Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 98608
Las Vegas, NV 89193-8608

JAN - 5 1996

L. Dale Foust
Technical Project Officer
for Yucca Mountain Site
Characterization Project
TRW Environmental Safety Systems, Inc.
Bank of America Center, Suite P-110
101 Convention Center Drive
Las Vegas, NV 89109

VERIFICATION OF CORRECTIVE ACTION AND CLOSURE OF CORRECTIVE ACTION REQUEST (CAR) YM-94-073 RESULTING FROM YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION'S (YMQAD) AUDIT YMP-94-01 OF THE CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM MANAGEMENT AND OPERATING CONTRACTOR (SCPB: N/A)

The YMQAD staff has verified the corrective action to CAR YM-94-073 and determined the results to be satisfactory. As a result, the CAR is considered closed.

If you have any questions, please contact either Robert B. Constable at 794-7945 or Stephen R. Dana at 794-7176.

Robert B Constable for

Richard E. Spence, Director
Yucca Mountain Quality Assurance Division

YMQAD:RBC-881

Enclosure:
CAR YM-94-073

cc w/encl:
T. A. Wood, HQ (RW-14) FORS
J. G. Spraul, NRC, Washington, DC
S. W. Zimmerman, NWPO, Carson City, NV
R. L. Strickler, M&O/TRW, Vienna, VA
R. P. Ruth, M&O/Duke, Las Vegas, NV
D. G. Horton, OQA (RW-3) NV
W. E. Barnes, YMSCO, NV

cc w/o encl:
W. L. Belke, NRC, Las Vegas, NV
D. G. Sult, YMQAD/QATSS, Las Vegas, NV

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THIS IS A RED STAMP

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT U.S. DEPARTMENT OF ENERGY WASHINGTON, D.C.

8 CAR NO.: YM-94-073
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CORRECTIVE ACTION REQUEST

1 Controlling Document
OCRWM QARD, DOE/RW-0333P, Revision 01

2 Related Report No.
YMP-94-01

3 Responsible Organization
M&O

4 Discussed With
J. Pye/S. Bonabien/J. Naaf

5 Requirement:

1) QARD, DOE/RW-0333P, Revision 0, Section 3.2.1.A states: "Design inputs shall be identified and documented, and their selection reviewed and approved by those responsible for the design."

Section 3.2.2.F states: "Applicable information derived from experience,
(Continued on next page)

6 Adverse Condition:

Design validation was not performed on the Starter Tunnel and used as input to the design of the North Ramp Package 2C. It was also determined that presently there is not a plan to use design validation data for making real time design modifications to the ground support.

Discussion:

10CFR60.141(a), (b), and (d) requires that the design validation activity be performed as part of the performance confirmation process. It specifically states that the geotechnical in-situ conditions found should be compared with the original design bases and assumptions. Further, the design validation process should be a real time activity that will provide the justification and documentation for ground support changes as the excavation is advancing.

9 Does a Significant Condition Adverse to Quality exist? Yes X No ___
If Yes, Check One: ☐A ☒B ☐C ☒D ☐E

10 Does a stop work condition exist?
Yes ___ No X ; If Yes - Attach copy of SWO
If Yes, Check One: ☐A ☐B ☐C

3 Response Due Date:
20 Working Days From Issuance

11 Required Actions: ☒ Remedial ☒ Extent of Deficiency ☒ Preclude Recurrence ☒ Root Cause Determination

12 Recommended Actions:
Complete the design validation for the starter tunnel. This will include classifying the starter tunnel rock mass and comparing this in-situ classification with the rock mass classification assumptions used in the Package 1A "Starter Tunnel" design. In addition, all convergence measurements and
(Continued on next page)

7 Initiator William R. Sublette 8-3-94	14 Issuance Approved by: QADD Date 8/5/94
15 Response Accepted QAR Date 12/21/94	16 Response Accepted QADD Date
17 Amended Response Accepted QAR C.C. Warren for R.E. Powe Date 12-21-94	18 Amended Response Accepted QADD Date 12/24/94
19 Corrective Actions Verified QAR Date 11/1/95	20 Closure Approved by: QADD Date 1-4-96

Exhibit QAP-16.1.1

ENCLOSURE

REV. 06/27/5

CORRECTIVE ACTION REQUEST (CONTINUATION PAGE)

5 Requirements (continued)

as set forth in reports or other documentation, shall be made available to cognizant design personnel."

Section 3.2.3.A "Design analyses shall be planned, controlled, and documented."

2) 10CFR60.141(d) "Confirmation of geotechnical and design parameters. These measurements and observations shall be compared with the original design bases and assumptions. If significant differences exist between the measurements and observations and the original design bases and assumptions, the need for modifications to the design or in construction methods shall be determined and these differences and the recommended changes reported to the Commission."

13 Recommended Action(s) (continued)

rockbolt load cell data should be evaluated and documented to validate that the engineered opening (starter tunnel) is performing as intended or as defined by a quantitative performance criteria (design criteria).

RESPONSE TO CAR NO. YM-94-073

DISCUSSION:

The Yucca Mountain Project" Review Record Memorandum for the ESF Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Locations" document was prepared to determine what 10 CFR 60 requirements apply to ESF construction during site characterization.

This document was prepared in consultation with the NRC. Volume 2 contains an appendix titled "Correlation of Criteria Derived for ESF Physical Elements with 10 CFR Part 60 Applicable Requirements". This appendix (pg I.3-72) indicates that criteria 60.140(b), 60.141(a), 60.141(b), and 60.141(d) do not apply to the ESF.

Remedial Action:

Based on our review and investigative action below, no remedial action is necessary.

Investigative Action:

The adverse condition statement uses the term "validation" which is not used in 10 CFR 60.141. (a), (b) and (d) ESFDR Section 3.2.1.J9 or the QARD Glossary (except for software validation). It is therefore assumed that the auditor is discussing performance confirmation.

Subpart F of 10 CFR 60 states in 60.140(b) under General Requirements, that the performance confirmation program "...shall have been started during site characterization and it will continue until permanent closure."

In 60.141(a) under Confirmation of Geotechnical and Design Parameters, it is further stated that "During repository construction and operation, a continuing program of surveillance, measurement, testing, and.....to ensure that geotechnical and design parameters are confirmed to ensure that appropriate action is taken to inform the Commission of changes....."

The example given in the Adverse Condition for this CAR is in 10 CFR 60.141(d), which falls under the section describing the "continuing performance confirmation program" that is to be conducted during construction and operation, and therefore does not apply to ESF design and testing.

The initial statements made by the auditor concern the starter tunnel and design package 1A. To address the ESFDR requirement 3.2.1.J, the following were initiated:

8/12/94 LV.ESSB.GH.8/94-737

The five ground support categories are identified in the ground support in Drawings BABEAB000-01717-2100-40151 through 40161.

Root Cause:

Investigative action has determined that no procedural violation has occurred.

Corrective Action:

Investigative action has determined that no procedural violation has occurred.

Amended Response to Corrective Action Report YM-94-073

Discussion

10 CFR 60.141.(a),(b) and (d) and the ESFDR 3.2.1.J9 requires that the design validation activity be performed as part of the performance confirmation process. It specifically states that the geotechnical in situ conditions found should be compared with the original bases and assumptions. Further, the design validation process should be a real time activity that will provide the justification and documentation for ground support as the excavation is advancing. It did not happen in the Starter Tunnel, and the question is whether it will happen in the North Ramp.

Investigative Action

The adverse condition statement uses the term "validation" which is not used in 10 CFR 60.141.(a),(b) and (d) ESFDR Section 3.2.1.J9 or the QARD Glossary.It is therefore assumed that the auditor is discussing performance confirmation.

The initial statements made by the auditor concern the starter tunnel and design package 1A. To address the ESFDR requirement 3.2.1.J the following were initiated as to develop a geotechnical baseline in support of performance confirmation:

- Geological mapping - USGS/USBR
- As-builting to record the type and location of ground support
- Deformation monitoring using extensometers
- Support load monitoring of selected rockbolts

It should be noted that additional analyses will be performed on the existing box cut and starter tunnel for the purpose of completing the headwall design at the portal. The final phase of design verification of the 1A design package will be initiated during the construction of the portal headwall, internal concrete liner and invert for the starter tunnel.

8/29/94 LV.ESSB.GH.8/94-737

The tunneling conditions and the methods of excavation and ground support have limited bearing on the construction of the North Ramp which will utilize a TBM mining system. When appropriate, relevant information derived from package 1A has been considered in the Ground Support Scoping Analysis BABEA0000-01717-0200-00008 Rev 01 as indicated on page 54 of 83:
"The limited information obtained from NRG boreholes, and mapping in the Starter Tunnel and Test Alcove 1, indicates that many of the joints are discontinuous ...."

The second part of the auditor's comment concerns relate to design validation for the Design package 2C. Plans for construction monitoring and design verification** have been discussed with the WBS 1.2.6 Manager and include for FY 95 the following:

- Geological Mapping (USGS/USBR)
- Production of geotechnical as-builts (USGS/USBR)
- Construction as-builts Title III A/E
- Geotechnical instrumentation SNL (Deformation monitoring, seismic monitoring, blast vibration monitoring, Rock mass classification)
- Verification analyses A/E

Note: The term "design verification " as used in this context is not to be confused with the QARD definition of design verification.

A summary of description of these design verification, construction monitoring and mapping activities are discussed in the TS North Ramp Ground Support Analyses BABEA00000-01717-0200-00008 Section 10.12.8 page 74 of 84.

Complete details, can be obtained in the current revisions of:

- Study Plan 8.3.15.1.5 Excavation Investigations Studies
- Study Plan 8.3.15.1.8 In situ Design Verification Studies
- Study Plan 8.3.1.4.2.2 Site Characterization Mapping

to be implemented through Work Plans

These activities will be performed for the A/E and coordinated by the TCO as indicated in the referenced correspondence. The data and information needs to complete design analyses have been identified in a series of letters:

"Meeting Notes For the Meeting Held June 16, 1994, On Sandia National Laboraties Suport For Exploratory Studies Facility 1.2.6 (SCPB:N/A) LA-EES-13-LV-06-94-028. H.Kalia/L.Costin to Distribution."

"Ground Support Design Verification Data Needs LV.ESSB.JHP.6/94-674 Sandifer to Elkins."

"Request for Technical Support to provide Geological/Geotechnical data Collection, Mapping and Reporting During Construction of the Exploratory Sudies, Facility(ESF)(SCP/NA).LV.ESSB.JHP.3/94-595."

The testing organizations have in response to the A/E's request for data and information developed work plans which identify the tests and test activities to be performed during the construction of the ESF. These plans can been seen to support the acquistion of baseline geotechnical data and information for performance confirmation (Ref. 10 CFR 60 140 (d)(2))

The process of ground support selection based on geotechnical criteria which is subject to verification** by SNL under the Construction Monitoring and Design Verification work plans, will provide the A/E with the basis to adjust and/or substitute the ground support categories identified in Drawings BABEAB000-01717-2100-40151 through 40161. The real time adjustment of ground support is described in Ground Support Scoping Analysis BABEA0000-01717-0200-00008 Rev 01 as indicated on page 74 of 83:
"To meet the data needs of the A/E, technical activities are to be developed to include:

- Evaluations of rock mass quality and other empirical geo-engineering parameters will be made near the face continuously during TBM operations. The evaluations will be made to support the M & O field change decisions to modify ground support at the face during construction."

Remedial Action

See investigative action

Root Cause

See investigative action

Corrective Action.

See investigative action

MGDS DEVELOPEMENT

8/29/94
DATE

OFFICE OF CIVILIAN
RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

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CORRECTIVE ACTION REQUEST (CONTINUATION PAGE)

EVALUATION OF AMENDED RESPONSE TO CAR YM-94-073

The DOE agrees that the M&O did consider information from construction of design package1A in the development of design package 2C; however, the M&O has not developed a plan/procedure for verifying the 2C design by collection of scientific data during construction of the ESF. In other words, the portion of this CAR that states "Design Validation was not performed on the Starter Tunnel and used as input to the design of the North Ramp Package 2C." is no longer an issue; however, the second part of the Adverse Condition requires a new response.

The response is unacceptable for the following reason:

The M&O has not committed to development of a plan/procedure that addresses implementing a portion of Performance Confirmation activities during ESF construction. The scientific community has documented their activities in Study Plans and the design organization has communicated their needs to the scientific community via letters; however, the design organization has no procedure that describes how they intend to use the data collected by the scientific community. The QARD, DOE/RW-0333P, Revision 1, Section 5 requires that work be prescribed by, and performed in accordance with, written implementing documents. OQA cannot find an M&O implementing document that describes the process of evaluating data from the scientific community to determine that the Geotechnical design is valid, e.g. when the M&O obtains data from the scientific investigation what M&O implementing document describes how they document that they have evaluated that data and determined that no changes to the Geotechnical design are needed? How often is this evaluation done? Daily? Weekly?

RECOMMENDATIONS:

1. The response should commit to development of an appropriate implementing document.

2. This implementing document (plan/procedure) needs to be in place within a reasonable time after start of tunnel boring, i.e. tunnel boring operations can begin prior to development of this procedure; however, this procedure should be in place prior to Phase 3: Operation of the TBM and conduct of scientific investigations following installation of the mapping platform.

3. The M&O should consider use of the attached terms when developing the implementing document.

R E Rome, QAR 7/8/94

OFFICE OF CIVILIAN
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U.S. DEPARTMENT OF ENERGY
WASHINGTON, D.C.

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CORRECTIVE ACTION REQUEST (CONTINUATION PAGE)

ATTACHMENT TO EVALUATION OF RESPONSE TO CAR YM-94-073

Recommended Terms for Consideration

Design Verification - Design verification shall be performed using one or a combination of the following methods:

Design Review - A documented evaluation of design output during the design process to determine design adequacy and conformance to specified acceptance criteria

Alternate Calculations - Calculations that are made with alternate methods to verify correctness of the original calculation

Qualification Testing - A test that is intended to provide a desired level of confidence that an item meets specified criteria

SOURCE: DOE/RW-0333P, Revision 1 OCRWM Quality Assurance Requirements and Description (QARD)

Performance Confirmation - The program of tests, experiments and analyses which is conducted to evaluate the accuracy and adequacy of the information used to determine with reasonable assurance that the performance objectives for the period after permanent closure will be met. (SOURCE: QARD)

Design Validation - That portion of Performance Confirmation that is used to ensure that geotechnical and design parameters used for the design of the ESF/Repository are confirmed (i.e. valid) and the engineered system is performing such that it meets the intended objectives of the performance or design criteria. The process of real time comparison during construction of in-situ subsurface conditions with design basis and assumptions to evaluate the need for design changes. This process also includes the real time monitoring of the engineered systems to determine if their performance satisfies the objectives of the performance or design criteria.* (SOURCE: Proposed definition by R. Powe and W. Sublette)

* Changes needed in design of the Repository to accommodate actual field conditions encountered will need to be reported to the Nuclear Regulatory Commission (SOURCE: 10CFR60 Subpart F)

Amended Response To CAR YM-94-073

The M&O will propose in the FY95 Engineering Plan that a plan and procedures be developed for implementing a portion of Performance Confirmation activities. The plan and procedures will be developed upon DOE approval of the Engineering Plan. The A/E does not agree about the arbitrary time frame (procedure should be in place prior to Phase 3 TBM Operations) contained in the recommendation section of the CAR. An amended response will be submitted for the implementation date of the plans and procedures after consideration and approval/disapproval by the DOE.

Alden M. Segrest
MGDS Development Manager

Date 9/16/94

9/16/94
VV.ESSB.GH.9/94-776

Amended Response to CAR YM-94-073

The M&O will propose in the FY95 Engineering Plan a design validation plan to develop technical data and information for possible use in performance confirmation. The plan will be developed upon DOE approval of the Engineering Plan.

Expected completion date for the FY95 Engineering Plan, November 18, 1994, and the design validation plan, January 2, 1995.

Responsible Individual - Robert S. Saunders

10/12/94 LV.ESSB.GH.10/94-168

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CORRECTIVE ACTION REQUEST (CONTINUATION PAGE)

This amended response is intended to replace all previous responses submitted by the M&O for this CAR.

The original response to this CAR was submitted to YMQAD on August 17, 1994. This response was rejected and a revised response was submitted on August 29, 1994. This response also was rejected on September 8, 1994. The evaluation of this second response accepted that the M&O did consider information from construction of Design Package 1A in the development of Design Package 2C. However, this evaluation recommended the M&O commit to development of a plan or procedure to address implementing a portion of performance confirmation activities during ESF construction. The evaluation requested an implementing document that describes the process of evaluating data from the scientific community to determine that the geotechnical design is valid.

The M&O response dated September 16, 1994, stated the FY95 Engineering Plan would propose a plan and procedures be developed for implementing a portion of performance confirmation activities. The response also stated the M&O would submit an amended response giving an implementation date for the plans and procedures.

On October 7, 1994, the M&O sent an amended response requesting YMQAD to disregard the previous response. This response stated the M&O would propose in the FY95 Engineering Plan a design validation plan to develop technical data and information for possible use in performance confirmation. The design validation plan was to be developed after DOE approval of the FY95 Engineering Plan. The M&O expected the Engineering Plan to be approved by November 18, 1994 and the design validation plan to be completed by January 2, 1995. On December 29, 1994, YMQAD accepted this response.

The M&O has now determined that writing a design validation plan will not properly address the issues of this CAR. Most elements of the process are described in the Site Characterization Plan. Rather than repeat this and expand upon it, our conclusion is that the M&O should write an implementing line procedure on the process for evaluation of field data received from the scientific community. The name of the new procedure will be "Impact Reviews for Revisions of Documents That Affect the MGDS Development Organization". The effective date of the new procedure will be April 14, 1995. Until the effective date of the new implementing line procedure the M&O will utilize QAP-3-9 for necessary reviews/evaluations of field data received from the scientific community.

Root Cause Determination

The root cause for this adverse condition has been determined to be a lack of a procedure to delineate responsibilities and actions necessary when data has been received from the scientific community. The cause code for this condition is 2B "Lack of procedure".

Alden M. Segrest, Manager
MGDS Development

3/28/95
Date

3/28/95 LV.MG.AMS.3/95.050

EVALUATION OF CAR YM-94-073 Amended Response dated 3/28/95.

The subject response was submitted by the M&O as a result of the actions outlined on the attached **CHRONOLOGY OF CAR YM-94-073.**

The Amended Response is acceptable pending verification.

Richard E. Powe — 3/30/95

Richard E. Powe, QAR — Date

ADVERSE CONDITION: "Design validation was not performed on the Starter Tunnel and used as input to the design of the North Ramp Package 2C. It was also noted that presently there is not a plan to use design validation data for making real time design modifications to the ground support."

8/5/95 CAR issued via YMQAD:RBC-4578 with response due date of 9/2/94.

8/18/94 Response received sent via LV.ESSB.GH.8/94-737 dated 8/17/94 which stated that indicated no root cause, remedial or preventative action was required since investigation had determined that no violation had occurred.

8/18/94 DOE informed the M&O (verbally) of intent to reject the response.

8/31/94 Received an Amended response via LV.ESSB.GH.8/94-737 dated 8/29/94. (NOTE: Correspondence letter had the same identification number as the 8/17/94 letter). The amended response did not commit to any action. It again attempted to explain that there was no problem.

9/8/94 DOE rejected the response as amended via Letter YMQAD:RBC-4996. DOE did accept the M&O statements that claimed that they had considered information from construction of design package 1A (Starter Tunnel) in development of design package 2C; however, the M&O had failed to commit to develop a plan/procedure for verifying the 2C design by collection of scientific data during construction of the ESF. New response due 9/22/94

9/20/94 Received second amended response via letter LV.ESSB.GH.9/94-776 which committed to propose in the FY95 Engineering Plan that a plan and procedures be developed for implementing a portion of Performance Conformation activities but provided no expected completion date.

10/12/94 Received a third amended response via Letter LV.ESSB.GH.10/94-168 dated 10/7/94 that told DOE to disregard the previous response and consider this response that had expected completion dates. The response stated:

> "Amended Response to CAR YM-94-073
>
> The M&O will propose in the FY95 Engineering Plan a design validation plan to develop technical data and information for possible use in performance confirmation. The plan will be developed upon DOE approval of the Engineering Plan.
>
> Expected completion date for the FY95 Engineering Plan, November 18, 1994, and the design validation plan, january 2, 1995.
>
> Responsible Individual - Robert S. Saunders"

12/29/94 DOE accepted the amended response via Letter YMQAD:RBC-1528 (NOTE: DOE overlooked the fact that the M&O had not provided a root cause determination.

12/29/94 DOE accepted the amended response via Letter YMQAD:RBC-1528 (NOTE: DOE overlooked the fact that the M&O had not provided a root cause determination.

3/20/95 DOE informed the M&O via Lotus Note of intent to reject the CAR because verification had determined that the M&O had not kept their commitment. See attached **VERIFICATION ACTIVITIES FOR CAR YM-94-073.**

3/29/95 A representative of the M&O provided OQA with an advance copy of an amended response to the subject CAR that replaced all previous responses. This new response provides a brief history of the CAR and commits to have a new procedure to address "Impact Reviews for Revisions to Documnets That Effect the MGDS Development Organization" in effect by 4/14/95.

The subject CAR has three issues:

1. Design Validation of Starter Tunnel (Design Package 1A)

2. Use of data from Starter Tunnel in design validation of Design Package 2C

3. Design Validation Plan and how it is being implemented.

STATUS:

ISSUE 1: The response states in part: "The final phase of design verification of the 1A design package will be initiated during construction of the portal headwall, internal concrete liner and invert for the starter tunnel."

This statement does not make any commitment to have the design verification for the Starter Tunnel completed as part of corrective action; therefore follow-up will consist of interviews with design personnel to determine the degree of planning and progress. These interviews will be conducted by W. R. Sublette.

ISSUE 2: The response states in part: "When appropriate, relavent information derived from package 1A has been considered in the Ground Support Scoping Analysis...."

Follow-up will consist of a review of the wording within the Analysis that addreses use of Design Package 1A and interviews with design personnel to determine what data was used in the design validation of Design Package 2C. These interviews will be conducted by W. R. Sublette.

ISSUE 3: The response states in part:

"The M&O will propose in the FY95 Engineering Plan a design validation plan to develop technical data and information for possible use in performance confirmation. The plan will be developed upon DOE approval of the Engineering Plan.

Expected completion date for the FY95 Engineering Plan, November 18, 1994, and the design validation plan, January 2, 1995."

The M&O FY95 Engineering Plan was approved by DOE and contains a description of the Design Validation process; however, it does not call for a Design Validation Plan, i.e. the M&O did not fulfill their commitment.

The M&O provided a Design Validation Plan that contains no approval signatures and no indication that it was created by the M&O. Furthermore, the "draft" Design Validation Plan does not provide any details regarding how M&O Engineering will process TDIFs once the scientific community supplies the in-situ data.

A re-review of the M&O response indicates no root cause determination was provided.

CONCLUSION

Since the committed corrective actions have not been completed and the root cause determination has not been properly stated this CAR is rejected at verification and a new response is requested.

***

Richard E. Powe, Date
Quality Assurance Representative

***

William R. Sublette, Date
Author of CAR YM-94-073

*** NOTE: This rejection documentation was never issued. The M&O submitted an amended response via Letter LV.MG.AMS.3/95.050 dated 3/28/95 based on an informal draft of this rejection.

In a normal process of documenting the verification process of a Corrective Action Request (CAR), each "Required Actions" identified on the CAR are addressed individually. However, in this instance, the responses and the objective evidence are not presented in a manner which makes this a viable method for outlining the CAR verification documentation. Documentation of this verification process will be done by identifying the objective evidence which was reviewed followed by the verification results.

Objective Evidence Reviewed:

1. Civilian Radioactive Waste Management System Management and Operating contractor (CRWMS M&O) responses and amended responses, the Office of Civilian Radioactive Waste Management (OCRWM) rejections and acceptances, as identified in the Chronology of CAR YM-94-073 (see Attachment 1).

2. CAR YM-94-073 (Design Validation) Closure Objective Evidence, July 13, 1995.

3. CAR YM-94-073 Additional Objective Evidence, July 27, 1995.

Verification Conclusion:

After reviewing the objective evidence, it has been concluded that the CRWMS M&O has completed the committed action of developing and implementing an impact review procedure (NLP 3-26).

The verification process resulted in the identification of several areas where either additional information is needed or improvement is recommended. These areas are discussed in the attached List of Recommendations (see Attachment 2). A written response to these Recommendations is requested.

The response to the Recommendations will be evaluated and results included in the record package for this CAR. Any new actions needed as a result of that evaluation will be documented on a separate report.

In conclusion this CAR can be closed as soon as an acceptable response to the attached recommendations has been obtained.

R. E. Powe 11/7/95

R. E. Powe
QA Representative

Date

CHRONOLOGY OF CAR YM-94-073

ADVERSE CONDITION: "Design validation was not performed on the Starter Tunnel and used as input to the design of the North Ramp Package 2C. It was also noted that presently there is not a plan to use design validation data for making real time design modifications to the ground support."

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8/18/94 DOE informed the CRWMS M&O (verbally) of intent to reject the response.

8/31/94 Received an Amended response via LV.ESSB.GH.8/94-737 dated 8/29/94. (NOTE: Correspondence letter had the same identification number as the 8/17/94 letter). The amended response did not commit to any action. It again attempted to explain that there was no problem.

9/8/94 DOE rejected the response as amended via Letter YMQAD:RBC-4996. DOE did accept the CRWMS M&O statements that claimed that they had considered information from construction of design package 1A (Starter Tunnel) in development of design package 2C; however, the CRWMS M&O had failed to commit to develop a plan/procedure for verifying the 2C design by collection of scientific data during construction of the ESF. New response due 9/22/94

9/20/94 Received second amended response via letter LV.ESSB.GH.9/94-776 which committed to propose in the FY95 Engineering Plan that a plan and procedures be developed for implementing a portion of Performance Conformation activities but provided no expected completion date.

10/12/94 Received a third amended response via Letter LV.ESSB.GH.10/94-168 dated 10/7/94 that told DOE to disregard the previous response and consider this response that had expected completion dates. The response stated:

> "Amended Response to CAR YM-94-073
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> The M&O will propose in the FY95 Engineering Plan a design validation plan to develop technical data and information for possible use in performance confirmation. The plan will be developed upon DOE approval of the Engineering Plan.

Expected completion date for the FY95 Engineering Plan, November 18, 1994, and the design validation plan, January 2, 1995.

Responsible Individual - Robert S. Saunders"

12/29/94 DOE accepted the amended response via Letter YMQAD:RBC-1528 (NOTE: DOE overlooked the fact that the CRWMS M&O had not provided a root cause determination).

2/17/95 DOE informed the CRWMS M&O via Lotus Note of intent to reject the CAR because verification had determined that the CRWMS M&O had not kept their commitment.

3/30/95 The CRWMS M&O provided OQA with an amended response to the subject CAR that replaced all previous responses. This new response (LV.MG.AMS.3/95.050 dated 3/28/95) provided a brief history of the CAR and committed to having a new procedure to address "Impact Reviews for Revisions to Documents That Effect the MGDS Development Organization" in effect by 4/14/95. The response indicated that the root cause was "Lack of procedure."

4/10/95 DOE accepted the CRWMS M&O amended response pending verification via Letter YMQAD:RBC-2718.

7/13/95 CRWMS M&O provided CAR YM-94-073 Objective Evidence for closure.

7/27/95 CRWMS M&O provided CAR YM-94-073 Additional Objective Evidence for closure.

Recommendations Regarding the Design Validation Process

A review of the objective evidence for CAR YM-94-073 has resulted in the following recommendations:

1. Background: A review of the Shift Reports and the Instrumented Steel Sets Location Key provided in the Objective Evidence Package for this CAR, showed that only one steel set was instrumented where noticeable raveling had occurred in the crown or rib. The Shift Report stated that Steel Set #158 was set under a crown that had developed 3-4 feet of raveling. The question here is why are the steel sets in the better ground conditions being instrumented instead of instrumenting the steel sets in the areas of extensive raveling. If we need to validate the design of an engineered system, we should not try to validate the performance of the engineered system for the most ideal conditions encountered in each ground support category, but instead we should be validating the performance of the engineered system for the worst case or less favorable conditions in each ground support category. The objective evidence did not appear to be complete. The Instrumented Steel Sets Location Key showed that 28 steel sets were instrumented, however, only 12 corresponding station locations were provided in the Shift Reports objective evidence.

   Recommendation: The design group needs to identify what steel sets the field group should instrument. A large percentage of the instrumented steel sets should be in the areas where there has been extensive raveling, since these areas have the greatest potential for developing large long-term loads, either due to further raveling filling the voids and/or due to the weight of backfill used to fill the voids, i.e., lean concrete, sand, etc. A comprehensive design validation plan should be developed which will identify what design parameters need to be validated, what design criteria (performance criteria) need to be validated, and the details of what field activities need to be performed to obtain the appropriate data to perform the design validation.

2. Background: Locations for convergent pins and multiple position borehole extensometers (MPBX's) were provided in the objective evidence, however, there was no displacement data given in the objective evidence, nor was there an application of this data in the design validation process. Also missing in this section is a quantitative performance acceptance criteria (design criteria) that would be compared with the displacements experienced in the field to determine the acceptability of the performance of the engineered system.

   Recommendation: Provide the displacement data objective evidence. Also identify what quantitative performance acceptance criteria (design criteria) will be used to evaluate the performance of the engineered system relative to the displacement data. If the quantitative design criteria has been clearly defined in the design analysis documents then these criteria can be implemented in the design validation process. In addition, the design validation plan recommended in Recommendation 1 could be used to identify the need to compare quantitative performance acceptance criteria (design criteria) with the displacement data.

3. Background: The objective evidence provided indicated that there were seventeen instances where the recommended ground support guideline category based on the in-situ rock mass quality estimates required a ground support category more conservative than the actual ground support category that was emplaced. There is no discussion of the impacts of these conditions in the Impact Review Action Notices for the "Rock Mass Quality Data for the NRT Stations." The as built construction does not appear to meet the design recommendations or guidelines. The following provides a list of stations along the ramp where the installed ground support is a category less than what the design recommends, based on in-situ rock mass classification: 375, 370, 365, 360, 390, 380, 395, 405, 410, 415, 425, 520, 525, 680, 722, 727, 741.

   Recommendation: Document this condition in the design validation process and evaluate its impacts.

4. Background: Some shift reports appear to be missing from the objective evidence. The most noticeable missing shift reports are those prior to Station 2+18.0 m in the area of the large raveled ground condition in the vicinity of steel sets 114 through 117 near the Bow Ridge Fault.

   Recommendation: Provide further objective evidence showing the missing Shift Reports from the period prior to 2/14/95.

5. Background: The Impact Review Action Notice for the "Rock Mass Quality Data for the NRT Stations" incorrectly stated that "Ground support category is not changed (category 31) with range 0.1 - 0.4." This statement seemed to suggest that the TBM-Q did not require ground support more conservative than Barton's Category 31 ground support which is consistent with the designs Category 4 ground support. The data for stations 520-525, 525-530, and 680-685 are not consistent with this statement. The TBM-Q's from these stations require a more conservative Category 34 ground support which is consistent with the design's Category 5 ground support.

   Recommendation: Reevaluate the referenced statement in the Impact Review Action.

6. Background: The design validation package does not adequately identify an acceptance criteria for the impact or evaluation studies provided in this package. In most instances the acceptance criteria will be the quantitative design criteria. This is another reason to clearly establish quantitative design criteria in the design analysis documents. The only instance where an acceptance criteria is identified in the objective evidence is in the Impact Review Action Notice for the steel set stresses versus their allowable AISC stress requirements. Even in the steel set Impact Review Action Notice, the acceptance criteria should be more clearly presented, including backup documentation of the impact analysis.

   Recommendation: Provide clear identification of the acceptance criteria used in the design validation process. The acceptance criteria should be the same as the quantitative design criteria that was used in the design basis of the design analysis documents (ideally). If no quantitative design criteria were used in the design analysis document, then the acceptance criteria should be clearly established before initiating the Impact Review Action Notice.

7. Background: The methods used in the Impact Review Action Notice of the "Rock Mass Quality Data for the NRT Stations" does not appear to be consistent with the Performance Confirmation Program described in 10CFR60.141 (d). The regulations state that the "measurements and observations taken during construction and operation shall be compared with the original design bases and assumptions. If significant differences exist between the measurements and observations and the original design bases and assumptions, the need for modifications to the design or in construction methods shall be determined and these differences and the recommended changes reported to the Commission." To perform the design validation process per the 10CFR60 requirements will necessitate comparing: the rock mass quality probability distribution that was developed from borehole data and used as design input in the "TS North Ramp Ground Support Scoping Analysis" to estimate ground support requirements; with the actual rock mass quality probability distribution developed from the in-situ data obtained from the ramp.

   It is not a simple matter of just comparing the measured in-situ Q's with the rock mass quality category. The entire rock mass quality probability distributions should be compared. The ground support design options are based on the probability distribution of the rock mass quality for each thermomechanical unit. The entire probability distribution of rock mass quality and the ground support categories are used in the design process to support construction, procurement, planning, and scheduling.

   Additionally, the actual ground support categories installed in the ramp (as built) should be compared with: 1) the recommended ground support as identified on the bottom of page 48 of the "TS North Ramp Ground Support Scoping Analysis" document, and 2) the ground support guideline category established from the in-situ rock quality classification data from the ramp.

Recommendation: Use the entire probability distribution of rock mass quality and ground support categories in the design validation process. This would entail revising the Impact Review Action Notice using the entire probability distribution of the rock mass quality instead of just the "Minimum Predicted Q."

CAR 94-073
VERIFICATION OF CORRECTIVE ACTION
Dated 12/27/95

Reference No. 1 - Letter Segrest to Craun, dated 12/18/95
Reference No. 2 - Verification of CAR YM-94-073, signed by R. Powe, dated 11/7/95

Recommendation No. 1

1a. The design group needs to identify what steel sets the field group should instrument.

1b. A comprehensive design validation plan should be developed.

M&O Response

1a. See Reference #1: A revised listing of where strain gages are installed on steel sets was provided. This revised list shows 31 gage locations versus 28 in the previous version. Also, a letter, Snell to Brady, dated 8/2/95, details steel set numbers 554 and 556 where crown voids exist that were instrumented.

1b. See Reference #1: The Design Validation Plan is under development and dependent on the FY96 budget allocation for performance confirmation.

Resolution: Response Acceptable

Recommendation No. 2

1a. Provide the displacement data objective evidence.

1b. Identify what quantitative performance acceptance criteria will be used to evaluate performance acceptance criteria will be used to evaluate performance of the engineered system.

M&O Response

1a. See Reference #1: Displacement data was provided.

1b See Reference #1: Criteria to address results of convergence measurements is being developed as part of the design validation plan. Data is being evaluated for unusual occurrences. Reference letter, Kicker to Grant, dated 8/16/95.

Resolution: Response Acceptable

Recommendation No. 3

Document condition of as-built ground support not appearing to meet design recommendations or guidelines in the design validation process and evaluate impacts.

M&O Response

See Reference No. 1: IOC, Kehram to File, dated 11/30/95, addresses installed versus recommended ground support.

Resolution: Response Acceptable

Recommendation No. 4

Provide further objective evidence showing the missing shift reports from the period prior to 2/14/95.

M&O Response

See Reference No. 1: Reviewed additional shift reports from 2/10/95 to 2/13/95.

Resolution: Response Acceptable

Recommendation No. 5

Reevaluate the Impact Review Action.Notice for the Rock Mass Quality Data for NRT Stations 520-525, 525-530, and 680-685.

M&O Response

See Reference No. 1: The response states that the Impact Review Action Notices were reevaluated and the recommendation provided was correct, i.e., the recommended ground support category did not change.

Note: A review of the shift reports for Stations 520-530 and 680-685 shows that Category 4 ground support was installed, i.e., steel sets with lagging. This would be consistent with Rock Support Category 31. Rock Support Category 31 (Category 4) requires steel sets at 1200 oc with partial lagging and Rock Support Category 34 (Category 5) requires steel sets at 610-1220 oc with full lagging.

Resolution: Response Acceptable

Recommendation No. 6

Provide clear identification of acceptance criteria used in the design validation process.

M&O Response

See Reference #1: The design validation plan and implementing procedures are under development. The criteria for evaluating the results of the monitoring data will be identified in the plan.

Note: See response to Recommendation 1b.

Resolution: Response Acceptable

Recommendation No. 7

Use the entire probability distribution of rock mass quality and ground support categories in the design validation process.

M&O Response

See Reference #1: The design validation plan will address the evaluation of all monitoring data not just the measured in -situ Q's. The details of how the data will be evaluated and documented will be presented in the plan and its implementing procedures.

Note: See response to Recommendation No. 1b and 6.

Resolution: Response Acceptable

Final Resolution for closure of CAR YM-94-073

All objective evidence required for closure of this CAR has been verified and is considered acceptable. The basis for verification of corrective action includes 1) Signature by R. Powe on Reference No. 1, Verification of CAR YM-94-073, signifying acceptance of objective evidence but requesting written response to seven recommendations; 2) receipt of Reference No. 1; and acceptance to each of the seven recommendations, as detailed above.

S. Dana _____

Date 12/27/95