Model
Error Resolution Document

Complete only applicable items.

INITIATION

1. Originator: Jim Houseworth/Ming Zhu	2. Date: 5/19/08	3. ERD No. MDL-NBS-HS-000006 ERD 03

4. Document Identifier: MDL-NBS-HS-000006 REV 03 AD 01	5. Document Title: UZ Flow Models and Submodels

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

I   Background Information Summary

This ERD is prepared to resolve CRs 12048 and 12142 associated with *UZ Flow Models and Submodels*, MDL-NBS-HS-000006 REV 03 ADD 01 (SNL 2007 [DIRS 184614]).

CR 12048: Section 6.9 of *UZ Flow Models and Submodels*, MDL-NBS-HS-000006 REV 03 AD 01 (SNL 2007 [DIRS 184614]) discusses the temporal damping of episodic infiltration pulses. The following statement is made in Section 6.9 of SNL (2007 [DIRS 184614]): "By comparison, the standard deviation in the mean flux implemented for the post-10k-yr climate is about 60%, and the range is 127% of the mean flux (Tables 6.1-3 and 6.8-1) over the repository footprint." The ratio of the standard deviation to the mean (60%) is incorrect. The actual value is 44%.

The only impacted product for this change is DOE/RW-0573, *Yucca Mountain Repository SAR*.

CR 12142: Table 6.1-1 in *UZ Flow Models and Submodels*, MDL-NBS-HS-000006 REV 03 AD 01 correlates the UZ model layers with hydrogeologic units for the Paintbrush Group (layers beginning with "Tp") as defined in Buesch et al. 1996 [DIRS 100106], Table 4. The lithostratigraphic unit at the base of the major unit "TSw" is shown as "Tptpv2". The corresponding UZ model layer is listed as "tsw39 (vit,zeo)" and the corresponding hydrogeologic unit is listed as "PV2". According to the source information in Buesch et al. 1996 [DIRS 100106], Table 4, the "PV2" (short for Tptpv2) is the uppermost lithostratigraphic unit in the major unit "CHn". The error in the unit classification has no impact on the output from the UZ flow model.

Other reports that have this same error are listed in ERD 01 of *Development of Numerical Grids for UZ Flow and Transport Modeling* ANL-NBS-HS-000015 REV 02 (BSC 2004 [DIRS 169855]). There is no impact of these changes to SNL (2007 [DIRS 184614]) on any downstream technical products.

(see attached)

CONCURRENCE

	Printed Name	Signature	Date
7. Checker	Charles Haukwa		05/21/2008
8. QCS/QA Reviewer	Peter Persoff		05/21/2008

APPROVAL

9. Originator	Jim Houseworth Ming Zhu		05/21/2008 5/21/08
10. Responsible Manager	Paul Dixon		5-22-08

SCI-PRO-006.3-R0

(Continued from Block 6)

For both CR 12408 and CR 12142, the following documents that cite *UZ Flow Models and Submodels*, MDL-NBS-HS-000006 REV 03 AD 01 [DIRS 184614] were checked for impacts as a result of these corrections:

- ANL-WIS-MD-000024 REV 01, *Postclosure Nuclear Safety Design Bases*

- ANL-WIS-MD-000027 REV 00, *Features, Events, and Processes for the Total System Performance Assessment: Analyses*

- MDL-WIS-PA-000005 REV 00 AD 01, *Total System Performance Assessment Model/Analysis for the License Application*

- TDR-NBS-HS-000020 REV 00, *Data Qualification Report for Simulation of Net Infiltration for Present Day and Potential Future Climates Preliminary Output*

- TDR-PCS-SE-000001 REV 05 AD 01, *Performance Confirmation Plan*

- ANL-EBS-MD-000049 REV 03 AD 01, *Multiscale Thermohydrologic Model*

- ANL-NBS-HS-000058 REV 00, *Calibrated Unsaturated Zone Properties*

- ANL-WIS-PA-000001 REV 03, *EBS Radionuclide Transport Abstraction*

- ANL-EBS-MD-000049 REV 03, AD 01 *Multiscale Thermohydrologic Model*

- ANL-NBS-HS-000058 REV 00, *Calibrated Unsaturated Zone Properties*

- MDL-MGR-HS-000001 REV 00, *Irrigation Recycling Model*

- MDL-NBS-HS-000001 REV 05 *Drift-Scale THC Seepage Model*

- MDL-NBS-HS-000008 REV 02 AD 01, *Radionuclide Transport Models Under Ambient Conditions*

- MDL-NBS-HS-000011 REV 03, *Saturated Zone Site-Scale Flow Model*

- MDL-NBS-HS-000019 REV 01 AD 01, *Abstraction of Drift Seepage*

- MDL-NBS-HS-000020 REV 02 AD 01, *Particle Tracking Model and Abstraction of Transport Processes*

- MDL-NBS-HS-000021 REV 03 AD 01, *Saturated Zone Flow and Transport Model Abstraction*

- MDL-NBS-HS-000023 REV 01 AD 01, *Simulation of Net Infiltration for Present-Day and Potential Future Climates*

- DOE/RW-0573, *Yucca Mountain Repository SAR*

II   Inputs and/or Software

None

III   Analysis and Results

III.1   Analysis to Address CR 12048

In *UZ Flow Models and Submodels* (SNL 2007 [DIRS 184614]), there is a statement in Section 6.9 stating that "By comparison, the standard deviation in the mean flux implemented for the post-10k-yr climate is about 60%, and the range is 127% of the mean flux (Tables 6.1-3 and 6.8-1) over the repository footprint." The ratio of the standard deviation to the mean should be 44% instead of 60%. The weighted mean and standard deviation are computed using the following:

$$\text{Mean, } \mu_I = \sum_{i=1}^{4} w_i I_i$$

$$\text{Standard Deviation, } \sigma_I = \left[\sum_{i=1}^{4} w_i (I_i - \mu_I)^2 \right]^{1/2}$$

where the subscript i refers to each of the four post-10,000-year uncertainty cases for infiltration, w_i are the average weighting factors from Table 6.8-1 (SNL 2007 [DIRS 184614]), and I_i are the average infiltration rates for the four post-10,000-year uncertainty cases given in Table 6.1-3 (SNL 2007 [DIRS 184614]).

III.2   Analysis to Address CR 12142

In Table 6.1-1 of *UZ Flow Models and Submodels*, MDL-NBS-HS-000006 REV 03 AD 01 (SNL 2007 [DIRS 184614]), the lithostratigraphic unit at the base of the major unit "TSw" is shown as "Tptpv2". The corresponding UZ model layer is listed as "tsw39 (vit, zeo)" and the corresponding hydrogeological unit is listed as "PV2". According to the source information in Buesch et al. (1996 [DIRS 100106], Table 4), which is cited from the source AMR BSC (2004 [DIRS 169855], Table 6-5), the "PV2" unit (short for Tptpv2) is the uppermost lithostratigraphic unit of the major unit "CHn". This correction to Table 6.1-1 of *UZ Flow Models and Submodels*, MDL-NBS-HS-000006 REV 03 AD 01 (SNL 2007 [DIRS 184614]) is given in Table 1 below. Note also that the designation of "tsw39" as the top model layer for the Calico Hills nonwelded (CHn) major unit (see Table 1) has no effect on the development of the UZ grid for use in the UZ flow model.

Table 1.   GFM2000 Lithostratigraphy, UZ Model Layer, and Hydrogeological Unit Correlation Used in the UZ Flow Model and Submodels

Major Unit[a]	Lithostratigraphic Nomenclature[b]	UZ Model Grid Unit/Layer[c]	Hydrogeological Unit[d]
Tiva Canyon welded (TCw)	Tpcr	tcw11	CCR, CUC
	Tpcp	tcw12	CUL, CW
	TpcLD		
	Tpcpv3	tcw13	CMW
	Tpcpv2		
Paintbrush nonwelded (PTn)	Tpcpv1	ptn21	CNW
	Tpbt4	ptn22	BT4
	Tpy (Yucca)		
		ptn23	TPY
		ptn24	BT3
	Tpbt3		
	Tpp (Pah)	ptn25	TPP
	Tpbt2	ptn26	BT2
	Tptrv3		
	Tptrv2		
Topopah Spring Welded (TSw)	Tptrv1	tsw31	TC
	Tptrn		
		tsw32	TR
	Tptrl, Tptf	tsw33	TUL
	Tptpul, RHHtop		
	Tptpmn	tsw34	TMN
	Tptpll	tsw35	TLL
	Tptpln	tsw36	TM2 (upper 2/3 of Tptpln)
		tsw37	TM1 (lower 1/3 of Tptpln)
	Tptpv3	tsw38	PV3
Calico Hills nonwelded (CHn)	Tptpv2	tsw39 (vit, zeo)[e]	PV2
	Tptpv1	ch1 (vit, zeo)	BT1 or BT1a (altered)
	Tpbt1		
	Tac (Calico)	ch2 (vit, zeo)	CHV (vitric) or CHZ (zeolitic)
		ch3 (vit, zeo)	
		ch4 (vit, zeo)	
		ch5 (vit, zeo)	
	Tacbt (Calicobt)	ch6 (vit, zeo)	BT
	Tcpuv (Prowuv)	pp4	PP4 (zeolitic)
	Tcpuc (Prowuc)	pp3	PP3 (devitrified)
	Tcpmd (Prowmd)	pp2	PP2 (devitrified)
	Tcplc (Prowlc)		
	Tcplv (Prowlv)	pp1	PP1 (zeolitic)
	Tcpbt (Prowbt)		
	Tcbuv (Bullfroguv)		
Crater Flat undifferentiated (CFu)	Tcbuc (Bullfroguc)	bf3	BF 3 (welded)
	Tcbmd (Bullfrogmd)		
	Tcblc (Bullfroglc)		
	Tcblv (Bullfroglv)	bf2	BF2 (nonwelded)
	Tcbbt (Bullfrogbt)		
	Tctuv (Tramuv)		
	Tctuc (Tramuc)	tr3	Not Available
	Tctmd (Trammd)		
	Tctlc (Tramlc)		
	Tctlv (Tramlv)	tr2	Not Available
	Tctbt (Trambt) and below		

Sources: BSC 2004 [DIRS 169855], Table 6-5.

NOTES: [a]Montazer and Wilson 1984 [DIRS 100161]; [b]BSC 2004 [DIRS 170029]; [c]BSC 2004 [DIRS 169855],
Table 6-5. Defined by the rock material type, represented by the code name, for grid layers or blocks
belonging to the same rock unit; [d]Flint 1998 [DIRS 100033]. Hydrogeological units or layers defined for
the UZ model exclude alluvial covers. The top model boundary is at the ground surface of the mountain
(or the tuff-alluvium contact in areas of significant alluvial covers). [e]The designation of "tsw39" as the
top model layer for the Calico Hills nonwelded (CHn) major unit has no effect on the development of the
UZ grid for use in the UZ flow model.

UZ = unsaturated zone.

IV   Impact Evaluation

IV.1   Impact Evaluation of CR 12048

This change corrects an error in the cited standard deviation divided by the mean infiltration
rates for the post-10,000-year period. However, the revised number still supports the statement
and the number is not used in TSPA or any other downstream documents. The error identified in
this CR does not impact the conclusions of SNL (2007 [DIRS 184614]) or DOE/RW-0573,
Yucca Mountain Repository SAR. This error does not impact any technical products or DTNs.

IV.2   Impact Evaluation of CR 12142

This change corrects an error in Table 6.1-1 of SNL (2007 [DIRS 184614]). The "Tptpv2"
lithostratigraphic unit, and the corresponding "tsw39 (vit, zeo)" UZ model layer and "PV2"
hydrogeologic unit have been moved from the "TSw" major unit to the "CHn" major unit. This
placement has no impact because the "TSw" and "CHn" major units are not used for the UZ flow
model and does not affect the model output. This change has no impact the conclusions of SNL
(2007 [DIRS 184614]).