



# memorandum

DATE: February 27, 2007

Audit Report Number: OAS-L-07-08

REPLY TO

ATTN OF: IG-32 (A06ID015)

SUBJECT: Audit of the "Design of the Engineered Barrier System at the Yucca Mountain Site"

TO: Principal Deputy Director, Office of Civilian Radioactive Waste Management

## INTRODUCTION AND OBJECTIVE

In accordance with the Nuclear Waste Policy Act of 1982, the Department of Energy's (Department) Office of Civilian Radioactive Waste Management (OCRWM) is responsible for designing, licensing, constructing, and operating a repository, known as Yucca Mountain, for the permanent disposal of spent nuclear fuel and high-level radioactive waste. Yucca Mountain will be designed with a series of natural and engineered barriers intended to contain the waste in order to minimize the risk that the waste poses to human health and the environment. OCRWM is pursuing an engineered barrier design that includes a drip shield and waste package with design features that were evaluated in the 2003 value engineering studies.

To ensure that it receives the best value, the Department is required by DOE M 413.3-1 to employ value engineering as early as possible in the project. Value engineering is a systematic effort analyzing alternative approaches for accomplishing a project's essential functions at the lowest life cycle cost consistent with required technical performance, quality, reliability, and safety. Based on the value engineering studies conducted by its contractor, Bechtel SAIC (Bechtel), the Department estimated that it will cost approximately \$15.3 billion for the fabrication of the engineered barrier system. Accordingly, we initiated our audit to determine whether the Department fully evaluated alternatives identified in value engineering studies for the Yucca Mountain Project's engineered barrier system.

## CONCLUSIONS AND OBSERVATIONS

The Office of Civilian Radioactive Waste Management (OCRWM) did not always fully evaluate alternatives for the Yucca Mountain engineered barrier system that were identified in value engineering studies conducted in Fiscal Year 2003. Specifically, OCRWM did not pursue a number of alternatives that the value engineering studies rated high technically and as costing less than alternatives selected for the engineered barrier system design.

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For example, Bechtel did not fully evaluate alternatives that a value engineering study rated as having higher technical performance and costing less than the selected design that employs a titanium drip shield. The purpose of the drip shield is to protect the waste packages from water seepage and falling rock once the repository is closed. In its 2003 value study, Bechtel evaluated the drip shield baseline design, which consisted of a titanium shield that fits over the waste package, against three other alternatives: backfill, a drift liner, and a shield that would be integrated with the waste package. Notably, one alternative, the integrated shield, received a technical score that was higher than the baseline titanium drip shield alternative and cost less. However, at the conclusion of the study OCRWM retained the drip shield design for the licensing application without pursuing further investigations of other promising alternatives. Additionally, Bechtel did not adequately document the rationale for not pursuing further investigation of the alternative receiving high technical ratings that cost less than the baseline design.

In explaining the reason for not pursuing other promising alternatives, OCRWM officials stated that there is sufficient time to revisit the drip shield since it will not be installed for more than 100 years. However, one alternative, the integrated shield, would be installed when waste is emplaced in the repository, rather than in 100 years. Accordingly, delays in fully investigating the integrated shield alternative could eliminate it from use once waste begins to be emplaced in the repository. Additionally, according to management the alternatives may not have been fully evaluated due the Department's efforts to meet the December 2004 license application schedule.

OCRWM also officials pointed out that they are researching alternatives to the drip shield that were not covered in the value engineering studies. Specifically, OCRWM is conducting research on alternative material coatings that may significantly reduce the cost of the drip shield baseline design. However, we remain concerned that OCRWM had not made the best use of the value engineering studies since it did not fully investigate promising alternatives to the drip shield or document the rationale for not pursuing them.

We also noted that the FY 2003 value engineering studies identified other promising alternatives to the baseline design for the waste package that were not fully investigated before selecting a more conservative design for the repository license application. While new design considerations may preclude the use of these alternatives, we concluded that OCRWM had not made the best use of its value engineering studies at the time they were conducted.

At the time of the 2003 value engineering studies, OCRWM's procedures did not provide for adequate oversight to ensure that alternatives were evaluated once the value engineering studies were completed. For example, OCRWM did not perform a detailed review of the value engineering study reports completed by Bechtel, and did not ensure that the contractor adequately supported the rationale for the alternatives selected from the studies. To its credit, OCRWM has taken steps to increase monitoring of the value engineering process. Specifically, in January 2004, OCRWM assigned a Certified Value Specialist to monitor all value engineering efforts at Yucca Mountain including completing management and technical quality reviews of reports.

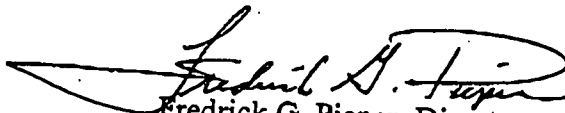
Because of the significant cost of the repository, we suggest that OCRWM continue to take steps to improve its value engineering process, including evaluating the new material coating against other alternatives. Otherwise, the Department is at risk of not selecting the repository design that represents the best value for meeting performance requirements.

### SCOPE AND METHODOLOGY

The audit was performed from February 2006 to December 2006 at the Office of Repository Development and Bechtel SAIC Company, LLC in Las Vegas, Nevada. The audit was limited to the waste package and drip shield design from 2002 to 2006. To accomplish the audit objective, we:

- Obtained and reviewed design documentation for the waste package and the drip shield;
- Interviewed key personnel at the Office of Repository Development and Bechtel SAIC Company, LLC.;
- Researched Federal and Departmental regulations;
- Reviewed findings from prior audit reports; and,
- Assessed internal controls and performance measures established under the Government Performance and Results Act of 1993.

The audit was performed in accordance with generally accepted Government auditing standards for performance audits and included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the audit objective. Specifically, we tested controls with respect to the Department's evaluation of alternatives for the Yucca Mountain engineered barrier system. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies. Because no formal recommendations are being made in this letter report, a formal response is not required. The Office of Chief Engineer waived an exit conference. We appreciate the cooperation of your staff as well as the contractor staff.



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cc: Chief of Staff  
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