U.S. NUCLEAR REGULATORY COMMISSION OBSERVATION AUDIT REPORT OAR–07–04, OBSERVATION AUDIT OF BECHTEL SAIC COMPANY, LLC QUALITY ASSURANCE, AUDIT BQA–BSC–07–07 OF DESIGN CONTROL FOR WASTE PACKAGE TRANSPORT AND EMPLACEMENT VEHICLE

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Enclosure

1.0 INTRODUCTION

On June 18–28, 2007, staff from the U.S. Nuclear Regulatory Commission (NRC), Division of High-Level Waste Repository Safety, and the Center for Nuclear Waste Regulatory Analyses (CNWRA) observed Bechtel SAIC Company, LLC (BSC), quality assurance (QA) audit BQA–BSC–07–07 in Las Vegas, Nevada. The audit team evaluated design control for the waste package transport and emplacement vehicle (TEV).

The primary objective of this audit was to determine whether the conceptual TEV had been designed using methods that were technically sound and defensible, with adequate transparency and traceability. The auditors also evaluated the design to determine if it satisfied selected technical criteria of the Yucca Mountain Review Plan, NUREG–1804. The objectives of the NRC observation was to evaluate the effectiveness of the audit process and the implementation of the QA program in the audited organization.

2.0 MANAGEMENT SUMMARY

The auditors concluded that, overall, the BSC Repository Project Management organization has effectively implemented the design control processes and procedures for the TEV design. The audit team identified five conditions adverse to quality, two opportunities for improvement, and four noteworthy practices, as described in Section 4.6. The audit team determined that implementation of studies, calculations, and hazards analysis was satisfactory. However, implementation of drawing controls was determined to be unsatisfactory. The observers determined that the audit was performed effectively and agreed with the audit team's conclusions and findings.

According to BSC, the Mechanical Handling Design Report (MHDR) is the key document that will support the TEV design in the potential license application. However, the MHDR had not been completed at the time of the audit and the TEV conceptual design documents available had insufficient detail to support an evaluation regarding satisfying selected technical criteria of NUREG–1804. The NRC staff determined that the objective of the audit may have been better achieved and BSC and NRC resources may have been more effectively used had the audit been conducted after the completion of the MHDR.

3.0 AUDIT PARTICIPANTS

Audit Team Members
Robert Habbe, Audit Team Leader
William Ang, Auditor
Robert Steele, Auditor
James Clark, Auditor
George Leguillon, Technical Specialist
Michael Plinski, Technical Specialist

Observers
Tom Matula, NRC, Observation Team Leader
Banad Jagannath, NRC, Technical Observer
Robert Brient, CNWRA, Quality Assurance Specialist
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4.0 REVIEW OF THE AUDIT AND AUDITED ORGANIZATION

The auditors conducted the audit in accordance with procedure QA–PRO–1046, QA Internal Audit Program. The auditors identified adverse conditions and recommendations in accordance with procedure AP–16.1Q, Condition Reporting and Resolution. The observers followed NRC Inspection Manual Chapter 2410, Conduct of Observation Audits.

4.1 Scope of the Audit

The audit utilized a "vertical slice" technique to evaluate conceptual TEV design documents and design control activities. At the time of the audit, the design documents associated with the TEV included a drawing and six diagrams, seven studies, a calculation, and a hazard analysis. These documents will contribute to the MHDR, which BSC plans to complete in August 2007. According to BSC, the MHDR will be a major contributor to the potential license application relating to the TEV design. The auditors evaluated the design information to determine if it satisfies applicable criteria of NUREG–1804.

4.2 Conduct and Timing of the Audit

The observers determined that the audit team performed the audit effectively and demonstrated knowledge of the applicable implementing procedures and QA program requirements. The audit team members conducted the audit through records reviews and interviews, challenged and questioned responses when appropriate, and effectively employed their checklists. The auditors caucused daily to discuss the current audit status and potential issues. The auditors and BSC management met as necessary to review the audit status and any new and developing issues.

4.3 Audit Team Qualifications and Independence

The observers reviewed the qualifications of the auditors with respect to procedure LP–18.4Q, Audit Personnel Qualification. The observers verified the audit team members' independence of the areas reviewed and the technical qualifications of the technical specialists.

4.4 Examination of Quality Assurance Elements

4.4.1 Personnel Qualification and Training

The auditors identified ten individuals involved with the TEV design and confirmed that their qualifications had been established, education and experience had been verified, and that appropriate training had been assigned and completed.

4.4.2 Self Assessments

While no self assessments had been performed specifically on the TEV design process, the auditors identified five Subsurface Engineering organization self assessments generally applicable to TEV design activities and the TEV design group. The auditors reviewed the self assessments and interviewed the Subsurface Engineering Project Engineer, and determined the implementation of the self assessment process to be satisfactory and effective.

4.4.3 Corrective Action and Follow-up

The audit team reviewed several Condition Reports related to design processes for corrective action effectiveness, including possible repetition of the adverse conditions. The auditors determined the overall processing of corrective actions to be effective.

4.5 Examination of Technical Activities

Teams of QA auditors and technical specialists assessed the elements of the audit through parallel technical and process evaluations. The technical evaluations relied on checklists based on the conceptual design documents, while the process evaluations used checklists based on applicable procedures and desktop instructions.

The audit included determinations of whether the TEV design documents satisfied selected criteria of NUREG–1804. The audit found that the TEV design documents reviewed did not provide the detail necessary to evaluate applicable NUREG–1804 criteria. The MHDR may provide the detailed design descriptions and analyses sufficient to make these determinations, however, this report is to be completed in August 2007 and was not available to the auditors.

4.5.1 Drawings and Diagrams

The auditors evaluated available TEV design documents classified as drawings: four block flow diagrams, two electrical schematics, and one overall dimensional layout of the TEV. The block diagrams describe each function of the TEV during a normal and off-normal waste package emplacement and retrieval operations. The electrical schematics depict, at a high-level, the electrical components used for sensing and controlling the motion and operation of the TEV. The overall layout drawing depicts the dimensions of the TEV, such as height, width, weight, and length with the baseplate fully extended and shield doors fully open.

The auditors identified a number of technical and process deficiencies with the drawings and associated review documentation, which resulted in an overall determination of unsatisfactory implementation of drawing controls. The auditors also noted a previously identified condition adverse to quality similar to a finding of this audit concerning traceability of drawing comments to the reviewer.

4.5.2 Engineering Studies

Of the seven TEV-related studies available, the auditors evaluated the four most directly affecting the TEV conceptual design: TEV ITS (Important to Safety) Standards Identification Study, TEV Gap Analysis Study, TEV Design Development Plan, and TEV Integrated System Operation Report (ISOR).

The TEV ITS Standard Identification Study identifies codes and standards applicable to the 19 safety requirements from the Basis of Design for the Transportation-Aging-Disposal Canister-Based Repository Design Concept. Areas of the TEV design not covered by codes and standards are identified in the TEV Gap Analysis Study document. The Design Development Plan addresses the identified gaps in the codes and standards. The ISOR addresses the various mechanical safety systems in the subsurface operations and their

interfaces. The primary purpose of the ISOR is to provide information for preclosure safety analysis.

Procedure EQ–PRO–3DP–G04B–00016, Engineering Studies, states that "the results of engineering studies used as inputs to design documents shall be confirmed by engineering calculations or technical reports ..." The MHDR, scheduled for completion in August 2007, is intended to confirm the results from the engineering studies, but was not available to allow an evaluation against the criteria of NUREG-1804.

The auditors identified three conditions adverse to quality in that (1) the ISOR did not meet the content required by the applicable desktop instruction; (2) the Gap Analysis had references to different versions of ASME NQA–1, Quality Assurance Program for Nuclear Facilities, without a rationale; and (3) the Gap Analysis did not address all ASME NOG–1, Rules for Construction of Overhead and Gantry Cranes, requirements for the TEV conceptual design particularly as it relates to the deviation to requirements in runway rail alignment tolerance (elevation and straightness) that may not be achieved due to the curvature and grade in the potential Yucca Mountain Repository subsurface facility.

4.5.3 Calculation

TEV design documents available for the audit included one calculation, TEV Envelope Calculations. This calculation determines some basic characteristics of the TEV, such as shielded compartment envelope dimensions, shielded compartment weights, beam size estimates for the TEV chassis, lift mechanism capacity, total weight estimates of the loaded and unloaded TEV, horizontal drive capacity, and overall envelope for TEV with doors open and closed. The auditors evaluated the general content, validity of the design inputs and assumptions, calculation methodology, calculation checking procedure, change/revision control, and interface control.

4.5.4 Hazard Analysis

The auditors evaluated the Hazard Analysis Report: Emplacement and Retrieval System (ERS) that presents, considering the conceptual design status of TEV, a systematic and thorough examination of the processes, equipment, structures, and personnel activities related to the operation of the ERS system. This hazard analysis is required for all the facilities as per the Integrated Safety Management System (ISMS) being implemented for both ITS and non-ITS items on this project. The observers noted that this analysis is not related to radiation safety (i.e., not related to 10 CFR Part 63), rather it is an industrial hazard assessment study that identifies hazards that may result in unacceptable consequences. The analysis also suggests remedial or mitigative measures.

4.6 Audit Findings

The auditors concluded that, overall, the BSC Repository Project Management organization has effectively implemented the design control processes and procedures for the TEV design. The audit team determined that implementation of studies, calculations, and hazards analysis was satisfactory.

The auditors identified the following findings, as presented in the post-audit conference and audit report.

Conditions Adverse to Quality

- Four technical and eleven procedure implementation errors were identified in one drawing and six diagrams.

- The Gap Analysis Study references ASME NOG–1–2004 and ASME NQA–1–2000 as applicable standards for the TEV design. However, ASME NOG–1–2004 references ASME NQA–1–2002, and the Gap Study did not discuss or provide rationale for the different NQA–1 versions referenced.

- The TEV Envelope Calculation includes assumptions regarding use of the South Texas Project (STP) Fuel Waste Package that are based on report DOE/RW–0539. DOE/RW–0539 is listed in the Document Reference System as "Established Facts," however, the STP data source and reliability were not established in DOE/RW–0539.

- The ISOR did not have the specified content for an Engineering Study.

- The TEV Gap Analysis Study did not thoroughly evaluate all ASME NOG–1 standard requirements for the design of the TEV. Also, since the TEV is a non-standard gantry crane, some portions of ASME NOG–1 may not apply. The Gap Analysis did not adequately address deviations from the standard requirements.

Opportunities for Improvement

- Several opportunities for design improvement were identified that should be considered in the proposed MHDR.

- The Engineering Drawings and Review of Engineering Documents procedures should specify how unsatisfactory items identified on the Engineering Drawing checklist are to be resolved.

The auditors also identified four noteworthy practices.

- Preparation for the audit by the subsurface design organization was excellent.

- Self assessment reports were thorough and detailed.

- Industrial hazards analysis was well done and added value.

- Engineering studies process was commendable.

5.0 NRC STAFF FINDINGS

5.1 NRC Observation Summary

The observers determined that the audit team conducted the audit effectively and demonstrated knowledge of the applicable implementing procedures and QA requirements. The auditors conducted thorough interviews, challenged and questioned responses when appropriate, and

effectively employed their checklists. In particular, the auditors conducted effective document reviews and team discussions.

The observers agreed with the auditor's conclusions and findings. The observers noted that the key document that will support the TEV design in the potential license application had not been completed at the time of the audit and the TEV design documents available had insufficient detail to fully support an evaluation using criteria of NUREG–1804. The NRC staff determined that the objective of the audit may have been better achieved and BSC and NRC resources may have been more effectively used if the audit had been delayed until the completion of the MHDR.

5.2 NRC Audit Observer Inquiry

The observers initiated no Audit Observer Inquiries during this audit.