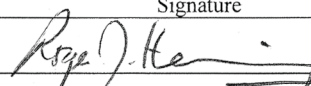
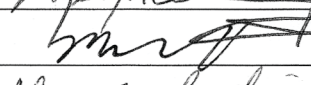
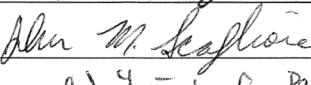
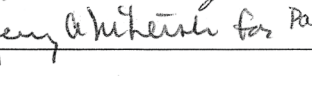
		<b>Scientific Analysis/Calculation Error Resolution Document</b> <i>Complete only applicable items.</i>		QA: QA Page 1 of 4
1. Document Number: CAL-DSD-NU-000007		2. Revision/Addendum: 00A	3. ERD: 01	
4. Title: Intact and Degraded Mode Criticality Calculations for the Codisposal of ATR Spent Nuclear Fuel in a Waste Package			5. No. of Pages Attached: 3	
6. Description of and Justification for Change (Identify affected pages, applicable CRs and TBVs): <b>Introduction:</b> This document is being written as part of an action to resolve CR-10788 to address deficiencies in the documentation of qualification of external source data used as direct input.				
<b>Background Information Summary:</b> During the extent of condition evaluation, a review of CAL-DSD-NU-000007 REV 00A revealed that additional information was required for the qualification of external data to meet the documentation requirements of SCI-PRO-001, <i>Qualification of Unqualified Data</i> . The quality of the data is not in question, only the documentation required by SCI-PRO-001 is insufficient. Therefore, there is no impact on the conclusions of this document and no impacts on the SAR, the LA, or any other documents. This ERD provides the additional documentation necessary to address the deficiencies.				
<b>Technical product change:</b>  Adding a couple of paragraphs to provide the justification of external source data for its intended use (see attached), and an additional three references.				
<b>Impact Evaluations/Results:</b> The following documents were evaluated for impact: 190-00C-CH00-00100-000-00B, ANL-DS0-NU-000001 Rev 00, ANL-WIS-MD-000027 Rev 00, CAL-DS0-NU-000005 Rev 00B, and the LA-SAR. No document is impacted by this change as the ERD only provides additional transparency for the use of an external source and qualifies it for its intended use within this technical product.				
	Printed Name	Signature	Date	
7. Checker	Roger J. Henning		4/17/2009	
8. QCS/QA Reviewer	Brian T. Mitcheltree		4/17/09	
9. Originator	John M. Scaglione		4/17/09	
10. Responsible Manager	Paul R. Dixon		4.22.09.	

### **ERD Change 1: Add the following text to Section 5**

The following method was selected for qualification of external source data used from Stout and Leider (1997) as outlined in Attachment 2 of SCI-PRO-001, *Qualification of Unqualified Data*:

**Method 2, Corroborating Data.** The rationale for using this method is that a qualified report developed by the waste generator, which represents the most authoritative source for this type of information, confirms that the selected value for use is reasonable and bounding for its intended use.

Qualification process attributes used are selected from the list provided in Attachment 3 of SCI-PRO-001, which represent the acceptance criteria used to determine if the data are qualified. Stout and Leider (1997) provide the Savannah River Site glass density in addition to other radioactive waste form characteristics. The following process attributes were used to assess the external data:

1. *The extent to which the data demonstrate the properties of interest (e.g., physical, chemical, geologic, mechanical)*
2. *Extent and quality of corroborating data or confirmatory testing results.*

Stout and Leider (1997) provide a consolidated source of radioactive waste form material characteristics taken from open literature. The data provided is considered to be the best available for the properties of interest, and was collected by a reputable source – Lawrence Livermore National Laboratory (Stout and Leider 1997). The value required was the mass density for the Savannah River Site glass composition which this report provides. Therefore, criterion 1 is satisfied. Ray 2007 is a qualified report that provides a recommended glass density for use in analysis. The recommended value is 2.64 Kg/L (2.64 g/cm<sup>3</sup>) (Ray 2007, Section 3) which is just slightly under the value reported in Stout and Leider 1997 of 2.69 g/cm<sup>3</sup> for the glass density at 825°C and 2.85g/cm<sup>3</sup> at 25°C. This demonstrates that the density value used from Stout and Leider is reasonable. Thus, criterion 2 is satisfied.

Based on the assessment made above, data qualification method 2 has been satisfied and the glass density data from Stout and Leider 1997 is qualified for use as direct input for this analysis.

### **ERD Change 2:**

Add the following references to Section 7.1:

Ray, J.W. 2007. *Projected Glass Composition and Curie Content of Canisters from Savannah River Site(U)*. X-ESR-S-00015, Rev. 1. [Aiken, South Carolina]: Washington Savannah River Company. ACC: MOL.20070703.0427.

Kim, S.S.; Pope, C.; and Taylor, L.L. 2007. *Criticality Analysis for Proposed Maximum Fuel Loading in a Standardized SNF Canister with Type 1a Baskets*. EDF-NSNF-068, Rev. 0. [Idaho Falls, Idaho: Idaho National Laboratory]. ACC: RPM.20080502.0001.

NEA (Nuclear Energy Agency) 2006. *International Handbook of Evaluated Criticality Safety Benchmark Experiments*. September 2006 Edition. NEA/NSC/DOC(95)03. [Paris, France]: Nuclear Energy Agency, Organisation for Economic Co-Operation and Development. TIC: 259708.

### **ERD Change 3: Add the following text to Section 5**

The following method was selected for qualification of external source data used from Reed (et al. 1992) as outlined in Attachment 2 of SCI-PRO-001, *Qualification of Unqualified Data*:

**Method 2, Corroborating Data.** The rationale for using this method is that a handbook published by the International Criticality Safety Benchmark Evaluation Project as an Organization for Economic Cooperation and Development – Nuclear Energy Agency document confirms that the selected value for use is reasonable.

Qualification process attributes used are selected from the list provided in Attachment 3 of SCI-PRO-001, which represent the acceptance criteria used to determine if the data are qualified. Reed (et al. 1992) provides the ATR  $^{235}\text{U}$  enrichment in addition to other waste form characteristics. The following process attributes were used to assess the external data:

1. *The extent to which the data demonstrate the properties of interest (e.g., physical, chemical, geologic, mechanical)*
2. *Extent and quality of corroborating data or confirmatory testing results.*

Reed (et al. 1992) provides a value for the  $^{235}\text{U}$  enrichment for the fuel which was the required information needed. Therefore, criterion 1 is satisfied. NEA (2006) is an established fact data source prepared by a working group of criticality safety personnel from the international community representing 19 countries. The handbook is recognized by the criticality safety community as the authoritative source for criticality benchmarks. One of the experiments evaluated involved the use of ATR fuel – experiment HEU-MET-THERM-022. Within NEA (2006, HEU-MET-THERM-022, Section 2.1.1) the fuel enrichment is specified as 93 wt% enriched with an uncertainty of 1.0 wt%. This value is in direct agreement with the value used from Reed (et al. 1992). Thus, criterion 2 is satisfied.

Based on the assessment made above, data qualification method 2 has been satisfied and the  $^{235}\text{U}$  enrichment data from Reed (et al. 1992) is qualified for use as direct input for this analysis.

### **ERD Change 4: Add the following text to Section 5**

The following method was selected for qualification of external source data used from Paige (1969) as outlined in Attachment 2 of SCI-PRO-001, *Qualification of Unqualified Data*:

**Method 5, Technical Assessment.** The rationale for using this method is that the documentation or proof of proper data acquisition is unavailable for review. The evaluation was performed independently from the data collection or data reduction process and by a subject matter expert. For Method 5, two “actions to be taken” from SCI-PRO-001 are considered: (b) determination that confidence in the data is warranted and (c) confirmation that the data have been used in similar applications.

Qualification process attributes used in the technical assessment of the external sources are selected from the list provided in Attachment 3 of SCI-PRO-001, which represent the acceptance criteria used to determine if the data are qualified. The following process attributes were used to assess the external data:

1. *The extent to which the data demonstrate the properties of interest (e.g., physical, chemical, geologic, mechanical);*
2. *Qualifications of personnel or organizations generating the data are comparable to qualification requirements of personnel generating similar data under an approved program that supports the YMP License Application process or post closure science;*
3. *Prior uses of the data and associated verification processes;*

Paige (1969) provides a detailed description of the ATR fuel elements, such as the fuel core composition, volume, and dimensions. The following statement comes from the Summary section of the report: “This report contains a summary of available information on the composition and structure of the uranium-aluminum alloy fuel elements used in the test reactors at the National Reactor Testing Station.” ATR is one of the reactors at the National Reactor Testing Station, so the report contains the information needed to describe the fuel elements. Therefore, criterion 1 is satisfied. The report was prepared by the Idaho Nuclear Corporation (National Reactor Testing Station, Idaho Falls, Idaho) for the U.S. Atomic Energy Commission. The information contained in the report was based on original fuel specifications for the reactors. When the report was written, the information served as the basis for reprocessing spent fuel from the test reactors. The data contained in the report was used for designing fuel storage in “wet basins”, criticality analyses related to wet basin storage and transport in the cask used to charge the fuel assemblies into the dissolver vessel, flowsheet development for predicting quantitatively the amount of nitric acid needed to dissolve the fuel assemblies, and fissile accountability bases for special nuclear material during reprocessing. Therefore, criterion 2 is satisfied.

The details of the ATR fuel elements contained in Paige (1969) have been used in a recent National Spent Nuclear Fuel Program engineering design file (Kim et al. 2007, p. 17). The EDF was developed to support a presentation to the U.S. Nuclear Regulatory Commission (NRC) relative to criticality risks in a DOE standard canister and to support justification of moderator exclusion from the canister during transport. Therefore, criterion 3 is satisfied.

Based on the assessment made above, data qualification method 5 has been satisfied and the data from Paige (1969) is qualified for use as direct input for this analysis.