DOE/RW-0482

WINTER 1996

OCRWM BULLETIN

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

OCRWM RECEIVES HALF ITS FISCAL YEAR 1996 BUDGET REQUEST

The Energy and Water Development Appropriation Act of 1996 was signed into law on November 13, 1995, providing a total of $400 million for the Office of Civilian Radioactive Waste Management (OCRWM). Of this $400 million, $85 million has been reserved for interim storage and may be used only upon enactment of new statutory authority. Lacking such authority, the program's fiscal year (FY) 1996 funding is limited to $315 million, half the amount requested last spring by the Administration.

The table below outlines the breakdown of funds as follows: the FY 1995 appropriation, the FY 1996 Administration request, and the FY 1996 appropriation.

As shown in the table, the result of the Congress' budget action is a 50-percent reduction from the FY 1996 request for the program, and a 40-percent reduction from the FY 1995 appropriation expenditure. Based on Congressional guidance, OCRWM has allocated $250 million to Yucca Mountain for site characterization activities. At this appropriation funding, continuation of the Program Approach adopted in FY 1994 is no longer feasible. The Congress recognized that situation, and the Conference Report accompanying the FY 1996 Appropriations Bill provides the following guidance:

"The conferees agree on the importance of continuing the existing scientific work at Yucca Mountain to determine the ultimate feasibility and licensability of the permanent repository at that site. The conferees direct the Department to refocus the repository program on completing the core scientific activities at Yucca Mountain. The Department should complete excavation of the necessary portions of the exploratory tunnel and the scientific tests needed to assess the performance

"Budget" continued on page 2

OCRWM BUDGET

Program Area	FY 95 (Dollars in Millions)	FY 96 Request (Dollars in Millions)	FY 96 Appropriations (Dollars in Millions)
Interim Storage	0	6	(85)
Yucca Mountain	375	472	250
Other	147	158	65
Total	522	630	315 (400)

In This Issue . . .

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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"Budget" continued from page 1

of the repository. It should defer preparation and filing of a license application for the repository with the Nuclear Regulatory Commission until a later date. The Department's goal should be to collect the scientific information needed to determine the suitability of the Yucca Mountain site and to complete a conceptual design for the repository and waste package for later submission to the Nuclear Regulatory Commission."

OCRWM has defined a new milestone for the Yucca Mountain Project in the form of specific work products that will contribute to a "viability assessment," which will be completed in 1998.

This viability assessment is not the same as the technical site suitability evaluation contemplated in the previous Program Approach. The viability assessment is intended to clarify the most uncertain aspects of geologic disposal at Yucca Mountain. The components of the assessment will make important contributions toward the development of a Secretarial recommendation to the President and preparation of a license application to the Nuclear Regulatory Commission (NRC), but they will not be sufficient for either of these formal actions.

Impacts on the OCRWM Program

The $315 million budget cannot support the following activities: the 1998 target date for the Department to issue the Yucca Mountain Technical Site Suitability evaluation; the 2001 target date for a repository license application to the NRC; and the 2010 target date for the initial emplacement of spent nuclear fuel in the geologic repository.

In addition, as a result of budget reductions, the multi-purpose canister (MPC) development program will end with the completion of the MPC safety analysis report design (see related article in this issue), and waste acceptance activities will be curtailed to minimum legal requirements.

Further information on the FY 1996 appropriation may be obtained via the OCRWM Home Page on the World Wide Web at http://www.rw.doe.gov. ■

YUCCA MOUNTAIN

Planned Activities for FY 1996

Site characterization activities planned for FY 1996 include the following:

- Complete numerical models of the natural barriers (geology, hydrology, and geochemistry) in support the Total System Performance Assessment
- Conduct hydrological testing of the repository rocks and faults in alcoves in the Exploratory Studies Facility
- Monitor the unsaturated zone along the Exploratory Studies Facility main drift
- Conduct testing of the saturated zone (ground water)
- Continue monitoring of transient events, such as earthquakes and rainfall, at a reduced rate
- Issue seismic Topical Report II
- Complete excavation of the tunnel's thermal testing alcove
- Begin *in situ* thermal test planning
- Provide input to Environmental Protection Agency rule making on the radiation release standard
- Develop contingency planning for permanent storage

WASTE ACCEPTANCE, STORAGE, AND TRANSPORTATION

Planned Activities for FY 1996

Activities related to Waste Acceptance, Storage, and Transportation planned for FY 1996 include the following:

- Submit the Topical Safety Analysis Report to the NRC on the design of the Dry Transfer system, which had been developed under a cooperative agreement with Edison Electric Institute
- Continue cooperative agreements between the program and external organizations at one-third of their FY 1995 budgets
- Develop and issue Section 180(c) Proposed Notice of Policy and Procedures
- Perform integrated safeguards and security requirements analysis
- Develop spent nuclear fuel verification requirements for utilities
- Develop waste acceptance and transportation concept of operations plan
- Continue contingency planning for storage, transportation, and operations.

Congressional Budget Action Halts Multi-Purpose Canister Development

As a result of Congressional budget action for fiscal year 1996, the Office of Civilian Radioactive Waste Management (OCRWM) has altered its plans concerning development and deployment of a multi-purpose canister (MPC)-based system.

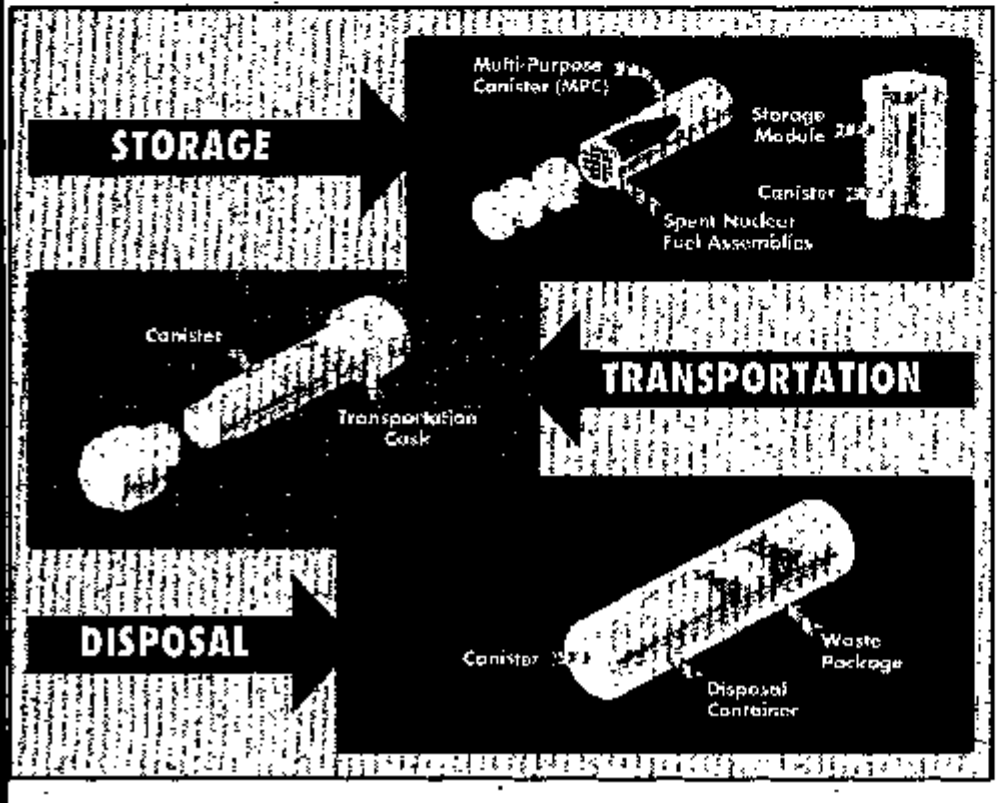
OCRWM had established a three-phase procurement strategy for the MPC and begun work on an environmental impact statement (EIS). The first phase includes a detailed design of the MPC and supporting systems and the preparation of safety analysis reports for submittal to the Nuclear Regulatory Commission (NRC) for review and approval. OCRWM and the awardee, Westinghouse Electric Corporation, are working to complete the first phase by the end of April 1996. The second phase was intended to lead to NRC certification of the MPC-based system for storage and transportation. The third phase included procurement of the first MPCs and supporting components. With funds needed to complete phases two and three unavailable, OCRWM had to cease development of the technology beyond phase one.

The idea of a universal system that could address spent fuel storage, transportation, and disposal was conceived by private industry, and several key organizations had previously encouraged the Department to develop the concept further. The NRC expressed concerns about functional compatibility as early as 1988 and codified these concerns in a 1990 rule that states, "To the extent practicable in the design of storage casks, consideration should be given to compatibility with removal of the stored spent fuel from a reactor site, transportation, and ultimate disposition by the Department of Energy."

OCRWM initiated development of the MPC system in response to these calls for standardization and compatibility among utilities' and the Federal Government's waste management systems. The MPC concept under development by OCRWM would have accommodated some 80 percent of all spent nuclear fuel to be discharged by the Nation's light-water reactors, and would have utilized a sealed canister for storage, transportation, and disposal. OCRWM personnel developed a schedule, in consultation with NRC staff, that would have enabled the first MPCs to be available in the fall of 1998.

A number of analyses were conducted to better identify and quantify the costs and benefits of implementing such an integrated-systems approach to spent nuclear fuel management. Obvious benefits included a large reduction in the number of spent nuclear fuel assembly handlings and a reduction in the number and cost of interfaces among utilities' and OCRWM's waste management systems.

OCRWM had insisted from the start that any decision to develop MPCs be grounded on; among other things, a broad-based support for doing so. To that end, OCRWM held two early-stage workshops to discuss preliminary considerations. The workshops were well attended by a broad spectrum of stakeholders, including prospective bidders on the MPC contract. Utility representatives, along with members of several environmental organizations, also contributed to OCRWM's decision



Plans to develop this proposed Multi-Purpose Canister-based system have been altered.

"Canister" continued on page 5

SECRETARY OF ENERGY TESTIFIES BEFORE CONGRESS ON SENATE BILL S. 1271

Secretary of Energy Hazel R. O'Leary appeared before the Senate Energy and Natural Resources Committee on December 14, 1995, to testify that the Administration would not support Senate Bill S. 1271, which, among other provisions, directs siting of an interim storage facility in Nevada.

The bill's provisions mandate expediting the construction of an interim storage facility for commercial spent nuclear fuel, beginning operations in phases by January 1998. The facility would be constructed at the Nevada test site in area 25, which is located near the Yucca Mountain site. Secretary O'Leary stated that the Administration is concerned that the siting of an interim storage facility in Nevada, and at an unreasonably rapid pace, would force the Office of Civilian Radioactive Waste Management (OCRWM) program into excessively curtailed regulatory processes and unreasonable and logistically untenable deadlines. Secretary O'Leary pointed out that the national policy, expressed in existing law, is that Nevada should be excluded from consideration as an interim storage site. "The selection of any site for an interim storage facility," she said, "deserves to be based upon objective analysis using substantive criteria...the relative merits of selecting Nevada as an interim storage site would certainly be influenced by the probability that the repository will also go forward. That probability cannot be evaluated at this time."

Secretary of Energy Hazel R. O'Leary

Secretary O'Leary expressed concern that the approach adopted in the proposed bill for resolving the interim storage need is likely to raise new issues for equally important aspects of the national nuclear waste system. "The bill as drafted," stated Secretary O'Leary, "assigns priority to an immediate initiative on interim storage with a highly accelerated schedule. This requirement coupled with the probable budget constraints would place the repository program in jeopardy and reduce the policy commitment to the long-term strategy of geologic disposal." She stated that geologic disposal is the end-point of the Federal radioactive waste management system, and that a decision to significantly defer or abandon it would have the effect of making at-reactor or interim storage of commercial spent nuclear fuel the open-ended, long-term strategy. "Unless the importance of geologic disposal is reflected in the articulation of public policy and in the funding of the program," testified Secretary O'Leary, "we will need to rethink our options for the long-term custody of all high-level nuclear waste."

S. 1271 provides for the continuation of site characterization activities at Yucca Mountain and for the licensing and development of a repository if the site is found suitable. In the event of constrained funding, however, the licensing, construction, and operation of the repository are designated to have a lower priority than the interim storage facility and its associated transportation system. "Because the measure does not change the budgetary treatment of the Nuclear Waste Fund collections," stated Secretary O'Leary, " it seems likely that the funding for the repository determination will be constrained as the requirements of an interim storage initiative increase."

In discussing her proposed course of action, Secretary O'Leary stated that the Administration continues to believe that completion of the scientific studies at Yucca Mountain is the most sensible and principled course of action. "If Yucca Mountain is found suitable and meets the test of licensing," commented Secretary O'Leary, "provision could have been made to take waste at the site in a receiving facility as early as 2004. The fiscal year

"S.1271" continued on page 5

"S.1271" continued from page 4

1996 budget submitted by the Administration would have supported this approach. However, funding constraints imposed by the fiscal year 1996 appropriations appear to have foreclosed this schedule."

Faced with current realities, Secretary O'Leary proposed five principles to be adopted into legislation that would maintain momentum toward permanent disposal, address the interim storage issue, and recognize the realities of the budget outlook. These five principles are:

- Providing adequate funding to resolve the major remaining technical uncertainties at Yucca Mountain
- Revising the repository regulatory structure to reflect current circumstances
- Selecting any interim storage site based on objective criteria
- Initiating generic interim storage activities
- Protecting the environment and assuring public and worker health and safety

Secretary O'Leary concluded her testimony by noting the past year's accomplishments made by OCRWM, including the adoption of a new program approach and the measurable progress that was made toward geologic disposal at the Yucca Mountain site.

A copy of Secretary O'Leary's complete statement before the Committee on Energy and Natural Resources on December 14, 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). ■

"Canister" continued from page 3

to move forward with the MPC concept. Three MPC EIS scoping meetings followed in late 1994. Feedback from the workshops and scoping meetings was positive.

As a result of strong encouragement of OCRWM's concept of an MPC-based system from the NRC, the Nuclear Waste Technical Review Board, the utility industry, and virtually all stakeholder groups, OCRWM revised its design of and operating scenario for the waste management system based on the MPC. In order to support OCRWM's efforts to develop an MPC system that would accommodate such a broad spectrum of spent nuclear fuel, the NRC established its Spent Fuel Project Office.

In light of Congressional action, OCRWM recently suspended all work on the Environmental Impact Statement for a Multi-Purpose Canister System for Management of Civilian and Naval Spent Nuclear Fuel. In this EIS, OCRWM was evaluating the environmental impacts of fabricating and deploying a standardized container system for the storage, transportation, and possible disposal of civilian and defense spent nuclear fuel and high-level radioactive waste. OCRWM had been working jointly with the Department of the Navy on the EIS after the Department of Energy determined that naval spent fuel should be addressed in the EIS, since the Navy recognized the benefits of the MPC for storage, transport, and disposal of its spent fuel.

The Navy now has decided that it will proceed with the part of the MPC EIS covering naval spent nuclear fuel and, on December 7, 1995, published a Notice in the *Federal Register* stating that it would assume lead responsibility for the EIS. The Department of Energy's role will be limited to that of a cooperating agency in the preparation of the report. The Navy plans to issue the Draft EIS by April 30, 1996. Following issuance of the Draft, which will be announced in the *Federal Register*, a 45-day comment period will be provided. During the comment period, public hearings will be held. The locations and dates of these public hearings will be announced in the *Federal Register* when the Draft EIS is issued. The Navy plans to issue the final EIS by November 30, 1996, and a Record of Decision by December 31, 1996.

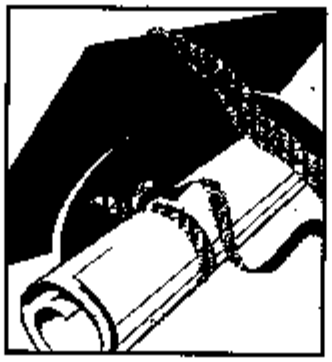
OCRWM continues to believe that the idea of an integrated systems approach to spent nuclear fuel management that would address all three functions—storage, transportation, and disposal—and accommodate the vast majority of spent fuel designs, is a good one—one that would produce benefits for utilities and the Federal Government. To that end, OCRWM is encouraging the private sector to work toward developing such an integrated systems approach. ■

OCRWM Participates in League of Women Voters Panel Discussion

This past December, Linda Desell, Director of the Environmental and Operational Activities Division of the Office of Civilian Radioactive Waste Management (OCRWM), participated in a panel discussion on the topic of radioactive waste. The symposium, which took place at Wesleyan University in Middletown, Connecticut, was sponsored by the Greater Middletown League of Women Voters. In addition to Ms. Desell, who represented OCRWM at the symposium, panel participants included Marvin Resnikoff of Radioactive Waste Management Associates; Susan Wiltshere of J.K. Research Associates; and Professor Jelle de Boer of Wesleyan University's Environmental Sciences Department. The audience included the general public and members of the local League organization.

The panel spent the first half of the symposium defining the existing nuclear waste problem and discussing possible solutions to that problem. The second half of the discussion related to regulatory framework and policy issues, including the U.S. policy on high-level radioactive waste disposal and the currently "favored" solution to the waste disposal problem (i.e., geologic disposal, as mandated by Congress).

The symposium concluded with a discussion on what citizens can do to become better educated and more informed of the problems related to the management and disposal of radioactive waste, and how they can provide meaningful input in terms of helping to select the "best" solution to these problems. ■



OCRWM HBCU Scholarship Recipients Selected

This past fall, 10 scholars were selected from a pool of more than 120 applicants to receive scholarships through the Historically Black Colleges and Universities (HBCU) Undergraduate Scholarship Program, sponsored by the Office of Civilian Radioactive Waste Management (OCRWM). The 10 recipients, all students attending historically black colleges or universities located throughout the United States, were chosen by a panel comprised of representatives from historically black colleges and universities and experts in civilian radioactive waste management from Department of Energy's national laboratories, academia, and private industry.

The HBCU Undergraduate Scholarship Program is designed to encourage students to consider a career in high-level radioactive waste management by providing support to academically superior juniors and seniors pursuing degrees in related fields at historically black colleges and universities. It is hoped that undergraduate scholars may, in the future, participate in OCRWM's Radioactive Waste Management Graduate Fellowship Program, thereby increasing the diversity of OCRWM's future workforce.

The scholarship award includes payment of tuition and fees and a monthly stipend, as well as a summer internship assignment at a Department of Energy site, where students perform work supporting the OCRWM program. Scholarship recipients also participate in an orientation workshop in Las Vegas, Nevada, the first of which was held in September 1995. The workshop included meetings with staff from the Yucca Mountain Site Characterization Office and the United States Geological Survey, an overview of the Yucca Mountain Project at the Yucca Mountain Science Center, and an all-day tour of the Yucca Mountain site.

For more information on the OCRWM HBCU scholarship program, or to request an application, please call the Oak Ridge Institute for Science and Education at 1-800-569-7749. ■

Editor's Note:

In the Fall 1995 issue of the OCRWM Bulletin, *OCRWM ran an article titled "Regulatory Drop Tests Planned for a Model Transportation Cask." The article should have noted that Precision Components Corporation (PCC) of York, Pennsylvania, a subcontractor to General Atomics, fabricated the GA-4 half-scale cask model discussed and pictured in the article.*

Our apologies to PCC.

■

Transportation External Coordination Working Group Convenes in San Antonio

The eighth semiannual meeting of the Transportation External Coordination Working Group (TEC/WG) was held January 16-18, 1996, in San Antonio, Texas. TEC/WG, a partnership between the Department of Energy (DOE) and its stakeholder organizations, works to identify and resolve significant issues related to DOE's transportation of radioactive hazardous materials. TEC/WG's members—all of whom share an interest in the Department's transportation-related activities—include personnel from various DOE program and project offices; national and regional organizations representing State, Tribal, and local governments; professional associations; and industry organizations.

In a series of plenary sessions, the group received updates on current activities within the Department. Representatives of the Office of Civilian Radioactive Waste Management and the Office of Environmental Management (EM) provided an overview of current activities within each office. Representatives from EM's Spent Nuclear Fuel Program, the Waste Isolation Pilot Plant, and EM's Coordinated Research Program provided updates on transportation-related activities within these programs. Representatives of the University of New Mexico shared findings from the study, "Transporting Radioactive Materials: Risks, Issues, and Public Perspectives," with the group. TEC/WG members representing the Council of State Governments Midwestern Office, the Council of State Governments/Eastern Regional Conference, and the Nuclear Energy Institute participated in a panel to share their perspectives with other members of TEC/WG and DOE.

Participants discussed specific issues in greater detail during a series of four breakout sessions. Two breakout sessions were devoted to topics within General Planning and Transportation Operations. A third breakout session involved participants in an evaluation of the effectiveness of the TEC/WG meetings. In the fourth breakout, participants visited a Communication and Information Data Resources Room to learn more about communication and resource systems currently in place.

The next TEC/WG meeting is tentatively scheduled for July 16-18 in Minneapolis, Minnesota.

New Publications

To order the publications or videotape 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 OCRWM National Information Center at 600 Maryland Avenue, SW, Suite 760, Washington, D.C. 20024. Additional publications are available through the Center or electronically through OCRWM's Home Page: http://www.rw.doe.gov.

Science, Society, and America's Nuclear Waste, Second Edition, Units 1-4 Teacher Guides, U.S. Department of Energy, DOE/RW-0361 TG, Rev. 1; DOE/RW-0362 TG, Rev. 1; DOE/RW-0363 TG, Rev. 1; and DOE/RW-0364 TG, Rev.1.

The second edition of the teacher guides accompanies the resource curriculum *Science, Society, and America's Nuclear Waste*. The curriculum is designed to assist science and social studies teachers in presenting issues related to the safe management and disposal of America's nuclear waste.

Site Characterization Progress Report: Yucca Mountain, Nevada, Number 12, U.S. Department of Energy, DOE/RW-0477, August 1995. This report covers the progress of site characterization activities performed at the Yucca Mountain, Nevada, site during the reporting period October 1, 1994, through March 31, 1995.

New Videotape

Yucca Mountain Project 1995 Year in Review, U.S. Department of Energy, January 1996 (playing time: 9 minutes).

The *Year-in-Review* videotape presents an overview of the significant progress made by the Yucca Mountain Project during 1995. Highlights cover the Exploratory Studies Facility, the surface-based testing program, development of an Environmental Impact Statement for a potential repository at Yucca Mountain, and public outreach efforts.

CYBERSPACE ENHANCES OCRWM COMMUNICATIONS

People from 30 countries on six continents have traveled thousands of miles to visit the OCRWM Home Page on the World Wide Web. They scale mountains, swim oceans, track through snow, and traverse severe weather conditions without ever leaving their desks. They arrive in a matter of seconds and stay as long as they like for a cost of only pennies. They obtain information about the U.S. Civilian Radioactive Waste Management program. They request videotapes and publications. They receive answers to questions and offer their opinions. And, even though the "Blizzard of '96" paralyzed the east coast for a week in January, they visited Washington, D.C., easily. Though weather shut down the Nation's capital, the Office of Civilian Radioactive Waste Management (OCRWM) and other Federal programs remained open to the public—virtually.

Technology is moving quickly and electronic communications are providing government, industry, and educational institutions with an environmentally friendly way to reach more people in more locations in less time while trimming costs.

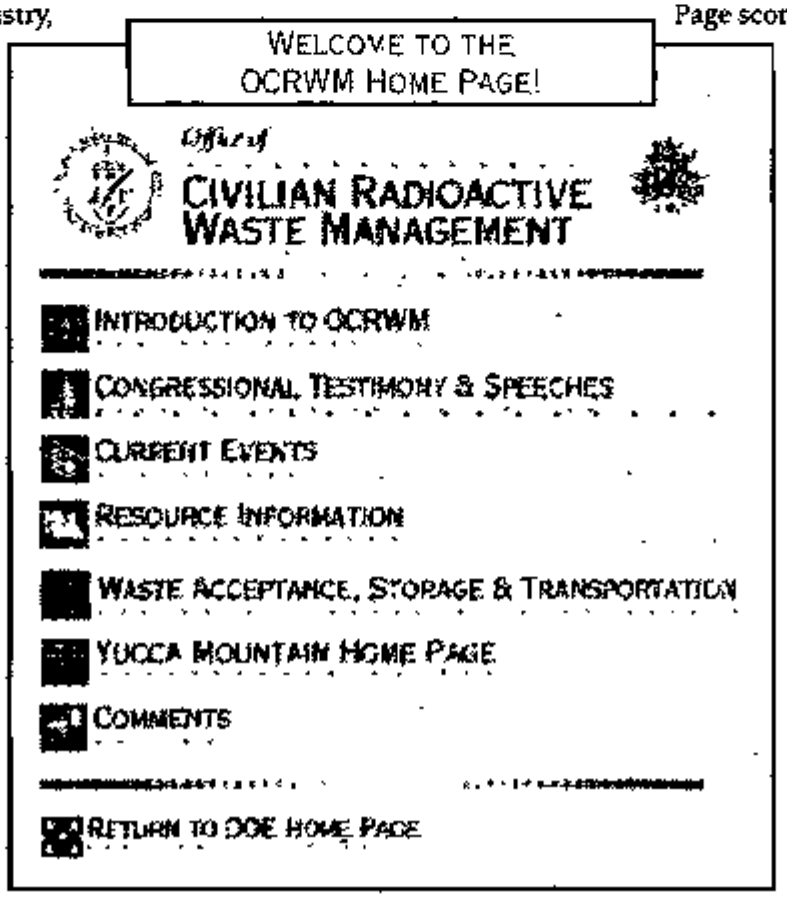
"Growing numbers of people are online whether it's at home or at work. And the Information Superhighway is the reason for this global phenomenon because it delivers timely, cost-effective, interesting, and relevant information," said Harold Brandt, Director of OCRWM's Administration Division and the person responsible for OCRWM's public information activities.

"Since its debut on the Information Superhighway nearly 1 year ago, the OCRWM Home Page has been accessed over 250,000 times by users in the public, commercial, and governmental domains. It now averages more than 10,000 accesses per week, significantly enhancing OCRWM's ability to relay program-specific information to stakeholders and the public at large," Brandt explained. "Especially in light of recent budget reductions and the resulting need to cut back on other information products and services, OCRWM plans to rely increasingly on its Home Page for external communications."

Among the activities that had to be scaled back or eliminated was the *OCRWM Bulletin*, which will be published semiannually instead of quarterly during fiscal year 1996. However, you can visit the OCRWM Home Page, which is updated continuously, to learn about activities under way and recent developments in the OCRWM program. In addition, users can read announcements, *Federal Register* notices, reports, testimony, speeches, and meeting news. A new product-ordering system enables publications and videotapes to be ordered easily. In addition, direct access is provided to a host of other information services available via the Internet, including the National Academy of Sciences, the Nuclear Regulatory Commission, the *Federal Register*, and the Library of Congress home pages.

Recently, the OCRWM Home Page was rated among the top 5 percent of all sites on the World Wide Web by a subsidiary of Lycos, one of the largest and most prestigious search engines on the Internet. Point Communications reviews sites on the World Wide Web to provide "surfers" with a standard of excellence and a catalog of the most lively and useful home pages. The OCRWM Home Page received an excellent review and was invited to display the "Top Five Percent of the Web" badge. Sites are rated on a scale of one to 50 in three categories. The OCRWM Home Page scored a 40/50 on content, a 33/50 on presentation, and a 32/50 on experience. The content category is evaluated for breadth and depth of information provided, presentation is evaluated for beauty and use of cutting-edge technology such as video, audio, and original graphics. The experience category addresses whether the site is fun to visit and if the user would recommend it to friends.

OCRWM is interested in hearing from users and learning what they want to see on its Home Page. Send us comments and questions by using the "Comments" selection on the OCRWM Home Page at http://www.rw.doe.gov. ■



1996

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MARCH

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
24	25	26	27	28	29	Waste Management '96 Yucca Mountain Tour 1
2	3	4	5	6	Nuclear Energy Assoc Radioactive Waste Mgmt Committee Meeting Paris, France Conference of Radiation Control Program Directors' Transportation Meeting Idaho Falls, ID 7	8
Conference of Radiation Control Program Directors, Transportation Meeting Idaho Falls, ID 9	10	11	12	Southern States Energy Board Advisory Committee on Radioactive Materials Transportation Meeting Nashville, TN (O) 13	DOE/NRC Management Meeting Washington, DC/Las Vegas, NV (Videoconference) (O) 14	15
16	17	18	19	20	21	Society of Environmental Journalists Mid-Atlantic Chapter Conference [Panelist - Dreyfus] Washington, DC 22
Yucca Mountain Open House Las Vegas, NV (O) 23	24	25	House Energy and Water Development Appropriation Subcommittee [Witness: Dreyfus - 10:00, O'Leary - 2:00] Washington, DC 26	DOE/NRC Meeting on Quality Assurance Washington, DC/Las Vegas, NV (Videoconference) (O) DOE/NRC Advisory Council on Nuclear Waste Las Vegas, NV (O) 27	28	29

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

1996

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APRIL

SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
30	31	1	2	3	4 International Program Directors' Meeting Antibes Juan Les Pins, France →	5 →
6	7	8	9	10	11	12
13	14 American Nuclear Society Decontamination and Decommissioning Topical Meeting Chicago, IL →	15 →	16 →	17	18	19
20 Yucca Mountain Open House Las Vegas, NV	21 NRC Atomic Safety and Licensing Board and Panel Meeting Atlanta, GA →	22 Council of State Governments' Eastern Regional Conference Atlantic City, NJ →	23 →	24 →	25 →	26
27	28	29 1996 International High-Level Radioactive Waste Management Conference [Speaker - Dreyfus] Las Vegas, NV →	30 NWTRB Full Board Meeting [Speaker - Barrett] Austin, TX →	1 →	2 →	3 →

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

1996 MAY

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SATURDAY	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
27	28	29 International High-Level Radioactive Waste Management '96 Las Vegas, NV	30 NWTRB Full Board Meeting Austin, TX	1	2 OCRWM Director's Program Review, Forrestal/Vienna, VA/ Las Vegas, NV (Videoconference) (O) Forbes Federal Facilities Conference Washington, DC DOE/NRC ACNW Rockville, MD (O)	3 [Panelist - Milner]
4 DOE/NRC ACNW Rockville, MD	5	6	7	8	9	10
11	12	13	14	15	16	17 Council of State Governments' High-Level Radioactive Waste Committee Meeting Chicago, IL
18 Yucca Mountain Open House Las Vegas, NV (O)	19	20	21	22	23	24
25	26	27	28	29	30	31

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

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

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Your views, comments, and suggestions are appreciated

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Of Mountains & Science

YUCCA MOUNTAIN PROJECT Studies

Winter 1996

Tunnel excavation reaches key area

The tunnel boring machine (TBM) has tunneled to the potential repository host rock. This is the area, or level, where a repository might be built at Yucca Mountain if the site is found suitable. It is situated in the middle of a densely welded section of the Topopah Spring volcanic tuffs, an area that has fewer cavities than other units of tuff found at Yucca Mountain. It lies approximately 2,720 meters (8,600 feet) from the entrance of the Exploratory Studies Facility (ESF).

Excavations here will provide valuable data about the ability to excavate full-scale openings in the potential repository area, and how rock and systems for moving waste into a repository will perform over time.

"I'm pleased we were able to reach this area within the ESF in 1995," said Wesley Barnes, Project

Continued on page 131

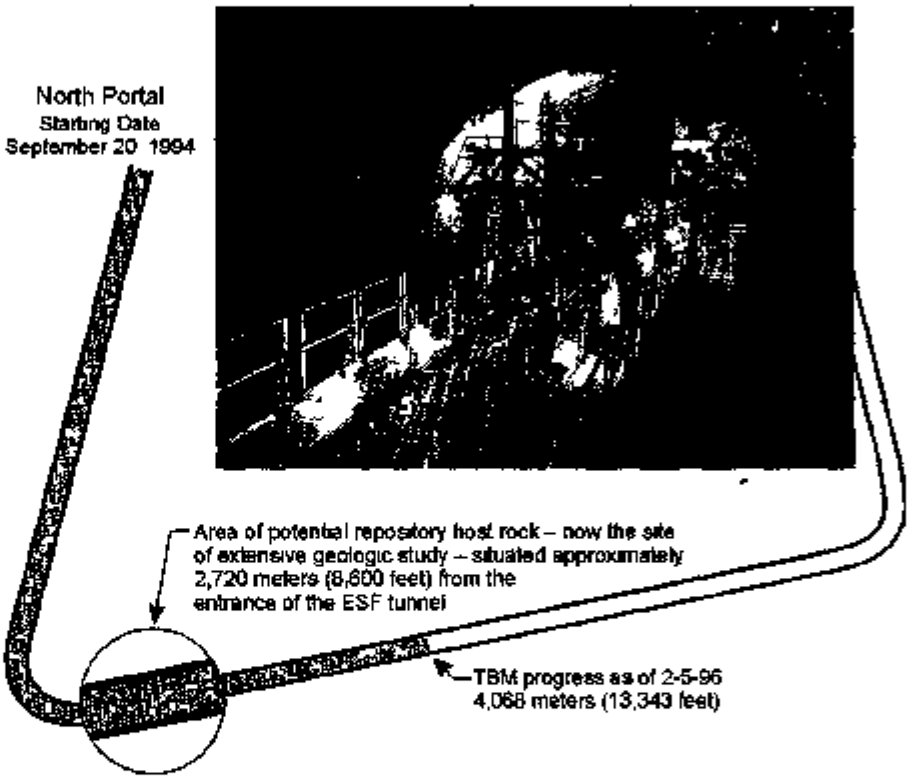

Figure shows the tunnel boring machine (TBM) progress and highlights the area of potential repository host rock. **Inset photo:** A view of the TBM at the end of the first curve, which is approximately 2,720 meters (8,600 feet) from the entrance

At a Glance

- Damage to the Yucca Mountain Field Operations Office from the Little Skull Mountain Quake in 1992 was vastly overstated. *See page 132.*
- Scientists find tritium near the Ghost Dance Fault. *See page 134.*
- The Yucca Mountain Project gets a conveyor-belt system for the ESF. *See page 135.*
- A newcomer to the Project talks about helping to solve an environmental problem. *See page 138.*

Project meteorologists take stock of a decade of weather at Yucca Mountain

Slightly over a century ago, an editorial in the *Hartford Courant* called attention to a widespread sociometeorological phenomenon. "Everybody talks about the weather," the paper complained, "but nobody does anything about it."

At Yucca Mountain, a small group has been working for nearly a decade to prove the editors of the *Hartford Courant* at least partly wrong. They still can't really *do* anything about the weather, says Project meteorologist Dale Ambos.

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Whither the weather?

"But we are making headway in understanding how it works, at least at Yucca Mountain.

On this arid stretch of land, where the air often seems to do little more than shimmer in the blazing heat or shudder in the night-time winds, scientists are mandated to take an active interest in the weather. They measure its output, probe its insides, prod its extremities, and record its ebbs and flows. Over time, they have learned that there is more — considerably more — to the weather at Yucca Mountain than most imagine.

Yucca Mountain was chosen as a potential site for a spent nuclear fuel and high-level radioactive waste repository in part because of the weather conditions there. The fact that only 15 centimeters (six inches) of rain, on average, falls over the course of the year bodes well for a repository. The small amount of rain means less risk that waste canisters might corrode underground as a result of contact with water.

Why study the weather?

There are other pressing reasons to study the weather at Yucca Mountain. First, it is important for scientists to understand the local and regional weather patterns at Yucca Mountain. Is the weather at Yucca Mountain similar to the weather found elsewhere in the region? Or are there important features there that are different from these patterns?

Secondly, scientists need to know more about weather conditions at the surface for facilities that will be built near a repository. Before spent nuclear fuel and high-level radioactive waste could ever reach the underground repository, they would have to be moved to Yucca Mountain and prepared for disposal in facilities located above ground. Weather conditions must be considered in the design, construction and operation of those surface facilities that will handle the waste.

Meteorologists also must study the winds at Yucca Mountain as part of performance and risk assessment studies. Winds have the potential to transport small quantities of radioactive material from surface facilities, or gases that conceivably could emanate from deep within a repository. How these gases might travel, and how the area's complex topography might affect that movement, is important

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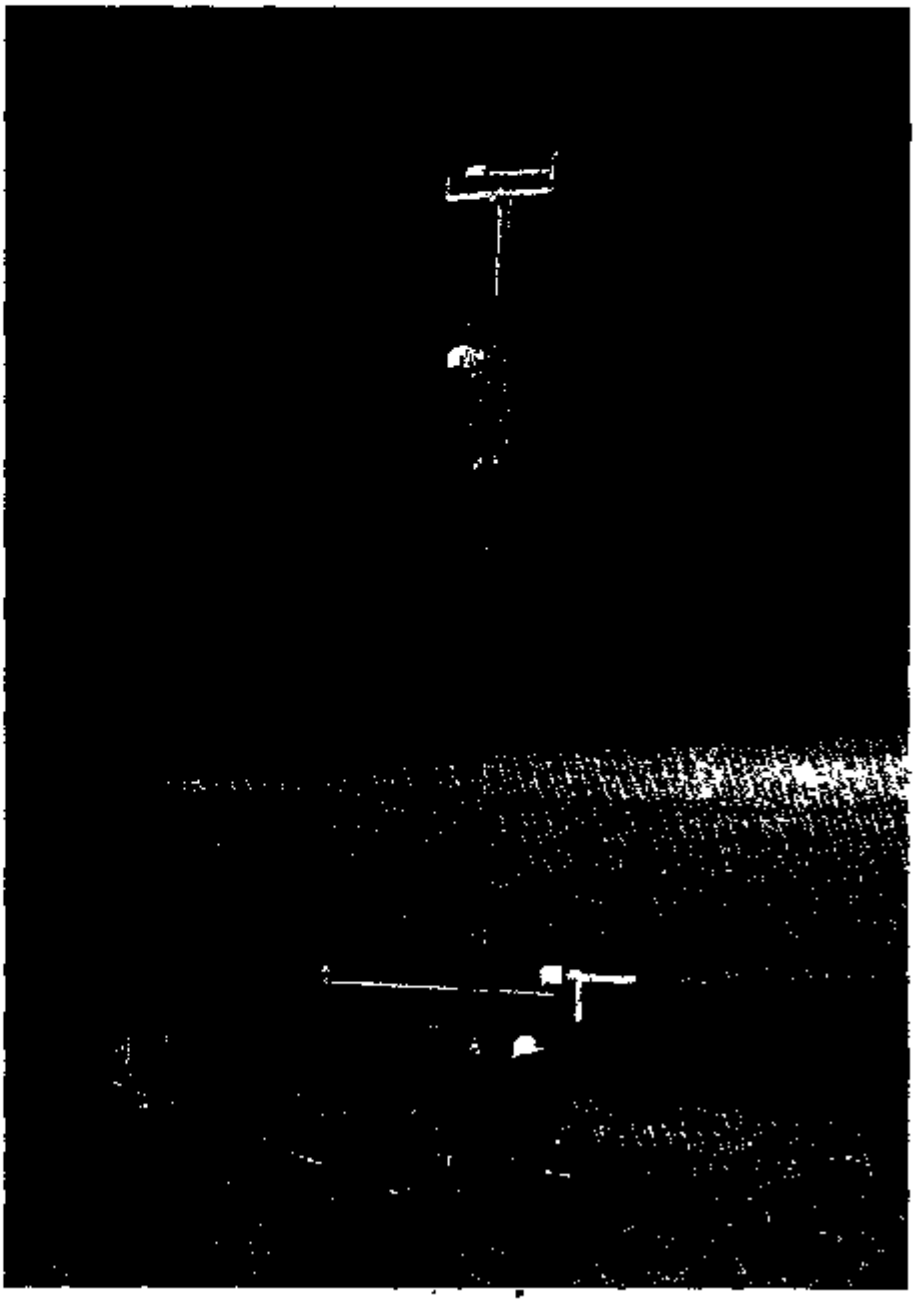

A meteorological field technician performs maintenance on a weather tower used to measure wind speed and direction as well as temperature.

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Whither the weather?

not only for health physicists, but for the engineers charged with designing a repository. They need to know how radioactive materials might move out from a repository and mix in the atmosphere under a variety of conditions.

Finally, to develop a sense of weather extremes, meteorologists must study the weather for a long enough time, and review historic data records from long-established observations in the region. Documenting extreme weather events is important in repository design and operation. For instance, the winter of 1995 was unusually wet. During the first three months of the year, Yucca Mountain received nearly twice the precipitation that usually falls for an entire year. One especially heavy storm in early March provided nearly 7.6 centimeters (three inches) of rain at Yucca Mountain. This resulted in flooding in nearby Fortymile Wash, an event that hadn't occurred since 1983. Such events can

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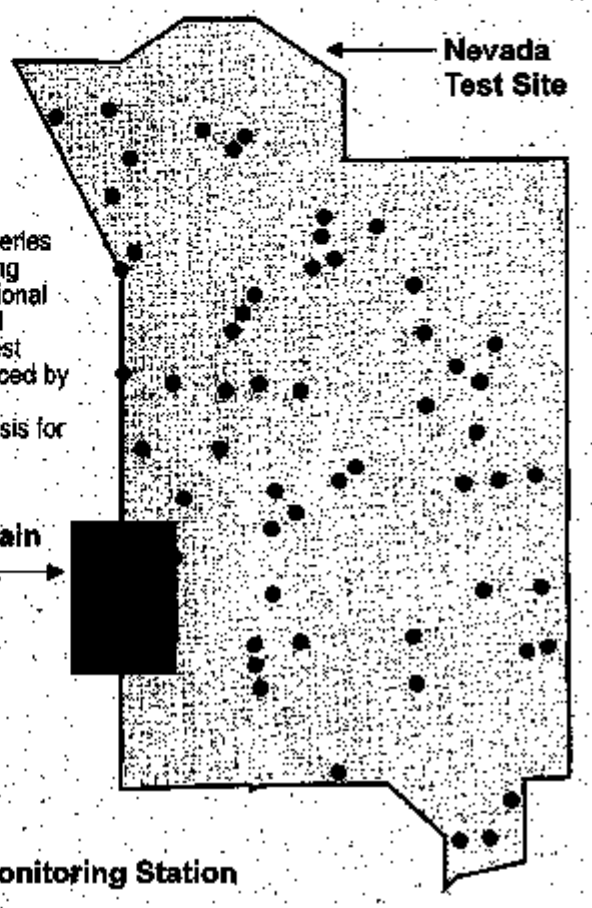

Project scientists are using meteorological data from a series of regional weather monitoring stations operated by the National Weather Service and located elsewhere on the Nevada Test Site. Much of the data produced by Project stations are stored in archives that will form the basis for other studies.

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Tunnel excavation

Manager for the Yucca Mountain Project. "This access we have to the potential host rock, 300 meters (900 feet) below the surface of the ground, will allow us to identify features that may not be detected from the surface."

The ESF serves as an underground laboratory for scientists and engineers to help determine if Yucca Mountain is suitable for the geologic disposal of spent nuclear fuel and high-level radioactive waste. Tests scheduled to be conducted in the ESF include:

- geomechanical testing to measure the rock's response to pressure;
- radial borehole tests to measure water and vapor movement through rock;

> **"I'm pleased we were able to reach this area within the ESF in 1995."**
> **– Wesley Barnes**

- thermal testing to measure the effect of heat on rock-water interactions; and
- testing of the potential movement of radioactive particles through rock.

Roughly the next 3,000 meters (9000 feet) of the horseshoe-shaped ESF tunnel will run through the Topopah Spring potential repository host rock. The TBM is expected to encounter a slightly different unit of rock at the south end of the ESF's main tunnel. This is just before the TBM enters the curve of the south ramp, and begins to tunnel back up through the same geologic units encountered in construction of the north ramp of the ESF. ■

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Damage to FOC from '92 quake less than first cited

Editor's Note: *The following is being published to correct erroneous information circulated by newspapers and by some state and public interest groups and organizations.*

On June 29, 1992, a moderately powerful earthquake rocked the Yucca Mountain Project Field Operations Center, or FOC, located in Area 25 of the Nevada Test Site. Its epicenter was Little Skull Mountain, Nevada, located about six-and-a-half kilometers (four miles) from the FOC, and 19 kilometers (12 miles) from Yucca Mountain.

Seismologists experienced little trouble establishing the magnitude of this particular tremor (known as the Little Skull Mountain earthquake), which registered at 5.6 on the Richter Scale. Assessing damage to the FOC, though, proved a bit trickier. Early estimates placed damage to the facility at about a million dollars. But a series of detailed reports and follow-up evaluations conducted by Raytheon Services, Nevada, and by the engineering firm of Martin & Peltyn Inc., have since shown these estimates to be off significantly.

Damage largely cosmetic

Structural inspections of the facility conducted after the quake determined that damage to the building appears to have been largely cosmetic. The bill for all necessary repairs came in at $40,000, not at a million dollars, as originally announced. The breakdown: repairs to broken windows totaled $23,000. Repairs to damaged stairwells cost $6,500. Another $9,500 covered miscellaneous painting, interior caulking, floor and ceiling tile replacement, and air conditioning duct repairs. This amount also included the cost of structural damage assessments for the building.

Differentiating between damage and improvements

Deputy Project Manager Russ Dyer attributes the discrepancy between the early estimate and the actual cost of repairs to a failure to differentiate between quake damage and improvements required to bring the facility up to code. The FOC was built in 1962, and was designed to meet 1951 Uniform Building Code Requirements. The million dollar estimate covered the cost of structural and other improvements to the building that would bring it into line with current standards. None of these improvements was directly related to the earthquake.

Comparing apples and elephants

"Unfortunately," acknowledges Dyer, "we weren't just comparing apples and oranges in our original estimate, but apples and elephants. That didn't become clear, though, until much later."

The misunderstanding may be traceable, at least in part, to an initial question about the integrity of the building's steel beams and their welds. Random inspections of these welds immediately after the Little Skull Mountain quake

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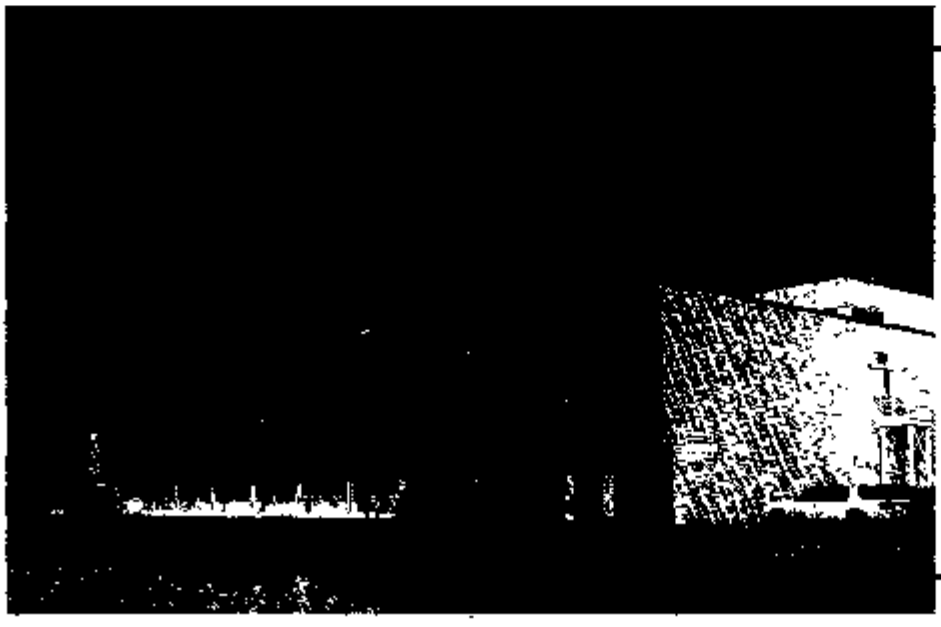

The extent to which the FOC was damaged by the Little Skull Mountain earthquake has almost no bearing on whether Yucca Mountain might safely house a repository for spent nuclear fuel and high-level radioactive waste.

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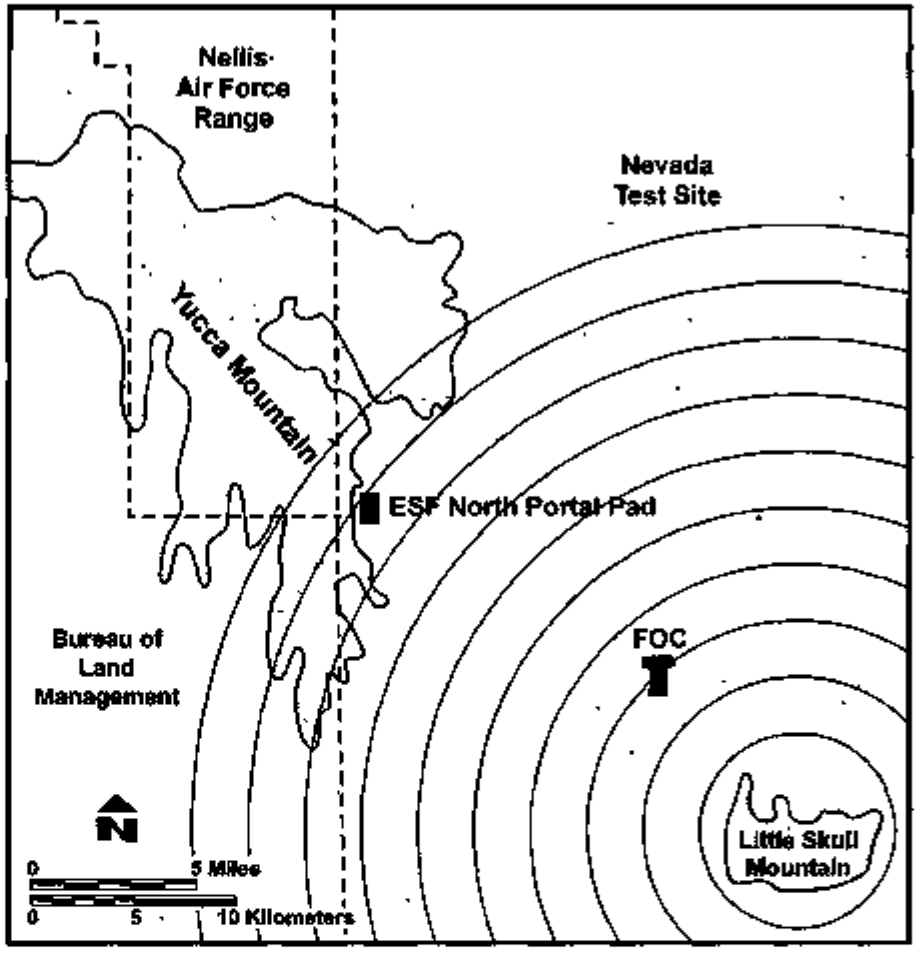
revealed possible damage. None of the welds failed, but a few of them seemed to have come slightly apart. Stresses brought on by the earthquake made it difficult to determine precisely how strong the building might be in its aftermath.

As a result, engineers and architects began a second, more systematic series of weld integrity tests in 1993. Their inspection revealed that some of the building's welded connections did indeed appear to be deficient. But according to the report issued by Martin & Peltyn Inc., these deficiencies appeared to be "a defect from the original construction." The building's welds will be studied further before action is taken to address any original design or installation deficiencies.

No connection between FOC damage and repository safety

The extent to which the FOC was damaged by the Little Skull Mountain earthquake has almost no bearing on whether Yucca Mountain might safely house a repository for spent nuclear fuel and high-level radioactive waste.

Project scientists have studied faults and monitored seismic activity at Yucca Mountain for more than a decade. These studies have produced a fairly comprehensive picture of the kind of seismic activity Yucca Mountain has experienced in the past. Based on this information, scientists believe they can anticipate the range of ground motion due in the future. If a repository is built at Yucca Mountain, all surface and subsurface installations will be designed to withstand the kind of ground motion common to the area.



Little Skull Mountain, the epicenter of the June 29, 1992 earthquake that damaged the Yucca Mountain Project Field Operations Center, or FOC, is located about 19 kilometers (12 miles) from Yucca Mountain.

Experience with earthquakes throughout the world shows that, generally, underground structures can withstand most ground motion generated by earthquakes. The energy released in earthquakes travels through rock as seismic waves that, in some senses, can be compared to waves moving through water. Just as waves create greater havoc at the surface of the ocean than underneath it, seismic waves cause the greatest destruction at the surface of the earth.

Tests of existing tunnels at the Nevada Test Site have demonstrated that tunnels can withstand ground motion from underground nuclear explosions that is far greater than any ground motion anticipated at or near Yucca Mountain.

Since ground motion does pose a hazard to surface facilities not designed to withstand them, efforts are underway to fortify the FOC against future earthquakes. Additionally, new water lines are being installed, and a new fire suppression system has been put in place. These activities are being undertaken at moderate cost. ■

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Project scientists assess tritium traces for evidence of fast routes to repository

Potential fast pathways for water movement from the surface to where a repository might be built are a concern because water in a repository could cause corrosion of the stored waste canisters disposed there.

With one proton and two neutrons, tritium is the heaviest and only radioactive isotope of hydrogen. It is three times as heavy as ordinary hydrogen, hence the name, which comes from the Latin *tri*, meaning three. The isotope, some of which occurs naturally, has a half-life of about 12 years, and decays to form helium.

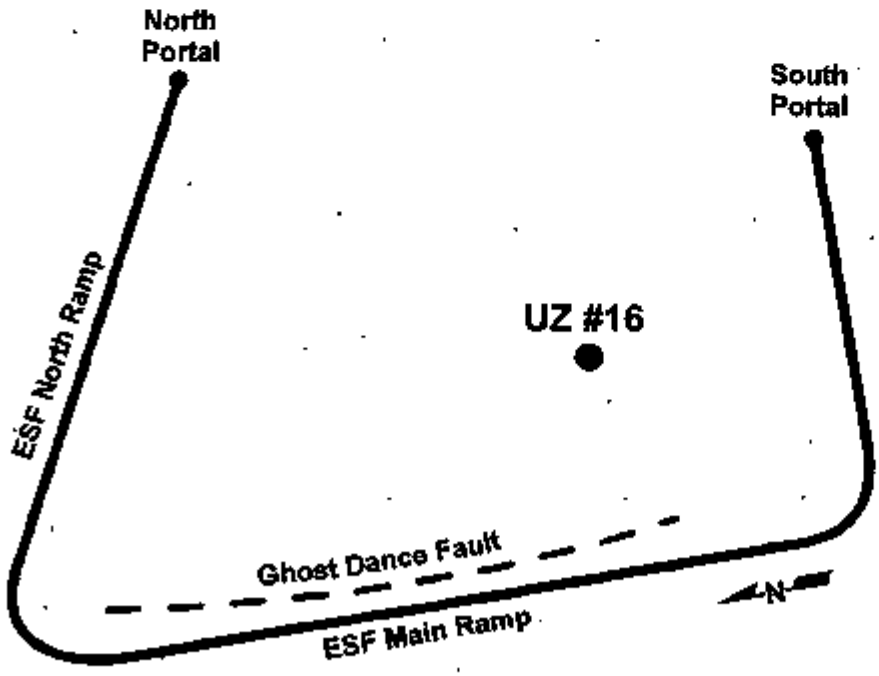
During the late 1950s and early 1960s, about 90 percent of the world's tritium was produced by nuclear detonations and thermonuclear reactions. Today, significant portions of existing tritium are produced in nuclear reactors. This tritium, which is created by bombarding lithium nuclei with neutrons, is absorbed in coolant water. It evaporates, and later reaches the Earth's surface as rain, where it sinks into the ground.

One of tritium's most important characteristics is its ability, as a hydrogen atom, to interact with other elements. This makes it easy for the isotope to make its way through air, water, food, and into virtually all living things.

Because the bulk of the world's tritium derives from thermonuclear tests conducted worldwide during the 1960s, the isotope works well for dating water and dead organic matter. A pocket of water containing substantial amounts of tritium, for example, can be characterized as less than 40 years old. This is because water isolated before the 1960s would contain significantly less tritium than water isolated afterwards.

Recently, Project scientists were a little surprised to discover significant amounts of the isotope at a depth of 430 meters (1,410 feet) in a borehole drilled near the Ghost Dance Fault, on the southeast side of Yucca Mountain. Background traces of naturally-occurring tritium in the area are usually measured in terms of a few "tritium units." Here, scientists found about 100 tritium units. They characterized this incidence as a tritium "spike," an unexpectedly large amount of the isotope.

The tritium's ability to move through fractures in the soil and rock at Yucca Mountain in so short a time and so large an amount suggested the existence of a possible fast pathway from the surface to the repository horizon — the area underground where a repository could be built.



Project scientists were surprised to discover significant amounts of tritium at a depth of 430 meters (1,410 feet) in the UZ-16 borehole.

Pathways a concern

Potential fast pathways for water movement from the surface to where a repository might be built are a concern because water in a

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TBM moves into high gear

For Project personnel, the last three months of 1995 were a time of serious belt tightening But deep under Yucca Mountain, there has been ample belt *loosening* of the tunnel boring machine (TBM) conveyor belt

Between mid-April and the end of June, 1995, the TBM, which completed its first mile of underground excavation over the summer, had been advancing at a rate of approximately 9 6 meters (31 feet) per day By December, though, it was tunneling at about five times that rate

Part of this increase can be attributed to a significant improvement of the ground conditions through which the TBM was moving The ground was less fractured, and therefore easier to move

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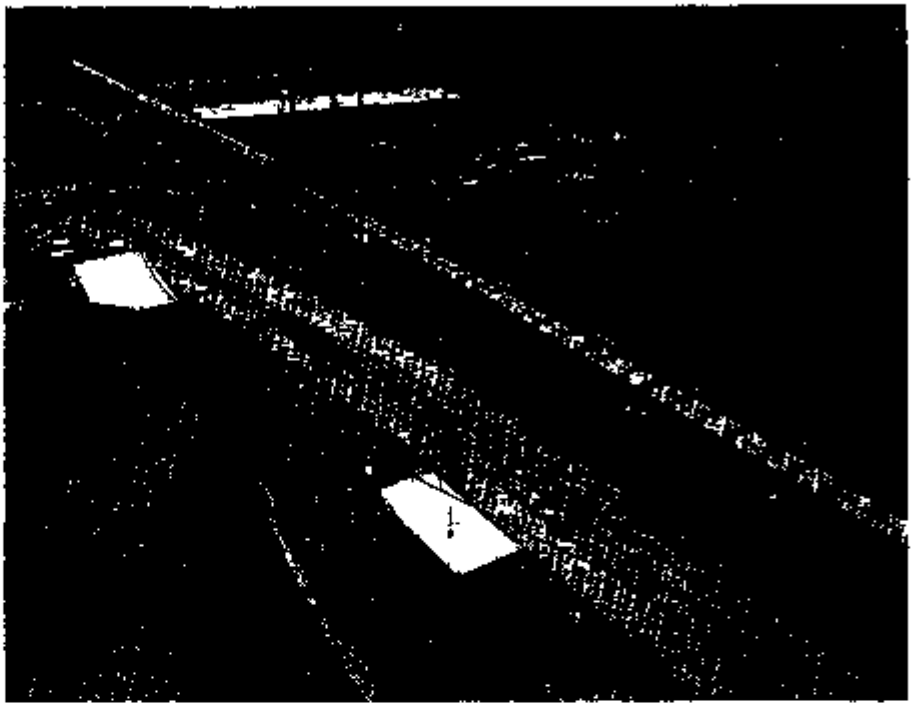
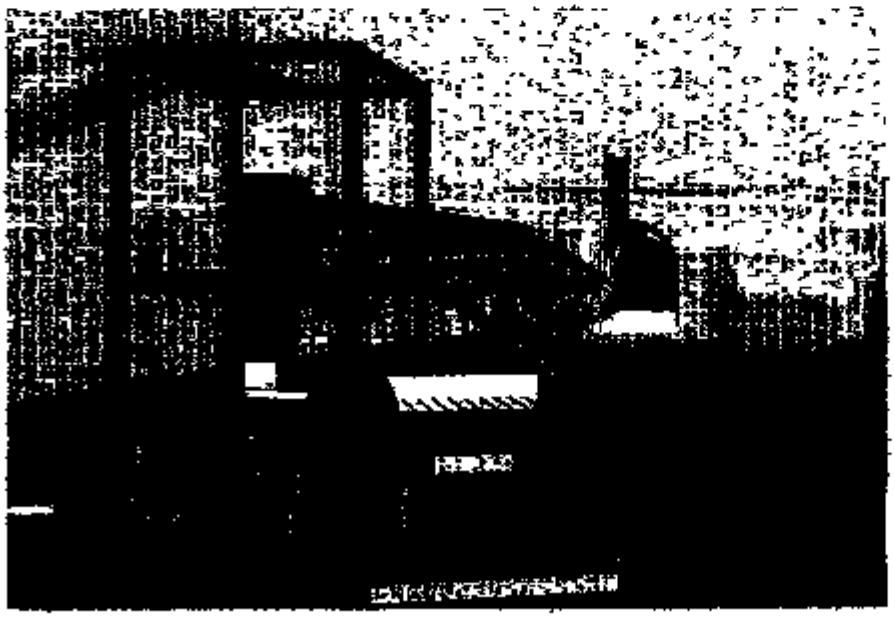


View of the new belt conveyor system as seen from the entrance of the Exploratory Studies Facility

Designing a conveyor system for Yucca Mountain



Early illustration of the conveyor belt system as it leaves the ESF entrance.

The design of the ESF muck conveyor system was dictated by the unique conditions required to support a TBM Typically, belt conveyors are designed to move material from one fixed point to another fixed point But at Yucca Mountain, the conveyor belt must continually grow longer, in keeping with the TBM's progress

To solve this problem, engineers designed a conveyor system in which the loading end of the conveyor is attached directly to the TBM To provide added belt as needed, a 300-meter (1,000-foot) length of extra conveyor belt is loaded

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Designing a conveyor

into a special belt magazine, or container. Construction personnel install additional conveyor supports behind the TBM. When all the stored belt in the magazine has been used, the TBM is stopped, and an additional 300 meters of belt is spliced into the magazine. This is done during scheduled TBM maintenance periods so that TBM progress will not be hindered.

The typical conveyor is designed to run along a straight line. But because the ESF is shaped like a 'U,' special supports were required to allow the belt to round two 300-meter radius curves. The existence of the curved sections also influenced the locations of a series of conveyor booster drives installed to keep the belt rolling.

Powering the belt

The electric power required to move the muck is directly related to the distance the muck has to move. As the TBM progresses, the belt lengthens, and the power requirements increase. When the conveyor system was first installed, all power was supplied to one point. This was the main drive, consisting of three 100-horsepower motors, located on the surface near the north portal.

But engineers recognized early on that it was not efficient to install motors at one point that were large enough to supply the total

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Early conceptual illustration of the conveyor belt system as it changed direction toward the muck pile.

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High gear

The conveyor collection chute on the rear of the TBM.

through, compared with earlier stretches. But much of the credit for this increased performance may also be attributed to the new conveyor belt system installed this summer to remove muck (excavated rock) and debris from the tunnel.

Why use a conveyor belt system?

At Yucca Mountain, the TBM was designed and purchased with thought toward the eventual purchase of a conveyer system to move materials and supplies to the TBM and to remove muck created by it. It came with a rail car loading system, though, because the conveyer system could not be delivered and installed at the outset of excavation. The rail system involved workers loading rock onto hopper cars using a system of short conveyors attached to the TBM. When a rail car filled up, it moved to the surface with some help from a small railroad engine. An empty rail car would then move into place to start collecting the muck.

This process required that the TBM stop during the replacement of full cars with empty ones. These

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stoppages slowed the TBM. Running several muck cars up and down the tunnel created a traffic jam, slowing down equipment and supply deliveries to the TBM. Indeed, as the TBM advanced, rail transport problems worsened. As the tunnel lengthened, the round trip for rail-mounted muck cars grew longer. Every delay meant lost productivity.

The new belt conveyor system removes material continuously. This eliminates the need for removing muck by rail car, and cuts down on the frequent TBM stoppages created by the movement of individual rail cars in and out of the ESF tunnel. And as the length of the tunnel increases, workers install new sections of belt to accommodate that length.

Conveyor systems have other advantages as well. They are relatively easy to install. They help lower the cost of ventilation by replacing muck cars. Conveyor systems are also believed to be safer. Hooking and unhooking trains can lead to accidents. This way, the trains are eliminated. Finally, they help save labor. It may take five or six people per shift to operate rail-mounted muck cars, but only one to oversee the conveyor system. ■

The end of the line for the conveyor belt. Muck dumped here is being used to expand surface facility areas.

Continued from page 136

Designing a conveyor

To reduce stresses within the conveyor system, power booster drive stations, like to one pictured above, are being installed along the length of the conveyor belt.

power required at the maximum length of the belt. They also realized that trying to supply all the power for the belt at a single point would create large stresses within the conveyor system.

A better solution was to distribute the power input along the length of the belt, in as many places as required. And so, as the tunnel and belt lengthened, additional power was added by installing booster drive stations consisting of one or two 100-horsepower motors. There are currently two booster drive stations in place. One was installed 983 meters (3,225 feet) inside the tunnel; the other at 1,760 meters (5,775 feet). When the belt conveyor reaches its full length, there will be up to six booster drive stations supplying up to 1,300 horsepower.

Back at the surface, the conveyor configuration includes a long run of belt to allow muck to be moved from the tunnel entrance to the edge of the construction pad. This portion of the belt is elevated at a little over five meters (17.5 feet) above the ground. This allows trucks to move alongside or even under the conveyor. The muck delivered to the edge of the pad is currently being used to extend the pad itself. Once the pad has reached its final size, a second conveyor will be erected to move muck to a storage area nearly one kilometer (a little more than half-a-mile) from the current tunnel portal. ■

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In their own words...

Paige Zielinski

As graduate theses go, Paige Zielinski's seemed to have more than its share of real world applicability. Of course, it helped that when Zielinski began her work on "Criticality of Waste Packages in a Tuff Repository" at the University of Nevada, Las Vegas (UNLV), she already had in mind securing an internship with the Yucca Mountain Project. And land one she did – in keeping with a cooperative agreement between the Department of Energy and UNLV, whereby doctoral students can pursue their studies while working full-time on the Project. We asked Zielinski, who at 28 now works as a regular Project employee, about her general engineering internship.

"It's a way of looking at the environment and saying, what can we do to deal with the problems that we have today and not make them worse."

"At school, I particularly liked the environmental aspects of the nuclear engineering courses I was taking. This project ties them together very well, notably mitigating the problems we're currently having with disposal of waste, making sure that it's done safely and in a responsible manner, without further disturbing the environment or populations near the repository. In engineering you don't get a chance to work with people often. This is a field of engineering which is definitely related to the public and public perception.

"At school, I particularly liked the environmental aspects of the nuclear engineering courses I was taking. This project ties them together very well . . ."

"It's a way of looking at the environment and saying, what can we do to deal with the problems that we have today and not make them worse. I decided to get involved, to learn as much as I could, and to make a positive contribution, instead of ignoring them or fighting them without understanding the issues. By learning and getting the education I did and then coming to work on the Project, I have a chance to do that.

"Holding down a full-time job while studying for your Ph.D., you don't sleep a whole lot. I started here full time even as a student intern and held a full-time class load, and it was very hectic juggling class work and work time, running back and forth between the university and the office. But luckily I had supervisors and other employees here who were very supportive and tried to make it as easy as possible for me. So did the faculty. I don't think a week goes by when I am not in touch with faculty and students to get information, talk back and forth, help them direct some of their work. They're very supportive of any kind of responsible engineering, and they regard what we're doing as very responsible.

"Yes, things are changing within the Project at precisely the time when I've started my career here. In a federal-type of project, you are always going to see a lot of fluctuation in funding and support. You have to be positive. I think this was a project that needed to be reexamined very closely, and possibly needed to be refocused. I think this (current reexamination of Program priorities and schedules) is doing that." ■

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Weather

directly affect repository operations.

According to Project Environmental Field Program Manager Larry Croft, meteorological data are provided to Project biologists, design engineers and hydrologists. Adds Croft, "Air quality and meteorological data are provided to DOE for reporting to the state of Nevada to meet the requirements of air quality operating permits related to site characterization activities."

The Yucca Mountain Project meteorologists and field technicians maintain a nine-station weather network. Five of the stations were established in 1985, three more were added in 1992, and another was activated in 1993 to improve understanding of complex weather patterns. The stations are instrumented to measure wind speed, wind direction, air temperature, relative humidity, solar radiation, barometric pressure, and, of course, precipitation.

Other sources of weather data

Project scientists are using meteorological data from a series of up to 40 regional weather monitoring stations operated by the National Weather Service and located elsewhere on the Nevada Test Site, as well as data from other agencies. Much of the data these organizations and agencies provide, and also the data produced by Project stations, are stored in archives that will form the basis for other studies.

Project meteorologists Paul Fransioli and Dale Ambos believe that some of the data collected from Project weather monitoring stations provide the basis for important scientific papers.

"We've had a special study of night-time air-flow conditions," says Fransioli, "that demonstrated the complexity of the airflow and atmospheric dispersion conditions that occur out there, particularly at night. The mountain-valley terrain structure of the area puts its own individual fingerprint on the local meteorology."

"We've learned a lot about local and regional weather that affects Yucca Mountain," says meteorologist Grover Prowell. ■

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Tritium assessment

repository could cause corrosion of the stored waste canisters disposed there. Water containing radionuclides released through corrosion could potentially move out of the repository and reach the environment quickly.

Robert Craig, acting chief of the United States Geologic Survey's Yucca Mountain Project Branch, notes that the mere existence of such a pathway would not necessarily make it unsafe to locate a repository at Yucca Mountain. The existence of a single fast pathway does not mean the site is riddled with cracks and fissures. More than 100 boreholes have been drilled into Yucca Mountain, but UZ-16 (UZ is the abbreviation used to signify the unsaturated zone) is the only one so far to show high concentrations of tritium at an extended depth.

Water found in other parts of the potential repository block may not reach the repository level at all. The water may flow down through a fault or crack, stopping before it reaches the repository horizon, perhaps forming a pocket of water. Or it may flow quickly over, under or around the repository block, acting as a drain for any water percolating down from the surface or flowing through the ground from concentrations elsewhere.

If a single or limited fast pathway exists that will bring water directly into a part of the repository block, engineers may respond by excavating their disposal tunnels away from that portion of the repository block.

"Whatever the case," says Craig, "it is not a difficult situation at all — yet. In my mind, it is an area of concern. We're not in the business of trying to show the site is suitable if it's not. We haven't seen this in the other boreholes. We certainly need to be looking for (tritium) carefully. If it's there, we don't want to miss it."

Craig notes that it will take further drilling to resolve conclusively questions hydrologists now have about how water moves through Yucca Mountain. In addition, excavation of the Exploratory Studies Facility will afford greater access to where the Ghost Dance Fault meets the repository horizon. Once scientists are able to study the area directly, they hope to gain new understanding of whether such pathways exist, and how they might work.

"That will give us a real good feel for whether we have water movement all the way down the fault," Craig says. ■

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Yucca Mountain Project Speaker Series in Nevada

Mother Nature preserves the past!

Tuesday, March 19 • Yucca Mountain Science Center, Las Vegas, 6:30 p.m.

How do scientists peer thousands of years into the past? Why, with pack-rat middens, of course! Found in arid regions of North and Central America, these crystallized globs contain sticks, plant fragments, bones and animal remains, offering today's scientists a snapshot of history by way of a natural time capsule. Join biologists Katherine Zander, Sheryl Morris and Ray Keeler as they look at how middens can reveal the changing tides of the heavens and Earth. Call (702) 295-1312 for reservations.

Lasers, lights, learning!

Tuesday, April 9 • Yucca Mountain Science Center, Las Vegas, 6:30 p.m.

Join nuclear engineer James Blink as he explores the magic of lasers and electricity. Dr. Blink will show Luke-Skywalker-wannabes how the light sword in the movie "Star Wars" can be created with an ordinary light bulb. You'll also learn how light bends, how holding hands can be truly shocking, and what a light wave looks like. Call (702) 295-1312 for reservations.

Tours of Yucca Mountain

Saturday, March 23 • Saturday, April 20 • Saturday, May 18

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.)

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

– William Blake

All photos used in "Of Mountains & Science" are provided courtesy of the U.S. DOE/M&O photographic staff.

Who do you call in Nevada?

For Group Tours?
Charlie Germack 794-7133

For Speakers?
Jackie Brandt 794-7759

For Educational Programs?
Jennifer Sizemore 295-0580

For Publications?
Sarah Haas 794-1818

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

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

P.O. Box 98608
Las Vegas, NV 89193-8608
(702) 794-7900

February 1996

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