preparation, community service, and the uplift of young men through enhanced self-esteem.

"I think it is so important that we understand that if we are going to prepare our youth for a future, we must begin now."

**"I think it is so important that we understand that if we are going to prepare our youth for a future, we must begin now."**

### Positive role models

"Mostly, though, I enjoy working with young people. I work with about 45 young men in a youth group, the Kappa Leadership League, which is under the aegis of Kappa Alpha Psi, a program for boys in grades nine through twelve. We try to serve as positive role models and to expose the kids to different ca-

People say kids don't listen. But they really do listen. They want guidance and they want help. I feel I have an obligation, and a spiritual belief, that my purpose on Earth is to work with young people. My job is to show them there is someone who cares; that there is hope. I don't impose my spiritual beliefs on anyone. But I believe we all have a purpose."

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I think that mine is to work diligently in the community.

"When I was growing up, we didn't have many people we could call role models. I grew up with a single mother in Las Vegas. My mother worked very hard. She wasn't there for us a lot because she needed to work to keep a roof over our heads and clothes on our backs. We didn't have people to guide us, and as I grew up I saw the need.

### Emphasis on glitter

"Las Vegas is not an easy place to grow up in. The emphasis is on the lights and the glitter and glamour. Tourists who visit Las Vegas do not really seem to believe that there are people who live here. But there are people here who are poor and homeless, who are have-nots. Not everyone runs and owns the casinos.

"I'm also involved with the Martin Luther King Committee of Las Vegas. These are people who believe that people should be judged not by the color of their skin but by the content of their character. We have a senior citizens program, a youth organization, we give out over \$15,000 in scholarships, we have a tutorial program in 19 different sites in Clark County — the list is endless."

"Most recently, I was appointed by (ex-) Councilman Frank Hawkins and the City Council to the Library Board of Trustees. You listen to the issues and are asked to make the decisions that positively affect the library district (in

areas) like allocation of funding for books, programs, etc. My concern is for the large number of people out there who are illiterate. We need to get help to people.

"When I graduated from Grambling State University in 1987, I came back home to Las Vegas, and it was hard for me to find a job in the broadcasting field. I had interned with Channel 8, but when I got out of school I was told I didn't have enough experience for a full-time job. But it was very rewarding for me. I had a chance to meet a lot of people. I still know them to this day.

**"Las Vegas is not an easy place to grow up in. The emphasis is on the lights and the glitter and the glamour."**

### Late-night jockey

"Anyway, I went to KCEP public broadcasting and they hired me as a late-night disc jockey for a year, playing love songs. Eventually I became their community affairs director, and started hosting a community affairs talk show, called "Straight Talk," which I have been doing for eight years. I'm a volunteer — I do it for the fun. I do it because it reaches a large number of people.

"I didn't have a lot of knowledge about the Yucca Mountain Project when I first started out. I was working in the Clark County School District on a contract that wasn't turning out great. A friend had talked to me about getting on board for two years, but I didn't know enough about it. It frightened

me, but he also works at the station, and he said I'd be good at it, that it was a good opportunity to advance in the communications field. I said I couldn't go out and speak about it because I didn't know enough, and he said, "yeah, but you can learn."

As a Speakers Bureau coordinator, I coordinate presentations for scientists and specialists as part of the outreach department. What I like about it is that I can now go out on PAYBAC (Professionals and Youth Building a Commitment), and by just knowing a teeny bit about the Project, I can talk during career days with students. Talking

to my kids is, after all, my first love.

"I'm not always comfortable representing the Project because

I'm afraid someone will ask me a question I can't answer. I feel I would not be doing it a service. But I'm learning that I can always say "I don't know."

### Educational opportunities

"I have noticed that the African American community as a whole is not up to speed on the Project. A lot of people ask me about it. Most are not very happy with it, but I always encourage them to take a tour or come to an open house or invite a speaker to discuss it. Listen, I say, because there are a lot of educational opportunities here. I don't tell people they should be for the Project — I just believe they should keep an open mind and listen to all sides, and then formulate an informed opinion."

# 1995 Yucca Mountain exhibit schedule for general and technical exhibits

Aug. 12-13 Eureka County Fair, Eureka, Nev., Sat. 10 a.m.-2 p.m. • Sun. 10 a.m.-2 p.m.  
Aug. 18-19 Lincoln County Fair, Panaca, Nev., Fri. 10 a.m.-2 p.m. • Sat. 10 a.m.-2 p.m.  
Aug. 23-27 Nevada State Fair, Reno, Nev., Wed. 4-11 p.m. • Thurs. 11 a.m.-11 p.m. • Fri. 11 a.m.-11 p.m.  
• Sat. 10 a.m.-11 p.m. • Sun. 10 a.m.-9 p.m.  
Aug. 26 White Pine County Fair, Ely, Nev., Sat. 10 a.m.-2 p.m.  
Aug. 31- Sept. 4 Tri-county Fair, Bishop, Calif., Thurs. 4-10:30 p.m. • Fri. 11 a.m.-10:30 p.m. • Sat. 11 a.m.-10:30 p.m.  
• Sun. 1 p.m.-10:30 p.m. • Mon. 11 a.m.-8 p.m.

## Tours of Yucca Mountain

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 at least 14 days in advance by calling (702) 794-7104 during business hours. Tours will be filled on a first-come, first-served basis.

Yucca Mountain is about 100 miles northwest of Las Vegas. To visit the site, information such as full names, addresses, social security numbers, dates and places of birth and telephone numbers must be provided when making a reservation. The tour is open to any U.S. citizen over the age of 14. Non-U.S. citizens must allow for about a month between applying and receiving authorization to take the tour.

Box lunches will be provided for \$4 per person. (Lunches come with beverages, but sodas can be purchased for an additional 60 cents.)

## Who do you call in Nevada?

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

— William Blake

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For Group Tours?  
Carleen Hill ..... 794-7375

For Exhibits?  
Joanna Magruder ..... 794-7056

For Speakers?  
Jackie Brandt ..... 794-7759

For Educational Programs?  
Jennifer Sizemore ..... 295-0580

For Publications?  
Nikki Weber ..... 295-9158



U.S. Department of Energy  
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P.O. Box 98608  
Las Vegas, NV 89193-8608  
(702) 794-7900

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