



Scientific Analysis/Calculation Error Resolution Document

 QA: QA
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Complete only applicable items.

INITIATION

1. Originator: Paul Reimus/Ming Zhu	2. Date: 3/20/08	3. ERD No. ANL-NBS-HS-000039 ERD 01
4. Document Identifier: ANL-NBS-HS-000039 REV02 ACN02	5. Document Title: Saturated Zone In-Situ Testing	

6. Description of and Justification for Change (Identify applicable CRs and TBVs):

I Background Information Summary

This ERD is prepared to resolve CRs associated with *Saturated Zone In-Situ Testing*, ANL-NBS-HS-000039 REV 02 ACN 02.

CR 11153: Editorial changes/additions were made to three DTNs (LA0303PR831231.002, LA0612PR831231.001, and LA0612PR831231.002) went beyond what is allowed by TST-PRO-001 for editorial corrections, so the DTNs were reprocessed as revisions. There are no changes to the actual data in the DTNs, so there are no changes necessary to ANL-NBS-HS-000039 REV 02 ACN 02.

CR 11548: There is a duplicate entry in Section 8.4 of ANL-NBS-HS-000039 Rev 02 ACN 02. The second entry for LA0403PR831231.001 on page 8-27 should be removed (2nd to last entry on page).

CR 11731: Three minor editorial problems were identified with ANL-NBS-HS-000039 REV 02 ACN 02

- There are two Section 6.5.5's in the analysis report. The second Section 6.5.5 should be changed to Section 6.5.6 (p. 6-73) and current Sections 6.5.6 and 6.5.7 should be renumbered to Sections 6.5.7 and 6.5.8, respectively (pp. 6-78 and 6-79, respectively). Corresponding changes should also be made to the document's Table of Contents (p. vi).

Internal references to Section 6.5.5 should be changed to Section 6.5.6 in the following places:

- p. 6-52, end of 2nd paragraph
- p. 6-57, 4th line
- p. 7-2, end of 3rd bullet and last line on page

(see attached)

CONCURRENCE

	Printed Name	Signature	Date
7. Checker	Charles Haukwa		03/20/2008
8. QCS/QA Reviewer	Charles Beach		3-20-08

APPROVAL

9. Originator	Paul Reimus Ming Zhu		3/20/08 3/20/08
10. Responsible Manager	Paul Dixon		3-20-08

(Continued from Block 6)

- p. 7-7, the last two sentences of the 3rd bullet should be changed to:
“Section 6.5 presents the results and interpretations of five single-well injection-withdrawal tracer tests and two cross-hole tracer tests in the saturated alluvium. Several laboratory experiments that have been conducted to support the alluvium field tracer testing efforts are discussed in Appendix H.”
- p. 7-8, 3rd line of first bullet after “Acceptance Criterion 3”: Section 6.5.5 can be kept here, but Section 6.5.6 should be added.

Internal references to Section 6.5.6 should be changed as follows:

- p. 6-19, in 3rd column of the last row of the table on this page: Section 6.5.6 can be kept here, but 6.5.7 should be added.
- p. 7-2, end of the 4th bullet: Section 6.5.6 can be kept here, but 6.5.7 should be added (also, Section G5.4.3 should be changed to G5.4.4 here).
- p. 7-12, the 5th bullet should be changed to:
“Tracer testing and test interpretations at the ATC and Nye County Site 22 are summarized in Sections 6.5.5 and 6.5.6 and discussed in detail in Appendix G, Sections G4 (for groundwater velocity or specific discharge estimates) and G5 (for transport parameter estimates).” Note that Section G.5.4.3 should be changed to Section G.5.4.4 on p. 6-75 (7th line) and on p. 6-79 (3rd line of the paragraph immediately before “Limitations and Uncertainties”).

Internal references to Section 6.5.7 should be changed to Section 6.5.8 in the following places:

- p. 7-8, 3rd line of first bullet after “Acceptance Criterion 3”.
- p. 7-9, 3rd line of 2nd bullet on page.

2. The first sentence of paragraph 2 of Section 1 (p. 1-1) is out of place. It refers to a TWP that is not mentioned prior to this sentence. To address this problem, the following revisions should be made:

- Page 1-1, paragraph 2 should be revised to: “This scientific analysis contributes the following to the assessment of the capability of the SZ to serve as part of a natural barrier for waste isolation for the Yucca Mountain repository system:”
- Page 1-2, paragraph 5 should be revised to: “The work activities in Rev. 02 of this scientific analysis are governed by the work direction and planning document *Technical Work Plan for Saturated Zone Flow and Transport Modeling* (BSC 2006 [DIRS 177375], Sections 1.2.3, 2.1.3, and 2.2.3). Although this TWP was prepared before transition to the Lead Laboratory, it was considered appropriate for developing this report, because it was prepared in compliance with LP-2.29Q-BSC, *Planning for Science Activities* (a BSC procedure (predecessor)), which corresponds to SCI-PRO-002, *Planning for Science Activities* (the Lead Laboratory procedure). There are only very minor deviations from this TWP in this report, and they have no technical impact on this or other SZ analysis and model reports:”

3. The TWP referred to in the third line of Section 2 (p. 2-1, paragraph 1) is identified with an incorrect title. The TWP title should be changed to: “*Technical Work Plan for Saturated Zone Flow and Transport Modeling* (BSC 2006 [DIRS 177375]).”

CR 11864: Section 7.2 of ANL-NBS-HS-000039 REV 02 ACN 02 contains some outdated references to internal sections of the Analysis Report that are no longer correct because of changes made to the report over time. The following changes should be made:

- On p. 7-4, 6th line under Subcriterion (1), change “Appendix F, Sections F1 and F2” to “Appendix F, Sections F1, F2, and F6”.
- On p. 7-4, and the end of the paragraph for Subcriterion (1), the last part of the last sentence should be changed to “including single-well hydraulic testing at the ATC (Section F1), cross-hole hydraulic testing at the ATC (Section F2), and cross-hole hydraulic testing at Nye County Site 22 (Section F6).”
- On p. 7-4, 4th line under Subcriterion (2), change the beginning of the last sentence from “Section F4” to “Section F7”.
- On p. 7-5, 4th line under Acceptance Criterion 4, Subcriterion (2), add “in the fractured volcanics” after “Model uncertainties and limitations”.
- On p. 7-6, 4th line under Subcriterion (3), change “Sections F1 and F2” to “Sections F1, F2, and F6”.
- On p. 7-6, 3rd to last line under Subcriterion (3), add a “)” after “C6.2.5”.
- On p. 7-7, 2nd to last sentence under Subcriterion (5), change this sentence to: “Sections 6.5.3 through 6.5.6 present the results and interpretations of five single-well injection-withdrawal tracer tests and two cross-hole tracer tests in the alluvium.”
- On p. 7-8, 6th line under Subcriterion (3), change “(Appendix D)” to “(Appendix E)”.
- On p. 7-8, 3rd line under Subcriterion (1), change “Sections 6.3.7, 6.5.5, 6.5.7;” to “Sections 6.3.7, 6.5.6, 6.5.8;”. Note that these changes are also suggested for addressing CR 11731.
- On p. 7-8, 4th line under Subcriterion (1), change “Section E10; Appendix G, Sections G3 and G4” to “Section E4; Appendix G, Sections G4, G5, and G6”.
- On p. 7-8, first sentence of Subcriterion (2), change to the following text: “Sections 6.3 and 6.5 (with details in Appendices D, E, G, and H) provide evidence ...”.
- On p. 7-8, last sentence of Subcriterion (2), change to the following text: “Models are demonstrated in Sections 6.3 and 6.5, and in Appendices D and G, to adequately predict field transport test results.”
- On p. 7-8, first line under Subcriterion (4), add “, Section G4” after “Appendix G”.
- On p. 7-8, first sentence of Subcriterion (5), change to the following text: “Sections 6.3 and 6.5, and Appendices D, E, and G show how...”
- On p. 7-9, 3rd line of Subcriterion (2), change “6.5.7” to “6.5.8”. Note that this change is also suggested for addressing CR 11731.
- On p. 7-9, last line of Subcriterion (2), change the end of the sentence to: “Sections G3, G4, and G5.”

The errors identified in CRs 11153, 11548, 11731, and 11864 are analyzed herein for potential impact on the parent report as well as the following technical products that use the information from the parent report.

MDL-NBS-HS-000010 REV 03 ACN 01, *Site-Scale Saturated Zone Transport*

MDL-NBS-HS-000011 REV 03 ACN 01, *Saturated Zone Site-Scale Flow Model*

MDL-NBS-HS-000021 REV 03 AD 02, *Saturated Zone Flow and Transport Model Abstraction*

MDL-MGR-HS-000001 REV 00 ACN 01, *Irrigation Recycling Model*

MDL-NBS-HS-000020 REV 02 AD 02, *Particle Tracking Model and Abstraction of Transport Processes*

ANL-WIS-MD-000027 REV 00, *Features, Events, and Processes for the Total System Performance Assessment: Analyses*

MDL-WIS-PA-000005 REV 00, *Total System Performance Assessment Model/Analysis for the License Application*

MDL-WIS-PA-000005 REV 00 ADD 01, *Total System Performance Assessment Model/Analysis for the License Application*

TDR-MGR-NS-000001 REV 00, *Qualification of Matrix Diffusion Data from Diffusion Cell Experiments*

This ERD also addresses the following TBVs, which have no impact on the conclusions of the analysis report or on any downstream products. A brief description of the TBVs and the original plans for resolving them are as follows. oppro

TBV-8378: On the title page of Appendix R of the parent report, the cited DTN should be changed from DTN: LA0705PR150304.006 to DTN LA0705PR150304.003. This TBV will be resolved when DTN LA0705PR150304.003 [DIRS 181201] records package is viewable and can be verified.

TBV-8380: DTN: LA0705PR150304.005 should not be listed as a source to Table R-2 of the parent report, but it should be given as a source for Figures N-2, N-3, N-4 and N-5 and Table N-1 of the parent report. Also, DTN: LA0705PR150304.006 should not be listed as a source for Figures N-2, N-3, N-4 and N-5. This TBV will be resolved when DTN LA0705PR150304.003 [DIRS 181201] records package is viewable and can be verified.

TBV-8392: The citation to *Particle Tracking Model and Abstraction of Transport Processes* incorrectly cites MDL-NBS-HS-000020 REV 03 [DIRS 177397], which was never produced. The correct citation should be MDL-NBS-HS-000020 REV 02 AD02 [DIRS 184748]. This TBV will be resolved when [DIRS 177397] is approved and values cited are verified.

TBV-8395: There are three occurrences where the citation to the SZ flow model AMR points to an incorrect location or should be referencing the SZ Flow and Transport Model Abstraction AMR instead. This TBV will be resolved when [DIRS 177391] is approved and values cited are verified.

II Inputs and/or Software

Direct inputs to this error resolution analysis include the following DTNs: DTN LA0705PR150304.003 [DIRS 181201]; DTN LA0705PR150304.005 [DIRS 181211]; and DTN LA0705PR150304.006 [DIRS 181212].

No software controlled under IM-PRO-003, *Software Management*, is used in this analysis.

III Analysis and Results

III.1 Analysis of CRs

CR 11153 involves minor revisions to three DTNs (LA0303PR831231.002, LA0612PR831231.001, and LA0612PR831231.002). None of these revisions involve any changes to data in the DTNs, so there is no impact on ANL-NBS-HS-000039 REV 02 ACN 02, its conclusions, or on any downstream products. This CR is strictly focused on improving data traceability.

CR 11548 involves a duplicate entry in Section 8.4 (Output Data, Listed by Data Tracking Number) of ANL-NBS-HS-000039 REV 02 ACN 02. The duplicate entry should be removed, but the problem has no impact on the conclusions of the analysis report or on any downstream products.

CR 11731 involves three minor editorial problems that were identified in ANL-NBS-HS-000039 REV 02 ACN 02. These problems have no impact on the conclusions of the analysis report or any downstream products, but the problem involving two Section 6.5.5s will result in a few incorrect citations by other documents to Section 6.5.5, 6.5.6 or 6.5.7 of ANL-NBS-HS-000039 REV 02 ACN 02 after the second Section 6.5.5 is changed to Section 6.5.6 (see impact evaluation below).

CR 11864 involves several minor errors in internal references to other sections in Section 7.2 (Acceptance Criteria) of ANL-NBS-HS-000039 REV 02 ACN 02. These errors reflect lack of updating of Section 7.2 as changes and additions were made to the analysis report, and they have no impact on the conclusions of the analysis report or on downstream products.

III.2 Analysis of TBVs

TBV-8378: On the title page of Appendix R of the parent report, the cited DTN should be changed from DTN: LA0705PR150304.006 to DTN LA0705PR150304.003. This is a typographical error that has no impact on the conclusions of the analysis report.

TBV-8380: DTN: LA0705PR150304.005 should not be listed as a source to Table R-2 of the parent report, but it should be given as a source for Figures N-2, N-3, N-4 and N-5 and Table N-1 of the parent report. Also, DTN: LA0705PR150304.006 should not be listed as a source for Figures N-2, N-3, N-4 and N-5. These are typographical errors that have no impact on the conclusions of the analysis report.

TBV-8392: The citation to *Particle Tracking Model and Abstraction of Transport Processes* incorrectly cites MDL-NBS-HS-000020 REV 03 [DIRS 177397], which was never produced. The correct citation should be MDL-NBS-HS-000020 REV 02 AD02 [DIRS 184748]. As a result, two corrections are required: On page 1-3, SNL 2007 [DIRS 177397] should be replaced with SNL 2008 [DIRS 184748]; and on page 8-14, the reference for [DIRS 177397] should be replaced with [DIRS 184748] and the following reference:

SNL (Sandia National Laboratories) 2008. *Particle Tracking Model and Abstraction of Transport Processes*. MDL-NBS-HS-000020 REV 02 AD 02. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20080129.0008.

There are no impacts on the conclusions of the analysis report.

TBV-8395: There are three occurrences where the citation to the SZ flow model AMR points to an incorrect location or should be referencing the SZ Flow and Transport Model Abstraction AMR instead. The following changes should be made:

- On page 6-11 of the parent report, replace the last full sentence with: “The exact location of this transition is uncertain (SNL 2008 [DIRS 183750] Section 6.5.2.2[a] and Table 6-7[a]) and will depend on the direction of the flow pathways from the repository footprint to the compliance boundary.” This will remove the statement about 2 to 10 km of saturated alluvium, which cannot be substantiated.
- On page 6-25 of the parent report, replace (SNL 2007 [DIRS 177391], Table 6-19) with (SNL 2007 [DIRS 177391], Table 6-9)
- On page 6-29 of the parent report, replace (SNL 2007 [DIRS 177391], Section 6.4.3) with (SNL 2008 [DIRS 183750] Section 6.5.2.10).
- In Section 8 of the parent report, add the citation for [DIRS 183750]:

SNL (Sandia National Laboratories) 2008. *Saturated Zone Flow and Transport Model Abstraction*. MDL-NBS-HS-000021 REV 03 AD 02. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20080107.0006.

There are no impacts of any of these errors on the conclusions of the analysis report.

In addition to the above TBVs, the citation to DIRS 101464 in Figure E-40 of the parent report should point to Figure 3 instead of Figure 1.

IV Impact Evaluation

IV.1 Impact Evaluation of CRs

Resolution of CR 11153 involves no changes to any of the data that are analyzed in ANL-NBS-HS-000039 REV 02 ACN 02, and thus there are no changes to ANL-NBS-HS-000039 REV 02 ACN 02. There are no impacts on the conclusions of the analysis report and also no downstream impacts.

Resolution of CR 11548 involves removal of one duplicate entry from ANL-NBS-HS-000039 REV 02 ACN 02. The removal of this entry does not change any of the data or analyses in the document. Thus, there are no impacts on the conclusions of the analysis report and no downstream impacts associated with the CR resolution.

Resolution of CR 11731 involves corrections to three minor editorial problems identified in the CR. These corrections do not change any of the data, analyses or conclusions in the document,

and they have no technical impacts on downstream products. However, the corrections result in the following incorrect citations in downstream products:

In *Site-Scale Saturated Zone Transport*, MDL-NBS-HS-000010 REV 03 ACN 01:

- p. 6-2, halfway down page, citation to DIRS 177394, Section 6.5.6 should be changed to Section 6.5.7.
- p. 7-20, 4th line from bottom, citation to DIRS 177394, Section 6.5.5 should be changed to Sections 6.5.6 and 6.5.7. Also, citation to DIRS 177394, Section G5.4.3 should be changed to Section G5.4.4.

In *Features, Events, and Processes for the Total System Performance Assessment: Analyses*, ANL-WIS-MD-000027 REV 00:

- p. 6-1019, 3rd line of TSPA Disposition, citation to DIRS 177394, Sections 6.3, 6.5.5, and G5.4.3, should be changed to Sections 6.3, 6.5.6, and G5.4.4).

Additionally, in the process of evaluating impacts, the following citation errors in downstream products were identified that are not directly related to the resolution of CR 11731:

In *Saturated Zone Site-Scale Flow Model*, MDL-NBS-HS-000011 REV 03 ACN 01:

- p. 7-3, two citations to DIRS 177394, Section 6.5 should be changed to Section 6.3.
- p. 7-33, 2nd line, citation to DIRS 177394, Section 6.4 should be changed to Section 6.5
- p. 8-6, 10th line, citation to DIRS 177394, Section 6.4 should be changed to Section 6.5

In *Saturated Zone Flow and Transport Model Abstraction*, MDL-NBS-HS-000021 REV 03 AD02:

- p. 6-20, 2nd line, citation to DIRS 177394, Section 6.2 should be changed to Section 6.1

In *Irrigation Recycling Model*, MDL-MGR-HS-000001 REV 00 ACN 01:

- p. 6-25, 3rd line from bottom, citation to DIRS 177394, Appendix F1.2 (2nd occurrence on this page) should be changed to Appendix F6.7

In *Qualification of Matrix Diffusion Data from Diffusion Cell Experiments*, TDR-MGR-NS-000001 REV 00:

- p. 9, 7th line, citation to DIRS 177394, Sections 6.3 and 6.4 should be changed to Sections 6.3 and 6.5

Resolution of CR 11864 involves several minor corrections or additions to Section 7.2 of ANL-NBS-HS-000039 REV 02 ACN 02. These corrections do not change any of the data or analyses in the document. Thus, there are no impacts on the conclusions of the analysis report and no downstream impacts associated with the CR resolution.

IV.2 Impact Evaluation of TBVs

As discussed in Section III.2 above, resolution of TBV-8378, 8380, 8392, and 8395 has no impact on the conclusions of the analysis report or on any downstream technical products.