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NUCLEAR WASTE

Preliminary Observations on the Quality Assurance Program at the Yucca Mountain Repository

Statement of Robin M. Nazzaro, Director
Natural Resources and Environment



Highlights of [GAO-03-826T](#), a testimony before the Subcommittee on Energy and Water Development, Committee on Appropriations, U.S. Senate

Why GAO Did This Study

A quality assurance program is required by the Nuclear Regulatory Commission (NRC) to ensure that the Department of Energy (DOE) can safely construct and operate a high-level radioactive waste repository. DOE is currently preparing an application to NRC for authorization to construct the repository. The quality assurance program includes procedures to assure NRC that the information DOE provides is verifiable and well documented. DOE will use the results of a computer simulation to demonstrate that the repository can be safely operated over the 10,000-year period required by the Environmental Protection Agency's health and safety standards. Some of the key elements of this simulation are shown in the illustration.

This testimony is based on ongoing and published GAO work. The testimony provides the history of DOE's actions to correct quality assurance problems, the status of DOE's efforts to improve the quality assurance program, and preliminary observations on the effect of quality assurance problems on DOE's ability to successfully meet its 2004 milestone for submitting an application to NRC requesting authorization to construct the repository.

www.gao.gov/cgi-bin/getrpt?GAO-03-826T.

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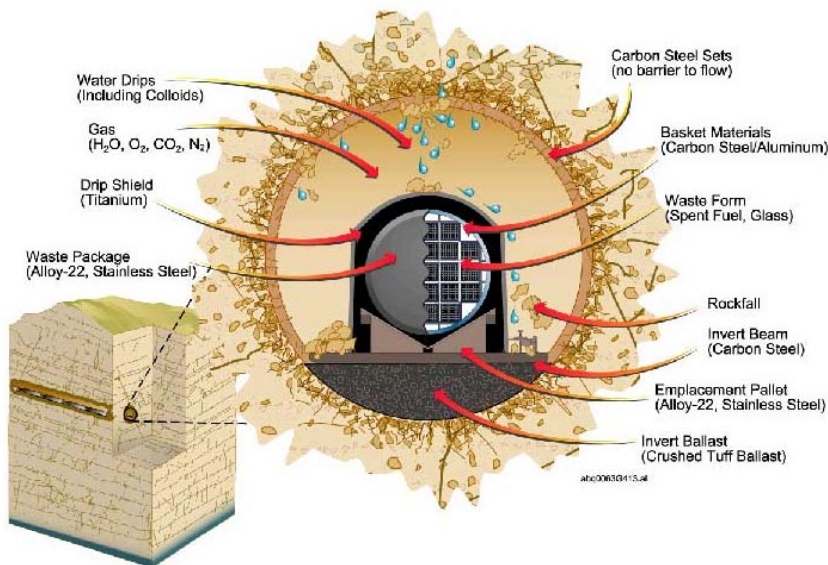
What GAO Found

DOE's track record of correcting problems with its quality assurance program is less than favorable. Recurring problems have persisted in the program despite DOE's numerous attempts to correct them. DOE evaluations and NRC oversight activities have concluded that the program still falls short of expectations.

DOE's 2002 quality assurance improvement plan represents the department's most recent attempt to correct quality assurance problems, including those involving the scientific models and software codes in the computer simulation that DOE will use to demonstrate the safety of the repository. Because DOE is still in the process of implementing this plan, it is too early to determine whether changes included in the plan will be effective. However, notwithstanding these changes, DOE has recently identified further quality assurance problems, including recurring problems with the data that will be used to support the NRC's decision on whether to authorize DOE to construct the repository.

Based on previously identified weaknesses and recent indications of new problems, we are concerned that DOE's current efforts to improve its quality assurance program may not yield the results it hopes for. Our observation is further supported by NRC's recent comment that DOE's quality assurance program has yet to produce outcomes necessary to ensure that this program meets NRC requirements.

Illustration of Yucca Mountain Repository Waste Package Emplacement



Source: DOE.

Senators Ensign and Reid:

We are pleased to be here today to discuss the Department of Energy's (DOE) quality assurance program for the Yucca Mountain repository project. As you know, Yucca Mountain is intended to serve as the nation's permanent repository for high-level nuclear waste. DOE is currently in the process of preparing an application to the Nuclear Regulatory Commission (NRC) for authorization to construct the repository, which it expects to submit by December 2004. To ensure that DOE can safely construct and operate the repository, NRC requires DOE to have a quality assurance program. The quality assurance program is designed to include procedures to assure NRC that the information submitted to it is verifiable and well documented. Audits and management reviews are also built into the program to monitor whether workers follow these procedures. In cases where they are not followed, DOE must develop and implement corrective actions and monitor their effectiveness. An ineffective quality assurance program could potentially impede the application process and could precipitate potentially adverse health, safety, and environmental effects.

In this context, you asked us to investigate the effectiveness of DOE's efforts to improve its quality assurance program. Although we are still in the early stages of our investigation, we are prepared today to provide (1) the history of DOE's actions to correct quality assurance problems, (2) the status of DOE's efforts to improve the quality assurance program, and (3) preliminary observations on the effect of quality assurance problems on DOE's ability to successfully meet its 2004 milestone for submitting an application to NRC requesting authorization to construct the repository.

In summary:

- DOE's track record of correcting problems with its quality assurance program is less than favorable. Recurring problems have persisted in the program despite DOE's numerous attempts to correct them. DOE evaluations and NRC oversight activities have concluded that the program still falls short of expectations.
- DOE's 2002 quality assurance improvement plan represents the department's most recent attempt to correct quality assurance problems, including those involving scientific models and software codes that DOE will use to demonstrate the safety of the repository. Because DOE is still in the process of implementing this plan, it is too early to determine whether changes included in the plan will be effective. However, notwithstanding

these changes, DOE has recently identified further quality assurance problems, including recurring problems with the data that will be used to support the NRC's decision on whether to authorize DOE to construct the repository.

- Based on previously identified weaknesses and recent indications of new problems, we are concerned that DOE's current efforts to improve its quality assurance program may not yield the results it hopes for. Our observation is further supported by NRC's recent comment that DOE's quality assurance program has yet to produce outcomes necessary to ensure that this program meets NRC requirements.

Background

The Nuclear Waste Policy Act of 1982 was enacted to establish a comprehensive policy and program for the safe, permanent disposal of commercial spent fuel and other high-level radioactive wastes. DOE was directed in the act to, among other things, investigate potential sites for locating a repository. Amendments to the Act in 1987 directed DOE to consider only Yucca Mountain, Nevada, as a potential site for a repository. In 2002, the Congress approved the President's recommendation of Yucca Mountain as a suitable site for the development of a permanent high-level waste repository. The next step in the process is for DOE to submit an application to NRC for an authorization to construct the repository.

In order to ensure that the information submitted to NRC is verifiable and well documented, NRC requires nuclear facilities to develop a quality assurance program that includes a process to identify problems, develop corrective actions, and monitor the effectiveness of these actions. Among other things, such a quality assurance program is required to (1) train personnel in quality assurance; (2) inspect activities that affect quality; (3) establish controls over testing programs and test equipment, such as ensuring that this equipment is properly calibrated; (4) establish and maintain records, including records documenting the qualifications of personnel performing repository work; and (5) verify compliance with the rules and procedures of the quality assurance program to determine the effectiveness of the program.

In carrying out its responsibility for the Yucca Mountain repository to meet the Environmental Protection Agency's (EPA) standards for protecting public health and safety, as well as its standards, NRC provides consultation and advice to DOE in the project's pre-application period. NRC officials are located onsite at the Yucca Mountain project office where they conduct daily oversight of project activities, including

observing and commenting on DOE's quality assurance audits and preparing bi-monthly reports on the overall status of the program. Additionally, DOE and NRC hold quarterly quality assurance meetings and conduct exchanges between staff on technical issues.

History of Actions Taken to Correct Quality Assurance Problems

DOE's quality assurance problems at the Yucca Mountain repository site date back to the late 1980s. In a 1988 report, we identified significant problems with the quality assurance program, noting that it failed to meet NRC standards.¹ We found that NRC had identified many specific concerns from the oversight activities it had performed at Yucca Mountain. For example, NRC noted that DOE's heavy reliance on contractors and its inadequate oversight of quality assurance activities would increase the likelihood that DOE might encounter quality-related problems. Furthermore, NRC said that the likelihood that the state of Nevada and others would contest the licensing proceedings increased the probability that DOE would have to defend its quality assurance program and the quality of the work performed. NRC noted that DOE's inability to properly defend its work could result in additional expense and time-consuming delays as program weaknesses are corrected. NRC also found that DOE staff and contractors exhibited negative attitudes toward the function of quality assurance, noting that participants appeared to lack a full appreciation for what it took to get a facility licensed by NRC.

DOE was put on notice of these shortcomings, but the problems continued. In its 1989 evaluation of DOE's Site Characterization Plan, NRC concluded that DOE and its key contractors had yet to develop and implement an acceptable quality assurance program. In March 1992, based on progress DOE had made in improving its quality assurance program, NRC allowed DOE to proceed with its site characterization work, noting that DOE had demonstrated its ability to evaluate and correct quality assurance program deficiencies. A year and a half later, however, NRC raised concerns with DOE about the acceptability of facility design activities requiring quality assurance. NRC reported that it had no confidence that DOE's management plan for resolving quality assurance issues related to the design activities would work because of DOE's and

¹U.S. General Accounting Office, *Nuclear Waste: Repository Work Should Not Proceed Until Quality Assurance Is Adequate*, GAO/RCED-88-159 (Washington, D.C.: Sept. 29, 1988).

the site contractors' inability to effectively implement corrective actions in the past.

DOE renewed its efforts to correct problems with its quality assurance program starting in the late 1990s when its own audits at Yucca Mountain identified quality assurance problems in three areas: data sources, validation of scientific models, and software development. First, DOE could not ensure that all the data needed to support the scientific models could be tracked back to original sources or that the data had been properly collected. Second, DOE had no standardized process to develop the scientific models needed to simulate geological events. Finally, DOE had no process for ensuring that the software being developed to support the models would work. In response to the issues raised in the audits, DOE issued a management plan in 1999 that prescribed remedies. Following implementation of this plan, DOE considered the issues resolved.

Model validation and software development problems, however, resurfaced in 2001. New quality assurance audits found that project personnel had not followed the required procedures for model development and validation or established a timeline for completing the models. In addition, these audits identified that project personnel had not followed the software development process, prompting a prohibition on further software development without prior management approval. According to DOE, the significance of these new observations was compounded by their similarity to those problems previously identified.

Status of DOE Efforts to Improve Quality Assurance

In July 2002, DOE provided NRC with a revised plan to correct its quality assurance problems at Yucca Mountain, including the problems with scientific models and software codes. In constructing the plan, DOE conducted an in-depth study of Yucca Mountain's management and work environment. The plan outlined five key areas needing improvement. Specifically, it noted the need for

- clarifying roles, responsibilities, accountability, and authority for DOE and contractor personnel,
- improving quality assurance processes and clarifying line management's quality responsibilities,
- improving DOE and contractor written procedures,

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- implementing more effective and consistent corrective action plans to preclude recurring quality problems, and
 - improving the work environment where employees can raise program concerns without fear of reprisal.

To fully address issues raised in the plan, DOE identified a total of 72 actions needed to correct the quality assurance program—35 to address the five key areas, 12 to address model development issues, and 25 to address software development issues. DOE recently reported that it had completed 41 of the 72 actions. The management plan also included performance measures to assess the effectiveness of the actions. DOE recently reported, however, that the Yucca Mountain project still lacks complete and useful performance measures and stated its intention to have the appropriate performance measures in place by September 2003.

Since DOE began to implement its latest improvement plan, new quality issues have emerged. In March 2003, DOE issued a “stop-work” order preventing further use of a procedure intended to help improve DOE and contractor quality assurance procedures. According to DOE, they cancelled the use of the procedure and reverted back to the existing procedure. In April 2003, DOE again found data-related problems similar to the data verification problems identified in 1998. For example, DOE found that, instead of verifying data back to appropriate sources, project scientists had been directed to reclassify the unverified data as “assumptions” which do not require verification.

At the April 2003 quality assurance meeting with NRC, DOE highlighted several recent improvements to the quality assurance program. These improvements included (1) management changes with DOE’s primary contractor at the site, including a new president and a new director of quality assurance, (2) increased line management involvement in quality assurance, and (3) the integration of quality engineers with DOE line employees. Despite this reported progress, an NRC official at the same meeting commented that the quality assurance program had still not produced the outcomes necessary to ensure the program is compliant with NRC requirements.

Preliminary Observations

Whether DOE can correct its quality assurance problems in time to meet its milestone for submitting an application that is acceptable to NRC is not clear. DOE’s unsuccessful efforts to address recurring quality assurance problems, the identification of new problems since the issuance of its 2002

improvement plan, and NRC's recent comment that DOE's quality assurance program has yet to produce outcomes necessary to ensure that this program meets NRC requirements do not instill much confidence that the quality assurance problems will soon be resolved. An ineffective quality assurance program could impede the application process, leading to time-consuming and expensive delays as weaknesses are corrected, or ultimately prevent DOE from receiving authorization to construct a repository. Moreover, continued reliance on data that are unverifiable and thus could be inaccurate could lead to adverse effects in the course of the 10,000-year period required by EPA's health and safety standards. At the same time, now that the project has shifted from scientific investigation to preparing an application, DOE may now have the proper motivation and focus to correct recurring quality assurance problems given the integral role that quality assurance plays in the application process.

As we continue our investigation, we will work to validate our observations and further assess the effectiveness of DOE's efforts to improve its quality assurance program.

Thank you, Senators Reid and Ensign. That concludes my testimony. I would be pleased to respond to any questions that you may have.

Contacts and Acknowledgments

For further information on this testimony, please contact Ms. Robin Nazzaro at (202) 512-3841. Individuals making key contributions to this testimony included Lee Carroll, Daniel Feehan, Thomas Kingham, Thomas Laetz, Chalane Lechuga, and Jonathan McMurray.

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