



Department of Energy

Washington, DC 20585

QA: QA

FEB 06 2002

R. W. Andrews, Manager
Science and Analysis Project
Bechtel SAIC Company, LLC
1180 Town Center Drive, M/S 423
Las Vegas, NV 89144

VERIFICATION OF CORRECTIVE ACTION AND CLOSURE OF DEFICIENCY REPORT
(DR) BSC-01-D-133 RESULTING FROM THE OFFICE OF QUALITY ASSURANCE (OQA)
AUDIT BSC-ARP-01-04

The OQA staff has evaluated the corrective action of DR BSC-01-D-133 and determined the results to be satisfactory. As a result, the DR is considered closed.

If you have any questions, please contact either James Blaylock at (702) 794-1420 or
F. Harvey Dove at (702) 794-5025.

OQA:JB-0625

Enclosure:
DR BSC-01-D-133

James Blaylock for
Ram Murthy, Acting Director
Office of Quality Assurance



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8. ☒ THIS IS A DEFICIENCY REPORT
☐ CORRECTIVE ACTION REPORT

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DEFICIENCY/CORRECTIVE ACTION REPORT

1. Controlling Document:

- (I) Quality Assurance Requirements Description, DOE/RW-0333P,
Revision 10 (QARD)
(II) Calculations, AP-3.10Q, Revision 0, ICN 03, BSCN 1

2. Related Report No.:

BSC-ARP-01-04

3. Responsible Organization:

Bechtel SAIC Company, LLC (BSC)/Science and
Analysis/Total Systems Performance Assessment
(TSPA)

4. Discussed With:

Robert Andrews, Jerry McNeish, Donald Kalinich, Steven
Swenning

5. Requirement:

- (I) QARD, Section 3.2.3, Design Analysis
"C. Calculations shall be identifiable by subject (including structure, system, or component to which the calculation applies), originator, reviewer, and date, or by other designators such that the calculations are traceable."
Traceability - The ability to trace the history, application, or location of an item, data, or sample using recorded documentation (QARD, Revision 10, page 53).
(II) AP-3.12Q, Section 2.0, Applicability
"This procedure applies to the Management Operating Contractor and the U.S. Geological Survey engaged in the performance of calculations subject to the QARD."
(III) AP-3.12Q, Section 5.2, Calculation Checking,
5.2.3a) 3) "Check that calculation results (including computer outputs) are reasonable compared to inputs."

6. Description of Condition:

Contrary to requirement (I), the TSPA-SR Model sensitivity analyses (calculations) listed in Table G-1 of the TSPA-SR (TDR-WIS-PA-000001, Revision 00, ICN 1) Appendix G are not identifiable by their subject, originator, reviewer and date. The recorded information in Table G-1 does not sufficiently trace the history of the calculations.

(Continued on page 2)

7. Initiator:

F. Harvey Dove
Floyd H. Dove

Date 09/12/01

9. Does a stop work condition exist? (Not required for a DR)

☐ Yes ☐ No

If Yes, Check One: ☐ A ☐ B ☐ C ☐ D

10. Recommended Actions:

(Continued on page 2)

11. QA Review:

QAR

F. Harvey Dove
Floyd H. Dove

Date 09/12/01

12. Response Due Date:

10 Working Days From Issuance

13. DOQA Issuance Approval:

Printed Name RAM MURPHY, ACTING

Signature

James B. Layford Jr.

Date 9/24/01

22. Corrective Actions Verified:

QAR

F. Harvey Dove

Date 02/01/02

23. Closure Approved by:

DOE/OQA *James B. Layford Jr.*

Date 2/1/02

Exhibit AP-16.1Q.1

Rev. 12/20/1999

Enclosure

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6 Description of Condition: (continued)

Contrary to requirement (II), no objective evidence was available for the audit team to verify implementation of AP-3.12Q for the development of calculations listed in Table G-1 of the TSPA-SR (TDR-WIS-PA-000001, Revision 00, ICN 1) Appendix G. Members of the TSPA group indicated an initial intent to perform and document the TSPA-SR Model sensitivity analyses (calculations) listed in table G-1 in accordance with AP-3.12Q. These calculations were not performed in accordance with AP-3.12Q. Instead, the calculations were documented per AP-3.11Q. This action deviated from the Technical Work Plan (TWP), TWP-MGR-PA-000001, Revision 01, which specified that calculations be performed in accordance with AP-3.12Q. This action was consistent with the common root cause of schedule versus quality identified during the root cause analysis for both Corrective Action Reports (CAR) BSC-01-C-001 and BSC-01-C-002.

Contrary to requirement (III), no objective evidence was available for the audit team to verify the checking process for the calculations listed in Table G-1 of the TSPA-SR (TDR-WIS-PA-000001, Revision 00, ICN 1) Appendix G. Members of the TSPA group indicated that internal checks were made as a matter of good scientific practice; however, no records were available to verify that checking had actually occurred.

10. Recommended Actions: (continued)

1. Evaluate the requirements of AP-3.10Q, AP-3.11Q, and AP-3.12Q with respect to the effective verification of the correctness of complex, computer calculations and system analyses such as the TSPA. Propose procedural enhancements, if necessary.
2. Evaluate the requirements of AP-3.10Q, AP-3.11Q, and AP-3.12Q with respect to the adequacy of documentation of calculations and analyses performed using complex computer models such as the TSPA. Propose procedural enhancements, if necessary.
3. Evaluate QARD requirements with respect to documentation and checking of complex computer calculations and analyses such as the TSPA. Propose enhancements to existing requirements, if necessary.

TYPE RESPONSE:

- ☒ Initial
☐ Complete
☐ Amended

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DEFICIENCY/CORRECTIVE ACTION REPORT (RESPONSE)**14a. Immediate Actions:**

The actions for procedures AP-3.10Q and AP-3.11Q with respect to the issues raised in the DR is underway. The two procedures are currently being revised. The current version of the in-process revision of the AP-3.11Q procedure prohibits the documentation of complex, computer calculations (i.e., computer codes controlled by AP-SI.1Q). The in-process revision of AP-3.10Q (now AP-SIII.10Q) changes the procedure to address only model reports rather than either analysis or model reports.

Compliance Date: 30 December 2001

14. Remedial Actions:

Following completion of the procedure revisions for AP-3.11Q, AP-SIII.9Q and AP-SIII.10Q, the training for procedure AP-SIII.9Q will make clear the fact that complex computer calculations, other than associated with model development/validation, can only be documented in accordance with AP-SIII.9Q and cannot be included in AP-3.11Q technical documents.

The Complete Response will be submitted on 14 December 2001.

15. Extent of Condition:

The SSPA is another example of a document prepared to AP-3.11Q that contains calculations. This case, however, was specifically discussed in the TWP and is not an example of the condition described in the DR.

A review of Technical Work Plans prepared during FY 2000 and 2001 will be performed to determine if there are any cases where Work Packages for Performance Assessment (pre 12 February 2001) or Science & Analysis Project (post 12 February) work has calculations with AP-3.12Q as the implementing procedure but contained statements allowing documentation in an AP-3.11Q controlled document. The results of the review will be presented in the Complete Response.

16. Cause: (Attach results of root cause determination prepared in accordance with AP-16.4Q for a significant deficiency.)

There are two root causes for this deficiency. One is that procedure AP-3.11Q did not prohibit the documentation of computer calculations in a technical report. The other is the same as stated in Root Cause #3 of the root cause determination submitted in Corrective Action Reports BSC-01-C-001 and BSC-01-C-002. This root cause is Project Planning and Work Management, which includes the point that production activities were not managed to assure adequate schedule time and resources would be provided to complete the required work with adequate attention to quality. (Although Root Cause #3 is associated with model validation, the cause is equally valid for this DR)

17. Action to Preclude Recurrence:

The concurrence draft of the in-process revision of AP-SIII.9Q will be reviewed to determine if additional procedural enhancements are required to complex, computer calculations. Since the current revision of AP-SIII.9Q is involved with completion of DRs involving model validation, any required procedural enhancements will be included in a subsequent revision to preclude impact on the existing model validation commitments.

18. Due Date: 14 December 2001

- ☒ For submittal of complete response
☐ For completion of corrective

19. Response by: William Watson

William Watson
Date: 26 October 2001 Phone: 5-5550-1111

20. Evaluation: ☒ Accept ☐ Partially Accept ☐ Reject

QAR *T. Harvey Dove* Date *11/04/01*

21. Concurrence:

DOQA *James B. Layford Jr* Date *11/5/01*

Exhibit AP-16.1Q.1

Rev. 12/20/1999

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Block 14a, Immediate Actions (cont.)

The current version of the in-process revision of AP-SIII.10Q only includes calculations associated with development/validation of models. The final version of these procedures will maintain these requirements. Therefore, calculations, such as those contained in Appendix G of TDR-WIS-PA-000001, Rev 00, ICN 1 will no longer be possible under AP-3.11Q or AP-SIII.10Q when these revised procedures go into effect.

TYPE RESPONSE:

- ☐ Initial
☒ Complete
☐ Amended

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DEFICIENCY/CORRECTIVE ACTION REPORT (RESPONSE)**14a. Immediate Actions:**

The actions for procedures AP-3.10Q and AP-3.11Q with respect to the issues raised in the DR are completed. The two procedures have been revised with AP-SIII.9Q and AP-SIII.10Q replacing AP-3.10Q. AP-3.11Q prohibits the documentation of complex, computer calculations (i.e., computer codes controlled by AP-SI.1Q) in a Technical Report. AP-SIII.10Q addresses only model reports, rather than either analysis or model reports, and only includes calculations associated with development/validation of models.

Compliance Date: 26 November 2001

14. Remedial Actions:

The training on procedures AP-SIII.10 Q and AP-SIII.9Q clarify the fact that analyses including complex computer calculations, other than those associated with model development/validation, must be documented in accordance with AP-SIII.9Q. Analyses including complex computer calculations associated with model development/validation must be documented in the model report (AP-SIII.10Q). The planned training was completed on 18 December 2001.

15. Extent of Condition:

The SSPA is another example of a document prepared to AP-3.11Q that contains calculations. This case, however, was specifically discussed in the TWP and is not an example of the condition described below, i.e., the TWP did not contain conflicting statements about governing procedures.

A review of Technical Work Plans (section 6.0 Implementing Documents) and Technical Development Plans (section 4 Implementing Documents) prepared during FY 2000 and 2001 (1 October 1999 to 29 October 2001) has been performed to determine if there are any cases where work plans for the Performance Assessment (pre 12 February 2001) or TSPA (post 12 February) groups contain statements where the implementing procedure for calculations is AP-3.12Q but other statements allow documentation in an AP-3.11Q controlled document. The results of the review are documented in this Complete Response on the Continuation Page. The review shows that this was an isolated instance.

16. Cause: (Attach results of root cause determination prepared in accordance with AP-16.4Q for a significant deficiency.)

There are two root causes for this deficiency. One is that procedure AP-3.11Q did not prohibit the documentation of complex computer calculations, which allowed the conflicting statements in TWP-MGR-PA-000001, Rev 01 to result in documenting complex computer calculations in a Technical Report. The other root cause is the same as stated in Root Cause #3 of the root cause determination submitted in Corrective Action Reports BSC-01-C-001 and BSC-01-C-002. This root cause is Project Planning and Work Management, which includes the point that production activities were not managed to assure adequate schedule time and resources would be provided to complete the required work with adequate attention to quality. (Although Root Cause #3 is associated with model validation, the cause is equally valid for this DR)

17. Action to Preclude Recurrence:

The approved versions of AP-SIII.10Q and AP-SIII.9Q were reviewed to determine if additional procedural enhancements are required for complex, computer calculations. The review was performed by William Watson and is documented herein. The review found that the issues raised by DR 133 were taken into consideration by the procedure author during preparation of AP-SIII.9Q and 10Q such that no further enhancements are required to address the issues. In addition to the procedures, the planning process implemented in the Science & Analysis Project emphasizes that adequate schedule time and resources be provided to complete the required work with adequate attention to quality. The planning direction from Science & Analysis Project management to the Responsible Managers demonstrates this.

18. Due Date: 18 December 2001

- ☐ For submittal of complete response
☒ For completion of corrective

19. Response by: William Watson

William Watson *JW* *JE* *BSC* *AE*
Date: 19 December 2001 Phone: 5-5550 *12/20/01*

20. Evaluation: ☒ Accept ☐ Partially Accept ☐ Reject

21. Concurrence:

QAR *F. Harvey Done* Date *01/07/02*

DOQA *James B. Layfield* Date *1/9/02*

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Block 15, Extent of Condition (cont.)

The review of technical planning documents for the performance of TSPA related work was performed by Jeff Weaver. The documents reviewed included:

- TWP-MGR-PA-000002 REV 00 Technical Work Plan For Total System Performance Assessment- License Application Methods and Assumptions
- TWP-MGR-PA-000003 REV 00 Technical Work Plan For Uncertainty Analysis Approach for total System Performance Assessment – License Application
- TWP-MGR-PA-000004 REV 00 Technical Work Plan For TSPA Sensitivity Analyses for Final Regulations
- TWP-MGR-MD-000017 REV 00 Technical Work Plan For Uncertainty Analysis Letter Report
- TWP-WIS-PA-000001 REV 00 Technical Work Plan For Preparation of the Report, "Conceptual and Computational Structure of the Total System Performance Assessment for the Yucca Mountain site Recommendation"
- TDP-WIS-PA-000001 REV 00 Develop the EBS Radionuclide Transport Abstraction Model for TSPA-LA
- TDP-WIS-PA-000002 REV 00 EBS FEPs/ Degradation Modes Abstraction
- TDP-WIS-PA-000003 REV 00 Total System Performance Assessment – Site Recommendation
- TDP-WIS-PA-000004 REV 00 Performance Assessment and Sensitivity Analyses of Disposal of Plutonium as Can-in-Canister Ceramic
- TDP-WIS-PA-000005 REV 00 Performance Assessment of U.S. Department of Energy Spent Fuel in Support of Site Recommendation
- TDP-WIS-PA-000006 REV00 Performance Assessment of Disposal of Selected U.S. Department of Energy Spent Fuel in High Integrity Cans
- TDP-WIS-PA-000008 REV 01 number of Waste Packages Hit by Igneous Intrusion
- TDP-WIS-PA-000009 REV 00 Total System Performance Assessment (TSPA) Model for Site Recommendation
- TDP-WIS-PA-0000013 REV 00 Total System Performance Assessment (TSPA) Database
- TDP-CRW-PA-000001 REV 00 LADS (EDA II)/ TSPA-DEIS Hybrid Case – Dose Calculations at 20 km for 60 MTHM/acre Base Case Inventory, Expected- Value Calculations at 10,000 and 1 million years post-closure
- TDP-CRW-PA-000002 REV 00 EIS Performance – Assessment Analyses for Disposal of Commercial and DOE Waste Inventories at Yucca Mountain
- TDP-EBS-PA-000003 REV 00 WAPDEG Analysis of Waste Package and Drip Shield Degradation
- TDP-EBS-PA-000004 REV 00 Geochemical Interactions in a Failed Co-Disposal Package for Selected U.S. Department of Energy Spent Fuels
- TDP-EBS-PA-000005 REV 00 Calculation of Mechanical Damage and Failure of DS and WPOB by Rockfall to Support WAPDEG Analysis

No Technical Work Plan or Technical Development Plan had statements that required calculations with AP-3.12Q as the implementing procedure but contained statements allowing documentation in an AP-3.11Q controlled document.

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22. Corrective Actions Verified: (Continued from Page 1)

Corrective action commitments contained in the initial response of November 1, 2001, and subsequent amendments were:

1. Commitment: The current version of the in-process revision of the AP-3.11Q procedure prohibits the documentation of complex, computer calculations (i.e., computer codes controlled by AP-SI.1Q).

Verification: AP-3.11Q, Revision 3, ICN 0, Section 5.1.3e states "Ensure technical reports do not include calculations that require the use of software subject to AP-SI.1Q, *Software Management*."

2. Commitment: The in-process revision of AP-3.10Q (now AP-SIII.10Q) changes the procedure to address only model reports rather than either analysis or model reports.

Verification: AP-3.10Q, *Analyses and Models*, has been replaced with two new Supplement III procedures, AP-SIII.9Q, *Scientific Analyses*, and AP-SIII.10Q, *Models* (effective December 21, 2001).

3. Commitment: The training for procedure AP-SIII.9Q will make clear the fact that complex computer calculations, other than associated with model development/validation, can only be documented in accordance with AP-SIII.9Q and cannot be included in AP-3.11Q technical documents.

Verification: Floyd H. Dove attended the transition overview training for AP-SIII.9Q and AP-SIII.10Q on December 11, 2001, and January 8, 2002. On both occasions, the instructor, Debra Bryan, made clear the fact that complex computer calculations, other than those associated with model development/validation, can only be documented in accordance with AP-SIII.9Q.

4. Commitment: A review of Technical Work Plans prepared during FY 2000 and 2001 will be performed to determine if there are any cases where Work Packages for Performance Assessment (pre February 2001) or Science and Analysis Project (post 12 February) has calculations with AP-3.12Q as the implementing procedure but contained statements allowing documentation in an AP-3.11Q controlled document.

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22. Corrective Actions Verified: (Continued from Page 1)

4. Verification: The review of 19 technical planning documents for the performance of TSPA related work was performed by Jeff Weaver and documented in the complete response of 19 December 2001. The conclusion of the Weaver review was "No Technical Work Plan or Technical Development Plan had statements that required calculations with AP-3.12Q as the implementing procedure but contained statements allowing documentation in an AP-3.11Q controlled document."
5. Commitment: The concurrence draft of the in-process revision of AP-SIII.9Q will be reviewed to determine if additional procedural enhancements are required to complex, computer calculations.

Verification: The QAR confirmed that the approved versions of AP-SIII.9Q and AP-SIII.10Q were reviewed by William Watson to determine if additional procedural enhancements are required for complex, computer calculations. The conclusion of the review is documented in the complete response of 19 December 2001. "The review found that the issues raised by DR 133 were taken into account by the procedure author during preparation of AP-SIII.9Q and 10Q such that no further enhancements are required to address the issues."

The corrective actions for BSC-01-D-133 are complete.

F. H. Harvey Dove
Floyd H. Dove

02/01/02
Date