YMP Yucca Mountain Project	**Model Error Resolution Document** *Complete only applicable items.*	QA: QA Page 1 of 8

INITIATION

1. Originator: John Case/Ernest Hardin	2. Date: 07/11/2008	3. ERD No. ANL-NBS-HS-000057 ERD 02
4. Document Identifier: ANL-NBS-HS-000057 REV 00	5. Document Title: Postclosure Analysis of the Range of Design Thermal Loadings	

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

Corrections and clarifications to ANL-NBS-HS-000057 REV 00 are made in response to CR-12172. A justification for no impact to results of the subject AMR, and for other products that use output from this report as direct input, is also included.

CONCURRENCE

	Printed Name	Signature	Date
7. Checker	Charles Haukwa	[signature]	08/21/2008
8. QCS/QA Reviewer	Robert E. Spencer	[signature]	08/25/08
APPROVAL			
9. Originator	John Case/Ernest Hardin	[signature]	8/25/08
10. Responsible Manager	Paul Dixon	[signature]	8.25.08

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CR 12172 Evaluation

I. Background Information Summary

Condition Report (CR) 12172 describes a set of clarifications and corrections needed for *Postclosure Analysis of the Range of Design Thermal Loadings* (SNL 2008 [DIRS 179962]). This document presents the disposition of those issues, identifying specific changes to the AMR, and evaluating the impact of those changes on the conclusions of the AMR.

II. Disposition of Major Issues/ Description of Change

II.1 (Fig. 6.2-1 caption). The caption states that an 85ºC objective was used; the actual objective as noted in the figure itself was 96.8ºC.

AMR Changes:

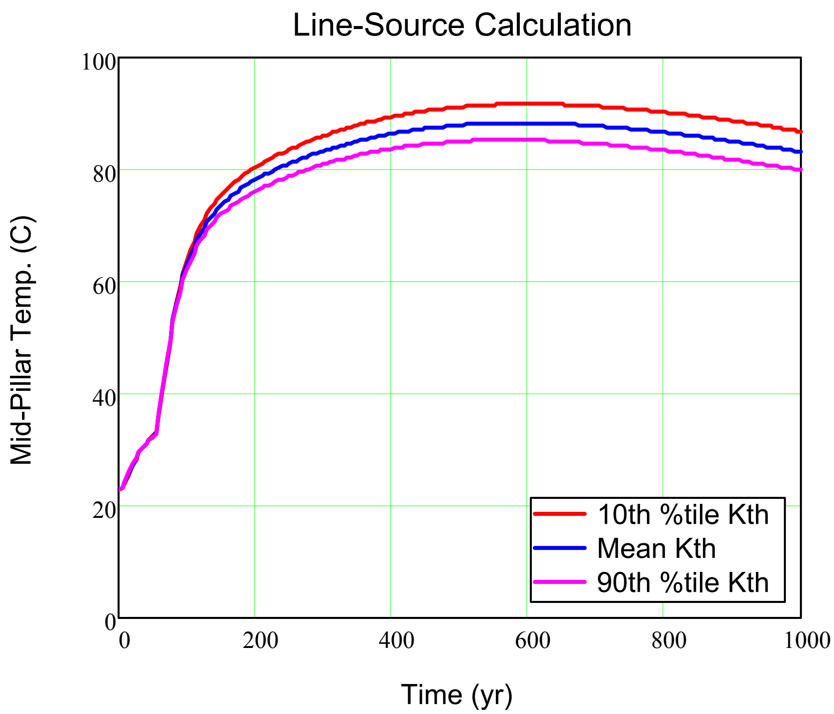
The caption for Figure 6.2-1 is changed to read:

"Figure 6.2-1 Repository Edge Loading Effects for the ELWS Case, Using the 96.8ºC Mid-Pillar Temperature Objective"

II.2 (Fig. 6.2-13 and output DTN MO0705SUPPCALC.000). This figure is reasonable but cannot be traced to the Mathcad file indicated as the source. A revised Mathcad file is provided (filename: *WPIMP vs. Kth (corrected) August 2008.xmcd*) containing a traceable plot for 50-yr ventilation, 86% efficiency, host rock saturation 100%, and neglecting the effect of lithophysal porosity on the (volumetric) heat capacitance. The DTN is revised to include the corrected file.

AMR Change:

Figure 6.2-13 and its accompanying notes are revised as follows:



Source: Output DTN: MO0705SUPPCALC.000, Directory: Other Supporting Files, File: *WPIMP vs. Kth (corrected) August 2008.xmcd*.

NOTES: The 10th percentile, mean, and 90th percentile values for wet thermal conductivity of the lower lithophysal (Tptpll) host unit are 1.69, 1.87, and 2.06 W/m-K, respectively. Calculated using a ventilation duration of 50 years, preclosure ventilation heat removal efficiency of 86%, and neglecting the effect from lithophysal porosity on heat capacitance.

Figure 6.2-13 Mid-Pillar Temperature for a Line-Source Solution, Using the Postclosure Reference Thermal Load and Varying Host-Rock Thermal Conductivity

II.3 (p. 6-42, 2nd full paragraph). The discussion of thermal-hydrologic margin is correct with respect to the explanations on the previous page, but is non-transparent because it was written to a tighter limit that was then relaxed at a later stage in preparing this section.

AMR Change:

The second and third sentences of this paragraph should be modified to read: The calculated peak mid-pillar temperature values (corresponding to WPIMP) range from approximately 85°C to 95°C. The difference between the results for the mean thermal conductivity, and the 10th percentile, is approximately 5 Centigrade degrees (temperatures are even lower for the 90th percentile). This is within the margin of 20 Centigrade degrees discussed above. Hence the mid-pillar temperature limit will be met for the 10th percentile host-rock thermal conductivity, if the infiltration flux is at least 1 mm/yr. For further thermal analyses (e.g., calculations involving conduction-only solutions) a margin of 10 degrees Centigrade is recommended for use based on this discussion. More margin (e.g., 20 degrees Centigrade) could be established by additional simulations to check on the influence of uncertainties pertaining to hydrologic properties, other host rock units, and the amount of condensation predicted to occur above the emplacement drifts.

II.4 (Section 6.4, page 6-74, bullet list). The third bullet should be deleted. Although the original scope of the study did not include three-dimensional thermal-hydrologic (TH) simulations, they were added later to Section 6.4.2.

AMR Change:

Delete the third bullet on page 6-74 in Section 6.4.

III. Inputs and/or Software

There is no change to the input values or to the software.

IV. Impact/Results and Conclusion

Corrections and clarifications have been provided to address CR-12172. There is no impact from these changes to the results or conclusions of the subject AMR. The output DTN MO0705SUPPCALC.000 is revised to add the Mathcad file used to calculate Figure 6.2-13, and the nature of the change does not impact the use of this figure in the text of the analysis. Other products that cite this report are not impacted because they cite only general information that the postclosure thermal limits can be met, that mid-pillar temperature is the controlling postclosure limit, and that thermal conduction-only calculations of postclosure peak mid-pillar temperature have approximately 10 Centigrade degrees (and up to 20 degrees) of associated margin that can be attributed to hydrologic effects.

Table 1. Summary of Documents Citing ANL-NBS-HS-000057 Rev. 00 and the Information Used

<table>
<tr><th>Document Number</th><th>Title</th><th>Description of Information Used</th></tr>
<tr><td>000-00C-DS00-00600-000-00F</td><td>HLW/DOE SNF CO DISPOSAL WASTE PACKAGE DESIGN REPORT</td><td rowspan="6">“…10ºC margin provided by vaporization and movement of water in the rock…”</td></tr>
<tr><td>000-00C-DSC0-00100-000-00B</td><td>TAD WASTE PACKAGE DESIGN REPORT</td></tr>
<tr><td>800-00C-WIS0-00500-000-00B</td><td>EVALUATION OF WASTE STREAM RECEIPT SCENARIOS FOR REPOSITORY LOADING</td></tr>
<tr><td>800-00C-WIS0-00600-000-00B</td><td>TEMPERATURES IN AN "AS-LOADED" AND THERMALLY-MISLOADED DRIFT SEGMENT</td></tr>
<tr><td>800-00C-WIS0-00700-000-00A</td><td>CALCULATION OF TEMPERATURES IN A TWELVE WASTE PACKAGE SEGMENT AT HIGH THERMAL LIMITS</td></tr>
<tr><td>800-IED-MGR0-00403-000-00B</td><td>IED GEOTECHNICAL AND THERMAL PARAMETERS III</td></tr>
<tr><td>ANL-WIS-MD-000020
Rev. 01, including
Addendum 01</td><td>INITIAL RADIONUCLIDE INVENTORIES</td><td>“…the thermal envelope study…evaluates the sensitivity of thermal performance to the potential variability in the waste stream, and the small dimensional changes above are much less significant than that potential variability…”</td></tr>
<tr><td>ANL-DS0-NU-000001
Rev. 00</td><td>SCREENING ANALYSIS OF CRITICALITY FEATURES, EVENTS, AND PROCESSES FOR LICENSE APPLICATION</td><td>“…the interior of the waste packages will be warmer than the external environment for a considerable time period…”</td></tr>
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Table 1. Summary of Documents Citing ANL-NBS-HS-000057 Rev. 00 and the Information Used (continued)

Document Number	Title	Description of Information Used
ANL-WIS-MD-000027 Rev. 00	FEATURES, EVENTS, AND PROCESSES FOR THE TOTAL YSTEM PERFORMANCE ASSESSMENT: ANALYSES	"…the peak waste package surface temperature could exceed 300°C in the event of a low probability seismic-induced drift collapse with low thermal conductivity rubble occurring within the first 90 years following closure…analyses have shown that the mean probability of these conditions occurring is about 1 in 10,000 within the first 10,000 years after closure …within a few hundred years of closure, the waste package surface temperature drops below 200°C…" "…260ºC…is above the maximum drift wall and drip shield temperatures under expected conditions…" "In a collapsed drift with rubble surrounding the drip shield, the peak waste package internal temperature may be conservatively bounded by adding 50°C to the maximum waste package surface temperature of 300°C…" "…drip shield surface temperature will be lower than 300°C except for the low-probability event of a drift collapse within the first approximately 90 years of emplacement…" "…drift wall temperatures of 200°C and rock mass temperatures greater than 250°C were achieved in the Drift Scale Test with only minor effects observed…the anticipated range of thermal loading will result in peak postclosure drift wall temperatures significantly less than 200°C…" "Simulations show that the peak temperature at the bottom of the PTn unit from repository heating will be 43°C, or approximately 25°C hotter than the prerepository in situ temperature…the cited figure also shows that the duration of repository heating at the base of the PTn unit is on the order of 10,000 years…" "…prior to rewetting of the near-field host rock…i.e., prior to approximately 1,000 to 3,000 years, depending on whether drift collapse has prolonged the boiling period in the EBS…" "…The temperature in the nearby Calico Hills Formation reaches a maximum temperature of about 80°C, which is a reasonable approximation for the maximum temperature at the elevated water table…" "…The top of the CHn unit will experience temperatures above ambient, exceeding ~60°C beginning at ~400 years and a peak of ~80°C at ~1,100 years during the thermal period…"

Table 1. Summary of Documents Citing ANL-NBS-HS-000057 Rev. 00 and the Information Used (continued)

Document Number	Title	Description of Information Used
CAL-DN0-NU-000002 Rev. 00C, including Addendum 01	WASTE PACKAGE FLOODING PROBABILITY EVALUATION	"…The accumulation of rubble can also produce a thermal blanketing effect with higher waste package temperature during the first few hundred years after repository closure…" "…the 'unit cell' for postclosure analysis …a separate analysis for a waste stream that is likely to be received at the repository …shows that the global average line load is similar…" "…after the thermal period (e.g., when waste package temperature cools below 90°C after approximately 2,000 years…" "…In the case of drift collapse, the probability of waste package temperatures exceeding 300ºC is low right after repository closure and peaks at about 25 years after closure then continues to decrease (SNL 2008 [DIRS 179962], Section 6.5.1) to a small value after 80 years…" "…Only drift collapse during the first 300 years after repository closure could lead to elevated waste package surface temperatures (>200°C)…"
TDR-TDIP-ES-000006 Rev. 00 TDR-TDIP-ES-000009 Rev. 00 TDR-TDIP-ES-000010 Rev. 00	TOTAL SYSTEM PERFORMANCE ASSESSMENT DATA INPUT PACKAGE FOR REQUIREMENTS ANALYSIS FOR: TRANSPORTATION AGING AND DISPOSAL CANISTER AND RELATED WASTE PACKAGE PHYSICAL ATTRIBUTES BASIS FOR PERFORMANCE ASSESSMENT DOE SNF/HLW AND NAVAL SNF WASTE PACKAGE PHYSICAL ATTRIBUTES BASIS FOR PERFORMANCE ASSESSMENT EBS IN-DRIFT CONFIGURATION	"The interface for the waste packages in the LA design inventory shall have the quantities, dimensions, materials, and characteristics controlled through the Waste Package Configuration IED." "Interfaces for the design waste package decay heat shall be controlled through the Waste Package Decay Heat Generation IEDs."