Scientific Analysis/Calculation Error Resolution Document

Complete only applicable items.

INITIATION

1. Originator:	2. Date:	3. ERD No.
Roger Henning / Palmer Vaughn	04/24/2008	ANL-WIS-MD-000024 ERD 01

4. Document Identifier:	5. Document Title:
ANL-WIS-MD-000024 Rev 01 and ACN 01	Postclosure Nuclear Safety Design Bases

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

I. Background Information Summary

CR 11949 was written to identify that as part of the extent of condition for CR 11854, a citation error was found in ANL-WIS-MD-000024 Rev 01 when referencing DIRS 177430. In the DIRS report and the text (pages 4-4 and A-38), there is reference to Section 6.7 of DIRS 177430. Section 6.7 does not exist. The correct reference is to 6.6.7. In both instances in the document (as well as the DIRS report), reference to 6.7 is corrected to 6.6.7.

CR 12003 was written to identify that an inconsistency was found between the SAR and the Postclosure Nuclear Safety Design Bases report. The SAR is correct and in line with the changes that were in response to review comments received during the concurrent review of the Postclosure Nuclear Safety Design Bases report and SAR. In the main body of the text of the Postclosure Nuclear Safety Design Bases report, changes were made to indicate that commercial SNF cladding is not important to barrier capability. A single FEP 1.2.03.02.0A "Seismic Ground Motion Damages EBS Components (Included)" in Appendix A was not changed to match the body text. The FEP should have been Relates to ITBC as "No" and the Core Parameter Characteristic and Control Parameter Characteristic should all be listed as Non-ITBC. This change also caused Table 7-3 to be changed to reflect that FEP is no longer ITBC.

II Inputs and/or Software

There are no direct inputs to this error resolution analysis. No software controlled under IM-PRO-003, Software Management, was used in this analysis.

III Analysis Results and Conclusions

The errors identified in CRs 11949 and 12003 are analyzed herein for potential impact on the parent report as well as on any technical products that use the information from the parent report.

CONCURRENCE

	Printed Name	Signature	Date
7. Checker	Charles Haukwa		05/01/2008
8. QCS/QA Reviewer	Brian Mitcheltree		5/1/08
APPROVAL			
9. Originator	Roger J. Henning		5/1/08
10. Responsible Manager	Palmer Vaughn For Paul R. Dixon		5-6-08

The following controlled and under development documents were evaluated for impacts:

- Document Input Reference System Impact Analysis for:

  DIRS 177464 SNL (Sandia National Laboratories) 2008. *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20080226.0002; DOC.20080314.0004.

- Controlled: 000-30R-MGR0-00500-000-004: *Q-List*

- ANL-WIS-MD-000026 Rev. 00: *Features, Events, And Processes for the Total System Performance Assessment: Methods*

- MDL-NBS-HS-000006 Rev. 03: *UZ Flow Models and Submodels*

- TDR-PCS-SE-000001 Rev. 05, ACN 01, Addendum 01; *Performance Confirmation Plan*

- TDR-PCS-SE-000001 Rev. 05, Addendum 01: *Performance Confirmation Plan*

- TDR-TDIP-ES-000010 Rev. 00: *Total System Performance Assessment Data Input Package for Requirements Analysis for EBS In-Drift Configuration*

- TDR-TDIP-PA-000001 Rev. 00: *Total System Performance Assessment Data Input Package for Requirements Analysis for Subsurface Facilities*

- Under Development: *LA Safety Analysis Report*

A search of DIRS for DTN MO0802ITWITABS.000 yields no records. The ATDT for DTN: MO0802ITWITABS.000 does not show any documents that use this DTN at this time.

There are no open TBVs associated with this document.

The remainder of this ERD consists of revised tables, which address CRs 11949 and 12003. The descriptions of the changes relative to the original tables are provided in Section I. None of these changes result in impacts to the analyses or conclusions in ANL-WIS-MD-00024 REV 01 ACN 01 or to any downstream technical products.

The changes to the following pages in the original document are made:

- DIRS Report. For DIRS 177430, change the section reference from 6.7 to 6.6.7.
- Table 4-1 page 4-4. Change 6.7 to 6.6.7 for DIRS 177430
- Table A-2 page A-38. Change 6.7 to 6.6.7 for DIRS 177430
- Table 7-3 pages 7-21 and 7-22. Delete lines that contain FEP 1.2.03.02.0A under the Feature "Cladding" leaving only FEP 2.1.02.25.0B as ITBC.
- Table A-2 page A-92. For FEP 1.2.03.02.0A, Change the column "Relates to ITBC" to "No". Change the "Core Parameter Characteristic" and "Control Parameter Characteristic" columns to "Non-ITBC" for all parameters.

IV Impact Evaluation for CRs 11949 and 12003

CR 11949 identified two minor typographical errors. The citation was direct input, so it was necessary to be corrected in the document. CR 12003 identified only minor typographical errors for consistency between the SAR and its supporting documentation. There are no impacts to the analyses or conclusions in ANL-WIS-MD-00024 REV 01 ACN 01 or to any downstream technical products. Table 7-3 is the source of DTN MO0802ITWITABS.000 which is revised. An evaluation of users of the DTN shows, that at the present time, no technical products use that DTN.

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CHANGES TO THE DOCUMENT SHOWN ON IMAGES OF THE ORIGINAL DOCUMENT

Copies of the pages showing the corrections are included with this ERD.

(see attached)

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Change required to DIRS Report

45	SNL (Sandia National Laboratories) 2007. *Dike/Drift Interactions*. MDL-MGR-GS-000005 REV 02. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20071009.0015. 177430 Verified	Entire	Table 6-4	In-Drift physical and chemical environment to feature emplacement drift interaction	Indirect Input	N/A	N/A	N/A
		Section ~~6.7~~ 6.6.7 PAH 5/1/08	Table 4-1, Table A-2	Flowing an unlikely magma intrusion into the repository, it is possible that the water chemistry in the emplacement drifts will be altered by basalt-water interactions	Direct Input	Data	Qualified	N/A
		Entire	Table 6-1	List of indirect inputs cited in this document	Indirect Input	N/A	N/A	N/A

Table 4-1. Source of Inputs (Continued)

Citation	Source Title	Specifically Used From	Specifically Used In (this AMR)	Input Description
SNL 2007 [DIRS 177407] (Continued)	EBS Radionuclide Transport Abstraction (Continued)	Section 6.3.4, Table 6.6-1	Table A-2	Diffusion of colloids is not a significant mode of release
		Section 6.3.4.4	Table A-2	If drip shield and waste package are not breached, advective transport of colloids through the invert is more significant than diffusive
		Section 6.5.2.6	Table A-2	Partitioning of released radionuclides from the EBS to the LNB is sensitive to advective flow, but is relatively insensitive to hydrologic properties of the invert
		Section 6.5.2.6, Table 6.4-1	Table A-2	Unsaturated flow occurs through the invert as a result of seepage or drift-wall condensation, imbibition from the host rock, or capillary condensation, and affects the release of radionuclides from the EBS to the LNB features
		Sections 5, 6	Table A-2	Unsaturated flow has been included in the abstractions for flow and transport through the EBS features
		Sections 6.1.1, Table 6.3-2	Table A-2	Only the smallest of colloidal particles, together with any associated radionuclides, may be transported significantly by diffusion in the EBS. Advection is a more significant method of transport in the invert
		Sections 6.3.1.1, 6.3.1.2	Table A-2	If drip shield and waste package are not breached, advective releases are more significant than diffusive from a system performance perspective
		Sections 6.4.1, 6.6.1	Table A-2	Release pulses caused by bathtub behavior of the waste package have been analyzed
SNL 2007 [DIRS 177412]	Engineered Barrier System: Physical and Chemical Environment	Sections 6.8, 6.8.4, 6.13, 6.13.4, 6.14, and 6.15	Table A-2	Chemical characteristics of water in the drift affect the likelihood of potential degradation, deterioration, and alteration of the other EBS components, as well as affecting the transport characteristics of any radionuclides released from the waste package to the invert
SNL 2007 [DIRS 177418]	Dissolved Concentration Limits of Elements with Radioactive Isotopes	Section 8.1	Table A-2	Uncertainty in these solubilities and the effects of waste package internal chemistry variability and uncertainty have been included in the models of waste form release
SNL 2007 [DIRS 177423]	Waste Form and In-Drift Colloids-Associated Radionuclide Concentrations	Sections 4.1.2, 6.3.1, 6.5.1, 6.6.8, 6.3.9	Table A-2	Corrosion product colloids included in the colloid models environment
		Section 6.6.8	Table A-2	Colloid stability in the invert is a function of the aqueous chemical conditions
		Table 4-2; Sections 6.3.2.2, 7.0	Table A-2	Co-precipitation of colloids due to the degradation of HLW glass waste forms has been included in the assessment of total colloidal release from the codisposal waste packages environment
SNL 2007 [DIRS 177430]	Dike/Drift Interactions	Section 6.6.7	Table A-2	Following an unlikely magma intrusion into the repository, it is possible that the water chemistry in the emplacement drifts will be altered by basalt-water interactions

Table A-2. ITBC Analyses of Engineered Barrier System FEPs (Continued)

Feature	FEP Number, Name, and Screening Decision	Discussion of Effect on Barrier Capability	Relates to ITBC[1]	Core Parameter Characteristic[2]	Control Parameter Characteristic[3]
Emplacement Drift	1.2.04.04.0A Igneous Intrusion interacts with EBS Components **Included**	Unlikely igneous intrusion events have the potential to degrade the emplacement drifts, drip shields, waste packages, cladding, waste package internals and waste forms, and waste package emplacement pallets that are contacted by the magma. . While, the number of drifts affected by such an unlikely event can be a significant depending on characteristics of the igneous event, the probability of igneous an igneous event compromising waste emplacement drifts is very small (1.69×10^{-8}, SNL 2008 [DIRS 183478], Volume I, Section 6.5, Table 6.5-2) and dominated by aspects that are beyond the control of design. Drift spacing, drift orientation, and repository layout affect this probability. The impact of the lack of these controls would raise the probability by a maximum of only 2%. This increase is insignificant and does not support an ITBC determination. **FEP Source:** SNL 2008 [DIRS 183041] – 1.2.04.04.0A	No	**Non-ITBC:** Characterization of Igneous Events In-Drift Chemical Environment In-Drift Thermal Environment	**Non-ITBC:** Emplacement Drift Spacing Orientation of Emplacement Drifts Emplacement Drift Configuration Repository Layout Repository Geographic and Geologic Location
Emplacement Drift	1.2.04.04.0B Chemical Effects of Magma and Magmatic Volatiles **Included**	The impact of magmatic volatiles on water chemistry is limited by both time and space and is not considered in the performance assessment. However, following an unlikely magma intrusion into the repository, it is possible that the water chemistry in the emplacement drifts will be altered by basalt-water interactions (SNL 2007 [DIRS 177430], Section 6.6.7). These effects have been included in the TSPA but do not significantly contribute to barrier capability. **FEP Source:** SNL 2008 [DIRS 183041] – 1.2.04.04.0B	No	**Non-ITBC:** In-Drift Chemical Environment Radionuclide Inventory and Source-Term Properties Corrosion Products Properties Invert Materials, Properties, and Configuration Characterization of Igneous Events	**Non-ITBC:** EBS Materials Interactions - Copper

Table 7-3 ITBC Features / Components and ITBC Parameter Characteristics of Engineered Barrier System (Continued)

Feature / Component	Characteristic	Type	Analysis Basis
Waste Package (Continued)	Waste Package Materials, Properties, and Configuration	Core	1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)
			2.1.03.01.0A - General Corrosion of Waste Packages (Included)
			2.1.03.02.0A - Stress Corrosion Cracking of Waste Packages (Included)
			2.1.03.03.0A - Localized Corrosion of Waste Packages (Included)
			2.1.03.10.0A - Advection of Liquids and Solids through Cracks in the Waste Package (Excluded)
			2.1.09.28.0A - Localized Corrosion on Waste Package Outer Surface due to Deliquescence (Excluded)
	Waste Package Outer Barrier Material Specifications	Control	1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)
			2.1.03.01.0A - General Corrosion of Waste Packages (Included)
			2.1.03.02.0A - Stress Corrosion Cracking of Waste Packages (Included)
			2.1.03.03.0A - Localized Corrosion of Waste Packages (Included)
			2.1.09.28.0A - Localized Corrosion on Waste Package Outer Surface due to Deliquescence (Excluded)
	Waste Package Quantities	Control	2.1.03.01.0A - General Corrosion of Waste Packages (Included)
			2.1.03.02.0A - Stress Corrosion Cracking of Waste Packages (Included)
			2.1.03.03.0A - Localized Corrosion of Waste Packages (Included)
			2.1.03.11.0A - Physical Form of Waste Package and Drip Shield (Included)
			2.1.09.28.0A - Localized Corrosion on Waste Package Outer Surface due to Deliquescence (Excluded)
	Waste Package Surface Damage Prior to Closure	Control	2.1.03.08.0A - Early Failure of Waste Packages (Included)
	Waste Package Surface Finish	Control	2.1.03.02.0A - Stress Corrosion Cracking of Waste Packages (Included)
			2.1.03.08.0A - Early Failure of Waste Packages (Included)
	Waste Package Welding Materials	Control	2.1.03.08.0A - Early Failure of Waste Packages (Included)
Cladding	~~Characterization of Seismic Events~~	~~Core~~	~~1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)~~
	Waste Package Thermal Limits	Control	2.1.02.25.0B - Naval SNF Cladding (Included)
	~~Drip Shield Seismic Performance~~	~~Control~~	~~1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)~~
	~~EBS Material Interactions~~	~~Control~~	~~1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)~~

Table 7-3 ITBC Features / Components and ITBC Parameter Characteristics of Engineered Barrier System (Continued)

Feature / Component	Characteristic	Type	Analysis Basis
Cladding (Continued)	~~Seismic Design of Waste Package~~	~~Control~~	~~1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)~~
	Waste Form/Package Internals Materials, Properties, and Configuration	Core	2.1.02.25.0B - Naval SNF Cladding (Included)
	~~Waste Package Materials, Properties, and Configuration~~	~~Core~~	~~1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)~~
	~~Waste Package Outer Barrier Material Specifications~~	~~Control~~	~~1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)~~
Waste Form and Waste Package Internals	As-Emplaced Waste Package-Drip Shield Configuration	Control	1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)
	Characterization of Seismic Events	Core	1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)
	Corrosion Products Properties	Core	2.1.02.09.0A - Chemical Effects of Void Space in Waste Package (Included)
			2.1.09.01.0B - Chemical Characteristics of Water in Waste Package (Included)
	Corrosion Products Properties	Core	2.1.09.02.0A - Chemical Interaction with Corrosion Products (Included)
	Drip Shield Materials, Properties, and Configuration	Core	1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)
	Drip Shield Seismic Performance	Control	1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)
	EBS Material Interactions - Copper	Control	1.2.03.02.0A - Seismic Ground Motion Damages EBS Components (Included)
		Core	2.1.02.01.0A - DSNF Degradation (alteration, dissolution, and radionuclide release) (Included)
			2.1.02.02.0A - CSNF Degradation (alteration, dissolution, and radionuclide release) (Included)
			2.1.02.09.0A - Chemical Effects of Void Space in Waste Package (Included)
			2.1.09.01.0B - Chemical Characteristics of Water in Waste Package (Included)
			2.1.09.02.0A - Chemical Interaction with Corrosion Products (Included)
			2.1.09.04.0A - Radionuclide Solubility, Solubility Limits, and Speciation in the Waste Form and EBS (Included)
			2.1.09.05.0A - Sorption of Dissolved Radionuclides in EBS (Included)

Table A-2. ITBC Analyses of Engineered Barrier System FEPs (Continued)

Feature	FEP Number, Name, and Screening Decision	Discussion of Effect on Barrier Capability	Relates to ITBC[1]	Core Parameter Characteristic[2]	Control Parameter Characteristic[3]
Cladding (Continued)	1.2.02.03.0A Fault Displacement Damages EBS Components **Included** (Continued)	Naval SNF canisters have additional requirements related to emplacement away from faults. For naval SNF packages, these emplacement requirements are important to waste isolation. There is a specific criterion for naval waste packages that requires an 8.2-ft (2.5-m) minimum emplacement standoff distance from mapped faults with vertical displacements greater than 6.5 ft (2 m) (BSC 2007 [DIRS 182131], Section 8.2.3.1.1). Based on this evaluation, this is ITBC (and also ITWI) specifically for naval waste packages. **FEP Source:** SNL 2008 [DIRS 183041] – 1.2.02.03.0A			
Cladding	1.2.03.02.0A Seismic Ground Motion Damages EBS Components **Included**	This FEP does not consider Naval cladding. FEP 2.1.02.25.0B: Naval SNF structure (including cladding) deals with Navy cladding separately. Seismic effects are included in the Seismic Ground Motion Modeling Case of the Seismic Scenario Class. Except for Naval SNF, no credit is taken for cladding integrity in the TSPA. However, cladding provides barrier capability and thus has core and control parameters characteristics that limit its degradation at high temperatures or from mechanical loads. The core and control parameter characteristics identified are not considered to be ITBC because this barrier feature/component is not accounted for in the technical basis. **FEP Source:** SNL 2008 [DIRS 183041] – 1.2.03.02.0A	~~Yes~~ No	**Non-ITBC:** Waste Package Materials, Properties, and Configuration Characterization of Seismic Events ~~**Non-ITBC:**~~ Waste Form/Package Internals Materials, Properties, and Configuration Properties of the Host Rock Unit	**Non-ITBC:** Seismic Design of Waste Package Drip Shield Seismic Performance Waste Package Outer Barrier Material Specifications EBS In-Drift Materials Interactions ~~**Non-ITBC:**~~ As-emplaced Waste Package-Drip Shield Configuration Emplacement Pallet Function Emplacement Pallet Fabrication and Corrosion Allowance