

Frequently Asked Questions: Yucca Mountain And Used Nuclear Fuel Management

July 2008

Q: Why is it necessary to create a deep geologic repository for used nuclear fuel?

A: Scientific consensus has long affirmed that the safest method for managing used nuclear fuel is in an engineered repository deep underground. Congress took this into account in enacting the Nuclear Waste Policy Act of 1982, mandating the federal government to begin collecting and disposing of used nuclear fuel from U.S. nuclear power plants in 1998.

The consensus supporting deep geologic disposal has strengthened since then. In 2001, the National Academy of Sciences concluded: "Geologic disposal remains the only scientifically and technically credible long-term solution available."

Q: What is the relationship between the development of a geologic repository and plans to recycle and reuse nuclear fuel with advanced technology?

A: Recycling and geologic disposal are complementary objectives that, along with safe interim storage until a recycling facility or repository becomes available, form what is known as an integrated

approach to used nuclear fuel management.

Advanced recycling technologies can enable the derivation of additional energy from the material. Using these technologies also could significantly reduce the volume of remaining byproducts that the U.S. Department of Energy must deposit in the repository. However, no technology can remove all of the radioactivity from the waste; therefore, a repository still will be necessary.

Finally, designing a repository so that materials emplaced in it are retrievable would allow disposal to proceed without foreclosing opportunities for recycling as advanced technologies are developed and refined in the future.

Q: Why is Yucca Mountain, Nev., the federal government's location for a deep geologic repository for the safe storage of used nuclear fuel?

A: The Nuclear Waste Policy Act required an examination of nine sites in six states. Several government agencies and scientific organizations participated in environmental studies and scientific evaluations of these sites. After a 1986 DOE

study ranking Yucca Mountain, Nev., first among these sites, Congress amended the law in 1987 and directed DOE to focus its scientific and environmental investigation entirely on Yucca Mountain.

All aspects of the geological, hydrological and geochemical environment have been studied, including a detailed evaluation of how conditions might evolve over thousands of years at Yucca Mountain.

In 2002, based on these studies, Congress and the president approved the Yucca Mountain site. In 2004, the U.S. Court of Appeals ruled on several challenges to this approval by repository opponents and fully affirmed the site decision.

To date, DOE has spent more than 25 years and \$10 billion conducting a scientific evaluation of Yucca Mountain as the site of a nuclear waste repository. This work forms the foundation of the department's recent license application seeking approval from the U.S. Nuclear Regulatory Commission to build and operate the repository.

The ongoing NRC licensing process thoroughly will test and verify all of the scientific



SUITE 400
1776 I STREET, NW
WASHINGTON, DC
20006-3708
202.739.8000
www.nei.org

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and technical information supporting the development of the repository before any authorization is given to construct it.

Q: What is the Yucca Mountain licensing process all about?

A: The next step for Yucca Mountain is the federal licensing process. DOE submitted an application for construction of the repository at Yucca Mountain to the NRC in June 2008. This application is now under review at the NRC. If the NRC approves construction, DOE must subsequently obtain separate approval from the NRC to operate the facility.

Although licensing a repository is a first for both DOE and the NRC, very little about the licensing process itself is new. The NRC has licensed the nation's 104 currently operating commercial reactors and other nuclear facilities such as uranium-enrichment plants and fuel storage facilities.

The NRC is using the same rigorous approach to regulation in its review of the Yucca Mountain application. In practice, this means the NRC will focus on issues most important to safety during each phase of the licensing process. The NRC also has undertaken a considerable effort over the past 20 years specifically preparing for the Yucca Mountain licensing process to ensure a technically sound review of the application.

In this case, the NRC's proven regulatory practices are applied over a phased approach uniquely suited to the long-term mission of a repository. Accordingly, licensing Yucca Mountain is a three-step process:

- DOE begins the process by submitting the license application to construct the repository; this was accomplished in June 2008.
- When the facility is complete, perhaps a decade or more from now, DOE will apply for an amendment to the license to receive and possess waste at the repository.
- Once all the waste is placed inside Yucca Mountain, a process expected to take 100 years or more, and monitoring and performance studies are complete, DOE will apply for another amendment to close the facility.

At each step of the process, the NRC's scientific and technical staff will exhaustively scrutinize every aspect of DOE's work. The NRC will prepare dozens of requests for additional information to which DOE must respond to support the staff's review. In some cases, DOE may need to amend its application or make changes to the repository design to satisfy NRC requirements.

After all NRC requests for additional information have been satisfied, the NRC staff

will prepare a safety evaluation report. This report, along with DOE's application and a consideration of challenges made by parties intervening in the process, will form the basis on which the NRC makes a licensing determination at each step of the process.

Further, the granting of a license to receive and possess used nuclear fuel at Yucca Mountain will require DOE to assure that an extensive confirmatory scientific research program is in place during repository development. If DOE's conclusions are found to be incorrect, decisions may be adjusted or reversed at any time.

Q: How have scientific studies supported Yucca Mountain as the used nuclear fuel repository site?

A: The scientific evaluation, encompassing more than 25 years and \$10 billion of scientific, environmental and engineering studies, was completed in 2002. DOE summarized this work in several scientific reports, which served as the basis for the 2002 decision to approve Yucca Mountain as the site of the repository. These reports form the foundation of DOE's June 2008 application to the NRC for a license to construct the repository. (The scientific reports and the application are available at www.doe.gov.)

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This work also incorporated input from extensive public review and comment on DOE's preliminary findings. The reports state that the repository will perform well within the safety standard for Yucca Mountain set by the U.S. Environmental Protection Agency.

The results of this work show that for 10,000 years the largest expected annual radiation dose near Yucca Mountain would be 0.24 millirem—a small fraction of EPA's annual 15-millirem limit for the facility.¹ Even for periods as long as 1 million years, DOE's analysis shows that the annual radiation dose in the vicinity of Yucca Mountain will be 0.9 millirem.

DOE's final supplemental environmental impact statements have shown negligible environmental impacts associated with the repository at Yucca Mountain and the transportation of material to the repository.

Q: Why does the nuclear energy industry support building and operating the national repository for used nuclear fuel at Yucca Mountain?

¹ "Dose" refers to the quantity of radiation to which people are exposed. Dose is measured in "rem" or "millirem"—one thousandth of a rem. U.S. residents normally receive about 300 millirem annually from the environment.

A: The nuclear industry bases its support for Yucca Mountain on clear and fundamental principles:

- the sound scientific conclusion that the proposed repository will protect public health and safety
- the importance of the project to national energy, environmental and security policies
- the industry's commitment to safety in managing used nuclear fuel.

Q: Who will pay for the development, licensing and construction of a deep geologic repository?

A: Electricity consumers pay one-tenth of a cent per kilowatt-hour of electricity used from nuclear power plants to the federal Nuclear Waste Fund to finance DOE's repository project. Approximately \$30 billion has been committed to the fund since 1983, which will be used for developing and licensing a repository at Yucca Mountain. So far, about \$10 billion has been spent to study geologic disposal, primarily at the Yucca Mountain site.

Q: Since no federal repository exists, where have nuclear power plants been storing used nuclear fuel?

A: Because the federal government defaulted on its legal

obligation to begin removing used nuclear fuel from power plants by January 1998, 104 operating and 14 shutdown U.S. commercial nuclear power reactors are safely storing fuel on site.

Although used fuel is adequately safeguarded at reactor sites, storage at these sites is not a substitute for permanent disposal at a federal repository. These on-site facilities were not designed to function for the thousands of years during which a deep geologic repository would safely contain the used fuel.

This temporary storage solution is costly to electricity consumers, who must pay for both storage and disposal. Each year of delay in the federal program for removing used nuclear fuel from reactor sites will add an estimated \$1 billion in temporary storage costs.

Additionally, scientists, the industry and the federal government have supported the disposal of used nuclear fuel at one centralized underground location, instead of multiple locations across the country. This will allow even more efficient and safer management and effective security of used fuel and defense radioactive waste. There is also growing support for the federal government to take possession of used nuclear fuel and move it to centralized above-ground interim storage until disposal

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and/or recycling capability can be developed.

Q: Who is responsible for transporting used nuclear fuel? What methods of transportation will be used to deliver it to the repository?

A: The federal government is responsible for transporting used nuclear fuel from U.S. nuclear power plant sites and federal nuclear facilities to the repository at Yucca Mountain. The repository will be equipped to receive radioactive material in federally certified shipping containers required by the NRC to withstand even the most severe accidents. DOE also is preparing to construct a 300-mile railroad spur to connect Yucca Mountain to the nation's existing rail system.

Q: How much radioactive waste will be stored at Yucca Mountain?

A: Congress has authorized the storage of up to 70,000 metric tons of used nuclear fuel and high-level radioactive defense waste at the repository. The supplemental environmental impact statement on the site demonstrated that 130,000 metric tons could be stored safely at Yucca Mountain. Independent scientific studies conclude that the repository could be expanded to contain an even greater volume. One study by the Electric Power Research Institute found the site capable of safely contain-

ing up to 570,000 metric tons of nuclear material.

Nuclear power plants are storing approximately 60,000 metric tons of used nuclear fuel. If these fuel rods were stacked on top of each other, the stack would be only the length and width of a football field and less than 10 yards high.

For more information on the Yucca Mountain project and nuclear energy issues, visit www.nei.org.