DOE/RW-0514

The OCRWM Enterprise

• JUNE 1999 •

A PUBLICATION OF THE OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT (OCRWM)

In This Issue...

Yucca Mountain Viability Assessment Completed

The Viability Assessment concluded that scientific and technical work at Yucca Mountain should proceed. Yucca Mountain is located about 100 miles northwest of Las Vegas, Nevada.

Over the past 15 years, OCRWM has been studying a site at Yucca Mountain, Nevada, to determine whether it is a suitable place to build a geologic repository for the Nation's spent nuclear fuel and high-level radioactive waste.

In 1996, OCRWM announced its intent to prepare a *Viability Assessment of a Repository at Yucca Mountain.*

The purpose of the document was to present the results of the scientific investigations of Yucca Mountain thus far and identify the critical issues that needed to be addressed. Congress later required the Viability Assessment in the Energy and Water Development Appropriations Act of 1997.

Viability Assessment Results

- No showstoppers have been identified to date at Yucca Mountain.
- Work should proceed toward a decision in 2001 whether to recommend the site to the President for development as a geologic repository.
- Uncertainties remain about key natural processes, the preliminary design, and how the site and the design would work together.

To address these uncertainties, OCRWM plans to improve the preliminary design, complete critical tests and analyses, and include a description in a final environmental impact statement.

When this work is completed in 2001, a decision will be made by the Secretary of Energy on whether to recommend the site to the President for development as a repository.

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A Message from the Director

In December 1998, the Department of Energy submitted a Viability Assessment of Yucca Mountain to the President and Congress. The purpose of the Viability Assessment was to provide Congress, the President, and the public with information on the progress of the Yucca Mountain Site Characterization Project. The Viability Assessment describes the following:

- The preliminary design concept for the critical elements of a repository and waste package;
- A total system performance assessment, based on the design concept and the scientific data and analyses available by 1998, that describes the probable behavior of a repository in the Yucca Mountain geologic setting;
- A plan and cost estimate for the remaining work required to complete and submit a license application to the Nuclear Regulatory Commission;
- An estimate of the costs to construct and operate a repository in accordance with the design concept.

The Viability Assessment serves as an important management tool for OCRWM to guide the completion of site characterization by identifying the critical issues that need to be addressed before the Secretary of Energy decides whether to recommend the Yucca Mountain site to the President for development as a repository. While the Viability Assessment is not one of the decision points defined in the Nuclear Waste Policy Act, its completion is significant because it gives policy makers key information regarding the prospects for geologic disposal at Yucca Mountain.

Based on the Viability Assessment, we believe that work should proceed to support a decision by the Secretary in 2001 on whether to recommend the site. While the Viability Assessment reveals no "show stoppers," it does identify areas where additional work is required before site suitability can be determined.

Lake H. Barrett, Acting Director
Office of Civilian Radioactive
Waste Management

June 1999

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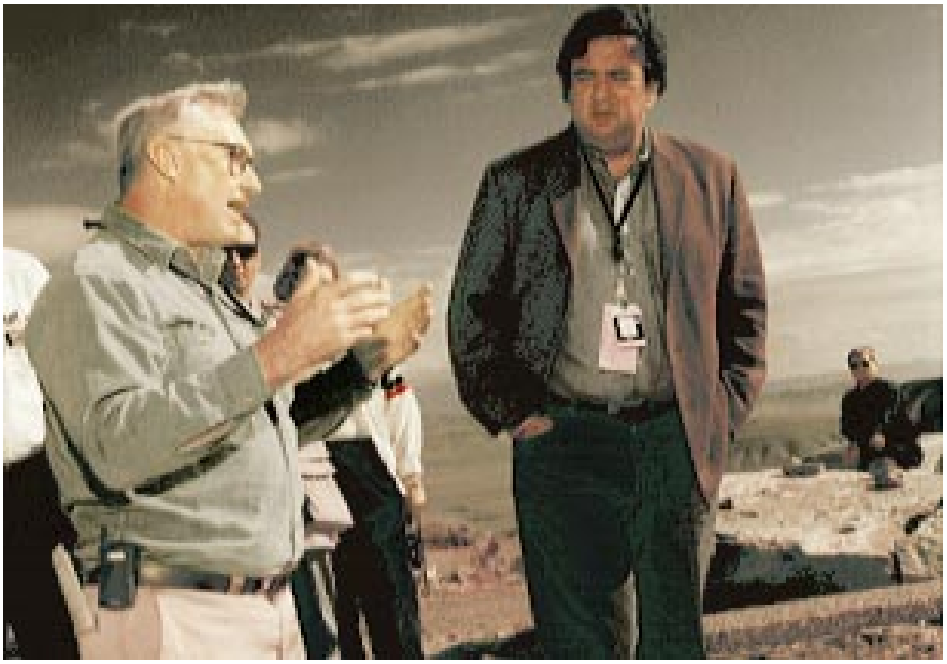
Secretary Tours Yucca Mountain



Secretary of Energy Bill Richardson joined senior OCRWM scientists atop Yucca Mountain on October 27, 1998, during the first of two visits to Nevada. Secretary Richardson told Project scientists and others that any decision on whether Yucca Mountain proves able to safely house a repository will be based solely on science.

Urging greater openness and responsiveness by the Department to the public, the Secretary reiterated that the Viability Assessment is a checkpoint, not a decision point.

After visiting the site again in December, the Secretary said that he was "very impressed with the high quality of the science that went into the development of the assessment, observing that this was "the first time in more than 15 years of scientific study and analysis OCRWM has pulled together what it knows about the site, the preliminary design of a repository, how the site and the design would work together and what questions remain to be answered. While there is technical work still to be done and questions to be answered, I believe the work thus far has been done well."

■

Yucca Mountain Viability Assessment - *continued*

Overview

The Viability Assessment *Overview* describes the worldwide nuclear waste problem and explains why the United States and other nations are considering deep geologic disposal as the solution. The overview then discusses highlights of the research described in *Volumes 1 through 5* of the Viability Assessment.

Volume 1: Introduction and Site Characteristics

Yucca Mountain is located about 100 miles northwest of Las Vegas, Nevada. Yucca Mountain is on the periphery of the nuclear weapons test site, where more than 900 nuclear tests have been conducted. This unpopulated land is owned by the Federal Government.

Yucca Mountain is a flat-topped ridge, running 6 miles from north to south, that has changed little over the last million years. Based on what is known about the site, disruption of a repository at Yucca Mountain by volcanoes, earthquakes, erosion, or other geologic processes and events appears to be highly unlikely.

Yucca Mountain has a desert climate. This is important because water movement is the primary means by which radioactive material could be transported from a repository to the accessible environment.

On average, Yucca Mountain currently receives about 7 inches of rain and snow per year. Nearly all the precipitation, about 95 percent, either runs off or evaporates. Geological information indicates that the regional climate has changed over the past million years, and the long-term average precipitation has been about 12 inches per year (comparable to that of present-day Santa Fe, New Mexico).

Even if this were to be the case in the future, it is believed that most of the water would run off or evaporate rather than soak into the ground and possibly reach the repository.

A repository would be built about 1,000 feet below the surface and 1,000 feet above the water table. Any precipitation that does not run off or evaporate at the surface would have to seep down nearly 1,000 feet before reaching the repository and through another 1,000 feet of the unsaturated zone before reaching the water table. The groundwater in the region is trapped within a closed desert basin and does not flow into any rivers that reach the ocean.

Volume 2: Preliminary Design Concept for the Repository and Waste Package

The primary design objectives for the repository are as follows: (1) protecting the health and safety of both the workers and the public during the period of repository operations; (2) minimizing the amount of radioactive material that may eventually reach the accessible environment; and (3) keeping costs down to an acceptable level.

To achieve the design objectives, engineers work with scientists to design the man-made components of a repository to work with the natural barriers -- the geology and climate of Yucca Mountain -- to contain and retard the movement of waste for thousands of years.

According to the preliminary design, spent nuclear fuel and high-level radioactive waste would be transported to Yucca Mountain by truck or rail in specially designed shipping containers approved by the Nuclear Regulatory Commission (NRC); removed from the shipping containers and placed in long-lived waste packages for disposal; carried into the underground repository by rail cars; placed on supports in the tunnels; and monitored until the repository is finally closed and sealed. OCRWM plans to improve the current design and is evaluating alternative designs and design features that could reduce uncertainties and improve performance.

Volume 3: Total System Performance Assessment

Using data about the site and the preliminary designs, scientists build detailed mathematical models of the features, events, and processes that could affect the performance of a repository's design, if it were built and if nuclear waste were emplaced. The performance assessment shows that the most significant single factor affecting the ability of the repository to protect public health and safety would be the amount of water that eventually contacts the waste.

The performance assessment for the preliminary design, though subject to uncertainties, indicates that for 10,000 years after the repository is closed, people living near Yucca Mountain would receive little or no increase in radiation exposure. After about 300,000 years, people living about 20 kilometers (12 miles) south of Yucca Mountain might receive additional radiation doses that are comparable to present-day doses from natural background radiation.

Although the performance assessment is encouraging, there are remaining uncertainties that need to be addressed before a site recommendation is made and a license application is submitted to the NRC. OCRWM plans to address these uncertainties in two ways: (1) by continuing to test the Yucca Mountain site and the candidate waste package materials, and (2) by evaluating alternative repository designs that could reduce the possible radiation doses to people living near the mountain thousands of years in the future.

Volume 4: License Application Plan and Costs

To obtain an NRC license, OCRWM must demonstrate that a repository can be constructed, operated, monitored, and eventually closed without unreasonable

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Yucca Mountain Viability Assessment - *continued*

risk to the health and safety of workers and the public. In the next four years, OCRWM will focus on improving the repository and waste package design, strengthening the understanding of the natural processes, preparing the environmental impact statement, and developing the information needed to support any site recommendation decision.

Volume 5: Costs to Construct and Operate the Repository

The additional cost to license, construct, operate, monitor, and close a repository is estimated to be $18.7 billion, in constant 1998 dollars.

This cost estimate includes monitoring a repository for 100 years and disposing of 70,000 metric tons of spent nuclear fuel and high-level waste at Yucca Mountain, currently the legal limit of what can be emplaced.

However, the cost of a monitored geologic repository is only one component of the total life cycle cost for the waste management system. Other components include: (1) transporting waste to the repository; (2) payments-equal-to-taxes and other benefits to the State of Nevada and affected units of local government; (3) expansion of the repository beyond the 70,000 metric-ton statutory limit, if authorized by Congress; and (4) overall system management.

The total estimated future cost of the system is $36.6 billion, in constant 1998 dollars. This covers the period from1999 through repository closure in 2116.

What is the long-term plan?

The Nuclear Waste Policy Act sets forth a multi-step process for deciding whether to proceed with development of a repository at Yucca Mountain, and OCRWM has a tentative schedule for completing this process.

A negative decision at any step along the way would stop the process and require that Congress develop a different approach to solving the Nation's spent nuclear fuel and high-level radioactive waste problem.

- Before deciding whether to recommend the Yucca Mountain site to the President, the Secretary of Energy will conduct a formal evaluation of the site, hold public hearings in the vicinity of Yucca Mountain to inform the residents of the possible recommendation of the site and receive the comments of interested parties. The current schedule calls for the Secretary of Energy to decide in 2001 whether to recommend the site.

- If, after these considerations, the Secretary of Energy decides to recommend the site, the President would then determine whether to recommend the site to Congress.

- If the President recommends the site to Congress, the Governor or legislature of Nevada may submit a notice of disapproval. If either does so, Congress must decide whether to override the notice of disapproval and approve the Yucca Mountain site.

- If Congress approves the Yucca Mountain site, in 2002 OCRWM would submit an application to the NRC to construct a repository.

- If the NRC approves the application, OCRWM would construct a repository and apply to the NRC for a license to begin receiving waste for disposal in the repository.

- If construction proceeds as currently planned, and OCRWM receives a license to operate the repository, then waste emplacement could begin in 2010.

Concluding observations: Achieving reasonable assurance

Based on the results of the Viability Assessment, the Department believes that scientific and technical work at Yucca Mountain should proceed to support a decision by the Secretary of Energy in 2001 on whether to recommend the site to the President for development as a geologic repository.

The performance of a geologic repository over such long time periods cannot be proven beyond all doubt. Forecasts about future geologic and climatic conditions and engineering estimates of how long the waste packages will remain intact cannot be directly validated.

The mathematical models used in the performance assessment are subject to uncertainties that can be reduced but never completely eliminated.

The challenge in licensing a geologic repository is demonstrating compliance with long-term safety standards for many thousands of years. The NRC's general standard for meeting geologic repository regulatory criteria and objectives is reasonable assurance.

While considerable uncertainties remain today, OCRWM believes that reasonable assurance should be achievable in the licensing process after the planned work is completed. OCRWM believes, therefore, that ongoing work at Yucca Mountain should proceed as planned. ■

To request a copy of the Viability Asesssment, contact:

U.S. Department of Energy

Yucca Mountain Site

Characterization Office

P.O. Box 30307

North Las Vegas, Nevada

Telephone:

1-800-225-6972

Spent Nuclear Fuel Dry Transfer System Demonstration

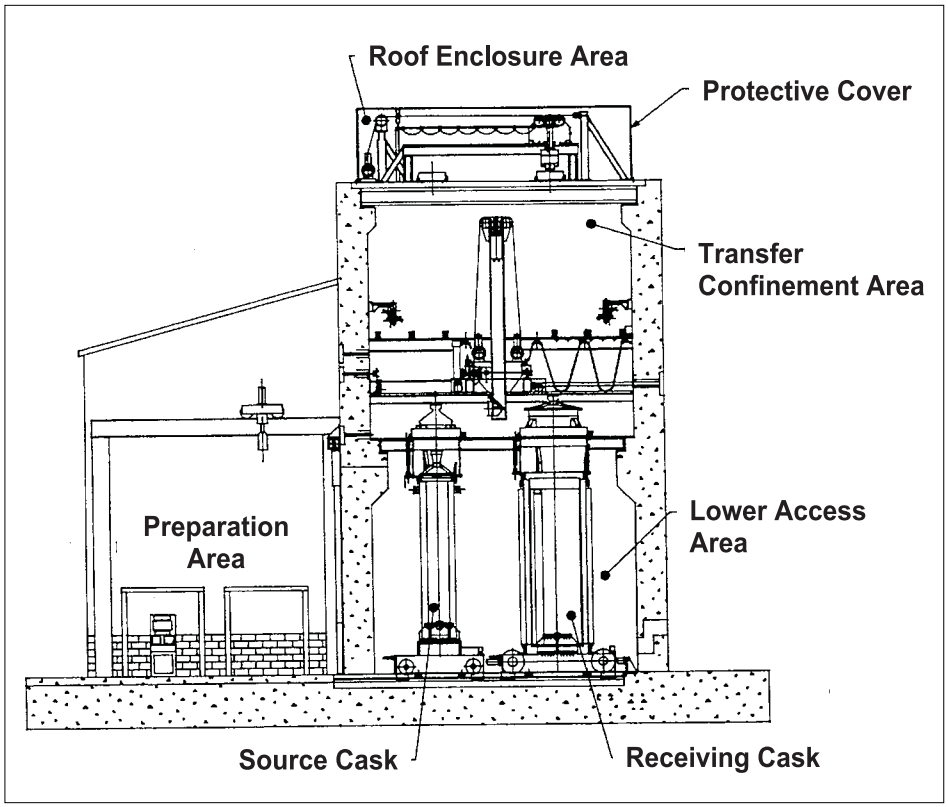

Figure 1 — Schematic of a dry transfer system.

Demonstration of a prototype spent nuclear fuel dry transfer system (DTS) began on September 30, 1998, at the Department of Energy's (DOE) Idaho National Engineering and Environmental Laboratory (INEEL).

The demonstration is the final phase of a cooperative agreement between the Office of Civilian Radioactive Waste Management (OCRWM) and the Electric Power Research Institute (EPRI) to develop a DTS that is licensable by the Nuclear Regulatory Commission (NRC). The prototype DTS was fabricated under quality assurance requirements of the NRC.

OCRWM initiated the $4.5 million "cold" demonstration project in June 1996 with Civilian Radioactive Waste Research and Development funds and additional funding from DOE's Office of Environmental Management. It is referred to as a "cold" demonstration because, instead of actual spent nuclear fuel, mockup fuel assemblies that are not radioactive are used.

The DTS will enable individual spent nuclear fuel assemblies to be transferred between conventional top-loading casks and multi-element canisters within a shielded overpack, and also between two conventional casks. Such a system offers several significant applications beneficial to DOE and commercial nuclear facility operators.

For example, the DTS provides a means for utilities presently capable of handling only truck casks to also have the option of loading spent nuclear fuel into a rail cask. The DTS would support current and future DOE spent nuclear fuel management activities.

EPRI contracted with Transnuclear, Inc. (TN) of Hawthorne, New York, to design the DTS and prepare a topical safety analysis report. EPRI delivered the completed Dry Transfer System for Spent Fuel: Project Report to OCRWM in December 1995, and the Dry Transfer System Topical Safety Analysis Report in August 1996. OCRWM submitted the topical safety analysis report to the NRC in September 1996: that review is expected to be completed in early 2000.

The DTS, shown in Figure 1, consists of several subsystems, including a spent nuclear fuel handling subsystem, and a concrete facility to provide shielding during spent nuclear fuel transfer operations.

All systems, except the concrete facility, are designed to be portable. The floors and ceilings in the concrete cell that contain the handling equipment can be transported to other locations to accommodate use of the same dry transfer system equipment at multiple sites.

The prototype demonstration system is shown in Figure 2. DTS testing includes all hardware, related control systems, and interlocks for shield plug and lid handling equipment, fuel assembly handling system, cask interfacing equipment, and the closed circuit television and lighting systems. It does not include cask preparation, decontamination, and closure activities that are to be performed in the preparation area.

Likewise, heating-ventilation-and-air-conditioning subsystems and radiation monitoring equipment are not being demonstrated. A space frame has replaced the concrete support and shielding structure in the EPRI/TN design.

The demonstration involves use of an existing overhead crane at the INEEL test facility. Although lower in height, this crane is capable of performing many of the functions of the crane in the EPRI/TN design.

To accommodate the lower height of the INEEL crane, shortened mockups of the source cask, receiving cask, and fuel assemblies are being used in the demonstration. The mating surfaces of the mockup casks have been designed to simulate a TN MP-187 receiving cask and a TN 8L source cask.

EPRI developed the DTS Demonstration Test Plan through a contract with Pacific Northwest National Laboratory. The demonstration will validate DTS per-

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Site Characterization

A technician inspects equipment used to inject a mixture of compressed air and a tracer gas (SF-6, sulfur hexaflouride) into a borehole in the cross-drift. After some time, scientists will recover the gases from a separate borehole. By knowing the distance between the boreholes and the travel time for the gas, they can determine how fast fluids and gases move through the rock.

Busted Butte

At Busted Butte, a small hill located just south of the main crest of Yucca Mountain, miners excavated a small tunnel about 92 meters (302 feet) long. This tunnel provides access to the Calico Hills formation between the potential repository and the groundwater table. Now, Project scientists can test these rocks in an underground setting.

Scientists inject tracers into a set of boreholes in the test area and collect them in other boreholes that intersect the tracer's path. Tracers are very small amounts of special fluids that are easily recognized by the scientists and normally are not found in the rocks at Yucca Mountain. Microscopic spheres also will be injected into the boreholes to understand the behavior of colloids, which are very small natural particles to which radionuclides could attach and move through fractures to the water table. Both the tracer tests and colloid studies will help scientists understand how water and potential radionuclides move through the rocks below the repository.

Scientists are doing these studies because they want to understand how radionuclides might move from a repository to the water table and whether the rocks of the Calico Hills will act as a barrier. The studies will help to predict whether radionuclides will move through quickly or take thousands of years.

Cross-drift Excavation Confirms Earlier Site Assessments

Scientists examining the rock in a 2.8 kilometer (1.7 mile) tunnel cutting across the Exploratory Studies facility (ESF) under Yucca Mountain found supporting evidence that earlier surface and underground studies produced a reasonably accurate picture of geologic conditions at the site.

Faults and rock layers detected in this cross-drift tunnel showed up where researchers ex-

Work Update

pected to find them. In addition, the tunnel disclosed the existence of three unexpected faults, but these are inactive and too small to affect a repository at Yucca Mountain.

Workers excavated the cross-drift tunnel last year to help researchers confirm earlier findings about the geological suitability of the Yucca Mountain site for the potential repository. The five-meter diameter tunnel crosses the larger ESF tunnel diagonally from northeast to southwest.

The cross-drift traverses a section of rock that would be occupied by the potential repository. Scientists have finished mapping the geologic features exposed along the tunnel's rock face. Thermal and hydrological tests designed to confirm the results of similar tests in the ESF are also planned. ■

This tunnel boring machine was used to excavate the cross drift. Workers assembled the machine underground and pushed it forward on rails to begin excavating the tunnel, which extends 2.8 kilometers (1.7 miles). The excavation started in December 1997 and ended in October 1998.

The 5-meter (16.5-foot)-diameter cross-drift was completed in October 1998. Here, it veers from the Main Exploratory Studies Facility, which measures 7.5 meters (24.6 feet) in diameter. Project scientists will use the cross-drift to check rock and moisture conditions above the potential repository area and to perform underground studies on the Solitario Canyon fault that borders the far side of the proposed repository area.

Spent Nuclear Fuel Dry Transfer System Demonstration - *continued*

formance and its ability to recover from off-normal conditions.

It will confirm loading cycle time and overall system throughput rate. Additional benefits of the demonstration include equipment fabrication and cost information generated by actual purchases, and the generation of information as a basis for improving future designs.

A DTS cold demonstration report will be published this summer. Leroy Stewart, RW-40, is the OCRWM contact for the project, and he can be reached at (202) 586-2797 or by e-mail at leroy.stewart@rw.doe.gov. ■

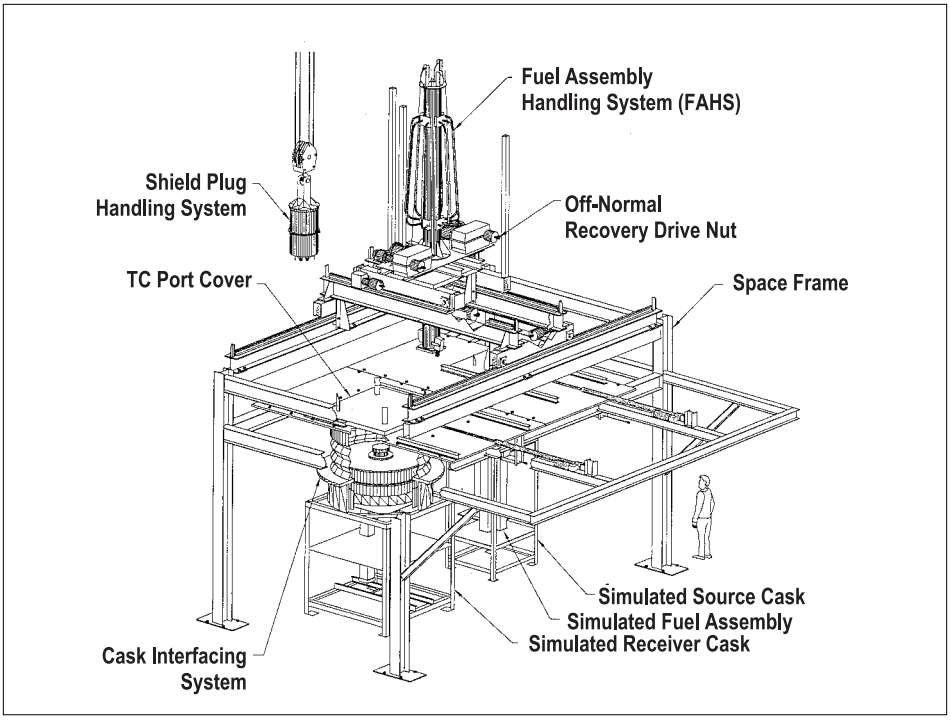

Figure 2 — Drawing of a prototype dry transfer system.

Geologic Disposal Crucial to Nuclear Non-proliferation Goals

In the aftermath of the Cold War, there remain significant quantities of nuclear weapons materials that are no longer needed and nuclear weapons production facilities that must be cleaned up.

In addition to environmental protection, nuclear proliferation concerns still exist. Meeting these serious global challenges will require the implementation of an environmentally sound geologic disposal program.

This was the message given by the Office of Civilian Radioactive Waste Management's (OCRWM) Acting Director, Lake Barrett, at a gathering of world peace advocates, environmentalists, journalists, and foreign embassy representatives at the Carnegie Endowment for International Peace in Washington, D.C., on September 11, 1998.

Ten days earlier, the White House had announced in a press release that President Clinton and Russian President Yeltsin had agreed on steps to ensure that plutonium recovered from dismantled weapons would not find its way into the hands of terrorists or countries seeking to develop nuclear weapons.

"The pursuit of a sound plan for the disposition of nuclear materials is imperative for achieving international nuclear non-proliferation goals," Mr. Barrett told meeting participants. "Continuing the endorsement of the international consensus on geologic disposition of nuclear materials sets an example for high standards of environmental protection and nuclear safeguards that the U.S. seeks worldwide."

The Department of Energy's (DOE) Office of Fissile Materials Disposition is implementing a program to make nuclear materials inaccessible and unattractive for weapons use. DOE's strategy for disposition of surplus plutonium involves an approach that allows immobilization of surplus plutonium in glass or ceramic material for disposal in a geologic repository pursuant to the Nuclear Waste Policy Act of 1982, as amended, and burning some of the surplus plutonium as mixed oxide fuel in existing, domestic, commercial reactors, with subsequent disposal of the spent fuel in a geologic repository.

These efforts will provide the basis for the United States to initiate disposition efforts either multilaterally or bilaterally, through negotiations with

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Geologic Disposal Crucial to Nuclear Non-proliferation Goals - *continued*

other nations, or unilaterally. Disposition of the surplus plutonium will serve as a non-proliferation and disarmament example, encourage similar actions by Russia and other nations, and foster multilateral or bilateral disposition efforts and agreements.

The United States and Russia pledged to remove from their weapons programs some 50 metric tons of plutonium each -- enough to make thousands of weapons -- so that it can never be used again in nuclear weapons. Appropriate transparency and international verification measures will apply to the non-proliferation program, as will stringent standards of safety, environmental protection, and material protection, control and accounting.

U.S.-Russian cooperation on plutonium disposition will be carried out in close cooperation and coordination with parallel efforts involving Russia and other G-8 countries.

President Clinton and President Yeltsin directed their experts to enter promptly into negotiations that will transform these agreed principles into a bilateral agreement that will lay out the concrete steps for plutonium disposition and govern their future cooperation in this area. ■

International Cooperation in Nuclear Waste Management

With 442 nuclear power facilities generating electricity in 35 nations, the management of nuclear waste, including spent nuclear fuel and high-level radioactive waste, is an international concern.

Many of these nations maintain radioactive waste management programs and generally accept deep geologic repositories as the long-term alternative for disposal of spent nuclear fuel and high-level radioactive waste.

The Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM), responsible for the disposition of spent nuclear fuel from commercial nuclear power facilities and U.S. Government-owned high-level radioactive wastes, participates in cooperative efforts with several nations and international organizations focused on solving problems associated with the nuclear fuel cycle.

OCRWM's international cooperation program involves information exchange and research and development technology sharing among nations. This benefits the OCRWM Program by 1) reducing overall long-term costs; 2) providing access to unique facilities; 3) allowing scientists and engineers to work with technical peers on cutting-edge technology; and 4) facilitating the development of consensus on common technical issues.

OCRWM's international program focuses on areas of technical exchange that specifically benefit the Yucca Mountain Site Characterization Project and enhances near-term objectives leading toward a decision on geologic disposal. International cooperative efforts also address waste acceptance, storage and transportation issues.

To achieve effective exchange of nuclear waste management technical information and to foster consensus development, OCRWM maintains bilateral agreements with Canada, Japan, France, Sweden, Switzerland, and Spain.

OCRWM is also developing a formal cooperative agreement with Russia on nuclear materials disposition. This agreement will focus on Russia's development of a repository for Russian-generated spent nuclear fuel and high-level radioactive waste.

Discussions are being held with the United Kingdom on the development of a cooperative agreement in the area of radioactive waste management, and it is planned that formal discussions will also take place with Germany in the near future.

In addition to agreements with other nations, OCRWM participates in programs and related activities sponsored by the International Atomic Energy Agency (IAEA) and the Organization of Economic Cooperation and Development's Nuclear Energy Agency (NEA). The IAEA work deals with consensus development on technical waste management issues, particularly spent fuel storage and systems integration, and involves participation in IAEA's Advisory Group on Spent Fuel Management as well as specific projects.

Cooperative work with the NEA focuses on interpretation of site characterization data and performance assessment through participation in the Site Evaluation and Design of Experiments Group and the Performance Assessment Advisory Group. These groups work cooperatively to improve the state-of-the-art in geosphere transport, two-phase flow characterization and modeling, thermochemical data base development, and performance assessment and modeling. ■

Scientists Review Heat Effects on Rock in Russian Facility

Krasnoyarsk-26 is a massive underground plutonium-production plant built after the Second World War on the banks of central Siberia's Yenisey River. Located 37 miles upstream is the city of Zheleznogorsk.

Plutonium is no longer produced here in the same amounts as yesteryear, but the Russians are eager, with help from the West, to find ways to secure these highly radioactive materials and the waste products generated during plutonium production. These substances, if not properly controlled, could fall into the wrong hands, a possibility the United States and Russia wish to prevent.

Last August, Yucca Mountain Project scientist, Bill Boyle, and Lawrence Livermore National Laboratory researcher, Leslie Jardine, accepted a Russian invitation to fly to Siberia to visit with scientists there.

The Russian Ministry of Atomic Energy coordinated the visit, and Jardine and Boyle were given a variety of briefings, participated in discussions, and visited a nearby waste injection borehole.

During much of the Cold War, the Soviets had injected some six million cubic meters of high- and low-level radioactive liquid waste into isolated water basins as deep as 500 meters inside the sedimentary rock overlaying solid masses of Siberian granite and gneiss. Since they began in 1965, these injections have caused significant increases in temperature both in the basin water and the rock encasing them.

Russian scientists claimed to have been monitoring the effects of this heat on the rock throughout this period. The International Science and Technology Center, an organization created by the United States, Japan and Europe to utilize the available talents of Russian atomic scientists, is now paying them to study this data for possible applicability to radioactive waste disposal efforts.

Boyle and Jardine were primarily interested in the effects of heat that had flooded into the rock mass around the steam generator room at the plutonium production facility over the course of the reactor's lifetime. They hoped data collected here might prove useful in assessing the effects of heat that would be generated by spent nuclear fuel emplaced in a repository.

The American scientists and a Japanese colleague were given a tour, some kilometers away from the plutonium plant, of the deep borehole injection site where liquid wastes were injected. Over the years, the Russians had injected an estimated (according to some American estimates) 300 million to one billion curies of liquid waste into the rock.

Before these injections, the water temperature in the deepest basins was measured at between 6 and 8 degrees centigrade (46 and 50 degrees Fahrenheit). It is now a little over 14 degrees centigrade (57 degrees Fahrenheit). Heating effects, says Boyle, were even more pronounced in the rock mass around the reactor steam room. Gauged at 6 degrees Celsius when the reactor began operating, the rock mass now sustains a temperature of over 70 degrees Celsius (158 degrees Fahrenheit).

"The temperatures there were by no means as hot as they would be in a repository at Yucca Mountain," explained Boyle, "but we believed we could learn something from it. I think we did."

Boyle says he left the region impressed by the level of science practiced there, and he is convinced that the data their hosts claimed to possess could prove useful to radioactive waste and spent nuclear fuel disposal efforts worldwide.

Some of the researchers Boyle and Jardine met visited Yucca Mountain in November to deliver presentations on their work to Project scientists. Boyle believes the visits further cemented bilateral cooperation between American and Russian scientists in the waste disposal arena. ■

Nye County Takes Scientific Oversight Very Seriously

The Nye County Nuclear Waste Project Office is conducting an independent assessment of the scientific data being gathered at Yucca Mountain. This will help the office determine what effects a potential repository might have on the residents of Nye County.

To perform this review, the county maintains a small staff led by Les Bradshaw, Director of its Natural Resources and Federal Facilities Department. Bradshaw, who administers the office and budget, invests most of the oversight office's more-than-$2 million dollars of annual funding in basic scientific fieldwork.

County staff members can frequently be found in the field collecting scientific data. "We have to investigate the science at Yucca Mountain very vigorously and independently," observes Bradshaw. "Our county residents depend on us for an independent assessment of the scientific facts about Yucca Mountain."

Six permanent staff members work at three different offices: in Pahrump, at the Nevada Test Site near Yucca Mountain, and at the Department of Energy facility in Las Vegas. Staff members include a mix of scientists, technicians, and office support personnel. The county also uses a number of different contractors to assist its permanent staff with collecting and analyzing scientific data.

In the spring of 1995, the office began using boreholes drilled into the rock to monitor the movement of moisture and air within the rock at Yucca Mountain. Workers placed instruments

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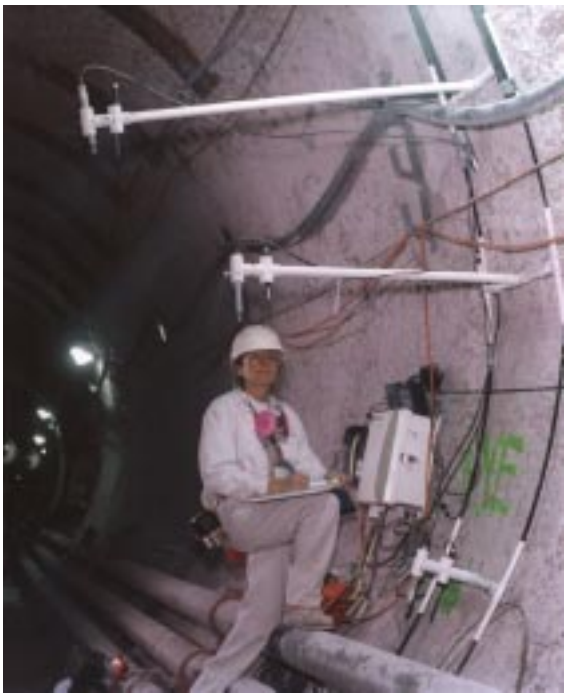
Nye County Takes Scientific Oversight Very Seriously - *continued*



A Nye County scientist installs instrumentation in the ESF. This instrumentation allows scientists to monitor humidity, temperature, and airflow and to obtain data on how tunneling within the mountain affects moisture migration in the potential repository area.

in these boreholes to help scientists monitor hydrologic conditions in the rock. Inside the underground laboratory called the Exploratory Studies Facility (ESF), the Nye County team set up sampling stations for monitoring humidity, temperature, and airflow. They did this to obtain data on how tunneling within the mountain affects the movement of moisture in the potential repository area.

The data not only add to the geology and hydrology data collected by the Department of Energy scientists, but also provide independent verification for the county. Both the Department and Nye County scientists share their data. However, their interpretations of the data may differ slightly.

For instance, Nye County has used the same data about airflow in rock at Yucca Mountain to propose a concept for designing a repository that uses natural airflow to ventilate the waste emplacement area. This differs somewhat from the Department's view, which didn't include natural ventilation in its repository design. Recently, and as a result of Nye County's efforts, the Department has begun considering natural ventilation as part of its alternative design studies.

The Nye County office is one of the few outside scientific organizations granted access to the ESF to perform scientific tests. OCRWM gave the office access because it presented a thoughtful scientific plan and an approved quality assurance program.

This required the county office to perform its work with the necessary documentation of scientific samples and conclusions, and adherence to written procedures that meet the stringent requirements of the NRC.

The data are being shared with OCRWM scientists, so it must be defensible in a licensing arena with the NRC. In addition, some of Nye County's conclusions may also be considered during licensing; these conclusions, therefore, must be traceable to the original data collection sites.

Nye County recently obtained a scientific grant from OCRWM in the amount of $3.6 million to conduct tests over a five-year period. These tests will be part of the office's Independent Scientific Investigation Program (ISIP).

The purpose of the ISIP is to investigate key issues related to conceptual design and performance of the potential repository that could have major impacts on human health, safety, and the environment.

"About 1,300 people in Amargosa Valley (an agricultural area of Nye County) are downgradient from the groundwater flow at Yucca Mountain," states Bradshaw. "We are responsible for their safety. We must do our best to assure them that the groundwater will be safe for future generations."

Another of the ISIP's objectives is to identify safety concerns beyond those being addressed by OCRWM. The county has its own views concerning a potential repository at Yucca Mountain and related long-term safety issues. "We are leaning toward the idea of keeping the repository open for a longer period and monitoring it," states Bradshaw.

In November 1998, and as part of this independent program, Nye County began a new and aggressive, three-year drilling and monitoring program called the "Early Warning Drilling Program (EWDP)."

This program will provide an early warning and detection system for Amargosa Valley. If radionuclides ever escape from a potential repository and start moving from Yucca Mountain towards Amargosa Valley, the radioactive particles would have to pass through these monitored boreholes. Instruments placed in these boreholes would help detect any radioactive contaminates moving towards the valley.

The initial drilling, hydrologic testing and monitoring data will help Nye County scientists better understand the regional groundwater aquifer, and contribute to the groundwater database in the Amargosa Valley.

Today, the oversight office continues to monitor from its scientific stations in the underground facility excavated at Yucca Mountain and from various boreholes. Nye County scientists participate in workshops and present their findings alongside their OCRWM counterparts at scientific forums such as Nuclear Waste Technical Review Board meetings.

You can find out more about Nye County Nuclear Waste Repository Project Office scientific programs by reading related documents on its web site at www.nyecounty.com. ■

OCRWM News in Brief

Total System Life Cycle Cost Analysis Completed

During Fiscal Year 1998, OCRWM conducted a new total system life cycle cost (TSLCC) analysis to support the Viability Assessment of the Yucca Mountain site, as well as an annual assessment of the adequacy of the 1-mil/kWh fee paid by the nuclear power generators.

These reports, *Analysis of the Total System Life Cycle Cost of the Civilian Radioactive Waste Management Program,* and *Nuclear Waste Fund Fee Adequacy: An Assessment*, were issued in December 1998 as companion documents of the *Viability Assessment of a Repository at Yucca Mountain*.

The TSLCC analysis represents a preliminary estimate based on the Viability Assessment design approach and the assumptions concerning development and operation of the waste management system specified in the TSLCC. The purpose of the TSLCC is to provide a cost estimate that aids in financial planning, to provide policy makers information for determining the course of the program, and to provide input to the fee adequacy analysis. The total estimated future cost to complete the Program is $36.6 billion, in constant 1998 dollars. This will cover Program activities from 1999 through closure and decommissioning of a repository, which is assumed to be in 2116.

In accordance with the Nuclear Waste Policy Act, the costs for disposal of commercial spent nuclear fuel in a geologic repository are funded by a fee levied on electricity generated and sold. *The Nuclear Waste Fund Fee Adequacy: An Assessment,* presents the Department's analysis of the adequacy of the 1 mil/kWh fee being paid by the nuclear utilities for the disposal of their spent nuclear fuel.

This latest assessment finds that the current fee is adequate and recommends that it not be changed. This recommendation is based on examination and analysis of the revenue forecasts and estimated costs for the Program's current approach to a waste management system, and on consideration of the uncertainties associated with economic assumptions, Program revenues, Program scope, and cost estimates. ■

OCRWM Ahead of Department's Y2K Compliance Schedule

OCRWM continues to be recognized as a leader within the Department of Energy in the application of information technology. Since Fiscal Year 1997, OCRWM has been working to upgrade its computer systems and networks with Year 2000 (Y2K)-compliant hardware and software. OCRWM declared four systems mission-critical, several others were designated mission-important. During Fiscal Year 1998, OCRWM began to assess and test all software applications. OCRWM's Acting Director monitored progress through weekly reports and periodic videoconferences with the Yucca Mountain Site Characterization Project.

OCRWM completed Y2K compliance validation and implemented all mission-critical systems ahead of the Department's stretch goal of January 31, 1999. Similarly, non-mission-critical systems were also validated and implemented ahead of the March 31, 1999, stretch goal. ■

OCRWM Publishes Program Plan, Revision 2

Last July, OCRWM published an updated Program Plan, Revision 2 , that describes key Program activities planned for Fiscal Years 1999 - 2003. The plan continues the thrust of the 1996 draft revised plan and is intended to serve as an improved foundation for program management and as a framework for evaluating progress. Reflecting guidance from the Administration, Congress, and the Department, it identifies strategic objectives, states underlying assumptions, defines measures of success, and provides for contingency planning.

The plan embodies the approach to planning that the Government Performance and Results Act (GPRA) requires at the departmental level. That Act took effect with the Fiscal Year 1999 budget cycle. It requires that each agency (1) prepare a strategic plan at least every 3 years covering a period of not less than 5 years forward from the fiscal year in which it is submitted, (2) prepare, for submission with its annual budget request, an annual performance plan that establishes performance goals and indicators, and (3) report to the President and the Congress each year on program performance for the previous year.

In the spirit of GPRA, strategic goals and objectives in the Department's 1997 Strategic Plan and in other GPRA documents are now formally linked to activities and objectives in the OCRWM Program Plan.

The Department is considering publication of a new Strategic Plan in early 2000. Any revisions to Departmental strategic goals and objectives — as well as other strategic developments — may require updating OCRWM's Program Plan.

The *OCRWM Program Plan, Revision 2*, can be ordered by contacting the National Information Center at 1-800-225-6972 or (202-488-6720 in Washington, D.C.). Electronic copies may be downloaded from the OCRWM Web site at **www.rw.doe.gov**. ■