Addendum Cover Page

Complete only applicable items.

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10. Remarks * see note below

The following individuals made significant contributions to the updated models documented in this addendum: Teklu Hadgu, Carl Axness, Randy Dockter, Barry Lester, and Sharad Kelkar.

Change History

11. Revision and Addendum No.	12. Description of Change
REV 03 AD 01	This addendum contains updates to the SZ flow and transport abstraction model and the SZ one-dimensional transport model that incorporate the revised SZ site-scale flow model and site-scale SZ transport model. The addendum also includes updated and reevaluated uncertainty distributions for some parameters, including the groundwater specific discharge multiplier, flowing interval spacing, northwestern boundary of the alluvial uncertainty zone, sorption coefficients for plutonium, cesium, and tin onto colloids, sorption coefficients for selenium and tin onto tuff and alluvium, and correlation coefficients among sorption coefficients. Radionuclide transport simulations have been extended to 1,000,000 years and have been conducted using groundwater flow rates estimated for glacial-transition climatic conditions using the SZ flow and transport abstraction model and have been conducted for selenium and tin. Condition Reports (CR) related to previous versions of this model report have been addressed as follows: - CR 7270 has been addressed in a revision of the SZ_Convolute (SZ_Convolute V 3.10.01 (STN: 10207-3.10.01-00 [DIRS 179880])) software code. - CR 7260 has been addressed in a separate data qualification task in Qualification of Matrix Diffusion Data from Diffusion Cell Experiments (SNL 2007 [DIRS 181989]), per SCI-PRO-001, Qualification of Unqualified Data - This addendum addresses TBV-7466, which was identified in the extent of condition review for CR 8553.

* Editorial corrections were made to the footer in pages 6-18, A-2 through A-29, and B-4.

For Paul R Dixon
PRD 9-12-07

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TABLES

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ACRONYMS

ATC	Alluvial Tracer Complex
CR	Condition Report
CDF	cumulative distribution function
DOE	U.S. Department of Energy
DTN	data tracking number
FEC	flowing fluid electrical conductivity
FEHM	finite-element heat and mass (model)
HFM	hydrogeologic framework model
SZ	saturated zone
TSPA	total system performance assessment
TSPA-LA	total system performance assessment for the license application
UZ	unsaturated zone

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1.[a] PURPOSE

The primary purpose of this addendum is to update the saturated zone (SZ) flow and transport abstraction model and the SZ one-dimensional transport model to incorporate the updated models that form their bases. The overall objectives and tasks associated with the report remain unchanged. The following reports, through their output data tracking numbers (DTNs), provide direct input to this addendum and also have been updated in other documents:

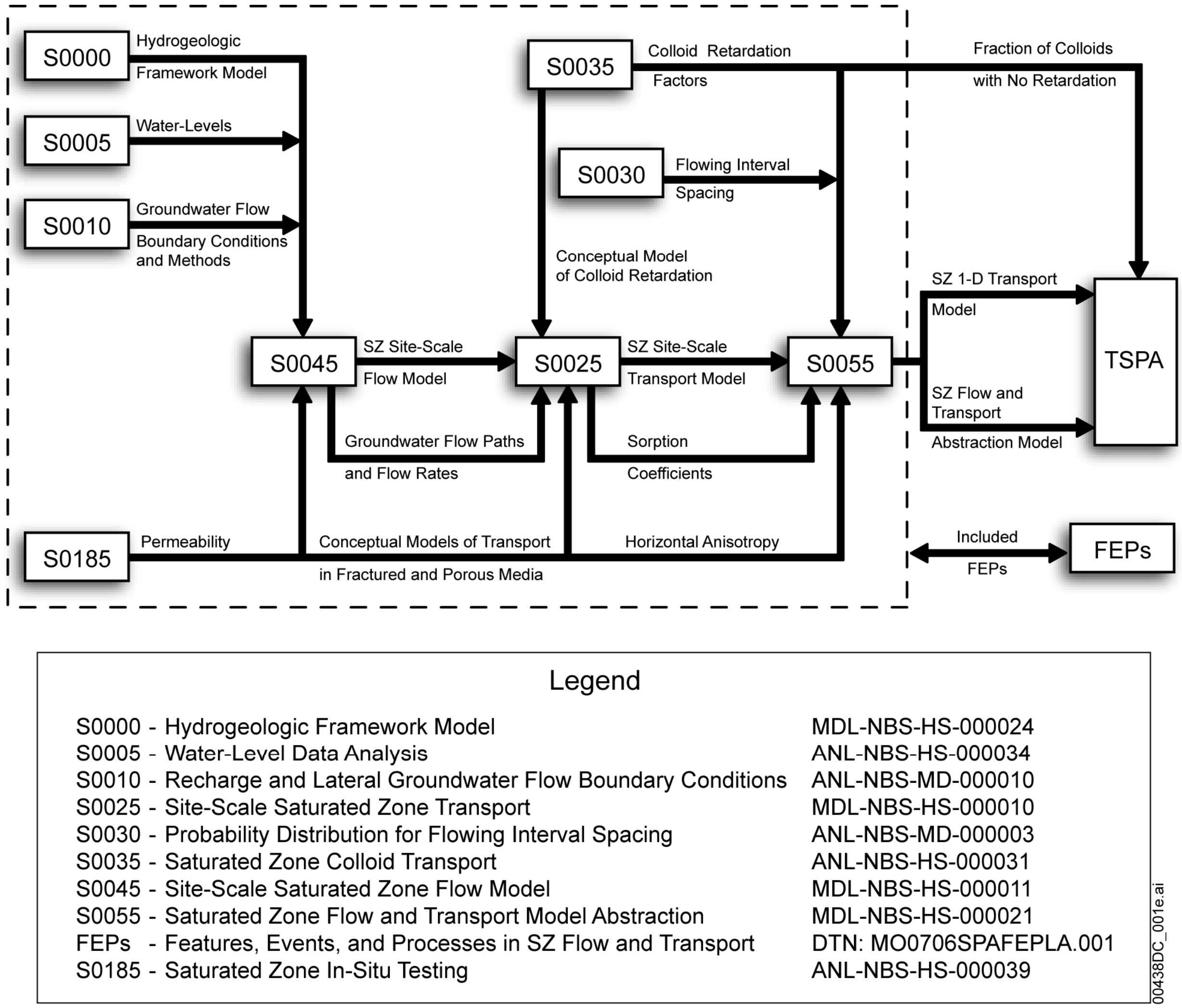
- *Site-Scale Saturated Zone Transport* (SNL 2007 [DIRS 177392])
- *Saturated Zone In-Situ Testing* (SNL 2007 [DIRS 177394])
- *Simulation of Net Infiltration for Present-Day and Potential Future Climates* (SNL 2007 [DIRS 174294])
- *UZ Flow Models and Submodels* (SNL 2007 [DIRS 175177])
- *Waste Form and In-Drift Colloids-Associated Radionuclide Concentrations: Abstraction and Summary* (SNL 2007 [DIRS 177423]).

Figure 1-1[a] shows the relationship of this report to other analysis or model reports that also pertain to groundwater flow and radionuclide transport in the saturated zone. Figure 1-1[a] replaces Figure 1-1. Although the site-scale SZ transport model (SNL 2007 [DIRS 177392]) is the only model used as direct input to this report, the hydrogeologic framework model (HFM) (SNL 2007 [DIRS 174109]) and the SZ site-scale flow model (SNL 2007 [DIRS 177391]) that form the bases for the site-scale SZ transport model have also been updated to incorporate new data.

In addition, this addendum includes reevaluation and incorporation of uncertainty distributions for input parameters that have been updated, including the groundwater specific discharge multiplier, flowing interval spacing, the northwestern boundary of the alluvial uncertainty zone, sorption coefficients for plutonium, cesium, and tin onto colloids, sorption coefficients for selenium and tin onto tuff and alluvium, and correlation coefficients among sorption coefficients. Radionuclide transport simulations have been extended to 1,000,000 years and have been conducted using groundwater flow rates estimated for glacial-transition climatic conditions using the SZ flow and transport abstraction model. Radionuclide transport simulations have been conducted for selenium and tin. Validation testing of the updated SZ flow and transport model and the SZ one-dimensional model is conducted and documented in this addendum.

Corrective action item CR (Condition Report) 7270 and software problem reports SPR003120051019 and SPR003420051031 have been addressed in a revision of SZ_Convolute (SZ_Convolute V. 3.10.01 (STN: 10207-3.10.01-00 [DIRS 179880])). The documentation of this revision of the software code is not contained in this addendum; however, SZ_Convolute V. 3.10.01 was used in the SZ flow and transport abstraction model documented herein. Corrective action item CR 7260, which is related to the qualification status of data on tritium and iodide diffusion coefficients in tuff matrix, has been addressed in a separate data qualification task in

Qualification of Matrix Diffusion Data from Diffusion Cell Experiments (SNL 2007 [DIRS 181989]), per SCI-PRO-001, *Qualification of Unqualified Data.*



NOTE: This figure is a simplified representation of the flow of information among saturated zone reports. See each report for a complete listing of data and parameter inputs. This figure does not show inputs external to this suite of saturated zone reports.

Figure 1-1[a]. Generalized Flow of Information among Reports Pertaining to Flow and Transport in the Saturated Zone

The work documented in this addendum differs from the governing technical work plan (*Technical Work Plan for Saturated Zone Flow and Transport Modeling* (BSC 2006 [DIRS 177375])) in some ways. The reevaluation of water-table rise in the saturated zone under glacial-transition climatic conditions is documented in the performance margin analysis in *Total System Performance Assessment Model /Analysis for the License Application* (SNL 2007 [DIRS 178871], Appendix C). Evaluation of the impact of potential reducing zones in the saturated zone on radionuclide transport is also incorporated into the performance margin analysis for the total system performance assessment (TSPA) model.

This addendum contains updated modeling approaches, inputs, and results relative to Revision 03 of *Saturated Zone Flow and Transport Model Abstraction* (BSC 2005 [DIRS 174012]), herein called the "parent report." The documentation is structured such that this addendum contains only information that is new or has been updated and thus supersedes information presented in the parent report. Information on topics that are not addressed in this addendum remains unchanged from the parent report. Consequently, a complete understanding of the technical work associated with SZ flow and transport abstraction requires access to this addendum and the parent report. Section numbers, table numbers, and figure numbers (and associated cross references) within this addendum contain the designator "[a]" to distinguish them from the numbers in the previous revision. Cross references within this report that do not contain the designator "[a]" refer to sections, tables, or figures in the parent report.

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2.[a] QUALITY ASSURANCE

The work documented in this addendum is planned in *Technical Work Plan for Saturated Zone Flow and Transport Modeling* (BSC 2006 [DIRS 177375]). The procedure directly governing the work and documentation in this addendum is SCI-PRO-006, *Models*.

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3.[a] USE OF SOFTWARE

This section contains a complete listing of the software used in producing the results documented in this addendum.

3.1[a] SOFTWARE TRACKED BY CONFIGURATION MANAGEMENT

The computer software codes used directly in this model report are listed in Table 3-1[a]. The qualification status of the software is noted in the Software Configuration Management database. All software was obtained from Software Configuration Management and is appropriate for the application, considering the simulation capabilities of the software, the range of inputs, and the functionality required by the computational task. Qualified codes were used only within the range of validation as required by IM-PRO-003, *Software Management*.

Table 3-1[a]. Computer Software Used in This Model Report

Software Name and Version (V)	Software Tracking Number (STN)	Description	Computer Type, Platform, and Location	Date Baselined
FEHM V2.24 [DIRS 179419]	10086−2.24-01-00	This code is a finite-element heat- and mass-transport code that simulates nonisothermal, multiphase, multicomponent flow, and solute transport in porous media.	Dell PowerEdge 2950 Windows Server 2003 YMP Offices, Las Vegas, Data Center	02/27/2007
GoldSim V. 8.02.500 [DIRS 179360]	10344−8.02-06	This code is the modeling software used in the TSPA-LA. Probabilistic simulations are represented graphically in GoldSim.	Dell PowerEdge 2650 Windows Server 2003 Sandia National Laboratories	10/11/2006
GoldSim V. 9.60 [DIRS 180224]	10344−9.60-00	This code is the modeling software used in the TSPA-LA. Probabilistic simulations are represented graphically in GoldSim.	Dell Precision 670 Windows XP Sandia National Laboratories	04/03/2007
SZ_Post V3.0 [DIRS 163571]	10915−3.0-00	This software is used to translate the output files from the SZ site-scale model into the format used by the SZ_Convolute software code. SZ_Post reads the output files from the FEHM software code and writes the breakthrough curve data for radionuclide transport in the saturated zone.	Sun UltraSPARC SunOS 5.7 Sandia National Laboratories	05/22/2003

Table 3-1[a]. Computer Software Used in This Model Report (Continued)

Software Name and Version (V)	Software Tracking Number (STN)	Description	Computer Type, Platform, and Location	Date Baselined
SZ_Convolute V. 3.10.01 [DIRS 179880]	10207−3.10.01-00	SZ_Convolute is used in the TSPA analyses to calculate the radionuclide mass flux at the water table beneath the repository. The version of SZ_Convolute is to correct the software problem identified in SPR008520070320. The operating environments shall be PC Windows 2000 and PC Windows 2003 Server.	Dell PowerEdge 2950 Windows 2003 Sandia National Laboratories	04/26/2007

NOTE: SZ site-scale model refers to the SZ flow and transport abstraction model.

FEHM = finite-element heat and mass model; SZ = saturated zone; TSPA-LA = total system performance assessment for the license application; YMP = Yucca Mountain Project.

3.2[a] EXEMPT SOFTWARE

The commercially available software applications cited in this section were used in a manner consistent with exempt status defined in IM-PRO-003, *Software Management*. Graphs, files, and visualization plots produced by these exempt software applications were verified by hand calculations and visual inspection, as required in SCI-PRO-006.

Commercial off-the-shelf software:

- **Excel 2003**: Used for spreadsheet calculations in the analyses of parameter uncertainty and for plotting. In addition, used to generate the input files for the SZ flow and transport abstraction model for multiple realizations. This pre-processing application to produce model input files is documented and verified in Appendix B.

- **Surfer 8.0**: Used for plotting and visualization.

- **Grapher 4.0**: Used for plotting graphs.

4.[a] INPUTS

4.1[a] DIRECT INPUT

This section lists only direct inputs that have changed or are new for the models and results documented in this addendum.

4.1.1[a] Data and Other Model Inputs

The data providing updated or new direct inputs to the development of parameters used in the models documented in this addendum are identified in Table 4-1[a]. Other model and repository design input information that has been updated is listed in Table 4-2[a].

Table 4-1[a]. Direct Inputs

Data Name	Originating Report	DTN
Infiltration for Climate States	SNL 2007 [DIRS 174294]	SN0609T0502206.028 [DIRS 178753], *PD_R1-R2_Parameter_Inputs.xls* SN0609T0502206.024 [DIRS 179063], *Monsoon_R1-R2_Parameter Inputs.xls* SN0609T0502206.029 [DIRS 178862], *GT_R1-R2_Parameter_Inputs.xls*
	SNL 2007 [DIRS 175177]	LB0701PAWFINFM.001 [DIRS 179283], *summary.xls*
Uncertainty in Groundwater Specific Discharge	CRWMS M&O 1998 [DIRS 100353]	MO0003SZFWTEEP.000 [DIRS 148744], Figure 3−2e
Uncertainty in Groundwater Specific Discharge at the Alluvial Tracer Complex (ATC)	SNL 2007 [DIRS 177394]	LA0303PR831231.002 [DIRS 163561], *ATC_SW_Flow_Velocity.xls*
Flowing Interval Spacing	BSC 2004 [DIRS 170014]	SN9907T0571599.001 [DIRS 122261], *fracture_dips2.xls*

Table 4-2[a]. Other Direct Inputs (Model and Repository Design)

Input Name	Input Description	DTN/IED
Site-Scale Saturated Zone Transport Model	The site-scale SZ transport model that forms the basis of the SZ flow and transport abstraction model.	LA0702SK150304.001 [DIRS 179416]
Repository Design	The coordinates of the outline of the repository design are used in defining the SZ source regions at the water table below the repository.	SNL 2007 [DIRS 179466], Section 4.1.1, *Subsurface Facilities Layout Geographical Data*

DTN = Data Tracking Number; IED = information exchange drawing; SZ = saturated zone.

NOTE: With regard to the input from SNL 2007 [DIRS 179466], coordinates that were used to define the outline of the repository design and that were taken from *800-IED-WISO-01701-000-00A* (BSC 2005 [DIRS 176805]) are the same as those given in *800-IED-WISO-01701-000-00B* (BSC 2007 [DIRS 179927]).

4.1.2[a] Parameters and Parameter Uncertainty

The parameters and parameter uncertainty distributions from external sources used directly in the modeling documented in this addendum are listed in Table 4-3[a]. The parameters and distributions that have been updated or are new are listed in Table 4-3[a].

Table 4-3[a]. Direct Input (Parameter Uncertainty)

Parameter Name	Parameter Source	DTN	Value(s)	Units	Parameter Type
Kd_Pu_Col (plutonium sorption coefficient onto smectite colloids)	SNL 2007 [DIRS 177423]	MO0701PASORPTN.000 [DIRS 180391], *DTN_Kds_Pu_Am_Th_Pa_Cs_REV03.doc*	CDF: Probability / Value 0.0 / 10^3 0.45 / 5×10^3 0.80 / 10^4 0.95 / 5×10^4 1.0 / 10^5	mL/g	Distribution
Kd_Cs_Col (cesium sorption coefficient onto smectite colloids)	SNL 2007 [DIRS 177423]	MO0701PASORPTN.000 [DIRS 180391], *DTN_Kds_Pu_Am_Th_Pa_Cs_REV03.doc*	CDF: Probability / Value 0.0 / 50 0.05 / 1×10^2 0.40 / 5×10^2 0.70 / 10^3 1.0 / 5×10^3	mL/g	Distribution
Correlation matrix for K_d sampling in the saturated zone	SNL 2007 [DIRS 177392]	LA0702AM150304.001 [DIRS 182480], *LA0702AM150304_001.xls*	See DTN	N/A	Matrix of single values
Kd_Sn_Col (tin sorption coefficient onto smectite colloids)	SNL 2007 [DIRS 177423]	MO0701PAKDSUNP.000 [DIRS 180392], *DTN_Kds_U_Np_Sn_Ra_REV03.doc*	Log-Uniform: Minimum 1×10^5 Maximum 1×10^6	mL/g	Distribution
Kd_Sn_Vo (devitrified tuff tin sorption coefficient in volcanic units)	SNL 2007 [DIRS 177392]	LA0702AM150304.001 [DIRS 179829], *DTN LA0702AM150304.001.xls*	Log-Uniform: Minimum 1×10^2 Maximum 1×10^5	mL/g	Distribution
Kd_Sn_Al (devitrified tuff tin sorption coefficient in alluvium)	SNL 2007 [DIRS 177392]	LA0702AM150304.001 [DIRS 179829], *DTN LA0702AM150304.001.xls*	Log-Uniform: Minimum 1×10^2 Maximum 1×10^5	mL/g	Distribution
Kd_Se_Vo (devitrified tuff selenium sorption coefficient in volcanic units)	SNL 2007 [DIRS 177392]	LA0702AM150304.001 [DIRS 182480], *LA0702AM150304_001.xls*	Truncated Log-Normal: Mean 14.0 Standard Deviation 11.2 Minimum 1.0 Maximum 50.0	mL/g	Distribution

Table 4-3[a]. Direct Input (Parameter Uncertainty) (Continued)

Parameter Name	Parameter Source	DTN	Value(s)	Units	Parameter Type
Kd_Se_Al (devitrified tuff selenium sorption coefficient in alluvium)	SNL 2007 [DIRS 177392]	LA0702AM150304.001 [DIRS 182480], *LA0702AM150304_001.xls*	Truncated Log-Normal: Mean 14.0 Standard Deviation 11.2 Minimum 1.0 Maximum 50.0	mL/g	Distribution

4.2[a] CRITERIA

No changes to this section. Section 8.3[a] describes how the acceptance criteria have been met by updated material presented in this addendum.

4.3[a] CODES, STANDARDS, AND REGULATIONS

No changes to this section.

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5.[a] ASSUMPTIONS

No changes to this section.

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6.[a] MODEL DISCUSSION

6.1[a] MODELING OBJECTIVES

The primary objective of the SZ flow and transport abstraction model and the SZ one-dimensional transport model is to simulate radionuclide transport in the saturated zone for use in the TSPA model of repository performance. The general approach and modeling structure described by Arnold et al. (2003 [DIRS 163857]) is not changed in this addendum. The SZ flow and transport abstraction model and the SZ one-dimensional transport model have been updated to incorporate changes to the underlying process models (SNL 2007 [DIRS 177391]; SNL 2007 [DIRS 177392]). Uncertainty distributions for some input parameters have been updated or reevaluated with additional data. In addition, radionuclide transport simulations with the SZ flow and transport abstraction model have been extended to generate breakthrough curves that extend to 1,000,000 years with glacial-transition climatic conditions.

6.2[a] FEATURES, EVENTS, AND PROCESSES FOR THIS MODEL REPORT

No changes to this section.

6.3[a] BASE-CASE CONCEPTUAL MODEL

No changes to this section.

6.3.1[a] SZ Flow and Transport Abstraction Model

Because the ingrowth of radionuclides is not explicitly included in the SZ flow and transport abstraction model, a simplified approach is used to account for this process for some of the radionuclides that have parent radionuclides. In this simplified approach, the mass of the decay product-radionuclide is boosted by the maximum mass of the parent radionuclide that would decay over the remaining TSPA simulation time (SNL 2007 [DIRS 178871], Section 6.3.10) in a process called inventory boosting.

6.3.2[a] SZ 1-D Transport Model

No changes to this section.

6.3.3[a] Interfaces with the UZ and the Biosphere

No changes to this section.

6.4[a] CONSIDERATION OF ALTERNATIVE CONCEPTUAL MODELS

No changes to this section.

6.5[a] MODEL FORMULATION FOR BASE-CASE MODELS

The basic form, domain, and boundary conditions of the SZ flow and transport abstraction model as described in Section 6.5 have not been changed in the update documented in this addendum. The numerical grid resolution in the horizontal direction has been enhanced from 500 m to

250 m. Groundwater flow and transport simulations are conducted with an updated version of the finite-element heat and mass (FEHM) software code, FEHM V. 2.24 (STN: 10086-2.24-01-00 [DIRS 179419]). The convolution integral method is implemented in the SZ flow and transport abstraction model with an updated version of the software code SZ_Convolute V. 3.10.01 (STN: 10207-3.10.01-00 [DIRS 179880]).

Estimates of the scaling factors for groundwater flow rates in the saturated zone under future climatic conditions are based on simulations of net infiltration in the area near Yucca Mountain (SNL 2007 [DIRS 174294]), weighting factors for alternative infiltration maps derived from calibration of the site-scale UZ flow model (SNL 2007 [DIRS 175177]), and corroborative information from simulations using the Death Valley regional groundwater flow model (D'Agnese et al. 1999 [DIRS 120425]).

Uncertainty in net infiltration in the Yucca Mountain site area has been evaluated using the MASSIF model by creating multiple realizations of the infiltration map for present-day, monsoonal, and glacial-transition climatic conditions (SNL 2007 [DIRS 174294]). Table 6-1[a] summarizes the values of site average infiltration rate over the MASSIF model domain for four percentiles from the modeling. The MASSIF model domain is shown in Figure 6.5.2.1-1 of *Simulation of Net Infiltration for Present-Day and Potential Future Climates* (SNL 2007 [DIRS 174294]) and consists of an area including, but significantly smaller than the site-scale SZ flow model domain.

Table 6-1[a]. Average Net Infiltration over the MASSIF Model Domain for Climate States

Infiltration Case	Average Present-Day Infiltration (mm/yr)[a]	Average Monsoonal Infiltration (mm/yr)[b]	Average Glacial-Transition Infiltration (mm/yr)[c]
10th percentile	3.5	7.2	16.0
30th percentile	8.2	12.2	22.5
50th percentile	13.4	19.8	30.5
90th percentile	24.2	65.8	46.2

Sources: DTNs: [a]SN0609T0502206.028 [DIRS 178753], *PD_R1-R2_Parameter_Inputs.xls*;
[b]SN0609T0502206.024 [DIRS 179063], *Monsoon_R1-R2_Parameter Inputs.xls*;
[c]SN0609T0502206.029 [DIRS 178862], *GT_R1-R2_Parameter_Inputs.xls*.

The realizations of simulated net infiltration have been weighted using the site-scale UZ flow model, to make them consistent with temperature and chloride concentration data from the unsaturated zone (SNL 2007 [DIRS 175177], Section 6.8.5). Multiple statistical methods for evaluating these weighting factors have been utilized and the results of those analyses are summarized in Table 6-2[a]. As stated in *UZ Flow Models and Submodels* (SNL 2007 [DIRS 175177, Section 6.8.5.3), the naming convention for the first column in Table 6-2[a] is: the immediate number after "s" refers to the four categories of likelihood measures, "a1" refers to averaging scheme 1 (average absolute residuals), "a2" refers to averaging scheme 2 (average residual squares), n is the exponent in likelihood category 2, and "sum" refers to the normalization of the four infiltration maps. Further information can be found in *UZ Flow Models and Submodels* (SNL 2007 [DIRS 175177, Section 6.8.5). The average weighting factor for each of the representative percentiles (10th, 30th, 50th, and 90th) is also calculated and given at the bottom of Table 6-2[a].

Table 6-2[a]. Summary of Weighting Factors for Net Infiltration

Weighting Method	Weighting Factor (%), 10th Percentile	Weighting Factor (%), 30th Percentile	Weighting Factor (%), 50th Percentile	Weighting Factor (%), 90th Percentile
S1	100.00	0.00	0.00	0.00
s2_a1_n=1	58.84	21.21	17.15	2.80
s2_a1_n=0.5	39.54	23.74	26.14	10.57
s2_a2_n=1	46.69	24.23	25.05	4.03
s2_a2_n=0.5	33.59	24.19	30.13	12.09
s3_a1	97.29	2.53	0.18	0.00
s3_a2	93.73	5.58	0.69	0.00
s4_sum	25.65	23.94	32.25	18.17
Average	61.91	15.68	16.45	5.96

Source: DTN: LB0701PAWFINFM.001 [DIRS 179283], *summary.xls*.

The weighting factors for the infiltration cases determined from the site-scale UZ flow model give an indication of confidence in each of the representative percentiles. The ratios of infiltration for each of the representative percentiles (monsoonal/present-day and glacial-transition/present-day) are calculated in Table 6-3[a]. Furthermore, the weighting factors for the representative percentile infiltration cases are used to weight each of these values of the ratio. The weighted average infiltration ratios for alternative climate states are calculated and reported at the bottom of Table 6-3[a] as 1.91 for the ratio of monsoonal/present-day infiltration and 3.75 for the ratio of glacial-transition/present-day infiltration in the Yucca Mountain area.

Table 6-3[a]. Weighted Groundwater Flow Scaling Factors

Percentile	Average Weighting Factor	Ratio of Average Infiltration, Monsoonal / Present Day	Weighted Ratio, Monsoonal / Present Day	Ratio of Average Infiltration, Glacial-Transition / Present Day	Weighted Ratio, Glacial-Transition / Present Day
10th	0.6191	2.06	1.28	4.57	2.83
30th	0.1568	1.49	0.23	2.74	0.43
50th	0.1645	1.48	0.24	2.28	0.38
90th	0.0596	2.72	0.16	1.91	0.11
Overall Flow Scaling Factor			1.91		3.75

NOTE: Values in this table were calculated based on data in Tables 6-1[a] and 6-2[a].

These results are summarized Table 6-4[a]. The new calculated glacial-transition scaling factor is compared to the result from the Death Valley regional flow model as shown in Table 6-4[a]. Although the Death Valley regional flow model has been revised since the analysis of climate change was conducted, the climate-change analysis has not been repeated with the updated Death Valley regional flow model. The original climate-change analysis is adequate because the scaling of groundwater flow for glacial-transition climatic conditions with the Death Valley regional flow model is primarily a function of the estimated changes in the boundary conditions of the model and secondarily a function of the detailed distribution of flow within the model domain. The estimated ratios from the weighting of the infiltration models (3.75) and the Death Valley regional flow model (3.9) for the glacial-transition climate are very similar. Because of this corroborative similarity and the more representative and larger scale of the Death Valley regional flow model, the value of 3.9 as the groundwater flow scaling factor for the glacial-transition climate is applied to the SZ flow and transport abstraction model for use in the TSPA analyses. For monsoonal climatic conditions, the approximate value estimated for the ratio from the weighting of the infiltration models of 1.9 is applied to the SZ flow rate as well.

Table 6-4[a]. Groundwater Flow Scaling Factors for Climate Change

Climate State	Ratio to Present Climate, Using UZ Model Weighting Factors	SZ Groundwater Flux Ratio from Death Valley Regional Flow Model	SZ Groundwater Flux Ratio for TSPA Simulations
Present-Day	1.0	1.0	1.0
Glacial-Transition	3.75	3.9[a]	3.9
Monsoonal	1.91	N/A	1.9

[a] Total System Performance Assessment-Viability Assessment (TSPA-VA) Analyses Technical Basis Document (CRWMS M&O 1998 [DIRS 100365], Table 8−16, p. T8−20).

6.5.1[a] Mathematical Description of Base-Case Conceptual Models

No changes to this section.

6.5.1.1[a] SZ Flow and Transport Abstraction Model

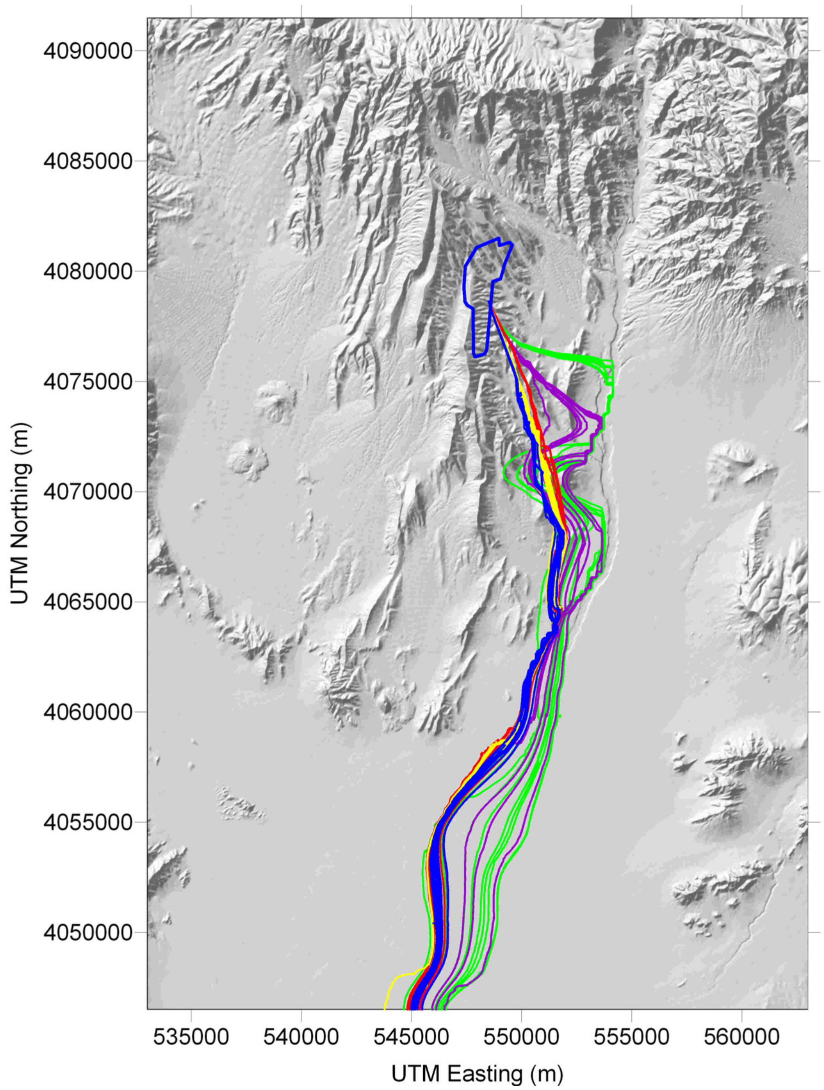
No fundamental changes have been made to the SZ flow and transport abstraction model relative to the characteristics described in Section 6.5.1.1. The SZ flow and transport abstraction model is implemented with an updated version of the FEHM software (FEHM V. 2.24 (STN: 10086-2.24-01-00) [DIRS 179419]) and the convolution integral method is implemented with an updated version of the SZ_Convolute software (SZ_Convolute V. 3.10.01 (STN: 10207-3.10.01-00) [DIRS 179880]). Parameter uncertainty distributions for some input parameters have been updated, as described in Section 6.5.2[a]. Transport simulations have been conducted for two additional radioelements, as described in Section 6.5.3[a].

6.5.1.2[a] SZ One-Dimensional Transport Model

The basic form, model setup, and mathematical implementation of the SZ one-dimensional transport model have not been changed in the update documented in this addendum. The SZ one-dimensional transport model is implemented with an updated version of GoldSim V. 9.60 (STN: 10344-9.60-00 [DIRS 180224]). Because the underlying process model, the SZ site-scale transport model, has been updated, the SZ one-dimensional transport model has been modified to approximate the behavior of the process model. The tabulated relationship between average specific discharge in each of the three pipe segments in the SZ one-dimensional transport model and the horizontal anisotropy (parameter HAVO) has been updated. The tabulated relationship between flow path pipe lengths, horizontal anisotropy, and the northwest contact between the alluvium and the volcanic units (parameter FPLANW) has also been updated to reflect changes in the SZ site-scale transport model and in the definition of the alluvial uncertainty zone.

Figure 6-1[a] shows a plot of the simulated flow paths from the repository as a function of the horizontal anisotropy in the SZ flow and transport abstraction model. Comparison of Figure 6-1[a] with Figure 6-6 shows that the general simulated flow paths from the repository are similar in the previous and the updated SZ flow and transport abstraction model. In both cases the flow paths for values of horizontal anisotropy of less than 1.0 are more easterly and are then captured in flow within the Fortymile Wash structural feature. Differences between the previous and updated SZ flow and transport abstraction model results are attributed to more tortuous and dispersed flow paths in the updated model, especially for values of HAVO less than 1.0.

The approach and methods for representing groundwater flow and radionuclide transport in the SZ one-dimensional transport model in a manner that approximates the SZ site-scale transport model is the same as described in Section 6.5.1.2. The functional relationships between average groundwater specific discharge in different pipe segments and horizontal anisotropy have been updated in Table 6-5[a]. The functional relationships between pipe segment lengths and horizontal anisotropy and the northwest contact between the alluvium and the volcanic units have been updated in Table 6-6[a]. The values in Tables 6-5[a] and 6-6[a] are incorporated as lookup tables in the stand-alone version of the SZ one-dimensional transport model constructed in GoldSim V. 9.60. In addition, the values of longitudinal and transverse dispersivity in the SZ one-dimensional transport model have been increased by one order of magnitude from the sampled values tabulated in Appendix A[a]. This adjustment results in better agreement between the SZ one-dimensional transport model and the SZ site-scale transport model, as documented in Section 7.3.2[a]. This adjustment to the values of dispersivity is necessary because of the higher contrasts in permeability among the hydrogeologic units in the three-dimensional SZ site-scale transport model, as explained in Section 7.4.2[a], and the resulting enhancement to the dispersion in the random walk particle tracking algorithm.



Source: Repository outline is from SNL 2007 [DIRS 179466], Section 4.1.1.

NOTE: Green, purple, blue, yellow, and red lines show simulated particle paths for horizontal anisotropy values of 0.05, 0.20, 1.0, 5.0, and 20.0, respectively.

Figure 6-1[a]. Simulated Particle Paths for Different Values of Horizontal Anisotropy in Permeability

Table 6-5[a]. Average Specific Discharge in Flow Path Segments

HAVO	Average Specific Discharge (m/yr)		
	0-5 km	**5-13 km**	**13-18 km**
0.05	0.354	0.408	2.56
1.00	0.459	0.486	0.769
5.00	0.409	0.544	5.98
20.00	0.555	0.500	5.93

Output DTN: SN0702PASZFTMA.002.

Table 6-6[a]. Flow Path Lengths of Pipe Segments

HAVO	Minimum and Maximum Flow Path Lengths of Pipe Segments (km)							
	Source Region 1		Source Region 2		Source Region 3		Source Region 4	
	5 to 13 km	13 to 18 km	5 to 13 km	13 to18 km	5 to 13 km	13 to 18 km	5 to 13 km	13 to 18 km
0.05	15.9 to 16.4	7.7 to 8.2	15.2 to 15.5	7.7 to 8.0	13.6 to 14.4	6.9 to 7.7	14.1 to 15.0	6.7 to 7.6
1.00	11.3 to 12.3	6.7 to 7.7	10.3 to 11.0	7.2 to 7.9	7.7 to 8.6	6.5 to 7.4	7.3 to 8.3	6.8 to 7.8
5.00	11.3 to 12.3	6.7 to 7.7	10.0 to 10.6	7.3 to 7.9	7.7 to 8.6	6.5 to 7.4	7.3 to 8.3	6.8 to 7.8
20.00	11.3 to 12.3	6.7 to 7.7	10.0 to 10.7	7.2 to 7.9	7.7 to 8.6	6.5 to 7.4	7.3 to 8.3	6.8 to 7.8

Output DTN: SN0702PASZFTMA.002.

NOTES: The terms “pipe length” and “path length of pipe segments” have the same meaning.
See Section 6.5.2.13 in the parent report for a description of the four source regions.

6.5.2[a] Base-Case Model Inputs

The SZ flow and transport abstraction model and the SZ one-dimensional transport model include uncertainty through stochastic simulations of uncertain parameters. Parameter uncertainties are quantified through uncertainty distributions, which numerically represent our state of knowledge about a particular parameter on a scale of the model domain. A comprehensive list of the inputs to the models and analyses used in the previous versions of the SZ flow and transport abstraction model and the SZ one-dimensional transport model is given in Table 6-8. The uncertainty distributions for some of these parameters have been reevaluated and updated, some of the parameters have been redefined, and some of the parameters are new. Those parameters that have changed or are new are listed in Table 6-7[a]. The analyses of parameters that have been updated in this addendum and do not come from an external source are presented in subsections of Section 6.5.2[a].

Table 6-7[a]. Updated or New Inputs Used in the SZ Flow and Transport Abstraction Model and the SZ One-Dimensional Transport Model

Input Name	Input Description	Input Source (DTN, if applicable)	Value or Distribution	Units	Type of Uncertainty
GWSPD	Groundwater specific discharge multiplier (updated uncertainty distribution)	Internal to this report (see Section 6.5.2.1[a] and Figure 6-2[a])	CDF (cumulative distribution function): (Log_{10}-transformed) Probability Value 0.0 −0.951 0.05 −0.506 0.10 −0.394 0.25 −0.208 0.5 0.000 0.75 0.208 0.90 0.394 0.95 0.506 1.0 0.951	N/A	Epistemic

Table 6-7[a]. Updated or New Inputs Used in the SZ Flow and Transport Abstraction Model and the SZ One-Dimensional Transport Model (Continued)

Input Name	Input Description	Input Source (DTN, if applicable)	Value or Distribution	Units	Type of Uncertainty
FISVO	Flowing interval spacing in volcanic units (updated uncertainty distribution)	Internal to this report (see Section 6.5.2.3[a] and Figure 6-5[a])	CDF: Probability Value 0.0 1.860 0.01 2.925 0.20 12.036 0.50 25.773 0.80 39.965 0.90 45.797 0.92 47.207 0.94 49.115 0.96 51.710 0.98 55.249 0.99 58.439 1.0 80.0	m	Epistemic
Kd_Pu_Col	Plutonium sorption coefficient onto smectite colloids (updated uncertainty distribution)	MO0701PASORPTN.000 [DIRS 180391]	CDF: Probability Value 0.0 1.e3 0.45 5.e3 0.80 1.e4 0.95 5.e4 1.0 1.e5	mL/g	Epistemic
Kd_Cs_Col	Cesium sorption coefficient onto smectite colloids (updated uncertainty distribution)	MO0701PASORPTN.000 [DIRS 180391]	CDF: Probability Value 0.0 5.e1 0.05 1.e2 0.40 5.e2 0.70 1.e3 1.0 5.e3	mL/g	Epistemic
FPLANW	Northwestern boundary of the alluvial uncertainty zone (new parameter)	Internal to this report (see Section 6.5.2.2[a])	Uniform: Minimum 0.0 Maximum 1.0	N/A	Epistemic
Kd_Se_Vo	Selenium sorption coefficient for devitrified tuff in volcanic units (new parameter)	LA0702AM150304.001 [DIRS 182480]	Truncated Log-Normal: Mean 14.0 Standard Deviation 11.2 Minimum 1.0 Maximum 50.0	mL/g	Epistemic
Kd_Se_Al	Selenium sorption coefficient for devitrified tuff in alluvium (new parameter)	LA0702AM150304.001 [DIRS 182480]	Truncated Log-Normal: Mean 14.0 Standard Deviation 11.2 Minimum 1.0 Maximum 50.0	mL/g	Epistemic
Kd_Sn_Col	Tin sorption coefficient onto smectite colloids (new parameter)	MO0701PAKDSUNP.000 [DIRS 180392]	Log-Uniform: Minimum 1.e5 Maximum 1.e6	mL/g	Epistemic
Kd_Sn_Vo	Tin sorption coefficient for devitrified tuff in volcanic units (new parameter)	LA0702AM150304.001 [DIRS 179829]	Log-Uniform: Minimum 1.e2 Maximum 1.e5	mL/g	Epistemic

Table 6-7[a]. Updated or New Inputs Used in the SZ Flow and Transport Abstraction Model and the SZ One-Dimensional Transport Model (Continued)

Input Name	Input Description	Input Source (DTN, if applicable)	Value or Distribution	Units	Type of Uncertainty
Kd_Sn_Al	Tin sorption coefficient for alluvium (new parameter)	LA0702AM150304.001 [DIRS 179829]	Log-Uniform: Minimum 1.e2 Maximum 1.e5	mL/g	Epistemic
Correlation matrix for K_d sampling in the saturated zone	Correlation coefficient values among radionuclides and between volcanic units and alluvium	LA0702AM150304.001 [DIRS 182480]	See DTN: LA0702AM150304.001 [DIRS 182480]	N/A	N/A
sw_x_min_up	UTM easting minimum, upper SW corner of alluvial uncertainty zone	Internal to this report	549110	m	N/A
sw_x_max_up	UTM easting maximum, upper SW corner of alluvial uncertainty zone	Internal to this report	547600	m	N/A
ne_x_min_up	UTM easting minimum, upper NE corner of alluvial uncertainty zone	Internal to this report	553280	m	N/A
ne_x_max_up	UTM easting maximum, upper NE corner of alluvial uncertainty zone	Internal to this report	552800	m	N/A
sw_x_min_lo w	UTM easting minimum, lower SW corner of alluvial uncertainty zone	Internal to this report	550000	m	N/A
sw_x_max_lo w	UTM easting maximum, lower SW corner of alluvial uncertainty zone	Internal to this report	547600	m	N/A
ne_x_min_low	UTM easting minimum, lower NE corner of alluvial uncertainty zone	Internal to this report	552500	m	N/A
ne_x_max_lo w	UTM easting maximum, lower NE corner of alluvial uncertainty zone	Internal to this report	552800	m	N/A

Table 6-7[a]. Updated or New Inputs Used in the SZ Flow and Transport Abstraction Model and the SZ One-Dimensional Transport Model (Continued)

Input Name	Input Description	Input Source (DTN, if applicable)	Value or Distribution	Units	Type of Uncertainty
sw_y_min_up	UTM northing minimum, upper SW corner of alluvial uncertainty zone	Internal to this report	4062470	m	N/A
sw_y_max_up	UTM northing maximum, upper SW corner of alluvial uncertainty zone	Internal to this report	4063400	m	N/A
ne_y_min_up	UTM northing minimum, upper NE corner of alluvial uncertainty zone	Internal to this report	4065900	m	N/A
ne_y_max_up	UTM northing maximum, upper NE corner of alluvial uncertainty zone	Internal to this report	4066000	m	N/A
sw_y_min_low	UTM northing minimum, lower SW corner of alluvial uncertainty zone	Internal to this report	4062470	m	N/A
sw_y_max_low	UTM northing maximum, lower SW corner of alluvial uncertainty zone	Internal to this report	4063400	m	N/A
ne_y_min_low	UTM northing minimum, lower NE corner of alluvial uncertainty zone	Internal to this report	4064590	m	N/A
ne_y_max_low	UTM easting maximum, lower NE corner of alluvial uncertainty zone	Internal to this report	4066000	m	N/A
sw_z_min_low	Elevation minimum, lower SW corner of alluvial uncertainty zone	Internal to this report	686	m	N/A
sw_z_max_low	Elevation maximum, lower SW corner of alluvial uncertainty zone	Internal to this report	727	m	N/A
ne_z_min_low	Elevation minimum, lower NE corner of alluvial uncertainty zone	Internal to this report	616	m	N/A

Table 6-7[a]. Updated or New Inputs Used in the SZ Flow and Transport Abstraction Model and the SZ One-Dimensional Transport Model (Continued)

Input Name	Input Description	Input Source (DTN, if applicable)	Value or Distribution	Units	Type of Uncertainty
ne_z_max_low	Elevation maximum, lower NE corner of alluvial uncertainty zone	Internal to this report	726	m	N/A

NOTES: CDF = cumulative distribution function;
UTM = Universal Transverse Mercator.

The uncertainty distributions for tin sorption coefficient for devitrified tuff in volcanic units (parameter Kd_Sn_Vo) and for tin sorption coefficient in alluvium (parameter Kd_Sn_Al) differ in Revision 000 [DIRS 179829] and Revision 003 of DTN: LA0702AM150304.001 [DIRS 182480]. The simulated breakthrough curves in Figure 6-10[a] were generated using the upper bound of the log-uniform distributions as 100,000 mL/g, as documented in Revision 000 of the DTN. However, Revision 003 of the DTN specifies an upper bound of the log-uniform distributions as 36,700 mL/g. The impact of using the larger upper bound value for the log-uniform uncertainty distributions is small with regard to the SZ tin breakthrough curves used in the TSPA model. The CDFs for the log-uniform uncertainty distributions using 100,000 mL/g and 36,700 mL/g as upper bounds differ somewhat for higher values of the tin sorption coefficient, but differ very little for values between 100 mL/g and 1,000 mL/g. Figure 6-10[a] indicates that about one third of the 200 realizations have median transport times for tin of less than 1,000,000 years and that the remaining realizations have transport times of greater than 1,000,000 years. Given the dominant role of sorption in determining the saturated zone transport time of highly sorbing species such as tin, it is clear that realizations with simulated median transport times of less than 1,000,000 years are associated with smaller values of the tin sorption coefficient. Because the uncertainty distributions with higher and lower upper bounds are quite similar for smaller values of the sorption coefficient and it is the realizations with smaller values of the sorption coefficient that are relevant to the TSPA model to times up to 1,000,000 years, the impact of using the larger upper bound (100,000 mL/g) for the log-normal uncertainty distribution in the tin sorption coefficient is minor.

The hydrogeologic units and the hydrogeologic unit numbers used in the SZ flow and transport abstraction model in this addendum are listed in Table 6-8[a]. The correspondence between these hydrogeologic unit numbers for the hydrogeologic framework model (HFM2006) and the HFM-19 unit numbers used in previous documentation of parameter values in Table 6-8 is given in *Hydrogeologic Framework Model for the Saturated Zone Site-Scale Flow and Transport Model* (SNL 2007 [DIRS 174109], Table 6-3).

Table 6-8[a]. Hydrogeologic Unit Definition

Hydrogeologic Unit	Hydrogeologic Unit Identification Number
Younger alluvial aquifer	28
Younger alluvial confining unit	27
Older alluvial aquifer	26
Older alluvial confining unit	25
Limestone aquifer	24
Lava-flow unit	23
Younger volcanic-rock unit	22
Volcanic- and sedimentary-rock unit (upper)	21
Thirsty Canyon-Timber Mountain volcanic-rock aquifer	20
Paintbrush volcanic-rock aquifer	19
Calico Hills volcanic-rock unit	18
Wahmonie volcanic-rock unit	17
Crater Flat-Prow Pass aquifer	16
Crater Flat-Bullfrog confining unit	15
Crater Flat-Tram aquifer	14
Belted Range unit	13
Older volcanic-rock unit	12
Volcanic- and sedimentary-rock unit (lower)	11
Sedimentary-rock confining unit	10
Upper carbonate-rock aquifer	9
Upper clastic-rock confining unit	8
Lower carbonate-rock aquifer (thrusted)	7
Lower clastic-rock confining unit (thrusted)	6
Lower carbonate-rock aquifer	5
Lower clastic-rock confining unit	4
Crystalline-rock confining unit	3
Intrusive-rock confining unit	2

Source: SNL 2007 [DIRS 174109], Table 6-2.

6.5.2.1[a] Groundwater Specific Discharge

The uncertainty in groundwater specific discharge is evaluated in the SZ flow and transport abstraction model and the SZ one-dimensional transport model using a multiplication factor (parameter GWSPD), which scales the groundwater specific discharge for advection in radionuclide transport. Uncertainty in this multiplication factor is assessed in Section 6.5.2.1 using two sources of information: 1) the saturated zone expert elicitation (CRWMS M&O 1998 [DIRS 100353]) and 2) estimates of groundwater specific discharge from tracer testing at the alluvial testing complex (ATC) (SNL 2007 [DIRS 177394]). This previous assessment utilized subjective updating of the uncertainty distribution in the GWSPD parameter based on the newer information from the tracer testing at the ATC. The subjective analysis used the approximate range of estimates in specific discharge at the ATC, but did not make use of all estimated values.

As an alternative to this subjective approach for combining the two sources of information, a Bayesian updating procedure is adopted here. The Bayes theorem provides an objective and formal basis for combining prior information with new data to produce an updated distribution.

Bayesian Updating

The Bayes theorem can be stated as follows:

$$P(\theta \mid z) = \frac{P(\theta)\, P(z \mid \theta)}{\int P(\theta)\, P(z \mid \theta)} \qquad \text{(Eq. 6-1[a])}$$

where $P(\theta)$ is the prior distribution of random variable θ, $P(z|\theta)$ is the likelihood function for observed data z given θ, and $P(\theta|z)$ is the posterior distribution for θ given z. The prior represents old information such as the saturated zone expert elicitation, the likelihood represents current data such as the estimates in specific discharge at the ATC, and the posterior represents the updated information. The Bayes theorem facilitates use of prior test data or engineering judgment to "adjust" new data. For the current analysis, the SZ expert elicitation data can be treated as the prior data and the ATC data as the likelihood function (new data). The ATC data were not available for use in the SZ expert elicitation and thus constitute new data.

If the prior and posterior belong to the same family, they are called conjugate distributions. For certain conjugate pairs, parameters of the posterior distribution can be directly computed from the parameters of the prior distribution and the likelihood function. The conjugate family of interest here is the normal-normal.

Let the prior mean be described as a normal distribution with mean μ_o and standard deviation σ_o, symbolically denoted as $N(\mu_o,\sigma_o)$. Let the likelihood function for the data be denoted by $N(x, \sigma/\sqrt{n})$, where x is the mean and σ the standard deviation from n samples. The posterior distribution for the mean can then be expressed as $N(\mu_1,\sigma_1)$ where:

$$\mu_1 = [x \cdot n/\sigma^2 + \mu_o \cdot 1/\sigma_o^2] \,/\, [1/\sigma_o^2 + n/\sigma^2] \qquad \text{(Eq. 6-2[a])}$$

$$1/\sigma_1^2 = [1/\sigma_o^2 + n/\sigma^2] \qquad \text{(Eq. 6-3[a])}$$

The posterior predictive distribution of a future observation, z^*, is also a normal distribution with the following mean and variance (Gelman et al. 2004 [DIRS 181396], pp. 47 to 48):

$$\mu^* = E[z^*|z] = E[\theta|z] = \mu_1 \qquad \text{(Eq. 6-4[a])}$$

$$\sigma^* = \mathrm{var}[z^*|z] = \sigma^2 + \sigma_1^2 \qquad \text{(Eq. 6-5[a])}$$

The posterior predictive distribution has the same mean as the posterior mean of θ because the variable of interest is a multiplication factor defined to have a mean value of 1.0, and has two components of variance: the predictive variance σ^2 from the model (data), and the variance σ_1^2 due to posterior uncertainty in θ.

Results of the Bayesian Updating

Given that GWSPD is a multiplication factor, establishing the exact value of the mean (or median) is not important. A reference value of 1 can be used for the mean by scaling the actual values. The important issue is establishing the uncertainty (spread) around the mean. Bayesian updating provides us with the tools to compute this quantity via Equations 6-3[a] and 6-5[a].

From the saturated zone expert elicitation (CRWMS M&O 1998 [DIRS 100353]), the standard deviation of log-specific discharge can be estimated using the aggregate cumulative distribution curve (DTN: MO0003SZFWTEEP.000 [DIRS 148744], Figure 3-2e). The first statistical moment (mean) and second statistical moment (variance) are defined as:

$$m_1 = \int_{-\infty}^{\infty} x \cdot f(x)dx \qquad \text{(Eq. 6-6[a])}$$

$$m_2 = \int_{-\infty}^{\infty} (x - m_1)^2 \cdot f(x)dx \qquad \text{(Eq. 6-7[a])}$$

Where m_1 is the first moment, m_2 is the second moment, x is the variable of interest ($\log_{10}$ transformed specific discharge in this case), and $f(x)$ is the probability density function of x. The values of the mean and variance are estimated using discrete values along the cumulative distribution curve and performing numerical integration according to Equations 6-6[a] and 6-7[a]. The resulting value of the variance in log-specific discharge from the saturated zone expert elicitation is 0.478.

A normal distribution fitted to the log-specific discharge data from the ATC (n=12) yields σ= 0.296. From Equation 6-3[a], the posterior standard deviation of the mean is given by:

$$\sigma_1 = \sqrt{} \, [1/\sigma_o^2 + n/\sigma^2]^{-1} = \sqrt{}[1/(0.478) + 12/(0.296)^2]^{-1} = 0.085$$

The posterior standard deviation for a new data point can be obtained using Equation 6-5[a] as:

$$\sqrt{\sigma^*} = \sqrt{[\sigma^2 + \sigma_1^2]} = \sqrt{[(0.296)^2 + (0.085)^2]} = 0.308$$

The uncertainty distribution for the parameter GWSPD in its log-transformed form derived from the Bayesian updating process is thus a normal distribution with a mean of 0 and standard deviation of 0.308. This distribution is truncated at ±3.1 standard deviations (0.001 and 0.999 quantile levels) to keep the distribution bounded, and it is approximated as the discrete cumulative distribution function (CDF) given in Table 6-7[a] and shown in Figure 6-2[a]. The resulting uncertainty distribution for GWSPD is somewhat narrower than the distribution based on subjective updating shown in Figure 6-7 but very similar in form.

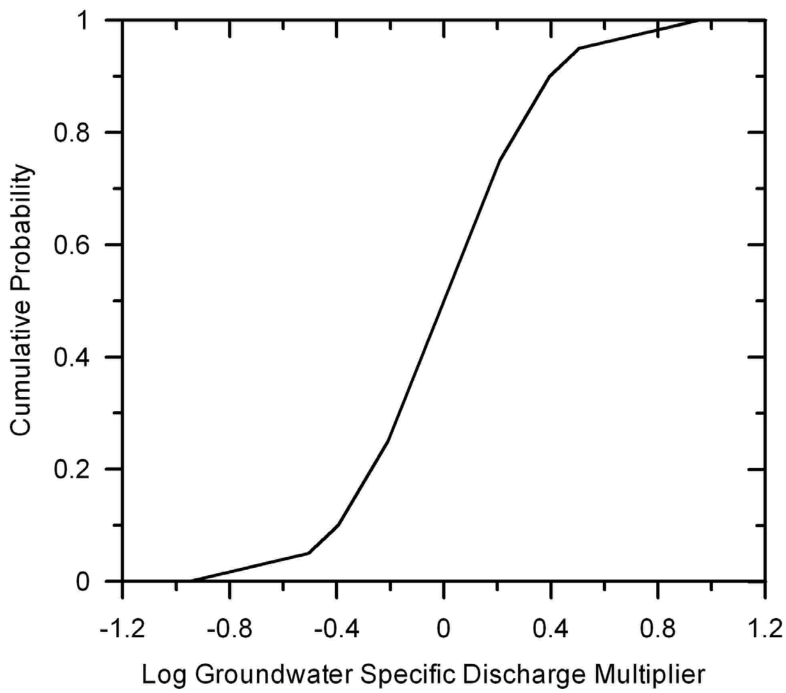


Figure 6-2[a]. Updated Cumulative Distribution Function of Uncertainty in Groundwater Specific Discharge Multiplier

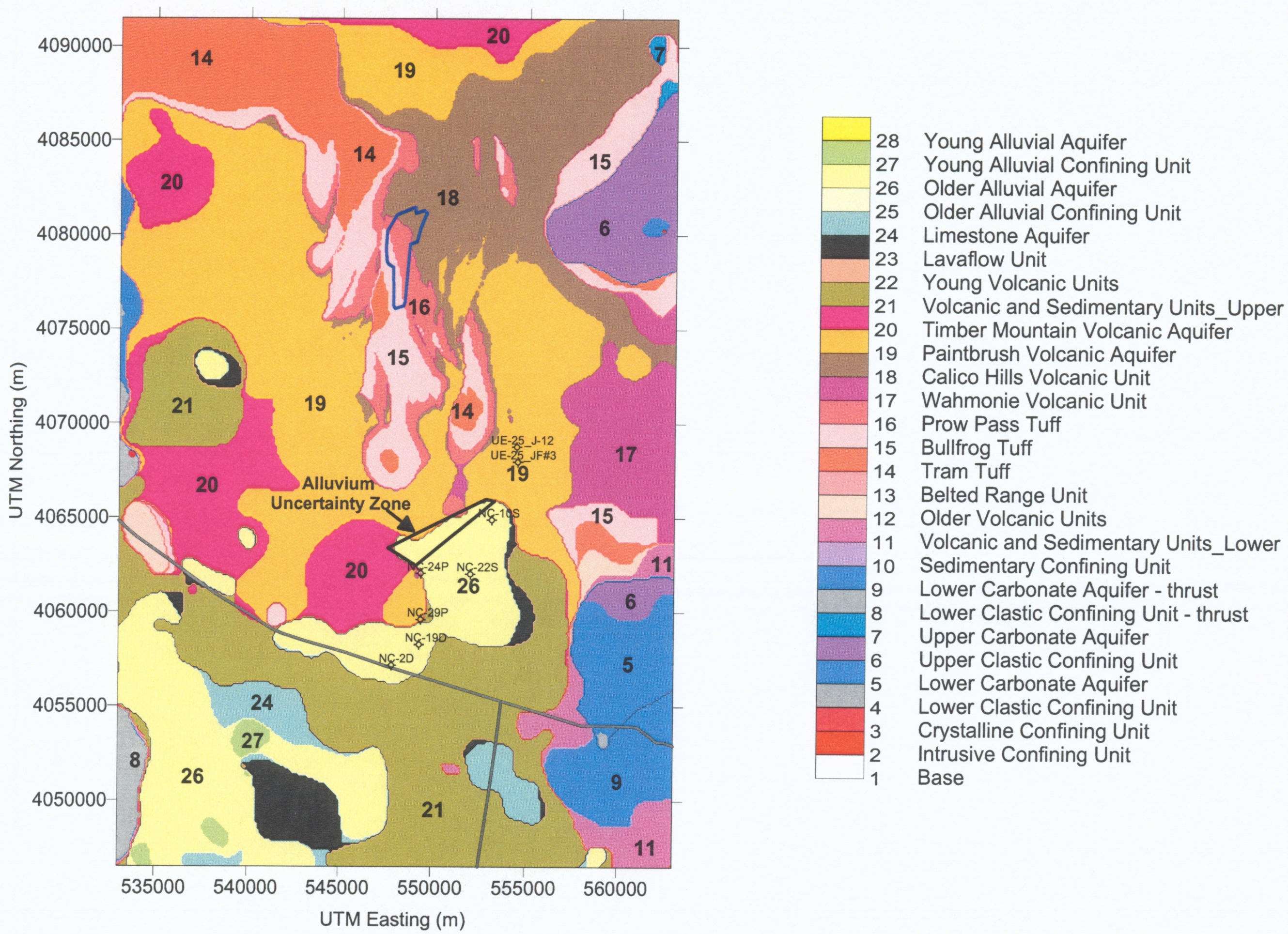
6.5.2.2[a] Alluvium Uncertainty Zone

The key geologic uncertainty in the SZ flow and transport abstraction model and the SZ one-dimensional transport model regarding radionuclide transport from the repository is the location of the contact between fractured volcanic units and the alluvium in the saturated zone. The representation of this uncertainty has been updated in this addendum to reflect changes in the hydrogeologic framework model with the HFM2006 (SNL 2007 [DIRS 174109]), the availability of new data from Nye County Early Warning Drilling Program, and the simulated flow paths from beneath the repository.

The updated HFM2006 included in the SZ flow and transport abstraction model is significantly different than the HFM-19 in its subsurface representation of alluvial units in the area south of the repository and north of the boundary of the accessible environment. Comparison of Figures 6-7a and 6-7c in *Hydrogeologic Framework Model for the Saturated Zone Site-Scale Flow and Transport Model* (SNL 2007 [DIRS 174109]) shows that alluvial units at the water table extend farther to the north in the HFM2006 and reflect greater geological detail resulting from information from the Nye County wells in this area. The previous implementation of the alluvium uncertainty zone described in Section 6.5.2.2 was designed to replace inaccuracies in the HFM-19 with regard to the distribution of alluvium in the saturated zone and to approximate the uncertainties in the western and northern boundaries of this zone.

Given the more realistic representation of the alluvial units in the HFM2006 relative to the HFM-19 and the greater density of subsurface information from wells, the updated definition of the alluvium uncertainty zone focuses on the potential inaccuracies in the critical northwest portion of the Older Alluvial Aquifer unit along the simulated flow path from beneath the repository. The updated alluvium uncertainty zone is located to the west of well NC-EWDP-10S and to the north of well NC-EWDP-24P and is approximated as a polygonal area (see Figure 6-3[a]). The lower boundary of the alluvium uncertainty zone dips to the southeast in approximate correspondence to the contact between the alluvial units and the underlying volcanic units in the HFM2006. In contrast to the previous implementation of the alluvium uncertainty zone, the updated alluvium uncertainty zone consists of alluvial units in the base-case SZ flow and transport abstraction model, and the uncertainty zone is partially replaced with fractured volcanic rock in each realization, as controlled by the parameter FPLANW. The parameter FPLANW has a uniform distribution from 0.0 to 1.0, where a value of 0.0 corresponds to the minimum northwesterly extent of the alluvium in the saturated zone and a value of 1.0 corresponds to the maximum extent of the alluvium. Details of the alluvium uncertainty zone, including the coordinates of the bounding points, are shown in Figure 6-4[a]. The outline of the alluvium uncertainty zone at the water table is shown with the solid black line and the boundaries below the water table are shown as dashed black lines in Figure 6-4[a].

The central portion of the alluvium uncertainty zone contains a correction zone in which the nodes in the SZ flow and transport abstraction model are replaced with the Prow Pass tuff in all realizations. This correction zone is coincident with the ridge of volcanic rock to the west-southwest of well NC-EWDP-10S. This feature is below the resolution of the HFM of 1,500 m in the Death Valley regional groundwater flow model (Belcher 2004 [DIRS 173179] and was consequently not captured in the HFM2006, but is important to include in the SZ flow and transport abstraction model because of its critical location along the simulated flow paths from beneath the repository.



Sources: SNL 2007 [DIRS 179466]) (repository outline (solid blue line)); DTN: MO0610MWDHFM06.002 [DIRS 179352] (HFM2006).

NOTES: Alluvium uncertainty zone shown as solid black line. Figure shows key wells relevant to alluvium uncertainty zone, and Highways 95 (east–west) and 373 (south) as gray lines. Nye County well names have been shortened by removing "EWDP" (e.g., NC-EWDP-24P shown as NC-24P) for legibility.

Figure 6-3[a]. Alluvium Uncertainty Zone and Hydrogeologic Units at the Water Table

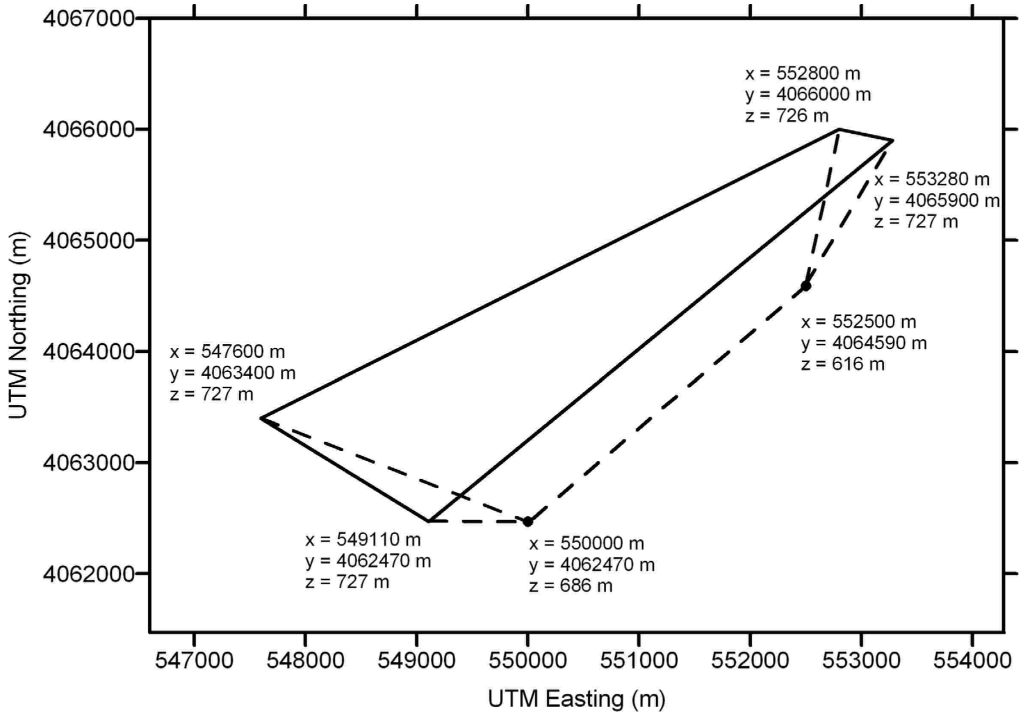


Figure 6-4[a]. Updated Coordinates of the Alluvium Uncertainty Zone

6.5.2.3[a] Flowing Interval Spacing

The flowing interval spacing is a key parameter in the dual porosity representation of radionuclide transport used in the SZ flow and transport abstraction model and the SZ one-dimensional transport model. The spacing between fractures or fracture zones that transmit flowing groundwater is reflective of the degree of groundwater flow channelization in the fractured volcanic units of the saturated zone and has a significant impact on the effectiveness of matrix diffusion as a retardation mechanism for radionuclide transport. Uncertainty in the flowing interval spacing parameter (FISVO) was evaluated in a Monte Carlo analysis in *Probability Distribution for Flowing Interval Spacing* (BSC 2004 [DIRS 170014]), as described in Section 6.5.2.4.

The previous analysis of uncertainty in the flowing interval spacing assessed the variability of this parameter among measurements in several wells. For the use of this parameter in the SZ flow and transport abstraction model and the SZ one-dimensional transport model, it is more appropriate and representative to consider the average flowing interval spacing. Consequently, the uncertainty in the average flowing interval spacing is what should be evaluated, not a distribution of the variability in flowing interval spacing. The Bayesian updating approach, as described in Section 6.5.2.1[a], can be used to assess the uncertainty in a more representative average value of the flowing interval spacing.

The data on flowing interval spacing in DTN: SN9907T0571599.001 [DIRS 122261], *fracture_dips2.xls*, were reanalyzed using the Bayesian updating approach. This analysis included re-weighting of the raw data on flowing interval spacing to account for the clustering of measurements in the C-wells. A description of the C-wells testing complex is provided in *Saturated Zone In-Situ Testing* (SNL 2007 [DIRS 177394], Section 6.2). Because of the closeness of the three wells at the C-wells complex, the information from the flowmeter surveys in these wells was considered to come from a single location and individual values of spacing were de-weighted accordingly. This re-weighting of the data had only a minor impact on the empirical CDF for apparent flowing interval spacing. Apparent flowing interval spacing was corrected for uncertainty in the dip of the flowing intervals in a manner similar to the method described in *Probability Distribution for Flowing Interval Spacing* (BSC 2004 [DIRS 170014]). The Monte Carlo analysis to correct for the dip of the flowing intervals used a uniform distribution of dip with a lower limit of 5^o and an upper limit of 90^o. The Bayesian updating method in this analysis used a normal-normal conjugate pair of prior information and new data, in which the prior information consists of professional judgment on the mean and standard deviation of flowing interval spacing. However, in this analysis the results showed that the posterior distribution calculated is insensitive to the assumed prior distribution, indicating that the analysis is driven almost exclusively by the data. Finally, the posterior distribution of the geometric mean is calculated to represent uncertainty in the flowing interval spacing for use in the SZ flow and transport abstraction model and the SZ one-dimensional transport model. The geometric mean is a more representative average value for this parameter than the simple distribution of variability used previously.

The resulting uncertainty distribution for the geometric mean of flowing interval spacing is approximated as the CDF shown in Figure 6-5[a]. This uncertainty distribution is somewhat narrower than the previous distribution shown in Figure 6-12, particularly for the upper end of the distribution, which has a maximum value of 80 m in the updated distribution, compared to a maximum value of 417 m in the previous distribution. The median value from the updated uncertainty distribution (25.8 m) is similar, but somewhat higher than the median value from the previous distribution (19.5 m).

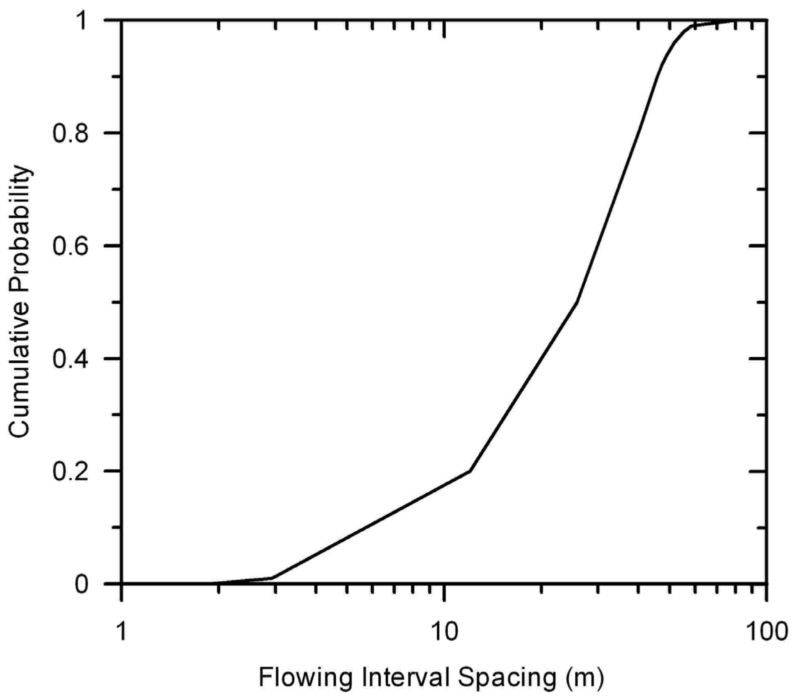


Figure 6-5[a]. Updated Cumulative Distribution Function of Uncertainty in Flowing Interval Spacing

6.5.2.4[a] Transport of Radionuclides Reversibly Sorbed on Colloids

The modeling approach used for transport of radionuclides reversibly sorbed onto colloids has not changed from the description in Section 6.5.2.12. However, the updated radionuclide transport modeling with the SZ flow and transport abstraction model and the SZ one-dimensional transport model described in this addendum includes the colloid-facilitated transport of tin by reversible attachment to colloids and incorporates changes to the uncertainty distribution for the sorption of plutonium and cesium onto colloids (SNL 2007 [DIRS 177423], Section 6.3.12). The parameters and parameter uncertainty distributions related to transport by reversible sorption onto colloids that have changed from the previous modeling are included in Table 6-7[a].

6.5.3[a] Summary of Computational Models

The general computational modeling approach for SZ flow and transport used to provide results to the TSPA has not changed from the documentation in Section 6.5.3. The scope of the modeling has been increased to include transport simulations for two additional radioelements, selenium and tin. The groupings of radionuclides, radionuclide group numbers, and transport modes are summarized in Table 6-9[a]. The radionuclides are combined into groups such that saturated zone transport properties of the radioelements within each group are identical and the mode of transport is the same. The radionuclide breakthrough curves generated with the SZ flow and transport abstraction model have been simulated for a time period of 1,000,000 years for 200 realizations of the saturated zone system. In contrast to the previous work described in Section 6.5.3, the steady-state groundwater flow fields used for the transport simulations in this addendum are for glacial-transition climatic conditions. The glacial-transition climatic state is appropriate for use in the post-10k-yr simulations of SZ flow and transport because the hydrologic conditions for this state are consistent with proposed regulations (10 CFR 63.342 [DIRS 180319]). The proposed regulation in 10 CFR 63.342 [DIRS 180319] specifies that the constant value for climate change in the post-10k-yr period be based on a distribution of deep percolation ranging from 13 to 64 mm/yr. As shown in Table 6-1[a], the range of simulated average glacial-transition infiltration from the MASSIF model (16.0 mm/yr at the 10th percentile to 46.2 mm/yr at the 90th percentile) approximately covers the range of deep percolation specified in 10 CFR 63.342 [DIRS 180319]. Therefore, the glacial-transition climate, as defined in the MASSIF infiltration model (SNL 2007 [DIRS 174294]) and in the SZ flow and transport abstraction model, is the appropriate constant representation of climate change for use in the post-10k-yr simulations of radionuclide transport.

Because the breakthrough curves generated with the SZ flow and transport abstraction model are for glacial-transition climatic conditions, the values of the groundwater flow multiplier applied for the present-day climate and the monsoonal climate in the convolution integral method are less than one, effectively scaling back the breakthrough curves for time of less than 2,000 years in the TSPA model. Although the groundwater flow for glacial-transition climatic conditions is extrapolated from the flow model that was calibrated for present-day conditions, glacial-transition climatic conditions are more representative of the long-term behavior of the saturated zone system with regard to radionuclide transport simulations. Uncertainty in the increase in groundwater flow rates under glacial-transition climatic conditions is within the range of uncertainty represented by the groundwater specific discharge multiplier, parameter GWSPD. The transport simulations with the SZ flow and transport model are performed with 500 particles released for each realization and source region. A sensitivity analysis with the SZ site-scale transport model (SNL 2007 [DIRS 177392], Figure 6.5-1) comparing the breakthrough curves with 500 particles and 1,000 particles, indicates that 500 particles are adequate to provide an acceptably stable transport simulation result. The random statistical fluctuations in the breakthrough curves resulting from using 500 particles are small compared to the uncertainty in radionuclide mass breakthrough among the realizations. In addition, each particle represents only 1/500 of the radionuclide mass released at any given time in the simulation using the convolution integral method, resulting in small impacts to the TSPA analysis from variations at the level of a single particle.

Previous implementation of the SZ flow and transport abstraction model used the pre-processing software code SZ_Pre V. 2.0 (STN: 10914-2.0-00, SNL 2003 [DIRS 163281]), as explained in Section 6.5.3.1. Changes to the input files for the SZ flow and transport abstraction precluded use of SZ_Pre V. 2.0 as a preprocessor, and an alternative method of implementation was developed using Excel spreadsheets for the work described in this addendum. Documentation of the use of Excel as exempt software for this purpose is presented in Appendix B[a].

Table 6-9[a]. Radioelements Transported in the SZ Flow and Transport Abstraction Model

Radionuclide Number	Transport Mode	Radioelements
1	Solute	Carbon, Technetium, Iodine, Chlorine
2	Colloid-Facilitated (Reversible)	Americium, Thorium, Protactinium
3	Colloid-Facilitated (Reversible)	Cesium
4	Colloid-Facilitated (Reversible)	Plutonium
5	Solute	Neptunium
6	Colloid-Facilitated (Irreversible)	Plutonium, Americium
7	Solute	Radium
8	Solute	Strontium
9	Solute	Uranium
10	Colloid-Facilitated (Fast Fraction of Irreversible)	Plutonium, Americium
11	Solute	Selenium
12	Colloid-Facilitated (Reversible)	Tin

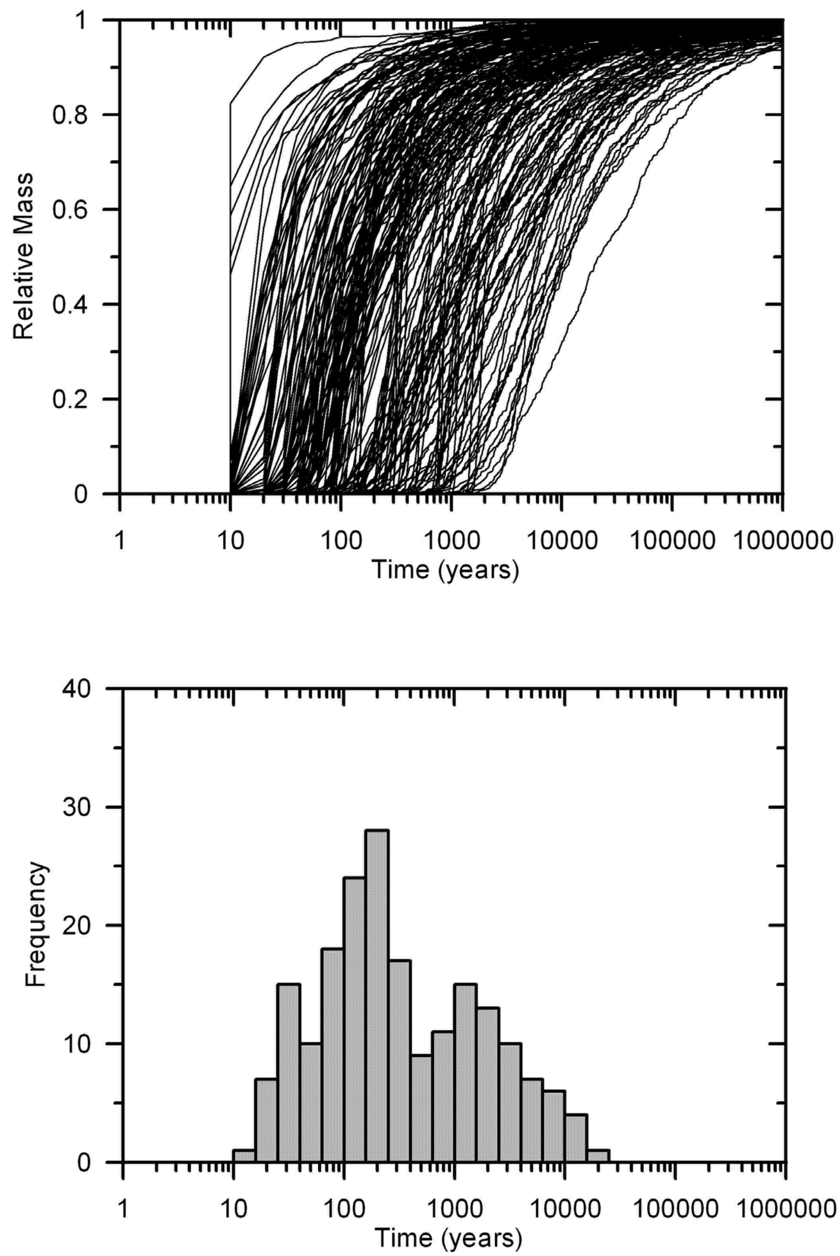
Output DTN: SN0702PASZFTMA.001, *Readme.txt*.

6.6[a] BASE-CASE MODEL RESULTS

No changes to this section.

6.6.1[a] Overview

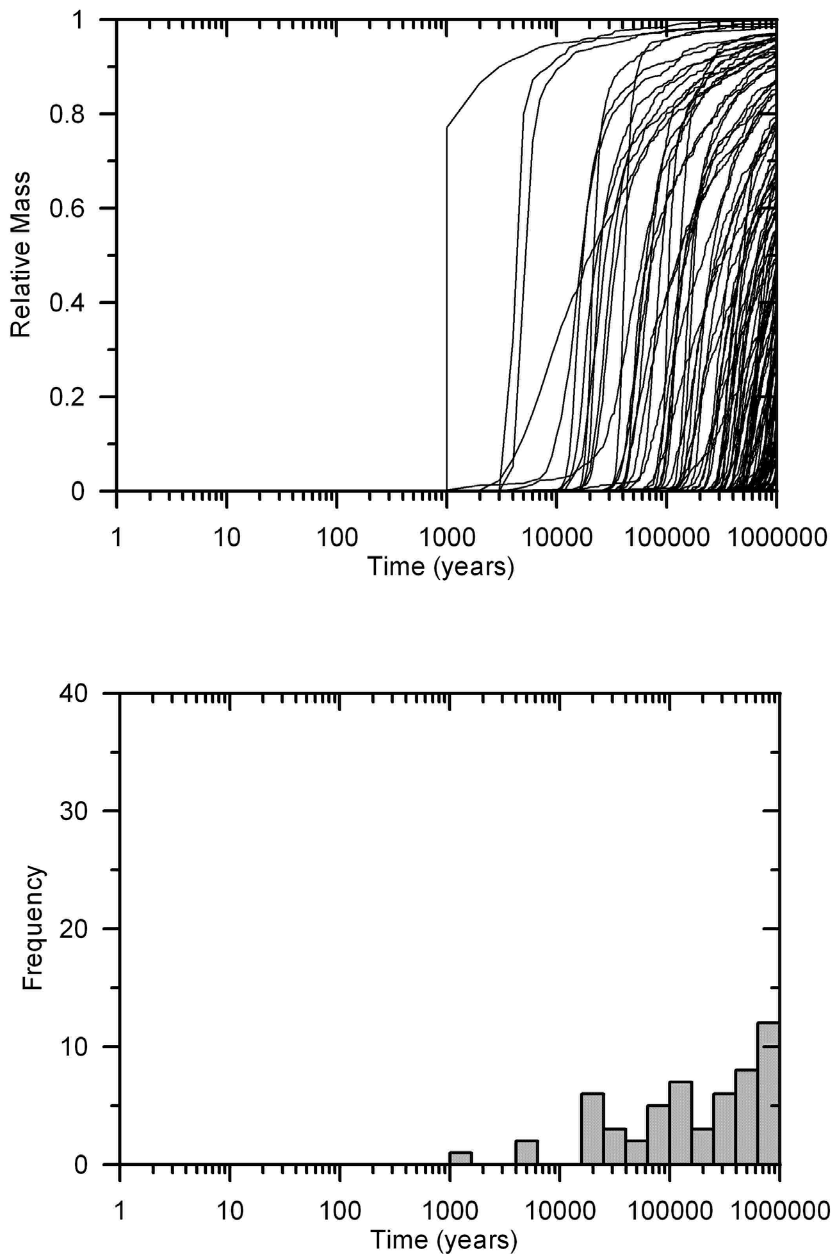
The results of the 200 realizations of the SZ flow and transport abstraction model are shown in Figures 6-6[a] to 6-17[a]. The breakthrough curves shown in these figures are for glacial-transition climatic conditions, and do not include the effects of radioactive decay. All breakthrough curves are for transport times in the saturated zone only; the simulated radionuclide source is initiated at the water table beneath the repository at time equal to zero. The breakthrough curves for some radionuclides for some of the realizations are affected by the minimum time step in the SZ flow and transport abstraction model simulations (e.g., earliest breakthrough curves for nonsorbing radionuclides, with a time step of 10 years).



Output DTN: SN0702PASZFTMA.001. Results from file *SZ_01_01*.

NOTE: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

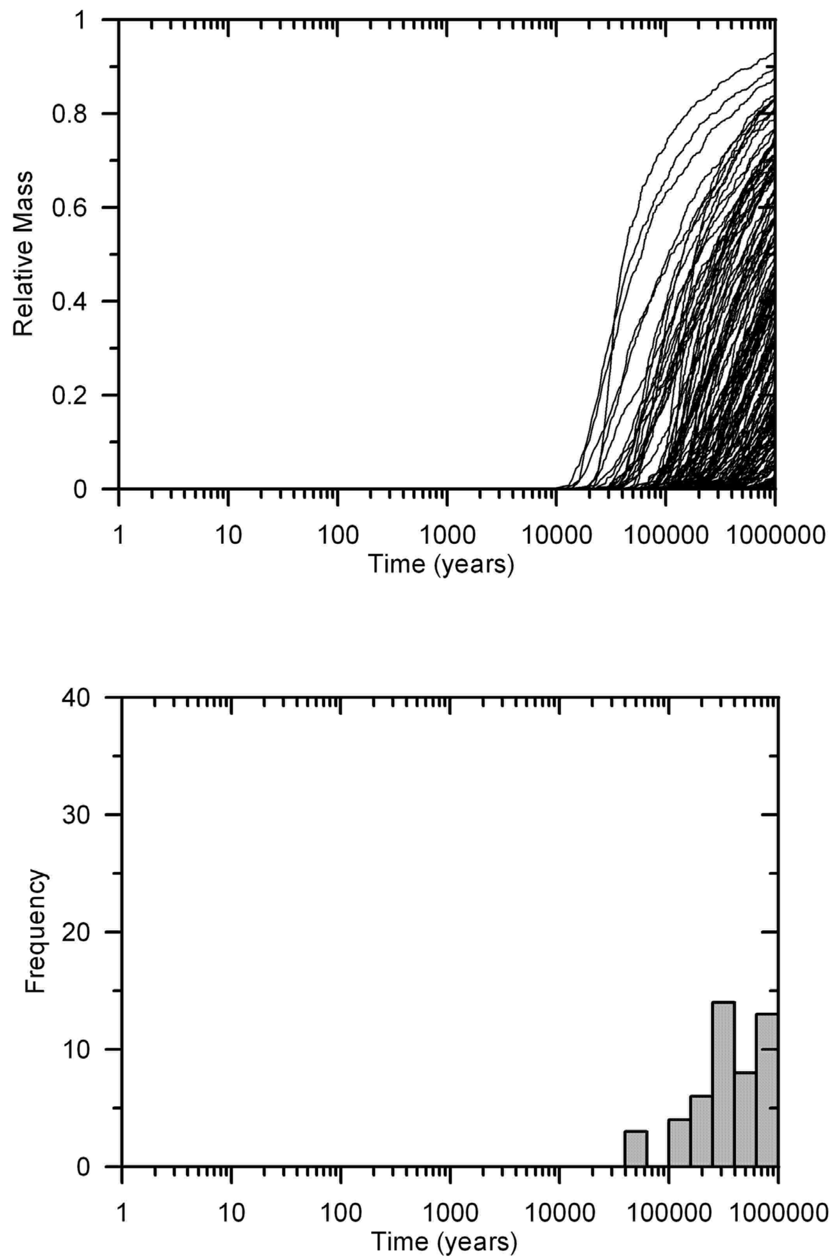
Figure 6-6[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Carbon, Technetium, Iodine, and Chlorine at the Boundary of the Accessible Environment



Output DTN: SN0702PASZFTMA.001. Results from file *SZ_02_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1

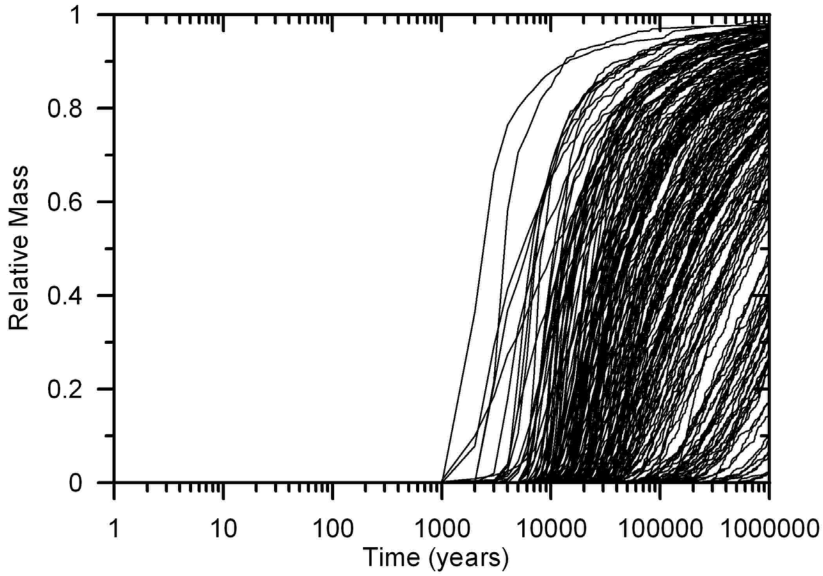
Figure 6-7[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Americium, Thorium, and Protactinium on Reversible Colloids at the Boundary of the Accessible Environment

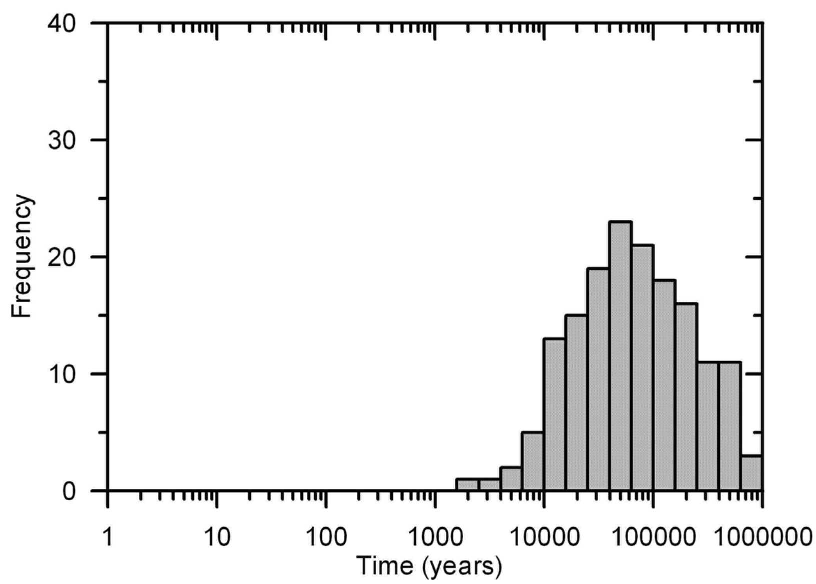


Output DTN: SN0702PASZFTMA.001. Results from file *SZ_03_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

Figure 6-8[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Cesium on Reversible Colloids at the Boundary of the Accessible Environment

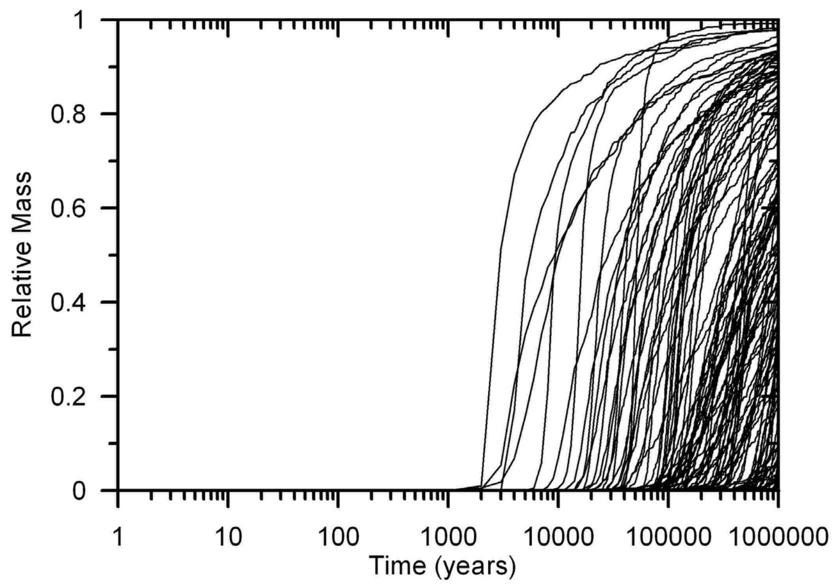


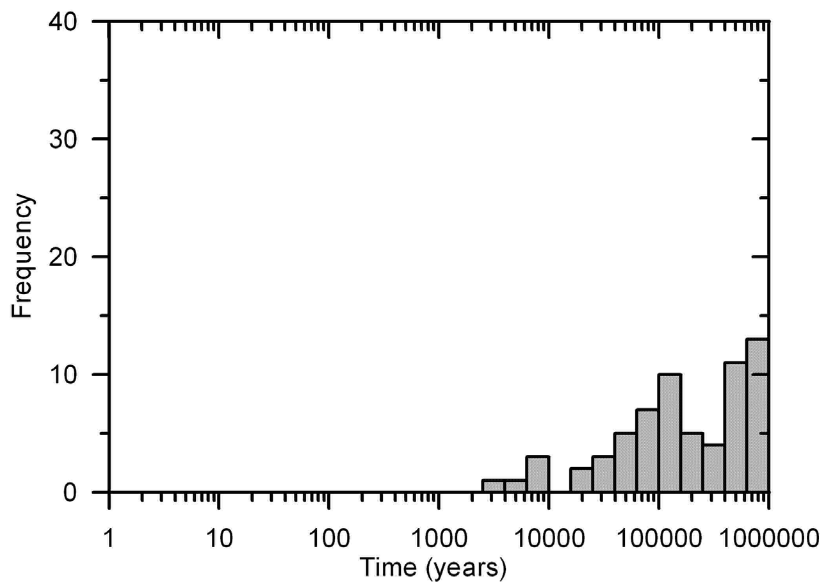


Output DTN: SN0702PASZFTMA.001. Results from file *SZ_04_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

Figure 6-9[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Plutonium on Reversible Colloids at the Boundary of the Accessible Environment

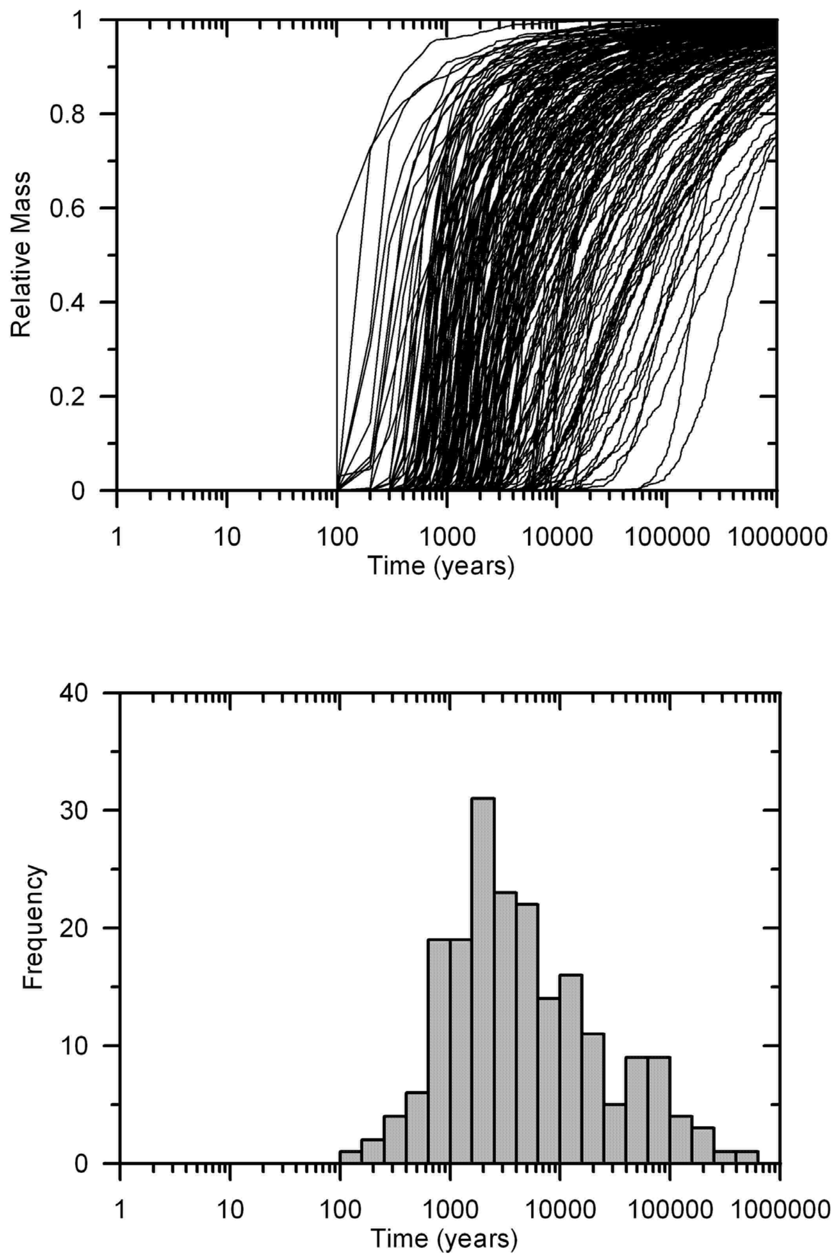




Output DTN: SN0702PASZFTMA.001. Results from file *SZ_12_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

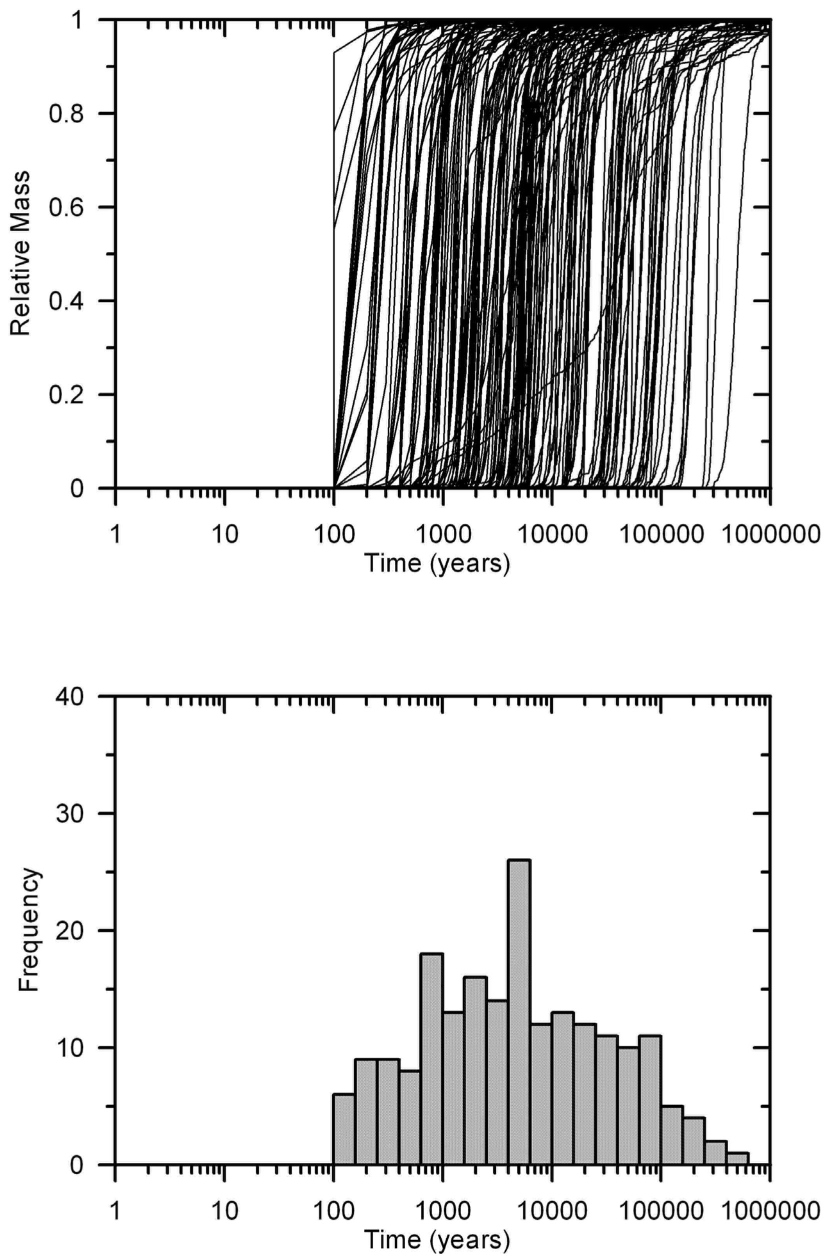
Figure 6-10[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Tin on Reversible Colloids at the Boundary of the Accessible Environment



Output DTN: SN0702PASZFTMA.001. Results from file *SZ_05_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

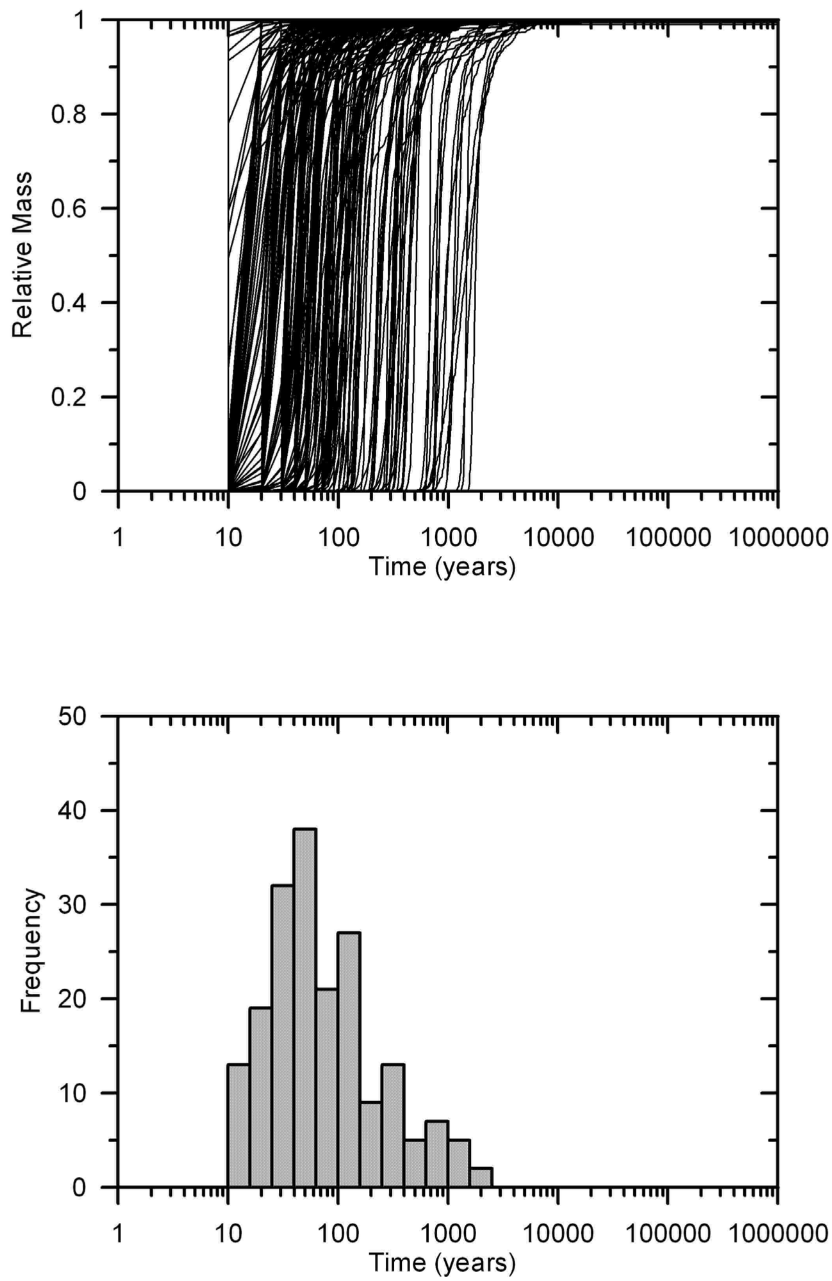
Figure 6-11[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Neptunium at the Boundary of the Accessible Environment



Output DTN: SN0702PASZFTMA.001. Results from file *SZ_06_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

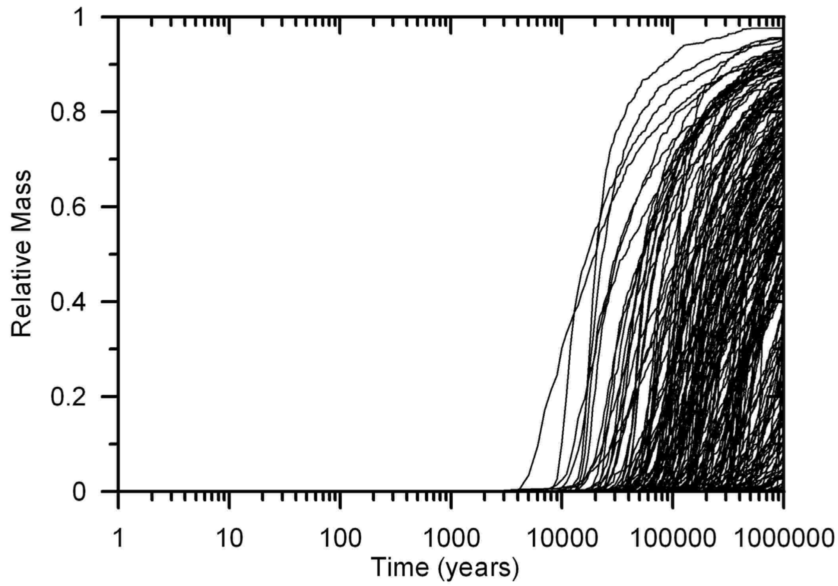
Figure 6-12[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Plutonium and Americium on Irreversible Colloids at the Boundary of the Accessible Environment

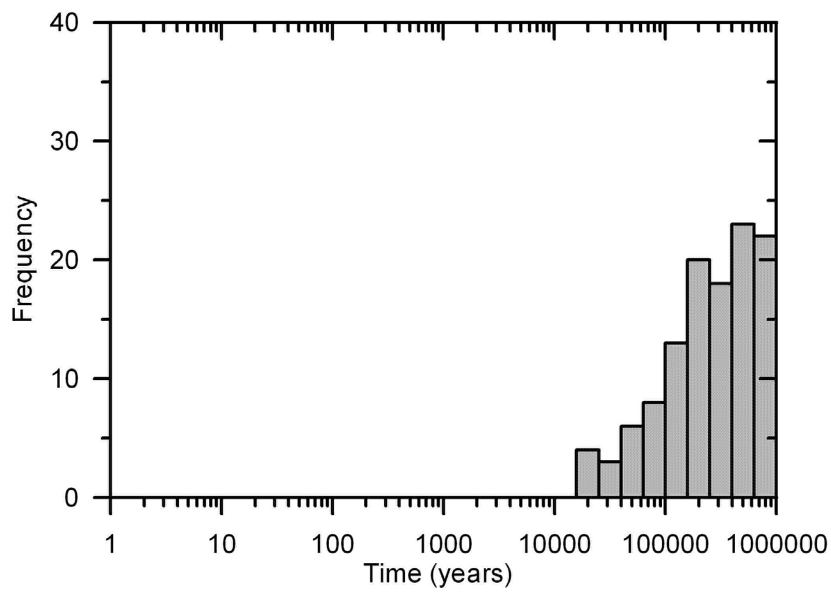


Output DTN: SN0702PASZFTMA.001. Results from file *SZ_10_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

Figure 6-13[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for the Fast Fraction of Plutonium and Americium on Irreversible Colloids at the Boundary of the Accessible Environment

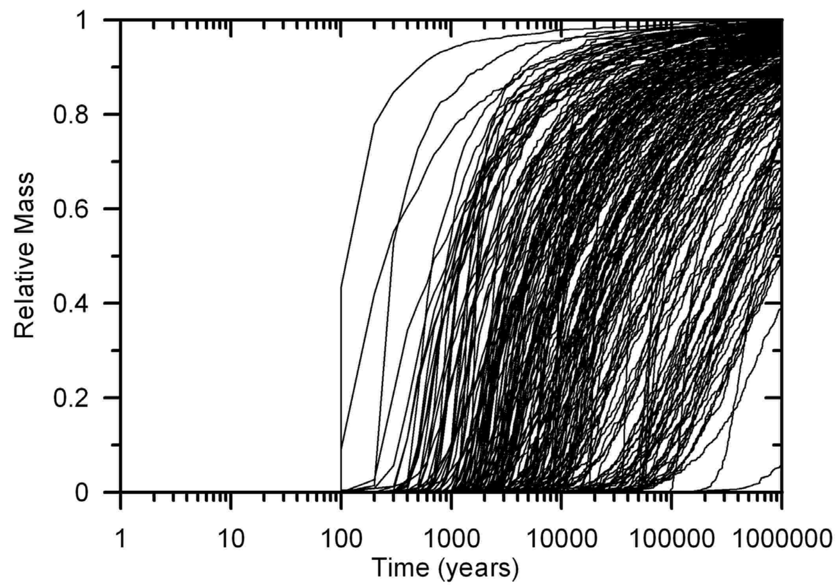


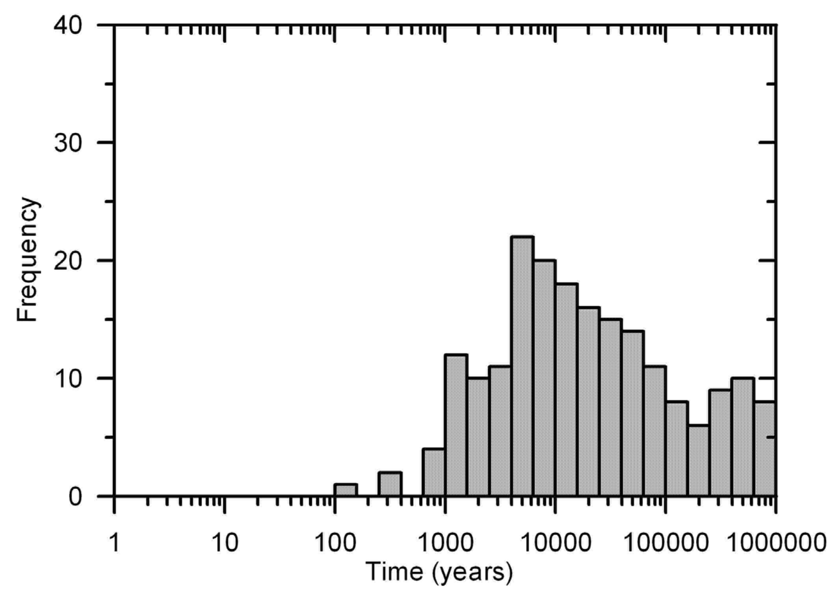


Output DTN: SN0702PASZFTMA.001. Results from file *SZ_07_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

Figure 6-14[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Radium at the Boundary of the Accessible Environment

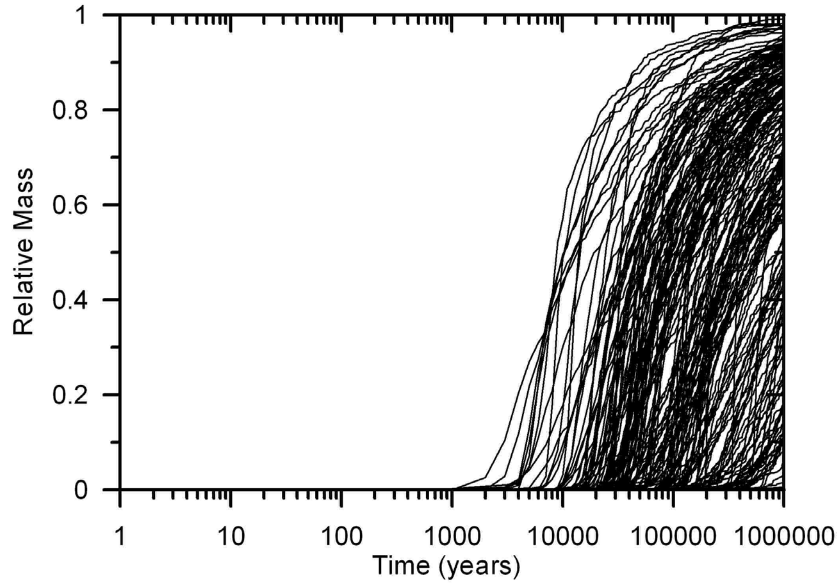


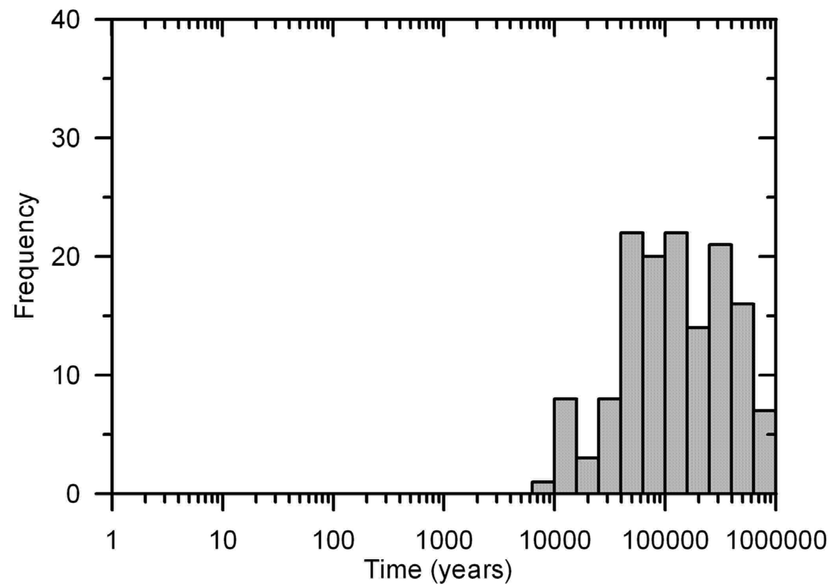


Output DTN: SN0702PASZFTMA.001. Results from file *SZ_11_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

Figure 6-15[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Selenium at the Boundary of the Accessible Environment

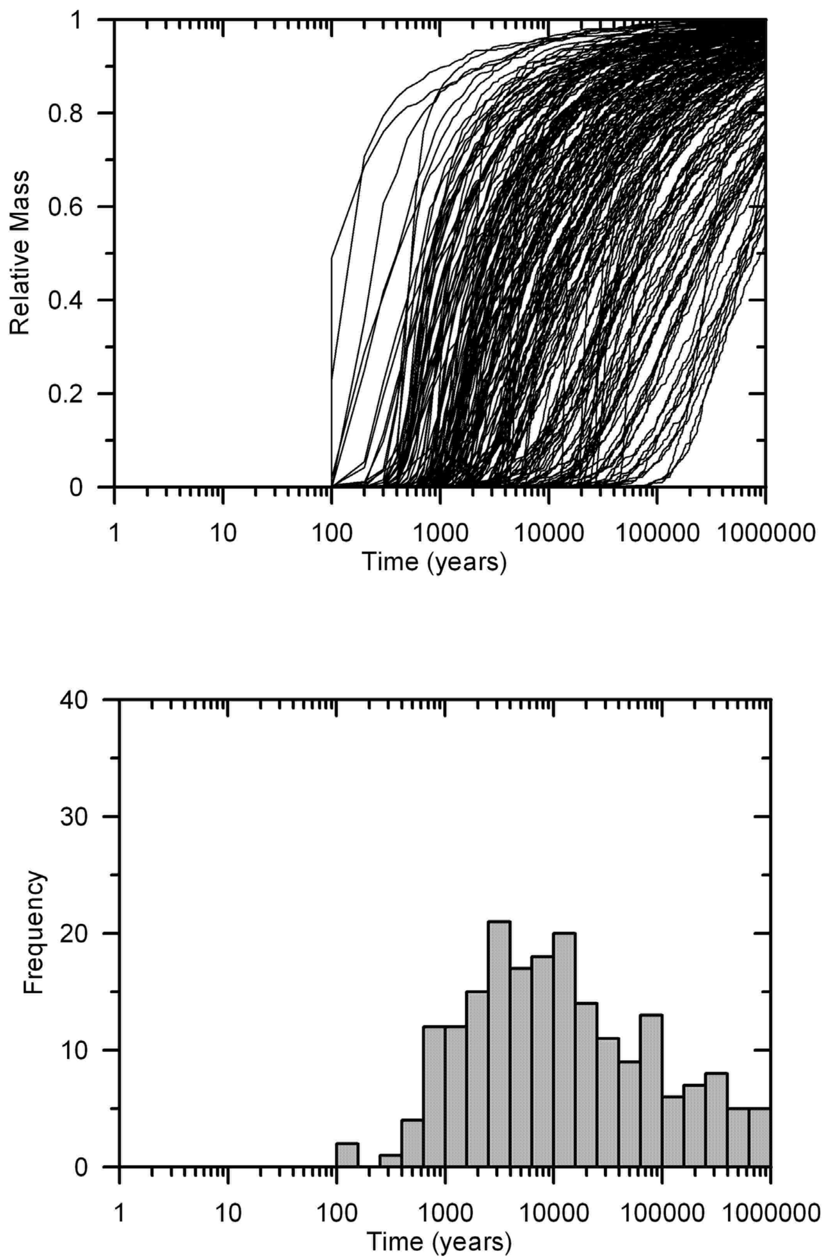




Output DTN: SN0702PASZFTMA.001. Results from file *SZ_08_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

Figure 6-16[a]. Mass Breakthrou gh Curves (upper) and Median Transport Times (lower) for Strontium at the Boundary of the Accessible Environment



Output DTN: SN0702PASZFTMA.001. Results from file *SZ_09_01*.

NOTES: Mass breakthrough curves and median transport times are for glacial-transition climate, and do not include radionuclide decay. Results shown for 200 realizations from source region 1.

Figure 6-17[a]. Mass Breakthrough Curves (upper) and Median Transport Times (lower) for Uranium at the Boundary of the Accessible Environment

6.6.2[a] Summary of Results

Results from the SZ flow and transport abstraction model for the nonsorbing radionuclides of carbon, technetium, iodine, and chlorine indicate that the uncertainty in simulated median transport times to the boundary of the accessible environment for glacial-transition climatic conditions ranges from about 10 years to about 20,000 years. The bulk of the realizations show transport times for nonsorbing species ranging from a few tens of years to a few thousand years and a median transport time among all realizations of about 230 years. All simulated transport times given in this section are without the effects of radioactive decay.

The simulated median transport times for americium, thorium, and protactinium reversibly sorbed onto colloids range from about 1,000 years to greater than 1,000,000 years, with about 72% of the realizations having simulated median transport times of greater than 1,000,000 years. Results for cesium reversibly sorbed onto colloids show median transport times that range from 42,000 years to greater than 1,000,000 years, with about 76% of the realizations with median transport times of greater than 1,000,000 years. The simulations of plutonium transport on reversible colloids indicate median transport times ranging from about 3,000 years to greater than 1,000,000 years, with about 20% of the realizations with median transport times of greater than 1,000,000 years. The simulated median transport times for tin reversibly sorbed onto colloids range from about 3,000 years to greater than 1,000,000 years, with about 68% of the realizations having simulated median transport times of greater than 1,000,000 years.

Simulated transport times from the SZ flow and transport abstraction model for neptunium vary from 100 years to about 450,000 years among the realizations. The bulk of the realizations show transport times ranging from several hundred years to about 100,000 years for neptunium and a median transport time among all the realizations of about 3,800 years.

For plutonium and americium irreversibly attached to colloids, the simulated median transport times vary from 100 years to about 500,000 years, with a median among all realizations of about 4,600 years. The simulated median transport times for the fast fraction of such colloids range from 10 years to about 1,800 years with a median among all realizations of about 60 years.

Radium and strontium are both strongly retarded in the saturated zone, with simulated median transport times ranging from 18,000 years to greater than 1,000,000 years for radium and 9,000 years to greater than 1,000,000 years for strontium. The median simulated transport time among all realizations is about 730,000 years for radium and about 286,000 years for strontium.

The simulated median transport times for selenium range from about 200 years to greater than 1,000,000 years with a median value among all realizations of about 149,000 years. For uranium, the results vary from 200 years to about 930,000 years with a median simulated transport time among all realizations of 8,900 years.

6.7[a] DESCRIPTION OF BARRIER CAPABILITY

The saturated zone forms a barrier to the migration of radionuclides and to the exposure of the potential receptor population to these radionuclides in two ways. Delay in the release of radionuclides to the accessible environment during transport in the saturated zone allows radioactive decay to diminish the mass of radionuclides that are ultimately released. Dilution of radionuclide concentrations in groundwater used by the potential receptor population occurs during transport in the saturated zone and in the process of producing groundwater from wells. Further discussion of the SZ flow system as a barrier to radionuclide migration at Yucca Mountain is found in a report by Eddebbarh et al. (2003 [DIRS 163577]).

6.7.1[a] Analyses of Barrier Capability

The simulated transport times of radionuclides in the saturated zone give a direct indication of the barrier capability of the saturated zone with regard to the delay in the release of radionuclides to the accessible environment. Uncertainty in the radionuclide transport times in the saturated zone is represented in the multiple realizations of the saturated zone system with the SZ transport abstraction model and shown in the breakthrough curves for various radionuclides in Figures 6-6[a] to 6-17[a]. As shown by these figures, the effectiveness of the saturated zone as a barrier to transport varies significantly among the classes of radionuclides included in the analyses. The ranges of median transport times and the median transport times from all realizations for the various radionuclides are summarized in Table 6-10[a].

For nonsorbing species, such as carbon, technetium, iodine, and chlorine, the delay afforded by the saturated zone under estimated glacial-transition climatic conditions can be less than 100 years to as much as about 22,000 years, within the range of uncertainty indicated by the simulation results shown in Figure 6-6[a]. The median transport time for nonsorbing species among all realizations is about 230 years. For the moderately sorbing species of neptunium, simulated median transport times range from about 100 years to greater than 400,000 years, with a median transport time among all realizations of 3,700 years (see Table 6-10[a]). For the strongly sorbing species of radium, simulated median transport times range from 18,000 years to greater than 1,000,000 years, with a median transport time among all realizations of greater than 700,000 years (see Table 6-10[a]).

Analyses with the SZ transport abstraction model indicate that there is considerable uncertainty in the delay of release of radionuclides to the accessible environment for all radionuclides. The upper bounds of uncertainty in the transport times are greater than 1,000,000 years (the upper limit of time in the transport simulations) for all radionuclides, with the exception of the nonsorbing species, neptunium, plutonium and americium irreversibly attached to colloids and their fast fraction, and uranium. The lower bounds of the uncertainty in transport times are indicated by the ranges given in Table 6-10[a].

The summary of simulated transport times presented in Table 6-10[a] is given for saturated zone groundwater flow under glacial-transition climatic conditions. Under present-day and monsoonal climatic conditions that are expected to continue for the next 2,000 years, the groundwater flow rate would be significantly lower and the radionuclide transport times would be correspondingly higher. The saturated zone transport simulations summarized in Table 6-16 were performed to a maximum time of 100,000 years, whereas the transport simulations documented in this addendum were extended to 1,000,000 years.

Table 6-10[a]. Summary of Simulated Transport Times in the Saturated Zone under Glacial-Transition Climatic Conditions

Species	Range of Median Transport Time (years)	Median Transport Time Among All Realizations (years)
Carbon Technetium Iodine	10 to 22,190	230
Reversible Colloids: Americium Thorium Protactinium	1,000 to >1,000,000	>1,000,000
Reversible Colloids: Cesium	42,000 to >1,000,000	>1,000,000
Reversible Colloids: Plutonium	3,000 to >1,000,000	95,000
Neptunium	100 to 455,300	3,700
Irreversible Colloids: Plutonium Americium	100 to 501,900	4,500
Radium	18,000 to >1,000,000	731,000
Strontium	9,000 to >1,000,000	286,000
Uranium	200 to 931,200	8,900
Fast Fraction of Irreversible Colloids: Plutonium Americium	10 to 1,790	60
Selenium	200 to >1,000,000	14,900
Reversible Colloids: Tin	3,000 to >1,000,000	>1,000,000

Output DTN: SN0702PASZFTMA.001.

6.7.2[a] Summary of Barrier Capability

Taken as a whole, these analyses indicate that the saturated zone is expected to be a significant barrier to the transport of radionuclides to the accessible environment, particularly within the first 10,000-year period of regulatory concern for the repository at Yucca Mountain. The expected behavior of the saturated zone system is to delay the transport of sorbing radionuclides and radionuclides associated with colloids for many thousands of years, even under future wetter climatic conditions. The fast fraction of radionuclides irreversibly attached to colloids are expected to move through the saturated zone in several tens of years, but this rapid transport is associated with a small fraction of the mass released from the repository. Nonsorbing radionuclides are expected to be delayed for a few hundred years during transport in the saturated zone.

However, analyses of uncertainty in radionuclide transport in the saturated zone indicate that delays in the release of nonsorbing radionuclides could be as small as ten years. The transport times in the saturated zone of neptunium, uranium, and of plutonium and americium irreversibly attached to colloids could be as small as 100 to 200 years, based on the analyses of uncertainty conducted with the SZ flow and transport abstraction model. Ranges of uncertainty based on analyses with 200 Monte Carlo realizations extend to relatively low probability (approximately

0.5% probability) and thus include relatively unlikely results. Nonetheless, lower values in the ranges of transport time are possible, given the degree of uncertainty included in the model.

The radioactive decay of radionuclides during transport in the saturated zone enhances the barrier capability of the saturated zone by reducing the mass of radionuclides ultimately released to the accessible environment. The effectiveness of the decay process in attenuating releases from the saturated zone is related to the delay in the saturated zone and the half-life of the radionuclide. For radionuclides with longer transport times in the saturated zone and relatively short half-lives, this process renders the saturated zone an extremely effective barrier. ^{90}Sr and ^{137}Cs transport times would exceed several thousand half-lives (i.e., greater than 100,000 years) based on the median transport time among the realizations (Table 6-10[a]). For comparison, the reduction in radioactivity after 20 half-lives is more than six orders of magnitude. For some radionuclides, a modest reduction in radionuclide mass would occur during transport in the saturated zone under estimated glacial-transition climatic conditions. Based on the median transport time among all realizations (Table 6-10[a]), ^{240}Pu that is irreversibly attached to colloids would be expected to experience about 0.69 half-lives. Several radionuclides would experience little attenuation due to radioactive decay during transport in the saturated zone. ^{99}Tc, ^{129}I, and ^{237}Np would have only very small reductions in mass during the delay in release afforded by the saturated zone, due to their long half-lives (2.13×10^5 years for ^{99}Tc to 1.57×10^7 years for ^{129}I, Baum et al. 2002 [DIRS 175238]).

The dilution of radionuclides in the saturated zone and during extraction of groundwater by the future hypothetical community in which the reasonably maximally exposed individual resides is not quantitatively assessed with the transport modeling approach used in the SZ transport abstraction model. The relatively low values of transverse dispersivity in the uncertainty distribution for this parameter suggest that a large amount of dilution in radionuclide concentration during transport from beneath the repository to the accessible environment in the saturated zone is not expected.

6.8[a] GROSS ALPHA CONCENTRATION

No changes to this section.

6.9[a] EVALUATION OF GROUNDWATER FLOW RATE OBSERVATIONS AT WELL NC-NWDP-24PB

High groundwater flow rates have been inferred in discrete zones within the Crater Flat Tuff near well NC-NWDP-24PB (24PB) (Freifeld et al. 2006 [DIRS 178611], Section 5). This inference is based on measurements using flowing fluid electrical conductivity (FEC) logs and thermal logging in borehole 24PB. The purpose of this section is to evaluate these observations relative to the modeling of groundwater flow and radionuclide transport in the SZ flow and transport abstraction model and the SZ one-dimensional transport model. A modeling sensitivity analysis is used to compare the potential impacts of the inferred groundwater flow rate to the range of uncertainty considered in the SZ flow and transport abstraction model.

6.9.1[a] Well Testing Results

FEC logging was used to characterize groundwater flow in fractured rock and its interaction with a wellbore. The method involved replacement of wellbore water with deionized water, pumping of the well at a low rate, and measuring profiles of electrical conductivity within the well as a function of time (Freifeld et al. 2006 [DIRS 178611], Section 3.1). The electrical conductivity of the wellbore water increased as higher-conductivity groundwater from fractures entered the wellbore and mixed with the lower-conductivity deionized water. A computer program (BORE II, Freifeld et al. 2006 [DIRS 178611], Section 3.1) was used to estimate the locations and magnitudes of groundwater flow rates into and out of the wellbore from the FEC logs.

The results of the FEC logging in well 24PB indicated a zone with a net cross flow of about 6 L/min at a depth of 200 to 230 m (Freifeld et al. 2006 [DIRS 178611], Figure 10). Additional cross flow of groundwater of about 2 L/min was inferred to occur between 230 and 320 m depth.

Thermal logging was also used to estimate the distribution and magnitude of groundwater flow near well 24PB. This logging method involved emplacement of an electrical heating element and distributed temperature sensor along with a piezometer tube, all of which were grouted into the borehole. A uniform heat source was provided by the heating element, and the resulting temperature profiles were recorded as a function of time (Freifeld et al. 2006 [DIRS 178611], Section 4). Advective lateral transport of heat by flowing groundwater resulted in less of an increase in temperature in those zones with flowing groundwater.

The results of the thermal logging in well 24PB indicated seven zones of reduced temperatures that correlate with flowing zones from the FEC logging (Freifeld et al. 2006 [DIRS 178611], Section 4.2), corroborating both methods. The highest of these zones, "A," corresponded to the zone in the Bullfrog Tuff of highest cross flow in the FEC logging, and the lower six zones were distributed between about 240 and 320 m depth, extending from the lower Bullfrog Tuff to the upper Tram Tuff. However, the estimated magnitude of groundwater flow from the thermal logging was significantly less than the estimates from the FEC logging. For example the estimated flow rates for zone "A" from the thermal logging were 0.70 to 1.10 L/min (Freifeld et al. 2006 [DIRS 178611], Table 4), which was less than the approximately 6 L/min estimated from the corresponding zone in the FEC logging (Freifeld et al. 2006 [DIRS 178611], Figure 10). The reason for the differences in estimated flow rates between the thermal logging and the FEC logging was not clear; however, the higher estimated flow rate is used in the sensitivity analysis presented in Section 6.9.3[a].

6.9.2[a] Implications for Flow and Transport Modeling

The estimated volumetric groundwater flow rates from the testing in well 24PB are significantly higher within the high-flow zone than those simulated by the calibrated SZ site-scale flow model at the location of 24PB. Based on the FEC logging and the thermal logging, the estimated volumetric cross flow rate at the well for the zone from a depth of about 200 m to 230 m is a few L/min. The simulated volumetric flow rate through the grid cells at the same depth and at the location of well 24PB in the calibrated SZ site-scale flow model is about 0.9 L/min. The simulated volumetric flow rate, however, is for the entire width of the model cell (250 m), whereas the estimated cross flow rate from the well testing is for a width about twice the borehole diameter (0.34 m). The SZ site-scale flow model uses a continuum approach in which representative homogeneous values of permeability are assigned to fractured volcanic units. Individual discrete zones of higher permeability are not represented in the SZ site-scale flow model because of the limitations of spatial resolution in the model grid and because observations of such discrete zones are available only in a few wells. In addition, observations of discrete zones of high flow such as those at well 24PB do not provide information on the orientation, length, width, or interconnectivity of such features for use in groundwater flow modeling.

One potential implication of the high flow rates inferred at well 24PB is that average specific discharge and groundwater flow velocity in the tuff units in the saturated zone (Freifeld et al. 2006 [DIRS 178611], Section 3.3.3.1, Table 4 and Section 5) may be higher than simulated in the SZ site-scale flow model. This implication is related to the question of how spatially representative the observations at well 24PB are. The scale of the measurement with the FEC logging is limited to approximately twice the borehole diameter. The thermal logging method investigates a somewhat larger but still limited volume around the borehole with regard to groundwater flow rates. It is difficult to assess how representative the observations are from testing in only well 24PB, but the estimates of groundwater flow rates from this site are relevant taken in conjunction with other sources of information. The overall water budget in the SZ site-scale flow model is constrained by estimates of groundwater flow rates at the lateral boundaries that are derived from the Death Valley regional groundwater flow model. Uncertainty in the specific discharge is assessed in the SZ flow and transport abstraction model (Section 6.5.2.1[a]) by multiplying the groundwater flow rates in the calibrated SZ site-scale flow model by a factor with values as high as 8.9 (Table 6-7[a]) and consequently incorporating the possibility of significantly higher flow rates.

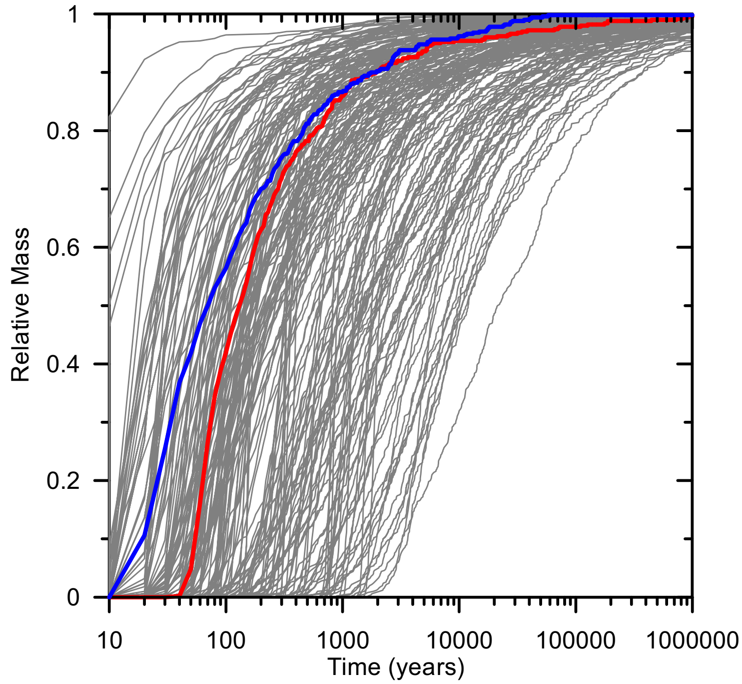
Another potential implication of the high flow rates inferred at well 24PB is that groundwater flow can be highly channelized in the fractured tuff units of the saturated zone. The spatial extent or length of the zone with high groundwater flow rates is uncertain, based on the limited scale of observation in the 24PB testing. The degree of groundwater channelization is represented by the flowing interval spacing parameter, FISVO, in the SZ flow and transport abstraction model (Section 6.5.2.3[a]). This parameter is the average spacing between features that conduct a significant amount of groundwater in fractured units of the saturated zone and impacts the simulation of radionuclide transport through the matrix diffusion process. The uncertainty distribution for the parameter FISVO has an upper limit of 80 m (Table 6-7[a]), corresponding to the maximum degree of flow channelization in the SZ flow and transport abstraction model.

6.9.3[a] Sensitivity Analysis with the SZ Flow and Transport Abstraction Model

The SZ flow and transport abstraction model was modified to evaluate the impact of including a high-permeability zone at the location of well 24PB on radionuclide transport simulations. The modifications to the SZ flow and transport abstraction model included reasonable assumptions about the potential orientation and dimensions of the zone in which high flow rates were inferred and were adjusted to approximately match the estimated magnitude (6 L/min) of the flow rates at 24PB. The high-permeability zone was assumed to be oriented in a north—south direction, to have a length of 6,000 m, and to be centered on the model node closest to the location of well 24PB. The north-south orientation is consistent with the approximate strike of major faults in this area to the south of Yucca Mountain (SNL 2007 [DIRS 177391], Figure 6-3). The high-permeability zone was also assumed to be 30-m thick and was specified at the elevation of the zone in well 24PB with the highest flow rates, at a depth of about 200 to 230 m (Freifeld et al. 2006 [DIRS 178611], Figure 10).

The groundwater flow rate through the location of well 24PB was calculated assuming that the flow occurs over a depth of 30 m at a rate of 6 L/min (Freifeld et al. 2006 [DIRS 178611], Figure 10) and across a lateral width of two borehole diameters (about 0.34 m). The resulting flow rate was extrapolated over an assumed east-west width of 100 m for the high-flow zone. Further assuming that the flow through this zone scales up for glacial-transition climatic conditions by a factor of 3.9, as estimated for the rest of the saturated zone (Section 6.5[a]), the resulting inter-nodal mass flow rate estimated at well 24PB is about 38 kg/s for each of the three model cells corresponding the 30-m-thick zone of high flow. Assigning a value of 5×10^{-8} m^2 permeability to the high-permeability zone results in a steady-state simulated inter-nodal mass flow rate of about 27 kg/s at the location of well 24PB. Although this simulated mass flow rate is somewhat smaller than the estimated value, it is a reasonable approximation and results in a high degree of groundwater flow channelization through the high-permeability zone relative to the base-case SZ flow and transport abstraction model.

The sensitivity of the radionuclide transport simulations to the presence of the assumed high-permeability zone was evaluated by comparing the transport simulation results from the median case defined for model validation (see Section 7.1[a]) with the modified SZ flow and transport abstraction model. The simulated mass breakthrough curves for these two cases for a nonsorbing radionuclide are shown in Figure 6-18[a], with the red curve representing the median case and the blue curve representing the model with the high-permeability zone at well 24PB. The simulated mass breakthrough generally occurs faster in the model with the high-permeability zone, as expected. Simulated transport times in the high-permeability-zone model are shorter because simulated flow paths are pulled to the west and into the higher flow of the high-permeability zone and because transport distances through the alluvium are somewhat shorter along the altered flow paths. Comparison of the blue curve to the gray curves showing the 200 breakthrough curves from the SZ flow and transport abstraction model in Figure 6-18[a] indicates that the simulated breakthrough curve for the model with the high-permeability zone at well 24PB falls within the envelope of realizations from the SZ flow and transport abstraction model utilized in the TSPA model. The existence of a high-flow zone at well 24PB, using reasonable assumptions about the orientation and dimensions of the zone, is thus captured within the range of uncertainty represented by the SZ flow and transport abstraction model.



NOTE: Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay. Gray breakthrough curves are for the 200 realizations from the SZ flow and transport abstraction model of a nonsorbing radionuclide, as shown in Figure 6-6[a].

Figure 6-18[a]. Simulated Mass Brea kthrough Curves for the Median Case (red curve) and the High-Permeability-Zone Model (blue curve) for a Nonsorbing Radionuclide

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7.[a] VALIDATION

This section of the report documents the validation of the SZ flow and transport abstraction model and the SZ one-dimensional transport model. Validation testing is required because the site-scale SZ transport model (SNL 2007 [DIRS 177392]), which forms the basis for these models, has been updated. The general structure and implementation of the abstraction has not changed, however.

The importance of and validation activities for the SZ flow and transport abstraction model and the SZ one-dimensional transport model are directly relevant to the use of these models as abstractions of SZ flow and transport processes in the TSPA model. The model validation plan for the SZ flow and transport abstraction model and the SZ one-dimensional transport model is described in *Technical Work Plan for Saturated Zone Flow and Transport Modeling* (BSC 2006 [DIRS 177375]). The validation plan includes a comparison of simulated breakthrough curves from the SZ one-dimensional transport model with those from the underlying SZ site-scale transport model, including qualitative and quantitative comparisons between simulated radionuclide breakthrough curves for a nonsorbing species and neptunium. The plan was developed under BSC procedures in effect at the time. This is equivalent to Level I validation as required by SCI-PRO-002, *Planning for Science Activities*. Level I validation is justified if a favorable comparison of these results can be obtained, because the underlying process model will be already validated (SNL 2007 [DIRS 177392]). Validation of the SZ flow and transport abstraction model and the SZ one-dimensional transport model is accomplished by the following postdevelopment validation method, as required by SCI-PRO-006, Section 6.3.2:

> Corroboration of abstraction model results to the results of the validated mathematical model or process model from which the abstraction model was derived.

7.1[a] VALIDATION PROCEDURES

The validation procedures are the same as those described in Section 7.1. However, the definitions of the median, fast, and slow cases have been modified to reflect changes in some parameter uncertainty distributions and in some parameter definitions. The updated parameter values for these three cases are given in Table 7-1[a].

Table 7-1[a]. Parameter Values in the Three Cases for SZ Transport Model Validation

Parameter Name	Parameter Description	Median Case	Fast Case	Slow Case
FISVO	Flowing interval spacing in volcanic units	25.8 m	45.8 m	7.24 m
HAVO	Ratio of horizontal anisotropy in permeability	4.2	16.25	1.0
LDISP	Longitudinal dispersivity	2.0 (100 m)	2.96 (920 m)	1.03 (10.9 m)
FPLANW	Northwestern boundary of the alluvial uncertainty zone	0.5	0.1	0.9
NVF26	Effective porosity in shallow alluvium	0.18	0.114	0.245

Table 7-1[a]. Parameter Values in the Three Cases for SZ Transport Model Validation (Continued)

Parameter Name	Parameter Description	Median Case	Fast Case	Slow Case
NVF11	Effective porosity in undifferentiated valley fill	0.18	0.114	0.245
FPVO	Fracture porosity in volcanic units	−3.0 (10^{-3})	−3.89 (1.29×10^{-4})	−1.50 (0.0316)
DCVO	Effective diffusion coefficient in volcanic units	−10.3 (5.0×10^{-11} m^2/s)	−10.68 (2.08×10^{-11} m^2/s)	−9.65 (2.22×10^{-10} m^2/s)
GWSPD	Groundwater specific discharge multiplier	0.0 (1.0)	0.394 (2.48)	−0.394 (0.404)
bulkdensity	Bulk density of alluvium	1910 kg/m^3	1810 kg/m^3	2010 kg/m^3
KDNPVO	Neptunium sorption coefficient in volcanic units	1.3 mL/g	1.04 mL/g	1.6 mL/g
KDNPAL	Neptunium sorption coefficient in alluvium	6.35 mL/g	4.26 mL/g	8.44 mL/g

NOTES: Values in parentheses are the parameter values from log-transformed uncertainty distributions. Values in this table have been calculated from the parameter uncertainty distributions given in Table 6-7[a] and Table 6-8.

7.1.1[a] SZ Flow and Transport Abstraction Model

The validation testing procedures for the SZ flow and transport abstraction model are the same as those described in Section 7.1.1. Model validation testing was performed with a revised version of the software code that implements the convolution integral method, SZ_Convolute V. 3.10.01 (STN: 10207-3.10.01-00 [DIRS 179880]).

7.1.2[a] SZ One-Dimensional Transport Model

The validation testing procedures for the SZ one-dimensional transport model are the same as those described in Section 7.1.2. The SZ one-dimensional transport model was implemented in a revised version of GoldSim V. 9.60, and the model validation testing was performed using the same version of the software.

7.2[a] VALIDATION CRITERIA

The model validation plan for the SZ flow and transport abstraction model and the SZ one-dimensional transport model is described in *Technical Work Plan for Saturated Zone Flow and Transport Modeling* (BSC 2006 [DIRS 177375]). The plan was developed under then-current BSC procedures. This is equivalent to Level I validation as required by SCI-PRO-002. Level I validation is justified if a favorable comparison of these results can be obtained, because the underlying process model will already be validated to Level II model validation requirements (SNL 2007 [DIRS 177392]). Comparison of an abstraction model with the underlying process model provides explicit evidence of the ability of the abstraction to capture the behavior of the process model.

The acceptance criterion for both the SZ flow and transport abstraction model and the SZ one-dimensional transport model is a favorable qualitative comparison between the simulated SZ breakthrough curves from these two models and the breakthrough curve from the SZ site-scale transport model. Simulated breakthrough curves are compared for a nonsorbing species and for neptunium using the median, fast, and slow cases outlined above. Qualitative acceptance criteria for comparisons with the SZ one-dimensional transport model are not as stringent as those for the SZ flow and transport abstraction model, given the inherent limitations of the SZ one-dimensional transport model and its limited intended use in the transport simulations of daughter products.

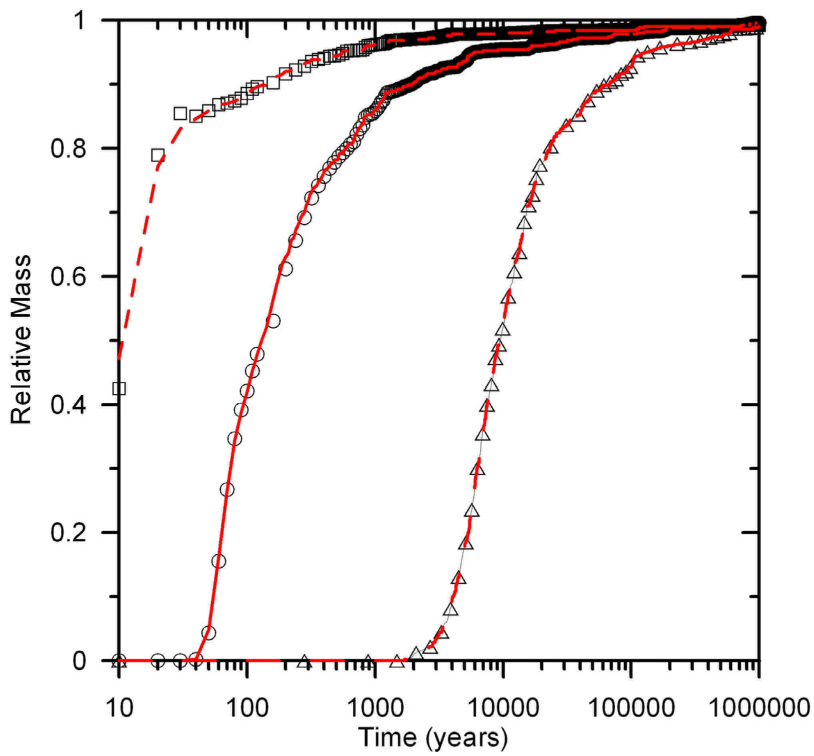
The acceptance criterion for the validation of the SZ flow and transport abstraction model is a favorable check of the radionuclide mass balance in the model. The mass input to the model should equal the mass output from the model over long time periods within a few percent (eliminating the effects of radioactive decay).

7.3[a] RESULTS OF VALIDATION ACTIVITIES

The numerical results of the model validation activities for the updated SZ flow and transport abstraction model and the SZ one-dimensional transport model are presented primarily as a set of plots of simulated breakthrough curves. A quantitative assessment of the mass balance in the SZ flow and transport abstraction model is also presented.

7.3.1[a] SZ Flow and Transport Abstraction Model Validation Results

Results of the SZ flow and transport abstraction model and the SZ site-scale transport model (SNL 2007 [DIRS 177392]) for a nonsorbing species are shown as simulated breakthrough curves in Figure 7-1[a]. This figure shows results for the median, fast, and slow cases of saturated zone transport. All simulations were conducted without radioactive decay. The simulated breakthrough curves from the SZ site-scale transport model are shown with the solid and dashed lines for the three cases. The results from the SZ flow and transport abstraction model are shown as the open symbols that are superimposed on the breakthrough curves from the site-scale model.



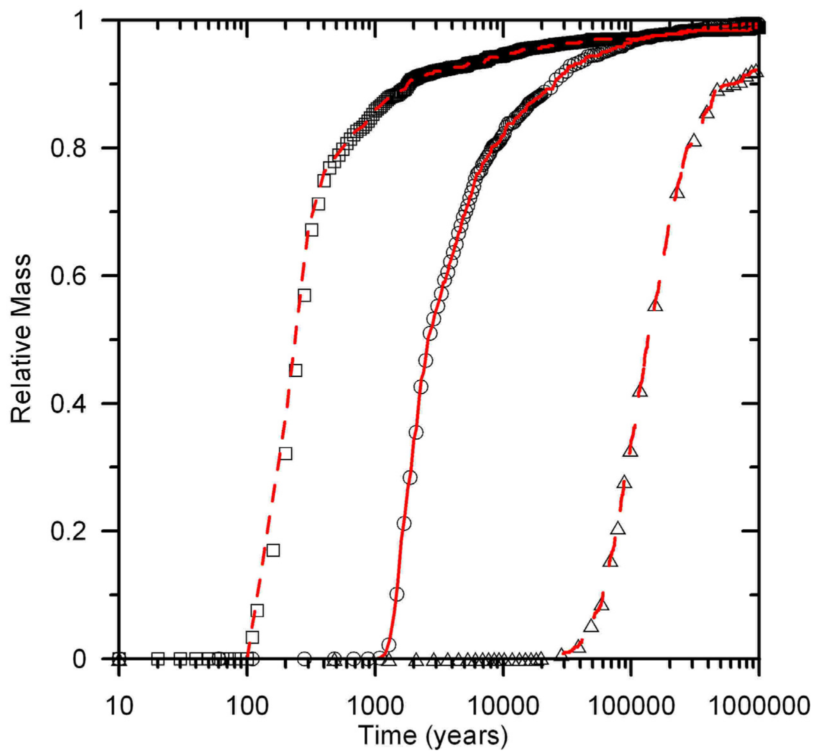
Source: SNL 2007 [DIRS 177392].

NOTES: Results from the SZ site-scale transport model are shown for the median case (solid line), fast case (short-dashed line), and slow case (long-dashed line). Results from the SZ transport abstraction model are shown for the median case (open circle), fast case (open square), and slow case (open triangle). Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay.

Figure 7-1[a]. Simulated Breakthrough Curves Comparing the Results of the SZ Flow and Transport Abstraction Model and the SZ Site-Scale Transport Model for a Nonsorbing Radionuclide

Visual comparison of the open symbols and the lines in Figure 7-1[a] indicates agreement within a few percent of relative mass in the results from the SZ flow and transport abstraction model and the SZ site-scale transport model for all three cases of SZ transport. Agreement between the results from the two models is approximately consistent at 10%, 50%, and 90% mass breakthrough.

Results of the SZ flow and transport abstraction model and the SZ site-scale transport model (SNL 2007 [DIRS 177392]) for neptunium are shown as simulated breakthrough curves in Figure 7-2[a]. This figure shows results for the median, fast, and slow cases of SZ transport. All simulations were conducted without radioactive decay. The simulated breakthrough curves from the SZ site-scale transport model are shown with the solid and dashed lines for the three cases. The results from the SZ flow and transport abstraction model are shown as the open symbols that are superimposed on the breakthrough curves from the site-scale model.



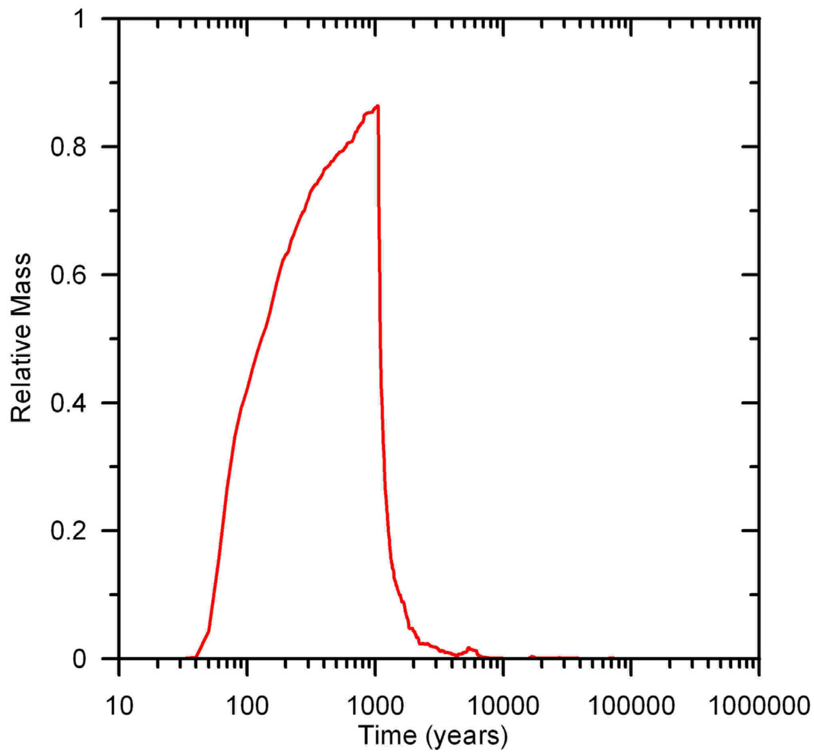
Source: SNL 2007 [DIRS 177392].

NOTE: Results from the SZ site-scale transport model are shown for the median case (solid line), fast case (short-dashed line), and slow case (long-dashed line). Results from the SZ transport abstraction model are shown for the median case (open circle), fast case (open square), and slow case (open triangle). Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay.

Figure 7-2[a]. Simulated Breakthrough Curves Comparing the Results of the SZ Flow and Transport Abstraction Model and the SZ Site-Scale Transport Model for Neptunium

Visual comparison of the open symbols and the lines in Figure 7-2[a] indicates agreement within a few percent of relative mass in the results from the SZ flow and transport abstraction model and the SZ site-scale transport model for all three cases of SZ transport. Agreement between the results from the two models is approximately consistent at 10%, 50%, and 90% neptunium mass breakthrough.

Figure 7-3[a] shows the simulated breakthrough curve from the SZ flow and transport abstraction model of a nonsorbing species for the median case. This simulation applies a radionuclide mass influx boundary condition of 1 g/yr for the first 1,000 years of the simulation, which results in a total mass input of 1,000 grams. The mass balance in the SZ transport abstraction model is checked by summing the total mass output from the simulated breakthrough curve shown in Figure 7-3[a] over the 1,000,000 years of the simulation. The output sum is approximately 1,004.4 grams, which is 100.4% of the input mass. The discrepancy is due to numerical approximation in implementing the convolution integral method in the SZ_Convolute V. 3.10.01 software code. This discrepancy is less than the allowable error of a few percent specified in the acceptance criterion and would overestimate the radionuclide mass release from the saturated zone in the TSPA model. The total output mass from the SZ flow and transport abstraction model for the fast case and the slow case is 99.8% and 101.6% of the input mass, respectively.

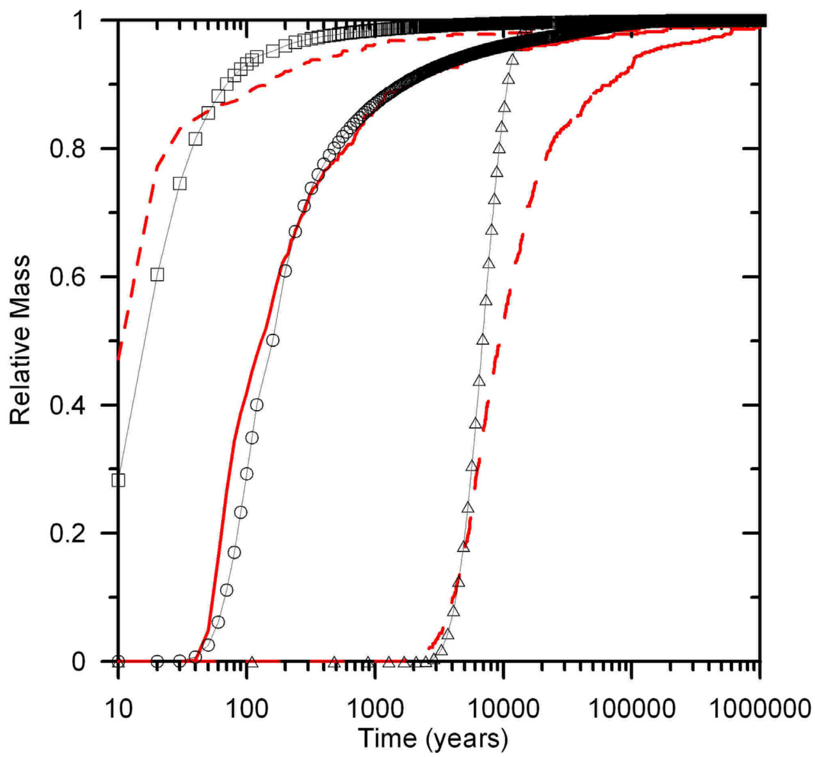


NOTE: Results from the SZ flow and transp ort abstraction model are shown for the median case. The breakthrough curve does not include radioactive decay.

Figure 7-3[a]. Simulated Breakthrough Curve for a Nonsorbing Radionuclide from a 1,000-Year-Duration Source

7.3.2[a] Saturated Zone One-Dimensional Transport Model Validation Results

Results of the SZ one-dimensional transport model and the SZ site-scale transport model for a nonsorbing species are shown as simulated breakthrough curves in Figure 7-4[a]. This figure shows results for the median, fast, and slow cases of saturated zone transport. All simulations were conducted without radioactive decay. The simulated breakthrough curves from the SZ site-scale transport model are shown with the solid and dashed lines for the three cases. The results from the SZ one-dimensional transport model are shown as the open symbols superimposed on the breakthrough curves from the SZ site-scale transport model.



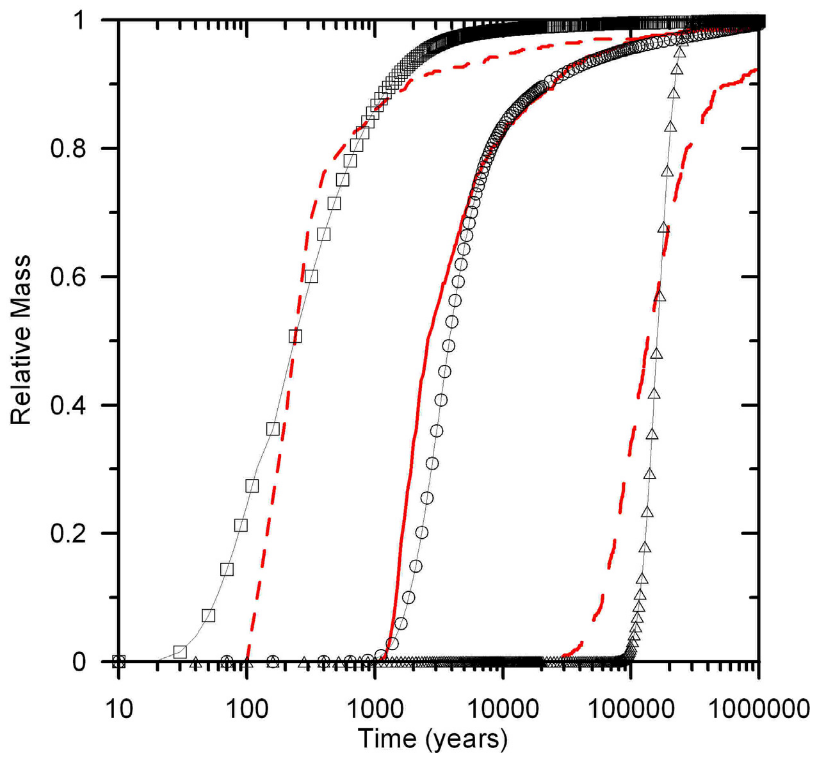
Source: SNL 2007 [DIRS 177392].

NOTE: Results from the SZ site-scale transport model are shown for the median case (solid line), fast case (short-dashed line), and slow case (long-dashed line). Results from the SZ one-dimensional transport model are shown for the median case (open circle), fast case (open square), and slow case (open triangle). Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay.

Figure 7-4[a]. Simulated Breakthrough Curves Comparing the Results of the SZ One-Dimensional Transport Model and the SZ Site-Scale Transport Model for a Nonsorbing Radionuclide

Visual comparison of the open symbols and the lines in Figure 7-4[a] indicates approximate agreement in the results for a nonsorbing species from the SZ one-dimensional transport model and the SZ site-scale transport model for the median case of SZ transport. There is generally close comparison in the overall shapes of the breakthrough curves from the SZ one-dimensional transport model and the SZ site-scale transport model, as indicated by the times of 10%, 50%, and 90% of mass breakthrough, with the notable exception of the 90% breakthrough for the slow case. Differences between the SZ one-dimensional transport model and the SZ site-scale transport model results for the fast case and the slow case are greater than for the median case, with greater deviation occurring for the upper tails of the breakthrough curves. Differences are most pronounced for the upper tails of the breakthrough curves in the slow case, for which the 90% breakthrough from the SZ site-scale transport model occurs at about 67,900 years and the 90% breakthrough from the SZ one-dimensional transport model occurs at about 10,800 years. As a consequence of this difference, radionuclide mass would be simulated to arrive at the accessible environment sooner in the SZ one-dimensional model for realizations with slower SZ transport. The underestimate of transport times in the saturated zone by the SZ one-dimensional transport model in these realizations leads to simulated consequences that occur sooner and higher simulated dose consequences in the TSPA.

Results of the SZ one-dimensional transport model and the SZ site-scale transport model for neptunium are shown as simulated breakthrough curves in Figure 7-5[a]. This figure shows results for the median, fast, and slow cases of saturated zone transport. All simulations were conducted without radioactive decay. The simulated breakthrough curves from the SZ site-scale transport model are shown with the solid and dashed lines for the three cases. The results from the SZ one-dimensional transport model are shown as the open symbols superimposed on the breakthrough curves from the SZ site-scale transport model.



Source: SNL 2007 [DIRS 177392].

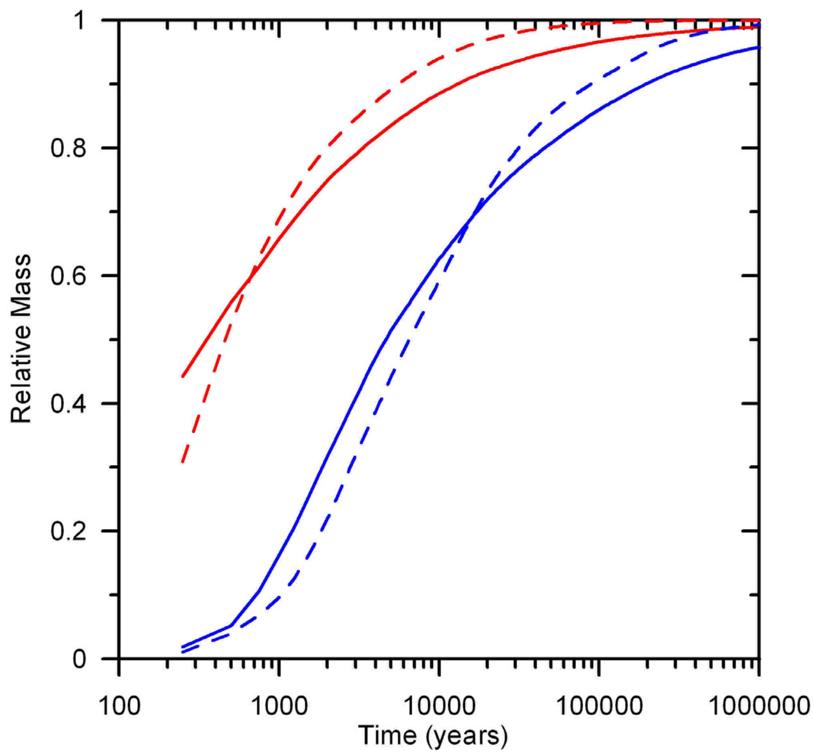
NOTE: Results from the SZ site-scale transport model are sh own for the median case (solid line), fast case (short-dashed line), and slow case (long-dashed line). Results from the SZ one-dimensional transport model are shown for the median case (open circle), fast case (open square), and slow case (open triangle). Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay.

Figure 7-5[a]. Simulated Breakthrough Curves Comparing the Results of the Saturated Zone One-Dimensional Transport Model and the Saturated Zone Site-Scale Transport Model for Neptunium

Visual comparison of the open symbols and the lines in Figure 7-5[a] indicates approximate agreement in the results for neptunium from the SZ one-dimensional transport model and the SZ site-scale transport model for the median case of saturated zone transport. There is generally close comparison in the overall shapes of the breakthrough curves from the SZ one-dimensional transport model and the SZ site-scale transport model, as indicated by the times of 10%, 50%, and 90% of mass breakthrough, with the exception of the upper and lower tails of the slow case. For the slow case, 10% mass breakthrough is simulated to occur at about 60,300 years in the SZ site-scale transport model and at about 117,000 years in the SZ one-dimensional transport model;

90% mass breakthrough is simulated to occur at about 574,000 years in the SZ site-scale transport model and at about 220,000 years in the SZ one-dimensional transport model. Differences between the SZ one-dimensional transport model and the SZ site-scale transport model results for the fast case and the slow case are greater than for the median case, with greater deviation occurring for the upper tails of the breakthrough curves. Differences are most pronounced for the breakthrough curves in the slow case. However, there is generally good agreement between the results from the SZ one-dimensional transport model and the SZ site-scale transport model at the mid-points of the breakthrough curves. Because the midpoints of the breakthrough curves approximately match, the bulk of the neptunium mass arrival at the accessible environment is accurately simulated by the SZ one-dimensional transport model. As a consequence of the differences in the upper and lower tails for the slow case, early arrival (and dose consequences) are underestimated by the SZ one-dimensional transport model and later arrival (and dose consequences) are overestimated in the TSPA.

Results of the SZ one-dimensional transport model and the SZ flow and transport abstraction model, expressed as the mean breakthrough curves from 200 realizations, for a nonsorbing species and neptunium are shown and compared in Figure 7-6[a]. These average results indicate similar behavior for the two models, with somewhat less apparent dispersion exhibited by the SZ one-dimensional transport model relative to the SZ flow and transport abstraction model. The SZ one-dimensional transport model results indicate somewhat slower simulated transport at early times and faster simulated transport at later times for both a nonsorbing species and for neptunium, on average, relative to the SZ flow and transport abstraction model.



NOTES: Mean results from the SZ flow and transport abstraction model are shown with the solid lines and the mean results from the SZ one-dimensional transport model are shown with the dashed lines. Results for a nonsorbing species are shown in red and for neptunium are shown in blue. Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay.

Figure 7-6[a]. Simulated Breakthrough Curves Comparing the Results of the SZ Flow and Transport Abstraction Model and the Saturated Zone One-Dimensional Transport Model for a Nonsorbing Radionuclide and Neptunium for the Mean of 200 Realizations

7.4[a] CONCLUSIONS

7.4.1[a] SZ Flow and Transport Abstraction Model Validation

Validation testing of the SZ flow and transport abstraction model indicates good agreement with the SZ site-scale transport model (SNL 2007 [DIRS 177392]). Acceptance criteria established for the model validation regarding the qualitative comparison of simulated breakthrough curves and the quantitative evaluation of radionuclide mass balance are met. Results of the validation testing indicate that the SZ transport abstraction model is valid for the approximate range of uncertainty incorporated into the model through parameter uncertainty distributions. Results also indicate that the SZ transport abstraction model is valid for both nonsorbing and sorbing radionuclide species for its intended use.

The discrepancy in radionuclide mass balance identified in the validation testing is a small percentage, particularly for the median case, and is acceptable based on the acceptance criterion specified for this validation test. Furthermore, the estimated total mass released exceeds the expected total at 1,000,000 years based on the tails of the input breakthrough curves for all three cases. These results indicate that the SZ flow and transport abstraction model slightly overestimates the radionuclide mass release for the median, fast, and slow cases.

7.4.2[a] Saturated Zone One-Dimensional Transport Model Validation

Validation testing of the SZ one-dimensional transport model indicates acceptable agreement with the SZ site-scale transport model (SNL 2007 [DIRS 177392]). Qualitative acceptance criteria regarding the comparison of the simulated breakthrough curves with the results of the SZ site-scale transport model are met. Results of the validation testing indicate that the SZ one-dimensional transport model is valid for the approximate range of uncertainty incorporated into the model through parameter uncertainty distributions. Results also indicate that the SZ one-dimensional transport model is valid for both nonsorbing and sorbing radionuclide species for its intended use.

It is relevant to consider the purpose and use of the SZ one-dimensional transport model in the evaluation of validation testing results. This model is used for the purpose of simulating radioactive decay and ingrowth for four decay chains. This simplified model is required because the SZ transport abstraction model is not capable of simulating ingrowth by radioactive decay. The results of the SZ one-dimensional transport model are used only for the decay products in these decay chains within the TSPA-LA analyses (SNL 2007 [DIRS 178871], Section 6.3.10).

It must also be considered that there are fundamental differences between the SZ one-dimensional transport model and the SZ site-scale transport model that limit the degree of consistency that can be expected between these two models. Groundwater flow and radionuclide transport simulation in the SZ site-scale transport model (SNL 2007 [DIRS 177392]) occur in three dimensions with a relatively complex representation of geological heterogeneity from the hydrogeologic framework model. The updated SZ site-scale transport model includes the changes to the underlying SZ site-scale flow model, which include significantly higher contrasts in permeability among the hydrogeologic units along the flow path from beneath the repository. These increased contrasts in permeability in the updated three-dimensional SZ site-scale flow model lead to the migration of some particles into lower-permeability units through the process of transverse dispersion. This process in turn results in longer upper tails in the simulated breakthrough curves from the SZ site-scale transport model. The SZ one-dimensional transport model does not include such hydrogeological heterogeneity, or the process of transverse dispersion, so it is not capable of simulating the tailing behavior produced by the SZ site-scale transport model. For the reasons stated above, the comparisons in validation test cases between the updated SZ one-dimensional transport model and the updated SZ site-scale transport model are not as close in this addendum as those reported for the previous models in Section 7.3.2.

Radionuclide transport in the SZ one-dimensional transport model is simulated in a significantly simplified representation of the SZ system consisting of three pipe segments. Each pipe segment has properties that represent the average characteristics in that area of the SZ site-scale transport model. There are also variations in the source location within the four source regions beneath the repository simulated by the SZ transport abstraction model that are not incorporated in the SZ one-dimensional transport model on a realization-by-realization basis, as discussed in Section 7.1.2.

Another difference between the SZ one-dimensional transport model and the SZ transport abstraction model is the way in which changes in groundwater flux related to climate change are handled. A fundamental limitation to the Laplace transform solution used by the GoldSim software code to simulate radionuclide transport in the “pipe” module is that radionuclide mass in transit through a particular pipe segment does not change in response to changes in specified groundwater flow rate. Consequently, radionuclide mass that has entered a pipe segment in the SZ one-dimensional transport model before increased flow rates are imposed at 600 and 2,000 years for the monsoonal and glacial-transition climate states in the TSPA-LA model, would not be instantaneously accelerated, as it is in the SZ transport abstraction model. Because peak releases of radionuclides to the saturated zone are not expected to occur within the first 2,000 years of the TSPA-LA simulations, this limitation to the SZ one-dimensional transport model is unlikely to have a significant impact on the simulation results.

Comparison of simulation results from the SZ one-dimensional transport model and the SZ flow and transport abstraction model shows that there are differences for individual realizations, as used in the TSPA-LA analyses. However, when results are averaged over numerous realizations the ensemble behavior of the SZ one-dimensional transport model is similar to the SZ flow and transport abstraction model (see Figure 7-6[a]). This indicates that there is little consistent bias in the simulation results from the SZ one-dimensional transport model relative to the SZ flow and transport abstraction model with regard to average transport time of radionuclide mass through the saturated zone. The SZ one-dimensional transport model does exhibit less apparent dispersion than the SZ flow and transport abstraction model for the reasons discussed above. Given this finding and the intended use of the SZ one-dimensional transport model for the simulation of decay chain products only, differences in the results with the SZ flow and transport abstraction model for individual realizations are acceptable.

Considering these factors, the SZ one-dimensional transport model provides an acceptable approximation of simulated radionuclide transport in the three-dimensional system of the saturated zone. No future activities are needed to complete this model validation for its intended use.

7.4.3[a] Validation Summary

The SZ flow and transport abstraction model and the SZ one-dimensional transport model have been validated by applying acceptance criteria based on an evaluation of the relative importance of the models to the potential performance of the repository system. All relevant validation requirements have been fulfilled, including corroboration of model results with comparison to the model from which they were derived and publication of the general approach in a refereed professional journal (Arnold et al. 2003 [DIRS 163857]). Activities requirements for confidence building during model development have also been satisfied. The model development activities and post-development validation activities described establish the scientific bases for the SZ flow and transport abstraction model and the SZ one-dimensional transport model. Models used to simulate the transport of radionuclides in the saturated zone are sufficiently accurate and adequate for intended use if they model radionuclide mass output as a function of time, consistent with the underlying transport model (SZ site-scale transport model), given that uncertainty of input parameters may impact simulated transport times by several orders of magnitude. Other criteria for accuracy and adequacy are radionuclide mass balance and non-biased ensemble transport behavior among multiple realizations, which were addressed in model validation activities. Based on these criteria, the SZ flow and transport abstraction model and the SZ one-dimensional transport model used in this report are considered to be sufficiently accurate and adequate for the intended purpose and to the level of confidence required by the models' relative importance to the potential performance of the repository system.

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8.[a] CONCLUSIONS

8.1[a] SUMMARY OF MODELING ACTIVITY

The SZ flow and transport abstraction model and the SZ one-dimensional transport model are updated to include changes to the underlying process models for use in the TSPA-LA analyses. In addition, updated analyses of uncertainty in input parameters for these models are conducted, and the results are documented as uncertainty distributions. Values of uncertain parameters are sampled for 200 realizations of the SZ flow and transport system. Simulations using the SZ flow and transport abstraction model are conducted for these 200 realizations, and the results are documented in this report.

Uncertainty in several input parameters has been reevaluated and updated, as described in Section 6.5.2[a] in this addendum. Parameter uncertainty distributions that have been updated include those for groundwater specific discharge multiplier, flowing interval spacing, the northwestern boundary of the alluvial uncertainty zone, sorption coefficients for plutonium, cesium, and tin onto colloids, sorption coefficients for selenium and tin onto tuff and alluvium, and correlation coefficients among sorption coefficients. Parameter values used in the 200 realizations of the SZ flow and transport abstraction model and the SZ one-dimensional transport model have been resampled to reflect these changes in parameter uncertainty.

Radionuclide transport simulations have been extended to 1,000,000 years and have been conducted using groundwater flow rates estimated for glacial-transition climatic conditions using the SZ flow and transport abstraction model, as described in Section 6.5.3[a]. Radionuclide transport simulations have also been conducted for selenium and tin.

Validation testing of the updated SZ flow and transport model and the SZ one-dimensional transport model is conducted and documented in Section 7[a]. Validation testing methods are the same as those previously used, as described in Section 7.1. Validation testing results for the SZ flow and transport abstraction model with regard to its comparison to the underlying SZ site-scale transport model and radionuclide mass balance indicate that the validation criteria have been met. Validation testing results for the SZ one-dimensional transport model with regard to its comparison to the SZ site-scale transport model and ensemble average results relative to the SZ flow and transport abstraction model indicate that the validation criteria have been met. Although comparisons between the SZ one-dimensional transport model and the SZ site-scale flow model are not as close as previously reported in Section 7.3.2, the comparisons for the updated SZ one-dimensional transport model in this addendum and are acceptable and discussed in Section 7.4.2[a] The SZ flow and transport abstraction model and the SZ one-dimensional transport model documented in this addendum are considered to be sufficiently accurate and adequate for the intended purpose of use in the TSPA model and to the level of confidence required by the models' relative importance to the potential performance of the repository system.

Corrective action item CR 7270 and software problem reports SPR003120051019 and SPR003420051031 have been addressed in a revision of the SZ_Convolute software code (SZ_Convolute V. 3.10.01). The documentation of this revision of the software code is not contained in this addendum; however, SZ_Convolute V. 3.10.01 was used in the SZ flow and transport abstraction model documented herein. Corrective action item CR 7260 related to the qualification status of data on tritium and iodide diffusion coefficients in tuff matrix has been addressed in a separate data qualification task in *Qualification of Matrix Diffusion Data from Diffusion Cell Experiments* (SNL 2007 [DIRS 181989]), per quality assurance procedure SCI-PRO-001, *Qualification of Unqualified Data*.

8.2[a] MODEL OUTPUTS

8.2.1[a] Developed Output

The technical output from this addendum is given in the three DTNs summarized in Table 8-1[a].

Table 8-1[a]. Summary of Developed Output

Output DTN	Description
SN0702PASZFTMA.001	Input and output files for the updated SZ flow and transport abstraction model. This DTN also contains the sampled parameter values for the 200 realizations and the spreadsheets used as preprocessors to generate the FEHM input files for the SZ flow and transport abstraction model.
SN0702PASZFTMA.002	Input and output files for the updated SZ one-dimensional transport model. This DTN also contains the sampled parameter values for the 200 realizations, tabulated input values for the SZ one-dimensional transport model, and estimated gross alpha concentration in groundwater.
SN0706INPUTSZF.000	Updated or new uncertainty distributions and parameters for the SZ flow and transport abstraction model and the SZ one-dimensional transport model.

Results of the SZ flow and transport abstraction model are contained in output DTN: SN0702PASZFTMA.001. These results include the sampled values of the uncertain parameters that were used in the 200 realizations of the SZ flow and transport abstraction model and that are tabulated in Appendix A[a]. The results also include the complete set of input files for the SZ flow and transport abstraction model that were generated by the pre-processing spreadsheets documented in Appendix B[a] and all of the corresponding output files for the 200 realizations. These results also include post-processed output of the SZ flow and transport abstraction model that have been reformatted and concatenated for direct input to the TSPA model. Output DTN: SN0702PASZFTMA.001 will supersede output DTNs: SN0310T0502103.010, SN0310T0502103.012, and SN0407T0502103.013 upon approval of this addendum.

Model output related to the SZ one-dimensional transport model are contained in Output DTN: SN0702PASZFTMA.002. These results include the sampled values of the uncertain parameters that were used in the 200 realizations of the SZ flow and transport abstraction model and that are tabulated in Appendix A1[a]. The results also include a stand-alone version of the SZ one-dimensional transport model implemented in the GoldSim V. 9.60 software code and intended for direct incorporation into the TSPA model. The uncertain parameters are included in the standalone version of the SZ one-dimensional transport model as arrays of parameter values within the model. Tabulated values of parameters that are used to approximate the match to the SZ site-scale transport model are also documented in output DTN: SN0702PASZFTMA.002. Estimates of the background gross alpha concentration in groundwater are also contained in this DTN. Output DTN: SN0702PASZFTMA.002 will supersede output DTNs: SN0306T0502103.005, MO0310SPANGRAC.000, SN0507T0502103.014, and MO0506SPAINPUT.001 upon approval of this addendum.

Updated or new uncertainty distributions and parameters for the SZ flow and transport abstraction model and the SZ one-dimensional transport model are contained in output DTN: SN0706INPUTSZF.000. The output in this DTN consists of the information given in Table 6-7[a].

8.2.2[a] Output Uncertainties and Limitations

The assessment of uncertainty in model parameters and model outputs is an integral part of the performed analyses in this report. Uncertainty in model parameters is quantitatively represented by the statistical distributions developed and given in Table 6-8 and Table 6-7[a]. Uncertainty in radionuclide transport in the SZ flow and transport abstraction model is embodied in the breakthrough curves for the 200 realizations given in Output DTN: SN0702PASZFTMA.001. The SZ one-dimensional transport model is intended for direct incorporation into the TSPA-LA model, with which uncertainty will be assessed using Monte Carlo probabilistic analyses.

All relevant uncertainties in data and model parameters, with respect to their affect upon groundwater flow and radionuclide transport, have been included in both the SZ flow and transport abstraction model and the SZ one-dimensional transport model. Uncertainties have been propagated through the results of the SZ flow and transport abstraction model (i.e., the radionuclide breakthrough curves for multiple realizations) documented in this addendum. These output uncertainties address the requirements of acceptance criterion 3 of *Yucca Mountain Review Plan, Final Report* (NRC 2003 [DIRS 163274], Sections 2.2.1.3.8 and 2.2.1.3.9) for the propagation of data uncertainty through model abstraction for flow paths in the saturated zone and for radionuclide transport in the saturated zone.

Use of the SZ flow and transport abstraction model and the SZ one-dimensional transport model is subject to the limitations and restrictions imposed by the assumptions listed in Sections 5, 6.3, and 6.5. Limitations in knowledge of specific parameter values are addressed in this report in the analysis of parameter uncertainties. The radionuclide breakthrough curves generated for the SZ transport abstraction model are limited to 1,000,000 years duration for glacial-transition climatic conditions.

8.2.3[a] Output to TSPA

All three of the output DTNs listed in Table 8-1[a] contain product output intended for use in the TSPA model. Output DTN: SN0702PASZFTMA.001 includes *output_to_TSPA_dir.zip*, which contains the direct inputs to the TSPA model. These direct inputs include the files with the simulated radionuclide breakthrough curves for input the convolution integral software code, SZ_Convolute V. 3.10.01 (STN: 10207-3.10.01-00 [DIRS 179880]) that is dynamically linked to the TSPA model. *Readme.txt* in this DTN contains a description of the file naming convention for these breakthrough curve files. Output DTN: SN0702PASZFTMA.001 also includes two control files for the SZ_Convolute software code named *sz_convolute2_20kyr.dat* and *sz_convolute2_1Myr.dat* for TSPA model runs to 20,000 years and 1,000,000 years, respectively.

Output DTN: SN0702PASZFTMA.002 contains the input file (*v4.014_GS_9.50.005_ SZ_Standalone_Pulse_Source_TDIP-SZFT-2.gsm*) to GoldSim V. 9.60 with a stand-alone version of the SZ one-dimensional transport model. The stand-alone version of the SZ one-dimensional transport model is intended for direct incorporation into the TSPA model. The stand-alone version of the SZ one-dimensional transport model contains updated parameter values derived from the updated SZ site-scale transport model and the sampled uncertain parameter vectors. The updated parameter values derived from the updated SZ site-scale transport model are also contained in the DTN in tabular form in *DTN_TDIP-SZFT-2.doc*.

8.3[a] YUCCA MOUNTAIN REVIEW PLAN ACCEPTANCE CRITERIA

The following information describes how this analysis addresses the acceptance criteria in *Yucca Mountain Review Plan, Final Report* (NRC 2003 [DIRS 163274], Sections 2.2.1.3.8.3 and 2.2.1.3.9.3). Only those acceptance criteria that are applicable to Section 4.2 and for which the technical inputs have been updated are presented in this addendum.

Acceptance Criteria from Section 2.2.1.3.8.3 Flow Paths in the Saturated Zone

Acceptance Criterion 1: System Description and Model Integration Are Adequate

> Subcriterion (3): The abstraction of flow paths in the saturated zone uses assumptions, technical bases, data, and models that are appropriate and consistent with other related U.S. Department of Energy abstractions. For example, the assumptions used for flow paths in the saturated zone are consistent with the total system performance assessment abstraction of representative volume (Section 2.2.1.3.12 of the Yucca Mountain Review Plan). The descriptions and technical bases provide transparent and traceable support for the abstraction of flow paths in the saturated zone;

Assumptions, described in Section 5, are consistent with those used in other model and analysis reports. For example, two of the six assumptions are carried forward directly from *Saturated Zone Colloid Transport* (BSC 2004 [DIRS 170006], Section 6.3). Technical bases, data, models, and local modeling assumptions are described in Section 6.3. Transparent and traceable support for the abstraction of flow paths in the saturated zone is provided for the SZ transport abstraction and the SZ saturated zone transport model. For example, estimates of the variation in groundwater specific discharge and flow-path lengths in the SZ one-dimensional transport model are explained and illustrated in Section 6.5.1.2[a].

> Subcriterion (4): Boundary and initial conditions used in the total system performance assessment abstraction of flow paths in the saturated zone are propagated throughout its abstraction approaches. For example, abstractions are based on initial and boundary conditions consistent with site-scale modeling and regional models of the Death Valley ground water flow system;

Boundary conditions used in the TSPA-LA abstraction of flow paths in the saturated zone are taken from the SZ site-scale flow model, as described in Section 6.5[a]. These boundary conditions are based on analyses that use the regional model of the Death Valley groundwater flow system, as described in *Site-Scale Saturated Zone Flow Model* (SNL 2007 [DIRS 177391]). The effects of these boundary conditions are implicitly propagated to the SZ one-dimensional transport model through estimates of flow rates and pipe-segment lengths, as described in Section 6.5.1.2[a]. Initial conditions are not used in the abstraction of flow paths because steady-state conditions are assumed.

Acceptance Criterion 5: Model Abstraction Output Is Supported by Objective Comparisons

> Subcriterion (1): The models implemented in this total system performance assessment abstraction provide results consistent with output from detailed process-level models and/or empirical observations (laboratory and field testings and/or natural analogs);

Results of TSPA-LA abstraction modeling are compared with results of detailed process-level models in Section 7. Graphical representations of these comparisons between the results of the SZ transport abstraction model and the SZ site-scale transport model, and between the results of the SZ one-dimensional transport model and the SZ site-scale transport model, are shown in Figures 7-1[a], 7-2[a], 7-4[a], and 7-5[a]. These figures show consistent results between the abstraction models and detailed process-level models.

> Subcriterion (4): Sensitivity analyses or bounding analyses are provided to support the abstraction of flow paths in the saturated zone, that cover ranges consistent with site data, field or laboratory experiments and tests, and natural analog research.

Bounding analyses consistent with Yucca Mountain field and laboratory data were conducted to support the TSPA abstraction of flow paths in the saturated zone. These analyses considered uncertainties in the parameter that characterizes horizontal anisotropy. In addition, analyses were completed to bound the effects of uncertainty in the geometry of the alluvial uncertainty zone (Section 6.5.2.2[a]) and the flow paths represented therein.

Acceptance Criteria from Section 2.2.1.3.9, Radionuclide Transport in the Saturated Zone

Acceptance Criterion 1: System Description and Model Integration Are Adequate

> Subcriterion (3): The abstraction of radionuclide transport in the saturated zone uses assumptions, technical bases, data, and models that are appropriate and consistent with other, related U.S. Department of Energy abstractions. For example, assumptions used for radionuclide transport in the saturated zone are consistent with the total system performance assessment abstractions of radionuclide release rates and solubility limits, and flow paths in the saturated zone (Sections 2.2.1.3.4 and 2.2.1.3.8 of the Yucca Mountain Review Plan, respectively). The descriptions and technical bases provide transparent and traceable support for the abstraction of radionuclide transport in the saturated zone;

Assumptions, described in Section 5, are consistent with those used in other model and analysis reports. For example, two of the six assumptions are carried forward directly from *Saturated Zone Colloid Transport* (BSC 2003 [DIRS 170006], Section 6.3). Section 6.3.3 addresses the issue of consistency with interfacing UZ and biosphere models. Technical bases, data, models, and local modeling assumptions are described in Section 6.3. Transparent and traceable support for the abstraction of radionuclide transport in the saturated zone is provided for the SZ transport abstraction and the SZ one-dimensional transport model. For example, estimates of the variation in groundwater-specific discharge and flow-path lengths in the SZ saturated zone transport model are explained and illustrated in Section 6.5.1.2[a].

Acceptance Criterion 5: Model Abstraction Output Is Supported by Objective Comparisons

> Subcriterion (1): The models implemented in this total system performance assessment abstraction provide results consistent with output from detailed process-level models and/or empirical observations (laboratory and field testings and/or natural analogs);

Results of TSPA-LA abstraction modeling are compared with results of detailed process-level models in Section 7. Graphical representations of these comparisons between the results of the SZ transport abstraction model and the SZ site-scale transport model, and between the results of the SZ one-dimensional transport model and the SZ site-scale transport model, are shown in Figures 7-1[a], 7-2[a], 7-4[a], and 7-5[a]. These figures show consistent results between the abstraction models and detailed process-level models.

9.[a] INPUTS AND REFERENCES

9.1[a] DOCUMENTS CITED

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IM-PRO-003, *Software Management*.

SCI-PRO-001, *Qualification of Unqualified Data*.

SCI-PRO-002, *Planning for Science Activities*.

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9.3[a] SOURCE DATA, LISTED BY DATA TRACKING NUMBER

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179880 SZ_Convolute V. 3.10. 2007. WINDOWS 2000. STN: 10207-3.10-00.

163571 SZ_Post V. 3.0. 2003. Sun O.S. 5.7. STN: 10915-3.0-00.

163281 SZ_Pre V. 2.0. 2003. SOLARIS 7. STN: 10914-2.0-00.

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APPENDIX A[a]
SAMPLED PARAMETER VALUES

A[a]. SAMPLED PARAMETER VALUES

This appendix contains the stochastic parameter values sampled for 200 realizations of the three-dimensional SZ flow and transport abstraction model and the SZ one-dimensional transport model. These parameter vectors were sampled using the uncertainty distributions described in Section 6.5.2[a]. The parameter sampling was performed using the GoldSim V. 8.02.500 (STN: 10344-8.02-06 [DIRS 179360]) software code. The base-case model results described in Section 6.6[a] correspond to the input parameter values tabulated in Table A-1[a].

Table A-1[a]. Sampled Stochastic Parameter Values

real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
1	0.61331	0.17939	0.24512	10.257	-3.8248	-11.253	1.1817	2.9452	246.09	23.459
2	0.13684	0.11408	0.11487	22.269	-2.1908	-10.542	1.3694	8.2906	57.7	268.4
3	0.97133	0.18689	0.20301	18.913	-1.0748	-10.369	1.8269	12.081	212.28	271.29
4	0.95304	0.15792	0.21281	52.51	-4.0288	-10.449	1.2424	4.7998	376.71	385.73
5	0.3768	0.21127	0.083927	14.218	-3.2734	-9.9334	1.0164	4.109	295.41	79.685
6	0.72993	0.14731	0.21163	18.769	-3.0427	-10.626	1.322	7.4549	111.5	250.11
7	0.11323	0.10118	0.16575	19.99	-3.1508	-9.5171	2.6553	8.6105	326.66	338.21
8	0.30199	0.26624	0.10631	20.77	-3.9555	-10.391	1.4026	4.8485	257.15	42.679
9	0.54047	0.22131	0.21951	27.403	-3.8841	-10.355	1.0622	2.6305	350.11	26.914
10	0.69878	0.24485	0.09997	30.185	-2.0052	-10.148	1.4271	6.7358	218.13	130.56
11	0.69208	0.16297	0.16612	44.619	-3.4103	-9.8462	1.3	5.5138	211.79	183.98
12	0.51855	0.16177	0.17671	38.727	-2.7493	-9.6179	1.6627	8.1609	151.2	200.41
13	0.86084	0.17432	0.18663	32.494	-2.8833	-9.9251	1.4132	5.9924	162.29	277.14
14	0.74071	0.12117	0.20404	15.149	-2.114	-10.469	1.153	4.3631	268.92	186.37
15	0.14179	0.21335	0.19217	12.735	-1.2718	-10.2	1.5827	3.0094	361.81	26.353
16	0.53666	0.23757	0.22169	17.932	-3.7174	-10.51	1.7619	7.6895	215.94	146.87
17	0.78472	0.1764	0.15444	31.651	-2.8256	-10.457	1.6384	6.0547	110.36	113.83
18	0.084835	0.14338	0.087999	19.427	-3.9712	-10.267	1.1782	8.3188	25.249	269.35
19	0.092993	0.16874	0.12009	45.896	-1.1551	-9.3046	0.91245	6.7585	97.202	363.07
20	0.22141	0.19893	0.18049	25.202	-3.6338	-10.606	1.3951	6.7553	161.95	96.782
21	0.15315	0.23131	0.07532	41.931	-2.7178	-10.28	1.7077	6.3558	189.56	228.11
22	0.73861	0.14775	0.17517	45.755	-2.5646	-10.364	1.0818	5.1216	206.15	242.25
23	0.16285	0.20725	0.1593	30.603	-1.4373	-11.221	1.7705	9.1354	312.38	393.72
24	0.19563	0.18585	0.16883	36.3	-2.2463	-10.472	1.2774	4.4344	147.66	43.013
25	0.82878	0.19173	0.26284	24.169	-4.7125	-10.179	1.1026	6.5225	73.878	108.03
26	0.90098	0.15347	0.17201	53.034	-3.2488	-10.428	1.6855	7.663	157.55	278.06
27	0.32094	0.11105	0.1861	47.548	-4.1457	-10.082	1.6724	5.2594	212.72	205.39
28	0.98722	0.23521	0.053929	26.173	-3.9616	-10.998	1.6665	7.6821	234.3	343.88
29	0.76688	0.12078	0.1676	40.105	-1.4805	-9.8115	1.0202	4.53	34.558	87.886
30	0.21118	0.17048	0.10311	37.393	-1.3229	-10.564	1.1762	5.1708	86.77	121.08

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
31	0.2609	0.10912	0.17843	56.897	−3.3455	−10.769	1.234	4.9639	333.22	201.53
32	0.3372	0.11284	0.19882	32.875	−3.8551	−10.131	1.2164	5.1362	131.84	62.16
33	0.037874	0.2104	0.16284	12.375	−1.2881	−10.259	1.0561	5.0719	51.021	218.43
34	0.36888	0.18025	0.18707	15.913	−4.319	−9.9468	1.1397	5.1333	154.89	150.66
35	0.033906	0.15763	0.13045	50.215	−2.3712	−10.312	1.6587	6.3303	228.97	235.34
36	0.49577	0.13898	0.19081	21.611	−3.1034	−10.459	1.2535	5.8076	251.41	191.71
37	0.7327	0.064858	0.1695	22.649	−1.7128	−10.317	1.1737	5.113	334.67	207.41
38	0.71257	0.17073	0.15785	53.94	−3.9375	−10.273	1.4827	5.9301	164.34	294.91
39	0.81858	0.17469	0.1795	8.0719	−2.9076	−10.422	1.1447	6.3066	297.14	375.59
40	0.39756	0.27779	0.11298	29.025	−3.5408	−10.244	1.3176	5.3474	323.29	48.898
41	0.10605	0.19533	0.17748	28.455	−1.2155	−10.058	1.7756	7.9786	250.13	255.2
42	0.35898	0.17567	0.15113	29.695	−3.119	−10.399	1.0095	4.6921	188.87	303.71
43	0.98413	0.18889	0.19525	16.636	−3.9954	−9.6862	1.1279	4.0434	262.36	45.807
44	0.079534	0.21288	0.19748	10.554	−2.9663	−10.08	1.8281	7.6967	156.47	163.25
45	0.70271	0.13104	0.095923	5.3765	−3.7591	−9.5589	1.2328	4.0952	321.26	65.759
46	0.68555	0.17212	0.14843	61.879	−4.2914	−9.9183	1.6086	7.2726	223.69	275.83
47	0.62997	0.048637	0.21442	23.234	−3.4446	−10.122	0.76079	4.323	23.181	201.89
48	0.38704	0.13991	0.20593	33.843	−2.9231	−10.638	1.7733	8.1005	219.86	191.24
49	0.80175	0.25328	0.17901	33.117	−3.0873	−9.9755	1.5942	7.2532	399.59	228.66
50	0.52885	0.25032	0.19922	38.882	−2.0279	−10.068	1.0254	4.6517	117.52	95.376
51	0.27162	0.15502	0.14136	19.725	−1.8908	−10.284	1.0078	4.3996	238.5	23.864
52	0.76468	0.14528	0.22367	17.599	−2.6102	−10.349	3.594	7.8597	373.39	224.32
53	0.55173	0.15182	0.14712	3.1707	−2.858	−10.671	1.6246	6.8611	359.4	243.94
54	0.96916	0.18828	0.17131	39.058	−1.9453	−9.8153	1.3378	4.7761	108.59	46.616
55	0.83325	0.25785	0.096324	25.546	−1.5205	−10.66	1.7176	6.6679	157.84	316.48
56	0.84697	0.21523	0.2761	34.879	−3.288	−10.051	1.779	6.433	337.89	324.1
57	0.66653	0.28314	0.20833	15.311	−3.3438	−9.9961	1.5248	7.2594	118.15	144.37
58	0.15725	0.20111	0.23127	31.001	−4.4429	−10.254	3.6245	7.7068	346.21	366.53
59	0.75492	0.1873	0.072509	46.571	−3.1668	−10.11	1.6655	6.2544	316.65	96.426
60	0.30986	0.1379	0.20891	56.24	−2.6185	−10.321	3.0443	8.4471	190.62	246.55
61	0.47933	0.19631	0.18439	9.0391	−3.4808	−9.979	1.17	2.634	143.21	29.314

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
62	0.77804	0.14847	0.19701	4.2004	-3.5141	-9.9163	5.3438	6.9297	112.03	99.622
63	0.34953	0.17999	0.18161	32.666	-3.6508	-10.614	1.0179	2.169	92.45	268.19
64	0.018099	0.22246	0.22977	20.074	-3.6972	-9.5041	1.7292	7.5766	114.1	366.12
65	0.14511	0.15072	0.20751	22.488	-2.2546	-9.9972	1.1232	6.3446	117.39	294.19
66	0.78618	0.17502	0.18945	13.137	-3.3942	-10.481	1.1099	5.9252	20.493	291.01
67	0.058215	0.19715	0.19132	12.625	-1.644	-10.129	1.5567	4.6816	391.61	360.06
68	0.46803	0.2408	0.15517	8.2387	-2.0934	-10.4	1.4433	4.6207	129.74	24.851
69	0.87844	0.22613	0.21365	36.546	-3.0917	-10.733	1.5708	7.2035	392.43	192.91
70	0.80687	0.18213	0.27987	7.1368	-2.2711	-10.492	2.833	8.2799	311.27	350.51
71	0.062208	0.23415	0.26998	41.211	-2.6728	-10.417	1.7121	8.0746	122.35	375.18
72	0.60382	0.15427	0.17439	36.133	-2.3075	-10.155	1.4673	7.0679	120.75	324.66
73	0.64922	0.24811	0.11975	4.0192	-2.4904	-10.536	1.1045	5.578	271.03	336.13
74	0.19266	0.21429	0.20577	48.627	-3.0257	-10.341	1.4944	6.5739	161.83	172.59
75	0.79283	0.21926	0.20281	31.427	-1.3395	-10.616	1.0961	5.7083	26.659	364.18
76	0.64422	0.18071	0.12158	34.279	-3.6824	-10.693	1.5493	8.505	299.78	159.21
77	0.41143	0.20249	0.19316	35.408	-3.8388	-11.053	1.5927	5.5644	372.03	174.38
78	0.91957	0.19013	0.25676	39.258	-1.5587	-10.004	1.4708	6.6078	52.538	125.82
79	0.75838	0.11607	0.18122	12.144	-2.9452	-10.574	1.0214	5.12	63.55	390.4
80	0.57455	0.22788	0.19986	18.165	-2.6487	-9.7701	1.5021	8.1849	158.85	311.48
81	0.066521	0.10282	0.22548	35.8	-2.526	-10.375	1.5144	5.0136	285.09	53.73
82	0.41883	0.22329	0.13661	9.172	-2.1389	-11.108	1.247	5.151	387.74	196.34
83	0.5453	0.13476	0.24087	20.734	-3.7423	-10.506	1.1003	3.9041	245.21	40.867
84	0.45269	0.15697	0.11679	9.4335	-3.9283	-9.9037	1.1585	6.1692	137.81	176.8
85	0.096493	0.17871	0.22874	44.229	-3.6095	-11.122	1.6303	4.6337	390.84	249.21
86	0.34271	0.12544	0.22486	24.625	-3.7092	-9.4071	1.0429	5.1099	33.707	169.1
87	0.32868	0.13686	0.20156	9.9218	-2.5733	-10.297	1.5986	7.4078	220.4	308.99
88	0.6793	0.17136	0.29058	14.51	-3.0518	-9.4712	1.2164	6.6854	38.729	194.38
89	0.40949	0.20964	0.16791	36.855	-2.4667	-9.3754	3.8709	8.6222	272.63	284.31
90	0.42029	0.24328	0.23031	39.898	-3.8094	-10.49	1.2193	5.9396	228.1	174.63
91	0.52282	0.17748	0.13717	23.912	-1.5273	-10.554	1.0907	5.5556	128.72	378.65
92	0.68067	0.21231	0.10727	21.121	-1.0366	-10.499	1.5896	6.4951	184.21	118.99

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
93	0.085228	0.22374	0.16178	22.934	−2.7725	−10.142	1.5473	6.9479	314.62	362.88
94	0.88372	0.16053	0.21214	20.289	−2.7587	−10.651	1.7332	6.9466	303.68	367.15
95	0.97634	0.13176	0.15667	8.7642	−4.8566	−10.544	1.4526	8.3998	92.62	119.35
96	0.22764	0.070533	0.15584	43.613	−1.59	−9.9109	1.3564	4.8936	251.6	254.11
97	0.31798	0.23951	0.12847	11.14	−3.1242	−10.582	1.0262	6.7813	252.23	384.45
98	0.28563	0.089285	0.21639	19.224	−3.7934	−10.917	1.6565	9.4713	78.617	343.67
99	0.63089	0.19061	0.22716	14.742	−2.2082	−10.679	1.5116	6.1753	376.15	133.57
100	0.48698	0.12253	0.20049	4.7127	−2.2218	−9.5403	0.28544	4.8487	44.059	388.62
101	0.82048	0.052355	0.14924	2.9452	−2.4254	−10.035	3.4438	7.122	386.02	273.64
102	0.92652	0.20619	0.1519	24.662	−2.7006	−10.672	5.257	7.4226	397.16	345.96
103	0.70661	0.16817	0.1885	45.477	−3.0639	−9.7574	1.4898	6.6189	237.55	270.27
104	0.91356	0.1939	0.20205	43.054	−1.7877	−9.4766	1.7146	6.5883	366.47	163.91
105	0.59488	0.092197	0.16021	5.5898	−2.2965	−9.9623	0.61282	4.3406	118.19	293.89
106	0.0068365	0.18534	0.13162	31.809	−1.0161	−10.409	1.5921	7.0475	360.88	189.53
107	0.94903	0.16504	0.15313	17.091	−3.3763	−10.594	1.7216	6.4096	196.91	40.932
108	0.84374	0.27156	0.23532	38.53	−2.0365	−10.29	1.5433	6.3476	172.15	84.549
109	0.50237	0.27545	0.23256	6.528	−2.7875	−10.938	1.707	6.2335	273.77	158.56
110	0.20405	0.15244	0.2108	6.9205	−3.8943	−10.787	1.6838	6.7305	104.86	76.676
111	0.11671	0.13676	0.21789	49.672	−1.3647	−10.447	1.4436	6.0598	168.99	291.66
112	0.86654	0.23582	0.18235	26.486	−1.7508	−10.413	1.7662	5.7615	311.33	131.29
113	0.25223	0.21716	0.17794	18.555	−3.9809	−9.8537	1.7984	6.4333	382.67	193.29
114	0.74818	0.25081	0.22697	7.3743	−2.0799	−10.604	1.3928	5.1738	376.59	52.072
115	0.46444	0.18441	0.15	40.689	−3.4277	−9.4566	1.4254	7.1691	333.27	221.44
116	0.63615	0.15577	0.12705	3.5294	−1.6733	−10.301	1.0421	2.5105	250.4	68.19
117	0.88827	0.16637	0.15376	9.755	−1.9871	−10.377	1.3172	6.3642	202.16	313.6
118	0.53043	0.16581	0.28089	33.446	−3.3028	−10.504	1.7498	7.3621	221.83	62.251
119	0.89271	0.17265	0.13346	43.298	−2.6625	−10.885	1.7205	7.7651	235.43	159.28
120	0.029057	0.24583	0.22147	21.263	−1.3955	−9.6455	1.5054	6.24	186.61	44.888
121	0.0018091	0.25403	0.24598	42.287	−3.2987	−10.619	1.013	4.5135	231.05	241.38
122	0.56853	0.21893	0.13887	7.5203	−1.8625	−10.015	1.6025	7.0323	53.237	259.5
123	0.9426	0.12918	0.15897	18.267	−2.541	−10.646	1.3514	7.9043	165.16	346.44

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
124	0.61624	0.1638	0.20696	32.329	−1.6157	−9.7203	1.0702	4.0507	219.77	36.221
125	0.55825	0.19996	0.14063	30.412	−2.8694	−10.306	1.2923	5.7877	77.848	202.33
126	0.47435	0.15944	0.15274	40.339	−2.6884	−9.8678	1.321	4.8674	284.59	289.63
127	0.99857	0.14089	0.17042	35.195	−3.0728	−9.699	1.352	8.1649	105.09	146.46
128	0.40211	0.12462	0.24028	28.243	−3.7681	−10.233	1.6445	6.595	230.46	291.8
129	0.58139	0.08441	0.15786	27.107	−3.7514	−9.7281	1.1921	6.9424	97.382	357.77
130	0.65641	0.20889	0.17611	46.414	−1.6861	−9.3586	1.3511	4.1709	365.43	44.223
131	0.42898	0.11757	0.24908	25.471	−3.265	−10.173	1.1856	5.803	182.17	388.92
132	0.043645	0.14276	0.19387	34.346	−1.2474	−9.9678	2.0184	11.395	287.53	365.1
133	0.87416	0.1497	0.14457	25.851	−3.8169	−11.011	2.2117	8.5642	370.07	362.57
134	0.44076	0.16073	0.16496	23.422	−3.1606	−9.5735	1.2489	6.7579	284.57	251.31
135	0.44885	0.11533	0.25325	3.8065	−1.7344	−10.023	1.2117	8.0911	40.998	190.54
136	0.014079	0.26015	0.17058	29.261	−1.8165	−10.17	0.28709	1.8956	190.18	79.147
137	0.39414	0.21771	0.26047	13.337	−2.5023	−10.689	1.6725	8.567	235.31	202.39
138	0.43338	0.2567	0.19021	15.56	−3.3801	−10.383	1.7257	10.716	346.84	197.81
139	0.33488	0.11912	0.23777	6.0272	−2.1551	−10.643	5.8039	11.922	278.18	329.12
140	0.90967	0.18381	0.14781	33.767	−2.39	−9.783	1.7917	8.2983	355.33	279.92
141	0.24933	0.20516	0.24424	16.309	−3.2255	−10.041	1.6322	9.7551	123.98	324.6
142	0.99468	0.20035	0.12554	24.871	−3.1936	−11.151	1.317	4.0651	247.78	59.62
143	0.35477	0.13232	0.25113	44.925	−2.0657	−9.9496	1.539	7.1683	210.86	282.05
144	0.12198	0.075385	0.21826	39.494	−1.4681	−9.9415	1.4443	8.6678	90.589	368.84
145	0.45993	0.099761	0.2382	4.3863	−2.3316	−10.432	4.7552	12.642	182.57	386.76
146	0.04982	0.22967	0.10123	31.925	−3.3182	−10.684	1.1493	7.6981	188	311.89
147	0.29341	0.093901	0.1227	36.9	−3.5622	−10.533	1.3672	7.7314	298.08	366.96
148	0.58786	0.18263	0.14408	5.1605	−1.9215	−10.654	1.1186	7.5537	40.599	184.27
149	0.66188	0.12757	0.14625	41.665	−4.6177	−10.15	1.0217	5.2414	261.9	361.58
150	0.93472	0.16928	0.18818	38.103	−1.1944	−10.052	1.4169	5.7568	277.18	134.38
151	0.56129	0.14396	0.26452	30.866	−3.7228	−10.329	1.344	7.8808	70.353	345.27
152	0.10206	0.19316	0.13411	37.2	−2.3524	−10.548	1.1962	7.2272	48.712	257.61
153	0.37418	0.23304	0.20966	27.746	−1.419	−11.288	1.7359	5.5594	160.59	212.61
154	0.27833	0.22884	0.14222	42.641	−3.5069	−10.517	1.2531	4.088	317.07	244.05

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
155	0.71654	0.14475	0.16243	16.561	−2.4475	−10.388	1.0683	7.3515	21.246	389.56
156	0.96062	0.2046	0.19583	4.9604	−3.4141	−10.666	1.0397	4.2283	156.27	92.532
157	0.23549	0.17357	0.13773	44.914	−3.9008	−10.217	1.4824	8.5627	270.51	398.32
158	0.17895	0.22476	0.18496	35.522	−2.8009	−10.075	1.2349	5.8756	98.125	300.65
159	0.858	0.13501	0.13566	6.2311	−2.4053	−10.699	1.6129	7.8426	310.02	240.22
160	0.85446	0.19772	0.22029	37.825	−2.3436	−10.088	1.2546	4.6612	322.53	145.12
161	0.62008	0.22654	0.14342	28.821	−3.6558	−9.3177	1.826	7.4608	261	182.42
162	0.24255	0.19121	0.12682	10.988	−3.4406	−10.359	4.7224	5.8611	361.4	115.77
163	0.070428	0.096858	0.17308	16.976	−2.1244	−10.328	1.5029	7.4896	133.69	208.42
164	0.3813	0.10695	0.1826	26.918	−3.4742	−10.485	1.131	4.1501	109	351.22
165	0.26555	0.21632	0.18526	22.04	−3.3565	−10.435	1.3787	6.0889	79.224	62.05
166	0.49267	0.12642	0.21678	6.363	−3.877	−10.588	1.6547	7.103	279.7	161.17
167	0.92211	0.24224	0.17395	51.282	−3.5493	−10.097	1.826	4.5628	273.68	113.74
168	0.60875	0.19841	0.1838	48.76	−1.0817	−9.8839	1.7385	8.5277	241.4	369.3
169	0.28369	0.18911	0.1926	24.335	−3.0156	−10.187	1.6545	8.3346	286.83	151.86
170	0.89774	0.1668	0.16429	75.839	−3.8607	−9.6075	1.5697	4.9133	125.69	49.34
171	0.1316	0.19256	0.16686	21.739	−3.0046	−10.56	1.438	4.3693	348.34	161.39
172	0.18377	0.15513	0.21493	27.981	−3.1384	−10.015	3.1328	6.2005	307.84	30.593
173	0.21815	0.13377	0.17292	48.159	−3.6307	−10.338	1.3875	4.5779	230.17	43.477
174	0.16997	0.18179	0.16388	13.568	−3.216	−10.581	0.50173	2.1296	190.33	112.54
175	0.5781	0.15892	0.12967	42.49	−3.3332	−10.63	4.9472	8.1385	298.82	371.4
176	0.20916	0.12876	0.26707	27.618	−3.6736	−10.162	1.3396	6.4668	133.62	100.98
177	0.95555	0.20163	0.045592	8.4981	−3.4606	−10.226	1.5383	8.6629	27.498	277.14
178	0.29674	0.14158	0.24225	34.624	−3.9153	−10.521	1.7726	5.117	247.92	58.239
179	0.18607	0.082572	0.10823	7.8207	−1.1148	−10.597	1.6109	8.0164	197.59	273.32
180	0.024592	0.15055	0.091297	13.86	−4.5409	−10.033	0.34373	2.8755	75.958	26.076
181	0.12616	0.20355	0.19617	14.095	−3.2402	−10.251	1.1836	4.4034	250.29	112.78
182	0.81391	0.16419	0.13944	47.088	−3.5703	−9.5983	1.798	8.3203	139.83	142.41
183	0.8359	0.20368	0.14546	14.852	−1.8463	−10.84	1.241	6.8624	301.74	296.3
184	0.7744	0.23864	0.25804	54.44	−3.5828	−9.3523	2.2123	10.064	161.33	295.24
185	0.59701	0.18463	0.086432	10.723	−3.2062	−9.4032	1.4841	5.0554	357.58	161.05

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
186	0.17437	0.23089	0.12394	41.097	-3.4955	-10.57	1.4093	8.0261	296.81	319.61
187	0.67066	0.26343	0.1607	43.872	-2.5861	-9.6591	1.005	4.1692	148.69	167.89
188	0.7972	0.20806	0.23394	11.398	-3.6122	-10.103	1.759	8.3051	193.97	357.42
189	0.052696	0.28832	0.22293	50.605	-1.1328	-10.347	1.0698	5.9855	160.84	51.811
190	0.25773	0.16217	0.11778	29.459	-2.4795	-9.4334	1.6847	5.7579	206.77	105.25
191	0.51272	0.19591	0.19479	2.5922	-3.5969	-10.21	1.1402	7.6617	132.5	313.46
192	0.48281	0.14608	0.20493	23.659	-3.5284	-10.442	1.2481	5.7668	191.63	68.078
193	0.31282	0.29252	0.24753	11.906	-3.7818	-10.525	1.0008	3.6125	99.971	51.818
194	0.65179	0.10579	0.23597	16.151	-4.9046	-10.115	1.1833	6.2507	150.61	226
195	0.93822	0.19449	0.13212	17.5	-2.1797	-10.465	1.8103	8.0132	319.36	259.94
196	0.50794	0.16731	0.29215	37.985	-3.1837	-9.9573	1.5959	8.5222	281.84	337.84
197	0.72439	0.26898	0.11042	2.2831	-2.9724	-10.203	3.7577	9.7342	355.6	346.85
198	0.43761	0.17809	0.25562	26.411	-2.9982	-10.196	1.068	4.1663	132.61	26.478
199	0.36087	0.20795	0.11238	29.952	-1.9654	-10.234	1.5744	5.5718	178.78	272
200	0.23312	0.22015	0.068105	11.585	-2.8445	-9.9863	1.2836	7.9702	21.56	157.51

Source: Output DTN: SN0702PASZFTMA.002.

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
1	5.9725	3.1257	−0.17835	1875.6	0.90315	1.249	0.14801	0.37912	0.95332	0.49935	0.55136
2	7.9076	8.3091	−0.49009	2066.2	1.1938	0.77885	0.092137	0.47786	0.91792	0.8188	0.97184
3	7.149	5.3516	−0.030631	1936.2	0.90379	0.77851	0.60439	0.68826	0.66009	0.53068	0.82956
4	5.8326	2.9176	0.76544	1914	3.1598	1.4824	0.41319	0.8772	0.87114	0.76593	0.015416
5	5.436	3.3113	−0.67814	1846.5	0.90303	1.5138	0.42084	0.42053	0.66879	0.14968	0.65052
6	6.9271	5.3053	0.27085	1871.3	0.90329	1.1456	0.016647	0.81447	0.35119	0.19017	0.45259
7	6.5411	5.6538	−0.15437	1957.1	3.4966	0.83018	0.54561	0.74242	0.22112	0.6963	0.84463
8	7.6354	4.7032	−0.87492	1895.9	0.90319	1.8458	0.48397	0.53618	0.81963	0.2233	0.06631
9	5.051	2.5081	0.084564	1972.7	0.90359	0.77867	0.20968	0.66388	0.56603	0.72163	0.16671
10	6.4859	4.9005	0.14586	1848.1	3.3813	0.77817	0.35921	0.91146	0.086184	0.26383	0.61428
11	6.6794	3.7477	0.43752	1955.5	3.0428	1.0566	0.25235	0.28583	0.14377	0.33995	0.37274
12	7.7771	6.267	0.91349	1908.5	0.96748	2.6259	0.96923	0.38967	0.53011	0.37712	0.87938
13	6.7232	3.8468	−0.36318	1824	1.3524	1.436	0.91852	0.74563	0.60164	0.51425	0.28382
14	5.5015	3.1161	−0.0083312	1860.2	0.90381	2.8391	0.061248	0.59919	0.035534	0.42406	0.12351
15	7.8559	4.6227	−0.38177	1901.3	1.0338	1.2741	0.18335	0.93868	0.44241	0.83114	0.66251
16	7.4329	5.7077	0.10859	1789.4	1.5556	2.8528	0.24504	0.23616	0.41568	0.56078	0.24768
17	7.1653	4.6712	0.050062	1904.9	0.90311	2.1018	0.56412	0.71879	0.45866	0.6612	0.88127
18	6.4534	6.0037	0.062013	1899.8	2.2769	1.4215	0.46985	0.17038	0.36892	0.4337	0.41587
19	5.6014	4.0801	−0.18808	2008.9	3.3885	2.2946	0.15415	0.29201	0.926	0.13578	0.10665
20	6.6668	5.4758	0.28696	1897.5	1.6537	0.90638	0.93395	0.38039	0.88069	0.83584	0.78477
21	7.9277	5.2056	0.10377	1967	2.8222	1.5622	0.70752	0.19571	0.96397	0.40507	0.072601
22	5.63	3.864	0.18416	1941.6	2.4794	1.1297	0.89898	0.51774	0.51472	0.44474	0.076803
23	7.1979	5.6592	0.075123	1871.8	2.7048	0.77872	0.11813	0.97456	0.31021	0.6663	0.22816
24	6.0584	4.2818	−0.76267	1913.5	2.9966	0.8072	0.59446	0.50489	0.98748	0.23154	0.36614
25	7.2969	5.8779	−0.13961	1786.8	1.5056	1.554	0.95635	0.59051	0.050116	0.64233	0.45837
26	7.3764	4.2886	0.19264	1876.9	0.90357	2.6816	0.74104	0.20259	0.33288	0.00056021	0.94328
27	6.4016	3.4974	−0.2158	1905.6	3.2025	1.1549	0.48661	0.5346	0.40274	0.22763	0.38021
28	10.512	5.9952	−0.2525	1986.6	1.743	2.5966	0.32813	0.3461	0.52155	0.30517	0.35838
29	5.7075	3.8339	−0.077085	1949.3	0.90353	1.2222	0.72812	0.35529	0.48028	0.18916	0.43491
30	5.4867	4.0164	0.45274	1917	0.90384	2.0319	0.57539	0.27621	0.90553	0.61556	0.49737

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
31	5.7965	4.0665	0.00069343	1997.8	3.5195	2.0158	0.67078	0.43256	0.86789	0.37068	0.3227
32	6.41	4.3106	−0.095361	1826.2	2.9475	0.82037	0.63578	0.087969	0.059871	0.013958	0.61861
33	6.9402	4.5671	0.35112	1928.6	3.0686	1.0455	0.32401	0.28237	0.62066	0.27631	0.64255
34	6.1416	3.9647	−0.20285	1938	0.90391	2.405	0.57426	0.17807	0.63746	0.13035	0.049985
35	8.0184	4.9454	−0.035732	1857.7	0.90374	1.7737	0.38832	0.5125	0.7477	0.040306	0.80321
36	6.1871	4.0891	0.54352	1884.8	1.9106	0.77881	0.021301	0.0098798	0.32113	0.24313	0.62202
37	6.4248	3.8028	−0.24944	1879.9	0.9031	1.6376	0.85906	0.67081	0.77494	0.5175	0.87397
38	6.5714	3.8355	−0.27086	1821.8	2.5739	1.3567	0.49032	0.78578	0.8421	0.92213	0.69837
39	5.5662	3.8588	−0.3174	1946.6	3.2872	1.7059	0.34929	0.10812	0.86475	0.26755	0.44695
40	7.0339	4.8972	−0.58281	1928.9	3.4907	0.77805	0.23383	0.96955	0.55518	0.21934	0.14791
41	7.8859	6.2423	−0.2289	1977.6	0.90347	0.78696	0.78578	0.67741	0.85998	0.44835	0.56415
42	5.5524	3.8987	−0.46991	1867.6	0.90364	1.887	0.79542	0.48809	0.30997	0.68955	0.27574
43	5.4176	3.0432	0.16158	1829.1	2.3007	1.3741	0.054658	0.409	0.65079	0.16031	0.03927
44	8.2813	5.3089	0.34529	1896.6	2.8908	1.5358	0.44201	0.36493	0.58549	0.10303	0.34881
45	5.761	2.9285	0.01772	1964	1.6772	2.5271	0.90287	0.84512	0.23369	0.88767	0.7561
46	6.3004	4.8446	0.12528	1906.4	0.9037	1.4949	0.76341	0.65504	0.38765	0.92522	0.81075
47	5.873	3.5648	−0.43469	1839.2	2.7542	1.3217	0.55681	0.080545	0.68236	0.78279	0.68201
48	7.2523	5.4774	0.30173	1849.6	0.90382	1.4538	0.47267	0.5233	0.42106	0.49153	0.4295
49	2.5731	3.5979	0.24637	1887	1.5231	1.4289	0.30719	0.9826	0.97391	0.34844	0.30095
50	6.8553	5.6262	0.3841	1907.9	1.9352	1.4188	0.75527	0.79521	0.79124	0.59169	0.94693
51	5.9102	4.7212	0.1289	1919.4	2.3538	1.6967	0.11262	0.78394	0.065009	0.96761	0.93778
52	7.4821	4.9052	−0.0033398	1843.4	0.90378	2.1284	0.21311	0.45059	0.101	0.87173	0.85482
53	6.3366	4.457	−0.40648	2040	1.7023	1.7024	0.63397	0.75733	0.63411	0.59665	0.73295
54	7.7507	3.8209	0.39988	1940	2.5819	0.77875	0.74928	0.0014343	0.017975	0.15992	0.5667
55	6.8886	3.5342	−0.086442	2075.6	0.90336	1.6481	0.59924	0.8652	0.39361	0.17097	0.78623
56	6.6048	3.0763	−0.1345	1881.2	2.2225	1.0983	0.46359	0.90716	0.64016	0.016186	0.5749
57	7.2706	5.4099	−0.01422	1862.5	0.90385	2.182	0.98781	0.7921	0.91338	0.19927	0.20202
58	7.8038	3.5232	−0.18625	2097.2	0.90303	1.6425	0.10519	0.22164	0.62929	0.081447	0.65732
59	6.7865	3.844	−0.095791	1890.7	3.4252	1.9758	0.16734	0.57493	0.6155	0.97189	0.060699

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
60	7.8471	5.3337	−0.86102	1794.2	2.1267	1.3454	0.75226	0.55725	0.82696	0.85085	0.68955
61	7.0901	3.3623	−0.17963	1816.9	1.789	0.77828	0.20405	0.61318	0.76903	0.7736	0.5395
62	8.1022	4.1281	−0.35634	1865.6	0.90313	1.6613	0.26243	0.87413	0.71708	0.71988	0.053525
63	6.8167	1.8104	0.15598	1974.2	1.7265	0.86279	0.94684	0.43978	0.19613	0.63319	0.52571
64	7.9504	5.3946	−0.51526	2025.1	0.90356	2.794	0.088359	0.48033	0.84602	0.86047	0.96369
65	5.9188	4.2914	0.31867	1662.6	1.995	0.88188	0.19983	0.046866	0.94455	0.35625	0.19656
66	7.514	5.1756	−0.37451	1930.3	1.967	0.77896	0.69036	0.15279	0.70221	0.95827	0.098062
67	6.839	2.9683	0.014094	1931.6	0.90386	0.77816	0.72359	0.12183	0.58056	0.039986	0.54263
68	7.0756	4.2615	−0.072712	1940.9	2.2592	2.2193	0.073801	0.96441	0.44882	0.88064	0.59544
69	5.6773	3.8865	−0.16347	1963.3	2.7847	1.2303	0.97696	0.20797	0.084584	0.57374	0.70334
70	7.0163	4.2252	−0.02775	1780.6	3.5667	0.79181	0.7142	0.26741	0.78112	0.79843	0.88713
71	17.617	5.8875	−0.266	1952.3	0.91759	0.98496	0.99908	0.803	0.59694	0.31095	0.11612
72	7.3474	5.3152	0.031064	1852.1	0.90392	1.7219	0.45309	0.23211	0.34683	0.29814	0.033845
73	5.5347	3.4392	0.06318	1990.3	1.1033	1.4748	0.61349	0.70253	0.6485	0.95109	0.83954
74	6.476	5.0236	0.025322	1869.4	1.3657	1.2939	0.40039	0.22715	0.12556	0.84679	0.92907
75	6.911	4.4782	0.23518	1947.8	2.1186	1.2692	0.13788	0.64172	0.39798	0.84111	0.76703
76	6.977	6.2345	0.34255	1850.1	3.5552	1.1377	0.93568	0.052459	0.43316	0.27091	0.95719
77	6.7344	4.1705	0.30807	1883.3	2.1891	2.4279	0.036244	0.31983	0.85241	0.099715	0.98777
78	7.9433	5.8334	0.36203	1977	0.90318	0.77863	0.52811	0.32228	0.69329	0.5458	0.17655
79	3.1724	2.3514	−0.47654	2036.5	3.0898	2.3931	0.23949	0.58398	0.51926	0.15459	0.62762
80	7.6189	6.6297	−0.20827	1968.9	2.9533	1.5442	0.79325	0.8985	0.93623	0.053707	0.48373
81	6.9653	4.4453	−0.44567	1962.3	0.9032	1.288	0.49932	0.12507	0.89771	0.82865	0.54536
82	5.806	3.5692	−0.019247	1969.6	1.2058	1.7129	0.33092	0.65045	0.69902	0.23748	0.72851
83	6.3852	3.5058	−0.14341	1760	3.6174	1.5253	0.92293	0.72545	0.89401	0.91693	0.47477
84	5.6579	3.5746	−0.055401	2004.7	0.90395	1.1809	0.36004	0.035625	0.67331	0.77605	0.8152
85	6.1259	3.1344	−0.45113	1903	2.5396	2.4615	0.10302	0.13938	0.2868	0.79406	0.9918
86	6.2138	4.4219	−0.42086	1922.1	3.4561	1.4602	0.4156	0.099152	0.46067	0.50898	0.35323
87	6.3597	3.2946	0.3637	1909.9	2.9123	2.566	0.88833	0.71028	0.55161	0.029548	0.60303
88	7.3952	5.1783	0.82141	1840.5	1.3934	1.7451	0.33803	0.99092	0.099285	0.11672	0.40881
89	7.8123	6.2351	−0.28778	1900.3	0.90326	1.2421	0.31854	0.46209	0.3012	0.5016	0.12874

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
90	4.8056	4.1811	0.26471	1916.2	0.90397	0.77889	0.68696	0.76919	0.80317	0.94606	0.0061426
91	6.014	3.5313	0.087577	1959.2	0.90339	1.0995	0.12672	0.92108	0.75997	0.99265	0.79816
92	6.5187	4.5572	0.024883	1882.1	1.6093	0.77841	0.89491	0.92686	0.50891	0.30263	0.52301
93	7.133	4.3591	0.043368	1942.7	0.90349	1.7296	0.029419	0.54533	0.97505	0.76008	0.082954
94	7.4628	3.4336	−0.059523	1993.1	0.90389	1.7347	0.0044655	0.7771	0.81418	0.60279	0.77636
95	6.5542	8.2103	0.24181	1934.2	0.90367	0.779	0.27625	0.75346	0.94982	0.73642	0.92474
96	6.0514	3.0299	−0.38227	1815.1	3.5953	2.3636	0.50903	0.54324	0.52673	0.1679	0.64838
97	0.48872	3.6545	0.081711	1845.5	2.6544	1.0609	0.86021	0.61537	0.43719	0.29445	0.4137
98	7.4958	5.695	0.6942	1994.9	1.2393	1.5103	0.53499	0.73858	0.54758	0.28177	0.71001
99	5.6455	3.78	−0.048794	1925.1	0.90337	1.4681	0.31493	0.44407	0.026816	0.41548	0.26677
100	5.5838	3.4444	0.49697	2131.4	1.3278	0.77801	0.37156	0.39791	0.34029	0.046676	0.71905
101	7.7408	4.3769	0.41779	1863.9	1.8433	1.2537	0.52369	0.89111	0.72414	0.94363	0.97783
102	8.0842	5.3976	0.039555	1958.2	2.6805	1.3798	0.92714	0.1456	0.15558	0.32354	0.57921
103	6.796	5.3313	0.80176	1809.1	3.6533	1.0224	0.61812	0.30333	0.26082	0.39232	0.38884
104	6.0888	3.7972	−0.11186	1765.8	0.9403	2.5396	0.66785	0.29726	0.31575	0.71377	0.40333
105	1.9233	3.0557	−0.34713	2012.3	2.3309	1.5695	0.88151	0.50933	0.15264	0.36659	0.76274
106	6.317	3.9717	−0.16015	2019.2	2.8064	1.0266	0.22383	0.85892	0.0025427	0.12428	0.23763
107	7.3034	4.2997	0.32801	1981.6	0.98874	1.5407	0.30208	0.62662	0.74214	0.43735	0.50232
108	6.1064	4.5397	0.1042	1917.9	3.6802	1.5234	0.8293	0.57726	0.96774	0.078148	0.29635
109	7.8795	5.6019	0.072417	1812	2.9781	1.0732	0.22898	0.49888	0.36227	0.80137	0.026276
110	15.634	6.0087	0.21815	1873	3.3533	0.7781	0.5898	0.88117	0.18919	0.96142	0.73885
111	6.635	3.9743	0.033322	1991.6	3.2485	1.0785	0.55213	0.70952	0.48706	0.97908	0.25633
112	7.8275	4.9267	0.049153	1904.1	1.4289	1.6676	0.033208	0.42755	0.76087	0.81213	0.74691
113	7.9741	4.3967	0.20481	1923.5	1.018	1.7611	0.12009	0.49013	0.49325	0.067976	0.15316
114	5.7395	5.068	0.32405	2000	0.90369	0.77822	0.069784	0.93143	0.33687	0.70245	0.63608
115	7.6891	5.9715	0.65187	1923.8	0.90344	1.4409	0.013986	0.63208	0.57667	0.39511	0.51207
116	5.6886	3.0546	−0.041682	1892.8	1.4837	0.85576	0.87464	0.021304	0.83896	0.45149	0.21883
117	5.7174	3.1028	−0.0383	1944.8	1.0634	0.77891	0.16343	0.15549	0.32769	0.80689	0.95205
118	8.1407	6.0276	0.41528	1935.9	0.90322	2.7216	0.8338	0.60597	0.1746	0.60799	0.53258
119	8.1476	6.2468	0.44585	1803.9	0.90352	1.6841	0.25947	0.3505	0.13133	0.69187	0.46983

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KDUVO	KDUAL	GWSPD	BULKDEN SITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
120	7.2136	5.0641	−0.19761	1889.1	0.90351	2.1477	0.17971	0.01696	0.12417	0.65725	0.21304
121	0.73131	2.5983	0.17546	1933.7	0.90341	1.5891	0.3682	0.32693	0.14919	0.82472	0.49172
122	7.5388	5.4274	0.61751	2022.8	0.90395	2.5036	0.26875	0.30965	0.53749	0.75493	0.63438
123	5.8931	3.6618	0.012171	2045.4	3.0164	2.7454	0.60795	0.21768	0.77931	0.20398	0.16495
124	5.4415	3.4167	0.25701	2019.8	2.4344	1.9289	0.18763	0.16686	0.20988	0.5691	0.58279
125	7.6474	4.7938	0.067429	1842.8	2.5249	1.5968	0.98125	0.76469	0.2517	0.3173	0.85904
126	5.7525	2.9364	0.20045	1832.8	2.4076	1.5787	0.39829	0.95212	0.034587	0.52336	0.1135
127	7.6758	6.1912	0.12146	1981	1.2767	1.6157	0.056255	0.90495	0.98011	0.48855	0.91575
128	7.599	4.9257	−0.08843	1835.2	1.5866	1.3035	0.87817	0.94688	0.25589	0.33424	0.20698
129	6.437	4.5798	0.099163	1798.4	1.7706	1.7714	0.47718	0.47024	0.19356	0.55568	0.55688
130	6.1543	3.7598	−0.22072	1720.1	3.1815	2.2739	0.95338	0.39089	0.73424	0.72894	0.50726
131	5.9386	2.9796	0.46561	1965.9	0.90343	1.116	0.69971	0.58612	0.92169	0.67742	0.27223
132	7.9887	6.2132	−0.20382	1985.9	0.90305	1.5025	0.1319	0.56659	0.26685	0.90542	0.13879
133	7.2478	6.0816	0.27632	1938.8	1.3017	1.6536	0.90639	0.66534	0.7532	0.2594	0.31207
134	6.0054	5.4818	−0.12658	1961	3.4344	1.1616	0.24114	0.94237	0.65911	0.34417	0.28603
135	6.696	6.1064	−0.081183	1859.2	0.90309	1.0038	0.042086	0.3139	0.012702	0.70527	0.89991
136	5.3906	2.0544	0.47737	2061.5	0.90365	0.93824	0.43459	0.98723	0.17691	0.36239	0.39637
137	7.18	5.9748	−0.052153	1892.1	1.4591	1.6802	0.8406	0.24623	0.24321	0.74055	0.34012
138	6.1703	6.2067	0.14014	1927.6	0.90399	2.8913	0.4496	0.73276	0.79884	0.86859	0.29014
139	19.885	8.1261	0.26128	1756	1.1114	2.2309	0.85058	0.013066	0.70983	0.98059	0.4625
140	7.5026	5.6096	−0.16633	2084.8	2.1687	1.4077	0.19363	0.91877	0.57169	0.062484	0.59253
141	6.9918	6.2617	0.1988	1915.2	2.1627	1.96	0.81428	0.213	0.23506	0.62553	0.8923
142	6.2718	3.8342	−0.15008	2033.8	1.5521	2.7681	0.28203	0.030125	0.99984	0.93706	0.43827
143	7.058	4.7386	−0.94765	2007.2	0.90372	1.0108	0.78117	0.1124	0.90435	0.68037	0.00137
144	6.7638	5.6594	0.092009	1920.1	0.90361	1.478	0.45778	0.62244	0.20289	0.1124	0.67711
145	10.659	8.5196	−0.29082	1782.1	3.6308	1.3834	0.54002	0.83238	0.54177	0.059496	0.055209
146	3.5351	3.8212	−0.11981	1856.2	1.4484	1.7392	0.58368	0.82026	0.49892	0.93132	0.8671
147	6.0321	4.5493	0.37754	1874.5	2.7317	1.1979	0.28947	0.064219	0.0087405	0.086082	0.042408
148	7.0463	5.7906	−0.23708	2010.9	2.048	1.5757	0.83873	0.18767	0.45303	0.24793	0.17381
149	5.4744	3.205	0.11709	1861	3.7102	1.4905	0.71606	0.45623	0.60712	0.106	0.8472

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
150	6.8808	4.9771	-0.2776	1955.4	0.90362	1.5925	0.772	0.25397	0.046208	0.35463	0.7418
151	7.3396	5.7647	0.16779	1887.6	0.9033	1.0412	0.99159	0.37394	0.16138	0.8983	0.33576
152	6.5049	5.4311	-0.11322	1876	0.92863	1.8934	0.078416	0.26234	0.47477	0.41185	0.8627
153	14.049	4.2353	0.056293	1950.4	0.90306	0.95402	0.37664	0.16391	0.072875	0.20549	0.98379
154	6.607	3.0553	-0.10223	1801.7	0.90376	1.3353	0.67507	0.85191	0.56233	0.91132	0.77248
155	5.8605	3.7371	-0.12959	1852.6	2.0553	1.7596	0.64711	0.24118	0.78982	0.14203	0.022912
156	5.776	3.1714	0.16282	1946.4	0.90324	1.3632	0.29059	0.11742	0.16658	0.5841	0.33087
157	5.9495	4.7204	-0.25774	1932	3.2184	0.77879	0.21752	0.56409	0.37232	0.071179	0.086622
158	7.1079	3.7186	0.29763	1818.8	1.876	0.92785	0.40653	0.028803	0.093443	0.45984	0.90492
159	7.3664	6.1582	-0.62242	1823.5	2.4529	1.8267	0.09683	0.8887	0.99051	0.28945	0.44384
160	6.3494	3.6492	0.20762	1921.2	3.3049	1.6886	0.77907	0.84141	0.82286	0.40239	0.14267
161	15.099	6.2336	-0.31177	1805.6	1.0831	0.77834	0.94128	0.067398	0.59004	0.87679	0.1026
162	12.74	4.0016	-0.38899	1748.7	1.8898	1.085	0.73848	0.27179	0.11254	0.033604	0.25055
163	8.061	6.0648	-0.33566	1943.2	2.0836	0.77865	0.5124	0.090902	0.29907	0.78995	0.93382
164	5.4574	2.1478	-0.19404	1979	2.3667	0.77856	0.65853	0.044761	0.71303	0.0092675	0.13014
165	7.2364	5.7647	-0.14715	1975.6	3.1379	0.94558	0.42716	0.99581	0.93247	0.63505	0.79472
166	6.2901	4.1535	-0.29973	1954	0.90328	1.5573	0.80914	0.14267	0.18078	0.46381	0.36175
167	7.6992	3.4719	-0.021399	1830.6	1.1302	1.6278	0.97148	0.19133	0.83382	0.54465	0.22192
168	8.1221	6.2479	-0.39528	1831.6	0.903	1.2828	0.86946	0.419	0.13968	0.55282	0.99942
169	7.1233	7.0136	0.15288	1999.3	0.99714	0.8477	0.34431	0.073091	0.68898	0.89467	0.4245
170	8.0225	4.6577	0.3721	1814.2	2.6418	1.1898	0.68117	0.33547	0.40532	0.90013	0.91304
171	5.8507	3.0721	0.11496	1893.7	2.401	1.1109	0.70351	0.69854	0.72757	0.98757	0.75225
172	8.0683	4.7402	-0.10631	1983.3	1.2186	1.4499	0.81611	0.25826	0.61445	0.46792	0.90571
173	7.5754	4.857	0.14313	2050.5	2.6047	2.3379	0.76866	0.058454	0.21765	0.58804	0.3155
174	1.1658	1.7803	0.89073	1911.2	2.7415	0.89771	0.082041	0.40006	0.060625	0.38108	0.96639
175	7.552	4.6349	0.22623	1894.7	0.90325	1.6091	0.91047	0.82838	0.88732	0.99868	0.18895
176	6.7562	5.2835	-0.72109	1776.4	3.2702	0.7785	0.66477	0.46953	0.042516	0.62485	0.48731
177	8.0456	6.6965	-0.066206	1855.9	2.0157	0.88506	0.96164	0.33283	0.29031	0.47929	0.60973
178	7.9909	4.8699	-0.36815	1988.5	2.8606	0.77832	0.0067321	0.52745	0.28427	0.74792	0.23012
179	6.6369	5.4109	0.0044132	1837.4	0.90374	0.77859	0.15811	0.55268	0.023901	0.18067	0.47559

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KDUVO	KDUAL	GWSPD	BULKDEN SITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
180	6.075	4.3224	0.29082	1899.1	2.8672	1.3971	0.62791	0.36613	0.37716	0.25127	0.19465
181	6.2387	3.2879	0.18909	1926.4	1.6385	0.77808	0.84643	0.60261	0.079115	0.17635	0.72495
182	7.6656	6.1638	−0.30503	1880.1	1.822	2.081	0.53641	0.4478	0.35914	0.38798	0.014873
183	5.6068	4.2512	0.3911	2052.7	2.5136	1.3331	0.43998	0.95684	0.41408	0.21347	0.83035
184	18.44	8.42	0.49267	2016.2	0.90358	1.3131	0.82124	0.41314	0.95968	0.61257	0.39318
185	7.7224	4.3037	−0.49985	2028.7	0.90389	1.2114	0.14096	0.86368	0.87878	0.73015	0.824
186	6.7098	5.8866	0.22981	1970.8	1.8143	1.6253	0.17332	0.83925	0.42664	0.75893	0.18395
187	4.2645	3.3483	−0.34362	1853.7	1.1646	2.6512	0.29535	0.6393	0.2468	0.32991	0.2443
188	7.5603	5.1399	−0.32222	1889.8	1.2623	1.2132	0.62056	0.077406	0.27678	0.12604	0.51919
189	5.527	5.0692	−0.0068214	1878.8	0.90314	1.1667	0.27374	0.81653	0.73931	0.52789	0.26466
190	6.9482	4.3955	0.3371	1912.5	0.90346	0.77845	0.80183	0.10476	0.10591	0.85939	0.80646
191	6.2326	5.4906	−0.06649	1868.6	1.4057	1.3999	0.50392	0.80569	0.22811	0.023383	0.32794
192	6.2522	4.6235	−0.3294	2003.6	3.3367	1.791	0.64456	0.1335	0.21443	0.53591	0.66755
193	7.4137	4.4366	−0.80827	1866	0.90332	0.7784	0.73013	0.97535	0.38237	0.67251	0.69203
194	5.9761	3.9867	0.17037	1735.4	1.9855	1.6741	0.38362	0.34451	0.67767	0.42816	0.70837
195	7.3178	5.1823	−0.17382	1768.8	0.90341	1.6045	0.51658	0.77213	0.27475	0.48303	0.58716
196	7.768	6.5404	−0.12256	1795.8	1.3102	0.9639	0.35128	0.64598	0.11775	0.64953	0.3061
197	6.1982	4.8575	−0.24181	1836.8	0.90334	1.7525	0.56869	0.694	0.50191	0.4735	0.6721
198	6.8284	4.1527	0.5678	1951.9	1.152	0.99489	0.39476	0.72323	0.46947	0.57942	0.092109
199	6.5811	3.1799	0.17943	1885.4	2.2515	1.178	0.65197	0.18141	0.47965	0.65273	0.37658
200	7.4513	6.2634	0.13358	1910.7	3.1226	0.77824	0.046482	0.68272	0.80814	0.091389	0.15855

Source: Output DTN: SN0702PASZFTMA.002.

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
1	0.92233	0.25505	0.74124	15.158	1.313	288.36	174.2	98.301	114.36	2570.7
2	0.95718	0.43026	0.82308	5.2309	1.996	441.64	988.27	123.12	104.1	3544.4
3	0.39566	0.78442	0.12747	7.7891	1.8919	268.98	226.85	112.77	134.5	3993.5
4	0.83861	0.26775	0.71883	8.0644	1.8993	736.01	539.95	106.47	98.669	5253.7
5	0.52003	0.57509	0.094709	6.2813	2.5643	470.69	216.45	98.599	80.671	1537.7
6	0.40076	0.96621	0.9459	9.4486	2.1515	764.09	494.69	35.821	97.937	7319.7
7	0.094518	0.093636	0.46901	4.9464	2.6278	361.91	785.5	235.94	104.22	3292.3
8	0.32186	0.17194	0.84957	5.3645	1.8634	545.46	443.82	62.502	103.95	49331
9	0.30145	0.85606	0.16371	15.893	2.2814	669.99	352.57	67.408	84.925	9497.9
10	0.57727	0.11274	0.96106	7.6892	1.4344	791.95	903.41	97.597	102.28	2227.5
11	0.74875	0.15598	0.086856	1.125	2.1713	849.22	335.7	90.047	103.04	1935.8
12	0.6884	0.20431	0.40849	9.0473	1.3276	972.52	164.3	100.84	104.87	3916.8
13	0.11426	0.97927	0.80415	0.96834	3.3988	444.69	537.54	95.738	108.44	6812
14	0.077847	0.038325	0.39857	4.6603	1.8369	192.91	208.99	120.71	94.932	4626.3
15	0.47977	0.67091	0.53651	2.5728	2.1315	831.69	831.51	70.164	95.22	6440.6
16	0.56804	0.91726	0.52864	5.6017	2.5869	258.77	122.81	102.32	90.401	60334
17	0.97516	0.75352	0.96649	4.9962	1.738	367.02	320.17	93.319	91.349	6970.5
18	0.22547	0.098027	0.27507	1.6755	2.8558	190	631.03	125.63	107.59	1484.2
19	0.11894	0.90477	0.51826	1.077	1.7207	264.86	760.47	47.53	107.9	1841
20	0.44268	0.65648	0.4869	3.1406	2.2336	901.01	594.29	113.09	94.799	1311.4
21	0.86671	0.87858	0.86223	3.0022	1.8704	393.42	848	104.74	82.968	2355.9
22	0.37889	0.51061	0.8531	4.3041	1.4624	317.61	204.43	82.927	100.11	35253
23	0.18952	0.45367	0.61803	4.7413	0.83082	461.49	821.45	129.18	111.01	8234.3
24	0.77685	0.032638	0.93762	3.8977	1.5078	376.32	231.83	98.235	96.142	27031
25	0.48162	0.79486	0.64681	3.6705	1.8783	400.03	220.48	100.83	102.11	5782.8
26	0.67481	0.28202	0.28096	2.7096	2.2218	652.15	757.15	95.807	94.214	2284.8
27	0.016023	0.91494	0.79437	15.809	0.67777	844.48	257.34	255.61	93.747	1852.6
28	0.48515	0.29132	0.2558	5.6755	1.7298	972.36	599.46	99.748	86.16	4694.5
29	0.31677	0.86088	0.87083	1.4014	3.1006	457.68	573.85	121.18	91.264	12511

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
30	0.47158	0.95708	0.22766	9.2308	1.3287	580.46	184.04	102.99	105.46	3381.1
31	0.87638	0.25117	0.35533	13.125	2.1624	335.74	872.42	118.62	138.2	3190
32	0.84049	0.75826	0.066926	4.4104	1.385	573.87	474.13	102.52	89.155	2624
33	0.79945	0.36122	0.71376	4.8772	2.6009	742.68	616.09	84.182	87.138	2499.8
34	0.087804	0.8988	0.88781	2.2414	2.7057	455.81	337.26	25.332	75.724	1701.3
35	0.73521	0.77603	0.2629	1.9565	2.0292	532.81	876.82	115.01	86.326	4986.3
36	0.28329	0.060343	0.24624	17.711	3.0503	149.51	803.62	119.52	126.23	5929.2
37	0.82935	0.82288	0.070104	2.4021	1.9786	211.15	635.38	114.43	116.45	4028
38	0.042963	0.33111	0.15903	1.1833	1.4821	653.74	836.64	287.24	115.78	3504.8
39	0.85708	0.73262	0.89719	3.3288	1.9402	685.43	674.91	122.53	110.67	2190.1
40	0.60087	0.72999	0.42689	10.239	2.6368	979.38	524.48	113.95	101.13	1072.5
41	0.49271	0.10448	0.77958	2.4453	2.3116	987.52	759.86	177.81	88.271	1650.7
42	0.64192	0.96389	0.50726	2.8439	2.2754	478.66	873.62	108.57	99.409	10831
43	0.2041	0.71481	0.94157	7.3146	2.1155	389.82	162.84	138.35	100.43	6420.2
44	0.18387	0.27955	0.6511	3.0408	2.3907	424.53	427.46	98.778	97.126	9947.1
45	0.98648	0.43556	0.40458	0.41701	2.7365	540.18	369.21	128.74	117.61	31585
46	0.23594	0.70606	0.097513	4.1325	2.3716	186.02	929.14	94.639	73.954	3852.2
47	0.9144	0.46205	0.26876	1.8281	2.0254	141.78	758.36	104.15	84.907	6916.7
48	0.63216	0.56861	0.30615	4.5316	1.1684	609.67	488.64	126.93	93.95	9117.7
49	0.51583	0.8261	0.74634	1.2771	2.1974	678.23	285.28	114.77	94.328	3675
50	0.8528	0.83683	0.2883	6.3543	2.0765	428.03	443.3	124.64	106.31	3230.4
51	0.53245	0.42635	0.90682	18.841	2.7894	157.37	748.35	49.528	107.71	2697.4
52	0.3125	0.12124	0.18823	3.5813	1.7479	890.49	894.97	105.85	84.666	15733
53	0.79448	0.99326	0.38079	0.8615	2.1889	975.01	972.11	108.3	95.641	46391
54	0.2736	0.41402	0.75965	0.66445	0.46339	839.05	283.8	87.322	102.25	6351.6
55	0.82136	0.94926	0.57277	3.4625	0.97016	419.14	923.79	41.535	85.932	37479
56	0.24226	0.47853	0.65891	9.2636	2.3606	745.58	402.45	127.21	96.739	5894
57	0.30565	0.31586	0.63843	13.715	1.6016	614.78	643.93	91.257	111.29	2967.7
58	0.87226	0.30481	0.23333	4.8274	0.25367	217.97	673.06	60.124	89.057	2734.1
59	0.34771	0.81349	0.55574	2.9053	2.5133	304.04	698.81	101.68	108.8	76827

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
60	0.53539	0.18244	0.43489	0.077649	0.93803	459.36	167.07	107.2	91.617	5678.3
61	0.69358	0.072783	0.20895	6.208	2.2049	119.64	657.7	105.28	95.365	6620.2
62	0.37424	0.0051665	0.43543	3.7696	2.1004	224.25	828.96	117.04	129.09	7078.3
63	0.80636	0.65482	0.62131	4.2705	1.5823	731.18	789.42	57.594	72.457	39949
64	0.95066	0.54284	0.91978	12.312	2.4195	635.57	752.77	75.327	100.35	33635
65	0.94153	0.97469	0.057611	14.551	1.4013	101.16	629.7	92.618	105.44	40908
66	0.38226	0.048251	0.4617	13.256	3.199	345.31	856.16	31.479	81.846	8962.7
67	0.62941	0.61653	0.38797	8.2961	1.7649	981.33	609.29	123.01	120.69	8844.5
68	0.56358	0.98803	0.62566	4.6968	1.6497	161.13	390.4	108.62	88.609	8468.1
69	0.753	0.13847	0.19972	2.3811	1.0524	286.49	699.32	96.59	101.38	3648.8
70	0.41038	0.61048	0.47687	3.7497	4.5701	551.87	775.53	115.55	124.9	2037.3
71	0.50596	0.76298	0.75346	4.7911	2.553	954.94	571.81	116.77	116.07	8057.5
72	0.35308	0.58728	0.83407	11.25	1.49	224.06	604.12	124.23	110.12	4297
73	0.72002	0.84202	0.17657	10.774	1.6344	563	881.82	226.67	113.89	4359.5
74	0.14626	0.68295	0.07776	4.0845	1.619	623.77	853.66	110.93	98.06	2457.8
75	0.066744	0.38841	0.026305	12.916	1.7716	422.83	954.12	32.139	76.757	9032.6
76	0.40925	0.42092	0.041884	1.9009	2.9928	398.79	122.66	107.63	111.18	4084.8
77	0.75816	0.63356	0.19002	0.97218	2.0748	145.13	902.65	120.82	96.95	6007
78	0.17325	0.53555	0.79986	11.716	0.036259	627.57	832.16	48.16	92.011	4122.1
79	0.17749	0.08885	0.50064	0.73485	1.2689	170.66	782.33	102.33	90.81	3481.1
80	0.65533	0.31436	0.13959	0.53328	2.8701	959.38	368.73	115.17	99.853	2875.3
81	0.13682	0.5298	0.543	1.2215	0.793	474.69	368.01	119.44	105.08	67019
82	0.34247	0.32268	0.29273	14.707	2.135	910.66	707.17	41.025	116.66	8329.7
83	0.8816	0.1638	0.0046957	3.2979	2.5754	881.91	554.66	60.516	106.79	5441.7
84	0.021631	0.93282	0.034844	0.4959	1.6476	750.49	101.52	94.286	85.825	3605.4
85	0.36704	0.28987	0.33286	2.0515	1.8058	862.26	768.43	108.18	108.92	13610
86	0.49834	0.98297	0.2155	2.1427	2.2666	654.14	607.58	93.851	111.6	9145.4
87	0.26303	0.59693	0.14617	2.23	3.1643	419.3	370.49	15.497	86.581	8548.4
88	0.77494	0.5598	0.64268	13.897	3.326	428.79	406.06	54.213	97.94	23376
89	0.29397	0.38192	0.4223	3.8284	3.2587	798.49	971.66	115.22	101.4	8424.3
90	0.89941	0.35616	0.44701	0.59262	1.22	228.04	591.62	90.953	88.517	36244

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
91	0.76656	0.80189	0.45487	4.9084	1.962	971.84	832.65	128.26	94.325	39121
92	0.63929	0.74595	0.53056	2.347	1.3698	200.86	152.7	128.36	116.06	2545.7
93	0.86447	0.92068	0.66988	2.0977	2.24	751.68	687.81	114.76	100.97	28611
94	0.9357	0.50364	0.31131	1.9757	3.4595	748.54	842.5	30.631	74.696	5601.7
95	0.35996	0.37754	0.98715	12.749	1.7585	854.55	321.13	108.66	108.3	1415.2
96	0.99924	0.64932	0.6606	0.79958	0.41495	481.04	556.84	19.054	69.656	1257.2
97	0.28863	0.35212	0.36658	2.7297	1.6868	531.12	802.47	93.554	90.133	7179.9
98	0.99314	0.34661	0.10037	0.64677	3.0595	104.47	939.54	98.624	103.68	3045.7
99	0.42653	0.23963	0.037187	7.9165	1.417	877.41	777.99	126.67	111.55	51546
100	0.33084	0.79766	0.17138	7.995	1.2469	789.86	969.03	117.79	97.513	20719
101	0.42259	0.22354	0.7233	3.6255	1.7033	609.24	514.18	118.05	83.394	5326.5
102	0.84776	0.62524	0.73714	4.3359	2.6104	997.49	408.79	97.385	79.195	4583.3
103	0.057725	0.36634	0.76158	12.561	1.2976	629.59	327.32	34.723	62.618	5130.4
104	0.96879	0.47187	0.13328	1.3729	0.89703	978.09	516.92	109.11	94.548	3043.7
105	0.7066	0.37193	0.57744	4.4521	1.4986	324.25	754.62	109.26	104.41	1898.9
106	0.2104	0.71681	0.99385	9.6608	1.93	941.32	421.68	38.595	97.627	93999
107	0.032139	0.30865	0.35219	0.76974	2.4818	358.89	212.89	122	104.2	9847.3
108	0.78493	0.55127	0.23633	3.2414	1.91	711.94	319.88	97.135	83.961	8910.4
109	0.54848	0.08343	0.68564	2.5181	2.4269	207.35	493.03	90.564	112.96	6672.5
110	0.96153	0.89494	0.54785	6.7847	0.337	514.71	133.39	76.488	105.55	43352
111	0.62488	0.044425	0.91427	3.8537	1.6652	646.85	699.32	256.92	150.52	4494.8
112	0.69681	0.85203	0.92816	6.6984	1.5314	413.96	918.97	109.29	100.58	4904.9
113	0.52809	0.86964	0.70423	1.461	2.0875	862.23	429.86	16.035	102.16	3719
114	0.61818	0.58153	0.80775	2.611	1.6168	615.28	449.07	103.55	75.715	29257
115	0.46203	0.41723	0.31862	3.1673	1.123	868.34	838.96	49.545	119.16	1713.2
116	0.20919	0.33963	0.49977	10.959	1.8505	940.31	419.19	125.18	92.767	6256.8
117	0.39316	0.84877	0.86639	1.5102	2.3377	207.93	763.14	18.553	86.344	4534.1
118	0.51324	0.69222	0.84208	10.391	2.0452	765.97	598.8	115.84	107.45	5807.6
119	0.50401	0.18607	0.37533	9.6216	2.6881	996.3	552.6	102.59	89.656	55877
120	0.97274	0.72227	0.32996	8.5513	2.0178	772.61	279.18	119.72	114.75	1298.1
121	0.90393	0.76623	0.69825	1.5367	2.2099	278.66	788.66	149	115.37	88864

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
122	0.16682	0.90667	0.3208	2.8123	1.1146	237.62	707.08	119.62	107.05	6559.5
123	0.88685	0.78667	0.33837	3.3767	1.8277	718.47	126.56	33.981	103.36	3934
124	0.93377	0.88469	0.049508	14.072	0.54525	608.77	566.13	201.21	101.28	7572.6
125	0.8012	0.49335	0.59546	3.4325	2.979	349.37	529.81	117.39	110.4	4932.5
126	0.27749	0.078469	0.90494	8.1951	1.963	537.24	608.86	108.89	88.023	1394.5
127	0.15151	0.11629	0.56557	5.1007	2.4552	113.94	194.64	112.76	150.2	5406.2
128	0.23227	0.66062	0.60165	4.0469	2.6825	545.09	408.91	122.54	89.078	9406.9
129	0.55875	0.88816	0.47306	16.849	2.1129	849.76	669.99	55.448	92.378	9753.4
130	0.2558	0.46514	0.20482	4.3706	1.9442	968.87	221.55	123.69	106.27	9544.7
131	0.98325	0.44402	0.78375	1.8793	2.0021	218.82	447.52	17.702	93.285	4790.3
132	0.70346	0.6861	0.51445	2.7902	2.6619	432.26	900.65	116.94	122.66	7491.3
133	0.43036	0.74351	0.67275	2.9934	2.3754	378.35	504.71	98.355	87.438	5020.9
134	0.59479	0.24391	0.18118	2.6733	2.8191	730.63	918.55	101.73	93.41	1185
135	0.029181	0.54944	0.44236	7.4784	3.5157	284.24	244.75	91.203	96.844	30250
136	0.29642	0.40806	0.16692	4.5124	2.9033	374.09	694.3	129.09	118.37	1608
137	0.71369	0.59312	0.59332	3.6942	3.0078	676.05	351.79	24.305	84.887	1161
138	0.91854	0.19074	0.63055	3.5288	3.307	809.19	501.75	103.17	118.3	6158.6
139	0.45967	0.51566	0.95385	7.0082	1.676	598.1	160.15	62.407	96.957	5174.8
140	0.25344	0.93944	0.52473	10.442	1.5508	345.5	951.89	115.05	119.61	6092
141	0.099923	0.80992	0.89486	3.2309	1.1519	216.72	210.63	114.02	103.22	4864.3
142	0.24977	0.13496	0.98272	10.658	2.4377	992.13	459.73	112.76	91.92	45879
143	0.036624	0.20762	0.24422	4.6117	3.5447	280.23	561.82	109.58	121.53	2305.6
144	0.051719	0.26209	0.0068935	8.6802	1.5218	394.27	215.91	106.91	99.632	8120.1
145	0.57483	0.63694	0.58037	9.9014	2.1419	125.91	907.02	125.53	102.76	9583.2
146	0.41881	0.15465	0.36144	2.3109	1.8391	517.58	395.04	11.901	83.08	83901
147	0.22244	0.14066	0.14225	7.6027	2.0595	168.87	600.03	99.652	75.935	7836
148	0.68188	0.19518	0.10796	3.9251	2.6459	640.36	518.08	99.004	114.73	2018.7
149	0.72764	0.10513	0.88462	1.5993	2.5012	971.36	387.55	109.23	117.9	9286
150	0.43902	0.44513	0.11251	5.203	1.2316	904.11	817.78	77.695	90.749	4759.2
151	0.83171	0.60065	0.25367	4.1603	2.3044	233.61	795.4	94.397	88.623	42279
152	0.21903	0.05082	0.99545	1.3229	1.7878	551.63	369.7	75.605	85	8754.1

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
153	0.73195	0.12708	0.83865	1.7913	2.8058	434.27	894.81	57.514	89.797	3100.6
154	0.6762	0.029674	0.77487	6.5113	1.1833	497.88	484.93	113.4	101.83	8688.5
155	0.15591	0.40127	0.2951	3.0875	0.99647	245.5	894.17	117.64	131.53	17580
156	0.65336	0.16679	0.45652	16.213	1.0783	149.84	102.88	26.791	102.8	3152.3
157	0.78953	0.64082	0.81817	2.9406	2.4897	463.66	789.06	108.48	84.712	4173.9
158	0.92559	0.17548	0.58945	16.672	2.3218	276.73	488.08	62.899	100.27	2154.6
159	0.6146	0.60552	0.56322	1.6848	0.70349	831.78	324.09	98.015	94.785	48346
160	0.16497	0.00029426	0.68255	12.22	1.5591	947.5	575.79	99.127	112.09	9250.7
161	0.59504	0.87101	0.019925	10.114	2.5235	662.61	923.44	94.514	87.064	3347.1
162	0.19052	0.39438	0.72575	5.8081	1.697	753.49	363.58	58.689	66.938	2853.4
163	0.74153	0.34185	0.87858	15.3	2.0564	679.6	108.25	102.88	111.99	1502.9
164	0.083627	0.52435	0.34361	1.0944	1.4214	226.99	193.96	121.84	97.327	1788.9
165	0.45195	0.81843	0.81288	0.70072	2.3472	690.74	367.95	127.16	120.37	4688.5
166	0.81384	0.22875	0.97654	0.44472	2.251	280.67	274.87	93.119	85.665	9667.9
167	0.2695	0.73651	0.30146	11.463	2.9584	348.93	909.79	288.15	118.78	3790.2
168	0.66599	0.29998	0.92251	2.1845	1.2731	850.27	523.56	11.054	77.688	2074.4
169	0.1286	0.21367	0.73255	3.9964	1.448	766.45	920.3	123.63	99.76	4284.8
170	0.90937	0.2454	0.34744	1.7522	1.09	206.02	179.81	90.302	82.802	7765.2
171	0.001231	0.77299	0.11959	8.781	3.8606	693.42	292.67	120.19	114.17	1027.6
172	0.4656	0.83016	0.93346	13.446	3.1732	910.57	163.63	92.744	90.383	4418.4
173	0.19628	0.022893	0.76523	11.081	3.6345	300.1	261.67	117.51	105.34	19130
174	0.54137	0.23146	0.60978	0.3668	1.8184	390.64	665.64	124.98	133.18	25885
175	0.36311	0.99983	0.053292	4.5671	3.1094	438.94	497.52	98.308	75.209	7266
176	0.60953	0.70036	0.27276	2.5341	2.7539	894.08	729.54	125.67	111.18	3418.8
177	0.064173	0.21845	0.15009	12.027	1.9175	801.43	214.36	97.72	103.87	2793.8
178	0.76396	0.92607	0.21335	6.5859	2.4006	216.71	556.03	113.55	85.78	95822
179	0.10918	0.39894	0.41905	1.6394	1.3675	692.42	724.88	115.9	88.001	7699.7
180	0.89186	0.018397	0.12176	4.2211	1.9905	979.04	257.66	161.07	99.162	5559.9
181	0.13459	0.45851	0.67736	6.8799	0.97985	757.85	116.49	127.81	113.47	9894.3
182	0.94536	0.066174	0.22481	1.313	2.8343	348.96	738.84	120.57	110.98	2939.5
183	0.074184	0.27323	0.063419	9.9881	2.8894	735.97	570.32	112.3	111.93	4240.1

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
184	0.33522	0.56336	0.69415	6.1458	1.5716	633.8	582.46	53.924	96.474	74019
185	0.38501	0.57366	0.4949	3.5171	0.89307	561.4	242.81	121.17	115.26	3811.6
186	0.64828	0.67742	0.78821	7.2074	0.75759	960.18	950.74	127.84	103.6	2415.1
187	0.55432	0.3274	0.82971	2.0345	1.3431	154.16	998.44	97.523	98.368	4449.8
188	0.58086	0.49706	0.48494	19.322	1.0364	309.09	585.43	113.93	109.58	8154.4
189	0.010006	0.95063	0.41403	0.84329	1.591	403.71	281.47	22.459	87.03	1095.4
190	0.81791	0.48478	0.97384	4.0371	2.9223	362.15	207.39	104.59	82.848	14208
191	0.10396	0.14898	0.95984	11.665	2.4702	804.34	939.88	52.037	94.609	7024.5
192	0.0082921	0.48702	0.022384	0.28879	2.7737	672.76	229.66	92.913	95.29	19773
193	0.66128	0.010403	0.85706	0.88664	2.5306	813.95	697.55	96.606	102.59	7873.5
194	0.44669	0.056335	0.013682	8.8329	1.7959	662.63	995.76	35.304	98.625	7929.1
195	0.58695	0.50667	0.080381	0.92354	0.60612	204.12	843.41	112.37	123.01	22898
196	0.14264	0.66797	0.39326	5.436	2.2902	912.83	107.64	99.089	90.813	7528.2
197	0.71574	0.5321	0.55188	1.0064	0.84056	479.83	587.79	60.367	108.55	6722.2
198	0.048634	0.62298	0.37462	5.9639	2.7289	344.03	361.74	21.366	97.216	7409.9
199	0.12266	0.69669	0.61218	7.1319	1.2041	102.01	382.58	126	87.918	8626.9
200	0.32612	0.9429	0.70614	5.8748	2.4135	194.53	623.45	36.609	80.817	2681.9

Source: Output DTN: SN0702PASZFTMA.002.

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
1	7536.5	6110.8	3.43×10^{6}	3876.4	190.13	4674.9	−4.572
2	2982.1	4758.2	2.78×10^{5}	5106.8	962.37	903.26	−5.7843
3	3681.6	9659.2	6.91×10^{4}	3957.2	228.48	3883.5	−8.8173
4	4944.3	4689.8	4.26×10^{6}	4266.4	828.49	4747.3	−8.0077
5	4306.1	5219	7.89×10^{4}	4322.7	281.21	93.203	−5.7211
6	4888.4	6619.5	5.71×10^{6}	6098.4	424.12	426.58	−6.7879
7	6187	4879.6	1.73×10^{5}	3564	873.03	2216.6	−7.6456
8	4392.8	5411.5	3.86×10^{4}	5120.7	473.6	199.71	−8.5382
9	6939.5	7236	4.81×10^{5}	5237.8	485.2	264.48	−8.3826
10	5065.5	6193.4	6.17×10^{5}	6363.4	799.58	2353.7	−7.8268
11	6260.6	5700.5	6.56×10^{4}	6529.9	252.55	317.68	−5.4308
12	6084.2	3543.1	4.95×10^{6}	6175.4	416.25	986.96	−7.4885
13	5901.9	5121.5	6.48×10^{6}	4382.1	572.63	63.693	−7.9463
14	6035.1	3167.6	2.09×10^{6}	3231.9	252.6	110.76	−5.3155
15	6776.7	3006.8	2.14×10^{5}	6029.9	855.16	3004.5	−6.3063
16	6286.8	4866.2	6.45×10^{5}	3007.8	260.34	2164.2	−6.038
17	8296	5233.4	3.90×10^{5}	4106.1	387.03	226.24	−8.9285
18	4695.3	7475.3	2.48×10^{6}	3038.4	741.09	827.44	−5.1203
19	5087.1	7753.6	2.16×10^{6}	3694.8	785.65	289.46	−5.015
20	5396.9	6976.8	6.12×10^{5}	6682	410.42	204.78	−8.6327
21	6785.1	5396.7	1.83×10^{5}	5049.3	720.49	3484	−7.7092
22	6802.5	4577.9	1.09×10^{5}	4230.4	195.57	361.06	−6.4254
23	5775.4	5917.5	2.25×10^{5}	4667.2	793.69	3198	−3.895
24	9482.4	4478.3	7.24×10^{5}	4140.8	273.76	308.16	−6.355
25	3226.9	5298.9	3.59×10^{6}	4663	231.57	1707.6	−6.8006
26	5518.5	7843.9	6.53×10^{5}	5001.7	836.01	721.47	−7.9992
27	8943.9	3492.1	2.69×10^{6}	5935.4	377.33	725.72	−5.2569
28	5600.9	5453.6	1.30×10^{5}	6572.2	738.41	2837.7	−8.3503
29	4925	5059	1.70×10^{6}	4512.3	636.71	302.9	−8.4815
30	9935.8	5095	1.23×10^{6}	4520.8	296.83	2616.4	−8.7293
31	7127.2	4495.2	7.37×10^{6}	3780.5	889.81	2073.9	−8.1127

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
32	6697.3	7382.1	1.35×10^4	4993.2	565.53	259.51	−5.0346
33	4826.2	6072.5	7.57×10^5	5985.6	562.65	610.07	−5.9699
34	5533.8	6581.2	2.32×10^5	4991.4	300.2	178.11	−8.3377
35	4244.1	6874.5	3.07×10^6	4594.1	905.27	183.49	−8.296
36	6083.9	7075.4	9.11×10^6	3318.5	702.38	4125.7	−5.8621
37	2653.4	5838.9	7.68×10^4	3240	709.91	75.137	−7.9177
38	4577.8	3456	8.06×10^6	5328	843.46	895.04	−4.4364
39	5596.2	6134.2	3.33×10^5	4770.7	836.03	366.07	−7.2399
40	3844.6	6691.1	9.11×10^5	6680	596.36	782.35	−6.1793
41	5441.9	4725.6	8.92×10^4	5805.3	985.33	560.04	−8.9181
42	6959.5	4002.8	7.35×10^4	4593	893.06	681.33	−6.3317
43	7511.7	6130.6	8.70×10^4	4942.4	138.47	523.33	−7.5121
44	5332.7	6684.8	7.43×10^5	4403.8	469.91	408.95	−7.3863
45	5266.2	5221.7	1.39×10^6	5533.5	271.86	273.62	−8.425
46	6366.3	5004.3	4.53×10^6	3832.9	788.6	475.54	−7.8574
47	4744.9	5150.9	5.38×10^4	3058	747.93	3381.5	−8.4126
48	6286.8	7622.4	5.34×10^5	6010.3	362.35	420.56	−6.7385
49	3738.4	6021.4	8.49×10^5	5382.2	377.48	1640.2	−8.0285
50	3916.2	4050.2	5.44×10^5	4281.3	500.54	415.79	−6.7708
51	1744.1	7201.3	1.65×10^5	987.22	913.32	114.62	−8.2752
52	5829.2	6597	2.63×10^6	6281.4	919.58	348.62	−8.5786
53	5356.2	5549	9.80×10^6	6624.1	982.43	591.22	−5.961
54	4901.8	6208.5	5.62×10^5	6299.9	282.73	997.13	−7.1264
55	8186.9	5543.4	9.96×10^4	4508.1	891.74	3829.4	−5.6324
56	7385.4	7280.7	4.13×10^5	5168.6	593.33	253.3	−5.6515
57	6286.9	6066.5	5.55×10^6	5377.4	638.72	245.56	−8.6058
58	5338.3	5597.3	2.89×10^6	3924.7	581.08	937.67	−6.5611
59	5881	6448.8	5.52×10^4	3459	770.12	4292.9	−4.6876
60	4968.1	6811.1	2.98×10^6	3722.9	329.1	3759.5	−7.1741
61	3420.1	5014.3	3.69×10^6	1087.5	740.07	155.62	−6.8259

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
62	8003.7	5656	6.78×10^5	3152.1	875.7	4585.9	−6.0998
63	2653.6	6738.8	3.55×10^6	5711.1	772.57	847.53	−5.5944
64	9105.3	4954.2	9.50×10^4	5342.3	773.61	1990.2	−5.5647
65	5377.2	6593.1	2.40×10^6	338.52	570.57	397.95	−4.9253
66	6681.1	5560.1	7.18×10^4	3766.7	879.54	1145.8	−4.7857
67	6857.3	5021.3	9.58×10^5	6538.4	817.57	788.04	−6.6733
68	4837.8	6308.7	4.38×10^6	3431.6	366.19	4838.7	−4.0582
69	2096.4	6630.1	8.00×10^5	4292.6	605.76	980.01	−7.6129
70	7454.6	5524.7	8.01×10^4	5953.1	579.09	278.65	−7.2777
71	3942.9	4412.1	1.96×10^5	5168.8	942.78	89.982	−4.6302
72	4546.6	3285	2.86×10^5	3226.1	709.77	689.75	−5.6844
73	4458.7	6340.7	4.33×10^4	5217.2	855.48	659.88	−5.2873
74	7500.7	6855.6	1.05×10^6	4166.7	956.74	608.06	−7.0552
75	5408	4923.3	4.96×10^5	4309.9	957.61	435.49	−8.7995
76	5135.3	7117.6	5.14×10^6	4144.4	150.1	68.08	−5.8189
77	3893	5486.3	1.92×10^4	3186.5	863.52	193.16	−7.2497
78	4608.8	4055.8	4.58×10^5	5736.1	765.67	1860.6	−6.2719
79	5221.5	5407.4	2.20×10^6	2635.3	865.53	2547.8	−8.0875
80	7669.2	5410.3	1.40×10^5	6119.5	646.6	4419.9	−8.6709
81	4062.6	4596.3	5.03×10^5	3685.3	601.08	970.41	−6.4535
82	5574.3	5555.1	8.41×10^4	6469.6	717.07	84.552	−6.5244
83	5255.3	4750.2	4.46×10^5	6059.1	688.01	383.66	−6.4857
84	5104.9	6901.1	5.21×10^5	5074.2	113.42	231.98	−4.3981
85	5704.4	2818.4	3.25×10^5	5505	911.75	4889.5	−4.5272
86	6779.3	4503.7	8.00×10^5	5194.6	690.08	239.8	−7.4294
87	4351	6472.9	3.80×10^4	3888.5	495.91	1057.6	−8.0503
88	3191.5	4993	6.71×10^6	4500	437.86	3981.9	−4.5105
89	7983.4	5549.5	1.20×10^5	5747.4	977.76	4181.6	−6.8462
90	7864.3	5478.6	2.54×10^6	3587.8	595.48	797.77	−7.9359
91	4416	5030	1.07×10^6	6335.8	947.47	635.79	−7.889
92	7571.3	4694	8.51×10^6	3160.2	226.8	105.45	−6.2493

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
93	4250.1	4614.8	2.04×10^6	6118.1	649.62	213.21	−7.4708
94	6250.2	7746.8	4.89×10^5	6382.7	679.14	169.93	−3.7317
95	8736.3	4154.3	1.63×10^6	5664.4	536.64	1215.2	−5.393
96	5198.9	5319	1.47×10^6	3691.4	789.75	3446.6	−5.5001
97	4020.9	4725.7	4.69×10^4	3429	972.89	329.52	−6.6074
98	3813.3	7964.1	2.08×10^5	1015.6	880.1	188.04	−8.3675
99	4943.1	6860.8	4.04×10^5	6257.9	801.73	323.08	−7.0308
100	3893.7	4321.2	3.70×10^6	6182.8	958.53	406.83	−7.7203
101	4330.6	4695.5	2.76×10^4	4724.4	612.34	353.11	−6.1279
102	7223.4	2210.9	3.02×10^5	6776	465.29	313.06	−8.0694
103	4255.3	3541.6	7.35×10^5	4789.1	464.14	344.72	−8.8338
104	5509.9	5475.8	3.26×10^6	6642.3	623.36	764.71	−7.0745
105	4229.3	3510.2	3.47×10^6	3879.9	774.98	674.77	−6.6485
106	5159.7	6695	2.31×10^4	6571.6	474.09	444.36	−5.4409
107	5280.8	8399.5	4.06×10^6	3460.4	355.47	1384.3	−7.6354
108	6051.5	4767.6	3.86×10^5	5684.4	376.71	535.51	−7.6714
109	6729.4	3666.2	9.15×10^5	3526.6	458.06	134.55	−6.9696
110	7713.6	6899.9	5.85×10^4	4124.7	206.42	744.38	−4.9795
111	8377.4	5846	8.24×10^5	5496.7	683.16	4641.7	−8.708
112	6908.9	4947.3	3.19×10^4	5207.6	798.74	4010.1	−7.1837
113	5276.6	5548.1	2.35×10^6	5780.7	623.65	648.13	−7.1191
114	5599.7	4246.3	4.82×10^6	5017	514.93	458.9	−8.9704
115	3572.2	6051.5	2.80×10^6	5657	932.57	145.44	−7.5521
116	4464.1	3016.5	7.04×10^5	6164.8	646.48	959.98	−7.0902
117	3517.3	6201.7	4.93×10^4	3562.9	729.93	118.17	−7.7541
118	3135.9	7422.3	4.37×10^6	6476.5	439.94	223.54	−6.1412
119	3029.9	6641.5	8.66×10^5	6746.9	719.77	1567	−8.158
120	5277.3	7678.7	1.86×10^6	5686.4	345.6	131.36	−8.9883
121	6327.1	7263.1	7.70×10^5	3934.4	719.86	389.6	−7.2082
122	7313.3	4287	3.51×10^4	3116.1	808.37	497.07	−6.9556
123	6747.9	8093.5	9.36×10^5	5894.9	127.46	2929	−8.4713

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
124	6284.2	5779.5	4.35×10^5	5677.5	493.28	1417.9	−5.9011
125	4502.4	5061.3	3.50×10^5	4718.7	424.02	2295.9	−6.5865
126	4824.9	4935.1	7.54×10^6	4528.5	716.76	286.08	−7.7741
127	2225.8	5164.6	1.79×10^6	2805	183.96	464.46	−8.1362
128	4255.2	3811	3.96×10^6	5013	432.91	1311.5	−6.0613
129	7230.9	5839.2	1.89×10^6	5792.1	812.9	915.08	−6.0073
130	8238.9	3716.6	8.85×10^5	6434.1	411.8	485.39	−8.2235
131	7508.1	7723.4	9.82×10^5	3278.1	564.82	871.04	−8.1668
132	2879.1	5218.9	2.68×10^5	4432.9	893.55	532.79	−7.3502
133	6395.2	4496.4	4.75×10^6	3964.8	625.52	294.72	−7.0104
134	5318.6	4735.2	4.73×10^6	3950.7	993.03	374.61	−6.6947
135	4478.7	5094.1	4.46×10^6	4114.8	228.67	480.94	−4.3359
136	3756.5	3332.4	6.22×10^6	4230.1	679.13	70.53	−5.7531
137	4784.2	6579.5	8.93×10^5	4814.2	537.87	554.49	−7.5684
138	4869.4	6000.7	2.27×10^6	6356.4	441.14	159.3	−5.3565
139	5739.5	6519	6.89×10^5	4924.4	233.65	956.11	−7.4479
140	5996.2	7762.4	4.17×10^5	4699.2	877.84	810.69	−6.7548
141	6662.8	4261.1	4.24×10^5	3278.4	276.53	1894.1	−6.9388
142	7971.8	2932.5	5.67×10^5	6739.4	577.54	218.07	−6.1196
143	5578.5	4340.5	3.91×10^6	3285.2	734.8	466.26	−6.7004
144	3647.1	5844.7	6.69×10^5	4131.5	271.41	3257.6	−7.371
145	5095.4	4718.5	1.50×10^5	3121.7	836.1	1111.2	−6.5065
146	9585.4	9535.8	2.46×10^5	4680.6	467.06	881.85	−6.4789
147	5228.6	7862.7	2.43×10^4	3784	460.62	632.25	−7.2809
148	3560.4	7288.6	3.76×10^6	6077	374.36	595.19	−7.8089
149	3979.7	2567	1.02×10^5	6704.5	383.06	3613.7	−5.0888
150	4086.7	3730.9	1.33×10^6	6641.5	705.26	698.81	−5.1417
151	2662	4671.3	3.33×10^6	3347	834.11	373.91	−8.2405
152	4538.7	5860.2	4.92×10^6	4004.9	597.74	4394.7	−7.6861
153	4821.2	6071.1	3.55×10^5	3965.9	938.24	3684	−4.374
154	2524.4	2295.5	2.93×10^5	4204.4	639.04	52.955	−8.8522

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
155	6904.8	5900.6	1.14×10^{6}	3497	907.7	3548.3	−6.1817
156	6364.7	5374.3	3.37×10^{5}	1949.3	110.96	1494.6	−7.5344
157	4969.2	6274.1	3.01×10^{6}	4440.9	818.32	840.63	−8.6836
158	3932.7	6122.9	7.09×10^{6}	3810.3	487.22	2059.5	−6.3775
159	4755.4	5062.4	4.24×10^{6}	5388.7	538.91	2465.8	−7.4084
160	4639.3	3373.4	8.35×10^{5}	6276.7	746.48	492.67	−8.8816
161	5973	3967.1	1.60×10^{5}	5439	917.29	4214.4	−8.2007
162	4839.2	6833.7	2.87×10^{6}	5310.5	537.4	883.53	−4.2662
163	6145.5	6205.4	8.79×10^{6}	4759.1	140.73	804.03	−7.3117
164	7664.3	2825.3	6.02×10^{4}	2575.1	397.27	581.36	−6.9054
165	5992.7	4294.4	2.55×10^{5}	5759.9	377.17	164.63	−7.598
166	4716.5	6771.9	1.87×10^{5}	1766.3	688.46	740.01	−5.2248
167	7595.1	4032.9	9.95×10^{5}	4106.6	884.17	656.34	−4.7488
168	6232.9	5654.3	6.00×10^{5}	5291.3	763.57	4485.8	−4.8991
169	2931.3	3995.7	5.82×10^{5}	5897.4	909.86	572.59	−6.2265
170	5917.3	5112.2	3.68×10^{5}	3566.1	180.37	148.93	−6.8629
171	8153.1	3573	4.07×10^{6}	5511.6	369.71	711.61	−6.4087
172	6137.8	6324.5	4.17×10^{6}	6226.1	286.96	549.77	−6.3856
173	6333.5	4761	1.31×10^{6}	2657.9	614.45	1776	−5.1919
174	5040.6	3240.2	4.62×10^{6}	5011	516.93	932.46	−6.0434
175	9871.4	5636.3	4.67×10^{5}	4688.7	489.78	3094.7	−7.3288
176	5352.8	5534.6	9.09×10^{4}	6712.7	553.26	622.47	−8.9459
177	6081.8	6100.4	9.47×10^{5}	5561.4	337.13	506.69	−5.8791
178	6926.9	4522.7	3.82×10^{6}	3740.9	518.61	2699.1	−7.157
179	3869.5	5517	5.23×10^{4}	5515.4	733.13	269.36	−8.7779
180	3993.4	4122.3	1.53×10^{6}	6390.1	541.35	2528.6	−6.5596
181	4187	4959.5	8.60×10^{5}	5481.2	152.45	920.27	−8.5473
182	7561	4977.4	3.73×10^{5}	4383.3	675.59	864.25	−5.4973
183	4569.6	6868.5	2.57×10^{5}	5516.8	649.87	3312.9	−8.1846
184	4381.5	5400.2	3.11×10^{5}	5754.4	518.62	947.68	−6.2812
185	3790.1	5354.2	3.17×10^{6}	4793.4	329.99	449.87	−8.5817

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
186	4359.9	6854.9	1.98×10^{6}	6502.1	964.47	753.79	−8.6539
187	4823.8	3707.3	3.23×10^{6}	3905	976.47	96.491	−7.8687
188	4708.1	7119.2	9.68×10^{5}	4134.9	559.27	852.35	−6.6348
189	2929	5760.4	9.48×10^{6}	4411.6	322.35	820.28	−6.9914
190	9628.3	4149.1	6.38×10^{4}	3612.3	336.55	55.079	−7.787
191	3093.4	7061.8	9.37×10^{4}	5966.1	943.09	2770.5	−8.7485
192	4150.7	5476.7	4.66×10^{6}	5315	303.1	769.44	−4.8491
193	4240.4	4868.1	1.14×10^{4}	6052.9	709.7	4973.3	−6.895
194	4791	7414.3	1.62×10^{6}	5107.6	996.7	396.5	−7.9751
195	7041.3	6698	4.53×10^{5}	3540.7	772.53	336.38	−4.7318
196	4872.1	5119.8	8.20×10^{6}	5884.1	155.03	704.98	−8.4518
197	8413.7	5717.9	6.29×10^{5}	5648.8	430.18	2962.3	−8.5185
198	4470.1	6312.3	2.61×10^{6}	3325.7	577.38	512.68	−8.3199
199	4441.3	5088.6	7.85×10^{5}	505.58	340.59	441.59	−8.8695
200	6617.8	5775.6	1.64×10^{4}	3057.9	720.6	125.69	−6.2063

Source: Output DTN: SN0702PASZFTMA.002.

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
1	6.9606	4.335	13676	2839.8	4.78×10^5
2	9.1038	19.072	137.53	390.57	1.64×10^5
3	34.457	35.515	425.3	45216	2.75×10^5
4	3.808	2.6396	353.15	256.39	1.23×10^5
5	5.0137	7.6967	366.33	1360.1	9.88×10^5
6	9.6141	7.8648	3608.8	12589	2.78×10^5
7	20.203	32.102	16757	9495.3	5.20×10^5
8	10.478	9.6681	4177	12844	7.39×10^5
9	4.5501	6.157	36892	61892	1.82×10^5
10	18.821	25.089	1069.5	5522	3.86×10^5
11	14.681	13.095	908.59	821.75	1.66×10^5
12	15.784	22.532	20366	4213.2	1.12×10^5
13	11.135	7.1054	11545	2972.7	6.85×10^5
14	2.8215	3.0266	12470	967.46	5.34×10^5
15	13.493	6.1604	33359	724	2.16×10^5
16	15.503	15.438	3779.2	1143.1	3.58×10^5
17	17.816	9.7417	83645	13866	1.36×10^5
18	9.0711	20.321	20094	89822	2.64×10^5
19	4.0408	8.8322	23074	90743	7.93×10^5
20	12.147	12.977	9440.4	24404	4.45×10^5
21	19.935	14.166	8103.9	1134.2	8.18×10^5
22	2.6583	3.7773	4420.3	1442.6	3.77×10^5
23	12.273	18.307	3670.6	6496.8	1.95×10^5
24	9.9895	11.149	27579	718.38	1.73×10^5
25	8.3039	20.539	637.94	21167	1.68×10^5
26	23.92	14.625	12390	28706	2.68×10^5
27	19.563	13.472	15417	156.34	2.35×10^5
28	13.521	12.998	4215.5	2852.4	4.52×10^5
29	7.679	6.5745	5883.4	3118.5	8.59×10^5
30	4.2754	4.9036	87610	8712.6	2.55×10^5
31	3.6703	6.1021	11790	4830.4	6.45×10^5
32	5.1347	6.7711	52504	72924	2.72×10^5
33	8.2937	6.7041	541.12	896.62	1.90×10^5
34	8.8936	9.429	1328.7	2949	1.88×10^5
35	20.669	11.232	633.64	1663.1	1.83×10^5
36	4.6574	7.633	5973.5	35100	8.23×10^5
37	6.3494	8.8317	204.92	4361.7	3.17×10^5
38	26.232	19.277	140.17	107.5	4.12×10^5
39	2.7266	3.4546	1330.8	2345.3	5.29×10^5
40	11.362	12.873	651.79	6651.7	8.62×10^5
41	18.464	25.335	224.47	177.17	2.83×10^5
42	2.4381	4.8082	3227.3	743.07	1.47×10^5
43	2.4821	2.317	16447	3781.7	4.19×10^5
44	37.612	23.449	1008.7	1471.7	2.38×10^5

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
45	10.615	7.7746	4336.8	2933.9	5.02×10^5
46	13.83	17.822	49089	29398	3.08×10^5
47	7.7118	7.2791	184.89	177.87	6.77×10^5
48	12.66	10.892	60808	71143	2.85×10^5
49	7.5971	13.737	151.29	748.65	1.20×10^5
50	4.094	7.1333	171.72	245.82	5.85×10^5
51	4.1502	7.9795	134.9	13321	1.45×10^5
52	27.45	23.359	68956	75558	2.13×10^5
53	7.7226	6.9626	12362	8663.8	1.62×10^5
54	16.133	9.3934	13078	20761	4.40×10^5
55	13.724	7.0172	90437	32656	7.24×10^5
56	24.392	10.983	23826	6696.3	1.33×10^5
57	22.542	21.507	2694.7	2871.6	2.18×10^5
58	29.923	14.29	674.31	412.19	4.00×10^5
59	10.453	11.87	11855	25219	5.70×10^5
60	37.25	26.308	1246.5	2131.3	4.53×10^5
61	9.7826	4.6689	4971.1	7839.6	3.51×10^5
62	49.661	22.771	97485	40495	9.08×10^5
63	9.6258	1.8278	699.3	1713.8	4.58×10^5
64	13.132	7.9842	78237	5075.4	1.16×10^5
65	4.2637	6.0668	450.45	2394.2	8.02×10^5
66	14.37	10.761	6342.3	1142.5	1.08×10^5
67	11.263	4.8197	8976.6	632.63	6.27×10^5
68	18.949	11.698	2825	4485.7	7.10×10^5
69	17.643	23.677	122.38	2222.8	1.94×10^5
70	25.411	15.103	50059	8355.3	3.11×10^5
71	34.95	27.293	597.62	742.21	1.56×10^5
72	18.87	21.788	159.22	133.49	2.25×10^5
73	3.7912	5.9015	2734.9	21697	2.52×10^5
74	9.8569	10.135	61432	49259	8.36×10^5
75	13.431	10.264	461.24	240.09	9.39×10^5
76	5.6398	16.446	949.56	21331	1.02×10^5
77	9.5791	9.5802	166.24	324.74	7.57×10^5
78	30.033	22.404	4758.2	1945.1	5.99×10^5
79	4.8559	3.0885	61796	37455	1.68×10^5
80	6.0899	12.629	2055.8	755.43	8.94×10^5
81	10.995	8.1568	237.97	216.35	9.17×10^5
82	3.3717	3.6143	2410.5	4695.1	1.21×10^5
83	5.9489	4.4621	8584.8	6075.1	2.34×10^5
84	10.866	12.024	18690	55446	8.79×10^5
85	9.5824	4.4025	41746	2045.9	8.04×10^5
86	12.306	12.94	1128.5	308.17	3.61×10^5
87	31.298	15.726	471.45	963.28	1.30×10^5

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
88	20.461	16.501	406.7	1306.2	1.77×10^5
89	18.884	21.905	72901	28838	2.46×10^5
90	6.6963	14.586	5796.2	2552.5	7.30×10^5
91	6.6329	6.9545	140.43	153.41	5.50×10^5
92	11.775	15.829	54638	19749	1.98×10^5
93	15.108	12.069	159.85	174.52	5.62×10^5
94	20.008	8.1545	43174	41868	1.44×10^5
95	6.1936	23.157	10479	1394.4	1.60×10^5
96	9.3601	6.0237	23042	13195	1.53×10^5
97	4.4583	10.478	865.54	5437.4	1.16×10^5
98	19.827	27.187	1731.8	58975	6.33×10^5
99	8.099	7.9861	589.68	2086	2.20×10^5
100	3.2389	3.5055	690.18	771.73	4.13×10^5
101	20.78	13.268	422.91	265.02	1.49×10^5
102	21.96	11.336	4216.1	119.23	1.35×10^5
103	7.638	7.7434	190.83	128.57	3.29×10^5
104	20.279	14.518	1491.7	796.85	3.27×10^5
105	6.9896	9.5672	120.58	114.84	2.44×10^5
106	13.744	10.98	671.67	1334.9	7.05×10^5
107	38.739	28.915	26725	70823	2.80×10^5
108	24.731	22.738	4731.9	1186.1	3.40×10^5
109	14.37	11.161	970.58	162.67	3.22×10^5
110	13.255	10.907	90219	82801	6.73×10^5
111	9.8106	8.9368	77579	30764	6.54×10^5
112	21.262	16.669	4454.4	592.21	3.46×10^5
113	16.754	8.4114	556.23	453.35	4.33×10^5
114	4.2869	10.234	804.78	855.74	3.93×10^5
115	8.8741	12.637	296.33	4666.8	3.84×10^5
116	6.2082	4.5631	317.02	133.05	1.27×10^5
117	12.301	9.791	746.03	5018.1	1.10×10^5
118	40.687	29.541	644.66	10090	6.47×10^5
119	26.622	12.906	365.55	1551.4	1.41×10^5
120	16.952	13.8	21430	55146	2.06×10^5
121	3.3383	4.0002	1952.1	5468.4	2.93×10^5
122	16.416	13.408	21432	932.58	1.55×10^5
123	7.6919	7.3554	6733	22435	2.96×10^5
124	6.8642	8.6649	5958.1	5485.1	1.41×10^5
125	16.807	17.23	5653.2	10552	9.96×10^5
126	8.8164	6.9131	9283	6813.7	9.50×10^5
127	8.3085	19.522	151.47	3355.8	1.70×10^5
128	11.563	6.6925	2859	658.49	1.22×10^5
129	6.7386	8.7912	10784	6579.5	1.25×10^5
130	6.6166	8.0118	66408	7663.5	2.29×10^5
131	5.2801	3.4706	27475	25639	6.96×10^5

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
132	22.062	32.996	124.82	403.36	1.28×10^5
133	9.9429	16.009	10723	3752	5.63×10^5
134	4.9119	14.971	1320.9	3999	8.43×10^5
135	13.792	27.562	4392.1	19079	4.31×10^5
136	3.5573	2.8335	743.05	389.01	1.91×10^5
137	8.8087	15.031	53467	91497	2.62×10^5
138	17.092	36.237	719.12	6870.3	2.02×10^5
139	36.488	25.322	2612.7	2484	8.88×10^5
140	18.368	28.432	1476.9	17799	3.33×10^5
141	4.9539	15.419	14657	7956.7	3.68×10^5
142	10.429	6.6569	4059.7	124.89	4.68×10^5
143	11.208	15.562	5063.3	4587.6	1.74×10^5
144	13.031	20.818	2994.2	26664	2.99×10^5
145	16.308	28.16	1248.8	1334	5.13×10^5
146	2.6669	6.8579	99841	99985	1.00×10^5
147	5.4163	9.9314	1679.2	26262	6.13×10^5
148	12.432	19.877	841.1	35590	1.05×10^5
149	3.3581	4.3231	10867	5700.5	5.45×10^5
150	14.071	15.038	423.47	338.52	9.75×10^5
151	19.132	26.193	106.93	154.64	1.12×10^5
152	9.6665	11.286	184.06	299.19	2.90×10^5
153	31.784	10.155	41763	31621	9.24×10^5
154	10.189	4.6564	108.35	101.83	3.15×10^5
155	8.7809	9.9855	60267	42998	5.37×10^5
156	4.811	4.1443	6711.5	4058.5	4.25×10^5
157	5.3726	9.8343	4157.3	19370	5.09×10^5
158	7.5914	4.077	11604	20187	1.07×10^5
159	7.955	9.4252	506.05	557.81	1.09×10^5
160	10.241	11.492	183.75	168.41	1.39×10^5
161	14.225	16.213	13009	2777.2	3.98×10^5
162	33.391	8.6137	1132.3	479.28	4.98×10^5
163	5.5954	5.3781	19194	20489	2.42×10^5
164	7.4277	3.0013	1372.2	105.91	1.57×10^5
165	15.112	17.65	8379.1	2048.6	7.62×10^5
166	15.029	11.175	7193.7	20108	1.50×10^5
167	16.689	5.4535	89832	6568.6	1.02×10^5
168	8.4497	10.97	19101	13599	1.06×10^5
169	14.109	34.229	182.33	758.78	5.95×10^5
170	19.403	10.072	5766.2	1105	3.53×10^5
171	5.6609	4.0309	23935	419.9	3.05×10^5
172	36.427	19.829	15727	9246.2	4.84×10^5
173	7.8999	8.7134	8134.7	3651.4	1.18×10^5
174	4.1505	3.2972	302.33	144.67	4.07×10^5
175	29.657	17.648	55530	821.22	2.50×10^5

Table A-1[a]. Sampled Stochastic Parameter Values (Continued)

real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
176	19.616	33.437	5045.2	13613	9.56×10^5
177	18.795	28.511	14748	23076	4.84×10^5
178	24.439	15.209	2643.7	239.96	3.38×10^5
179	21.267	26.589	850.56	3390	3.74×10^5
180	3.7914	7.8184	258.97	586.32	1.84×10^5
181	7.8278	4.4562	259.53	244.84	2.21×10^5
182	30.814	41.79	63352	38046	7.84×10^5
183	4.766	5.8558	515.13	4448.2	2.11×10^5
184	26.559	31.739	441.42	1300.8	1.14×10^5
185	4.3924	2.7643	12487	19957	2.30×10^5
186	3.6527	8.2106	608.19	10327	4.94×10^5
187	4.5726	5.0473	556.56	325.54	7.50×10^5
188	17.036	8.2702	4305.2	9428.5	6.67×10^5
189	7.0053	12.462	236.35	4605.8	1.31×10^5
190	12.397	17.096	23776	473.08	6.19×10^5
191	6.2283	9.8415	818.63	33853	7.75×10^5
192	7.6295	9.5975	220.52	686.6	3.64×10^5
193	6.7196	7.6747	263.35	538.25	1.78×10^5
194	5.9066	5.9046	15142	59773	1.37×10^5
195	19.489	19.326	4260.8	4108.5	2.01×10^5
196	9.8806	23.208	523.48	1868.8	5.79×10^5
197	11.325	13.238	74907	32238	6.06×10^5
198	5.6324	6.5977	407.48	3064.4	2.59×10^5
199	11.352	6.0069	469.24	238.44	4.63×10^5
200	17.85	31.503	4047.5	4817.3	2.09×10^5

Source: Output DTN: SN0702PASZFTMA.002.

NOTE: Some parameter names included in the GoldSim file for the SZ one-dimensional transport model file differ from the parameter names given in this table, as follows: BULKDENSITY = Alluvium_Density, KDNPVO = Kd_NP_Vo, KDNPAL = Kd_NP_Al, KDSRVO = Kd_Sr_Vo, KDSRAL = Kd_Sr_Al, KDUVO = Kd_U_Vo, KDUAL = Kd_U_Al, KDRAVO = Kd_Ra_Vo, KDRAAL = Kd_Ra_Al.

APPENDIX B[a]
EXCEL SPREADSHEETS FOR PREPROCESSING OF INPUT FILES

B[a]. EXCEL SPREADSHEETS FOR PREPROCESSING OF INPUT FILES

This appendix documents the Excel spreadsheets used to produce the input files for multiple realizations of the SZ flow and transport abstraction model. This documentation of the preprocessing of input files provides sufficient detail of the use of Excel as exempt software to allow verification by visual inspection of the spreadsheets, as required by SCI-PRO-006, *Models*.

Uncertain parameters were sampled for 200 realizations of the SZ flow and transport abstraction model. A separate spreadsheet file was constructed for each group of radionuclides as indicated in Table B-1[a]. Worksheets for each FEHM V. 2.24 (STN: 10086-2.24-01-00) [DIRS 179419] input file were included in the spreadsheets and variable parameters were inserted at the proper locations within those worksheets for each realization. Some parameters required mathematical transformation for insertion in the worksheet. Finally, Excel macros were constructed to export the FEHM input files in text format to the proper filename for input to the SZ flow and transport abstraction model.

The spreadsheet filenames and the corresponding input filenames and macro filenames are shown in Table B-1[a]. Figure B-1[a] shows the flow of information during the preprocessing process to generate FEHM input files. Because a separate input file must be written for each realization, the total number of files written for the 200 realizations is 12,400. Excel macros were used to automate the process of writing the large number of FEHM input files and to avoid potential errors associated with hand entry of file save commands.

Table B-1[a]. Spreadsheet Files for Preprocessing

Spreadsheet Filename	Radioelements	Input Files Written From Spreadsheet	Macro Filename
SZ_preprocess_C.xls	C, Cl, I, Tc	*SZ06_C.0XXX* *rock_macro.0XXX* *alluv_uncert_zone.0XXX* *sptr_1k_C_01.0XXX* *sptr_1k_C_02.0XXX* *sptr_1k_C_03.0XXX* *sptr_1k_C_04.0XXX*	*SZ_C_macro_1−200.bas*
SZ_preprocess_Kc_Am.xls	Am, Th, Pa (reversible colloids)	*SZ06_KA.0XXX* *sptr_1k_KA_01.0XXX* *sptr_1k_KA_02.0XXX* *sptr_1k_KA_03.0XXX* *sptr_1k_KA_04.0XXX*	*SZ_Kc_Am_macro_200.bas*
SZ_preprocess_Kc_Cs.xls	Cs (reversible colloids)	*SZ06_KC.0XXX* *sptr_1k_KC_01.0XXX* *sptr_1k_KC_02.0XXX* *sptr_1k_KC_03.0XXX* *sptr_1k_KC_04.0XXX*	*SZ_Kc_Cs_macro_200.bas*

Table B-1[a]. Spreadsheet Files for Preprocessing (Continued)

Spreadsheet Filename	Radioelements	Input Files Written From Spreadsheet	Macro Filename
SZ_preprocess_Kc_Pu.xls	Pu (reversible colloids)	*SZ06_KP.0XXX* *sptr_1k_KP_01.0XXX* *sptr_1k_KP_02.0XXX* *sptr_1k_KP_03.0XXX* *sptr_1k_KP_04.0XXX*	*SZ_Kc_Pu_macro_200.bas*
SZ_preprocess_Kc_Sn.xls	Sn (reversible colloids)	*SZ06_KS.0XXX* *sptr_1k_KS_01.0XXX* *sptr_1k_KS_02.0XXX* *sptr_1k_KS_03.0XXX* *sptr_1k_KS_04.0XXX*	*SZ_Kc_Sn_macro_200.bas*
SZ_preprocess_Np.xls	Np	*SZ06_Np.0XXX* *sptr_1k_Np_01.0XXX* *sptr_1k_Np_02.0XXX* *sptr_1k_Np_03.0XXX* *sptr_1k_Np_04.0XXX*	*SZ_Np_macro_200.bas*
SZ_preprocess_Pu.xls	Pu, Am (irreversible colloids)	*SZ06_Pu.0XXX* *sptr_1k_Pu_01.0XXX* *sptr_1k_Pu_02.0XXX* *sptr_1k_Pu_03.0XXX* *sptr_1k_Pu_04.0XXX*	*SZ_Pu_macro_200.bas*
SZ_preprocess_Pu_fast.xls	Pu, Am (irreversible colloids – no retardation)	*SZ06_Pu_fast.0XXX* *sptr_1k_Pu_fast_01.0XXX* *sptr_1k_Pu_fast_02.0XXX* *sptr_1k_Pu_fast_03.0XXX* *sptr_1k_Pu_fast_04.0XXX*	*SZ_Pu_fast_macro_200.bas*
SZ_preprocess_Ra.xls	Ra	*SZ06_Ra.0XXX* *sptr_1k_Ra_01.0XXX* *sptr_1k_Ra_02.0XXX* *sptr_1k_Ra_03.0XXX* *sptr_1k_Ra_04.0XXX*	*SZ_Ra_macro_200.bas*
SZ_preprocess_Se.xls	Se	*SZ06_Se.0XXX* *sptr_1k_Se_01.0XXX* *sptr_1k_Se_02.0XXX* *sptr_1k_Se_03.0XXX* *sptr_1k_Se_04.0XXX*	*SZ_Se_macro_200.bas*

Table B-1[a]. Spreadsheet Files for Preprocessing (Continued)

Spreadsheet Filename	Radioelements	Input Files Written From Spreadsheet	Macro Filename
SZ_preprocess_Sr.xls	Sr	*SZ06_Sr.0XXX* *sptr_1k_Sr_01.0XXX* *sptr_1k_Sr_02.0XXX* *sptr_1k_Sr_03.0XXX* *sptr_1k_Sr_04.0XXX*	*SZ_Sr_macro_200.bas*
SZ_preprocess_U.xls	U	*SZ06_U.0XXX* *sptr_1k_U_01.0XXX* *sptr_1k_U_02.0XXX* *sptr_1k_U_03.0XXX* *sptr_1k_U_04.0XXX*	*SZ_U_macro_200.bas*

Output DTN: SN0702PASZFTMA.001.
XXX = realization number.

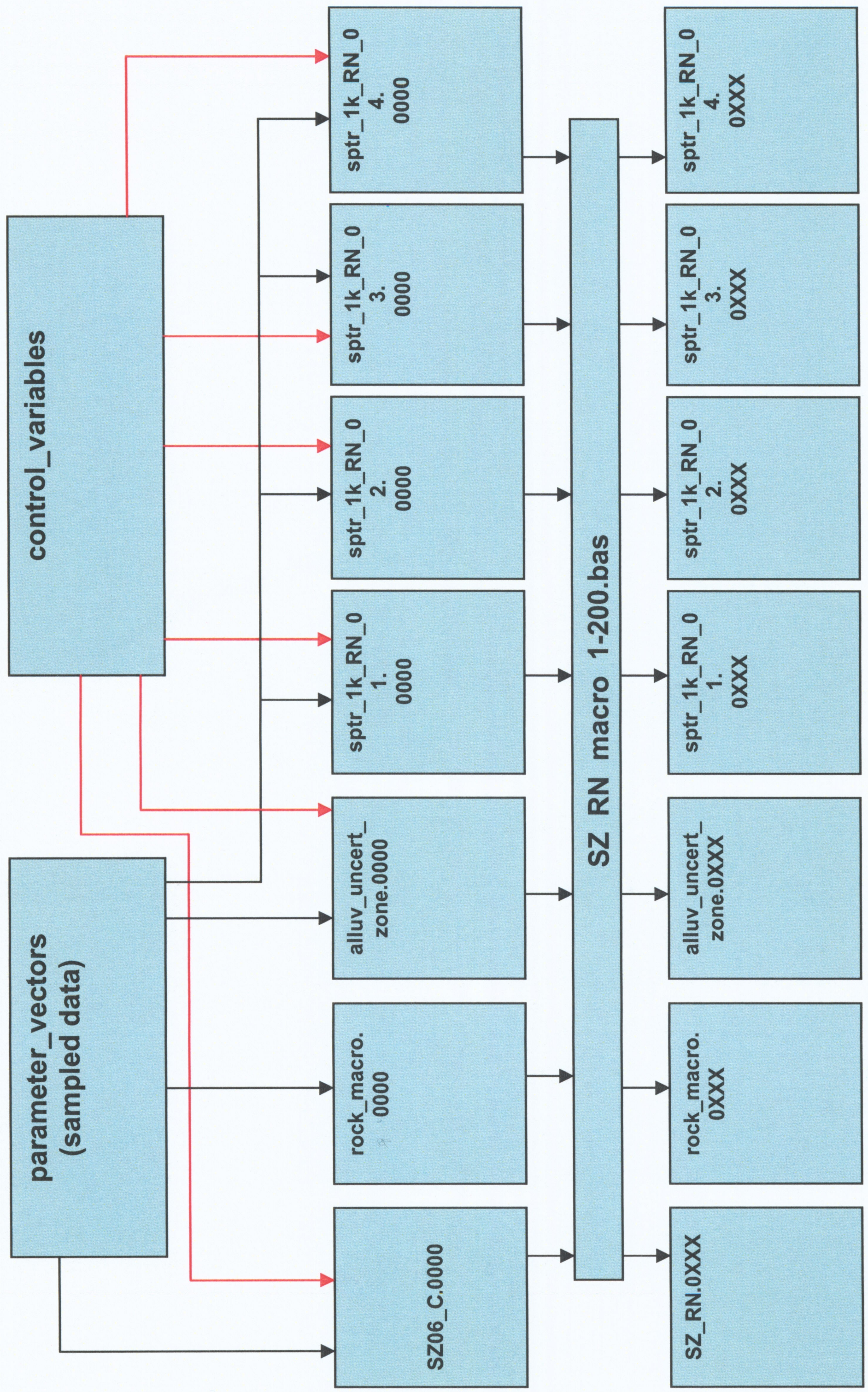

Figure B-1[a]. Flow of Information within the Preprocessing Excel Spreadsheet to Generate FEHM Input Files

Each spreadsheet file used for the preprocessing of FEHM V. 2.24 (STN: 10086-2.24-01-00) [DIRS 179419] input files contains multiple worksheets that correspond to individual input file types. These spreadsheet filenames and worksheet names are listed in the first two columns of Table B-2[a]. The cells in these spreadsheets that contain model input variables that vary from realization to realization are keyed to the realization number specified in the "parameter_vectors" worksheet. The "control_variables" worksheet contains specific numerical values that are used to calculate entries in the FEHM input files (e.g., the coordinate values of the boundaries of the source regions beneath the repository). Table B-2[a] also contains the spreadsheet cells that vary by realization number and the formula used to calculate the values inserted in those cells from the sampled parameter values. The spreadsheets described in this appendix are available in Output DTN: SN0702PASZFTMA.001, *preprocess_dir.zip*.

The Excel spreadsheets used for the preprocessing of FEHM V. 2.24 (STN: 10086-2.24-01-00) [DIRS 179419] input files were verified by visual inspection of the input files for realization number 1 and comparisons to the values hand calculated from the corresponding formulas. The values for realization number 1 for each variable cell are also listed in the last column of Table B-2[a]. This verification process indicated that these calculations are correctly implemented in the preprocessing spreadsheets.

Table B-2[a]. Parameter Values and Formulas in Spreadsheets

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
SZ_preprocess_C.xls	SZ06_C.0000	B198 $= 1/\sqrt{HAVO}$	2.568×10^{-1}
		C198 $= \sqrt{HAVO}$	3.893
		B328 $= 10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $= (10^{GWSPD})glacial\_flux\_multiplier$	2.587
	rock_macro.0000	B12 $= NVF11$	2.451×10^{-1}
		B13, B14, B15, B16, B17, B18, B19, B20, B21, and B23 $= 10^{FPVO}$	1.497×10^{-4}
		B22, B27, B28, and B29 $= Bulkdensity$	1.876×10^{3}
		D22, D27, D28, and D29 $= NVF26$	1.794×10^{-1}
	alluv_uncert_zone.0000	B3 $= 549110. - FPLANW\,(549110. - 547600.)$	5.48184×10^{5}
		C3 $= 553280. - FPLANW\,(553280. - 552800.)$	5.52986×10^{5}
		B4 $= 550000. - FPLANW\,(550000. - 547600.)$	5.48528×10^{5}
		C4 $= 552500. - FPLANW\,(552500. - 552800.)$	5.52684×10^{5}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B5 $=4062470.-FPLANW\,(4062470.-4063400.)$	4.063040 × 10^{6}
		C5 $=4065900.-FPLANW\,(4065900.-4066000.)$	4.065961 × 10^{6}
		B6 $=4062470.-FPLANW\,(4062470.-4063400.)$	4.063040 × 10^{6}
		C6 $=4064590.-FPLANW\,(4064590.-4066000.)$	4.065455 × 10^{6}
		B8 $=686.-FPLANW\,(686.-727.)$	7.111 × 10^{2}
		C8 $=616.-FPLANW\,(616.-726.)$	6.835 × 10^{2}
	sptr_1k_C_01.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and B20 $=10^{(LDISP-1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-3.3)}$	1.030 × 10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-5.3)}$	1.030 × 10^{-4}
		E11, B12, I12, B13, I13 ,B14, I14, B15, I15, B16, I16, B17, I17, B18, I18, B19, I19, and E20 $=10^{DCVO}$	5.585 × 10^{-12}
		E12, E13, E14, E15, E16, E17, E18, and E19 $=FISVO\times\left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $=547570.+SRC1X\,(548500.-547570.)$	5.48259 × 10^{5}
		C55 $=4078630.+SRC1Y\,(4081090.-4078630.)$	4.079257 × 10^{6}
	sptr_1k_C_02.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and B20 $=10^{(LDISP-1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-3.3)}$	1.030 × 10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-5.3)}$	1.030 × 10^{-4}
		E11, B12, I12, B13, I13 ,B14, I14, B15, I15, B16, I16, B17, I17, B18, I18, B19, I19, and E20 $=10^{DCVO}$	5.585 × 10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		E12, E13, E14, E15, E16, E17, E18, and E19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC2X\ (549320. - 548500.)$	5.48952×10^{5}
		C55 $= 4078630. + SRC2Y\ (4081210. - 4078630.)$	4.079918×10^{6}
	sptr_1k_C_03.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and B20 $= 10^{(LDISP - 1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, B12, I12, B13, I13 ,B14, I14, B15, I15, B16, I16, B17, I17, B18, I18, B19, I19, and E20 $= 10^{DCVO}$	5.585×10^{-12}
		E12, E13, E14, E15, E16, E17, E18, and E19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464×10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439×10^{6}
	sptr_1k_C_04.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and B20 $= 10^{(LDISP - 1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, B12, I12, B13, I13 ,B14, I14, B15, I15, B16, I16, B17, I17, B18, I18, B19, I19, and E20 $= 10^{DCVO}$	5.585×10^{-12}
		E12, E13, E14, E15, E16, E17, E18, and E19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B55 $= 548500. + SRC4X\,(548890. - 548500.)$	5.48648 × 10^5
		C55 $= 4076170. + SRC4Y\,(4078630. - 4076170.)$	4.076534 × 10^6
SZ_preprocess_Kc_Am.xls	SZ06_Kc_Am.0000	B198 $= 1/\sqrt{HAVO}$	2.568 × 10^{-1}
		C198 $= \sqrt{HAVO}$	3.893
		B328 $= 10^{FPVO}$	1.497 × 10^{-4}
		B331, C331, and D331 $= (10^{GWSPD})glacial\_flux\_multiplier$	2.587
	sptr_1k_Kc_Am_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP-3.3)}$	1.030 × 10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP-5.3)}$	1.030 × 10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $= 10^{DCVO}$	5.585 × 10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times (10^{FPVO})$	1.535 × 10^{-3}
		B55 $= 547570. + SRC1X\,(548500. - 547570.)$	5.48259 × 10^5
		C55 $= 4078630. + SRC1Y\,(4081090. - 4078630.)$	4.079257 × 10^6
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO})/(1 + (KD\_AM\_COL \times 10^{CONC\_COL}))^2$	6.478 × 10^{-16}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_AM\_VO$	7.537 × 10^3
		B20 $= \dfrac{\left(KD\_AM\_AL \times \left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_AM\_COL \times 10^{CONC\_COL}\right)}$	39.36
	sptr_1k_Kc_Am_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP-1.)}$	2.056

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=548500.+SRC2X\ (549320.-548500.)$	5.48952×10^{5}
		C55 $=4078630.+SRC2Y\ (4081210.-4078630.)$	4.079918×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $=(10^{DCVO})/\left(1+\left(KD\_AM\_COL\times10^{CONC\_COL}\right)\right)^{2}$	6.478×10^{-16}
		B12, B13, B14, B15, B16, B17, B18, and B19 $=KD\_AM\_VO$	7.537×10^{3}
		B20 $=\dfrac{\left(KD\_AM\_AL\times\left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1+KD\_AM\_COL\times10^{CONC\_COL}\right)}$	39.36
	sptr_1k_Kc_Am_03.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=547720.+SRC3X\ (548500.-547720.)$	5.48464×10^{5}
		C55 $=4076170.+SRC3Y\ (4078630.-4076170.)$	4.078439×10^{6}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO})/\left(1+\left(KD\_AM\_COL\times 10^{CONC\_COL}\right)\right)^2$	6.478×10^{-16}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_AM\_VO$	7.537×10^{3}
		B20 $= \dfrac{\left(KD\_AM\_AL\times\left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1+KD\_AM\_COL\times 10^{CONC\_COL}\right)}$	39.36
	sptr_1k_Kc_Am_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648×10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO})/\left(1+\left(KD\_AM\_COL\times 10^{CONC\_COL}\right)\right)^2$	6.478×10^{-16}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_AM\_VO$	7.537×10^{3}
		B20 $= \dfrac{\left(KD\_AM\_AL\times\left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1+KD\_AM\_COL\times 10^{CONC\_COL}\right)}$	39.36

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
SZ_preprocess_Kc_Cs.xls	SZ06_Kc_Cs.0000	B198 $=1/\sqrt{HAVO}$	2.568×10^{-1}
		C198 $=\sqrt{HAVO}$	3.893
		B328 $=10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $=\left(10^{GWSPD}\right) glacial\_flux\_multiplier$	2.587
	sptr_1k_Kc_Cs_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $=FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=547570.+SRC1X\,(548500.-547570.)$	5.48259×10^{5}
		C55 $=4078630.+SRC1Y\,(4081090.-4078630.)$	4.079257×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $=(10^{DCVO})/\left(1+\left(KD\_Cs\_COL \times 10^{CONC\_COL}\right)\right)^2$	4.411×10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $=KD\_Cs\_VO$	3.876×10^{3}
		B20 $=\dfrac{\left(KD\_Cs\_AL \times \left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1+KD\_Cs\_COL \times 10^{CONC\_COL}\right)}$	1.010×10^{2}
	sptr_1k_Kc_Cs_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=548500.+SRC2X\ (549320.-548500.)$	5.48952×10^{5}
		C55 $=4078630.+SRC2Y\ (4081210.-4078630.)$	4.079918×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $=(10^{DCVO})/\left(1+\left(KD\_Cs\_COL\times10^{CONC\_COL}\right)\right)^2$	4.411×10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $=KD\_Cs\_VO$	3.876×10^{3}
		B20 $=\dfrac{\left(KD\_Cs\_AL\times\left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1+KD\_Cs\_COL\times10^{CONC\_COL}\right)}$	1.010×10^{2}
	sptr_1k_Kc_Cs_03.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=547720.+SRC3X\ (548500.-547720.)$	5.48464×10^{5}
		C55 $=4076170.+SRC3Y\ (4078630.-4076170.)$	4.078439×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $=(10^{DCVO})/\left(1+\left(KD\_Cs\_COL\times10^{CONC\_COL}\right)\right)^2$	4.411×10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Cs\_VO$	3.876 × 10^{3}
		B20 $= \frac{\left(KD\_Cs\_AL \times \left(\frac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Cs\_COL \times 10^{CONC\_COL}\right)}$	1.010 × 10^{2}
	sptr_1k_Kc_Cs_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP-3.3)}$	1.030 × 10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP-5.3)}$	1.030 × 10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $= 10^{DCVO}$	5.585 × 10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648 × 10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534 × 10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO}) / \left(1 + \left(KD\_Cs\_COL \times 10^{CONC\_COL}\right)\right)^{2}$	4.411 × 10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Cs\_VO$	3.876 × 10^{3}
		B20 $= \frac{\left(KD\_Cs\_AL \times \left(\frac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Cs\_COL \times 10^{CONC\_COL}\right)}$	1.010 × 10^{2}
SZ_preprocess_Kc_Pu.xls	SZ06_Kc_Pu.0000	B198 $= 1/\sqrt{HAVO}$	2.568 × 10^{-1}
		C198 $= \sqrt{HAVO}$	3.893
		B328 $= 10^{FPVO}$	1.497 × 10^{-4}
		B331, C331, and D331 $= \left(10^{GWSPD}\right) glacial\_flux\_multiplier$	2.587

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
	sptr_1k_Kc_Pu_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030 × 10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030 × 10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585 × 10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $=FISVO\times\left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $=547570.+SRC1X\ (548500.-547570.)$	5.48259 × 10^{5}
		C55 $=4078630.+SRC1Y\ (4081090.-4078630.)$	4.079257 × 10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $=(10^{DCVO})/\left(1+\left(KD\_Pu\_COL\times10^{CONC\_COL}\right)\right)^2$	4.888 × 10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $=KD\_Pu\_VO$	98.30
		B20 $=\dfrac{\left(KD\_Pu\_AL\times\left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1+KD\_Pu\_COL\times10^{CONC\_COL}\right)}$	63.98
	sptr_1k_Kc_Pu_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030 × 10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030 × 10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585 × 10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC2X\ (549320. - 548500.)$	5.48952×10^{5}
		C55 $= 4078630. + SRC2Y\ (4081210. - 4078630.)$	4.079918×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO})/\left(1 + \left(KD\_Pu\_COL \times 10^{CONC\_COL}\right)\right)^2$	4.888×10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Pu\_VO$	98.30
		B20 $= \dfrac{\left(KD\_Pu\_AL \times \left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Pu\_COL \times 10^{CONC\_COL}\right)}$	63.98
	sptr_1k_Kc_Pu_03.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464×10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO})/\left(1 + \left(KD\_Pu\_COL \times 10^{CONC\_COL}\right)\right)^2$	4.888×10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Pu\_VO$	98.30

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B20 $= \frac{\left(KD\_Pu\_AL \times \left(\frac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Pu\_COL \times 10^{CONC\_COL}\right)}$	63.98
	sptr_1k_Kc_Pu_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648×10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO}) / \left(1 + \left(KD\_Pu\_COL \times 10^{CONC\_COL}\right)\right)^2$	4.888×10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Pu\_VO$	98.30
		B20 $= \frac{\left(KD\_Pu\_AL \times \left(\frac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Pu\_COL \times 10^{CONC\_COL}\right)}$	63.98
SZ_preprocess_Kc_Sn.xls	SZ06_Kc_Sn.0000	B198 $= 1/\sqrt{HAVO}$	2.568×10^{-1}
		C198 $= \sqrt{HAVO}$	3.893
		B328 $= 10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $= \left(10^{GWSPD}\right) glacial\_flux\_multiplier$	2.587

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
	sptr_1k_Kc_Sn_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547570. + SRC1X\ (548500. - 547570.)$	5.48259×10^{5}
		C55 $= 4078630. + SRC1Y\ (4081090. - 4078630.)$	4.079257×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO}) / \left(1 + \left(KD\_Sn\_COL \times 10^{CONC\_COL}\right)\right)^2$	2.935×10^{-14}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Sn\_VO$	1.368×10^{4}
		B20 $= \dfrac{\left(KD\_Sn\_AL \times \left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Sn\_COL \times 10^{CONC\_COL}\right)}$	1.231×10^{2}
	sptr_1k_Kc_Sn_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC2X\,(549320. - 548500.)$	5.48952×10^{5}
		C55 $= 4078630. + SRC2Y\,(4081210. - 4078630.)$	4.079918×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO}) / \left(1 + \left(KD\_Sn\_COL \times 10^{CONC\_COL}\right)\right)^2$	2.935×10^{-14}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Sn\_VO$	1.368×10^{4}
		B20 $= \dfrac{\left(KD\_Sn\_AL \times \left(\dfrac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Sn\_COL \times 10^{CONC\_COL}\right)}$	1.231×10^{2}
	sptr_1k_Kc_Sn_03.0 000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547720. + SRC3X\,(548500. - 547720.)$	5.48464×10^{5}
		C55 $= 4076170. + SRC3Y\,(4078630. - 4076170.)$	4.078439×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO}) / \left(1 + \left(KD\_Sn\_COL \times 10^{CONC\_COL}\right)\right)^2$	2.935×10^{-14}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Sn\_VO$	1.368×10^{4}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B20 $= \frac{\left(KD\_Sn\_AL \times \left(\frac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Sn\_COL \times 10^{CONC\_COL}\right)}$	1.231×10^{2}
	sptr_1k_Kc_Sn_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, J12, J13, J14, J15, J16, J17, J18, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648×10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534×10^{6}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= (10^{DCVO}) / \left(1 + \left(KD\_Sn\_COL \times 10^{CONC\_COL}\right)\right)^{2}$	2.935×10^{-14}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KD\_Sn\_VO$	1.368×10^{4}
		B20 $= \frac{\left(KD\_Sn\_AL \times \left(\frac{NVF26}{0.30}\right)\right)}{\left(1 + KD\_Sn\_COL \times 10^{CONC\_COL}\right)}$	1.231×10^{2}
SZ_preprocess_Np.xls	SZ06_Np.0000	B198 $= 1/\sqrt{HAVO}$	2.568×10^{-1}
		C198 $= \sqrt{HAVO}$	3.893
		B328 $= 10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $= \left(10^{GWSPD}\right) glacial\_flux\_multiplier$	2.587

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
	sptr_1k_Np_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=547570.+SRC1X\,(548500.-547570.)$	5.48259×10^{5}
		C55 $=4078630.+SRC1Y\,(4081090.-4078630.)$	4.079257×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right)<0.001$: $=1.0$ If $\left(10^{FPVO}\right)\geq 0.001$: $=1+\left[\frac{\left(\left(10^{FPVO}\right)-0.001\right)}{(0.22-0.001)}\right]\times\left[\frac{1.88\times KDNPVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $=KDNPVO$	1.182
		B20 $=\left(KDNPAL\times\left(\frac{NVF26}{0.30}\right)\right)$	1.761
	sptr_1k_Np_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC2X\ (549320. - 548500.)$	5.48952×10^{5}
		C55 $= 4078630. + SRC2Y\ (4081210. - 4078630.)$	4.079918×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $=1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $=1+\left[\frac{\left(\left(10^{FPVO}\right)-0.001\right)}{(0.22-0.001)}\right]\times\left[\frac{1.88\times KDNPVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDNPVO$	1.182
		B20 $=\left(KDNPAL\times\left(\frac{NVF26}{0.30}\right)\right)$	1.761
	sptr_1k_Np_03.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464×10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439×10^{6}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{\left(0.22 - 0.001\right)}\right] \times \left[\frac{1.88 \times KDNPVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDNPVO$	1.182
		B20 $= \left(KDNPAL \times \left(\frac{NVF26}{0.30}\right)\right)$	1.761
	sptr_1k_Np_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648×10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{\left(0.22 - 0.001\right)}\right] \times \left[\frac{1.88 \times KDNPVO}{0.22}\right]$	1.000

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDNPVO$	1.182
		B20 $= \left(KDNPAL \times \left(\frac{NVF26}{0.30} \right) \right)$	1.761
SZ_preprocess_Pu.xls	SZ06_Pu.0000	B198 $= 1 / \sqrt{HAVO}$	2.568 × 10^{-1}
		C198 $= \sqrt{HAVO}$	3.893
		B328 $= 10^{FPVO}$	1.497 × 10^{-4}
		B331, C331, and D331 $= \left(10^{GWSPD}\right) glacial\_flux\_multiplier$	2.587
	sptr_1k_Pu_01.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and D20 $= 10^{(LDISP - 3.3)}$	1.030 × 10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and E20 $= 10^{(LDISP - 5.3)}$	1.030 × 10^{-4}
		E11, I12, I13, I14, I15, I16, I17, I18, I19, and F20 $= 10^{DCVO}$	5.585 × 10^{-12}
		E12, E13, E14, E15, E16, E17, E18, and E19 $= FISVO \times \left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $= 547570. + SRC1X\ (548500. - 547570.)$	5.48259 × 10^{5}
		C55 $= 4078630. + SRC1Y\ (4081090. - 4078630.)$	4.079257 × 10^{6}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= (10^{DCVO}) \times 10^{-10}$	5.585 × 10^{-22}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= 10^{CORVO}$	17.74
		B20 $= \frac{NVF26 \times \left(\left(10^{CORAL}\right) - 1\right)}{(0.001 \times Bulkdensity)}$	6.696 × 10^{-1}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
	sptr_1k_Pu_02.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, I12, I13, I14, I15, I16, I17, I18, I19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		E12, E13, E14, E15, E16, E17, E18, and E19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=548500.+SRC2X\ (549320.-548500.)$	5.48952×10^{5}
		C55 $=4078630.+SRC2Y\ (4081210.-4078630.)$	4.079918×10^{6}
		B12, B13, B14, B15, B16, B17, B18, and B19 $=(10^{DCVO})\times 10^{-10}$	5.585×10^{-22}
		C12, C13, C14, C15, C16, C17, C18, and C19 $=10^{CORVO}$	17.74
		B20 $=\dfrac{NVF26\times\left(\left(10^{CORAL}\right)-1\right)}{\left(0.001\times Bulkdensity\right)}$	6.696×10^{-1}
	sptr_1k_Pu_03.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, I12, I13, I14, I15, I16, I17, I18, I19, and F20 $=10^{DCVO}$	5.585×10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		E12, E13, E14, E15, E16, E17, E18, and E19 $= FISVO \times \left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464 × 10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439 × 10^{6}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= (10^{DCVO}) \times 10^{-10}$	5.585 × 10^{-22}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= 10^{CORVO}$	17.71
		B20 $= \dfrac{NVF26 \times \left(\left(10^{CORAL}\right) - 1\right)}{(0.001 \times Bulkdensity)}$	6.696 × 10^{-1}
	sptr_1k_Pu_04.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and D20 $= 10^{(LDISP - 3.3)}$	1.030 × 10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and E20 $= 10^{(LDISP - 5.3)}$	1.030 × 10^{-4}
		E11, I12, I13, I14, I15, I16, I17, I18, I19, and F20 $= 10^{DCVO}$	5.585 × 10^{-12}
		E12, E13, E14, E15, E16, E17, E18, and E19 $= FISVO \times \left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648 × 10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534 × 10^{6}
		B12, B13, B14, B15, B16, B17, B18, and B19 $= (10^{DCVO}) \times 10^{-10}$	5.585 × 10^{-22}
		C12, C13, C14, C15, C16, C17, C18, and C19 $= 10^{CORVO}$	17.71
		B20 $= \dfrac{NVF26 \times \left(\left(10^{CORAL}\right) - 1\right)}{(0.001 \times Bulkdensity)}$	6.696 × 10^{-1}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
SZ_preprocess_Pu_fast.xls	SZ06_Pu_fast.0000	B198 $=1/\sqrt{HAVO}$	2.568×10^{-1}
		C198 $=\sqrt{HAVO}$	3.893
		B328 $=10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $=\left(10^{GWSPD}\right)glacial\_flux\_multiplier$	2.587
	sptr_1k_Pu_fast_01.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and B20 $=10^{(LDISP-1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, I12, I13, I14, I15, I16, I17, I18, I19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $=(10^{DCVO})\times 10^{-10}$	5.585×10^{-22}
		E12, E13, E14, E15, E16, E17, E18, and E19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=547570.+SRC1X\,(548500.-547570.)$	5.48259×10^{5}
		C55 $=4078630.+SRC1Y\,(4081090.-4078630.)$	4.079257×10^{6}
	sptr_1k_Pu_fast_02.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and B20 $=10^{(LDISP-1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, I12, I13, I14, I15, I16, I17, I18, I19, and F20 $=10^{DCVO}$	5.585×10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B12, B13, B14, B15, B16, B17, B18, and B19 $=(10^{DCVO})\times 10^{-10}$	5.585 × 10^{-22}
		E12, E13, E14, E15, E16, E17, E18, and E19 $= FISVO \times \left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $= 548500. + SRC2X\ (549320. - 548500.)$	5.48952 × 10^{5}
		C55 $= 4078630. + SRC2Y\ (4081210. - 4078630.)$	4.079918 × 10^{6}
	sptr_1k_Pu_fast_03.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and B20 $=10^{(LDISP-1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-3.3)}$	1.030 × 10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-5.3)}$	1.030 × 10^{-4}
		E11, I12, I13, I14, I15, I16, I17, I18, I19, and F20 $=10^{DCVO}$	5.585 × 10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $=(10^{DCVO})\times 10^{-10}$	5.585 × 10^{-22}
		E12, E13, E14, E15, E16, E17, E18, and E19 $= FISVO \times \left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464 × 10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439 × 10^{6}
	sptr_1k_Pu_fast_04.0000	B11, F12, F13, F14, F15, F16, F17, F18, F19, and B20 $=10^{(LDISP-1.)}$	2.056
		C11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-3.3)}$	1.030 × 10^{-2}
		D11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-5.3)}$	1.030 × 10^{-4}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		E11, I12, I13, I14, I15, I16, I17, I18, I19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		B12, B13, B14, B15, B16, B17, B18, and B19 $=(10^{DCVO})\times 10^{-10}$	5.585×10^{-22}
		E12, E13, E14, E15, E16, E17, E18, and E19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=548500.+SRC4X\,(548890.-548500.)$	5.48648×10^{5}
		C55 $=4076170.+SRC4Y\,(4078630.-4076170.)$	4.076534×10^{6}
SZ_preprocess_Ra.xls	SZ06_Ra.0000	B198 $=1/\sqrt{HAVO}$	2.568×10^{-1}
		C198 $=\sqrt{HAVO}$	3.893
		B328 $=10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $=\left(10^{GWSPD}\right)glacial\_flux\_multiplier$	2.587
	sptr_1k_Ra_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $=FISVO\times\left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $=547570.+SRC1X\,(548500.-547570.)$	5.48259×10^{5}
		C55 $=4078630.+SRC1Y\,(4081090.-4078630.)$	4.079257×10^{6}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)}\right] \times \left[\frac{1.88 \times KDRAVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDRAVO$	2.884×10^{2}
		B20 $= \left(KDRAAL \times \left(\frac{NVF26}{0.30}\right)\right)$	1.042×10^{2}
	sptr_1k_Ra_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC2X\ (549320. - 548500.)$	5.48952×10^{5}
		C55 $= 4078630. + SRC2Y\ (4081210. - 4078630.)$	4.079918×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)}\right] \times \left[\frac{1.88 \times KDRAVO}{0.22}\right]$	1.000

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDRAVO$	2.884×10^{2}
		B20 $= \left(KDRAAL \times \left(\frac{NVF26}{0.30} \right) \right)$	1.042×10^{2}
	sptr_1k_Ra_03.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464×10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)} \right] \times \left[\frac{1.88 \times KDRAVO}{0.22} \right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDRAVO$	2.884×10^{2}
		B20 $= \left(KDRAAL \times \left(\frac{NVF26}{0.30} \right) \right)$	1.042×10^{2}
	sptr_1k_Ra_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP-1.)}$	2.056

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times (10^{FPVO})$	1.535×10^{-3}
		B55 $=548500.+SRC4X\ (548890.-548500.)$	5.48648×10^{5}
		C55 $=4076170.+SRC4Y\ (4078630.-4076170.)$	4.076534×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $(10^{FPVO})<0.001$: $=1.0$ If $(10^{FPVO})\geq 0.001$: $=1+\left[\frac{((10^{FPVO})-0.001)}{(0.22-0.001)}\right]\times\left[\frac{1.88\times KDRAVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $=KDRAVO$	2.884×10^{2}
		B20 $=\left(KDRAAL\times\left(\frac{NVF26}{0.30}\right)\right)$	1.042×10^{2}
SZ_preprocess_Se.xls	SZ06_Se.0000	B198 $=1/\sqrt{HAVO}$	2.568×10^{-1}
		C198 $=\sqrt{HAVO}$	3.893
		B328 $=10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $=(10^{GWSPD})glacial\_flux\_multiplier$	2.587
	sptr_1k_Se_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547570. + SRC1X\ (548500. - 547570.)$	5.48259×10^{5}
		C55 $= 4078630. + SRC1Y\ (4081090. - 4078630.)$	4.079257×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $=1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $=1+\left[\frac{\left(\left(10^{FPVO}\right)-0.001\right)}{(0.22-0.001)}\right]\times\left[\frac{1.88\times Kd\_Se\_Vo}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= Kd\_Se\_Vo$	6.961
		B20 $=\left(Kd\_Se\_Al\times\left(\frac{NVF26}{0.30}\right)\right)$	2.592
	sptr_1k_Se_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC2X\ (549320. - 548500.)$	5.48952×10^{5}
		C55 $= 4078630. + SRC2Y\ (4081210. - 4078630.)$	4.079918×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{\left(0.22 - 0.001\right)}\right] \times \left[\frac{1.88 \times Kd\_Se\_Vo}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= Kd\_Se\_Vo$	6.961
		B20 $= \left(Kd\_Se\_Al \times \left(\frac{NVF26}{0.30}\right)\right)$	2.592
	sptr_1k_Se_03.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464×10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439×10^{6}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)}\right] \times \left[\frac{1.88 \times Kd\_Se\_Vo}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= Kd\_Se\_Vo$	6.961
		B20 $= \left(Kd\_Se\_Al \times \left(\frac{NVF26}{0.30}\right)\right)$	2.592
	sptr_1k_Se_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030 × 10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030 × 10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585 × 10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535 × 10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648 × 10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534 × 10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)}\right] \times \left[\frac{1.88 \times Kd\_Se\_Vo}{0.22}\right]$	1.000

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B12, B13, B14, B15, B16, B17, B18, and B19 $= Kd\_Se\_Vo$	6.961
		B20 $= \left(Kd\_Se\_Al \times \left(\frac{NVF26}{0.30} \right) \right)$	2.592
SZ_preprocess_Sr.xls	SZ06_Sr.0000	B198 $= 1 / \sqrt{HAVO}$	2.568×10^{-1}
		C198 $= \sqrt{HAVO}$	3.893
		B328 $= 10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $= \left(10^{GWSPD}\right) glacial\_flux\_multiplier$	2.587
	sptr_1k_Sr_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547570. + SRC1X\ (548500. - 547570.)$	5.48259×10^{5}
		C55 $= 4078630. + SRC1Y\ (4081090. - 4078630.)$	4.079257×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)} \right] \times \left[\frac{1.88 \times KDSRVO}{0.22} \right]$	1.000

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDSRVO$	2.461×10^{2}
		B20 $= \left(KDSRAL \times \left(\frac{NVF26}{0.30} \right) \right)$	14.03
	sptr_1k_Sr_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC2X\ (549320. - 548500.)$	5.48952×10^{5}
		C55 $= 4078630. + SRC2Y\ (4081210. - 4078630.)$	4.079918×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)} \right] \times \left[\frac{1.88 \times KDSRVO}{0.22} \right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDSRVO$	2.461×10^{2}
		B20 $= \left(KDSRAL \times \left(\frac{NVF26}{0.30} \right) \right)$	14.03
	sptr_1k_Sr_03.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464×10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $=1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $=1+\left[\frac{\left(\left(10^{FPVO}\right)-0.001\right)}{(0.22-0.001)}\right]\times\left[\frac{1.88\times KDSRVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDSRVO$	2.461×10^{2}
		B20 $=\left(KDSRAL\times\left(\frac{NVF26}{0.30}\right)\right)$	14.03
	sptr_1k_Sr_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $=10^{(LDISP-1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $=10^{(LDISP-3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $=10^{(LDISP-5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $=10^{DCVO}$	5.585×10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648×10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)}\right] \times \left[\frac{1.88 \times KDSRVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDSRVO$	2.461×10^{2}
		B20 $= \left(KDSRAL \times \left(\frac{NVF26}{0.30}\right)\right)$	14.03
SZ_preprocess_U.xls	SZ06_U.0000	B198 $= 1/\sqrt{HAVO}$	2.568×10^{-1}
		C198 $= \sqrt{HAVO}$	3.893
		B328 $= 10^{FPVO}$	1.497×10^{-4}
		B331, C331, and D331 $= \left(10^{GWSPD}\right) glacial\_flux\_multiplier$	2.587
	sptr_1k_U_01.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547570. + SRC1X\ (548500. - 547570.)$	5.48259×10^{5}
		C55 $= 4078630. + SRC1Y\ (4081090. - 4078630.)$	4.079257×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)}\right] \times \left[\frac{1.88 \times KDUVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDUVO$	5.973
		B20 $= \left(KDUAL \times \left(\frac{NVF26}{0.30}\right)\right)$	1.869
	sptr_1k_U_02.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 548500. + SRC2X\ (549320. - 548500.)$	5.48952×10^{5}
		C55 $= 4078630. + SRC2Y\ (4081210. - 4078630.)$	4.079918×10^{6}

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{\left(0.22 - 0.001\right)}\right] \times \left[\frac{1.88 \times KDUVO}{0.22}\right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDUVO$	5.973
		B20 $= \left(KDUAL \times \left(\frac{NVF26}{0.30}\right)\right)$	1.869
	sptr_1k_U_03.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO}\right)$	1.535×10^{-3}
		B55 $= 547720. + SRC3X\ (548500. - 547720.)$	5.48464×10^{5}
		C55 $= 4076170. + SRC3Y\ (4078630. - 4076170.)$	4.078439×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{\left(0.22 - 0.001\right)}\right] \times \left[\frac{1.88 \times KDUVO}{0.22}\right]$	1.000

Table B-2[a]. Parameter Values and Formulas in Spreadsheets (Continued)

Spreadsheet Filename	Worksheet	Spreadsheet Cell(s) and Formula	Value for Realization #1
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDUVO$	5.973
		B20 $= \left(KDUAL \times \left(\frac{NVF26}{0.30} \right) \right)$	1.869
	sptr_1k_U_04.0000	B11, G12, G13, G14, G15, G16, G17, G18, G19, and C20 $= 10^{(LDISP - 1.)}$	2.056
		C11, H12, H13, H14, H15, H16, H17, H18, H19, and D20 $= 10^{(LDISP - 3.3)}$	1.030×10^{-2}
		D11, I12, I13, I14, I15, I16, I17, I18, I19, and E20 $= 10^{(LDISP - 5.3)}$	1.030×10^{-4}
		E11, C12, J12, C13, J13, C14, J14, C15, J15, C16, J16, C17, J17, C18, J18, C19, J19, and F20 $= 10^{DCVO}$	5.585×10^{-12}
		F12, F13, F14, F15, F16, F17, F18, and F19 $= FISVO \times \left(10^{FPVO} \right)$	1.535×10^{-3}
		B55 $= 548500. + SRC4X\ (548890. - 548500.)$	5.48648×10^{5}
		C55 $= 4076170. + SRC4Y\ (4078630. - 4076170.)$	4.076534×10^{6}
		D12, D13, D14, D15, D16, D17, D18, and D19 If $\left(10^{FPVO}\right) < 0.001$: $= 1.0$ If $\left(10^{FPVO}\right) \geq 0.001$: $= 1 + \left[\frac{\left(\left(10^{FPVO}\right) - 0.001\right)}{(0.22 - 0.001)} \right] \times \left[\frac{1.88 \times KDUVO}{0.22} \right]$	1.000
		B12, B13, B14, B15, B16, B17, B18, and B19 $= KDUVO$	5.973
		B20 $= \left(KDUAL \times \left(\frac{NVF26}{0.30} \right) \right)$	1.869

'N: SN0702PASZFTMA.001.

The Excel macro files used to export the FEHM V. 2.24 (STN: 10086-2.24-01-00) [DIRS 179419] input files in text format to the proper filename for input to the SZ flow and transport abstraction model consist of "scripts" of keyboard entry. The basic script structure for these operations was recorded as a macro, verified for accuracy, and then extended to all 200 realizations by editing the macro file. The first step of the macro is to enter the current realization number (starting with "1") in the worksheet that contains the vectors of sampled parameter values ("parameter_vectors"). The correct entries of variables in other worksheets are linked to the realization number and are updated with this step. The worksheets to be written as FEHM input files are then chosen and saved as text files with the appropriate filenames in subsequent steps. After all of the input files have been written for that realization, the next realization number is entered, and the process is repeated.

Part of the macro file *SZ_C_macro_1-200.bas* is shown below. The steps in the script described above can be seen and verified in this example fragment of the macro file. The macros were also verified by inspecting the directory into which the FEHM input files were written and verifying that files were written for all 200 realizations. Screen prints from three of the directories into which the files were written are shown in Figure B-2[a] and from these it can be verified that files were written for all 200 realizations. The macro files are specific to the directory structure of the computer on which they were created and run; however, the macro files could be edited to run on a different directory structure, if necessary.

```
.
.
.
' SZ06_C Macro
' Macro recorded 1/19/2007 by Bill Arnold
'

'
    Range("B4").Select
    ActiveCell.FormulaR1C1 = "1"
    Range("B5").Select
    ActiveWorkbook.Save
    Sheets("SZ06_C.0000").Select
    ChDir "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ06_dat\C"
    ActiveWorkbook.SaveAs Filename:= _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ06_dat\C\SZ06_C.0001" _
        , FileFormat:=xlTextPrinter, CreateBackup:=False
    ActiveWindow.Close
    Workbooks.Open Filename:= _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ_preprocess_C.xls"
    Sheets("rock_macro.0000").Select
    ChDir "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\rock_macro"
    ActiveWorkbook.SaveAs Filename:= _

"C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\rock_macro\rock_macro.0001" _
        , FileFormat:=xlTextPrinter, CreateBackup:=False
    ActiveWindow.Close
    Workbooks.Open Filename:= _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ_preprocess_C.xls"
    Sheets("alluv_uncert_zone.0000").Select
    ChDir _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\alluv_uncert_zone"
    ActiveWorkbook.SaveAs Filename:= _

"C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\alluv_uncert_zone\alluv_uncert_zo
ne.0001" _
        , FileFormat:=xlTextPrinter, CreateBackup:=False
    ActiveWindow.Close
    Workbooks.Open Filename:= _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ_preprocess_C.xls"
    Sheets("sptr_1k_C_01.0000").Select
    ChDir "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\sptr_1k\C"
    ActiveWorkbook.SaveAs Filename:= _

"C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\sptr_1k\C\sptr_1k_C_01.0001" _
        , FileFormat:=xlTextPrinter, CreateBackup:=False
    ActiveWindow.Close
    Workbooks.Open Filename:= _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ_preprocess_C.xls"
    ActiveWindow.ScrollWorkbookTabs Position:=xlLast
    Sheets("sptr_1k_C_02.0000").Select
    ActiveWorkbook.SaveAs Filename:= _

"C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\sptr_1k\C\sptr_1k_C_02.0001" _
        , FileFormat:=xlTextPrinter, CreateBackup:=False
    ActiveWindow.Close
    Workbooks.Open Filename:= _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ_preprocess_C.xls"
    ActiveWindow.ScrollWorkbookTabs Position:=xlLast
    Sheets("sptr_1k_C_03.0000").Select
    ActiveWorkbook.SaveAs Filename:= _

"C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\sptr_1k\C\sptr_1k_C_03.0001" _
        , FileFormat:=xlTextPrinter, CreateBackup:=False
    ActiveWindow.Close
    Workbooks.Open Filename:= _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ_preprocess_C.xls"
    ActiveWindow.ScrollWorkbookTabs Position:=xlLast
    Sheets("sptr_1k_C_04.0000").Select
    ActiveWorkbook.SaveAs Filename:= _
```

```
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        , FileFormat:=xlTextPrinter, CreateBackup:=False
    ActiveWindow.Close
    Workbooks.Open Filename:= _
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    Range("B4").Select
    ActiveCell.FormulaR1C1 = "2"
    Range("B5").Select
    ActiveWorkbook.Save
    Sheets("SZ06_C.0000").Select
    ChDir "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ06_dat\C"
    ActiveWorkbook.SaveAs Filename:= _
        "C:\data\fy07\tspa07\SZ_abstraction\inputs\preprocess\final\SZ06_dat\C\SZ06_C.0002" _
        , FileFormat:=xlTextPrinter, CreateBackup:=False
.
.
.
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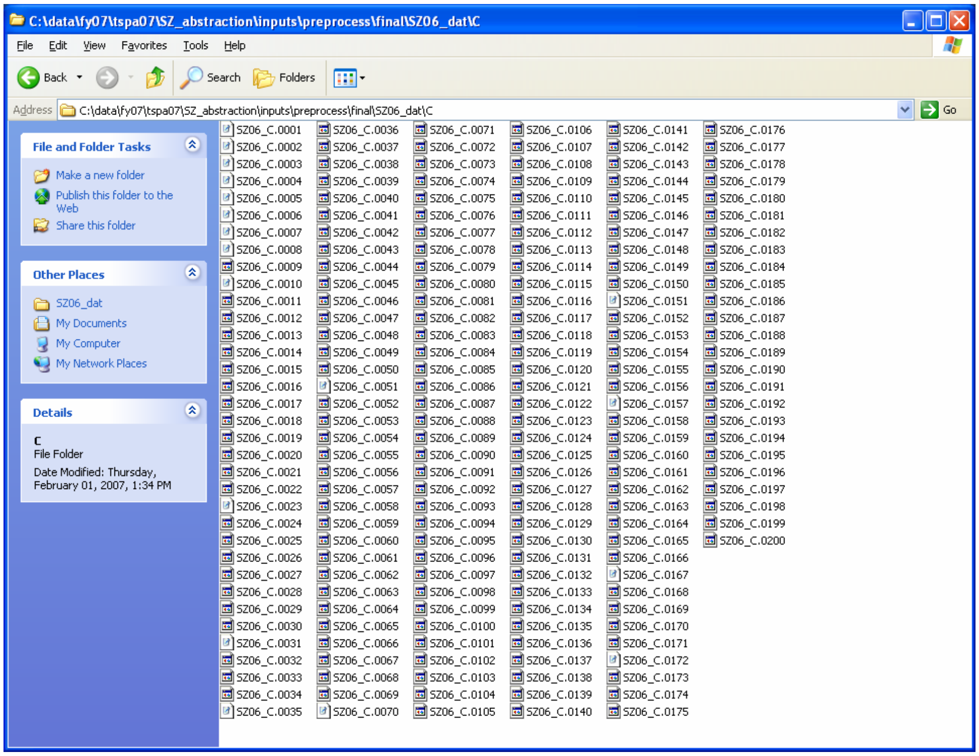

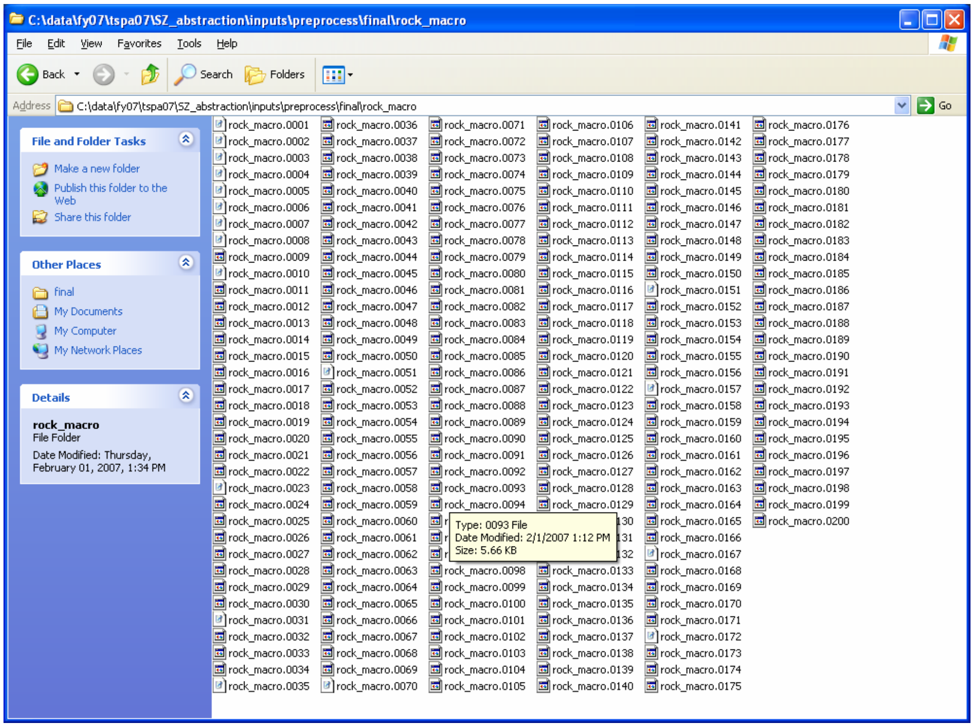

Figure B-2[a]. Screen Print Showing a List of Generated FEHM Input Files for the 200 Realizations

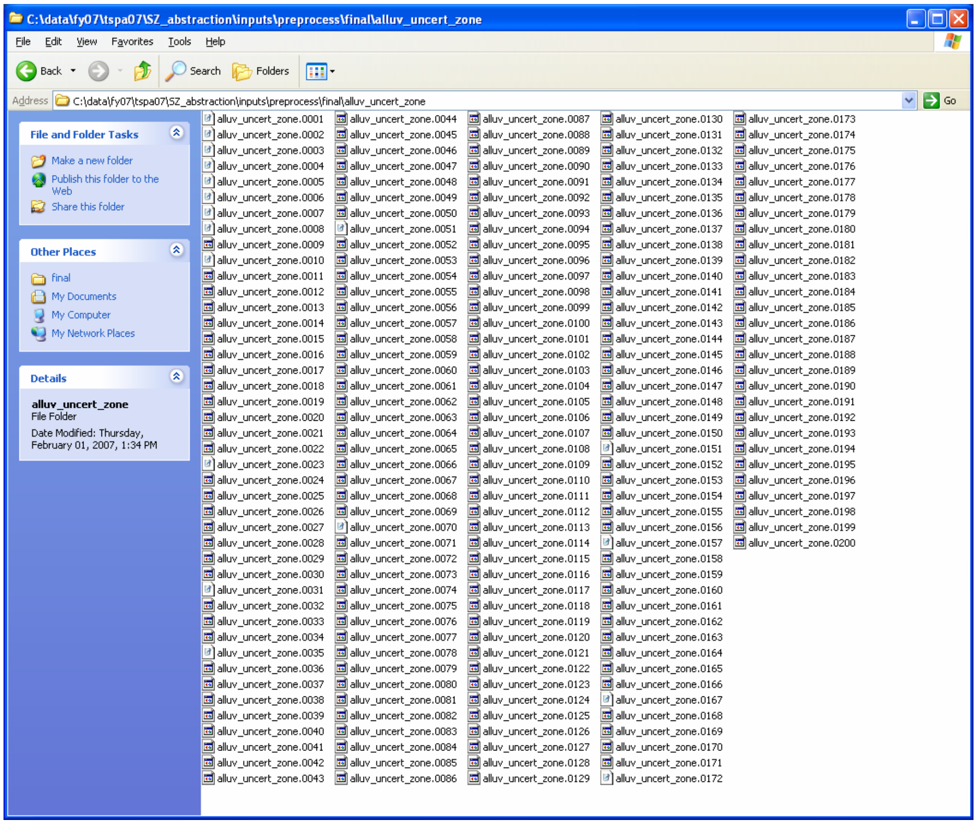

Figure B-2[a]. Screen Print Showing a List of Generated FEHM Input Files for the 200 Realizations (Continued)

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Addendum Cover Page

Complete only applicable items.

QA: QA

1. Total Pages: ~~75~~ 76 KRR 1/2/2008
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2. Addendum to (Title): Saturated Zone Flow and Transport Model Abstraction			
3. DI (including Revision and Addendum No.): MDL-NBS-HS-000021 REV 03 AD 02			
	Printed Name	Signature	Date
4. Originator	Bill W. Arnold	Bill W. Arnold	12/20/2007
5. Independent Technical Reviewer	Susan Altman	[signature]	12/20/07
6. Checker	~~Alicia Aragon~~ Kenneth Rehfeldt for	Kenneth Rehfeldt	12/21/07
7. QCS / QA Reviewer	John Devers	John K Devers	01/02/08
8. Responsible Manager / Lead	Ming Zhu	[signature]	1/2/08
9. Responsible Manager	Kathryn Knowles	K Knowles	1/2/08

10. Remarks

Change History

11. Revision and Addendum No.	12. Description of Change
REV 03 AD 02	Initial Issue. This addendum contains an update to the saturated zone one-dimensional transport model with regard to the uncertainty distribution and scaling of longitudinal dispersivity. The calculation of the free water diffusion coefficient is corrected with regard to the adjustment for matrix porosity and the values of the half-life for ^{79}Se and ^{126}Sn have been corrected. Condition reports (CR) related to previous versions of this model report have been addressed as follows: CR 11345 has been addressed by using a qualified version of the GoldSim software, GoldSim V. 9.60.100 (STN: 10344-9.60-01 [DIRS 181903] for the saturated zone one-dimensional transport model.

Change History	
11. Revision and Addendum No.	12. Description of Change
REV 03 AD 02 (Con't)	Issue 1 of CR 11567 has been addressed by a data submittal of DTN: SN0712CORMATRX.001 [DIRS 184432] that contains documentation of the approximation and implementation of the correlation matrix for the sampling of sorption coefficients. Issue 3 of CR 11567 has been addressed by an evaluation of the impact of a discrepancy in the uncertainty distribution for colloid concentration, as documented in Section 6.5.2[b].

CONTENTS

Page

CONTENTS (Continued)

Page

FIGURES

Page

TABLES

Page

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ACRONYMS

ATC	Alluvial Tracer Complex
CR	Condition Report
CDF	cumulative distribution function
DOE	U.S. Department of Energy
DTN	data tracking number
FEC	flowing fluid electrical conductivity
FEHM	finite-element heat and mass (model)
HFM	hydrogeologic framework model
SZ	saturated zone
TSPA	total system performance assessment
TSPA-LA	total system performance assessment for the license application
UZ	unsaturated zone

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1[b]. PURPOSE

The primary purpose of this addendum is to update the saturated zone (SZ) one-dimensional transport model relative to the documentation in the parent report. The SZ one-dimensional transport model is changed with regard to the scaling of longitudinal dispersivity in the model and a truncated uncertainty distribution for longitudinal dispersivity is documented. The calculation of the free water diffusion coefficient in the SZ one-dimensional transport model is also corrected with regard to the adjustment for matrix porosity. The model validation testing and documentation is also updated to reflect the changes to the SZ one-dimensional transport model. The changes to the SZ one-dimensional transport model are made for use in the total system performance assessment (TSPA) model documented in *Total System Performance Assessment Model /Analysis for the License Application* (SNL 2007 [DIRS 183478]), which is an addendum to the TSPA model utilized for regulatory compliance analyses (SNL 2007 [DIRS 178871]).

Corrective action item CR (Condition Report) 11345 has been addressed with output data tracking number (DTN): SN0702PASZFTMA.002 (Revision 001) from this addendum. A qualified version of the GoldSim software, GoldSim V. 9.60.100 (STN: 10344-9.60-01 [DIRS 181903]), was used for the SZ one-dimensional transport model to address CR 11345. No other unqualified software were used in Addendum 01 of this report and the extent of the condition of CR 11345 is limited to the use of the unqualified version of the GoldSim software described in the CR.

The work documented in this addendum differs from the governing technical work plan (BSC 2006 [DIRS 177375]) in some ways. The reevaluation of water-table rise in the saturated zone under glacial-transition climatic conditions is documented in the performance margin analysis in *Total System Performance Assessment Model /Analysis for the License Application* (SNL 2007 [DIRS 178871], Appendix C). Evaluation of the impact of potential reducing zones in the saturated zone on radionuclide transport is also incorporated into the performance margin analysis for the TSPA model.

This addendum contains updated modeling approaches, inputs, and results relative to Revision 03 of the parent report and Addendum 01 of the same report. The documentation is structured such that this addendum contains only information that is new or has been updated and thus supersedes information presented in the parent report or the previous addendum. Information on topics that are not addressed in this addendum remains unchanged from the parent report and Addendum 01 of the parent report. Consequently, a complete understanding of the technical work associated with SZ flow and transport abstraction requires access to this addendum, the parent report, and Addendum 01 of the parent report. Section numbers, table numbers, and figure numbers (and associated cross references) within this addendum contain the designator "[b]" to distinguish them from the numbers in the previous revisions. Cross references within this report that do not contain the designator "[b]" refer to sections, tables, or figures in the parent report or Addendum 01 of the parent report.

Corrective action item CR 11567 is related to traceability and consistency of certain saturated zone inputs to TSPA. Issue 1 of CR 11567 concerns the traceability of the correlation matrix for sorption coefficients in the saturated zone, as documented in Addendum 01 of the parent report,

Table 6-7[a]. Issue 1 of CR 11567 has been addressed by a data submittal of DTN: SN0712CORMATRX.001 [DIRS 184432] that contains documentation of the approximation and implementation of the correlation matrix for sorption coefficients in the saturated zone and by the response provided within CR 11567. This data submittal documents the Cholesky factorization of the correlation matrix in a Mathcad software file and provides traceability from the source of the correlation matrix to the GoldSim software file, GoldSim V. 8.02.500 (STN: 10344−8.02-06 [DIRS 179360]), used to sample the uncertain parameters for the SZ flow and transport abstraction model and the SZ one-dimensional transport model.

Issue 3 of CR 11567 concerns a discrepancy in the value for the upper bound of the uncertainty distribution for the concentration of colloids, as specified in the parent report, Table 6-8, and the value used to sample the parameters in the GoldSim software file. This issue is addressed in Section 6.5.2[b] of this addendum by an evaluation of the impact of this discrepancy. The impact of this discrepancy was found to be negligible.

2[b]. QUALITY ASSURANCE

The work documented in this addendum is planned in *Technical Work Plan for Saturated Zone Flow and Transport Modeling* (BSC 2006 [DIRS 177375]). The procedure directly governing the work and documentation in this addendum is SCI-PRO-006, *Models*.

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3[b]. USE OF SOFTWARE

This section contains a complete listing of the software used in producing the results documented in this addendum.

3.1[b] SOFTWARE TRACKED BY CONFIGURATION MANAGEMENT

The computer software codes used directly in this addendum are listed in Table 3-1[b]. The qualification status of the software is noted in the Software Configuration Management database. All software was obtained from Software Configuration Management and is appropriate for the application, considering the simulation capabilities of the software, the range of inputs, and the functionality required by the computational task. Qualified codes were used only within the range of validation as required by IM-PRO-003, *Software Management*.

Table 3-1[b]. Computer Software Used in This Model Report

Software Name and Version (V)	Software Tracking Number (STN)	Description	Computer Type, Platform, and Location	Date Baselined
FEHM V2.24-01 [DIRS 179419]	10086−2.24-01-00	This code is a finite-element heat- and mass-transport code that simulates nonisothermal, multiphase, multicomponent flow, and solute transport in porous media.	Dell PowerEdge 2950 Windows Server 2003 YMP Offices, Las Vegas, Data Center	02/27/2007
GoldSim V. 8.02.500 [DIRS 179360]	10344−8.02-06	This code is the modeling software used in the TSPA-LA. Probabilistic simulations are represented graphically in GoldSim.	Dell PowerEdge 2650 Windows Server 2003 Sandia National Laboratories	10/11/2006
GoldSim V. 9.60.100 [DIRS 181903]	10344−9.60-01	This code is the modeling software used in the TSPA-LA. Probabilistic simulations are represented graphically in GoldSim.	Dell Precision 670 Windows XP Sandia National Laboratories	07/10/2007

NOTE: FEHM = finite-element heat and mass (model); TSPA-LA = total system performance assessment for the license application.

3.2[b] EXEMPT SOFTWARE

The commercially available software applications cited in this section were used in a manner consistent with exempt status defined in IM-PRO-003. Graphs, files, and visualization plots produced by these exempt software applications were verified by hand calculations and visual inspection, as required in SCI-PRO-006.

Commercial off-the-shelf software:

- **Excel 2003**: Used for spreadsheet calculations in the analyses of parameter uncertainty and for plotting.
- **Surfer 8.0**: Used for plotting and visualization.
- **Grapher 4.0**: Used for plotting graphs.

4[b]. INPUTS

4.1[b] DIRECT INPUT

This section lists only direct inputs that have changed or apply to the models and results documented in this addendum.

4.1.1[b] Data and Other Model Inputs

The data providing direct input to the development of the updated parameter distribution for the parameter LDISP and to the specification of radionuclide half-life are identified in Table 4-1[b]. The model input information for the site-scale SZ transport model for use in Section 7[b] is listed in Table 4-2[b].

Table 4-1[b]. Direct Inputs

Data Name	Originating Report	DTN
Uncertainty in Longitudinal Dispersivity	CRWMS M&O 1998 [DIRS 100353]	MO0003SZFWTEEP.000 [DIRS 148744], Table 3-2
Half-life of Radionuclides	SNL 2007 [DIRS 180472]	MO0702PASTREAM.001 [DIRS 179925], file: *DTN-Inventory-Rev00.xls*

Table 4-2[b]. Other Direct Inputs (Model)

Input Name	Input Description	DTN
Site-Scale Saturated Zone Transport Model	The site-scale SZ transport model that forms the basis of the SZ flow and transport abstraction model and used for model validation of the SZ one-dimensional transport model	LA0703SK150304.001 [DIRS 184393]

4.1.2[b] Parameters and Parameter Uncertainty

No new parameters or parameter uncertainty distributions are used as direct input in this addendum.

4.2[b] CRITERIA

No changes to this section.

4.3[b] CODES, STANDARDS, AND REGULATIONS

No changes to this section.

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5[b]. ASSUMPTIONS

No changes to this section.

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6[b]. MODEL DISCUSSION

6.1[b] MODELING OBJECTIVES

The primary objective of the SZ flow and transport abstraction model and the SZ one-dimensional transport model is to simulate radionuclide transport in the saturated zone for use in the TSPA model of repository performance. The general approach and modeling structure described by Arnold et al. (2003 [DIRS 163857]) are not changed in this addendum.

6.2[b] FEATURES, EVENTS, AND PROCESSES FOR THIS MODEL REPORT

No changes to this section.

6.3[b] BASE-CASE CONCEPTUAL MODEL

No changes to this section.

6.4[b] CONSIDERATION OF ALTERNATIVE CONCEPTUAL MODELS

No changes to this section.

6.5[b] MODEL FORMULATION FOR BASE-CASE MODELS

No changes to this section.

6.5.1[b] Mathematical Description of Base-Case Conceptual Models

No changes to this section.

6.5.1.1[b] SZ Flow and Transport Abstraction Model

The values of half-life for radionuclides transported in the SZ flow and transport abstraction model component of the TSPA are taken from DTN: MO0702PASTREAM.001, Revision 000 [DIRS 179925]. In particular, the values of half-life for ^{79}Se and ^{126}Sn have been corrected in output DTN: SN0710PASZFTMA.003, files: *sz_convolute2.dat*, *sz_convolute2_1Myr.dat*, and *sz_convolute2_20kyr.dat*, such that they are equal to the values used in other components of the TSPA model.

6.5.1.2[b] SZ One-Dimensional Transport Model

The basic form, model setup, and mathematical implementation of the SZ one-dimensional transport model have not been changed in the update documented in this addendum. The approach and methods for representing groundwater flow and radionuclide transport in the SZ one-dimensional transport model in a manner that approximates the SZ site-scale transport model are the same as described in Section 6.5.1.2. The values of longitudinal and transverse dispersivity in the SZ one-dimensional transport model are not increased by one order of magnitude from the sampled values tabulated in Appendix A[b], as they were in Addendum 01 of the parent report (SNL 2007 [DIRS 181650], Section 6.5.1.2[a]). Increasing the value of longitudinal dispersivity by one order of magnitude results in unreasonably high values of this parameter for the upper tail of the uncertainty distribution, when compared to a compilation of data on longitudinal dispersivity as a function of length scale from Neuman 1990 ([DIRS 101464], Figure 1). Not increasing the value of longitudinal dispersivity in the SZ one-dimensional transport model does not have a large impact on the radionuclide transport simulations for most realizations of the SZ flow and transport system. Comparison of the simulated breakthrough curves for the SZ one-dimensional transport model shown in Figure 7-1[b] and Figure 7-4[a] indicates differences that are not large for the fast and median validation test cases with a non-sorbing radionuclide. Comparison of Figure 7-2[b] and Figure 7-5[a] indicates somewhat larger differences in simulated breakthrough curves for neptunium in the fast and median validation test cases. However, the differences in simulated transport times for the fast and median validation test cases are not large relative to the overall uncertainty in neptunium transport times through the SZ.

In addition, the uncertainty distribution for longitudinal dispersivity for the SZ one-dimensional transport model has been truncated at two standard deviations above the geometric mean, as described in Section 6.5.2.1[b]. Also, examination of the definition of effective matrix diffusion coefficient in the governing equations for the pipe element of the GoldSim software code indicated that the free water diffusion coefficient should not be divided by the matrix porosity. The updated SZ one-dimensional transport model input file was corrected by removing the matrix porosity term from the calculation of the free water diffusion coefficient value.

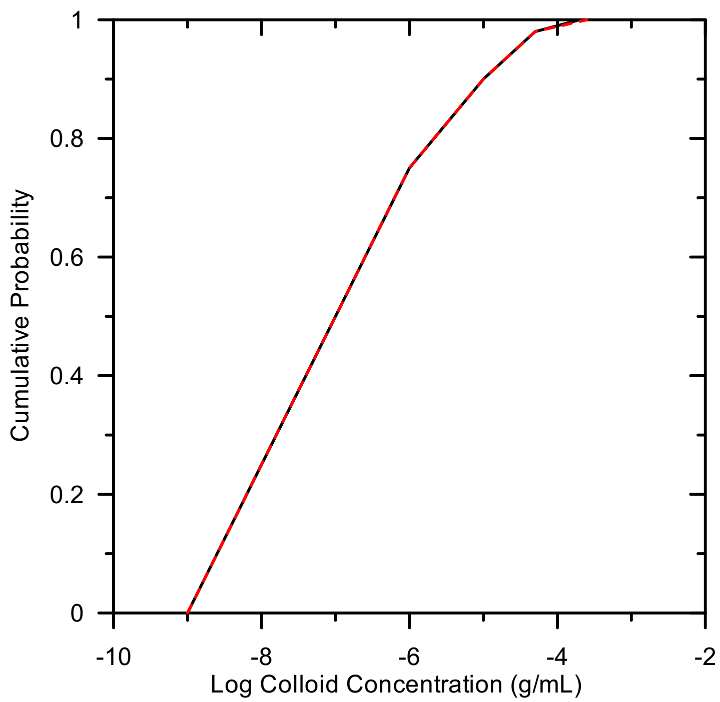
6.5.2[b] Base-Case Model Inputs

The SZ flow and transport abstraction model and the SZ one-dimensional transport model include uncertainty through stochastic simulations of uncertain parameters. Parameter uncertainties are quantified through uncertainty distributions, which numerically represent the state of knowledge about a particular parameter on a scale of the model domain. A comprehensive list of the inputs to the models and analyses used in the previous versions of the SZ flow and transport abstraction model and the SZ one-dimensional transport model is given in Table 6-8 and Table 6-7[a]. The uncertainty distributions for longitudinal dispersivity in the SZ one-dimensional transport model has been reevaluated and updated. The dispersivity parameter that has changed is listed in Table 6-1[b].

Table 6-1[b]. Updated Input Used in the SZ Flow and Transport Abstraction Model and the SZ One-Dimensional Transport Model

Input Name	Input Description	Input Source (DTN, if applicable)	Value or Distribution	Units	Type of Uncertainty
LDISP (for the SZ one-dimensional transport model)	Longitudinal dispersivity	Internal to this report (see Section 6.5.2.1[b]) and MO0003SZFWTEEP.000 [DIRS 148744]	Truncated Normal: (Log_{10}-transformed) Mean 2.0 Standard Deviation 0.75 Upper Bound 3.5	m	Epistemic
LDISP (for the SZ flow and transport abstraction model)	Longitudinal dispersivity	MO0003SZFWTEEP.000 [DIRS 148744]	Normal: (Log_{10}-transformed) Mean 2.0 Standard Deviation 0.75	m	Epistemic

A discrepancy exists in the value for the upper bound of the uncertainty distribution for the concentration of colloids, as specified in the parent report, Table 6-8, and the value used in the GoldSim input file to sample the parameters in output DTN: SN0702PASZFTMA.001. This discrepancy is the subject of Issue 3 in CR 11567. The log-transformed value (g/mL) specified in Table 6-8 is −3.7 and the value used to sample the parameters is −3.6. The impact of this discrepancy is evaluated by graphically comparing the uncertainty distributions using the two discrepant values, as shown in Figure 6-1[b]. The cumulative distribution function (CDF) using an upper bound of −3.7 is shown by the black line and the CDF using an upper bound of -3.6 is shown by the dashed red line. A very small difference between the two CDFs is discernible near a cumulative probability of 1.0, but the overall impact of the discrepancy is negligible. Furthermore, the value of −3.6 used to sample the uncertainty distribution of colloid concentration results in a few realizations with higher colloid concentrations. Higher colloid concentration results in more rapid simulated migration of radionuclides subject to reversible sorption onto colloids.



Source: Output DTN: SN0702PASZFTMA.001.

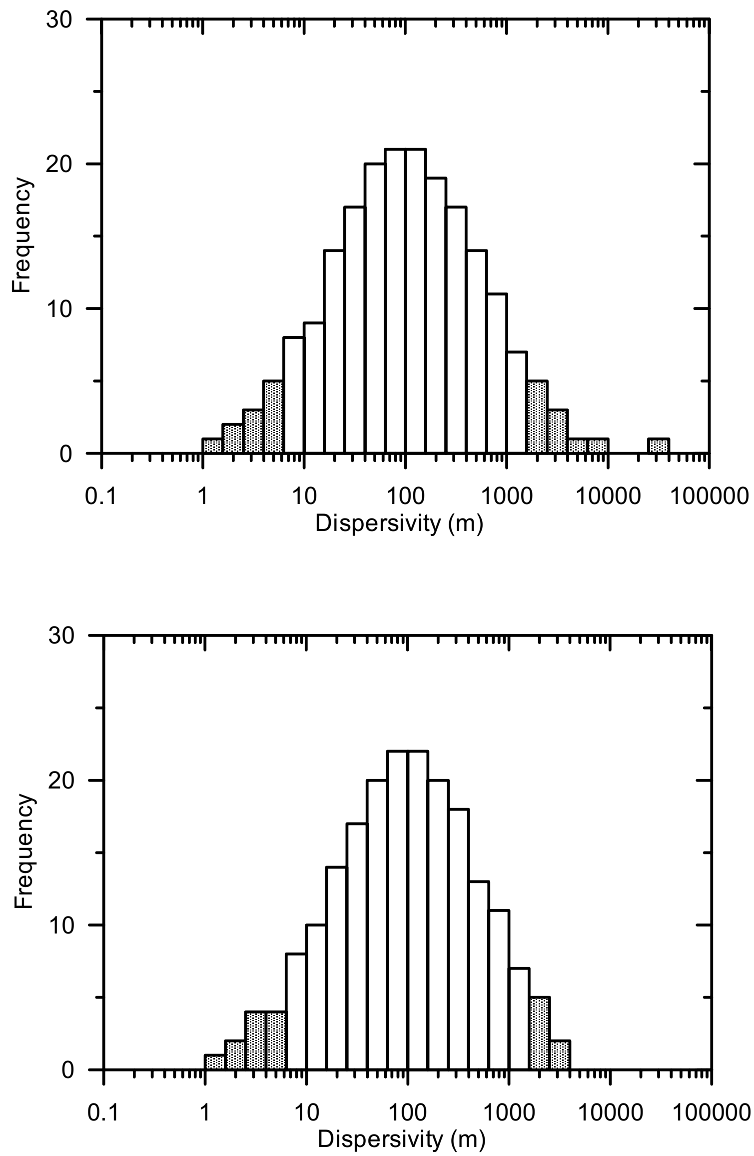
NOTE: CDF with an upper bound of −3.7 shown with the black line and the CDF with an upper bound of −3.6 shown with the red dashed line.

Figure 6-1[b]. Cumulative Distribution Functions of the Uncertainty Distribution for Colloid Concentration

6.5.2.1[b] Dispersivity

The uncertainty distribution for longitudinal dispersivity used in the SZ one-dimensional transport model has been reevaluated based on concerns that the unbounded log-normal distribution for this parameter can result in sampling of unreasonably large values for longitudinal dispersivity. Examination of data on longitudinal dispersivity as a function of length scale presented by Neuman (1990 [DIRS 101464], Figure 1) indicates that estimated values of this parameter vary from a few tens of meters to about 1000 m at the length scale of approximately 20 km. Although the uncertainty in longitudinal dispersivity extends beyond the range of the limited data, it is reasonable to infer that the longitudinal dispersivity would not be greater than several thousand meters at the representative length scale for radionuclide transport in the saturated zone at Yucca Mountain. Consequently, the uncertainty distribution for longitudinal dispersivity in the SZ one-dimensional transport model has been redefined by truncating the log-normal distribution from the SZ expert elicitation (CRWMS M&O 1998 [DIRS 100353]) at two standard deviations above the geometric mean. This upper limit to the distribution corresponds to a value of 3162 m for longitudinal dispersivity. The uncertainty distribution for longitudinal dispersivity in the SZ flow and transport abstraction model is not truncated because the values of dispersivity input to the model are reduced by one order of magnitude, as described in Section 6.5.2.9.

The redefinition of the uncertainty distribution for longitudinal dispersivity in the SZ one-dimensional transport model only has a significant impact on the sampling of a few realizations at the upper end of the distribution. Figure 6-2[b] shows the histogram of sampled values of longitudinal dispersivity without truncation of the log-normal distribution in the upper plot and with truncation in the lower plot.



Sources: Output DTNs: SN0702PASZFTMA.002 (Revision 001) and SN0710PASZFTMA.003 (Revision 000).

Figure 6-2[b]. Sampled Values of Longitudinal Dispersivity without Truncation of the Uncertainty Distribution (Upper Histogram) and with Truncation at Two Standard Deviations above the Mean (Lower Histogram)

6.5.3[b] Summary of Computational Models

The general computational modeling approach for SZ flow and transport used to provide results to TSPA has not changed from the documentation in Section 6.5.3 of the parent report. The SZ one-dimensional transport model is used to simulate radionuclide decay, ingrowth, and transport for the actinium series, neptunium series, thorium series, and uranium series decay chains (Section 6.5.1.2 of the parent report). The ingrowth of radionuclides beyond ^{239}Pu in the actinium series, beyond ^{237}Np in the neptunium series, beyond ^{236}U in the thorium series, and beyond ^{234}U in the uranium series is simulated in the SZ one-dimensional transport model.

Radionuclide mass arriving at the saturated zone (from the unsaturated zone) for the following radionuclides is routed through the three-dimensional SZ flow and transport abstraction model (using the SZ_Convolute software): ^{231}Pa, ^{229}Th, ^{232}Th, and ^{226}Ra. The mass of these four radionuclides arriving from the unsaturated zone is not routed through the SZ one-dimensional transport model because the SZ flow and transport abstraction model provides a more accurate method of simulating transport. The mass of these four radionuclides exiting the SZ flow and transport abstraction model is added to the mass exiting the SZ one-dimensional transport model (that has formed by ingrowth) to calculate the total mass released to the biosphere. All other radionuclides beyond ^{239}Pu in the actinium series, beyond ^{237}Np in the neptunium series, beyond ^{236}U in the thorium series, and beyond ^{234}U in the uranium series are simulated only in the SZ one-dimensional transport model or calculated assuming secular equilibrium at the interface with the biosphere, as appropriate.

6.6[b] BASE-CASE MODEL RESULTS

No changes to this section.

6.7[b] DESCRIPTION OF BARRIER CAPABILITY

No changes to this section.

6.8[b] GROSS ALPHA CONCENTRATION

No changes to this section.

6.9[b] EVALUATION OF GROUNDWATER FLOW RATE OBSERVATIONS AT WELL NC-EWDP-24PB

No changes to this section.

7[b]. VALIDATION

This section of the report documents the validation of the SZ flow and transport abstraction model and the SZ one-dimensional transport model. The general structure and implementation of the abstraction has not changed.

The importance of the SZ flow and transport abstraction model and the SZ one-dimensional transport model, and the validation activities for them, are directly related to the use of these models as abstractions of SZ flow and transport processes in the TSPA model. The model validation plan for the SZ flow and transport abstraction model and the SZ one-dimensional transport model is described in *Technical Work Plan for Saturated Zone Flow and Transport Modeling* (BSC 2006 [DIRS 177375]). The validation plan includes a comparison of simulated breakthrough curves from the SZ one-dimensional transport model with those from the underlying SZ site-scale transport model, including qualitative and quantitative comparisons between simulated radionuclide breakthrough curves for a nonsorbing species and neptunium. The plan was developed under BSC procedures in effect at the time. This is equivalent to Level I validation as required by SCI-PRO-002, *Planning for Science Activities*. Level I validation is justified if a favorable comparison of these results can be obtained, because the underlying process model will be already validated (SNL 2007 [DIRS 177392]). Validation of the SZ flow and transport abstraction model and the SZ one-dimensional transport model is accomplished by the following postdevelopment validation method, as required by SCI-PRO-006, Section 6.3.2:

- Corroboration of abstraction model results to the results of the validated mathematical model or process model from which the abstraction model was derived.

7.1[b] VALIDATION PROCEDURES

The validation procedures are the same as those described in Section 7.1 of the parent report. The parameter values for the median, fast, and slow cases are given in Table 7-1[b].

Table 7-1[b]. Parameter Values in the Three Cases for SZ Transport Model Validation

Parameter Name	Parameter Description	Median Case	Fast Case	Slow Case
FISVO	Flowing interval spacing in volcanic units	25.8 m	45.8 m	7.24 m
HAVO	Ratio of horizontal anisotropy in permeability	4.2	16.25	1.0
LDISP	Longitudinal dispersivity	2.0 (100 m)	2.96 (920 m)	1.03 (10.9 m)
FPLANW	Northwestern boundary of the alluvial uncertainty zone	0.5	0.1	0.9
NVF26	Effective porosity in shallow alluvium	0.18	0.114	0.245

Table 7-1[b]. Parameter Values in the Three Cases for SZ Transport Model Validation (Continued)

Parameter Name	Parameter Description	Median Case	Fast Case	Slow Case
NVF11	Effective porosity in undifferentiated valley fill	0.18	0.114	0.245
FPVO	Fracture porosity in volcanic units	−3.0 (10^{-3})	−3.89 (1.29×10^{-4})	−1.50 (0.0316)
DCVO	Effective diffusion coefficient in volcanic units	−10.3 (5.0×10^{-11} m^2/s)	−10.68 (2.08×10^{-11} m^2/s)	−9.65 (2.22×10^{-10} m^2/s)
GWSPD	Groundwater specific discharge multiplier	0.0 (1.0)	0.394 (2.48)	−0.394 (0.404)
bulkdensity	Bulk density of alluvium	1,910 kg/m^3	1,810 kg/m^3	2,010 kg/m^3
KDNPVO	Neptunium sorption coefficient in volcanic units	1.3 mL/g	1.04 mL/g	1.6 mL/g
KDNPAL	Neptunium sorption coefficient in alluvium	6.35 mL/g	4.26 mL/g	8.44 mL/g

NOTES: Values in parentheses are the parameter values from log-transformed uncertainty distributions.

Values in this table have been calculated from the parameter uncertainty distributions given in Table 6-7[a] and Table 6-8 of the parent report.

The longitudinal dispersivity is not increased by one order of magnitude in the SZ one-dimensional transport model for the validation test cases, as discussed in Section 6.5.1.2[b].

7.1.1[b] SZ Flow and Transport Abstraction Model

No changes to this section.

7.1.2[b] SZ One-Dimensional Transport Model

No changes to this section.

7.2[b] VALIDATION CRITERIA

No changes to this section.

7.3[b] RESULTS OF VALIDATION ACTIVITIES

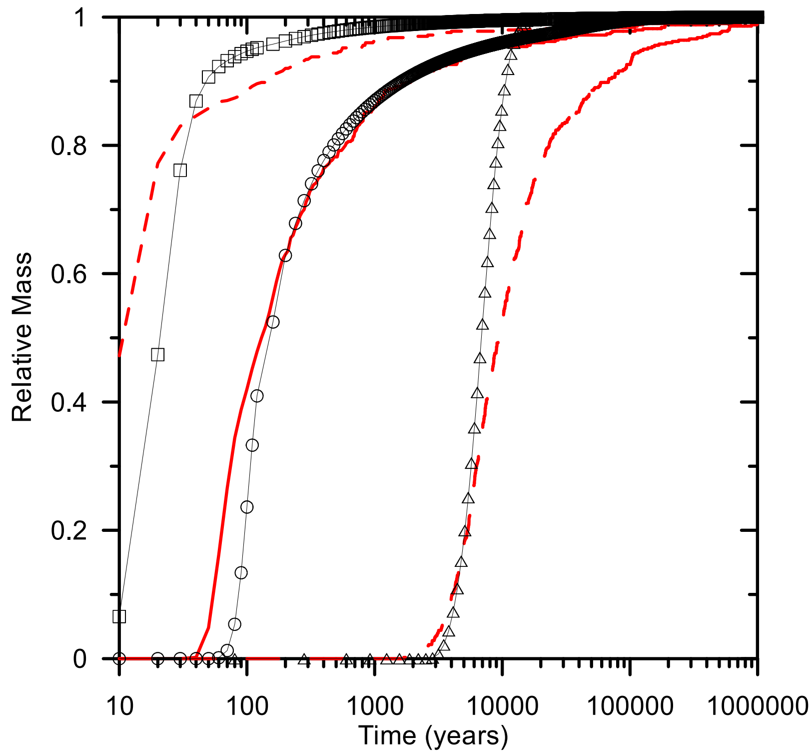
No changes to this section.

7.3.1[b] SZ Flow and Transport Abstraction Model Validation Results

No changes to this section.

7.3.2[b] Saturated Zone One-Dimensional Transport Model Validation Results

Results of the SZ one-dimensional transport model and the SZ site-scale transport model for a nonsorbing species are shown as simulated breakthrough curves in Figure 7-1[b]. This figure shows results for the median, fast, and slow cases of saturated zone transport. All simulations were conducted without radioactive decay. The simulated breakthrough curves from the SZ site-scale transport model are shown with the solid and dashed lines for the three cases. The results from the SZ one-dimensional transport model are shown as the open symbols superimposed on the breakthrough curves from the SZ site-scale transport model.



Source: SNL 2007 [DIRS 177392].

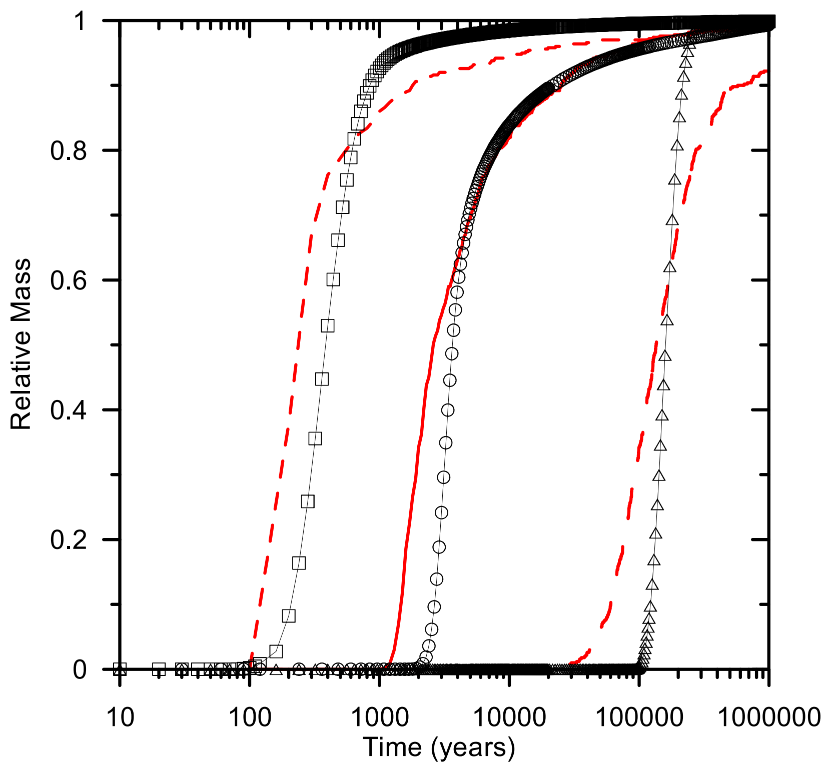
NOTE: Results from the SZ site-scale transport model are shown for the median case (solid line), fast case (short-dashed line), and slow case (long-dashed line). Results from the SZ one-dimensional transport model are shown for the median case (open circle), fast case (open square), and slow case (open triangle). Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay.

Figure 7-1[b]. Simulated Breakthrough Curves Comparing the Results of the SZ One-Dimensional Transport Model and the SZ Site-Scale Transport Model for a Nonsorbing Radionuclide

Visual comparison of the open symbols and the lines in Figure 7-1[b] indicates approximate agreement in the results for a nonsorbing species from the SZ one-dimensional transport model and the SZ site-scale transport model for the median case of SZ transport. There is generally close comparison in the overall shapes of the breakthrough curves from the SZ one-dimensional transport model and the SZ site-scale transport model, as indicated by the times of 10%, 50%, and 90% of mass breakthrough, with the notable exception of the 90% breakthrough for the slow case. Differences between the SZ one-dimensional transport model and the SZ site-scale transport model results for the fast case and the slow case are greater than for the median case, with greater deviation occurring for the upper tails of the breakthrough curves. Differences are most pronounced for the upper tails of the breakthrough curves in the slow case, for which the 90% breakthrough from the SZ site-scale transport model occurs at about 67,900 years and the 90% breakthrough from the SZ one-dimensional transport model occurs at about 10,700 years. As a consequence of this difference, radionuclide mass would be simulated to arrive at the accessible environment sooner in the SZ one-dimensional model for realizations with slower SZ transport. The underestimate of transport times in the saturated zone by the SZ one-dimensional transport model in these realizations leads to simulated consequences that occur sooner and higher simulated dose consequences in TSPA.

The change to the SZ one-dimensional transport model with regard to longitudinal dispersivity, as described in Section 6.5.1.2[b], has greater impacts on the model validation test results for the fast and median cases than for the slow case. Comparison of Figure 7-1[b] with Figure 7-4[a] indicates that the lower tail of the breakthrough curve for the median case does not match the results from the SZ site-scale transport model as closely when the longitudinal dispersivity is not increased by one order of magnitude in the SZ one-dimensional transport model. Similarly, the lower tail of the breakthrough curve for the fast case matches the results from the SZ site-scale transport model less closely when the longitudinal dispersivity is not increased by one order of magnitude in the SZ one-dimensional transport model. However, the differences in simulated transport times for the fast and median validation test cases are on the order of a few years to a few tens of years, which is small relative to the time scale of TSPA analyses and the overall uncertainty in transport times through the saturated zone.

Results of the SZ one-dimensional transport model and the SZ site-scale transport model for neptunium are shown as simulated breakthrough curves in Figure 7-2[b]. This figure shows results for the median, fast, and slow cases of saturated zone transport. All simulations were conducted without radioactive decay. The simulated breakthrough curves from the SZ site-scale transport model are shown with the solid and dashed lines for the three cases. The results from the SZ one-dimensional transport model are shown as the open symbols superimposed on the breakthrough curves from the SZ site-scale transport model.



Source: SNL 2007 [DIRS 177392].

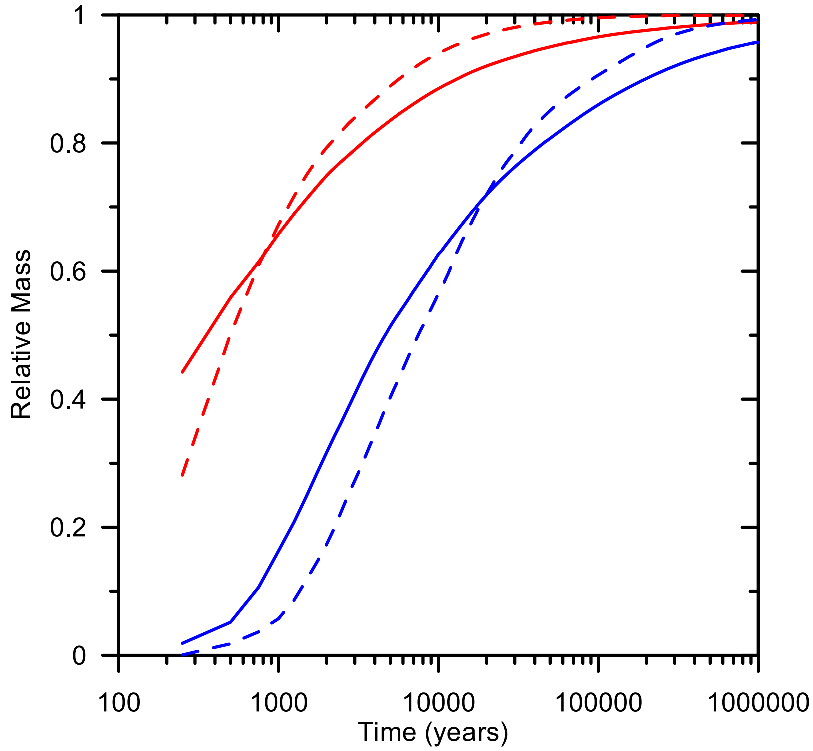
NOTE: Results from the SZ site-scale transport model are shown for the median case (solid line), fast case (short-dashed line), and slow case (long-dashed line). Results from the SZ one-dimensional transport model are shown for the median case (open circle), fast case (open square), and slow case (open triangle). Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay.

Figure 7-2[b]. Simulated Breakthrough Curves Comparing the Results of the Saturated Zone One-Dimensional Transport Model and the Saturated Zone Site-Scale Transport Model for Neptunium

Visual comparison of the open symbols and the lines in Figure 7-2[b] indicates approximate agreement in the results for neptunium from the SZ one-dimensional transport model and the SZ site-scale transport model for the median case of saturated zone transport. There is generally close comparison in the overall shapes of the breakthrough curves from the SZ one-dimensional transport model and the SZ site-scale transport model, as indicated by the times of 10%, 50%, and 90% of mass breakthrough, with the exception of the upper and lower tails of the slow case. For the slow case, 10% mass breakthrough is simulated to occur at about 60,300 years in the SZ site-scale transport model and at about 123,000 years in the SZ one-dimensional transport model; 90% mass breakthrough is simulated to occur at about 574,000 years in the SZ site-scale transport model and at about 216,000 years in the SZ one-dimensional transport model. Differences between the SZ one-dimensional transport model and the SZ site-scale transport model results for the fast case and the slow case are generally greater than for the median case. Differences are most pronounced for the breakthrough curves in the slow case. However, there is generally good agreement between the results from the SZ one-dimensional transport model and the SZ site-scale transport model at the mid-points of the breakthrough curves. Because the midpoints of the breakthrough curves approximately match, the bulk of the neptunium mass arrival at the accessible environment is accurately simulated by the SZ one-dimensional transport model. As a consequence of the differences in the upper and lower tails for the slow case, early arrival (and dose consequences) are underestimated by the SZ one-dimensional transport model, and later arrival (and dose consequences) are overestimated in the TSPA.

Comparison of Figure 7-2[b] with Figure 7-5[a] for simulated neptunium transport indicates that the lower tail of the breakthrough curve for the median case does not match the results from the SZ site-scale transport model as closely when the longitudinal dispersivity is not increased by one order of magnitude in the SZ one-dimensional transport model. Similarly, the lower tail of the breakthrough curve and the median transport time for the fast case matches the results from the SZ site-scale transport model less closely when the longitudinal dispersivity is not increased by one order of magnitude in the SZ one-dimensional transport model. However, the differences in simulated transport times for the fast and median validation test cases are not large relative to the overall uncertainty in neptunium transport times through the saturated zone.

Results of the SZ one-dimensional transport model and the SZ flow and transport abstraction model, expressed as the mean breakthrough curves from 200 realizations, for a nonsorbing species and neptunium are shown and compared in Figure 7-3[b]. These average results indicate similar behavior for the two models, with somewhat less apparent dispersion exhibited by the SZ one-dimensional transport model relative to the SZ flow and transport abstraction model. The SZ one-dimensional transport model results indicate somewhat slower simulated transport at early times and faster simulated transport at later times for both a nonsorbing species and for neptunium, on average, relative to the SZ flow and transport abstraction model.



NOTES: Mean results from the SZ flow and transport abstraction model are shown with the solid lines and the mean results from the SZ one-dimensional transport model are shown with the dashed lines. Results for a nonsorbing species are shown in red and for neptunium are shown in blue. Breakthrough curves are for glacial-transition climatic conditions and do not include radioactive decay.

Figure 7-3[b]. Simulated Breakthrough Curves Comparing the Results of the SZ Flow and Transport Abstraction Model and the Saturated Zone One-Dimensional Transport Model for a Nonsorbing Radionuclide and Neptunium for the Mean of 200 Realizations

7.4[b] CONCLUSIONS

7.4.1[b] SZ Flow and Transport Abstraction Model Validation

No changes to this section.

7.4.2[b] Saturated Zone One-Dimensional Transport Model Validation

Validation testing of the SZ one-dimensional transport model indicates acceptable agreement with the SZ site-scale transport model (SNL 2007 [DIRS 177392]). Qualitative acceptance criteria regarding the comparison of the simulated breakthrough curves with the results of the SZ site-scale transport model are met. Results of the validation testing indicate that the SZ one-dimensional transport model is valid for the approximate range of uncertainty incorporated into the model through parameter uncertainty distributions. Results also indicate that the SZ one-dimensional transport model is valid for both nonsorbing and sorbing radionuclide species for its intended use.

It is relevant to consider the purpose and use of the SZ one-dimensional transport model in the evaluation of validation testing results. This model is used for the purpose of simulating radioactive decay and ingrowth for four decay chains. This simplified model is required because the SZ transport abstraction model is not capable of simulating ingrowth by radioactive decay. The results of the SZ one-dimensional transport model are used only for the decay products in these decay chains within the TSPA-LA analyses (SNL 2007 [DIRS 178871], Section 6.3.10).

It must also be considered that there are fundamental differences between the SZ one-dimensional transport model and the SZ site-scale transport model that limit the degree of consistency that can be expected between these two models. Groundwater flow and radionuclide transport simulation in the SZ site-scale transport model (SNL 2007 [DIRS 177392]) occur in three dimensions with a relatively complex representation of geological heterogeneity from the hydrogeologic framework model. The updated SZ site-scale transport model includes the changes to the underlying SZ site-scale flow model, which include significantly higher contrasts in permeability among the hydrogeologic units along the flow path from beneath the repository. These increased contrasts in permeability in the updated three-dimensional SZ site-scale flow model lead to the migration of some particles into lower-permeability units through the process of transverse dispersion. This process in turn results in longer upper tails in the simulated breakthrough curves from the SZ site-scale transport model. The SZ one-dimensional transport model does not include such hydrogeological heterogeneity, or the process of transverse dispersion, so it is not capable of simulating the tailing behavior produced by the SZ site-scale transport model. For the reasons stated above, the comparisons in validation test cases between the updated SZ one-dimensional transport model and the updated SZ site-scale transport model are not as close in this addendum as those reported for the previous models in Section 7.3.2.

Radionuclide transport in the SZ one-dimensional transport model is simulated in a significantly simplified representation of the SZ system consisting of three pipe segments. Each pipe segment has properties that represent the average characteristics in that area of the SZ site-scale transport model. There are also variations in the source location within the four source regions beneath the repository simulated by the SZ transport abstraction model that are not incorporated in the SZ one-dimensional transport model on a realization-by-realization basis, as discussed in Section 7.1.2.

Another difference between the SZ one-dimensional transport model and the SZ transport abstraction model is the way in which changes in groundwater flux related to climate change are handled. A fundamental limitation to the Laplace transform solution used by the GoldSim software code to simulate radionuclide transport in the "pipe" module is that radionuclide mass in transit through a particular pipe segment does not change its rate of migration once it enters a specific pipe segment. Consequently, radionuclide mass that has entered a pipe segment in the SZ one-dimensional transport model before increased flow rates are imposed at 600 and 2,000 years for the monsoonal and glacial-transition climate states in the TSPA-LA model, would not be instantaneously accelerated, as it is in the SZ transport abstraction model. Because peak releases of radionuclides to the saturated zone are not expected to occur within the first 2,000 years of the TSPA-LA simulations, this limitation to the SZ one-dimensional transport model is unlikely to have a significant impact on the simulation results.

Comparison of simulation results from the SZ one-dimensional transport model and the SZ flow and transport abstraction model shows that there are differences for individual realizations, as used in the TSPA-LA analyses. However, when results are averaged over numerous realizations the ensemble behavior of the SZ one-dimensional transport model is similar to the SZ flow and transport abstraction model (see Figure 7-3[b]). This indicates that there is little consistent bias in the simulation results from the SZ one-dimensional transport model relative to the SZ flow and transport abstraction model with regard to average transport time of radionuclide mass through the saturated zone. The SZ one-dimensional transport model does exhibit less apparent dispersion than the SZ flow and transport abstraction model for the reasons discussed above. Given this finding and the intended use of the SZ one-dimensional transport model for the simulation of decay chain products only, differences in the results with the SZ flow and transport abstraction model for individual realizations are acceptable.

Considering these factors, the SZ one-dimensional transport model provides an acceptable approximation of simulated radionuclide transport in the three-dimensional system of the saturated zone. No future activities are needed to complete this model validation for its intended use.

7.4.3[b] Validation Summary

The SZ flow and transport abstraction model and the SZ one-dimensional transport model have been validated by applying acceptance criteria based on an evaluation of the relative importance of the models to the potential performance of the repository system. All relevant validation requirements have been fulfilled, including corroboration of model results with comparison to the model from which they were derived and publication of the general approach in a refereed professional journal (Arnold et al. 2003 [DIRS 163857]). Activities requirements for confidence building during model development have also been satisfied. The model development activities and post-development validation activities described establish the scientific bases for the SZ flow and transport abstraction model and the SZ one-dimensional transport model. Models used to simulate the transport of radionuclides in the saturated zone are sufficiently accurate and adequate for intended use if they model radionuclide mass output as a function of time, consistent with the underlying transport model (SZ site-scale transport model), given that uncertainty of input parameters may impact simulated transport times by several orders of magnitude. Other criteria for accuracy and adequacy are radionuclide mass balance and non-biased ensemble transport behavior among multiple realizations, which were addressed in model validation activities. Based on these criteria, the SZ flow and transport abstraction model and the SZ one-dimensional transport model used in this report are considered to be sufficiently accurate and adequate for the intended purpose and to the level of confidence required by the models' relative importance to the potential performance of the repository system.

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8[b]. CONCLUSIONS

8.1[b] SUMMARY OF MODELING ACTIVITY

The SZ one-dimensional transport model is updated to include changes regarding the scaling of longitudinal dispersivity, the uncertainty distribution for longitudinal dispersivity, and the calculation of the free water diffusion coefficient. The SZ flow and transport abstraction model is updated to include changes in the values of the half-life of ^{79}Se and ^{126}Sn. The uncertainty in the longitudinal dispersivity has been reevaluated in consideration of values that can be sampled from the upper tail of the log-normal distribution and their reasonableness.

Validation testing of the updated SZ one-dimensional transport model is conducted and documented in Section 7[b]. Validation testing methods are the same as those previously used, as described in Section 7.1 of the parent report. Validation testing results for the SZ one-dimensional transport model with regard to its comparison to the SZ site-scale transport model and ensemble average results relative to the SZ flow and transport abstraction model indicate that the validation criteria have been met. Although comparisons between the SZ one-dimensional transport model and the SZ site-scale transport model are not as close as previously reported in Section 7.3.2 of the parent report, the comparisons for the updated SZ one-dimensional transport model in this addendum are acceptable and discussed in Section 7.4.2[b]. The updated SZ one-dimensional transport model documented in this addendum is considered to be sufficiently accurate and adequate for the intended purpose of use in the TSPA model and to the level of confidence required by the models' relative importance to the potential performance of the repository system.

Corrective action item CR (Condition Report) 11345 has been addressed with output DTN: SN0702PASZFTMA.002 (Revision 001) from this addendum. A qualified version of the GoldSim software, GoldSim V. 9.60.100 (STN: 10344-9.60-01 [DIRS 181903]), was used for the SZ one-dimensional transport model to address CR 11345.

8.2[b] MODEL OUTPUTS

8.2.1[b] Developed Output

The technical output from this addendum is given in the two DTNs summarized in Table 8-1[b].

Table 8-1[b]. Summary of Developed Output

Output DTN	Description
SN0702PASZFTMA.002 (Revision 001)	Input and output files for the updated SZ one-dimensional transport model. This DTN also contains the sampled parameter values for the 200 realizations, tabulated input values for the SZ one-dimensional transport model, and estimated gross alpha concentration in groundwater. The following changes have been made relative to Revision 000: - The values of longitudinal dispersivity have been increased by one order of magnitude above the sampled values. - The free water diffusion coefficient is divided by 1 instead of being divided by the average tuff matrix porosity. - The input file for the SZ one-dimensional transport model was developed using a qualified version of the GoldSim software, GoldSim V. 9.60.100 (STN: 10344-9.60-01 [DIRS 181903]).
SN0710PASZFTMA.003 (Revision 000)	Input and output files for the updated SZ one-dimensional transport model. This DTN also contains the sampled parameter values for the 200 realizations, updated tabulated input values for the SZ one-dimensional transport model, and estimated gross alpha concentration in groundwater. This output DTN contains the updated SZ one-dimensional transport model for use in the TSPA model documented in SNL 2007 [DIRS 183478], which is an addendum to the TSPA model utilized for regulatory compliance analyses (SNL 2007 [DIRS 178871]). The following changes have been made relative to SN0702PASZFTMA.002 (Revision 001): - The values of longitudinal dispersivity are not increased by one order of magnitude above the sampled values. - The values of half-life for ^{79}Se and ^{126}Sn have been changed in the SZ flow and transport abstraction model.

Model output related to the SZ one-dimensional transport model is contained in output DTN: SN0702PASZFTMA.002 (Revision 001). The SZ one-dimensional transport model files contained in this DTN are used in the TSPA model runs for regulatory compliance analyses documented in *Total System Performance Assessment Model/Analysis for the License Application* (SNL 2007 [DIRS 178871], Section 6.3.10). These results include the sampled values of the uncertain parameters that were used in the 200 realizations of the SZ flow and transport abstraction model and that are tabulated in Appendix A[a]. The results also include a stand-alone version of the SZ one-dimensional transport model implemented in the GoldSim V. 9.60.100 software code and intended for direct incorporation into the TSPA model. The uncertain parameters are included in the stand-alone version of the SZ one-dimensional transport model as arrays of parameter values within the model. Tabulated values of parameters that are used to match approximately the specific discharge and groundwater flow paths from the SZ site-scale transport model are also documented in output DTN: SN0702PASZFTMA.002 (Revision 001). Estimates of the background gross alpha concentration in groundwater are also contained in this DTN.

Updated model output related to the SZ one-dimensional transport model are contained in output DTN: SN0710PASZFTMA.003. The updated SZ one-dimensional transport model files contained in this DTN are used in the additional TSPA model runs documented in Addendum 01 of *Total System Performance Assessment Model /Analysis for the License Application* (SNL 2007 [DIRS 183478]). These results also include the sampled values of the uncertain parameters used in the updated SZ one-dimensional transport model, including the values of longitudinal dispersivity sampled using the truncated log-normal distribution documented in Section 6.5.2.1[b] and tabulated in Table A-1[b]. The changes to the SZ one-dimensional transport model listed in Table 8-1[b] for output DTN: SN0702PASZFTMA.002 (Revision 001) are also included in output DTN: SN0710PASZFTMA.003, with the exception of the values of longitudinal dispersivity being increased by one order of magnitude above the sampled value.

8.2.2[b] Output Uncertainties and Limitations

The assessment of uncertainty in model parameters and model outputs is an integral part of the performed analyses in this report. Uncertainty in model parameters is quantitatively represented by the statistical distributions developed and given in Table 6-8, Table 6-7[a], and Table 6-1[b]. The SZ one-dimensional transport model is intended for direct incorporation into the TSPA-LA model, with which uncertainty will be assessed using Monte Carlo probabilistic analyses.

All relevant uncertainties in data and model parameters, with respect to their effect upon groundwater flow and radionuclide transport, have been included in the updated SZ one-dimensional transport model documented in this addendum. These output uncertainties address the requirements of Acceptance Criterion 3 of *Yucca Mountain Review Plan, Final Report* (NRC 2003 [DIRS 163274], Sections 2.2.1.3.8 and 2.2.1.3.9) for the propagation of data uncertainty through model abstraction for flow paths in the saturated zone and for radionuclide transport in the saturated zone.

Use of the updated SZ one-dimensional transport model is subject to the limitations and restrictions imposed by the assumptions listed in Sections 5, 6.3, and 6.5 of the parent report. Limitations in knowledge of specific parameter values are addressed in this report in the analysis of parameter uncertainties.

8.2.3[b] Output to TSPA

Both output DTNs listed in Table 8-1[b] contain product output intended for use in the TSPA model. The stand-alone versions of the SZ one-dimensional transport model are intended for direct incorporation into the TSPA model. The SZ one-dimensional transport model in ouput DTN: SN0702PASZFTMA.002 (Revision 001) is used in the TSPA model for regulatory compliance analyses (SNL 2007 [DIRS 178871]). The SZ one-dimensional transport model in output DTN: SN0710PASZFTMA.003 is used for the additional TSPA model analyses in Addendum 01 of *Total System Performance Assessment Model /Analysis for the License Application* (SNL 2007 [DIRS 183478]).

8.3[b] YUCCA MOUNTAIN REVIEW PLAN ACCEPTANCE CRITERIA

No changes to this section.

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9[b]. INPUTS AND REFERENCES

9.1[b] DOCUMENTS CITED

163857 Arnold, B.W.; Kuzio, S.P.; and Robinson, B.A. 2003. "Radionuclide Transport Simulation and Uncertainty Analyses with the Saturated-Zone Site-Scale Model at Yucca Mountain, Nevada." Journal of Contaminant Hydrology, 62-63, 401-419. New York, New York: Elsevier. TIC: 254205.

177375 BSC 2006. *Technical Work Plan for Saturated Zone Flow and Transport Modeling*. TWP-NBS-MD-000006 REV 02. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20060519.0002.

100353 CRWMS M&O 1998. *Saturated Zone Flow and Transport Expert Elicitation Project*. Deliverable SL5X4AM3. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.19980825.0008.

101464 Neuman, S.P. 1990. "Universal Scaling of Hydraulic Conductivities and Dispersivities in Geologic Media." *Water Resources Research, 26,* (8), 1749-1758. Washington, D.C.: American Geophysical Union. TIC: 237977.

163274 NRC (U.S. Nuclear Regulatory Commission) 2003. *Yucca Mountain Review Plan, Final Report.* NUREG-1804, Rev. 2. Washington, D.C.: U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. TIC: 254568.

180472 SNL (Sandia National Laboratories) 2007. *Initial Radionuclides Inventories.* ANL-WIS-MD-000020 REV 01 ADD 01. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20050927.0005; DOC.20070801.0001.

181650 SNL 2007. *Saturated Zone Flow and Transport Model Abstraction.* MDL-NBS-HS-000021 REV 03 AD 01. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20050808.0004; DOC.20070913.0002.

177392 SNL 2007. *Site-Scale Saturated Zone Transport*. MDL-NBS-HS-000010 REV 03. Las Vegas, Nevada: Sandia National Laboratories. ACC: DOC.20070822.0003.

178871 SNL 2007. *Total System Performance Assessment Model /Analysis for the License Application.* MDL-WIS-PA-000005 REV 00. Las Vegas, Nevada: Sandia National Laboratories.

183478 SNL 2008. *Total System Performance Assessment Model /Analysis for the License Application.* MDL-WIS-PA-000005 REV 00 AD 01. Las Vegas, Nevada: Sandia National Laboratories.

9.2[b] CODES, STANDARDS, REGULATIONS, AND PROCEDURES

IM-PRO-003, *Software Management*.

SCI-PRO-002, *Planning for Science Activities*.

SCI-PRO-006, *Models*.

9.3[b] SOURCE DATA, LISTED BY DATA TRACKING NUMBER

184393 LA0703SK150304.001. Base Case SZ Transport Model. Submittal date: 03/12/2007.

148744 MO0003SZFWTEEP.000. Data Resulting from the Saturated Zone Flow and Transport Expert Elicitation Project. Submittal date: 03/06/2000.

179925 MO0702PASTREAM.001. Waste Stream Composition and Thermal Decay Histories for LA. Submittal date: 02/15/2007.

184432 SN0712CORMATRX.001. IMPLEMENTATION OF CORRELATION MATRIX FOR SORPTION COEFFICIENTS IN THE SATURATED ZONE (SZ). Submittal date: 12/17/2007.

9.4[b] OUTPUT DATA

SN0702PASZFTMA.002 Revision 001. Saturated Zone 1-D Transport Model. Submittal date: 02/15/2007.

SN0710PASZFTMA.003. Updated Saturated Zone 1-D Transport Model. Submittal Date: 10/10/2007.

9.5[b] SOFTWARE CODES

179419 FEHM V. 2.24-01. 2007. WIN2003, 2000, & XP, Red Hat Linux 2.4.21, OS 5.9. STN: 10086-2.24-01-00.

179360 GOLDSIM V. 8.02 500. 2006. WINDOWS 2003. STN: 10344-8.02-06.

181903 Goldsim V. 9.60.100. 2007. WIN 2000, 2003, XP. STN: 10344-9.60-01.

APPENDIX A[b]
SAMPLED PARAMETER VALUES

A[b]. SAMPLED PARAMETER VALUES

This appendix contains the stochastic parameter values sampled for 200 realizations of the updated SZ one-dimensional transport model, as documented in output DTN: SN0710PASZFTMA.003. These parameter vectors were sampled using the uncertainty distributions described in Sections 6.5.2[a] and 6.5.2[b]. The parameter sampling was performed using the GoldSim V. 8.02.500 (STN: 10344-8.02-06 [DIRS 179360]) software code. The sampled parameter values in Table A-1[b] are the same as those tabulated in Table A-1[a], except for the sampled values of longitudinal dispersivity (parameter LDISP). Note that the updated parameter sampling presented in Table A-1[b] applies only to the SZ one-dimensional transport model and not to the SZ flow and transport abstraction model.

Table A-1[b]. Sampled Stochastic Parameter Values

Real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
1	0.61331	0.17939	0.24512	10.257	−3.8248	−11.253	1.1817	2.9452	246.09	23.459
2	0.13684	0.11408	0.11487	22.269	−2.1908	−10.542	1.3694	8.2906	57.7	268.4
3	0.97133	0.18689	0.20301	18.913	−1.0748	−10.369	1.8269	12.081	212.28	271.29
4	0.95304	0.15792	0.21281	52.51	−4.0288	−10.449	1.2424	4.7998	376.71	385.73
5	0.3768	0.21127	0.083927	14.218	−3.2734	−9.9334	1.0164	4.109	295.41	79.685
6	0.72993	0.14731	0.21163	18.769	−3.0427	−10.626	1.322	7.4549	111.5	250.11
7	0.11323	0.10118	0.16575	19.99	−3.1508	−9.5171	2.6553	8.6105	326.66	338.21
8	0.30199	0.26624	0.10631	20.77	−3.9555	−10.391	1.4026	4.8485	257.15	42.679
9	0.54047	0.22131	0.21951	27.403	−3.8841	−10.355	1.0622	2.6305	350.11	26.914
10	0.69878	0.24485	0.09997	30.185	−2.0052	−10.148	1.4271	6.7358	218.13	130.56
11	0.69208	0.16297	0.16612	44.619	−3.4103	−9.8462	1.3	5.5138	211.79	183.98
12	0.51855	0.16177	0.17671	38.727	−2.7493	−9.6179	1.6627	8.1609	151.2	200.41
13	0.86084	0.17432	0.18663	32.494	−2.8833	−9.9251	1.4132	5.9924	162.29	277.14
14	0.74071	0.12117	0.20404	15.149	−2.114	−10.469	1.153	4.3631	268.92	186.37
15	0.14179	0.21335	0.19217	12.735	−1.2718	−10.2	1.5827	3.0094	361.81	26.353
16	0.53666	0.23757	0.22169	17.932	−3.7174	−10.51	1.7619	7.6895	215.94	146.87
17	0.78472	0.1764	0.15444	31.651	−2.8256	−10.457	1.6384	6.0547	110.36	113.83
18	0.084835	0.14338	0.087999	19.427	−3.9712	−10.267	1.1782	8.3188	25.249	269.35
19	0.092993	0.16874	0.12009	45.896	−1.1551	−9.3046	0.91245	6.7585	97.202	363.07
20	0.22141	0.19893	0.18049	25.202	−3.6338	−10.606	1.3951	6.7553	161.95	96.782
21	0.15315	0.23131	0.07532	41.931	−2.7178	−10.28	1.7077	6.3558	189.56	228.11
22	0.73861	0.14775	0.17517	45.755	−2.5646	−10.364	1.0818	5.1216	206.15	242.25
23	0.16285	0.20725	0.1593	30.603	−1.4373	−11.221	1.7705	9.1354	312.38	393.72
24	0.19563	0.18585	0.16883	36.3	−2.2463	−10.472	1.2774	4.4344	147.66	43.013
25	0.82878	0.19173	0.26284	24.169	−4.7125	−10.179	1.1026	6.5225	73.878	108.03
26	0.90098	0.15347	0.17201	53.034	−3.2488	−10.428	1.6855	7.663	157.55	278.06
27	0.32094	0.11105	0.1861	47.548	−4.1457	−10.082	1.6724	5.2594	212.72	205.39
28	0.98722	0.23521	0.053929	26.173	−3.9616	−10.998	1.6665	7.6821	234.3	343.88
29	0.76688	0.12078	0.1676	40.105	−1.4805	−9.8115	1.0202	4.53	34.558	87.886
30	0.21118	0.17048	0.10311	37.393	−1.3229	−10.564	1.1762	5.1708	86.77	121.08

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
31	0.2609	0.10912	0.17843	56.897	−3.3455	−10.769	1.234	4.9639	333.22	201.53
32	0.3372	0.11284	0.19882	32.875	−3.8551	−10.131	1.2164	5.1362	131.84	62.16
33	0.037874	0.2104	0.16284	12.375	−1.2881	−10.259	1.0561	5.0719	51.021	218.43
34	0.36888	0.18025	0.18707	15.913	−4.319	−9.9468	1.1397	5.1333	154.89	150.66
35	0.033906	0.15763	0.13045	50.215	−2.3712	−10.312	1.6587	6.3303	228.97	235.34
36	0.49577	0.13898	0.19081	21.611	−3.1034	−10.459	1.2535	5.8076	251.41	191.71
37	0.7327	0.064858	0.1695	22.649	−1.7128	−10.317	1.1737	5.113	334.67	207.41
38	0.71257	0.17073	0.15785	53.94	−3.9375	−10.273	1.4827	5.9301	164.34	294.91
39	0.81858	0.17469	0.1795	8.0719	−2.9076	−10.422	1.1447	6.3066	297.14	375.59
40	0.39756	0.27779	0.11298	29.025	−3.5408	−10.244	1.3176	5.3474	323.29	48.898
41	0.10605	0.19533	0.17748	28.455	−1.2155	−10.058	1.7756	7.9786	250.13	255.2
42	0.35898	0.17567	0.15113	29.695	−3.119	−10.399	1.0095	4.6921	188.87	303.71
43	0.98413	0.18889	0.19525	16.636	−3.9954	−9.6862	1.1279	4.0434	262.36	45.807
44	0.079534	0.21288	0.19748	10.554	−2.9663	−10.08	1.8281	7.6967	156.47	163.25
45	0.70271	0.13104	0.095923	5.3765	−3.7591	−9.5589	1.2328	4.0952	321.26	65.759
46	0.68555	0.17212	0.14843	61.879	−4.2914	−9.9183	1.6086	7.2726	223.69	275.83
47	0.62997	0.048637	0.21442	23.234	−3.4446	−10.122	0.76079	4.323	23.181	201.89
48	0.38704	0.13991	0.20593	33.843	−2.9231	−10.638	1.7733	8.1005	219.86	191.24
49	0.80175	0.25328	0.17901	33.117	−3.0873	−9.9755	1.5942	7.2532	399.59	228.66
50	0.52885	0.25032	0.19922	38.882	−2.0279	−10.068	1.0254	4.6517	117.52	95.376
51	0.27162	0.15502	0.14136	19.725	−1.8908	−10.284	1.0078	4.3996	238.5	23.864
52	0.76468	0.14528	0.22367	17.599	−2.6102	−10.349	3.594	7.8597	373.39	224.32
53	0.55173	0.15182	0.14712	3.1707	−2.858	−10.671	1.6246	6.8611	359.4	243.94
54	0.96916	0.18828	0.17131	39.058	−1.9453	−9.8153	1.3378	4.7761	108.59	46.616
55	0.83325	0.25785	0.096324	25.546	−1.5205	−10.66	1.7176	6.6679	157.84	316.48
56	0.84697	0.21523	0.2761	34.879	−3.288	−10.051	1.779	6.433	337.89	324.1
57	0.66653	0.28314	0.20833	15.311	−3.3438	−9.9961	1.5248	7.2594	118.15	144.37
58	0.15725	0.20111	0.23127	31.001	−4.4429	−10.254	3.6245	7.7068	346.21	366.53
59	0.75492	0.1873	0.072509	46.571	−3.1668	−10.11	1.6655	6.2544	316.65	96.426
60	0.30986	0.1379	0.20891	56.24	−2.6185	−10.321	3.0443	8.4471	190.62	246.55
61	0.47933	0.19631	0.18439	9.0391	−3.4808	−9.979	1.17	2.634	143.21	29.314

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
62	0.77804	0.14847	0.19701	4.2004	−3.5141	−9.9163	5.3438	6.9297	112.03	99.622
63	0.34953	0.17999	0.18161	32.666	−3.6508	−10.614	1.0179	2.169	92.45	268.19
64	0.018099	0.22246	0.22977	20.074	−3.6972	−9.5041	1.7292	7.5766	114.1	366.12
65	0.14511	0.15072	0.20751	22.488	−2.2546	−9.9972	1.1232	6.3446	117.39	294.19
66	0.78618	0.17502	0.18945	13.137	−3.3942	−10.481	1.1099	5.9252	20.493	291.01
67	0.058215	0.19715	0.19132	12.625	−1.644	−10.129	1.5567	4.6816	391.61	360.06
68	0.46803	0.2408	0.15517	8.2387	−2.0934	−10.4	1.4433	4.6207	129.74	24.851
69	0.87844	0.22613	0.21365	36.546	−3.0917	−10.733	1.5708	7.2035	392.43	192.91
70	0.80687	0.18213	0.27987	7.1368	−2.2711	−10.492	2.833	8.2799	311.27	350.51
71	0.062208	0.23415	0.26998	41.211	−2.6728	−10.417	1.7121	8.0746	122.35	375.18
72	0.60382	0.15427	0.17439	36.133	−2.3075	−10.155	1.4673	7.0679	120.75	324.66
73	0.64922	0.24811	0.11975	4.0192	−2.4904	−10.536	1.1045	5.578	271.03	336.13
74	0.19266	0.21429	0.20577	48.627	−3.0257	−10.341	1.4944	6.5739	161.83	172.59
75	0.79283	0.21926	0.20281	31.427	−1.3395	−10.616	1.0961	5.7083	26.659	364.18
76	0.64422	0.18071	0.12158	34.279	−3.6824	−10.693	1.5493	8.505	299.78	159.21
77	0.41143	0.20249	0.19316	35.408	−3.8388	−11.053	1.5927	5.5644	372.03	174.38
78	0.91957	0.19013	0.25676	39.258	−1.5587	−10.004	1.4708	6.6078	52.538	125.82
79	0.75838	0.11607	0.18122	12.144	−2.9452	−10.574	1.0214	5.12	63.55	390.4
80	0.57455	0.22788	0.19986	18.165	−2.6487	−9.7701	1.5021	8.1849	158.85	311.48
81	0.066521	0.10282	0.22548	35.8	−2.526	−10.375	1.5144	5.0136	285.09	53.73
82	0.41883	0.22329	0.13661	9.172	−2.1389	−11.108	1.247	5.151	387.74	196.34
83	0.5453	0.13476	0.24087	20.734	−3.7423	−10.506	1.1003	3.9041	245.21	40.867
84	0.45269	0.15697	0.11679	9.4335	−3.9283	−9.9037	1.1585	6.1692	137.81	176.8
85	0.096493	0.17871	0.22874	44.229	−3.6095	−11.122	1.6303	4.6337	390.84	249.21
86	0.34271	0.12544	0.22486	24.625	−3.7092	−9.4071	1.0429	5.1099	33.707	169.1
87	0.32868	0.13686	0.20156	9.9218	−2.5733	−10.297	1.5986	7.4078	220.4	308.99
88	0.6793	0.17136	0.29058	14.51	−3.0518	−9.4712	1.2164	6.6854	38.729	194.38
89	0.40949	0.20964	0.16791	36.855	−2.4667	−9.3754	3.8709	8.6222	272.63	284.31
90	0.42029	0.24328	0.23031	39.898	−3.8094	−10.49	1.2193	5.9396	228.1	174.63
91	0.52282	0.17748	0.13717	23.912	−1.5273	−10.554	1.0907	5.5556	128.72	378.65
92	0.68067	0.21231	0.10727	21.121	−1.0366	−10.499	1.5896	6.4951	184.21	118.99

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
93	0.085228	0.22374	0.16178	22.934	−2.7725	−10.142	1.5473	6.9479	314.62	362.88
94	0.88372	0.16053	0.21214	20.289	−2.7587	−10.651	1.7332	6.9466	303.68	367.15
95	0.97634	0.13176	0.15667	8.7642	−4.8566	−10.544	1.4526	8.3998	92.62	119.35
96	0.22764	0.070533	0.15584	43.613	−1.59	−9.9109	1.3564	4.8936	251.6	254.11
97	0.31798	0.23951	0.12847	11.14	−3.1242	−10.582	1.0262	6.7813	252.23	384.45
98	0.28563	0.089285	0.21639	19.224	−3.7934	−10.917	1.6565	9.4713	78.617	343.67
99	0.63089	0.19061	0.22716	14.742	−2.2082	−10.679	1.5116	6.1753	376.15	133.57
100	0.48698	0.12253	0.20049	4.7127	−2.2218	−9.5403	0.28544	4.8487	44.059	388.62
101	0.82048	0.052355	0.14924	2.9452	−2.4254	−10.035	3.4438	7.122	386.02	273.64
102	0.92652	0.20619	0.1519	24.662	−2.7006	−10.672	5.257	7.4226	397.16	345.96
103	0.70661	0.16817	0.1885	45.477	−3.0639	−9.7574	1.4898	6.6189	237.55	270.27
104	0.91356	0.1939	0.20205	43.054	−1.7877	−9.4766	1.7146	6.5883	366.47	163.91
105	0.59488	0.092197	0.16021	5.5898	−2.2965	−9.9623	0.61282	4.3406	118.19	293.89
106	0.0068365	0.18534	0.13162	31.809	−1.0161	−10.409	1.5921	7.0475	360.88	189.53
107	0.94903	0.16504	0.15313	17.091	−3.3763	−10.594	1.7216	6.4096	196.91	40.932
108	0.84374	0.27156	0.23532	38.53	−2.0365	−10.29	1.5433	6.3476	172.15	84.549
109	0.50237	0.27545	0.23256	6.528	−2.7875	−10.938	1.707	6.2335	273.77	158.56
110	0.20405	0.15244	0.2108	6.9205	−3.8943	−10.787	1.6838	6.7305	104.86	76.676
111	0.11671	0.13676	0.21789	49.672	−1.3647	−10.447	1.4436	6.0598	168.99	291.66
112	0.86654	0.23582	0.18235	26.486	−1.7508	−10.413	1.7662	5.7615	311.33	131.29
113	0.25223	0.21716	0.17794	18.555	−3.9809	−9.8537	1.7984	6.4333	382.67	193.29
114	0.74818	0.25081	0.22697	7.3743	−2.0799	−10.604	1.3928	5.1738	376.59	52.072
115	0.46444	0.18441	0.15	40.689	−3.4277	−9.4566	1.4254	7.1691	333.27	221.44
116	0.63615	0.15577	0.12705	3.5294	−1.6733	−10.301	1.0421	2.5105	250.4	68.19
117	0.88827	0.16637	0.15376	9.755	−1.9871	−10.377	1.3172	6.3642	202.16	313.6
118	0.53043	0.16581	0.28089	33.446	−3.3028	−10.504	1.7498	7.3621	221.83	62.251
119	0.89271	0.17265	0.13346	43.298	−2.6625	−10.885	1.7205	7.7651	235.43	159.28
120	0.029057	0.24583	0.22147	21.263	−1.3955	−9.6455	1.5054	6.24	186.61	44.888
121	0.0018091	0.25403	0.24598	42.287	−3.2987	−10.619	1.013	4.5135	231.05	241.38
122	0.56853	0.21893	0.13887	7.5203	−1.8625	−10.015	1.6025	7.0323	53.237	259.5
123	0.9426	0.12918	0.15897	18.267	−2.541	−10.646	1.3514	7.9043	165.16	346.44

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
124	0.61624	0.1638	0.20696	32.329	−1.6157	−9.7203	1.0702	4.0507	219.77	36.221
125	0.55825	0.19996	0.14063	30.412	−2.8694	−10.306	1.2923	5.7877	77.848	202.33
126	0.47435	0.15944	0.15274	40.339	−2.6884	−9.8678	1.321	4.8674	284.59	289.63
127	0.99857	0.14089	0.17042	35.195	−3.0728	−9.699	1.352	8.1649	105.09	146.46
128	0.40211	0.12462	0.24028	28.243	−3.7681	−10.233	1.6445	6.595	230.46	291.8
129	0.58139	0.08441	0.15786	27.107	−3.7514	−9.7281	1.1921	6.9424	97.382	357.77
130	0.65641	0.20889	0.17611	46.414	−1.6861	−9.3586	1.3511	4.1709	365.43	44.223
131	0.42898	0.11757	0.24908	25.471	−3.265	−10.173	1.1856	5.803	182.17	388.92
132	0.043645	0.14276	0.19387	34.346	−1.2474	−9.9678	2.0184	11.395	287.53	365.1
133	0.87416	0.1497	0.14457	25.851	−3.8169	−11.011	2.2117	8.5642	370.07	362.57
134	0.44076	0.16073	0.16496	23.422	−3.1606	−9.5735	1.2489	6.7579	284.57	251.31
135	0.44885	0.11533	0.25325	3.8065	−1.7344	−10.023	1.2117	8.0911	40.998	190.54
136	0.014079	0.26015	0.17058	29.261	−1.8165	−10.17	0.28709	1.8956	190.18	79.147
137	0.39414	0.21771	0.26047	13.337	−2.5023	−10.689	1.6725	8.567	235.31	202.39
138	0.43338	0.2567	0.19021	15.56	−3.3801	−10.383	1.7257	10.716	346.84	197.81
139	0.33488	0.11912	0.23777	6.0272	−2.1551	−10.643	5.8039	11.922	278.18	329.12
140	0.90967	0.18381	0.14781	33.767	−2.39	−9.783	1.7917	8.2983	355.33	279.92
141	0.24933	0.20516	0.24424	16.309	−3.2255	−10.041	1.6322	9.7551	123.98	324.6
142	0.99468	0.20035	0.12554	24.871	−3.1936	−11.151	1.317	4.0651	247.78	59.62
143	0.35477	0.13232	0.25113	44.925	−2.0657	−9.9496	1.539	7.1683	210.86	282.05
144	0.12198	0.075385	0.21826	39.494	−1.4681	−9.9415	1.4443	8.6678	90.589	368.84
145	0.45993	0.099761	0.2382	4.3863	−2.3316	−10.432	4.7552	12.642	182.57	386.76
146	0.04982	0.22967	0.10123	31.925	−3.3182	−10.684	1.1493	7.6981	188	311.89
147	0.29341	0.093901	0.1227	36.9	−3.5622	−10.533	1.3672	7.7314	298.08	366.96
148	0.58786	0.18263	0.14408	5.1605	−1.9215	−10.654	1.1186	7.5537	40.599	184.27
149	0.66188	0.12757	0.14625	41.665	−4.6177	−10.15	1.0217	5.2414	261.9	361.58
150	0.93472	0.16928	0.18818	38.103	−1.1944	−10.052	1.4169	5.7568	277.18	134.38
151	0.56129	0.14396	0.26452	30.866	−3.7228	−10.329	1.344	7.8808	70.353	345.27
152	0.10206	0.19316	0.13411	37.2	−2.3524	−10.548	1.1962	7.2272	48.712	257.61
153	0.37418	0.23304	0.20966	27.746	−1.419	−11.288	1.7359	5.5594	160.59	212.61
154	0.27833	0.22884	0.14222	42.641	−3.5069	−10.517	1.2531	4.088	317.07	244.05

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
155	0.71654	0.14475	0.16243	16.561	−2.4475	−10.388	1.0683	7.3515	21.246	389.56
156	0.96062	0.2046	0.19583	4.9604	−3.4141	−10.666	1.0397	4.2283	156.27	92.532
157	0.23549	0.17357	0.13773	44.914	−3.9008	−10.217	1.4824	8.5627	270.51	398.32
158	0.17895	0.22476	0.18496	35.522	−2.8009	−10.075	1.2349	5.8756	98.125	300.65
159	0.858	0.13501	0.13566	6.2311	−2.4053	−10.699	1.6129	7.8426	310.02	240.22
160	0.85446	0.19772	0.22029	37.825	−2.3436	−10.088	1.2546	4.6612	322.53	145.12
161	0.62008	0.22654	0.14342	28.821	−3.6558	−9.3177	1.826	7.4608	261	182.42
162	0.24255	0.19121	0.12682	10.988	−3.4406	−10.359	4.7224	5.8611	361.4	115.77
163	0.070428	0.096858	0.17308	16.976	−2.1244	−10.328	1.5029	7.4896	133.69	208.42
164	0.3813	0.10695	0.1826	26.918	−3.4742	−10.485	1.131	4.1501	109	351.22
165	0.26555	0.21632	0.18526	22.04	−3.3565	−10.435	1.3787	6.0889	79.224	62.05
166	0.49267	0.12642	0.21678	6.363	−3.877	−10.588	1.6547	7.103	279.7	161.17
167	0.92211	0.24224	0.17395	51.282	−3.5493	−10.097	1.826	4.5628	273.68	113.74
168	0.60875	0.19841	0.1838	48.76	−1.0817	−9.8839	1.7385	8.5277	241.4	369.3
169	0.28369	0.18911	0.1926	24.335	−3.0156	−10.187	1.6545	8.3346	286.83	151.86
170	0.89774	0.1668	0.16429	75.839	−3.8607	−9.6075	1.5697	4.9133	125.69	49.34
171	0.1316	0.19256	0.16686	21.739	−3.0046	−10.56	1.438	4.3693	348.34	161.39
172	0.18377	0.15513	0.21493	27.981	−3.1384	−10.015	3.1328	6.2005	307.84	30.593
173	0.21815	0.13377	0.17292	48.159	−3.6307	−10.338	1.3875	4.5779	230.17	43.477
174	0.16997	0.18179	0.16388	13.568	−3.216	−10.581	0.50173	2.1296	190.33	112.54
175	0.5781	0.15892	0.12967	42.49	−3.3332	−10.63	4.9472	8.1385	298.82	371.4
176	0.20916	0.12876	0.26707	27.618	−3.6736	−10.162	1.3396	6.4668	133.62	100.98
177	0.95555	0.20163	0.045592	8.4981	−3.4606	−10.226	1.5383	8.6629	27.498	277.14
178	0.29674	0.14158	0.24225	34.624	−3.9153	−10.521	1.7726	5.117	247.92	58.239
179	0.18607	0.082572	0.10823	7.8207	−1.1148	−10.597	1.6109	8.0164	197.59	273.32
180	0.024592	0.15055	0.091297	13.86	−4.5409	−10.033	0.34373	2.8755	75.958	26.076
181	0.12616	0.20355	0.19617	14.095	−3.2402	−10.251	1.1836	4.4034	250.29	112.78
182	0.81391	0.16419	0.13944	47.088	−3.5703	−9.5983	1.798	8.3203	139.83	142.41
183	0.8359	0.20368	0.14546	14.852	−1.8463	−10.84	1.241	6.8624	301.74	296.3
184	0.7744	0.23864	0.25804	54.44	−3.5828	−9.3523	2.2123	10.064	161.33	295.24
185	0.59701	0.18463	0.086432	10.723	−3.2062	−9.4032	1.4841	5.0554	357.58	161.05

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	FPLANW	NVF26	NVF11	FISVO	FPVO	DCVO	KDNPVO	KDNPAL	KDSRVO	KDSRAL
186	0.17437	0.23089	0.12394	41.097	−3.4955	−10.57	1.4093	8.0261	296.81	319.61
187	0.67066	0.26343	0.1607	43.872	−2.5861	−9.6591	1.005	4.1692	148.69	167.89
188	0.7972	0.20806	0.23394	11.398	−3.6122	−10.103	1.759	8.3051	193.97	357.42
189	0.052696	0.28832	0.22293	50.605	−1.1328	−10.347	1.0698	5.9855	160.84	51.811
190	0.25773	0.16217	0.11778	29.459	−2.4795	−9.4334	1.6847	5.7579	206.77	105.25
191	0.51272	0.19591	0.19479	2.5922	−3.5969	−10.21	1.1402	7.6617	132.5	313.46
192	0.48281	0.14608	0.20493	23.659	−3.5284	−10.442	1.2481	5.7668	191.63	68.078
193	0.31282	0.29252	0.24753	11.906	−3.7818	−10.525	1.0008	3.6125	99.971	51.818
194	0.65179	0.10579	0.23597	16.151	−4.9046	−10.115	1.1833	6.2507	150.61	226
195	0.93822	0.19449	0.13212	17.5	−2.1797	−10.465	1.8103	8.0132	319.36	259.94
196	0.50794	0.16731	0.29215	37.985	−3.1837	−9.9573	1.5959	8.5222	281.84	337.84
197	0.72439	0.26898	0.11042	2.2831	−2.9724	−10.203	3.7577	9.7342	355.6	346.85
198	0.43761	0.17809	0.25562	26.411	−2.9982	−10.196	1.068	4.1663	132.61	26.478
199	0.36087	0.20795	0.11238	29.952	−1.9654	−10.234	1.5744	5.5718	178.78	272
200	0.23312	0.22015	0.068105	11.585	−2.8445	−9.9863	1.2836	7.9702	21.56	157.51

Source: Output DTN: SN0710PASZFTMA.003.

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
1	5.9725	3.1257	−0.17835	1875.6	0.90315	1.249	0.14801	0.37912	0.95332	0.49935	0.55136
2	7.9076	8.3091	−0.49009	2066.2	1.1938	0.77885	0.092137	0.47786	0.91792	0.8188	0.97184
3	7.149	5.3516	−0.030631	1936.2	0.90379	0.77851	0.60439	0.68826	0.66009	0.53068	0.82956
4	5.8326	2.9176	0.76544	1914	3.1598	1.4824	0.41319	0.8772	0.87114	0.76593	0.015416
5	5.436	3.3113	−0.67814	1846.5	0.90303	1.5138	0.42084	0.42053	0.66879	0.14968	0.65052
6	6.9271	5.3053	0.27085	1871.3	0.90329	1.1456	0.016647	0.81447	0.35119	0.19017	0.45259
7	6.5411	5.6538	−0.15437	1957.1	3.4966	0.83018	0.54561	0.74242	0.22112	0.6963	0.84463
8	7.6354	4.7032	−0.87492	1895.9	0.90319	1.8458	0.48397	0.53618	0.81963	0.2233	0.06631
9	5.051	2.5081	0.084564	1972.7	0.90359	0.77867	0.20968	0.66388	0.56603	0.72163	0.16671
10	6.4859	4.9005	0.14586	1848.1	3.3813	0.77817	0.35921	0.91146	0.086184	0.26383	0.61428
11	6.6794	3.7477	0.43752	1955.5	3.0428	1.0566	0.25235	0.28583	0.14377	0.33995	0.37274
12	7.7771	6.267	0.91349	1908.5	0.96748	2.6259	0.96923	0.38967	0.53011	0.37712	0.87938
13	6.7232	3.8468	−0.36318	1824	1.3524	1.436	0.91852	0.74563	0.60164	0.51425	0.28382
14	5.5015	3.1161	−0.0083312	1860.2	0.90381	2.8391	0.061248	0.59919	0.035534	0.42406	0.12351
15	7.8559	4.6227	−0.38177	1901.3	1.0338	1.2741	0.18335	0.93868	0.44241	0.83114	0.66251
16	7.4329	5.7077	0.10859	1789.4	1.5556	2.8528	0.24504	0.23616	0.41568	0.56078	0.24768
17	7.1653	4.6712	0.050062	1904.9	0.90311	2.1018	0.56412	0.71879	0.45866	0.6612	0.88127
18	6.4534	6.0037	0.062013	1899.8	2.2769	1.4215	0.46985	0.17038	0.36892	0.4337	0.41587
19	5.6014	4.0801	−0.18808	2008.9	3.3885	2.2946	0.15415	0.29201	0.926	0.13578	0.10665
20	6.6668	5.4758	0.28696	1897.5	1.6537	0.90638	0.93395	0.38039	0.88069	0.83584	0.78477
21	7.9277	5.2056	0.10377	1967	2.8222	1.5622	0.70752	0.19571	0.96397	0.40507	0.072601
22	5.63	3.864	0.18416	1941.6	2.4794	1.1297	0.89898	0.51774	0.51472	0.44474	0.076803
23	7.1979	5.6592	0.075123	1871.8	2.7048	0.77872	0.11813	0.97456	0.31021	0.6663	0.22816
24	6.0584	4.2818	−0.76267	1913.5	2.9966	0.8072	0.59446	0.50489	0.98748	0.23154	0.36614
25	7.2969	5.8779	−0.13961	1786.8	1.5056	1.554	0.95635	0.59051	0.050116	0.64233	0.45837
26	7.3764	4.2886	0.19264	1876.9	0.90357	2.6816	0.74104	0.20259	0.33288	0.00056021	0.94328
27	6.4016	3.4974	−0.2158	1905.6	3.2025	1.1549	0.48661	0.5346	0.40274	0.22763	0.38021
28	10.512	5.9952	−0.2525	1986.6	1.743	2.5966	0.32813	0.3461	0.52155	0.30517	0.35838
29	5.7075	3.8339	−0.077085	1949.3	0.90353	1.2222	0.72812	0.35529	0.48028	0.18916	0.43491
30	5.4867	4.0164	0.45274	1917	0.90384	2.0319	0.57539	0.27621	0.90553	0.61556	0.49737

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
31	5.7965	4.0665	0.00069343	1997.8	3.5195	2.0158	0.67078	0.43256	0.86789	0.37068	0.3227
32	6.41	4.3106	−0.095361	1826.2	2.9475	0.82037	0.63578	0.087969	0.059871	0.013958	0.61861
33	6.9402	4.5671	0.35112	1928.6	3.0686	1.0455	0.32401	0.28237	0.62066	0.27631	0.64255
34	6.1416	3.9647	−0.20285	1938	0.90391	2.405	0.57426	0.17807	0.63746	0.13035	0.049985
35	8.0184	4.9454	−0.035732	1857.7	0.90374	1.7737	0.38832	0.5125	0.7477	0.040306	0.80321
36	6.1871	4.0891	0.54352	1884.8	1.9106	0.77881	0.021301	0.0098798	0.32113	0.24313	0.62202
37	6.4248	3.8028	−0.24944	1879.9	0.9031	1.6376	0.85906	0.67081	0.77494	0.5175	0.87397
38	6.5714	3.8355	−0.27086	1821.8	2.5739	1.3567	0.49032	0.78578	0.8421	0.92213	0.69837
39	5.5662	3.8588	−0.3174	1946.6	3.2872	1.7059	0.34929	0.10812	0.86475	0.26755	0.44695
40	7.0339	4.8972	−0.58281	1928.9	3.4907	0.77805	0.23383	0.96955	0.55518	0.21934	0.14791
41	7.8859	6.2423	−0.2289	1977.6	0.90347	0.78696	0.78578	0.67741	0.85998	0.44835	0.56415
42	5.5524	3.8987	−0.46991	1867.6	0.90364	1.887	0.79542	0.48809	0.30997	0.68955	0.27574
43	5.4176	3.0432	0.16158	1829.1	2.3007	1.3741	0.054658	0.409	0.65079	0.16031	0.03927
44	8.2813	5.3089	0.34529	1896.6	2.8908	1.5358	0.44201	0.36493	0.58549	0.10303	0.34881
45	5.761	2.9285	0.01772	1964	1.6772	2.5271	0.90287	0.84512	0.23369	0.88767	0.7561
46	6.3004	4.8446	0.12528	1906.4	0.9037	1.4949	0.76341	0.65504	0.38765	0.92522	0.81075
47	5.873	3.5648	−0.43469	1839.2	2.7542	1.3217	0.55681	0.080545	0.68236	0.78279	0.68201
48	7.2523	5.4774	0.30173	1849.6	0.90382	1.4538	0.47267	0.5233	0.42106	0.49153	0.4295
49	2.5731	3.5979	0.24637	1887	1.5231	1.4289	0.30719	0.9826	0.97391	0.34844	0.30095
50	6.8553	5.6262	0.3841	1907.9	1.9352	1.4188	0.75527	0.79521	0.79124	0.59169	0.94693
51	5.9102	4.7212	0.1289	1919.4	2.3538	1.6967	0.11262	0.78394	0.065009	0.96761	0.93778
52	7.4821	4.9052	−0.0033398	1843.4	0.90378	2.1284	0.21311	0.45059	0.101	0.87173	0.85482
53	6.3366	4.457	−0.40648	2040	1.7023	1.7024	0.63397	0.75733	0.63411	0.59665	0.73295
54	7.7507	3.8209	0.39988	1940	2.5819	0.77875	0.74928	0.0014343	0.017975	0.15992	0.5667
55	6.8886	3.5342	−0.086442	2075.6	0.90336	1.6481	0.59924	0.8652	0.39361	0.17097	0.78623
56	6.6048	3.0763	−0.1345	1881.2	2.2225	1.0983	0.46359	0.90716	0.64016	0.016186	0.5749
57	7.2706	5.4099	−0.01422	1862.5	0.90385	2.182	0.98781	0.7921	0.91338	0.19927	0.20202
58	7.8038	3.5232	−0.18625	2097.2	0.90303	1.6425	0.10519	0.22164	0.62929	0.081447	0.65732
59	6.7865	3.844	−0.095791	1890.7	3.4252	1.9758	0.16734	0.57493	0.6155	0.97189	0.060699

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
60	7.8471	5.3337	−0.86102	1794.2	2.1267	1.3454	0.75226	0.55725	0.82696	0.85085	0.68955
61	7.0901	3.3623	−0.17963	1816.9	1.789	0.77828	0.20405	0.61318	0.76903	0.7736	0.5395
62	8.1022	4.1281	−0.35634	1865.6	0.90313	1.6613	0.26243	0.87413	0.71708	0.71988	0.053525
63	6.8167	1.8104	0.15598	1974.2	1.7265	0.86279	0.94684	0.43978	0.19613	0.63319	0.52571
64	7.9504	5.3946	−0.51526	2025.1	0.90356	2.794	0.088359	0.48033	0.84602	0.86047	0.96369
65	5.9188	4.2914	0.31867	1662.6	1.995	0.88188	0.19983	0.046866	0.94455	0.35625	0.19656
66	7.514	5.1756	−0.37451	1930.3	1.967	0.77896	0.69036	0.15279	0.70221	0.95827	0.098062
67	6.839	2.9683	0.014094	1931.6	0.90386	0.77816	0.72359	0.12183	0.58056	0.039986	0.54263
68	7.0756	4.2615	−0.072712	1940.9	2.2592	2.2193	0.073801	0.96441	0.44882	0.88064	0.59544
69	5.6773	3.8865	−0.16347	1963.3	2.7847	1.2303	0.97696	0.20797	0.084584	0.57374	0.70334
70	7.0163	4.2252	−0.02775	1780.6	3.5667	0.79181	0.7142	0.26741	0.78112	0.79843	0.88713
71	17.617	5.8875	−0.266	1952.3	0.91759	0.98496	0.99908	0.803	0.59694	0.31095	0.11612
72	7.3474	5.3152	0.031064	1852.1	0.90392	1.7219	0.45309	0.23211	0.34683	0.29814	0.033845
73	5.5347	3.4392	0.06318	1990.3	1.1033	1.4748	0.61349	0.70253	0.6485	0.95109	0.83954
74	6.476	5.0236	0.025322	1869.4	1.3657	1.2939	0.40039	0.22715	0.12556	0.84679	0.92907
75	6.911	4.4782	0.23518	1947.8	2.1186	1.2692	0.13788	0.64172	0.39798	0.84111	0.76703
76	6.977	6.2345	0.34255	1850.1	3.5552	1.1377	0.93568	0.052459	0.43316	0.27091	0.95719
77	6.7344	4.1705	0.30807	1883.3	2.1891	2.4279	0.036244	0.31983	0.85241	0.099715	0.98777
78	7.9433	5.8334	0.36203	1977	0.90318	0.77863	0.52811	0.32228	0.69329	0.5458	0.17655
79	3.1724	2.3514	−0.47654	2036.5	3.0898	2.3931	0.23949	0.58398	0.51926	0.15459	0.62762
80	7.6189	6.6297	−0.20827	1968.9	2.9533	1.5442	0.79325	0.8985	0.93623	0.053707	0.48373
81	6.9653	4.4453	−0.44567	1962.3	0.9032	1.288	0.49932	0.12507	0.89771	0.82865	0.54536
82	5.806	3.5692	−0.019247	1969.6	1.2058	1.7129	0.33092	0.65045	0.69902	0.23748	0.72851
83	6.3852	3.5058	−0.14341	1760	3.6174	1.5253	0.92293	0.72545	0.89401	0.91693	0.47477
84	5.6579	3.5746	−0.055401	2004.7	0.90395	1.1809	0.36004	0.035625	0.67331	0.77605	0.8152
85	6.1259	3.1344	−0.45113	1903	2.5396	2.4615	0.10302	0.13938	0.2868	0.79406	0.9918
86	6.2138	4.4219	−0.42086	1922.1	3.4561	1.4602	0.4156	0.099152	0.46067	0.50898	0.35323
87	6.3597	3.2946	0.3637	1909.9	2.9123	2.566	0.88833	0.71028	0.55161	0.029548	0.60303
88	7.3952	5.1783	0.82141	1840.5	1.3934	1.7451	0.33803	0.99092	0.099285	0.11672	0.40881
89	7.8123	6.2351	−0.28778	1900.3	0.90326	1.2421	0.31854	0.46209	0.3012	0.5016	0.12874

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KDUVO	KDUAL	GWSPD	BULKDEN SITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
90	4.8056	4.1811	0.26471	1916.2	0.90397	0.77889	0.68696	0.76919	0.80317	0.94606	0.0061426
91	6.014	3.5313	0.087577	1959.2	0.90339	1.0995	0.12672	0.92108	0.75997	0.99265	0.79816
92	6.5187	4.5572	0.024883	1882.1	1.6093	0.77841	0.89491	0.92686	0.50891	0.30263	0.52301
93	7.133	4.3591	0.043368	1942.7	0.90349	1.7296	0.029419	0.54533	0.97505	0.76008	0.082954
94	7.4628	3.4336	−0.059523	1993.1	0.90389	1.7347	0.0044655	0.7771	0.81418	0.60279	0.77636
95	6.5542	8.2103	0.24181	1934.2	0.90367	0.779	0.27625	0.75346	0.94982	0.73642	0.92474
96	6.0514	3.0299	−0.38227	1815.1	3.5953	2.3636	0.50903	0.54324	0.52673	0.1679	0.64838
97	0.48872	3.6545	0.081711	1845.5	2.6544	1.0609	0.86021	0.61537	0.43719	0.29445	0.4137
98	7.4958	5.695	0.6942	1994.9	1.2393	1.5103	0.53499	0.73858	0.54758	0.28177	0.71001
99	5.6455	3.78	−0.048794	1925.1	0.90337	1.4681	0.31493	0.44407	0.026816	0.41548	0.26677
100	5.5838	3.4444	0.49697	2131.4	1.3278	0.77801	0.37156	0.39791	0.34029	0.046676	0.71905
101	7.7408	4.3769	0.41779	1863.9	1.8433	1.2537	0.52369	0.89111	0.72414	0.94363	0.97783
102	8.0842	5.3976	0.039555	1958.2	2.6805	1.3798	0.92714	0.1456	0.15558	0.32354	0.57921
103	6.796	5.3313	0.80176	1809.1	3.6533	1.0224	0.61812	0.30333	0.26082	0.39232	0.38884
104	6.0888	3.7972	−0.11186	1765.8	0.9403	2.5396	0.66785	0.29726	0.31575	0.71377	0.40333
105	1.9233	3.0557	−0.34713	2012.3	2.3309	1.5695	0.88151	0.50933	0.15264	0.36659	0.76274
106	6.317	3.9717	−0.16015	2019.2	2.8064	1.0266	0.22383	0.85892	0.0025427	0.12428	0.23763
107	7.3034	4.2997	0.32801	1981.6	0.98874	1.5407	0.30208	0.62662	0.74214	0.43735	0.50232
108	6.1064	4.5397	0.1042	1917.9	3.6802	1.5234	0.8293	0.57726	0.96774	0.078148	0.29635
109	7.8795	5.6019	0.072417	1812	2.9781	1.0732	0.22898	0.49888	0.36227	0.80137	0.026276
110	15.634	6.0087	0.21815	1873	3.3533	0.7781	0.5898	0.88117	0.18919	0.96142	0.73885
111	6.635	3.9743	0.033322	1991.6	3.2485	1.0785	0.55213	0.70952	0.48706	0.97908	0.25633
112	7.8275	4.9267	0.049153	1904.1	1.4289	1.6676	0.033208	0.42755	0.76087	0.81213	0.74691
113	7.9741	4.3967	0.20481	1923.5	1.018	1.7611	0.12009	0.49013	0.49325	0.067976	0.15316
114	5.7395	5.068	0.32405	2000	0.90369	0.77822	0.069784	0.93143	0.33687	0.70245	0.63608
115	7.6891	5.9715	0.65187	1923.8	0.90344	1.4409	0.013986	0.63208	0.57667	0.39511	0.51207
116	5.6886	3.0546	−0.041682	1892.8	1.4837	0.85576	0.87464	0.021304	0.83896	0.45149	0.21883
117	5.7174	3.1028	−0.0383	1944.8	1.0634	0.77891	0.16343	0.15549	0.32769	0.80689	0.95205
118	8.1407	6.0276	0.41528	1935.9	0.90322	2.7216	0.8338	0.60597	0.1746	0.60799	0.53258
119	8.1476	6.2468	0.44585	1803.9	0.90352	1.6841	0.25947	0.3505	0.13133	0.69187	0.46983

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
120	7.2136	5.0641	−0.19761	1889.1	0.90351	2.1477	0.17971	0.01696	0.12417	0.65725	0.21304
121	0.73131	2.5983	0.17546	1933.7	0.90341	1.5891	0.3682	0.32693	0.14919	0.82472	0.49172
122	7.5388	5.4274	0.61751	2022.8	0.90395	2.5036	0.26875	0.30965	0.53749	0.75493	0.63438
123	5.8931	3.6618	0.012171	2045.4	3.0164	2.7454	0.60795	0.21768	0.77931	0.20398	0.16495
124	5.4415	3.4167	0.25701	2019.8	2.4344	1.9289	0.18763	0.16686	0.20988	0.5691	0.58279
125	7.6474	4.7938	0.067429	1842.8	2.5249	1.5968	0.98125	0.76469	0.2517	0.3173	0.85904
126	5.7525	2.9364	0.20045	1832.8	2.4076	1.5787	0.39829	0.95212	0.034587	0.52336	0.1135
127	7.6758	6.1912	0.12146	1981	1.2767	1.6157	0.056255	0.90495	0.98011	0.48855	0.91575
128	7.599	4.9257	−0.08843	1835.2	1.5866	1.3035	0.87817	0.94688	0.25589	0.33424	0.20698
129	6.437	4.5798	0.099163	1798.4	1.7706	1.7714	0.47718	0.47024	0.19356	0.55568	0.55688
130	6.1543	3.7598	−0.22072	1720.1	3.1815	2.2739	0.95338	0.39089	0.73424	0.72894	0.50726
131	5.9386	2.9796	0.46561	1965.9	0.90343	1.116	0.69971	0.58612	0.92169	0.67742	0.27223
132	7.9887	6.2132	−0.20382	1985.9	0.90305	1.5025	0.1319	0.56659	0.26685	0.90542	0.13879
133	7.2478	6.0816	0.27632	1938.8	1.3017	1.6536	0.90639	0.66534	0.7532	0.2594	0.31207
134	6.0054	5.4818	−0.12658	1961	3.4344	1.1616	0.24114	0.94237	0.65911	0.34417	0.28603
135	6.696	6.1064	−0.081183	1859.2	0.90309	1.0038	0.042086	0.3139	0.012702	0.70527	0.89991
136	5.3906	2.0544	0.47737	2061.5	0.90365	0.93824	0.43459	0.98723	0.17691	0.36239	0.39637
137	7.18	5.9748	−0.052153	1892.1	1.4591	1.6802	0.8406	0.24623	0.24321	0.74055	0.34012
138	6.1703	6.2067	0.14014	1927.6	0.90399	2.8913	0.4496	0.73276	0.79884	0.86859	0.29014
139	19.885	8.1261	0.26128	1756	1.1114	2.2309	0.85058	0.013066	0.70983	0.98059	0.4625
140	7.5026	5.6096	−0.16633	2084.8	2.1687	1.4077	0.19363	0.91877	0.57169	0.062484	0.59253
141	6.9918	6.2617	0.1988	1915.2	2.1627	1.96	0.81428	0.213	0.23506	0.62553	0.8923
142	6.2718	3.8342	−0.15008	2033.8	1.5521	2.7681	0.28203	0.030125	0.99984	0.93706	0.43827
143	7.058	4.7386	−0.94765	2007.2	0.90372	1.0108	0.78117	0.1124	0.90435	0.68037	0.00137
144	6.7638	5.6594	0.092009	1920.1	0.90361	1.478	0.45778	0.62244	0.20289	0.1124	0.67711
145	10.659	8.5196	−0.29082	1782.1	3.6308	1.3834	0.54002	0.83238	0.54177	0.059496	0.055209
146	3.5351	3.8212	−0.11981	1856.2	1.4484	1.7392	0.58368	0.82026	0.49892	0.93132	0.8671
147	6.0321	4.5493	0.37754	1874.5	2.7317	1.1979	0.28947	0.064219	0.0087405	0.086082	0.042408
148	7.0463	5.7906	−0.23708	2010.9	2.048	1.5757	0.83873	0.18767	0.45303	0.24793	0.17381
149	5.4744	3.205	0.11709	1861	3.7102	1.4905	0.71606	0.45623	0.60712	0.106	0.8472

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
150	6.8808	4.9771	−0.2776	1955.4	0.90362	1.5925	0.772	0.25397	0.046208	0.35463	0.7418
151	7.3396	5.7647	0.16779	1887.6	0.9033	1.0412	0.99159	0.37394	0.16138	0.8983	0.33576
152	6.5049	5.4311	−0.11322	1876	0.92863	1.8934	0.078416	0.26234	0.47477	0.41185	0.8627
153	14.049	4.2353	0.056293	1950.4	0.90306	0.95402	0.37664	0.16391	0.072875	0.20549	0.98379
154	6.607	3.0553	−0.10223	1801.7	0.90376	1.3353	0.67507	0.85191	0.56233	0.91132	0.77248
155	5.8605	3.7371	−0.12959	1852.6	2.0553	1.7596	0.64711	0.24118	0.78982	0.14203	0.022912
156	5.776	3.1714	0.16282	1946.4	0.90324	1.3632	0.29059	0.11742	0.16658	0.5841	0.33087
157	5.9495	4.7204	−0.25774	1932	3.2184	0.77879	0.21752	0.56409	0.37232	0.071179	0.086622
158	7.1079	3.7186	0.29763	1818.8	1.876	0.92785	0.40653	0.028803	0.093443	0.45984	0.90492
159	7.3664	6.1582	−0.62242	1823.5	2.4529	1.8267	0.09683	0.8887	0.99051	0.28945	0.44384
160	6.3494	3.6492	0.20762	1921.2	3.3049	1.6886	0.77907	0.84141	0.82286	0.40239	0.14267
161	15.099	6.2336	−0.31177	1805.6	1.0831	0.77834	0.94128	0.067398	0.59004	0.87679	0.1026
162	12.74	4.0016	−0.38899	1748.7	1.8898	1.085	0.73848	0.27179	0.11254	0.033604	0.25055
163	8.061	6.0648	−0.33566	1943.2	2.0836	0.77865	0.5124	0.090902	0.29907	0.78995	0.93382
164	5.4574	2.1478	−0.19404	1979	2.3667	0.77856	0.65853	0.044761	0.71303	0.0092675	0.13014
165	7.2364	5.7647	−0.14715	1975.6	3.1379	0.94558	0.42716	0.99581	0.93247	0.63505	0.79472
166	6.2901	4.1535	−0.29973	1954	0.90328	1.5573	0.80914	0.14267	0.18078	0.46381	0.36175
167	7.6992	3.4719	−0.021399	1830.6	1.1302	1.6278	0.97148	0.19133	0.83382	0.54465	0.22192
168	8.1221	6.2479	−0.39528	1831.6	0.903	1.2828	0.86946	0.419	0.13968	0.55282	0.99942
169	7.1233	7.0136	0.15288	1999.3	0.99714	0.8477	0.34431	0.073091	0.68898	0.89467	0.4245
170	8.0225	4.6577	0.3721	1814.2	2.6418	1.1898	0.68117	0.33547	0.40532	0.90013	0.91304
171	5.8507	3.0721	0.11496	1893.7	2.401	1.1109	0.70351	0.69854	0.72757	0.98757	0.75225
172	8.0683	4.7402	−0.10631	1983.3	1.2186	1.4499	0.81611	0.25826	0.61445	0.46792	0.90571
173	7.5754	4.857	0.14313	2050.5	2.6047	2.3379	0.76866	0.058454	0.21765	0.58804	0.3155
174	1.1658	1.7803	0.89073	1911.2	2.7415	0.89771	0.082041	0.40006	0.060625	0.38108	0.96639
175	7.552	4.6349	0.22623	1894.7	0.90325	1.6091	0.91047	0.82838	0.88732	0.99868	0.18895
176	6.7562	5.2835	−0.72109	1776.4	3.2702	0.7785	0.66477	0.46953	0.042516	0.62485	0.48731
177	8.0456	6.6965	−0.066206	1855.9	2.0157	0.88506	0.96164	0.33283	0.29031	0.47929	0.60973
178	7.9909	4.8699	−0.36815	1988.5	2.8606	0.77832	0.0067321	0.52745	0.28427	0.74792	0.23012
179	6.6369	5.4109	0.0044132	1837.4	0.90374	0.77859	0.15811	0.55268	0.023901	0.18067	0.47559

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KDUVO	KDUAL	GWSPD	BULKDENSITY	CORAL	CORVO	SRC4Y	SRC4X	SRC3X	SRC2Y	SRC2X
180	6.075	4.3224	0.29082	1899.1	2.8672	1.3971	0.62791	0.36613	0.37716	0.25127	0.19465
181	6.2387	3.2879	0.18909	1926.4	1.6385	0.77808	0.84643	0.60261	0.079115	0.17635	0.72495
182	7.6656	6.1638	−0.30503	1880.1	1.822	2.081	0.53641	0.4478	0.35914	0.38798	0.014873
183	5.6068	4.2512	0.3911	2052.7	2.5136	1.3331	0.43998	0.95684	0.41408	0.21347	0.83035
184	18.44	8.42	0.49267	2016.2	0.90358	1.3131	0.82124	0.41314	0.95968	0.61257	0.39318
185	7.7224	4.3037	−0.49985	2028.7	0.90389	1.2114	0.14096	0.86368	0.87878	0.73015	0.824
186	6.7098	5.8866	0.22981	1970.8	1.8143	1.6253	0.17332	0.83925	0.42664	0.75893	0.18395
187	4.2645	3.3483	−0.34362	1853.7	1.1646	2.6512	0.29535	0.6393	0.2468	0.32991	0.2443
188	7.5603	5.1399	−0.32222	1889.8	1.2623	1.2132	0.62056	0.077406	0.27678	0.12604	0.51919
189	5.527	5.0692	−0.0068214	1878.8	0.90314	1.1667	0.27374	0.81653	0.73931	0.52789	0.26466
190	6.9482	4.3955	0.3371	1912.5	0.90346	0.77845	0.80183	0.10476	0.10591	0.85939	0.80646
191	6.2326	5.4906	−0.06649	1868.6	1.4057	1.3999	0.50392	0.80569	0.22811	0.023383	0.32794
192	6.2522	4.6235	−0.3294	2003.6	3.3367	1.791	0.64456	0.1335	0.21443	0.53591	0.66755
193	7.4137	4.4366	−0.80827	1866	0.90332	0.7784	0.73013	0.97535	0.38237	0.67251	0.69203
194	5.9761	3.9867	0.17037	1735.4	1.9855	1.6741	0.38362	0.34451	0.67767	0.42816	0.70837
195	7.3178	5.1823	−0.17382	1768.8	0.90341	1.6045	0.51658	0.77213	0.27475	0.48303	0.58716
196	7.768	6.5404	−0.12256	1795.8	1.3102	0.9639	0.35128	0.64598	0.11775	0.64953	0.3061
197	6.1982	4.8575	−0.24181	1836.8	0.90334	1.7525	0.56869	0.694	0.50191	0.4735	0.6721
198	6.8284	4.1527	0.5678	1951.9	1.152	0.99489	0.39476	0.72323	0.46947	0.57942	0.092109
199	6.5811	3.1799	0.17943	1885.4	2.2515	1.178	0.65197	0.18141	0.47965	0.65273	0.37658
200	7.4513	6.2634	0.13358	1910.7	3.1226	0.77824	0.046482	0.68272	0.80814	0.091389	0.15855

Source: Output DTN: SN0710PASZFTMA.003.

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
1	0.92233	0.25505	0.74124	15.158	1.3012	288.36	174.2	98.301	114.36	2570.7
2	0.95718	0.43026	0.82308	5.2309	1.9747	441.64	988.27	123.12	104.1	3544.4
3	0.39566	0.78442	0.12747	7.7891	1.8727	268.98	226.85	112.77	134.5	3993.5
4	0.83861	0.26775	0.71883	8.0644	1.88	736.01	539.95	106.47	98.669	5253.7
5	0.52003	0.57509	0.094709	6.2813	2.5213	470.69	216.45	98.599	80.671	1537.7
6	0.40076	0.96621	0.9459	9.4486	2.1263	764.09	494.69	35.821	97.937	7319.7
7	0.094518	0.093636	0.46901	4.9464	2.5805	361.91	785.5	235.94	104.22	3292.3
8	0.32186	0.17194	0.84957	5.3645	1.8447	545.46	443.82	62.502	103.95	49331
9	0.30145	0.85606	0.16371	15.893	2.2519	669.99	352.57	67.408	84.925	9497.9
10	0.57727	0.11274	0.96106	7.6892	1.4215	791.95	903.41	97.597	102.28	2227.5
11	0.74875	0.15598	0.086856	1.125	2.1455	849.22	335.7	90.047	103.04	1935.8
12	0.6884	0.20431	0.40849	9.0473	1.3157	972.52	164.3	100.84	104.87	3916.8
13	0.11426	0.97927	0.80415	0.96834	3.2114	444.69	537.54	95.738	108.44	6812
14	0.077847	0.038325	0.39857	4.6603	1.8187	192.91	208.99	120.71	94.932	4626.3
15	0.47977	0.67091	0.53651	2.5728	2.1068	831.69	831.51	70.164	95.22	6440.6
16	0.56804	0.91726	0.52864	5.6017	2.5424	258.77	122.81	102.32	90.401	60334
17	0.97516	0.75352	0.96649	4.9962	1.7214	367.02	320.17	93.319	91.349	6970.5
18	0.22547	0.098027	0.27507	1.6755	2.7878	190	631.03	125.63	107.59	1484.2
19	0.11894	0.90477	0.51826	1.077	1.7044	264.86	760.47	47.53	107.9	1841
20	0.44268	0.65648	0.4869	3.1406	2.2058	901.01	594.29	113.09	94.799	1311.4
21	0.86671	0.87858	0.86223	3.0022	1.8516	393.42	848	104.74	82.968	2355.9
22	0.37889	0.51061	0.8531	4.3041	1.4492	317.61	204.43	82.927	100.11	35253
23	0.18952	0.45367	0.61803	4.7413	0.82216	461.49	821.45	129.18	111.01	8234.3
24	0.77685	0.032638	0.93762	3.8977	1.4941	376.32	231.83	98.235	96.142	27031
25	0.48162	0.79486	0.64681	3.6705	1.8594	400.03	220.48	100.83	102.11	5782.8
26	0.67481	0.28202	0.28096	2.7096	2.1944	652.15	757.15	95.807	94.214	2284.8
27	0.016023	0.91494	0.79437	15.809	0.66981	844.48	257.34	255.61	93.747	1852.6
28	0.48515	0.29132	0.2558	5.6755	1.7133	972.36	599.46	99.748	86.16	4694.5
29	0.31677	0.86088	0.87083	1.4014	2.9953	457.68	573.85	121.18	91.264	12511

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
30	0.47158	0.95708	0.22766	9.2308	1.3168	580.46	184.04	102.99	105.46	3381.1
31	0.87638	0.25117	0.35533	13.125	2.1368	335.74	872.42	118.62	138.2	3190
32	0.84049	0.75826	0.066926	4.4104	1.3726	573.87	474.13	102.52	89.155	2624
33	0.79945	0.36122	0.71376	4.8772	2.5555	742.68	616.09	84.182	87.138	2499.8
34	0.087804	0.8988	0.88781	2.2414	2.6525	455.81	337.26	25.332	75.724	1701.3
35	0.73521	0.77603	0.2629	1.9565	2.0072	532.81	876.82	115.01	86.326	4986.3
36	0.28329	0.060343	0.24624	17.711	2.9543	149.51	803.62	119.52	126.23	5929.2
37	0.82935	0.82288	0.070104	2.4021	1.9577	211.15	635.38	114.43	116.45	4028
38	0.042963	0.33111	0.15903	1.1833	1.4687	653.74	836.64	287.24	115.78	3504.8
39	0.85708	0.73262	0.89719	3.3288	1.9201	685.43	674.91	122.53	110.67	2190.1
40	0.60087	0.72999	0.42689	10.239	2.5889	979.38	524.48	113.95	101.13	1072.5
41	0.49271	0.10448	0.77958	2.4453	2.281	987.52	759.86	177.81	88.271	1650.7
42	0.64192	0.96389	0.50726	2.8439	2.2462	478.66	873.62	108.57	99.409	10831
43	0.2041	0.71481	0.94157	7.3146	2.0913	389.82	162.84	138.35	100.43	6420.2
44	0.18387	0.27955	0.6511	3.0408	2.3568	424.53	427.46	98.778	97.126	9947.1
45	0.98648	0.43556	0.40458	0.41701	2.6806	540.18	369.21	128.74	117.61	31585
46	0.23594	0.70606	0.097513	4.1325	2.3386	186.02	929.14	94.639	73.954	3852.2
47	0.9144	0.46205	0.26876	1.8281	2.0034	141.78	758.36	104.15	84.907	6916.7
48	0.63216	0.56861	0.30615	4.5316	1.1578	609.67	488.64	126.93	93.95	9117.7
49	0.51583	0.8261	0.74634	1.2771	2.1708	678.23	285.28	114.77	94.328	3675
50	0.8528	0.83683	0.2883	6.3543	2.0533	428.03	443.3	124.64	106.31	3230.4
51	0.53245	0.42635	0.90682	18.841	2.7285	157.37	748.35	49.528	107.71	2697.4
52	0.3125	0.12124	0.18823	3.5813	1.7311	890.49	894.97	105.85	84.666	15733
53	0.79448	0.99326	0.38079	0.8615	2.1626	975.01	972.11	108.3	95.641	46391
54	0.2736	0.41402	0.75965	0.66445	0.45626	839.05	283.8	87.322	102.25	6351.6
55	0.82136	0.94926	0.57277	3.4625	0.96077	419.14	923.79	41.535	85.932	37479
56	0.24226	0.47853	0.65891	9.2636	2.328	745.58	402.45	127.21	96.739	5894
57	0.30565	0.31586	0.63843	13.715	1.5869	614.78	643.93	91.257	111.29	2967.7
58	0.87226	0.30481	0.23333	4.8274	0.24721	217.97	673.06	60.124	89.057	2734.1
59	0.34771	0.81349	0.55574	2.9053	2.4733	304.04	698.81	101.68	108.8	76827

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
60	0.53539	0.18244	0.43489	0.077649	0.92882	459.36	167.07	107.2	91.617	5678.3
61	0.69358	0.072783	0.20895	6.208	2.1781	119.64	657.7	105.28	95.365	6620.2
62	0.37424	0.0051665	0.43543	3.7696	2.0766	224.25	828.96	117.04	129.09	7078.3
63	0.80636	0.65482	0.62131	4.2705	1.5678	731.18	789.42	57.594	72.457	39949
64	0.95066	0.54284	0.91978	12.312	2.3844	635.57	752.77	75.327	100.35	33635
65	0.94153	0.97469	0.057611	14.551	1.3887	101.16	629.7	92.618	105.44	40908
66	0.38226	0.048251	0.4617	13.256	3.072	345.31	856.16	31.479	81.846	8962.7
67	0.62941	0.61653	0.38797	8.2961	1.7479	981.33	609.29	123.01	120.69	8844.5
68	0.56358	0.98803	0.62566	4.6968	1.6343	161.13	390.4	108.62	88.609	8468.1
69	0.753	0.13847	0.19972	2.3811	1.0425	286.49	699.32	96.59	101.38	3648.8
70	0.41038	0.61048	0.47687	3.7497	3.4959	551.87	775.53	115.55	124.9	2037.3
71	0.50596	0.76298	0.75346	4.7911	2.5107	954.94	571.81	116.77	116.07	8057.5
72	0.35308	0.58728	0.83407	11.25	1.4766	224.06	604.12	124.23	110.12	4297
73	0.72002	0.84202	0.17657	10.774	1.6192	563	881.82	226.67	113.89	4359.5
74	0.14626	0.68295	0.07776	4.0845	1.6041	623.77	853.66	110.93	98.06	2457.8
75	0.066744	0.38841	0.026305	12.916	1.7545	422.83	954.12	32.139	76.757	9032.6
76	0.40925	0.42092	0.041884	1.9009	2.9064	398.79	122.66	107.63	111.18	4084.8
77	0.75816	0.63356	0.19002	0.97218	2.0517	145.13	902.65	120.82	96.95	6007
78	0.17325	0.53555	0.79986	11.716	0.030378	627.57	832.16	48.16	92.011	4122.1
79	0.17749	0.08885	0.50064	0.73485	1.2575	170.66	782.33	102.33	90.81	3481.1
80	0.65533	0.31436	0.13959	0.53328	2.8003	959.38	368.73	115.17	99.853	2875.3
81	0.13682	0.5298	0.543	1.2215	0.78453	474.69	368.01	119.44	105.08	67019
82	0.34247	0.32268	0.29273	14.707	2.1102	910.66	707.17	41.025	116.66	8329.7
83	0.8816	0.1638	0.0046957	3.2979	2.5316	881.91	554.66	60.516	106.79	5441.7
84	0.021631	0.93282	0.034844	0.4959	1.6322	750.49	101.52	94.286	85.825	3605.4
85	0.36704	0.28987	0.33286	2.0515	1.7882	862.26	768.43	108.18	108.92	13610
86	0.49834	0.98297	0.2155	2.1427	2.2377	654.14	607.58	93.851	111.6	9145.4
87	0.26303	0.59693	0.14617	2.23	3.0455	419.3	370.49	15.497	86.581	8548.4
88	0.77494	0.5598	0.64268	13.897	3.1635	428.79	406.06	54.213	97.94	23376
89	0.29397	0.38192	0.4223	3.8284	3.1162	798.49	971.66	115.22	101.4	8424.3
90	0.89941	0.35616	0.44701	0.59262	1.209	228.04	591.62	90.953	88.517	36244

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
91	0.76656	0.80189	0.45487	4.9084	1.9414	971.84	832.65	128.26	94.325	39121
92	0.63929	0.74595	0.53056	2.347	1.3575	200.86	152.7	128.36	116.06	2545.7
93	0.86447	0.92068	0.66988	2.0977	2.212	751.68	687.81	114.76	100.97	28611
94	0.9357	0.50364	0.31131	1.9757	3.2485	748.54	842.5	30.631	74.696	5601.7
95	0.35996	0.37754	0.98715	12.749	1.7416	854.55	321.13	108.66	108.3	1415.2
96	0.99924	0.64932	0.6606	0.79958	0.40798	481.04	556.84	19.054	69.656	1257.2
97	0.28863	0.35212	0.36658	2.7297	1.671	531.12	802.47	93.554	90.133	7179.9
98	0.99314	0.34661	0.10037	0.64677	2.9618	104.47	939.54	98.624	103.68	3045.7
99	0.42653	0.23963	0.037187	7.9165	1.4042	877.41	777.99	126.67	111.55	51546
100	0.33084	0.79766	0.17138	7.995	1.2356	789.86	969.03	117.79	97.513	20719
101	0.42259	0.22354	0.7233	3.6255	1.6873	609.24	514.18	118.05	83.394	5326.5
102	0.84776	0.62524	0.73714	4.3359	2.5643	997.49	408.79	97.385	79.195	4583.3
103	0.057725	0.36634	0.76158	12.561	1.2859	629.59	327.32	34.723	62.618	5130.4
104	0.96879	0.47187	0.13328	1.3729	0.88803	978.09	516.92	109.11	94.548	3043.7
105	0.7066	0.37193	0.57744	4.4521	1.485	324.25	754.62	109.26	104.41	1898.9
106	0.2104	0.71681	0.99385	9.6608	1.9101	941.32	421.68	38.595	97.627	93999
107	0.032139	0.30865	0.35219	0.76974	2.4435	358.89	212.89	122	104.2	9847.3
108	0.78493	0.55127	0.23633	3.2414	1.8905	711.94	319.88	97.135	83.961	8910.4
109	0.54848	0.08343	0.68564	2.5181	2.3913	207.35	493.03	90.564	112.96	6672.5
110	0.96153	0.89494	0.54785	6.7847	0.33028	514.71	133.39	76.488	105.55	43352
111	0.62488	0.044425	0.91427	3.8537	1.6496	646.85	699.32	256.92	150.52	4494.8
112	0.69681	0.85203	0.92816	6.6984	1.5175	413.96	918.97	109.29	100.58	4904.9
113	0.52809	0.86964	0.70423	1.461	2.064	862.23	429.86	16.035	102.16	3719
114	0.61818	0.58153	0.80775	2.611	1.6019	615.28	449.07	103.55	75.715	29257
115	0.46203	0.41723	0.31862	3.1673	1.1126	868.34	838.96	49.545	119.16	1713.2
116	0.20919	0.33963	0.49977	10.959	1.8321	940.31	419.19	125.18	92.767	6256.8
117	0.39316	0.84877	0.86639	1.5102	2.3061	207.93	763.14	18.553	86.344	4534.1
118	0.51324	0.69222	0.84208	10.391	2.0228	765.97	598.8	115.84	107.45	5807.6
119	0.50401	0.18607	0.37533	9.6216	2.6363	996.3	552.6	102.59	89.656	55877
120	0.97274	0.72227	0.32996	8.5513	1.996	772.61	279.18	119.72	114.75	1298.1
121	0.90393	0.76623	0.69825	1.5367	2.1828	278.66	788.66	149	115.37	88864

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
122	0.16682	0.90667	0.3208	2.8123	1.1043	237.62	707.08	119.62	107.05	6559.5
123	0.88685	0.78667	0.33837	3.3767	1.8096	718.47	126.56	33.981	103.36	3934
124	0.93377	0.88469	0.049508	14.072	0.53782	608.77	566.13	201.21	101.28	7572.6
125	0.8012	0.49335	0.59546	3.4325	2.8947	349.37	529.81	117.39	110.4	4932.5
126	0.27749	0.078469	0.90494	8.1951	1.9424	537.24	608.86	108.89	88.023	1394.5
127	0.15151	0.11629	0.56557	5.1007	2.4183	113.94	194.64	112.76	150.2	5406.2
128	0.23227	0.66062	0.60165	4.0469	2.6311	545.09	408.91	122.54	89.078	9406.9
129	0.55875	0.88816	0.47306	16.849	2.0888	849.76	669.99	55.448	92.378	9753.4
130	0.2558	0.46514	0.20482	4.3706	1.924	968.87	221.55	123.69	106.27	9544.7
131	0.98325	0.44402	0.78375	1.8793	1.9806	218.82	447.52	17.702	93.285	4790.3
132	0.70346	0.6861	0.51445	2.7902	2.6121	432.26	900.65	116.94	122.66	7491.3
133	0.43036	0.74351	0.67275	2.9934	2.3422	378.35	504.71	98.355	87.438	5020.9
134	0.59479	0.24391	0.18118	2.6733	2.7551	730.63	918.55	101.73	93.41	1185
135	0.029181	0.54944	0.44236	7.4784	3.2803	284.24	244.75	91.203	96.844	30250
136	0.29642	0.40806	0.16692	4.5124	2.8295	374.09	694.3	129.09	118.37	1608
137	0.71369	0.59312	0.59332	3.6942	2.919	676.05	351.79	24.305	84.887	1161
138	0.91854	0.19074	0.63055	3.5288	3.1504	809.19	501.75	103.17	118.3	6158.6
139	0.45967	0.51566	0.95385	7.0082	1.6603	598.1	160.15	62.407	96.957	5174.8
140	0.25344	0.93944	0.52473	10.442	1.5367	345.5	951.89	115.05	119.61	6092
141	0.099923	0.80992	0.89486	3.2309	1.1414	216.72	210.63	114.02	103.22	4864.3
142	0.24977	0.13496	0.98272	10.658	2.4017	992.13	459.73	112.76	91.92	45879
143	0.036624	0.20762	0.24422	4.6117	3.2958	280.23	561.82	109.58	121.53	2305.6
144	0.051719	0.26209	0.0068935	8.6802	1.508	394.27	215.91	106.91	99.632	8120.1
145	0.57483	0.63694	0.58037	9.9014	2.117	125.91	907.02	125.53	102.76	9583.2
146	0.41881	0.15465	0.36144	2.3109	1.8209	517.58	395.04	11.901	83.08	83901
147	0.22244	0.14066	0.14225	7.6027	2.0367	168.87	600.03	99.652	75.935	7836
148	0.68188	0.19518	0.10796	3.9251	2.5974	640.36	518.08	99.004	114.73	2018.7
149	0.72764	0.10513	0.88462	1.5993	2.4619	971.36	387.55	109.23	117.9	9286
150	0.43902	0.44513	0.11251	5.203	1.2204	904.11	817.78	77.695	90.749	4759.2
151	0.83171	0.60065	0.25367	4.1603	2.2741	233.61	795.4	94.397	88.623	42279
152	0.21903	0.05082	0.99545	1.3229	1.7704	551.63	369.7	75.605	85	8754.1

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
153	0.73195	0.12708	0.83865	1.7913	2.7432	434.27	894.81	57.514	89.797	3100.6
154	0.6762	0.029674	0.77487	6.5113	1.1726	497.88	484.93	113.4	101.83	8688.5
155	0.15591	0.40127	0.2951	3.0875	0.98692	245.5	894.17	117.64	131.53	17580
156	0.65336	0.16679	0.45652	16.213	1.0683	149.84	102.88	26.791	102.8	3152.3
157	0.78953	0.64082	0.81817	2.9406	2.451	463.66	789.06	108.48	84.712	4173.9
158	0.92559	0.17548	0.58945	16.672	2.2908	276.73	488.08	62.899	100.27	2154.6
159	0.6146	0.60552	0.56322	1.6848	0.69543	831.78	324.09	98.015	94.785	48346
160	0.16497	0.00029426	0.68255	12.22	1.5449	947.5	575.79	99.127	112.09	9250.7
161	0.59504	0.87101	0.019925	10.114	2.4829	662.61	923.44	94.514	87.064	3347.1
162	0.19052	0.39438	0.72575	5.8081	1.681	753.49	363.58	58.689	66.938	2853.4
163	0.74153	0.34185	0.87858	15.3	2.0337	679.6	108.25	102.88	111.99	1502.9
164	0.083627	0.52435	0.34361	1.0944	1.4087	226.99	193.96	121.84	97.327	1788.9
165	0.45195	0.81843	0.81288	0.70072	2.3152	690.74	367.95	127.16	120.37	4688.5
166	0.81384	0.22875	0.97654	0.44472	2.2227	280.67	274.87	93.119	85.665	9667.9
167	0.2695	0.73651	0.30146	11.463	2.8771	348.93	909.79	288.15	118.78	3790.2
168	0.66599	0.29998	0.92251	2.1845	1.2616	850.27	523.56	11.054	77.688	2074.4
169	0.1286	0.21367	0.73255	3.9964	1.4349	766.45	920.3	123.63	99.76	4284.8
170	0.90937	0.2454	0.34744	1.7522	1.0799	206.02	179.81	90.302	82.802	7765.2
171	0.001231	0.77299	0.11959	8.781	3.42	693.42	292.67	120.19	114.17	1027.6
172	0.4656	0.83016	0.93346	13.446	3.0524	910.57	163.63	92.744	90.383	4418.4
173	0.19628	0.022893	0.76523	11.081	3.3393	300.1	261.67	117.51	105.34	19130
174	0.54137	0.23146	0.60978	0.3668	1.8006	390.64	665.64	124.98	133.18	25885
175	0.36311	0.99983	0.053292	4.5671	3.0023	438.94	497.52	98.308	75.209	7266
176	0.60953	0.70036	0.27276	2.5341	2.6964	894.08	729.54	125.67	111.18	3418.8
177	0.064173	0.21845	0.15009	12.027	1.8979	801.43	214.36	97.72	103.87	2793.8
178	0.76396	0.92607	0.21335	6.5859	2.3663	216.71	556.03	113.55	85.78	95822
179	0.10918	0.39894	0.41905	1.6394	1.3553	692.42	724.88	115.9	88.001	7699.7
180	0.89186	0.018397	0.12176	4.2211	1.9693	979.04	257.66	161.07	99.162	5559.9
181	0.13459	0.45851	0.67736	6.8799	0.97039	757.85	116.49	127.81	113.47	9894.3
182	0.94536	0.066174	0.22481	1.313	2.7686	348.96	738.84	120.57	110.98	2939.5
183	0.074184	0.27323	0.063419	9.9881	2.8174	735.97	570.32	112.3	111.93	4240.1

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	SRC3Y	SRC1Y	SRC1X	HAVO	LDISP	KDRAVO	KDRAAL	KD_PU_VO	KD_PU_AL	KD_PU_COL
184	0.33522	0.56336	0.69415	6.1458	1.5572	633.8	582.46	53.924	96.474	74019
185	0.38501	0.57366	0.4949	3.5171	0.8841	561.4	242.81	121.17	115.26	3811.6
186	0.64828	0.67742	0.78821	7.2074	0.74928	960.18	950.74	127.84	103.6	2415.1
187	0.55432	0.3274	0.82971	2.0345	1.331	154.16	998.44	97.523	98.368	4449.8
188	0.58086	0.49706	0.48494	19.322	1.0266	309.09	585.43	113.93	109.58	8154.4
189	0.010006	0.95063	0.41403	0.84329	1.5764	403.71	281.47	22.459	87.03	1095.4
190	0.81791	0.48478	0.97384	4.0371	2.846	362.15	207.39	104.59	82.848	14208
191	0.10396	0.14898	0.95984	11.665	2.4325	804.34	939.88	52.037	94.609	7024.5
192	0.0082921	0.48702	0.022384	0.28879	2.7143	672.76	229.66	92.913	95.29	19773
193	0.66128	0.010403	0.85706	0.88664	2.4896	813.95	697.55	96.606	102.59	7873.5
194	0.44669	0.056335	0.013682	8.8329	1.7784	662.63	995.76	35.304	98.625	7929.1
195	0.58695	0.50667	0.080381	0.92354	0.59846	204.12	843.41	112.37	123.01	22898
196	0.14264	0.66797	0.39326	5.436	2.2604	912.83	107.64	99.089	90.813	7528.2
197	0.71574	0.5321	0.55188	1.0064	0.83186	479.83	587.79	60.367	108.55	6722.2
198	0.048634	0.62298	0.37462	5.9639	2.6736	344.03	361.74	21.366	97.216	7409.9
199	0.12266	0.69669	0.61218	7.1319	1.1931	102.01	382.58	126	87.918	8626.9
200	0.32612	0.9429	0.70614	5.8748	2.3786	194.53	623.45	36.609	80.817	2681.9

Source: Output DTN: SN0710PASZFTMA.003.

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
1	7536.5	6110.8	3.43×10^6	3876.4	190.13	4674.9	−4.572
2	2982.1	4758.2	2.78×10^5	5106.8	962.37	903.26	−5.7843
3	3681.6	9659.2	6.91×10^4	3957.2	228.48	3883.5	−8.8173
4	4944.3	4689.8	4.26×10^6	4266.4	828.49	4747.3	−8.0077
5	4306.1	5219	7.89×10^4	4322.7	281.21	93.203	−5.7211
6	4888.4	6619.5	5.71×10^6	6098.4	424.12	426.58	−6.7879
7	6187	4879.6	1.73×10^5	3564	873.03	2216.6	−7.6456
8	4392.8	5411.5	3.86×10^4	5120.7	473.6	199.71	−8.5382
9	6939.5	7236	4.81×10^5	5237.8	485.2	264.48	−8.3826
10	5065.5	6193.4	6.17×10^5	6363.4	799.58	2353.7	−7.8268
11	6260.6	5700.5	6.56×10^4	6529.9	252.55	317.68	−5.4308
12	6084.2	3543.1	4.95×10^6	6175.4	416.25	986.96	−7.4885
13	5901.9	5121.5	6.48×10^6	4382.1	572.63	63.693	−7.9463
14	6035.1	3167.6	2.09×10^6	3231.9	252.6	110.76	−5.3155
15	6776.7	3006.8	2.14×10^5	6029.9	855.16	3004.5	−6.3063
16	6286.8	4866.2	6.45×10^5	3007.8	260.34	2164.2	−6.038
17	8296	5233.4	3.90×10^5	4106.1	387.03	226.24	−8.9285
18	4695.3	7475.3	2.48×10^6	3038.4	741.09	827.44	−5.1203
19	5087.1	7753.6	2.16×10^6	3694.8	785.65	289.46	−5.015
20	5396.9	6976.8	6.12×10^5	6682	410.42	204.78	−8.6327
21	6785.1	5396.7	1.83×10^5	5049.3	720.49	3484	−7.7092
22	6802.5	4577.9	1.09×10^5	4230.4	195.57	361.06	−6.4254
23	5775.4	5917.5	2.25×10^5	4667.2	793.69	3198	−3.895
24	9482.4	4478.3	7.24×10^5	4140.8	273.76	308.16	−6.355
25	3226.9	5298.9	3.59×10^6	4663	231.57	1707.6	−6.8006
26	5518.5	7843.9	6.53×10^5	5001.7	836.01	721.47	−7.9992
27	8943.9	3492.1	2.69×10^6	5935.4	377.33	725.72	−5.2569
28	5600.9	5453.6	1.30×10^5	6572.2	738.41	2837.7	−8.3503
29	4925	5059	1.70×10^6	4512.3	636.71	302.9	−8.4815
30	9935.8	5095	1.23×10^6	4520.8	296.83	2616.4	−8.7293
31	7127.2	4495.2	7.37×10^6	3780.5	889.81	2073.9	−8.1127

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
32	6697.3	7382.1	1.35×10^4	4993.2	565.53	259.51	−5.0346
33	4826.2	6072.5	7.57×10^5	5985.6	562.65	610.07	−5.9699
34	5533.8	6581.2	2.32×10^5	4991.4	300.2	178.11	−8.3377
35	4244.1	6874.5	3.07×10^6	4594.1	905.27	183.49	−8.296
36	6083.9	7075.4	9.11×10^6	3318.5	702.38	4125.7	−5.8621
37	2653.4	5838.9	7.68×10^4	3240	709.91	75.137	−7.9177
38	4577.8	3456	8.06×10^6	5328	843.46	895.04	−4.4364
39	5596.2	6134.2	3.33×10^5	4770.7	836.03	366.07	−7.2399
40	3844.6	6691.1	9.11×10^5	6680	596.36	782.35	−6.1793
41	5441.9	4725.6	8.92×10^4	5805.3	985.33	560.04	−8.9181
42	6959.5	4002.8	7.35×10^4	4593	893.06	681.33	−6.3317
43	7511.7	6130.6	8.70×10^4	4942.4	138.47	523.33	−7.5121
44	5332.7	6684.8	7.43×10^5	4403.8	469.91	408.95	−7.3863
45	5266.2	5221.7	1.39×10^6	5533.5	271.86	273.62	−8.425
46	6366.3	5004.3	4.53×10^6	3832.9	788.6	475.54	−7.8574
47	4744.9	5150.9	5.38×10^4	3058	747.93	3381.5	−8.4126
48	6286.8	7622.4	5.34×10^5	6010.3	362.35	420.56	−6.7385
49	3738.4	6021.4	8.49×10^5	5382.2	377.48	1640.2	−8.0285
50	3916.2	4050.2	5.44×10^5	4281.3	500.54	415.79	−6.7708
51	1744.1	7201.3	1.65×10^5	987.22	913.32	114.62	−8.2752
52	5829.2	6597	2.63×10^6	6281.4	919.58	348.62	−8.5786
53	5356.2	5549	9.80×10^6	6624.1	982.43	591.22	−5.961
54	4901.8	6208.5	5.62×10^5	6299.9	282.73	997.13	−7.1264
55	8186.9	5543.4	9.96×10^4	4508.1	891.74	3829.4	−5.6324
56	7385.4	7280.7	4.13×10^5	5168.6	593.33	253.3	−5.6515
57	6286.9	6066.5	5.55×10^6	5377.4	638.72	245.56	−8.6058
58	5338.3	5597.3	2.89×10^6	3924.7	581.08	937.67	−6.5611
59	5881	6448.8	5.52×10^4	3459	770.12	4292.9	−4.6876
60	4968.1	6811.1	2.98×10^6	3722.9	329.1	3759.5	−7.1741
61	3420.1	5014.3	3.69×10^6	1087.5	740.07	155.62	−6.8259

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
62	8003.7	5656	6.78×10^5	3152.1	875.7	4585.9	−6.0998
63	2653.6	6738.8	3.55×10^6	5711.1	772.57	847.53	−5.5944
64	9105.3	4954.2	9.50×10^4	5342.3	773.61	1990.2	−5.5647
65	5377.2	6593.1	2.40×10^6	338.52	570.57	397.95	−4.9253
66	6681.1	5560.1	7.18×10^4	3766.7	879.54	1145.8	−4.7857
67	6857.3	5021.3	9.58×10^5	6538.4	817.57	788.04	−6.6733
68	4837.8	6308.7	4.38×10^6	3431.6	366.19	4838.7	−4.0582
69	2096.4	6630.1	8.00×10^5	4292.6	605.76	980.01	−7.6129
70	7454.6	5524.7	8.01×10^4	5953.1	579.09	278.65	−7.2777
71	3942.9	4412.1	1.96×10^5	5168.8	942.78	89.982	−4.6302
72	4546.6	3285	2.86×10^5	3226.1	709.77	689.75	−5.6844
73	4458.7	6340.7	4.33×10^4	5217.2	855.48	659.88	−5.2873
74	7500.7	6855.6	1.05×10^6	4166.7	956.74	608.06	−7.0552
75	5408	4923.3	4.96×10^5	4309.9	957.61	435.49	−8.7995
76	5135.3	7117.6	5.14×10^6	4144.4	150.1	68.08	−5.8189
77	3893	5486.3	1.92×10^4	3186.5	863.52	193.16	−7.2497
78	4608.8	4055.8	4.58×10^5	5736.1	765.67	1860.6	−6.2719
79	5221.5	5407.4	2.20×10^6	2635.3	865.53	2547.8	−8.0875
80	7669.2	5410.3	1.40×10^5	6119.5	646.6	4419.9	−8.6709
81	4062.6	4596.3	5.03×10^5	3685.3	601.08	970.41	−6.4535
82	5574.3	5555.1	8.41×10^4	6469.6	717.07	84.552	−6.5244
83	5255.3	4750.2	4.46×10^5	6059.1	688.01	383.66	−6.4857
84	5104.9	6901.1	5.21×10^5	5074.2	113.42	231.98	−4.3981
85	5704.4	2818.4	3.25×10^5	5505	911.75	4889.5	−4.5272
86	6779.3	4503.7	8.00×10^5	5194.6	690.08	239.8	−7.4294
87	4351	6472.9	3.80×10^4	3888.5	495.91	1057.6	−8.0503
88	3191.5	4993	6.71×10^6	4500	437.86	3981.9	−4.5105
89	7983.4	5549.5	1.20×10^5	5747.4	977.76	4181.6	−6.8462
90	7864.3	5478.6	2.54×10^6	3587.8	595.48	797.77	−7.9359
91	4416	5030	1.07×10^6	6335.8	947.47	635.79	−7.889
92	7571.3	4694	8.51×10^6	3160.2	226.8	105.45	−6.2493

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
93	4250.1	4614.8	2.04×10^6	6118.1	649.62	213.21	−7.4708
94	6250.2	7746.8	4.89×10^5	6382.7	679.14	169.93	−3.7317
95	8736.3	4154.3	1.63×10^6	5664.4	536.64	1215.2	−5.393
96	5198.9	5319	1.47×10^6	3691.4	789.75	3446.6	−5.5001
97	4020.9	4725.7	4.69×10^4	3429	972.89	329.52	−6.6074
98	3813.3	7964.1	2.08×10^5	1015.6	880.1	188.04	−8.3675
99	4943.1	6860.8	4.04×10^5	6257.9	801.73	323.08	−7.0308
100	3893.7	4321.2	3.70×10^6	6182.8	958.53	406.83	−7.7203
101	4330.6	4695.5	2.76×10^4	4724.4	612.34	353.11	−6.1279
102	7223.4	2210.9	3.02×10^5	6776	465.29	313.06	−8.0694
103	4255.3	3541.6	7.35×10^5	4789.1	464.14	344.72	−8.8338
104	5509.9	5475.8	3.26×10^6	6642.3	623.36	764.71	−7.0745
105	4229.3	3510.2	3.47×10^6	3879.9	774.98	674.77	−6.6485
106	5159.7	6695	2.31×10^4	6571.6	474.09	444.36	−5.4409
107	5280.8	8399.5	4.06×10^6	3460.4	355.47	1384.3	−7.6354
108	6051.5	4767.6	3.86×10^5	5684.4	376.71	535.51	−7.6714
109	6729.4	3666.2	9.15×10^5	3526.6	458.06	134.55	−6.9696
110	7713.6	6899.9	5.85×10^4	4124.7	206.42	744.38	−4.9795
111	8377.4	5846	8.24×10^5	5496.7	683.16	4641.7	−8.708
112	6908.9	4947.3	3.19×10^4	5207.6	798.74	4010.1	−7.1837
113	5276.6	5548.1	2.35×10^6	5780.7	623.65	648.13	−7.1191
114	5599.7	4246.3	4.82×10^6	5017	514.93	458.9	−8.9704
115	3572.2	6051.5	2.80×10^6	5657	932.57	145.44	−7.5521
116	4464.1	3016.5	7.04×10^5	6164.8	646.48	959.98	−7.0902
117	3517.3	6201.7	4.93×10^4	3562.9	729.93	118.17	−7.7541
118	3135.9	7422.3	4.37×10^6	6476.5	439.94	223.54	−6.1412
119	3029.9	6641.5	8.66×10^5	6746.9	719.77	1567	−8.158
120	5277.3	7678.7	1.86×10^6	5686.4	345.6	131.36	−8.9883
121	6327.1	7263.1	7.70×10^5	3934.4	719.86	389.6	−7.2082
122	7313.3	4287	3.51×10^4	3116.1	808.37	497.07	−6.9556
123	6747.9	8093.5	9.36×10^5	5894.9	127.46	2929	−8.4713

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
124	6284.2	5779.5	4.35×10^5	5677.5	493.28	1417.9	−5.9011
125	4502.4	5061.3	3.50×10^5	4718.7	424.02	2295.9	−6.5865
126	4824.9	4935.1	7.54×10^6	4528.5	716.76	286.08	−7.7741
127	2225.8	5164.6	1.79×10^6	2805	183.96	464.46	−8.1362
128	4255.2	3811	3.96×10^6	5013	432.91	1311.5	−6.0613
129	7230.9	5839.2	1.89×10^6	5792.1	812.9	915.08	−6.0073
130	8238.9	3716.6	8.85×10^5	6434.1	411.8	485.39	−8.2235
131	7508.1	7723.4	9.82×10^5	3278.1	564.82	871.04	−8.1668
132	2879.1	5218.9	2.68×10^5	4432.9	893.55	532.79	−7.3502
133	6395.2	4496.4	4.75×10^6	3964.8	625.52	294.72	−7.0104
134	5318.6	4735.2	4.73×10^6	3950.7	993.03	374.61	−6.6947
135	4478.7	5094.1	4.46×10^6	4114.8	228.67	480.94	−4.3359
136	3756.5	3332.4	6.22×10^6	4230.1	679.13	70.53	−5.7531
137	4784.2	6579.5	8.93×10^5	4814.2	537.87	554.49	−7.5684
138	4869.4	6000.7	2.27×10^6	6356.4	441.14	159.3	−5.3565
139	5739.5	6519	6.89×10^5	4924.4	233.65	956.11	−7.4479
140	5996.2	7762.4	4.17×10^5	4699.2	877.84	810.69	−6.7548
141	6662.8	4261.1	4.24×10^5	3278.4	276.53	1894.1	−6.9388
142	7971.8	2932.5	5.67×10^5	6739.4	577.54	218.07	−6.1196
143	5578.5	4340.5	3.91×10^6	3285.2	734.8	466.26	−6.7004
144	3647.1	5844.7	6.69×10^5	4131.5	271.41	3257.6	−7.371
145	5095.4	4718.5	1.50×10^5	3121.7	836.1	1111.2	−6.5065
146	9585.4	9535.8	2.46×10^5	4680.6	467.06	881.85	−6.4789
147	5228.6	7862.7	2.43×10^4	3784	460.62	632.25	−7.2809
148	3560.4	7288.6	3.76×10^6	6077	374.36	595.19	−7.8089
149	3979.7	2567	1.02×10^5	6704.5	383.06	3613.7	−5.0888
150	4086.7	3730.9	1.33×10^6	6641.5	705.26	698.81	−5.1417
151	2662	4671.3	3.33×10^6	3347	834.11	373.91	−8.2405
152	4538.7	5860.2	4.92×10^6	4004.9	597.74	4394.7	−7.6861
153	4821.2	6071.1	3.55×10^5	3965.9	938.24	3684	−4.374
154	2524.4	2295.5	2.93×10^5	4204.4	639.04	52.955	−8.8522

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
155	6904.8	5900.6	1.14×10^{6}	3497	907.7	3548.3	−6.1817
156	6364.7	5374.3	3.37×10^{5}	1949.3	110.96	1494.6	−7.5344
157	4969.2	6274.1	3.01×10^{6}	4440.9	818.32	840.63	−8.6836
158	3932.7	6122.9	7.09×10^{6}	3810.3	487.22	2059.5	−6.3775
159	4755.4	5062.4	4.24×10^{6}	5388.7	538.91	2465.8	−7.4084
160	4639.3	3373.4	8.35×10^{5}	6276.7	746.48	492.67	−8.8816
161	5973	3967.1	1.60×10^{5}	5439	917.29	4214.4	−8.2007
162	4839.2	6833.7	2.87×10^{6}	5310.5	537.4	883.53	−4.2662
163	6145.5	6205.4	8.79×10^{6}	4759.1	140.73	804.03	−7.3117
164	7664.3	2825.3	6.02×10^{4}	2575.1	397.27	581.36	−6.9054
165	5992.7	4294.4	2.55×10^{5}	5759.9	377.17	164.63	−7.598
166	4716.5	6771.9	1.87×10^{5}	1766.3	688.46	740.01	−5.2248
167	7595.1	4032.9	9.95×10^{5}	4106.6	884.17	656.34	−4.7488
168	6232.9	5654.3	6.00×10^{5}	5291.3	763.57	4485.8	−4.8991
169	2931.3	3995.7	5.82×10^{5}	5897.4	909.86	572.59	−6.2265
170	5917.3	5112.2	3.68×10^{5}	3566.1	180.37	148.93	−6.8629
171	8153.1	3573	4.07×10^{6}	5511.6	369.71	711.61	−6.4087
172	6137.8	6324.5	4.17×10^{6}	6226.1	286.96	549.77	−6.3856
173	6333.5	4761	1.31×10^{6}	2657.9	614.45	1776	−5.1919
174	5040.6	3240.2	4.62×10^{6}	5011	516.93	932.46	−6.0434
175	9871.4	5636.3	4.67×10^{5}	4688.7	489.78	3094.7	−7.3288
176	5352.8	5534.6	9.09×10^{4}	6712.7	553.26	622.47	−8.9459
177	6081.8	6100.4	9.47×10^{5}	5561.4	337.13	506.69	−5.8791
178	6926.9	4522.7	3.82×10^{6}	3740.9	518.61	2699.1	−7.157
179	3869.5	5517	5.23×10^{4}	5515.4	733.13	269.36	−8.7779
180	3993.4	4122.3	1.53×10^{6}	6390.1	541.35	2528.6	−6.5596
181	4187	4959.5	8.60×10^{5}	5481.2	152.45	920.27	−8.5473
182	7561	4977.4	3.73×10^{5}	4383.3	675.59	864.25	−5.4973
183	4569.6	6868.5	2.57×10^{5}	5516.8	649.87	3312.9	−8.1846
184	4381.5	5400.2	3.11×10^{5}	5754.4	518.62	947.68	−6.2812
185	3790.1	5354.2	3.17×10^{6}	4793.4	329.99	449.87	−8.5817

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_AM_VO	KD_AM_AL	KD_AM_COL	KD_CS_VO	KD_CS_AL	KD_CS_COL	CONC_COL
186	4359.9	6854.9	1.98×10^{6}	6502.1	964.47	753.79	−8.6539
187	4823.8	3707.3	3.23×10^{6}	3905	976.47	96.491	−7.8687
188	4708.1	7119.2	9.68×10^{5}	4134.9	559.27	852.35	−6.6348
189	2929	5760.4	9.48×10^{6}	4411.6	322.35	820.28	−6.9914
190	9628.3	4149.1	6.38×10^{4}	3612.3	336.55	55.079	−7.787
191	3093.4	7061.8	9.37×10^{4}	5966.1	943.09	2770.5	−8.7485
192	4150.7	5476.7	4.66×10^{6}	5315	303.1	769.44	−4.8491
193	4240.4	4868.1	1.14×10^{4}	6052.9	709.7	4973.3	−6.895
194	4791	7414.3	1.62×10^{6}	5107.6	996.7	396.5	−7.9751
195	7041.3	6698	4.53×10^{5}	3540.7	772.53	336.38	−4.7318
196	4872.1	5119.8	8.20×10^{6}	5884.1	155.03	704.98	−8.4518
197	8413.7	5717.9	6.29×10^{5}	5648.8	430.18	2962.3	−8.5185
198	4470.1	6312.3	2.61×10^{6}	3325.7	577.38	512.68	−8.3199
199	4441.3	5088.6	7.85×10^{5}	505.58	340.59	441.59	−8.8695
200	6617.8	5775.6	1.64×10^{4}	3057.9	720.6	125.69	−6.2063

Source: Output DTN: SN0710PASZFTMA.003.

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
1	6.9606	4.335	13676	2839.8	4.78×10^5
2	9.1038	19.072	137.53	390.57	1.64×10^5
3	34.457	35.515	425.3	45216	2.75×10^5
4	3.808	2.6396	353.15	256.39	1.23×10^5
5	5.0137	7.6967	366.33	1360.1	9.88×10^5
6	9.6141	7.8648	3608.8	12589	2.78×10^5
7	20.203	32.102	16757	9495.3	5.20×10^5
8	10.478	9.6681	4177	12844	7.39×10^5
9	4.5501	6.157	36892	61892	1.82×10^5
10	18.821	25.089	1069.5	5522	3.86×10^5
11	14.681	13.095	908.59	821.75	1.66×10^5
12	15.784	22.532	20366	4213.2	1.12×10^5
13	11.135	7.1054	11545	2972.7	6.85×10^5
14	2.8215	3.0266	12470	967.46	5.34×10^5
15	13.493	6.1604	33359	724	2.16×10^5
16	15.503	15.438	3779.2	1143.1	3.58×10^5
17	17.816	9.7417	83645	13866	1.36×10^5
18	9.0711	20.321	20094	89822	2.64×10^5
19	4.0408	8.8322	23074	90743	7.93×10^5
20	12.147	12.977	9440.4	24404	4.45×10^5
21	19.935	14.166	8103.9	1134.2	8.18×10^5
22	2.6583	3.7773	4420.3	1442.6	3.77×10^5
23	12.273	18.307	3670.6	6496.8	1.95×10^5
24	9.9895	11.149	27579	718.38	1.73×10^5
25	8.3039	20.539	637.94	21167	1.68×10^5
26	23.92	14.625	12390	28706	2.68×10^5
27	19.563	13.472	15417	156.34	2.35×10^5
28	13.521	12.998	4215.5	2852.4	4.52×10^5
29	7.679	6.5745	5883.4	3118.5	8.59×10^5
30	4.2754	4.9036	87610	8712.6	2.55×10^5
31	3.6703	6.1021	11790	4830.4	6.45×10^5
32	5.1347	6.7711	52504	72924	2.72×10^5
33	8.2937	6.7041	541.12	896.62	1.90×10^5
34	8.8936	9.429	1328.7	2949	1.88×10^5
35	20.669	11.232	633.64	1663.1	1.83×10^5
36	4.6574	7.633	5973.5	35100	8.23×10^5
37	6.3494	8.8317	204.92	4361.7	3.17×10^5
38	26.232	19.277	140.17	107.5	4.12×10^5
39	2.7266	3.4546	1330.8	2345.3	5.29×10^5
40	11.362	12.873	651.79	6651.7	8.62×10^5
41	18.464	25.335	224.47	177.17	2.83×10^5
42	2.4381	4.8082	3227.3	743.07	1.47×10^5
43	2.4821	2.317	16447	3781.7	4.19×10^5
44	37.612	23.449	1008.7	1471.7	2.38×10^5

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
45	10.615	7.7746	4336.8	2933.9	5.02×10^5
46	13.83	17.822	49089	29398	3.08×10^5
47	7.7118	7.2791	184.89	177.87	6.77×10^5
48	12.66	10.892	60808	71143	2.85×10^5
49	7.5971	13.737	151.29	748.65	1.20×10^5
50	4.094	7.1333	171.72	245.82	5.85×10^5
51	4.1502	7.9795	134.9	13321	1.45×10^5
52	27.45	23.359	68956	75558	2.13×10^5
53	7.7226	6.9626	12362	8663.8	1.62×10^5
54	16.133	9.3934	13078	20761	4.40×10^5
55	13.724	7.0172	90437	32656	7.24×10^5
56	24.392	10.983	23826	6696.3	1.33×10^5
57	22.542	21.507	2694.7	2871.6	2.18×10^5
58	29.923	14.29	674.31	412.19	4.00×10^5
59	10.453	11.87	11855	25219	5.70×10^5
60	37.25	26.308	1246.5	2131.3	4.53×10^5
61	9.7826	4.6689	4971.1	7839.6	3.51×10^5
62	49.661	22.771	97485	40495	9.08×10^5
63	9.6258	1.8278	699.3	1713.8	4.58×10^5
64	13.132	7.9842	78237	5075.4	1.16×10^5
65	4.2637	6.0668	450.45	2394.2	8.02×10^5
66	14.37	10.761	6342.3	1142.5	1.08×10^5
67	11.263	4.8197	8976.6	632.63	6.27×10^5
68	18.949	11.698	2825	4485.7	7.10×10^5
69	17.643	23.677	122.38	2222.8	1.94×10^5
70	25.411	15.103	50059	8355.3	3.11×10^5
71	34.95	27.293	597.62	742.21	1.56×10^5
72	18.87	21.788	159.22	133.49	2.25×10^5
73	3.7912	5.9015	2734.9	21697	2.52×10^5
74	9.8569	10.135	61432	49259	8.36×10^5
75	13.431	10.264	461.24	240.09	9.39×10^5
76	5.6398	16.446	949.56	21331	1.02×10^5
77	9.5791	9.5802	166.24	324.74	7.57×10^5
78	30.033	22.404	4758.2	1945.1	5.99×10^5
79	4.8559	3.0885	61796	37455	1.68×10^5
80	6.0899	12.629	2055.8	755.43	8.94×10^5
81	10.995	8.1568	237.97	216.35	9.17×10^5
82	3.3717	3.6143	2410.5	4695.1	1.21×10^5
83	5.9489	4.4621	8584.8	6075.1	2.34×10^5
84	10.866	12.024	18690	55446	8.79×10^5
85	9.5824	4.4025	41746	2045.9	8.04×10^5
86	12.306	12.94	1128.5	308.17	3.61×10^5
87	31.298	15.726	471.45	963.28	1.30×10^5

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
88	20.461	16.501	406.7	1306.2	1.77×10^5
89	18.884	21.905	72901	28838	2.46×10^5
90	6.6963	14.586	5796.2	2552.5	7.30×10^5
91	6.6329	6.9545	140.43	153.41	5.50×10^5
92	11.775	15.829	54638	19749	1.98×10^5
93	15.108	12.069	159.85	174.52	5.62×10^5
94	20.008	8.1545	43174	41868	1.44×10^5
95	6.1936	23.157	10479	1394.4	1.60×10^5
96	9.3601	6.0237	23042	13195	1.53×10^5
97	4.4583	10.478	865.54	5437.4	1.16×10^5
98	19.827	27.187	1731.8	58975	6.33×10^5
99	8.099	7.9861	589.68	2086	2.20×10^5
100	3.2389	3.5055	690.18	771.73	4.13×10^5
101	20.78	13.268	422.91	265.02	1.49×10^5
102	21.96	11.336	4216.1	119.23	1.35×10^5
103	7.638	7.7434	190.83	128.57	3.29×10^5
104	20.279	14.518	1491.7	796.85	3.27×10^5
105	6.9896	9.5672	120.58	114.84	2.44×10^5
106	13.744	10.98	671.67	1334.9	7.05×10^5
107	38.739	28.915	26725	70823	2.80×10^5
108	24.731	22.738	4731.9	1186.1	3.40×10^5
109	14.37	11.161	970.58	162.67	3.22×10^5
110	13.255	10.907	90219	82801	6.73×10^5
111	9.8106	8.9368	77579	30764	6.54×10^5
112	21.262	16.669	4454.4	592.21	3.46×10^5
113	16.754	8.4114	556.23	453.35	4.33×10^5
114	4.2869	10.234	804.78	855.74	3.93×10^5
115	8.8741	12.637	296.33	4666.8	3.84×10^5
116	6.2082	4.5631	317.02	133.05	1.27×10^5
117	12.301	9.791	746.03	5018.1	1.10×10^5
118	40.687	29.541	644.66	10090	6.47×10^5
119	26.622	12.906	365.55	1551.4	1.41×10^5
120	16.952	13.8	21430	55146	2.06×10^5
121	3.3383	4.0002	1952.1	5468.4	2.93×10^5
122	16.416	13.408	21432	932.58	1.55×10^5
123	7.6919	7.3554	6733	22435	2.96×10^5
124	6.8642	8.6649	5958.1	5485.1	1.41×10^5
125	16.807	17.23	5653.2	10552	9.96×10^5
126	8.8164	6.9131	9283	6813.7	9.50×10^5
127	8.3085	19.522	151.47	3355.8	1.70×10^5
128	11.563	6.6925	2859	658.49	1.22×10^5
129	6.7386	8.7912	10784	6579.5	1.25×10^5
130	6.6166	8.0118	66408	7663.5	2.29×10^5
131	5.2801	3.4706	27475	25639	6.96×10^5

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
132	22.062	32.996	124.82	403.36	1.28×10^5
133	9.9429	16.009	10723	3752	5.63×10^5
134	4.9119	14.971	1320.9	3999	8.43×10^5
135	13.792	27.562	4392.1	19079	4.31×10^5
136	3.5573	2.8335	743.05	389.01	1.91×10^5
137	8.8087	15.031	53467	91497	2.62×10^5
138	17.092	36.237	719.12	6870.3	2.02×10^5
139	36.488	25.322	2612.7	2484	8.88×10^5
140	18.368	28.432	1476.9	17799	3.33×10^5
141	4.9539	15.419	14657	7956.7	3.68×10^5
142	10.429	6.6569	4059.7	124.89	4.68×10^5
143	11.208	15.562	5063.3	4587.6	1.74×10^5
144	13.031	20.818	2994.2	26664	2.99×10^5
145	16.308	28.16	1248.8	1334	5.13×10^5
146	2.6669	6.8579	99841	99985	1.00×10^5
147	5.4163	9.9314	1679.2	26262	6.13×10^5
148	12.432	19.877	841.1	35590	1.05×10^5
149	3.3581	4.3231	10867	5700.5	5.45×10^5
150	14.071	15.038	423.47	338.52	9.75×10^5
151	19.132	26.193	106.93	154.64	1.12×10^5
152	9.6665	11.286	184.06	299.19	2.90×10^5
153	31.784	10.155	41763	31621	9.24×10^5
154	10.189	4.6564	108.35	101.83	3.15×10^5
155	8.7809	9.9855	60267	42998	5.37×10^5
156	4.811	4.1443	6711.5	4058.5	4.25×10^5
157	5.3726	9.8343	4157.3	19370	5.09×10^5
158	7.5914	4.077	11604	20187	1.07×10^5
159	7.955	9.4252	506.05	557.81	1.09×10^5
160	10.241	11.492	183.75	168.41	1.39×10^5
161	14.225	16.213	13009	2777.2	3.98×10^5
162	33.391	8.6137	1132.3	479.28	4.98×10^5
163	5.5954	5.3781	19194	20489	2.42×10^5
164	7.4277	3.0013	1372.2	105.91	1.57×10^5
165	15.112	17.65	8379.1	2048.6	7.62×10^5
166	15.029	11.175	7193.7	20108	1.50×10^5
167	16.689	5.4535	89832	6568.6	1.02×10^5
168	8.4497	10.97	19101	13599	1.06×10^5
169	14.109	34.229	182.33	758.78	5.95×10^5
170	19.403	10.072	5766.2	1105	3.53×10^5
171	5.6609	4.0309	23935	419.9	3.05×10^5
172	36.427	19.829	15727	9246.2	4.84×10^5
173	7.8999	8.7134	8134.7	3651.4	1.18×10^5
174	4.1505	3.2972	302.33	144.67	4.07×10^5
175	29.657	17.648	55530	821.22	2.50×10^5

Table A-1[b]. Sampled Stochastic Parameter Values (Continued)

Real. #	KD_SE_VO	KD_SE_AL	KD_SN_VO	KD_SN_AL	KD_SN_COL
176	19.616	33.437	5045.2	13613	9.56×10^5
177	18.795	28.511	14748	23076	4.84×10^5
178	24.439	15.209	2643.7	239.96	3.38×10^5
179	21.267	26.589	850.56	3390	3.74×10^5
180	3.7914	7.8184	258.97	586.32	1.84×10^5
181	7.8278	4.4562	259.53	244.84	2.21×10^5
182	30.814	41.79	63352	38046	7.84×10^5
183	4.766	5.8558	515.13	4448.2	2.11×10^5
184	26.559	31.739	441.42	1300.8	1.14×10^5
185	4.3924	2.7643	12487	19957	2.30×10^5
186	3.6527	8.2106	608.19	10327	4.94×10^5
187	4.5726	5.0473	556.56	325.54	7.50×10^5
188	17.036	8.2702	4305.2	9428.5	6.67×10^5
189	7.0053	12.462	236.35	4605.8	1.31×10^5
190	12.397	17.096	23776	473.08	6.19×10^5
191	6.2283	9.8415	818.63	33853	7.75×10^5
192	7.6295	9.5975	220.52	686.6	3.64×10^5
193	6.7196	7.6747	263.35	538.25	1.78×10^5
194	5.9066	5.9046	15142	59773	1.37×10^5
195	19.489	19.326	4260.8	4108.5	2.01×10^5
196	9.8806	23.208	523.48	1868.8	5.79×10^5
197	11.325	13.238	74907	32238	6.06×10^5
198	5.6324	6.5977	407.48	3064.4	2.59×10^5
199	11.352	6.0069	469.24	238.44	4.63×10^5
200	17.85	31.503	4047.5	4817.3	2.09×10^5

Source: Output DTN: SN0710PASZFTMA.003.

NOTE: Some parameter names included in the GoldSim file for the SZ one-dimensional transport model file differ from the parameter names given in this table, as follows: BULKDENSITY = Alluvium_Density, KDNPVO = Kd_Np_Vo, KDNPAL = Kd_Np_Al, KDSRVO = Kd_Sr_Vo, KDSRAL = Kd_Sr_Al, KDUVO = Kd_U_Vo, KDUAL = Kd_U_Al, KDRAVO = Kd_Ra_Vo, KDRAAL = Kd_Ra_Al.