



Scientific Analysis/Calculation Error Resolution Document

QA: QA

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Complete only applicable items.

 3-24-08
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INITIATION

1. Originator: John A. McClure	2. Date: 03/20/2008	3. ANL-EBS-NU-000009 ERD 01
4. Document Identifier: ANL-EBS-NU-000009 REV 00	5. Document Title: Commercial Spent Nuclear Fuel Igneous Scenario Criticality Evaluation	

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

The following changes/corrections are posted to correct the conditions identified in ANL-EBS-NU-000009 REV 00 are given in the following attachments to this ERD.

- A. The condition report, CR 11854, identified the use of an unqualified data source as direct input in the referenced document. The qualification process from SCI-PRO-005 is used to qualify the data for use in the referenced document.
- B. Change an incorrect citation generated by citing a draft version of MDL-MGR-GS-000005 REV 02 to permit resolution of TBV-8487.
- C. Rationale for resolution of TBV-8484.

CONCURRENCE

	Printed Name	Signature	Date
7. Checker	John M. Scaglione		3/21/08
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APPROVAL

9. Originator	John A. McClure		03/21/2008
10. Responsible Manager	Clifford L. Howard <i>made 3-21-08</i> Paul R. Dixon		3-21-08

A. CR 11854

I. Background Information Summary

CR-11854 identifies a parameter used as direct input in ANL-EBS-NU-000009 REV 00 obtained from an unqualified source. This condition was identified during citation checking for resolution of TBV-8487. Table 4-2 in *Commercial Spent Nuclear Fuel Igneous Scenario Criticality Evaluation* (SNL 2007 [DIRS 181373]) cites the weight percent of UO_2 that may be dissolved in basalt from (SNL 2007 [DIRS 177430], Section 6.4.8.3) as direct input that is subsequently used in Section A2.3. However, the source for this datum is an external document cited as indirect input in DIRS 177430. The resolution is to replace the citation of (SNL 2007 [DIRS 177430], Section 6.4.8.3) with (Westrich 1982 [DIRS 100492, Section 3.2).

II. Inputs and/or Software

N/A

III. Analysis and Results

The planning and documentation for the data qualification of the unqualified external source data used as direct input only for the referenced analysis are performed in accordance with SCI-PRO-005, *Scientific Analyses and Calculations*.

Data for Qualification

The external data used as direct input for the analysis documented in ANL-EBS-NU-000009 REV 00 is the solubility of UO_2 in basalt from Westrich 1982 [DIRS 100492] and identified in Table 4-2 and Section A2.3 of ANL-EBS-NU-000009 REV 00.

Method of Qualification Selected

This input is justified in this ERD for use as direct input in ANL-EBS-NU-000009 REV 00 and is considered qualified for intended use within the document in accordance with SCI-PRO-005, *Scientific Analyses and Calculations*, using the criteria found in SCI-PRO-001, *Qualification of Unqualified Data*. The action to be taken in the qualification process follows Method 1, Equivalent QA Program, from Attachment 3 of SCI-PRO-001. The rationale for choosing this method is "The Equivalent QA Program approach may be used for the qualification of unqualified data when the acquisition, development, or processing of data can be demonstrated to be functionally equivalent (i.e., similar in scope and implementation) to the general process requirements of the QARD." (SCI-PRO-001, Method 1. Equivalent QA Program). The evaluation criteria used for the following justification represent a subset of the methods and attributes required for qualification of data per Attachment 4 of SCI-PRO-001, *Qualification of Unqualified Data*. The following information is provided for the source: the full reference citation, a description of the data that were used from the source, and the extent to which the data demonstrate the properties of interest. In addition, one or more of the following criteria is also addressed:

- Reliability of data source
- Qualifications of personnel or organizations generating the data.

The criteria described above meet the requirements of SCI-PRO-001 for justification that information that has been used from outside source can be considered as qualified for intended use.

Justification for the appropriate use of data from the scientific journal article *The Solubility of LWR Core Debris in Sacrificial Floor Material* (Westrich 1982 [DIRS 100482]):

1) Reference:

Westrich, H.R. 1982. "The Solubility of LWR Core Debris in Sacrificial Floor Material." *Journal of Nuclear Materials*, 110, 324-332. Amsterdam, The Netherlands: North-Holland Publishing Company. TIC: 234101 [DIRS 100492].

2) Description of data:

Solubility in weight percent of UO_2 in molten basaltic glasses.

3) Reliability of the data source:

The referenced article, *The Solubility of LWR Core Debris in Sacrificial Floor Material*, was published in the *Journal of Nuclear Materials* which is a peer reviewed scientific journal, thus establishing its reliability as an information source.

4) Qualifications of personnel generating the data:

The author of the above journal article, Henry R. Westrich, was a staff scientist at Sandia National Laboratories and the work was supported by the U.S. Department of Energy for the U.S. Nuclear Regulatory Commission, thus establishing the qualifications of the author and organization where the work was performed.

Based on the assessment made above, data from *The Solubility of LWR Core Debris in Sacrificial Floor Material* (Westrich 1982 [DIRS 100482]) are qualified for use as direct input for ANL-EBS-NU-000009 REV 00. The affected sections, i.e., Table 4-2 and Section A2.3, from ANL-EBS-NU-000009 REV 00 should be updated.

The corrected DIRS report per SCI-PRO-004 is attached to this document and the DIRS report for ANL-EBS-NU-000009 REV 00 should be updated.

IV. Impact Evaluation

These changes do not affect any result or conclusion since only the source for the information and not the information itself is being revised. Likewise, these changes do impact any other technical products. Products evaluated for impact include *Screening Analysis of Criticality Features, Events, and Processes for License Application*. ANL-DS0-NU-000001 REV 00 [DIRS 173869], *Features, Events, and Processes for the Total System Performance Assessment: Analyses*. ANL-WIS-MD-000027 REV 00 [DIRS 183041], and *PWR Radial Burnup Gradient Reactivity Evaluation*. ANL-DSC-NU-000001 REV 00 [DIRS 182953].

B. Resolution of TBV-8487

I. Background Information Summary

In the approved document, information initially in Section 6.7 was moved to Section 6.6.

II. Inputs and/or Software

N/A

III. Analysis and Results

The citations of (SNL 2007 [DIRS 177430], Section 6.7) should be changed to (SNL 2007 [DIRS 177430], Section 6.6). The DIRS report should be updated and citations changed in ANL-EBS-NU-000009 REV 00 in the affected sections which are Sections 6.1 and Appendix A4.

The corrected DIRS report per SCI-PRO-004 is attached to this document.

The resolution plan for TBV-8487 states the TBV “will be resolved when DIRS 177430 is completed and values cited are addressed”. Revising the citations will correct them and complete the TBV-8487 resolution plan.

IV. Impact Evaluation

These changes do not affect any result or conclusion since there no change to input values, nor do they impact any other technical products. Products evaluated for impact include *Screening Analysis of Criticality Features, Events, and Processes for License Application*. ANL-DSO-NU-000001 REV 00 [DIRS 173869], *Features, Events, and Processes for the Total System Performance Assessment: Analyses*. ANL-WIS-MD-000027 REV 00 [DIRS 183041], and *PWR Radial Burnup Gradient Reactivity Evaluation*. ANL-DSC-NU-000001 REV 00 [DIRS 182953].

C. Rationale for resolution of TBV-8484.

I. Background Information Summary

Table 4-2 from ANL-EBS-NU-000009 identifies (SNL 2007 [DIRS 181165], Section 6.3.16) as the source for $\text{Eu}_2(\text{CO}_3)_3$ and $\text{Nd}_2(\text{CO}_3)_3$ as direct input whereas these minerals are not identified in Section 6.3.16.

II. Inputs and/or Software

N/A

III. Analysis and Results

Section 6.5.1 of SNL 2007 [DIRS 181165] states that all the lanthanide fission products (gadolinium, neodymium, samarium, europium) that act as neutron absorbers in the spent fuel are represented by gadolinium in the geochemistry calculations although $\text{Sm}_2(\text{CO}_3)_3$ is identified as a stable form of the carbonate of samarium (SNL 2007 [DIRS 181165], Table 6.3-10). Although $\text{Eu}_2(\text{CO}_3)_3$ and $\text{Nd}_2(\text{CO}_3)_3$ are not identified in (SNL 2007 [DIRS 181165], Section 6.3.16), they are identified in Table 6.3-9 of SNL 2007 ([DIRS 181165]) as solid solutions of "La-carbonate-ss" that were added to the database and included in the output DTN. It is further stated that solid solutions are the most likely form of corrosion products for lanthanide minerals and are used to provide results in Section 6.5.1 of SNL 2007 [DIRS 181165] (SNL 2007 [DIRS 181165], Section 6.5.3.1). The citation of Section 6.3.16 should be revised to Table 6.3-9 in Table 4-2 and Section A6 of ANL-EBS-NU-000009 and the DIRS record revised correspondingly.

The corrected DIRS report per SCI-PRO-004 is attached to this document.

The resolution plan for TBV-8484 states the TBV "will be resolved when DIRS 181165 is completed and values cited are addressed". Revising the citations will correct them and complete the TBV-8487 resolution plan.

IV. Impact Evaluation

These changes do not affect any result or conclusion since input parameters obtained from SNL 2007 ([DIRS 181165]) are unchanged by revising the citation source, nor do they impact any other technical products. Products evaluated for impact include *Screening Analysis of Criticality Features, Events, and Processes for License Application*. ANL-DS0-NU-000001 REV 00 [DIRS 173869], *Features, Events, and Processes for the Total System Performance Assessment: Analyses*. ANL-WIS-MD-000027 REV 00 [DIRS 183041], and *PWR Radial Burnup Gradient Reactivity Evaluation*. ANL-DSC-NU-000001 REV 00 [DIRS 182953].