Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
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JAN 20 1995

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ISSUANCE OF SURVEILLANCE RECORD YMP-SR-95-005 RESULTING FROM YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION'S (YMQAD) SURVEILLANCE OF THE CIVILIAN RADIOACTIVE WASTE MANAGEMENT SYSTEM MANAGEMENT AND OPERATING CONTRACTOR (CRWMS M&O) MINED GEOLOGICAL DISPOSAL SYSTEM DESIGN ORGANIZATION (SCPB: N/A)

Enclosed is the record of Surveillance YMP-SR-95-005 conducted by the YMQAD at the CRWMS M&O facilities in Las Vegas, Nevada, October 6, 1994.

The purpose of the surveillance was to review the Exploratory Studies Facility Package 2C Design Products.

No Corrective Action Requests were issued as a result of this surveillance.

This surveillance is considered completed and closed as of the date of this letter. A response to this surveillance record and any documented recommendations is not required.

If you have any questions, please contact either Robert B. Constable at 794-7945 or Robert L. Howard at 794-7820.

R E. Spence

Richard E. Spence, Director
Yucca Mountain Quality Assurance Division

YMQAD:RBC-1779

Enclosure:
Surveillance Record
YMP-SR-95-005

YMP-5

270076

NH03
WM-11
102.7

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

QUALITY ASSURANCE SURVEILLANCE RECORD

SURVEILLANCE DATA

[1]ORGANIZATION/LOCATION:	[2]SUBJECT:	[3]DATE: 10/6/94
Management & Operating (M&O) Contractor Mined Geological Disposal System (MGDS) Design Organization/LV	Exploratory Studies Facility (ESF) Package 2C Design Products	

[4]SURVEILLANCE OBJECTIVE:
Verify design package 2C products have been prepared , reviewed, and approved in accordance with M&O QAPs and meet appropriate QARD requirements. OCRWM QAP 6.2 review criteria will be used as a basis for the evaluation.

[5]SURVEILLANCE SCOPE:
This surveillance covers design package 2C for the ESF, Topapah Springs North Ramp.

[6]SURVEILLANCE TEAM:
Team Leader:
Robert Howard
Additional Team Members:
John Pelletier
Richard Peck
Stephen Dana
William Sublette
Kenneth Gilkerson

[7]PREPARED BY:
Robert L. Howard — 10/6/94
Surveillance Team Leader — Date

[8]CONCURRENCE:
N/A — ____
QA Division Director — Date

SURVEILLANCE RESULTS

[9]BASIS OF EVALUATION/DESCRIPTION OF OBSERVATIONS:
See pages 2 through 15

[10]SURVEILLANCE CONCLUSIONS:
See page 15

[11]COMPLETED BY:
Robert Howard — 1/9/95
Surveillance Team Leader — Date

[12]APPROVED BY:
Robert [illegible] — 1.19.95
QA Division Director — Date

ENCLOSURE

Block 9 (continued) Basis of Evaluation/Description of Observations:

This surveillance was conducted from October 6, 1994 through November 29, 1994 at the Management and Operating Contractor (M&O) offices in Las Vegas, Nevada. The surveillance team reviewed the documents listed in Attachment 1. The team used the review criteria in Quality Assurance Procedure (QAP) 6.2 and M&O QAPs 3-8, 3-9, and 3-10 as the bases for the surveillance. The following observations were made. Information in brackets after the observation indicate where M&O Design personnel have responded to observations in a Design Verification Package. Comments that required some action are identified as corrected during the surveillance, or as an adverse condition documented as part of extent of deficiency on an existing corrective action request. No new Corrective Action Requests (CAR) were generated as a result of this surveillance.

1. BAB000000-01717-6300-01501, Revision 2 (draft), Specification Section 01501 Exploratory Studies Facility (ESF) Construction Requirements, Paragraph 3.01C.3: Ventilation requirements refer to "satisfying air quality/velocity criteria imposed by regulatory requirements." It is recommended that the M&O detail the requirements with which the constructor must comply. No references to regulatory requirements are found in Section 1.03. **Recommendation.** {3rd Release Comment No.JJC01}

2. Specification Section 01501, ESF Construction Requirements, Paragraph 3.01P: This requirement limits water 7.4 m^3 per linear meter is not as strict as the Determination of Importance Evaluation (DIE) requirement of 22 m^3/ 3 linear meters. This comment was documented on the QAP 6.2 review of Revision 1 to 1501. The A/E agreed to change the specification requirement to 22 m^3 per 3 linear meters. The Architect/Engineer (A/E) has not changed the requirement. (QAP 6.2 review criteria 3.11) **Corrected during the course of the surveillance.** {3rd Release Comment No. JJC02}

3. Specification Section 01501, ESF Construction Requirements, Paragraph 3.01: DIE Requirement 13 requires diesel fuel consumed in the tunnel must be reported in accordance with the Tracers,Fluids, and Materials (TFM) Management Plan. It is not clear where this requirement is translated into the specifications. {3rd Release Comment No JJC03}.

4. BABEAB000-01717-0200-00002, Revision 2, Structural Steel Set Analysis: The outputs of the design analyses Design Piping Support Calculation (Reference 8.17 in the Steel Set Analysis), Cable Tray support Design Calculation (Reference 8.18) and Ventilation Support Design Calculation (Reference 8.19) appear to be related to the Loading Conditions and therefore should be

listed as design inputs in Section 5.0 of the calculation. This specific deficiency was corrected during the course of the surveillance; however see CARs YM-94-065 and YM-94-072 for other problems related to the proper documentation of design inputs. (QAP 6.2 review criteria 3.7) **Corrected during the course of the surveillance.**

5. DI BABEAB000-01717-2100-40151, Revision 1 (Draft), Topapah Springs (TS) North Ramp Ground Support Master Elevation and Section: The Table on this drawing calls out installation of Structural Steel Sets for Category 5 ground support. However, the TS North Ramp Scoping Analysis DI BABEAB000-01717-0200-00010 Revision 1 page 50 of 81 specifically calls out installation of W8 x 31 steel sets. It is not clear where the source of the specific requirement for installation of W8 x 31 steel sets comes from for the analysis and why this requirement is not captured in drawing 40151. (QAP 6.2 Review Criteria 3.7 and 3.11) **This is part of the extent of the deficiency documented in CAR YM-94-065 and YM-94-072.** {3rd Release Comment JJC04}

6. The Specification Inputs list for BABEAB000-01717-6300-02169, Revision 4, "Rockbolts ad Accessories," identifies the Material Dedication Analysis (DI BABEAB000-01717-0200-00009, Revision 1) as a design input. This analysis clearly describes both Inspection and Test requirements as addressed in Quality Assurance Requirements and Description document (QARD), Section 7.2.12 for commercial grade items. (The QARD allows for either). Testing (Section 11.0 and Inspection (QARD section 10.0) are different elements of the Yucca Mountain Project (YMP) Quality Assurance (QA) program. Section 6.0 of the analysis refers to QARD Section 7.2.12 D and QARD Section 10 but not to QARD Section 11.0. The analysis specifically calls for inspection or testing of commercial grade items in paragraph 10.1.4; inspection and testing in 10.3.1.1 and 10.3.1.3 for rockbolts; testing of shotcrete cores in paragraph 10.3.2.2; rockbolt test requirements in 10.4.3.1 and separate inspection requirements in paragraph 10.4.3.3; construction testing requirements in 10.5.3.1 and construction inspection requirements in paragraph 10.5.3.3. QARD, Section 11.0 (Testing) requirements are not imposed as required by the QARD. (QAP 6.2 Review Criteria 3.9) **This is part of the extent of the deficiency documented in CAR YM-94-065 and YM-94-072.** {3rd Release Comment JJC05}

7. Specification Section 01501, ESF Construction Requirements, Paragraph 3.01.X: This requirement requires development of a plan for Tunnel Boring Machine (TBM) advance in the event of adverse ground support. The plan must address alternative

excavation methods. Since excavation is a quality affecting activity, it appears that this requirement should be called out as a quality (Q) control. (QAP 6.2 Review Criteria 3.5) {3rd Release Comment JJC05}

8. TS North Ramp Ground Support Master Elevation and Section DI BABEAB000-01717-2100-40151, Revision 1 (Draft): It is not clear why To Be Verified (TBV)-011 (Rock Mass Rating [RMR] values) is not carried through to the design drawings detailing ground support. (QAP 6.2 Review Criteria 3.7 and 3.11) **Corrected during the surveillance.** {3rd Release Comment JJC07}

9. DI BABEAB000-01717-0200-00010, TS North Ramp Ground Support Scoping Analysis: Page 11 of the scoping analysis calls out the following design inputs:

    TDIF #302273 provided by Sandia National Laboratories (SNL) (Design Input 5.2)
    TS North Ramp Rock Mass Classification (Design Input 5.3)
    TS North Ramp Stability Analysis (Design Input 5.4)
    TS North Ramp Alcove Ground Support Analysis (Design Input 5.5)

    These design inputs are not listed in Section 5.0 of the Analysis. (Review criteria: compliance with QAP-3-9) **This is part of the extent of the deficiency documented in CAR YM-94-065 and YM-94-072.** {3rd Release Comment JJC08}

10. DI BABEAB000-01717-0200-00010 TS North Ramp Ground Support Scoping Analysis: On page 11 please clarify the use and appropriateness of using Schmidt-Hammer logs to develop strength indices. **Recommendation.** (QAP 6.2 review criteria 3.11) {3rd Release Comment JJC09}

11. Specification Section 02165: Paragraph 2.01 B.2 states that "Rockbolts shall be a solid deformed bar complying with American Society for Testing and Materials (ASTM) A615 grade 60. Length and diameter shall be as indicated on the Drawings." No diameter is indicated on "TS North Ramp Rockbolts and Accessories Details," BABEAB000-01717-2100-40157. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {3rd Release Comment JJC10}

12. Specification Section 02165: Paragraph 2.01 D.1 & F1 require Certificates of Compliances (C of C)for Standard Swellex and Super Swellex Rockbolts to be kept as QA records. It is not clear why a C of C is required to be kept as a QA record for a non-Q item. (QAP 6.2 review criteria 3.4) **Corrected during the surveillance.** {3rd Release Comment JJC11}

13. Specification Section 02165: Paragraph 3.02 C, states, "If directed by the A/E, the Super Swellex rockbolt system shall be used in place of the grouted rockbolts when Test Interference restrictions preclude the use of the grouted rockbolts." This statement allows the A/E & constructor to deviate from the designed Q ground support and substitute a non-Q item for a Q-item. This does not appear to be an appropriate application of the QA program. {3rd Release Comment JJC12}

14. Specification Section 02165: Paragraph 3.02 G.1, There appears to be information missing in the second sentence which reads "The pattern rockbolts and shall be used for the initial installation of the fabric". (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {3rd Release Comment JJC13}

15. Specification Section 02165: Paragraph 1.04C b, states, "Verification that Certification Documentation required by the Purchasing Documents are received, acceptable, and in accordance with the requirements of this Specification Section." The type of documentation should be specified (either Certificate of Compliance or Certified Material Test Reports). Clarify where specific documentation is required. Section 1.05 F also requires mill test reports. Section 2.01 B.1 and Section 1.05 C 1 requires C of C but no mill test reports or material test reports. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {3rd Release Comment 9 by John Peters}

16. Specification Section 02165: Paragraph 1.04D 1. It is not clear if Specification Section 01600 currently calls out storage levels. (QAP 6.2 review criteria 3.5) **Corrected during the surveillance.** {3rd Release Comment 8 by John Peters}

17. Specification Section 02165: Paragraph 3.01 A, states, "Depending on the test results, the A/E may direct that changes be made to the proof load and the allowable displacement used for rockbolt testing carried out in accordance with paragraphs 3.03D2-D4." It does not appear that the A/E has a method for making such changes other than revision to the specification. (QAP 6.2 review criteria 3.5) **Corrected during the surveillance.** {3rd Release Comment 4 by Fred Arth}

18. Specification Section 02165: Paragraph 3.02 E.2. The instructions here for installing rockbolts should be identified as Q controls. SEE DIE requirement 6. (QAP 6.2 review criteria 3.5) **Corrected during the surveillance.** {3rd Release Comment 7 by John Peters}

19. Specification Section 02165: Paragraph 3.02 F.1 The instructions here for installing rockbolts should be identified as Q controls. See DIE requirement 6. (QAP 6.2 review criteria 3.5) **Corrected during the surveillance.** {3rd Release Comment 5 by Fred Arth}

20. Specification Section 02165: Paragraph 3.02 H.1, states, "The constructor shall remove the water from the Swellex Rockbolts within the practical limits of the Swellex Water Recovery System." Quantified limits should be imposed. {3rd Release Comment 6 by Fred Arth}

21. Specification Section 02165: Paragraph 3.03 D.1 and E.1 require the Constructor to submit test procedures to the A/E for information. The QARD section 11.2.2.C requires test implementing documents to address the following requirement: "Test requirements and acceptance criteria provided or approved by the organization responsible for the design of the item unless otherwise designated." It is therefore not clear why test procedure submittals are for information instead of approval or acceptance. (QAP 6.2 review criteria 3.5) **Corrected during the surveillance.** {3rd Release Comment 7 by Fred Arth}

22. Specification Section 02165: Paragraph 2.01 B2 a-c: It is not clear if thread requirements are critical attributes for loading and therefore need to be inspected/verified. ASTM F432 computes yield loads and tensile loads based on thread stress areas. Thread stress areas are in turn calculated based on mean root and pitch diameters of the threads. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {3rd Release Comment 3 by Fred Arth}

23. Specification Section 02165: DIE Requirement 7 calls for documentation of receipt verification of ground support to be treated as QA records. It is not clear where this requirement gets implemented in Specification 2165. {3rd Release Comment 6 by John Peters}

24. Steel Sets and Accessories Subsurface Specification, Section 1.02 Related Sections. Add Specification 01501 See 3.01A {4th Release Comment 12 by John Peters}

25. Steel Sets and Accessories Subsurface Specification, Section 1.03 References. Add specific American Institute of Steel Construction (AISC) numbers to specification i.e., AISC M016-89? Manual of Steel Construction. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {4th Release Comment 11 by John Peters}

26. Steel Sets and Accessories Subsurface Specification, Section 1.04K. It is not clear where or how this requirement of 10 percent, 20 percent (1.04M) for visual inspection is imposed. How are the samples taken, random, 1st 10..? (QAP 6.2 review criteria 3.5) **Corrected during the surveillance.** {4th Release Comment 10 by John Peters}

27. Steel Sets and Accessories Subsurface Specification section 2.02D1. QA control welding shall be in accordance with Paragraph 1.04J, this section deals with inspection of welds. This reference must refer to a American Welding Society (AWS) Standard. Reference 1.04J should be changed to 103.C2. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {4th Release Comment 9 by John Peters}

28. Steel Sets and Accessories Subsurface Specification, Section 3.036. The use of temporary wood blocking shall be minimized to the extent practical. Need to impose quantifiable/measurable limits See CAR 94-075.(QAP 6.2 Review Criteria 3.10) **Corrected during the surveillance.** {4th Release Comment 8 by John Peters}

29. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 04. The hand calculations in this analysis do not appear to consistently use significant digits. Also some calculations are not correct; for example bottom of page III-39 says 25x12x7.14/290.72=7.41 The numerical answer should be 7.36. Explain how hand computations are handled and checked. {4th Release Comment 7 by John Peters}

30. Requirements Allocation Analysis for Furnishings, DI BABEAC000-01717-0200-00001, Revision 1, and the Requirements Allocation Analysis (RAA) for Linings and Ground Support, DI BABEAB000-01717-0200-00008, Revision 1, under method state: The method used to identify applicable requirements was done "by detailed review of the ESF Design Requirement (ESFDR)." Contrary to the stated method it has been determined that inconsistencies exists between RAAs. It is not clear what the rational is for determining which ESFDR requirements are applicable to each individual RAA. For example ESFDR requirement 3.2.1 J.4 is identified as applicable to Requirements Allocation Analysis for Furnishings, DI BABEAC000-01717-0200-00001, Revision 1, but is not identified in the Ground Support RAA. Additionally engineers preparing RAAs have different approaches to identifying upper tier requirements. In one case, the Ground Support RAA preparer identifies each ESFDR requirement as

stated, in another case the preparer for the Furnishing RAA specifies only one requirement if that requirement is restated elsewhere (See ESFDR Requirements 3.2.1g, 3.2.1S & T, 3.2.1.25.4 for this type of inconsistency. (QAP 6.2 review criteria 3.11) {4th Release Comment 28 by John Peters}

31. Requirements Allocation Analyses are identified as inputs to individual drawings and specifications; however it is not clear how individual ESFDR requirements are addressed in these output documents. (QAP 6.2 review Criteria 3.7, 3.9) {4th Release Comment 29 by John Peters}

32. Requirements Allocation Analysis for Furnishings DI BABEAC000-01717-0200-00001 Revision 1: Add requirement 3.2.1.4 B.3. (QAP 6.2 review Criteria 3.7, 3.9) **Corrected during the surveillance.**

33. Requirements Allocation Analysis for Furnishings, DI BABEAC000-01717-0200-00001, Revision 1: Add requirement 3.2.2.4 O. (QAP 6.2 review Criteria 3.7, 3.9) **Corrected during the surveillance.**

34. BABEAB000-01717-0200-00003, Revision 3, Material Dedication Analysis for Commercial Grade Items-Steel Sets: This analysis states that "the items analyzed in this document are steel sets and accessories used in the TS north ramp ground support". This analysis hinges on the premise that items procured as "commercial grade" are to be dedicated and provides the inspection and test methodology for doing this. By definition an "engineered item" cannot be "commercial grade". However a review of the M&O steel set procurement drawings disclose that the steel sets are "engineered items". Per the QARD definition Commercial Grade Items are those "not subject to design or specification criteria unique to the Program or nuclear facilities; used in applications other than the nuclear industry, and ordered from the manufacturer or supplier on the basis of specifications set forth in the manufacturer's published product description." As such while steel set components may in fact be procured as commercial grade and dedicated at the site, fabricated steel sets to the M&O drawings must be procured from a qualified supplier in accordance with QARD requirements and have nothing to do with commercial grade dedication. This analysis fails to make this distinction and infers that the steel sets are procured as commercial grade. They are not. (QAP 6.2 review criteria 3.11) **This is part of the extent of the deficiency documented in CAR YM-94-065 and YM-94-072.** {4th Release Comment 13 by John Peters}

35. BABEAB000-01717-0200-00003, Revision 3, Material Dedication Analysis for Commercial Grade Items-Steel Sets: Definition for " Commercial Grade Items " should be included. (QAP 6.2 review criteria 3.3) {4th Release Comment 14 by John Peters}

36. BABEAB000-01717-0200-00003, Revision 3, Material Dedication Analysis for Commercial Grade Items-Steel Sets: Paragraph 6.1. As identified in the Material Dedication Analysis for Rockbolts, Testing Criteria must meet QARD Section 11 criteria. This analysis Specifically addresses meeting QARD Section 10 requirements for satisfying "Inspection and Test Plan" requirements. QARD, Section 11 also applies. The analysis and specification specifically identify "testing" requirements. See previous comments. {4th Release Comment 15 by John Peters}

37. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 4 ,Attachment I, Page I-5: Equations for determining the horizontal and vertical components of the jacking force are incorrect. $F_x = P_J \sin \alpha$ should be $F_x = P_J \cos \alpha$ and $F_y = P_J \cos \alpha$ should be $F_y = P_J \sin \alpha$. This impacts the jacking load analysis and possibly some of the subsequent structural analyses. (QAP 6.2 review criteria 3.11) **This is part of the extent of the deficiency documented in CAR YM-94-065 and YM-94-072.** {4th Release Comment 16 by John Peters}

38. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 4, Attachment I, Page I-6: In each of the equations where the horizontal and vertical loading components are determined, the equation is multiplied by (2); does this mean there are two jacks side by side. If this is the case then document that fact in the analysis. {4th Release Comment 19 by John Peters}

39. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 4, Attachment I, Page I-10, lines 27 and 28: It is assumed from the statement that nodes 3, 9, 37, and 43 are fixed with respect to F_y and M_y, and nodes 16, 22, 23, 24, and 30 are fixed with respect to F_x and M_y. It is not clear on how the boundary conditions were developed in this analysis and why not fix node 23 in both the vertical and horizontal direction and nodes 9 and 37 in the horizontal direction. {4th Release Comment 17 by John Peters}

40. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 4, Attachment II, Page I-2: Assumptions 1 and 2 at the bottom of the page need to be identified in Section 7 "Assumptions," of the text.(QAP 6.2 review criteria 3.11) **This is part of the extent of the deficiency documented in CAR YM-94-065** {4th Release Comment 18 by John Peters}

41. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 4, Attachment II, Page II-5: e_1 is identified as an active soil pressure, however, in this case due to the jacking loads on the steel sets, e_1 should be considered as a passive soil pressure. It should also be considered more than "0" value given on this page.(QAP 6.2 review criteria 3.11) {4th Release Comment 20 by John Peters}

42. Structural Steel Sets Analysis DI # BABEAB000-01717-0200-00002, Revision 4, Attachment II, Page II-5: The seismic vertical load is identified as equal to 0.37W = 1.11 K. What is the value for W and show, document, or reference how it was determined. (QAP 6.2 review criteria 3.11) {4th Release Comment 21 by John Peters}

43. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 4, Attachment II, Page II-6: At the bottom of the page it states that "thermal loads are unknown at present and will be determined during performance confirmation." Why wasn't the thermal loading stress developed by SNL in their document "Design Support Analyses: North Ramp Design Package 2C, Revision 1," used? This input was used in the "TS North Ramp Stability Analysis," document. The point is the project does have estimates of thermal loading conditions and they are not unknown as stated in this document. {4th Release Comment 22 by John Peters}

44. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 4, Attachment IV, Page IV-5: The assumption that the steel set loading H_p will be equal to 0.25B needs to be identified in Section 7 "Assumptions," of the text. (QAP 6.2 review criteria 3.11) **This is part of the extent of the deficiency documented in CAR YM-94-065** {4th Release Comment 23 by John Peters}

45. Structural Steel Sets Analysis, DI # BABEAB000-01717-0200-00002, Revision 4, Attachment IV, Page IV-5: The documentation justifying the use of 0.25B for the steel set loading is not satisfactory and is contradicting. The last sentence which states that the 0.25B load "coincidently corresponds to rock condition number (3)," from Terzaghi's table is baffling. Why bother with presenting Terzaghi's table on the previous page and recommending on that table that rock condition number (3) be used if it is only "coincidental" that rock condition (3) corresponds with the 0.25B steel set loading recommendation. It is not a coincidence, the Lead Design Engineer (LDE) picked that rock condition on the table on page IV-4 and stated "used for this analysis* this rock condition is appropriate as basis for design", and further stated that this is the "loading

condition". Picking a rock condition such as "Massive, moderately jointed" is not even close to the nonlithified weakly cemented low density soil type condition that exists in the Pre-Rainier Mesa Bedded Tuff or the Ash-Flow Tuff. Since this material is classified as a weakly cemented silty sand, it is suggested that Terzaghi's recommendations for soil loading conditions be used to estimate the loading on the steel sets. His recommendations for a low density raveling ground which contains some binder capabilities is as follows: H_p min = 0.47 B for yield of 0.02 B; H_p max = 0.60 B for yield of 0.15 B. If the designers feel that even H_p min is to high then they need to present their rationale as to why they are reducing H_p from the minimum value, but at least they will have started with a soil or rock condition that is more representative of actual ground conditions. Also get rid of the "coincidental" terminology. (QAP 6.2 review criteria 3.11) {4th Release Comment 24 by John Peters}

46. It is not clear why TBV-011 is not carried down to Drawing BABEAB000-01717-2100-41101. This TBV is carried down to drawing BABEAB000-01717-2100-40155. (QAP 6.2 review criteria 3.7) {4th Release Comment 25 by John Peters}

47. Attachment IV, Page IV-6: "e_1" is identified as an active soil pressure. Due to the nature of the circular jacked steel sets, the lateral soil pressure "e_1" is passive and not active. The difference can be noted in the following equations for lateral stress:
σ_{xa} (active) = $K_a z\gamma - 2c\sqrt{K_a}$ where $K_a = \tan^2(45-\phi/2)$
σ_{xp} (passive) = $K_p z\gamma + 2c\sqrt{K_p}$ where $K_p = \tan^2(45+\phi/2)$
As can be seen in the above equations, there is a significant difference between active and passive stresses. (QAP 6.2 review criteria 3.11) {4th Release Comment 27 by John Peters}

48. Page 8: Where is the quantitative design criteria in Section 6. There is no quantitative design criteria in the ESFDR regarding excavation and ground support. The Department of Energy (DOE) states that the quantitative criteria does not belong in the ESFDR, they feel that quantitative criteria should be established in the subtier design documents to the ESFDR. However, it is apparent that this quantitative design criteria has not been picked up in the ESFDR subtier design documents. Quantitative design criteria establishes what criteria the designers are designing to and what criteria the design validation and performance confirmation process are evaluating the design and its performance to. Examples of this could consist of identifying factors of safety or AISC design limits. Other examples could include identifying operational or construction dimension constraints, possibly with regard to

the TBM as stated on page 11, paragraph 4. It should also be noted that the QAP section which defines criteria, states that criteria can only be derived from the requirements documents. This is a Catch-22 situation, since the DOE states that no quantitative criteria shall be included in the ESFDR. Therefore, it is impossible to include quantitative criteria design documents or requirements documents with the present mandates from DOE and the criteria definition in the QAP. (QAP 6.2 review criteria 3.11) {4th Release Comment 26 by John Peters}

49. The Schmidt-Hammer Tests were conducted by Scientific Applications International Corporation personnel at the Sample Management Facility (SMF). This testing was not performed under a qualified "Q" program rendering the results as indeterminate. SNL released this as "Q" data to the M&O. There currently is an existing CAR against SNL for identifying non-Q data as "Q". A TBV needs to be established in the analysis for this data. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {4th Release Comment 31 by John Peters}

50. How are the steel sets that are placed to support the nonlithified tuffs going to be supported when the concrete inverts are removed? {4th Release Comment 32 by John Peters}

51. In Specification "Wet/Dry" Shotcrete, Section 1.04C6 the reference to "if applicable" should be removed and replaced with "if reinforcement placement are used" Reference Paragraph 3.12B.(QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 30 by John Peters}

52. In Specification "Wet/Dry" Shotcrete, Section 2.01C it is not clear why additional criteria is levied against the "WET" process shotcrete and not against the "DRY" process shotcrete; shouldn't the criteria be applicable to both processes. {5th Release Comment 31 by John Peters}

53. In Specification "Wet/Dry" Shotcrete, Section 2.01.4c have the manufacture's procedures been identified to establish this criteria. Reference American Concrete Institute (ACI) 506.2,section 1.7.4.(QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 32 by John Peters}

54. In Specification "Dry" Shotcrete, Section 3.04A add

drawings or as necessary for worker safety." (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 33 by John Peters}

55. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.12 B: There is no mention of the requirement to inspect and/or clean the rock surface prior to shotcreting to ensure that it is a clean surface and there is no loose rock. See ACI 506.2-7, Section 3.2.4 for recommendation. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance** {5th Release Comment 12 by John Peters}

56. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.09: This section is not consistent with ACI 506.2-7, Section 3.7 and ACI 308-81, Section 3.4.3. (QAP 6.2 review criteria 3.11) {5th Release Comment 13 by John Peters}

57. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.09 C: Why not use liquid, membrane-forming, curing compounds? Do they have undesirable TFM's. {5th Release Comment 14 by John Peters}

58. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 2.02 A: Change "unconfined compressive strength of 34.5 MPa f_c' " to "unconfined compressive strength (f_c') of 34.5 MPa". (QAP 6.2 review criteria 3.11) **Corrected during the Surveillance.** {5th Release Comment 15 by John Peters}

59. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 2.02: Where is the calculations or analysis document referenced for the shotcrete mix design? It is assumed that all the shotcrete mix design material data is known at this time and the A/E would perform the mix design for the construction contractor. {5th Release Comment 16 by John Peters}

60. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, the requirement in ACI 506.2-4, Section 1.6.3.2 "Field cure panels in the same manner as the work, except that the test specimens shall be soaked in water for a minimum of 40 hours prior to testing" has not be addressed in the Specifications. (QAP 6.2 review criteria 3.11) {5th Release Comment 24 by John Peters}

61. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, there is no reference to the ACI 506.2-5, Section 2.2.1 or ACI 506R-9, Section 2.4.1 recommendations for combined gradation limits for coarse and fine aggregates. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 18 by John Peters}

62. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, there is no reference in the Specifications to the ACI 506.3R-91 certification requirements of shotcrete nozzlemen. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 19 by John Peters}

63. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, the strength acceptance criteria identified in ACI 506.2-4, Section 1.6.3.3, has not been addressed in this Specification. (QAP 6.2 review criteria 3.11) {5th Release Comment 20 by John Peters}

64. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 2.02 B does not completely address ACI 506.2-4, Section 1.6.4.2, regarding panel construction. The dimensions recommended in the ACI Standard are 762 x 762 mm with the third dimension being equal to the dimension of the structure, but not less than 76 mm. Also it recommends providing the same reinforcement as in the structure in at least half of the panel to test for proper embedment of reinforcing steel.(QAP 6.2 review criteria 3.11) **This is part of the extent of the deficiency documented in CAR YM-94-065** {5th Release Comment 21 by John Peters}

65. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.04 does not seem to adequately address the placement recommendation in ACI 506.2-6, Section 3.3. There are numerous important placement details identified in ACI 506.2-6, Section 3.3 that are not addressed or referenced in this Specification. (QAP 6.2 review criteria 3.11) {5th Release Comment 22 by John Peters}

66. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.05: The last sentence which addresses placement of shotcrete around welded wire fabric, should be moved under Section 3.04 "Shotcrete Placement." (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 23 by John Peters}

67. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, there is no mention in the Specifications of shotcrete slump recommendations as described in ACI 506R-27, Sections 6.3.2, 8.4.2, and 8.5.3. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 24 by John Peters}

68. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 2.02 C: The third sentence does not make sense. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 25 by John Peters}

69. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.01 A: What certification and training will be required? Reference the Standard defining the certification or training. {5th Release Comment 26 by John Peters}

70. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.12 D: Reference where the shotcrete core grading came from.(QAP 6.2 review criteria 3.11) {5th Release Comment 27 by John Peters}

71. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.12 E: The first two requirements in this section refer to Paragraph 3.12B. This is the wrong reference since Paragraph 3.12B addresses inspection and not evaluation of strength test results. (QAP 6.2 review criteria 3.11) **Corrected during the surveillance.** {5th Release Comment 28 by John Peters}

72. DI # BABEAB000-01717-6300-03363, Wet Process Shotcrete, Section 3.12 F: Shotcrete slump and air entrainment are not addressed in this section. Wouldn't they be appropriate items to monitor. (QAP 6.2 review criteria 3.11) {5th Release Comment 29 by John Peters}

Block 10 (continued) Surveillance Conclusions:

Through comment resolution and discussions with the A/E, it was determined that Design Package 2C products meet appropriate QARD requirements. However, the surveillance team found evidence that analyses supporting Design Package 2C were not sufficiently developed or checked in accordance with prescribed procedures. As a result there is a potential that some of these analyses may not be entirely adequate to support further design. These deficiencies, as identified in Section 9 above, are considered to be part of the extent of the deficiencies already documented in CARs YM-94-065 and YM-94-072.

Attachment 1

Objective Evidence Reviewed

1) Reviewed Inputs lists for Drawings and Specifications
Drawings:

BABEAB000-01717-2100-40152 -TS North Ramp Ground Support - Category 1 Revision 01 Elevation and Section

BABEAB000-01717-2100-40153 -TS North Ramp Ground Support - Category 2 Revision 01 Elevation and Section

BABEAB000-01717-2100-40154 -TS North Ramp Ground Support - Category 3 Revision 01 Elevation and Section

BABEAB000-01717-2100-40155 -TS North Ramp Ground Support - Category 4 Revision 01 Elevation and Sections

BABEAB000-01717-2100-40156 -TS North Ramp Ground Support - Category 5 Revision 01 Elevation and Sections

BABFA0000-01717-2100-41111 -TS North Ramp Piping Brackets Installation

BABFA0000-01717-2100-41121 -TS North Ramp Cable Tray Supports Elevation, Details, Sections

BABFA0000-01717-2100-41130 -TS North Ramp, Ventilation Brackets, Elevations, Details

BABEAB000-01717-2100-41101-03 -TS North Ramp Steel Sets & Lagging Elevation

BABEAB000-01717-2100 -41102-03 -TS North Ramp Steel Sets & Lagging Sections & Details

BABEAB000-01717-2100-41103-03 -TS North Ramp Steel Sets & Lagging Sections & Details

SPECIFICATIONS:

BABE00000-01717-6300-03362 -Dry Process Shotcrete

BABE00000-01717-6300-03363 -Wet Process Shotcrete

BAB000000-01717-6300-01501 -Subsurface General Construction Revision 02

BABEAB000-01717-6300-02341 -Steel Sets & Accessories, Subsurface

BABEAB000-01717-2100-40151 -TS North Ramp Ground Support Master Revision 01 Elevation and Sections

BABEAB000-01717-6300-02165 -Rockbolts & Accessories Revision 04

Drawings:

BABEAB000-01717-2100-40152 -TS North Ramp Ground Support - Category 1 Revision 01 Elevation and Section

BABEAB000-01717-2100-40153 -TS North Ramp Ground Support - Category 2 Revision 01 Elevation and Section

BABEAB000-01717-2100-40154 -TS North Ramp Ground Support - Category 3 Revision 01 Elevation and Section

BABEAB000-01717-2100-40155 -TS North Ramp Ground Support - Category 4 Revision 01 Elevation and Sections

BABEAB000-01717-2100-40156 -TS North Ramp Ground Support - Category 5 Revision 01 Elevation and Sections

BABFA0000-01717-2100-41111 -TS North Ramp Piping Brackets Installation

BABFA0000-01717-2100-41121 -TS North Ramp Cable Tray Supports Elevation, Details, Section

BABFA0000-01717-2100-41130 -TS North Ramp, Ventilation Brackets, Elevations, Details

BABEAB000-01717-2100-41101-03 -TS North Ramp Steel Sets & Lagging Elevation

BABEAB000-01717-2100-41102-03 -TS North Ramp Steel Sets & Lagging Sections & Details

BABEAB000-01717-2100-41103-03 -TS North Ramp Steel Sets & Lagging Sections & Details

SPECIFICATIONS:

BABE00000-01717-6300-03362 -Dry Process Shotcrete

BABE00000-01717-6300-03363 -Wet Process Shotcrete

BAB000000-01717-6300-01501 -Subsurface General Construction Revision 02

BABEAB000-01717-6300-02341 -Steel Sets & Accessories, Subsurface

BABEAB000-01717-2100-40151 -TS North Ramp Ground Support Master Elevation and Sections Revision 01

BABEAB000-01717-6300-02165 -Rockbolts & Accessories Revision 04

Analysis:

Requirements Allocation Analysis for Furnishings, CII: BABEAC000

Requirements Allocation Analysis for linings and Ground Support, CII: BABEAB000

BABEAB000-01717-0200-00002, Revision 2 and Revision 4 -Structural Steel Sets Analysis

BABEAB000-01717-0200-00010 -TS North Ramp Ground Support Scoping Analysis

BABEAB000-01717-0200-0003 -Material Dedication Analysis for Commercial Grade items-Steel Sets

BABEAB000-01717-0200- 00005 -TS North Ramp Mass Classification Analysis

BABEAB000-01717-0200-00006 -TS North Ramp Alcove Ground Support Analysis

Determination of Importance Evaluation (for 2 C) BAB000000-01717-2200-00005

BABEAC000-01717-0200-00006 Ventilation Duct Supports

Other Documents

Yucca Mountain Site Characterization Project Geoengineering Characterization of Nonlithified Tuffs to be Encountered by the North Ramp West of the Bow Ridge Fault, SLTR94-001 Revision 7, dated October 1, 1994.

Attachment 2

Personnel Contacted

Alden Segrest	M&O	MGDS Design Manager
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