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TRANSMITTAL OF *TOTAL SYSTEM PERFORMANCE ASSESSMENT – SITE RECOMMENDATION* (TSPA-SR), REVISION 00, ICN 01, BIN 3 MODEL VALIDATION REVIEW INTERIM REPORT

Reference: Ltr., Brocoum to Reamer, dtd. 8/31/01

The referenced letter summarized the ongoing model validation review effort and the available results in the "In-Process Review of Model Validation" (enclosure 5). The letter described the Yucca Mountain Site Characterization Project's requirements, methodology for conducting the impact review and indicated that the final results of the model validation review would be available to the U.S. Nuclear Regulatory Commission (NRC) in mid-October 2001. The review is continuing and the final results are not yet available. Final results will be available to the NRC by the end of November 2001.

This letter summarizes the preliminary model validation impact review results as outlined in Enclosure 5 of the above referenced letter. The primary objective of the review was to evaluate the adequacy of model validation associated with the Analysis Model Reports (AMR) containing model input to the TSPA-SR, and to determine whether the identified issues have the potential to impact the results or conclusions of the TSPA-SR.

This review was performed in response to Corrective Action Request, BSC-01-C-01, pursuant to Quality Assurance review findings of an adverse trend in model validation deficiencies. A team of Technical Specialists, i.e., Sr. Engineering Specialist/Sr. Science Specialist, was convened to evaluate which of the TSPA-SR supporting technical work products contained models, and whether the work (as documented) complied with procedural requirements for model validation (AP-3.10Q).

The review encompassed 125 AMRs plus supporting documents and data needed to assess model validity. A resulting 128 models were identified and sorted into bins per the following criteria:

WM-11
NMSS07

- Bin 1: validated per AP-3.10Q (*Models and Analyses)*
- Bin 2: can be readily validated per AP-3.10Q using available data/information
- Bin 3: not readily validated

The results of the binning process were:
- 17 Bin 1 models
- 77 Bin 2 models
- 34 Bin 3 models

For Bin 3 models, impact reviews were prepared to address the impact of the model validation review findings on the conclusions presented in the TSPA-SR, i.e., the calculated dose rate histories. In some cases, the impact reviews noted that existing Key Technical Issue (KTI) agreements had been created to address some of the technical questions and concerns included in the model validation review findings. The impact reviews also describe the path forward, i.e., further documentation, development, or data support planned for models intended to support a potential license application.

Of the 34 Bin 3 models, initial assessments indicate that, while additional work is required to fully comply with the procedural requirements of AP-3.10Q, there are no significant impacts on the TSPA-SR conclusions.

The following summarizes the preliminary results of the extent of conditions associated with the 34 Bin 3 models:

- Eight models were <u>not used</u> in the TSPA-SR and <u>did not serve</u> as a basis for screening out Features, Events and Processes (FEPs); thus have no impact on the TSPA-SR.
- Seven models were <u>not used</u> in the TSPA-SR, but <u>served</u> as a basis for screening out FEPs. A determination of the impact of the models on the TSPA-SR and FEPs screening is pending completion of the review.
- Fourteen models <u>were used</u> in the TSPA-SR, but <u>did not serve</u> as a basis for screening out FEPs. A determination of the impact of the models on the TSPA-SR is pending completion of the review.
- Five models <u>were used</u> in the TSPA-SR and <u>also served</u> as a basis for screening out FEPs. A determination of the impact of the models on the TSPA-SR and FEPs screening is pending completion of the review.

Enclosure 1 provides the list of Bin 3 models and use in TSPA-SR products. Summaries of the preliminary model validation reviews are presented in Enclosure 2. In the event that any of the continuing efforts identify a problem that impacts the results or conclusions of the TSPA-SR, the U. S. Department of Energy will notify the NRC.

If you have any questions concerning this correspondence, please contact April V. Gil at (702) 794-5578.

April V. Gil

for Stephan Brocoum
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OL&RC:AVG-0112

Enclosures:
1. Summary of Bin 3 Models
2. Model Validation Review Summaries, Bin 3 Models

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ENCLOSURE 1
Transmittal of TSPA-SR REV 00, ICN 01 Model Validation Review Summaries

Summary of Bin 3 Models

Model Area	Models Identified (SEE ENCLOSURE 2: IDENTIFIERS IN PARENTHESIS)	Used for TSPA?	Used for FEPs?
G. Mountain-Scale/Near-Field THM	▪ THM Model (G.1)	N	Y
H. In-Drift Chemistry	▪ Cement Grout Model (H.3-2) ▪ Corrosion of Steel Used in the Ex-Container EBS (H.3-3) ▪ Effect of Evaporation in the Invert (H.3-4) ▪ EBS Colloids Model (H.3-5) ▪ Seepage/Cement Interaction Model (H.7)	N N N N N	Y Y Y Y N
I. EBS Moisture Distribution and TH	▪ Ventilation Model (I.5) ▪ In-Drift THC Model (I.7) ▪ Effective Thermal Conductivity Model (I.8)	Y N Y	N N N
J. Waste Package/Drip Shield Degradation: General and Localized Corrosion	▪ WAPDEG Analysis of Waste Package and Drip Shield Degradation (J.6) ▪ Incorporation of Uncertainty & Variability of Drip Shield & Waste Package Degradation in WAPDEG (J.8)	Y N	N N
K. Waste Form Degradation: General Information	▪ Waste Form Degradation Abstract. - Best Estimate Model (K.4-3) ▪ Waste Form Degradation Abstract. - Immobilized Pu Model (K.4-4)	N N	N Y
K. Waste Form Degradation: Cladding Degradation	▪ Alternative Wet Clad Unzipping Model (K.14-1) ▪ Summary and Abstract. - Clad Unzipping & Fuel Dissolution (K.16) ▪ Thermal Evaluation of Breached 21-PWR Waste Packages (K.18) ▪ Breakage of CSNF Clad by Seismic Loading (K.19-1) ▪ Breakage of CSNF Clad by Static Loading (K.19-2)	Y Y Y Y N	N N Y N N
L. EBS Degradation	▪ DRKBA Rockfall Model (L.1) ▪ Flow into Waste Packages Through Small Lid Openings Model (L.6)	Y N	Y N
M. EBS Radionuclide Transport	▪ In-Drift Transport of Radionuclides (M.2) ▪ In-Drift Colloids and Concentrations (M.3) ▪ Seepage/Invert Interaction Model (M.4) ▪ EBS Radionuclide Transport Abstraction Model (M.5)	N Y N Y	N Y Y N
N. UZ Transport	▪ FRACL Calibration to Borehole Chloride (N.3-1)	Y	N
P. SZ Transport	▪ Abstraction of FEHM and Coupling with UZ Mass Flux (P.4-2) ▪ Transport Parameters from C-Wells and Laboratory Studies (P.4-3)	Y Y	N Y
Q. Biosphere	▪ Surface Soil Model in GENII (Q.9-1) ▪ Radionuclide Transfer to Animals (Q.9-4) ▪ Radionuclide Transfer to Aquatic Food (Q.9-5)	Y Y Y	N N N
R. Igneous Disruption	▪ Geometry of Volcanic Feeder System Model (R.2)	Y	N
U. PA Modeling	▪ TSPA Model (U.1-1) ▪ Soil Removal Model for Volcanic Disruption (U.1-2) ▪ Pu-Ceramic Degradation Model for TSPA-SR (U.4)	Y Y N	Y N N

Model Validation Review Summaries, Bin 3 Models

ENCLOSURE 2
Transmittal of TSPA-SR REV 00, ICN 01 Model Validation Review Summaries

MODEL VALIDATION REVIEW SUMMARIES

October 2001

Model Validation Review Summaries, Bin 3 Models

(SEE ENCLOSURE 1 FOR MODEL IDENTIFIER NUMBERS IN PARENTHESIS)

G. MOUNTAIN-SCALE/NEARFIELD THM

Thermal-Hydrologic-Mechanical (THM) Model (G.1). The need for additional validation of this model has been previously recognized and steps have already been initiated to complete the validation process. This model is not used in TSPA-SR, but does serve as a basis for screening Features, Events and Processes (FEPs). Alternative modeling approaches have been implemented and a new analysis/model report (AMR) was issued in August 2001. This new AMR includes more extensive information on model validation based primarily on measured field data from the Drift Scale Test (DST), Large Block Test, and Single Heater Test (SHT). Additional information to be developed to address DOE-NRC agreements on Key Technical Issues related to THM processes will provide increased confidence.

Analyses completed to date indicate that the THM effects on permeability are relatively small (within an order of magnitude change in permeability, based on measurements from both the SHT and DST) compared to the range of permeability (three to four orders of magnitude) arising from natural spatial heterogeneity. The results of these analyses support the "screening-out" of THM effects from the TSPA-SR as both reasonable and defensible, thus further model validation activities are not expected to impact the TSPA–SR dose-rate calculations.

Based on the above information, the conclusion is that the model validation issues associated with the THM Model have no impact on the conclusions of TSPA-SR.

H. IN-DRIFT CHEMISTRY

Cement Grout Model (H.3-2)
The Cement Model is not used in TSPA-SR, but is used as the basis for screening FEPs. The predicted pH for leachate compositions is considered to be conservative. In addition, waste package and drip shield corrosion rate models indicate that water compositions similar to the predicted cement leachate compositions have no significant effect on degradation of these components. Additional information developed to address NRC Key Technical Issues agreements related to cement/seepage composition and interactions will provide further confidence in the model.

Based on the above information, the model validation issues associated with this model have no significant impact on the conclusions of TSPA-SR.

Model Validation Review Summaries, Bin 3 Models

Corrosion of Steel Used in the Ex-Container Engineered Barrier System (EBS) (H.3-3). The Corrosion of Steel used in the Ex-Container EBS Model estimates a range of effects from steel corrosion on the oxygen content of the gas phase in the emplacement drift. The model is not used in TSPA-SR, but is used for screening FEPs. The approach used is considered to be conservative, and the calculated range of oxygen fugacities is less than the range needed to significantly affect the redox potential of the aqueous phase. Further model development, testing, and comparison to natural or man-made analogs would not likely change this conclusion.

Based on this information, the model validation issues associated with this model have no impact on the conclusions of TSPA-SR.

Effect of Evaporation in the Invert (H.3-4). The Effect of Evaporation in the Invert Model is not used in TSPA-SR, but does serve as a basis for screening FEPs. Changes in porosity of the invert would have no effect on radionuclide transport as calculated for TSPA-SR, except during the period when advection is minimal and Fickian diffusion dominates radionuclide transport in the invert. During this period calculated peak doses are low compared to later times, and EBS transport has only a small effect.

Based on the above information, there is no significant impact on the conclusions of TSPA-SR from the validation issues associated with this model.

Engineered Barrier System Colloids Model (H.3-5). The EBS Colloids Model is not used in TSPA-SR, but does serve as a basis for screening FEPs. Colloidal transport in the waste package and the ex-container engineered barrier system is included in TSPA-SR based on the In-Drift Colloids and Concentration Model and the Waste Form Colloid-Associated Concentrations Limits: Abstraction and Summary.

Based on the above information, there is no significant impact on the conclusions of TSPA-SR from the validation issues associated with this model.

Seepage/Cement Interaction Model (H.7). The Seepage/Cement Interaction Model estimated the rate of carbonation of grout around rock bolts based on Fick's first law. The model was not used in TSPA-SR and was not used for FEPs screening. Consequently, the validation issues associated with this model had no impact on TSPA-SR.

Model Validation Review Summaries, Bin 3 Models

I. EBS MOISTURE DISTRIBUTION AND TH

Ventilation Model (I.5). The Ventilation Model is used in TSPA-SR, but does not serve as a basis for screening FEPs. The model is used to demonstrate the feasibility of thermal management using forced ventilation. Thermal analyses and thermal-hydrologic models that support TSPA-SR represent pre-closure ventilation as a decrease in the waste heat output by a fixed proportion. The more detailed information produced by the model is not used.

Based on this information, the model validation issues associated with the Ventilation Model have no impact on the conclusions of TSPA-SR.

In-Drift THC Model (I.7). The In-Drift THC Model was not used in TSPA-SR and did not serve as a basis for screening FEPs. The model was preliminary and was developed for the backfill case (coupled thermal-hydrologic-chemical processes were to be incorporated in a revision). Consequently, the validation issues associated with this model had no impact on TSPA-SR.

Effective Thermal Conductivity Model (I.8). The Effective Thermal Conductivity Model is a simplification that is used in TSPA-SR, but is not used as a basis for screening FEPs. Temperatures computed using this approach are spatially smoothed such that local spot variations in temperature along the surfaces of waste packages, drip shields, or drift walls are not represented. The effect of this smoothing on TSPA-SR is small because the evolution of temperature and humidity primarily affect the timing, but not the occurrence of other processes such as waste package degradation. Therefore, the effects of small differences in temperature or humidity on processes such as corrosion, as represented in the TSPA-SR model are minor.

Based on the above information, the model validation issues associated with this model have no significant impact on the conclusions of TSPA-SR.

J. WASTE PACKAGE/DRIP SHEILD DEGRADATION: GENERAL AND LOCALIZED CORROSION

WAPDEG Analysis of Waste Package and Drip Shield Degradation (J.6). The WAPDEG model is used in TSPA-SR, but does not serve as a basis for screening FEPs. The WAPDEG model is an integration model for waste package and drip shield degradation analysis and is based on supporting process models and abstraction models. The abstraction models are fully supported by the underlying process models, so the abstraction models and the WAPDEG model are considered validated as long as the corresponding process models are validated. The process models are based on Project-generated data relevant to repository conditions, and are considered validated. The technical basis for the process models is the focus of several DOE-NRC agreements on Key Technical Issues related to Alloy-22 and titanium degradation. The additional information developed to address these agreements will provide further confidence in the WAPDEG model.

Based on the above information, model validation issues associated with the WAPDEG Model have no significant impact on the conclusions of TSPA-SR.

Incorporation of Uncertainty and Variability of Drip Shield and Waste Package Degradation in WAPDEG (J.8). The model was developmental and was partially complete in its present form. It was originally intended that the AMR would be revised for use as supporting information for TSPA-SR. However, this model was not used in TSPA-SR and did not serve as a basis for screening FEPs. Consequently, the model validation issues associated with this model had no impact on the conclusions of TSPA-SR.

K. WASTE FORM DEGRADATION: GENERAL INFORMATION

Waste Form Degradation Abstraction - Best Estimate Model (K.4-3). The model is based on preliminary or approximate information and has limitations as discussed in the AMR. Based on these limitations, an upper-limit (instant release) approach is used for TSPA-SR in lieu of this model. This model is not used in TSPA-SR and does not serve as a basis for screening FEPs. Consequently, the validation issues associated with this model have no impact on the conclusions of TSPA-SR.

Waste Form Degradation Abstraction - Immobilized Pu Model (K.4-4). The model is based on preliminary or approximate information and has limitations as discussed in the AMR. Based on these limitations, an upper-limit (instant release) approach is used for TSPA-SR in lieu of this model. Investigation of immobilized Pu waste forms is conducted separately from the TSPA-SR. This model is not used in TSPA-SR, but does serve as a basis for screening FEPs.

Based on the above information, the validation issues associated with this model have no impact on the conclusions of TSPA-SR.

K. WASTE FORM DEGRADATION: CLADDING DEGRADATION

Alternative Wet Clad Unzipping Model (K.14-1). This model estimates the range of the unzipping rate multiplier and thus the effectiveness of cladding in limiting Commercial Spent Nuclear Fuel (CSNF) radionuclide release. The model is used in TSPA-SR, but does not serve as the basis for screening FEPs. Because the contribution of cladding to total system performance is minor, there is no significant impact from uncertainty in the cladding degradation model.

Based on this information, the model validation issues associated with this model have no significant impact on the conclusions TSPA-SR.

Model Validation Review Summaries, Bin 3 Models

Summary and Abstraction - Clad Unzipping and Fuel Dissolution (K.16). This model estimates the range of the unzipping rate multiplier and thus the effectiveness of cladding in limiting CSNF radionuclide release. This model is used in TSPA-SR, but does not serve as the basis for screening FEPs. Because the contribution of cladding to total system performance is minor, there is no significant impact from uncertainty in the cladding degradation model. Additional work performed to address the DOE-NRC agreements on Key Technical Issues related to cladding degradation will provide additional confidence in the cladding abstraction models.

Based on this information, the model validation issues associated with this model have no significant impact on the conclusions TSPA-SR.

Thermal Evaluation of Breached 21-PWR Waste Packages (K.18). This model calculates the difference in temperature between the cladding and the waste package surface to support evaluation of cladding degradation. The model is used in TSPA-SR and does serve as a basis for screening FEPs. Because the contribution of cladding to total system performance is minor, there is no significant impact from uncertainty with respect to cladding degradation.

Based on this information, the model validation issues associated with this model have no significant impact on the conclusions TSPA-SR.

Breakage of CSNF Clad by Seismic Loading (K.19-1). This model is used to determine the likelihood of a seismic event causing breakage of the cladding. This model is abstracted for use in TSPA-SR, but does not serve as a basis for screening FEPs. Because the contribution of cladding to total system performance is minor, there is no significant impact from uncertainty in the cladding degradation model. Additional work performed to address the DOE-NRC agreements on Key Technical Issues related to cladding degradation will provide additional confidence in the cladding abstraction models.

Based on this information, the model validation issues associated with this model have no significant impact on the conclusions TSPA-SR.

Breakage of CSNF Clad by Static Loading (K.19-2). This model is not used in TSPA-SR and does not serve as a basis for screening FEPs. The cladding will be protected from static loading by the waste package and drip shield, throughout the 10,000-yr performance period. Consequently, the validation issues associated with this model have no impact on the conclusions of TSPA.

Model Validation Review Summaries, Bin 3 Models

L. EBS DEGRADATION

Discrete Rock Key Block Analysis (DRKBA) Rockfall Model (L.1). The DRKBA Rock Fall Model is used in TSPA-SR and does serve as a basis for screening FEPs. The DRKBA model is reasonably conservative for predicting the occurrence of large rockfall blocks. These blocks are then used for structural analysis of the drip shield design. Additional work performed to address the DOE-NRC agreements on Key Technical Issues related to rockfall analyses will provide additional confidence in the model. Although the DOE has agreed to make model improvements, the current model and its supporting and related documentation are considered to provide adequate confidence that the effects of rockfall on the integrity of the waste package can be limited for 10,000 years by use of the drip shield.

Based on the above information, the model validation issues associated with the DRKBA Rock Fall Model have no significant impact on the conclusions of TSPA-SR (i.e. dose calculations)

Flow into Waste Packages Through Small Lid Openings (FLO) Model (L.6). This model was developed after TSPA-SR. The purpose of the model was to improve understanding of processes controlling water flow into waste packages. This model was not used in TSPA-SR and did not serve as a basis for FEP screening. Consequently, the validation issues associated with this model had no impact on the conclusions of TSPA-SR.

M. EBS RADIONUCLIDE TRANSPORT

In-Drift Transport of Radionuclides Model (M.2). This model is primarily a sensitivity analysis that shows how breakthrough curves change for different dispersion coefficients and Peclet numbers. The model is not used in TSPA-SR and does not serve as the basis for FEPs screening. Consequently, there is no impact on the conclusions of TSPA-SR from validation issues associated with this model.

In-Drift Colloids and Concentrations Model (M.3). This model is a conceptual model that cannot be readily tested against experimental data. The model provides direct input to TSPA-SR representing a potentially important mode of radionuclide transport, and serves as a basis for FEPs screening. Colloid-associated radionuclide releases calculated by TSPA-SR are not significantly impacted because the TSPA-SR colloid abstraction approach uses conservative and/or bounding values for parameters. A similar conservative and/or bounding approach is used for FEPs screening.

Based on this information, there is no impact on the conclusions of TSPA-SR from validation issues associated with this model.

Model Validation Review Summaries, Bin 3 Models

Seepage/Invert Interactions Model (M.4). The Seepage-Invert Interaction is not used in TSPA-SR, but does serve as a basis for FEPs screening. Since the invert has a small benefit for performance, and invert materials will have limited influence on the composition of water entering the drifts, there is no significant impact on the conclusions of TSPA-SR from validation issues associated with this model.

EBS Radionuclide Transport Abstraction Model (M.5). The AMR makes transparent and logical arguments regarding model features and assumptions that provide confidence in the representation of EBS performance in the TSPA-SR. The EBS Transport Abstraction is used in TSPA-SR, but does not serve as a basis for screening FEPs. The abstraction provides conservative and/or bounding representation of processes controlling radionuclide transport from the waste package to the drift wall.

Based on this information, there is no impact on the conclusions of TSPA-SR from validation issues associated with this model.

N. UZ TRANSPORT

FRACL Calibration to Borehole Chloride (N.3-1). This model is used in TSPA-SR, but does not serve as a basis for screening FEPs. However, the FRACL model itself is not used to simulate radionuclide transport in the TSPA-SR. Instead, Unsaturated Zone (UZ) radionuclide transport is simulated for TSPA-SR using the FEHM code with the residence time transfer function particle-tracking technique. The FRACL model-data comparison results for chloride support the UZ radionuclide transport model. The results are consistent with other methods used to assess the reasonableness of the UZ radionuclide transport model, and would not significantly affect the overall TSPA-SR results even if they are excluded. DOE-NRC agreements on Key Technical Issues will address additional information (such as porewater chloride concentrations) and overall validation of the transport calculations that will provide further confidence in the validation of the FRACL model.

Based on this information there is no impact on the conclusions of TSPA-SR from validation issues associated with this model.

P. SZ TRANSPORT

Abstraction of FEHM and Coupling with UZ Mass Flux (P.4-2). This model is used in TSPA-SR, but does not serve as a basis for screening out FEPs. The abstraction is a simple calculation procedure that combines other validated models with appropriate qualified data, and uses a verified computer subroutine to perform the calculations. Accordingly, the model is considered to be appropriate for its intended use. Additional verification of the model by comparison to other model results and experimental results are being performed to provide additional confidence in the model.

Based on this information there is no impact on the conclusions of TSPA-SR from validation issues associated with this model.

Transport Parameters from C-Wells and Laboratory Studies (P.4-3). This model is used in TSPA-SR and does serve as a basis for screening FEPs. Comparison of results from laboratory and field responses is used to show that laboratory-derived sorption parameters could be used defensibly in field-scale predictive calculations. The use of overlapping laboratory and field testing, and complementary analyses of laboratory and field test results provide confidence in the parameterization of the dual-porosity model used for TSPA-SR. Additional laboratory testing will provide further confidence in the selection of the dual-porosity model, the use of RELAP and RETRAN to simulate field test results, and the use of laboratory-measured K_d values as well as other specific parameters to model Saturated Zone (SZ) transport.

Based on this information, there is no impact on the conclusions of TSPA-SR from validation issues associated with this model.

Q. BIOSPHERE

Surface Soil Model in GENII-S (Q.9-1). The soil model is a simplified evaluation of the processes that affect the buildup of radionuclides in the soil. The model is used in TSPA-SR, but does not serve as a basis for screening FEPs. The model is considered appropriate for analyzing long-term performance, even though it produces demonstrably conservative results. This is the same basic model used in other Biosphere models developed internationally, and is both accepted and well documented. DOE-NRC agreements on Key Technical Issues related to the selection of K_d values, the assessment of the realistic vs. conservative nature of the K_d values, and other element-specific biosphere parameters important in the Biosphere Dose Conversion Factor (BDCF) calculations are expected to increase confidence in the model and quantitatively demonstrate that the model adequately represents uncertainty and variability. The current approach is simplified and conservative, and therefore defensible for its intended use. Potential future revisions of the model are unlikely to significantly impact dose assessments.

Based on this information, there is no impact on the conclusions of TSPA-SR from validation issues associated with this model.

Radionuclide Transfer to Animals (Q.9-4). The Radionuclide Transfer to Animals Model is used in TSPA-SR, but does not serve as a basis for screening FEPs. The GENII-S based approach used for TSPA-SR dose calculations includes the primary pathways that contribute to dose, but does not include incidental ingestion of contaminated soil while grazing, or inhalation of resuspended particles. Contributions from additional pathways are much smaller and not likely to be significant to dose calculations.

Based on this information, there is no significant impact on the conclusions of TSPA-SR from the validation issues associated with this model.

Model Validation Review Summaries, Bin 3 Models

Radionuclide Transfer to Aquatic Food (Q.9-5). The Radionuclide Transfer to Aquatic Foods was used in TSPA-SR, but did not serve as a basis for screening FEPs. The need for the aquatic food pathway in Amargosa Valley arose because a small commercial catfish farm was in operation. The catfish farm subsequently discontinued operations. For all radionuclides except ^{14}C, the dose contribution from aquatic foods was insignificant. For ^{14}C in groundwater (if any should be present from the repository) the dose was overestimated by an order of magnitude. These results were demonstrably conservative.

Based on this information, there was no impact on the conclusions of TSPA-SR from the validation issues associated with this model.

R. IGNEOUS DISTRUPTION

Geometry of Volcanic Feeder System Model (R.2). The Geometry of Volcanic Feeder System Model is used in TSPA-SR, but does not serve as a basis for screening out FEPs. For TSPA-SR, only eruptions fed by conduits are considered, and the inference is made that any waste package that is wholly or partly intersected by a conduit would be damaged to the extent that it would provide no further protection for waste. This model is conservative in several respects. Although additional validation activities are underway which will address the DOE-NRC agreements on Key Technical Issues related to the consequences of igneous disruption, it is unlikely that the conclusions of the TSPA-SR will be affected by these activities.

Based on this information, there is no significant impact on the conclusions of TSPA-SR from the validation issues associated with this model.

U. PA MODELING

Total System Performance Assessment-Site Recommendation Model (U.1-1). The TSPA-SR incorporates an appropriate degree of confidence in the models used to demonstrate compliance with the draft regulations. The evolution of TSPA has undergone independent peer review with favorable conclusions regarding the basic framework and the use of abstractions and component models. In addition, sensitivity studies in the form of uncertainty importance analyses, subsystem sensitivity analyses, and robustness analyses have been performed to represent the level of uncertainty, the influence of conservatism, the limitations of the models, and the impacts on individual-dose associated with various time periods and hazards. These analyses indicate that the TSPA-SR model is sufficiently robust and that even given the uncertainties that may exist in the subsystem models, the relevant performance standards will likely be met. Additional sensitivity analyses have been performed to provide insight into potential conservatism and optimism in the TSPA-SR, to express a wider representation of uncertainty, and to provide updated and more realistic models for processes. The results of these sensitivity analyses also indicate that the relevant numerical performance standards can be met for a range of thermal operating modes, by a margin of several orders of magnitude.

Based on this information, there is no significant impact on the conclusions of TSPA-SR from the validation issues identified for the TSPA-SR system model by this review.

Model Validation Review Summaries, Bin 3 Models

Soil Removal Model for Volcanic Disruption (U.1-2). The Soil Removal Model for Volcanic Disruption was used in TSPA-SR, but did not serve as a basis for screening FEPs. Instead of explicitly including aeolian and fluvial processes that could transport sediment from the area of ashfall to the location of the receptor, TSPA-SR analyses used a conservative approach in which the wind direction was fixed toward the receptor for all eruptive events. This and other features of the model resulted in overestimating radiation exposure from volcanic disruption. The overall representation of ash redistribution processes in the model for TSPA-SR was conservative.

Based on this information, there was no significant impact on the conclusions of TSPA-SR from the validation issues associated with this model.

Pu-Ceramic Degradation Model for TSPA-SR (U.4). This model was used in a sensitivity analysis of the potential effects of using High Level Waste (HLW) as a surrogate for plutonium in canister-in-canister ceramic form. The model was not used in TSPA-SR and was not used for screening FEPs. Based on this information, there was no significant impact on the conclusions of TSPA-SR from the validation issues associated with this model.