BSC

Model Administrative Change Notice

Complete only applicable items.

1. Document Number:	MDL-NBS-GS-000004	2. Revision:	01	3. ACN:	01
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6. Approvals:			
Preparer:	G.H. Nieder-Westermann Print name and sign	SIGNATURE ON FILE	02/14/2005 Date
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7. Affected Pages	8. Description of Change:
E-14	Corrected typographical error DTN incorrectly identified as *DB831321AN98*.002 [DIRS 109003]. The correct DTN is *LADB831321AN98.002* [DIRS 109003]. This error was identified in CR 4170.
7-1	Bad Citation In 2nd paragraph change: (BSC 2004 [DIRS 169854], *Table 7-10* and *Table 7-11* To: (BSC 2004 [DIRS 169854], *Table 6-6* and *Table 6-7*. This change is associated with TBV 6062.
7-5	Bad Citation Section 7.2.2 2nd paragraph change: BSC 2004 [DIRS 166107], *Section 6.1.2, 6.1.4.2, and Attachment XV* To: BSC 2004 [DIRS 166107], *Sections 6.1.2 and 6.1.4.2, and Appendix O* This change is associated with TBV 6079
7-8	Bad Citation 1st paragraph change: "It was felt that the angular traverses and panel map data were of similar resolution (BSC 2004 [DIRS 166107], *Attachment XV, Section XV.1*) and therefore the results of the tape measurement data were corrected (BSC 2004 [DIRS 166107], *Attachment XV, Table XV-10*)." To: "It was felt that the angular traverses and panel map data were of similar resolution (BSC 2004 [DIRS 166107], *Appendix O, Section O1*) and therefore the results of the tape measurement data were corrected (BSC 2004 [DIRS 166107], *Appendix O, Table O-10*)." This change is associated with TBV 6079

7. VALIDATION

The purpose of this section is to validate the model by showing how the confidence building criteria were satisfied during and after model development. Section 7.1 explains how the model development process satisfies the criteria in the TWP (BSC 2004 [DIRS 169635] and AP-SIII.10Q. Section 7.2 provides a detailed discussion of the postdevelopment validation of the product output parameters: matrix and lithophysal porosity and bulk density. These validations were demonstrated with data not relied on as direct input in the construction of the model. These parameters are used by *Saturated Zone Flow and Transport Model Abstraction*, MDL-NBS-HS-000021, REV 02 (BSC 2004 [DIRS 170042]).

In contrast, the representations for thermal conductivity and hydraulic conductivity developed in this report are not used as direct input by project documents and will not be validated. Therefore, the representations of thermal conductivity and hydraulic conductivity developed in this report should not be cited as direct input in support of the Total System Performance Assessment for License Application (TSPA-LA). More recent representations of thermal conductivity and hydraulic conductivity are available and should be cited instead. For thermal conductivity the reader is referred to *Thermal Conductivity of the Potential Repository Horizon Model Report*, (BSC 2004, [DIRS 169854], Table 6-6 and Table 6-7) and *Thermal Conductivity of the Non-Repository Lithostratigraphic Layers Model Report*, (BSC 2004 [DIRS 170033], Table 6-13). Similarly, for hydraulic conductivity, the reader is referred to *Analysis of Hydrologic Properties Data* (BSC 2004 [DIRS 170038], Table 6-6).

The level of confidence required for the model validation activity for the rock property model has been determined from the guidelines in AP-2.27Q, Attachment 3, *Levels of Model Importance, Validation, and Confidence* to be Level I for the following reasons. Because the rock properties model does not provide any direct input to the total system performance model, its level of significance depends in part on its association with models that do provide direct input to the TSPA-LA. The rock properties model is associated with the *Saturated Zone Flow and Transport Model Abstraction* MDL-NBS-HS-000021, REV 01 (BSC 2003 [DIRS 167651]) which is a direct feed to the TSPA-LA. The *Saturated Zone Flow and Transport Model Abstraction* has been identified as Level II in Table 1 of AP-2.27Q. However, the *Saturated Zone Flow and Transport Model Abstract* is insensitive to the rock properties model parameters cited when compared to the models overal uncertainty. Citation of the rock properties model parameters are as mean values and used as deterministic or constant values. Accordingly validation Level I applies.

7.1 CONFIDENCE BUILDING DURING MODEL DEVELOPMENT

For Level I validation, Section 2.2.3 of TWP-NBS-GS-000003 REV 05 (BSC 2004 [DIRS 169635]) specifies the following steps for 'Confidence Building During Model Development'. The development of the model should be documented in accordance with the requirements of Section 5.3.2(b) of AP-SIII.10Q. Attachment 3 of AP-2.27Q also provides model validation guidance that is documented in the TWP (BSC 2004 [DIRS 169635] Section 2.2.3).

based on values directly measured from core samples (Table 3-2). These data are qualified and verified and are either supported by a records package or data qualification report that establishes that its adequate for its intended use.

Note that although this validation is only performed for the TSw model layer, it is appropriate to extend it as supporting the validation of the other model layers because all the data used in this corroboration are measured values of matrix porosity. For example, because all the data are measured values and the measurement of matrix porosity on core samples is relatively standardized, differences would most likely indicate differences in sampling. Although a similar corroborative validation could be performed for the other model layers, the known heterogeneity observed in the PTn and CHn layers makes it more appropriate to compare the corroborative data to the matrix porosity histogram distributions, Figures 6.4-6 and 6.4-12, respectively. Corroboration for the Tcp model layer could be performed based on the mean value provided in Table 6.4-10, or the histogram distribution provided by Figure 6.4-14.

7.2.2 Validation: Lithophysal Porosity

The purpose of this section is to validate the model by corroboration of model output representation of lithophysal porosity with data not cited as direct input. The product output values for mean porosity value for the TSw layer is listed in Table 6.4.2 and provided by DTN: SN0004T0501399.003 [DIRS 155045]. The planned approach for validation is corroboration with data that were not used as direct input in the development of the product output of this report. The explicit criterion for successful validation is that the mean value calculated for the corroborating data set should fall within the range defined by the mean value and standard deviation for the model layers listed in Table 6.4-2.

The independent corroborative lithophysal porosity data are collected from the ECRB and presented in Table 7-2. Two sets of ECRB data are available for comparison. The first is provided by Mongano et al., (1999, ACC: MOL.20000324.0614 [DIRS 149850], p. 77, Figure 13), and a second is from the *Drift Degradation Analysis Report*, ANL-EBS-MD-000027, REV 02 (BSC 2004 [DIRS 166107], Sections 6.1.2 and 6.1.4.2, and Appendix O). The lithophysal data that are presented in the Drift Degradation Analysis Report are provided by the DTN: GS021008314224.002 [DIRS 161910].

Table 7-2. Lithophysal Porosity Data Supporting Model Validation

Data Source Description	Reference
ECRB Lithophysal porosity data	ACC: MOL.20000324.0614 [DIRS 149850]
ECRB Lithophysal porosity data	DTN: GS021008314224.002 [DIRS 161910]

ACC = Accession Number; ECRB = Enhanced Characterization of the Repository Block; DIRS = Document Input Reference System; DTN = data tracking number

Corroborating RPM lithophysal porosity data with data acquired from the ECRB is not straightforward. The following factors that complicate the comparison:

- Direct comparison ECRB and borehole data are not possible since the ECRB is oriented horizontally, and boreholes are oriented vertically. For the most part the boreholes transect and, therefore, sample the horizontal formation completely (example,

As illustrated while the tape measurements are available for the entire exposure of the Tptpll zone the mean value of 19.4 percent is high when compared mean value observed for the entire ECRB of 21.3 percent in Mongano et al., (1999 [DIRS 149850]). This is graphically illustrated by examining Figure 7-1. It was felt that the angular traverses and panel map data were of similar resolution (BSC 2004 [DIRS 166107], Appendix O, Section O1) and therefore the results of the tape measurement data were corrected (BSC 2004 [DIRS 166107], Appendix O, Table O-10). This correction shifted the mean value for lithophysal porosity from 19.4 to 13.1 percent that appears to be consistent with the results provided by Mongano et al., (1999 [DIRS 149850]).

The range for validation of lithophysal porosity for the TSw layer is 7.0 to 22.2 percent. The mean values for all of the corroborating data sets are observed to fall within the range defined by model layer, therefore this validation is determined to be successful.

Prior to discussing the adequacy and accuracy of this validation the three factors listed earlier will be addressed. While the three factors complicate the corroboration they do not invalidate it. First, while faults are observed in the ECRB they occur towards the end of the tunnel and do not appear to significantly truncate the Topopah Spring Tuff zones. Second, to account for regional and stratigraphic differences in lithophysal porosity, values from the model could be extracted along the ECRB transect for comparison. However, for the purposes of validating the mean lithophysal porosity value for the TSw layer this activity was not warranted. Third, while none of the ECRB derived data samples the entire TSw model layer the data from Mangano et al., (1999 [DIRS 149850]) nearly does. Further, the examination of the Tptpll zone (BSC 2004, [DIRS 166107] and DTN: GS021008314224.002 [DIRS 161910]) provides results, which are consistent with the results of the Mongano et al., (1999 [DIRS 149850]) data.

In addition the mean value for lithophysal porosity provided by this model report is 14.6 percent. This value is used in the *Saturated Zone Flow and Transport Model Abstraction*, MDL-NBS-HS-000021, REV 02 (BSC 2004 [DIRS 170042]). The mean value from Mongano et al., (1999 [DIRS 149850]) is 21.3 percent. The mean value from the *Drift Degradation Analysis Report* (BSC 2004 [DIRS 166107]) is 13.1 percent. Therefore, the mean values for the two independent corroborating data sets bracket the value provided by this model report. The bracketing of model reports mean value by the two independent data sets provides further confidence that it is appropriate for its intended use.

This validation is deemed to be adequate and accurate for the following reasons: 1) Comparisons between the data used for corroboration with the model's product output the lithophysal porosity values and overall trends are comparable and consistent. The corroborative data are also consistent with the complicating factors that affect the distribution of lithophysal porosity; borehole versus tunnel data, vertical and lateral heterogeneity, and differing stratigraphic divisions. 2) The method of determining lithophysal porosity values differs for the model and the corroborative data set, and both are equally valid. The model's product output was calculated based on borehole geophysical data, while the corroborative data are based on physical measurements or visual observations. Both techniques are valid methods of determining lithophysal porosity.

[DIRS 109003]. Inputs to the Mineralogic Model (MM3.0) (BSC 2004 [DIRS 170031]) in DTN: LA9908JC831321.001 [DIRS 113495] also are derived from DTN: LADB831321AN98.002 [DIRS 109003].

Table E-9. Comparison for Equivalence of USW WT-1 Analyzed Samples Included in Data Packages

MO0101XRDDRILC.001 [DIRS 169517] (depth interval in ft/m)	LADB831321AN98.002 [DIRS 109003] (depth interval in ft)	LA9908JC831321.001 [DIRS 113495] (midpoint elevation in m/depth in ft)
440-450/134.1-137.2	440-450	1065.4/445
500-510/152.4-155.4	500-510	1047.1/505
550-560/167.6/170.7	550-560	1031.8/555
640-650195.1/198.1	640-650	1004.4/645
690-700/210.3-213.4	690-700	989.2/695
780-790/237.7-240.8	780-790	961.7/785
840-850/256.0-259.1	840-850	943.4/845
930-940/283.5-286.5	930-940	916.0/935
1000-1010/304.8-307.8	1000-1010	894.7/1005
1090-1100/332.2-335.3	1090-1100	867.2/1095
1160-1170/353.6-356.6	1160-1170	845.9/1165
1220-1230/371.9-374.9	1220-1230	827.6/1225
1300-1310/396.2-399.3	1300-1310	*
1320-1330/402.3-405.4	1320-1330	*
1340-1350/408.4-411.5	1340-1350	*
1380-1390/420.6-423.7	1380-1390	778.9/1385
1410-1420/429.8-432.8	1410-1420	769.7/1415
1470-1480/448.1-451.1	1470-1480	*
1510-1520/460.2-463.3	1510-1520	*
1550-1560/472.4-475.5	1550-1560	*
1570-1580/478.5-481.6	1570-1580	*

*Exclusion of these analyses is documented in Table F-5.

USW WT-2

As shown in table E-10, the USW WT-2 sample analyses in DTN: MO0101XRDDRILC.001 [DIRS 169517] are derived completely and exclusively from DTN: LADB831321AN98.002 [DIRS 109003]. Inputs to the Mineralogic Model (MM3.0) (BSC 2004 [DIRS 170031]) in DTN: LA9908JC831321.001 [DIRS 113495] are also derived from DTN: LADB831321AN98.002 [DIRS 109003]. One sample number (shown in bold type, corresponding to the sampling depth interval in feet) in DTN: LADB831321AN98.002 [DIRS 109003] is incorrect, and the error is also present in DTN: MO0101XRDDRILC.001 [DIRS 169517]. The sample number, “420-450,” does not conform to the typical 10 foot sampling interval for drill cuttings. Notebook entries documenting the collection, description, and receipt of the USW WT-2 samples from the USGS Core Library confirm that the correct footage for the sample is 420-430 ft (Broxton 1990 [DIRS 169640], p. 58; Caporuscio 1986