REVIEW BY THE U.S. NUCLEAR REGULATORY COMMISSION OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS OF THE U.S. DEPARTMENT OF ENERGY AGREEMENT RESPONSES RELATED TO THE POTENTIAL GEOLOGIC REPOSITORY AT YUCCA MOUNTAIN, NEVADA: KEY TECHNICAL ISSUE AGREEMENTS RADIONUCLIDE TRANSPORT 1.05, 2.02, 2.10 AND 3.08 AND TOTAL SYSTEM PERFORMANCE ASSESSMENT AND INTEGRATION 3.31 AND 3.32 AND GENERAL 1.01, COMMENTS 28, 34, 43 and 45

1.0 INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) issue resolution goal during this interim pre-licensing period is to ensure U.S. Department of Energy (DOE) has assembled enough information about a given issue for NRC to accept a License Application for review. Closure of an issue by the NRC during pre-licensing does not prejudge the NRC staff evaluation of the issue during the licensing review. Issues are closed by the NRC staff during pre-licensing when the staff have no further questions or comments about how DOE is addressing an issue. Pertinent new information could raise new questions or comments about a previously resolved issue.

By letter dated October 2, 2003, DOE submitted a report titled Technical Basis Document No. 11: Saturated Zone Flow and Transport (Bechtel SAIC Company, LLC, 2003a) that contains responses to 25 key technical issue (KTI) agreements in Appendices A–M. Staff reviews of six of the agreements are described in the following sections. Each section provides information on the background and wording of the agreements followed by brief summaries of the information provided by DOE for each agreement, and finally, NRC's staff evaluations of the extent to which DOE's responses satisfy the agreements.

2.0 REVIEW OF TECHNICAL BASIS DOCUMENT NO. 11, APPENDIX I: DOE RESPONSE TO AGREEMENTS RADIONUCLIDE TRANSPORT (RT) 2.02 AND TOTAL SYSTEM PERFORMANCE ASSESSMENT AND INTEGRATION (TSPAI) 3.32

Appendix I of Bechtel SAIC Company, LLC (2003a) provides the combined DOE response to Agreements RT.2.02 and TSPAI.3.32. Agreement RT.2.02 was reached at a meeting held December 5–7, 2000, to discuss the RT KTI (Reamer, 2000b). The wording of this agreement follows.

> RT.2.02. "The DOE should demonstrate that TSPA captures the spatial variability of parameters affecting radionuclide transport in alluvium. DOE will demonstrate that TSPA captures the variability of parameters affecting radionuclide transport in alluvium. This information will be provided in the TSPA-LA document due in FY 2003."

Agreement TSPAI.3.32 was reached at a meeting held August 6–10, 2001, to discuss the TSPAI KTI (Reamer, 2001a). The wording of this agreement follows.

> TSPAI.3.32. "Provide the technical basis that the representation of uncertainty in the saturated zone as essentially all lack-of-knowledge uncertainty (as opposed to real sample variability) does not result in an underestimation of risk when propagated to the

performance assessment (SZ2.4.1)."[1]

"DOE will provide the technical basis that the representation of uncertainty (i.e., lack of knowledge uncertainty) in the saturated zone does not result in an underestimation of risk when propagated to the performance assessment. A deterministic case from the Saturated Zone Flow Patterns and Analyses AMR (ANL–NBS–HS–000038) will be compared to TSPA analyses. The comparison will be documented in the TSPA for any potential License Application expected to be available to NRC in FY 2003."

2.1 Relevance to Repository Performance

Agreements RT.2.02 and TSPAI.3.32 request DOE to address variability and uncertainties associated with radionuclide transport in the saturated zone. Risk insights communicated by NRC (2004) indicate retardation in the saturated alluvium has the potential to delay movement of radionuclides that tend to sorb onto porous materials. Furthermore, NRC (2004) indicates that while current retardation factors for significant radionuclides, such as Neptunium-237, likely provide a reasonable estimate of sorption, the technical bases rely on experiments with limited accounting of saturated zone chemistry or variation in alluvium mineralogy. Because the agreements are intended to bolster confidence in processes that are likely reasonably accounted for, NRC (2003) has rated these agreements as low and medium, respectively.

2.2 NRC Evaluation and Comment

2.2.1 RT.2.02

The DOE's response to Agreement RT.2.02 is provided in Appendix I of Bechtel SAIC Company, LLC, (2003a). The DOE's response acknowledges the heterogeneous nature of the saturated alluvium and its transport properties. The DOE used a Monte Carlo approach to sampling parameter distributions for effective parameters in the TSPA to best account for effects of spatial variability in a model that contains numerous complex processes (Bechtel SAIC Company, LLC, 2003a, Appendix I). Parameter uncertainties are quantified using these distributions, which represent what is known about the parameter and reflect current understanding of the range and the likelihood of parameter values (Bechtel SAIC Company, LLC, 2003a, Appendix I). The DOE's response identifies permeability, effective porosity, and sorption coefficients as the principal parameters of concern. The DOE argues that flow parameters such as permeability and effective porosity are estimated through model calibration and field tests that inherently account for smaller scale variability, and the use of effective porosity adequately accounts for the possibilities of preferential flow paths (Bechtel SAIC Company, LLC, 2003a, Appendix I). Moreover, DOE concludes that the range of effective porosity and flux values used within TSPA conservatively bounds the influence of heterogenities in the alluvium (Bechtel SAIC Company, 2003a, Appendix I).

The DOE also presents a geostatistical analysis to demonstrate that use of a single effective sorption coefficient for the model domain adequately reproduces particle travel times estimated by explicit representation of a small-scale heterogeneous distribution of sorption coefficients

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[1]SZ2.4.1 in this agreement refers to NRC integrated subissue SZ2 (NRC 2002, Table 1.1-2).

(Bechtel SAIC Company, LLC, 2003a, Appendix I). Heterogeneous sorption coefficient distributions for several radionuclides were stochastically determined using site-specific, field-derived mineralogical data and experimentally derived sorption data. The DOE's results are consistent with previous work (Painter, et al., 2001) that suggests effective sorption coefficients produce conservative estimates of transport times relative to use of heterogeneous distributions at smaller scales. The DOE cautions that effective parameters are useful only when no large correlation lengths are present within the model domain, and DOE's response notes that, based on the limited data collected to date, no large (relative to the model domain) correlated lengths exist (Bechtel SAIC Company, LLC, 2003a, Appendix I).

Agreement RT.2.02 was developed in December 2000 partly as a result of the lack of available data to describe the transport properties of the saturated alluvium (Reamer, 2000b). Since that time, substantial data have been developed as part of Nye County's Early Warning Drilling Program. These data have been incorporated into TSPA transport parameter distributions for the saturated alluvium and are briefly described in other sections of Bechtel SAIC Company, LLC (2003a, e.g., Appendix H). The Early Warning Drilling Program data and the analyses presented in Appendix I of Bechtel SAIC Company, LLC (2003a) indicate that adequate information will be available to review the technical bases for representation of the spatial variability of alluvium transport parameters in a potential License Application. Therefore, Agreement RT.2.02 is considered closed.

2.2.2 TSPAI.3.32

The DOE's response to Agreement TSPAI.3.32 is also provided in Appendix I of Bechtel SAIC Company, LLC (2003a). The DOE's response presents a discussion of sources of uncertainty and how uncertainty is captured and propagated through the TSPA model to a determination of risk (Bechtel SAIC Company, LLC, 2003a). A site-scale saturated zone flow and transport model mean value realization is compared to a multiple realization case in which input values are stochastically sampled. The DOE's analysis concludes that since the multiple realization case (which includes parameter uncertainty) produces greater estimated activity flux than the deterministic mean value realization, the uncertainty propagation is appropriate and does not underestimate risk (Bechtel SAIC Company, LLC, 2003a).

The DOE's response (Bechtel SAIC Company, LLC, 2003a) does not address the issue of lack of knowledge uncertainty relative to uncertainty produced by spatial variation and heterogeneity. Similar to Agreement RT.2.02, Agreement TSPAI.3.32 was developed in part because of a lack of data to bound or confirm the saturated alluvium transport parameters used in performance assessment models (Reamer, 2001a). A concern was that use of a large range or erroneous distribution for an important transport parameter due to lack of knowledge (i.e., lack of data to constrain that parameter) might result in underestimation of risk. The DOE's response does not directly address this issue (Bechtel SAIC Company, LLC, 2003a, Appendix I). Instead, DOE's response focuses on uncertainty caused by real sample variability and the incorporation of that uncertainty within the TSPA (Bechtel SAIC Company, LLC, 2003a). However, since 2001, a significant amount of data on the transport properties of the saturated alluvium has been collected and used to inform parameter and uncertainly distributions used in TSPA (e.g., Bechtel SAIC Company, LLC, 2003a, Appendix H). The substantial increase in the data collected to date has significantly reduced the lack of knowledge uncertainty. Therefore, it appears that sufficient information will be available to review a potential License Application with respect to the effects on risk of uncertainty in saturated zone transport parameters. Therefore, Agreement TSPAI.3.32 is considered complete.

3.0 REVIEW OF TECHNICAL BASIS DOCUMENT NO. 11, APPENDIX L: DOE RESPONSE TO AGREEMENT TSPAI.3.31

Appendix L of Bechtel SAIC Company, LLC (2003a), provides DOE's response to Agreement TSPAI.3.31. Agreement TSPAI.3.31 was reached at a meeting held August 6–10, 2001, to discuss the TSPA and Integration KTI (Reamer, 2001a). The wording of this agreement follows.

> TSPAI.3.31. "Evaluate the effects of temporal changes in saturated zone chemistry on radionuclide concentrations (SZ2.3.2)."[2]
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> "DOE will reexamine the FEPs, currently included in the performance assessment, that may lead to temporal changes in saturated zone hydrochemistry. If the DOE determines that these FEPs can be excluded, the results will be documented in the FEP Saturated Zone Flow and Transport AMR (ANL–NBS–MD–000002) in FY 2003. If the DOE determines that these FEPs cannot be excluded from the performance assessment, the DOE will evaluate the effects of temporal changes in saturated zone chemistry on radionuclide concentrations and will document this evaluation in above-mentioned AMR."

3.1 Relevance to Repository Performance

The sorption coefficient is a measure of the potential for radionuclide retardation. For a given radionuclide, important factors determining the magnitude of the sorption coefficient include the chemistry of groundwater and the mineralogy of the substrate on which the radionuclide might sorb. Variations in groundwater chemistry over time could lead to variations in sorption coefficient values, which could affect the radionuclide concentrations in the groundwater to which the receptor is exposed. NRC was concerned that the potential for temporal changes in groundwater chemistry was not adequately considered in the TSPA models, which assume temporally invariant sorption coefficients for each realization.

3.2 NRC Evaluation and Comment

The DOE's response to Agreement TSPAI.3.31 in Appendix L (Bechtel SAIC Company, LLC, 2003a) states that the effects of changes in some water chemistry parameters such as pH and major ion concentration are included in performance assessment through sorption coefficient probability functions (Bechtel SAIC Company, LLC, 2003a). This conclusion is based on observation of the spatial and age-related variation in groundwater chemistry both of which, according to DOE, are accounted for in the sorption coefficient distribution functions (Bechtel SAIC Company, LLC, 2003a, Appendix L). Given DOE expects temporal changes in saturated zone chemistry, as evident by incorporation of the effect of these changes on sorption co-efficient probability density functions, the staff recommends that DOE should consider the effect

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[2]SZ2.3.2 in this agreement refers to NRC integrated subissue SZ2 (NRC 2002, Table 1.1-2).

on radionuclide concentrations.

The DOE's response (Bechtel SAIC Company, LLC, 2003a, Appendix L) also described the potential for changes in system Eh and dissolved oxygen, which could produce reducing conditions rather than the oxidizing conditions generally observed to be present in the saturated zone. Although reducing conditions would generally lead to higher sorption (i.e., more retardation) for most radionuclides, the DOE discussion examines the potential for transient reducing conditions, which could lead to a temporary storage and subsequent release (during re-oxidation) of radionuclides possibly producing higher radionuclide concentrations than would be predicted under a steady state scenario (Bechtel SAIC Company, LLC, 2003a, Appendix L). The DOE postulates that changes in oxidizing conditions are unlikely and need not be included in the total system performance system. However, the supporting evidence is limited. For example, DOE's response states that "...the cause of reducing conditions in ground water from borehole NC-EDDP-5SB is not clear..." and DOE suggests reducing agents may be responsible. However, the reducing agents were not observed in borehole cuttings (Bechtel SAIC Company, LLC, 2003a).

The DOE presents a limited range of scenarios that could produce transient effects on hydrochemistry (specifically Eh and dissolved oxygen). Some processes that could impact system Eh and produce transients on repository time scales, are not discussed. The NRC staff notes that climate changes are expected within the regulatory period and included in TSPA simulations. However, DOE's response does not appear to address the possible transient effects of climate changes on saturated zone chemistry and how that might affect radionuclide concentrations. In the accessible environment, a possible cause for change in the saturated zone chemistry could result from variations in deep percolation (e.g., Stonestrom et al. 2003). If DOE chooses to exclude temporal changes of saturated-zone chemistry as a feature, event, and processes, it should provide an evaluation which reasonably demonstrates temporal changes in saturated zone chemistry will not occur or that the effects of these changes on radionuclide concentrations are adequately captured by the ranges and probability distribution of sorption coefficients used in DOE's modeling of saturated zone transport. This agreement is considered incomplete.

4.0 REVIEW OF TECHNICAL BASIS DOCUMENT NO. 11, APPENDIX M: DOE RESPONSE TO AGREEMENT RT.3.08 AND GEN.1.01 (COMMENTS 43 AND 45)

Appendix M of Bechtel SAIC Company, LLC (2003a), provides DOE's response to Agreement RT.3.08 Additional Information Needed (AIN-1) and GEN.1.01 (Comments 43 and 45). Agreement RT.3.08 was reached at a meeting held December 5–7, 2000, to discuss the RT KTI (Reamer, 2000b). The wording of this agreement is as follows.

> RT.3.08. "Provide justification that microspheres can be used as analogs for colloids (for example, equivalent ranges in size, charge, etc.). DOE will provide documentation in the C–Wells AMR to provide additional justification that microspheres can be used as analogs for colloids. The C–Wells AMR will be available to the NRC in October 2001."

Agreement RT.3.08 was initially addressed by letter report (Ziegler, 2002). NRC review of this response resulted in the following request for additional information (Schlueter, 2002).

RT.3.08 AIN–1. "Provide a stronger technical basis and adequate experimental evidence to indicate that carboxylate modified latex (CML) microspheres can be used as analogs for colloids in alluvium. Provide a response to General Agreement 1.01 (#45) to address the potential for remobilization of microspheres and/or colloids."

Agreement GEN.1.01 was reached at a meeting held September 18–19, 2001, to discuss the Range of Thermal Operating Temperatures (Reamer, 2001b). The wording of Comments 45 are is follows.

GEN.1.01 Comment 45. "In discussing preliminary microsphere transport tests at the Alluvial Testing Complex, it is mentioned that flow transients can remobilize microspheres. Is such a process possible in the repository system? If so, how can it be accommodated in the models? These questions may be addressed under Agreement RT.3.08, although that agreement specifically discusses fractured rock rather than alluvium."

4.1 Relevance to Repository Performance

Agreement RT.3.08 AIN–1 and Comment 45 of GEN.1.01 pertain directly to results of experiments used to support DOE's response to RT.3.08 (Ziegler, 2002) in which carboxylate-modified latex microspheres were preferentially retained in alluvium-filled columns relative to silica colloids and suggested that carboxylate-modified microspheres may not be an adequate analog for colloid transport studies in alluvium. One way in which highly sorbing radionuclides may be transported in groundwater is by attachment on natural colloids present in groundwater. As part of the NRC risk insights initiatives (NRC, 2004), the potential for colloid-facilitated RT in the saturated zone has been ranked as having medium significance to waste isolation. Similarly, Agreement RT.3.08 has been ranked as having medium significance to waste isolation (NRC, 2003). The individual comments within GEN.1.01 were not separately rated within the significance framework.

4.2 NRC Evaluation and Comment

The DOE addresses Agreement RT.3.08 AIN–1 and GEN.1.01 Comment 45 in Appendix M of Bechtel SAIC Company, LLC (2003a). The DOE's response provides additional experimental evidence to support the use of carboxylate-modified latex microspheres as analogs for colloids in saturated alluvium. Results of recent experiments indicate that small diameter microspheres [diameters less than 200 µm (7.8×10^{-3} in)] are transported at similar rates and with retention similar to natural colloids in columns packed with saturated alluvium from the Yucca Mountain vicinity.

The DOE's response for GEN.1.01 Comment 45 states that the effects of flow transients are not explicitly considered in performance assessment models, but colloid detachment factors are, in part, based on results of tests in which known flow transients occurred (Bechtel SAIC Company, LLC, 2003a). The DOE argues that the transients experienced in the tests exceed any likely naturally occurring flow transients. Based on the implicit inclusion of transients in the detachment rates and the low likelihood of natural transients of similar magnitude, exclusion of transient effects on colloids in the TSPA is justified. Therefore, based on review of DOE's response, Agreements RT.3.08 AIN–1 and GEN.1.01 Comment 45 are considered closed.

5.0 REVIEW OF TECHNICAL BASIS DOCUMENT NO. 11 APPENDIX H: DOE RESPONSE TO AGREEMENTS RT.1.05, RT.2.10

Agreements RT.1.05 and RT.2.10 were reached at a meeting, held December 5–7, 2000, to discuss the RT KTI (Reamer, 2000b). The wordings of these agreements are as follows:

> RT.1.05. "Provide additional documentation to explain how transport parameters used for performance assessment were derived in a manner consistent with NUREG–1563, as applicable. Consistent with the less structured approach for expert judgment acknowledged in NUREG–1563 guidance and consistent with DOE procedure AP-3.10Q, DOE will document how it derived the transport parameter distributions for performance assessment, in a report expected to be available in FY 2002."
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> RT.2.10. "Provide additional documentation to explain how transport parameters used for PA were derived in a manner consistent with NUREG–1563, as applicable. Consistent with the less structured approach for expert judgment acknowledged in NUREG–1563 guidance and consistent with AP-3.10Q, DOE will document how it derived the transport distributions for performance assessment, in a report expected to be available in FY 2002."

Technical Information Provided for Agreements RT.1.05, RT.2.10

The DOE combined response to Agreements RT.1.05 and RT.2.10, is provided in Appendix H of Bechtel SAIC Company, LLC (2003a). Detailed supporting information is provided in two documents by Bechtel SAIC Company, LLC (2003c, Attachment I; 2003d, Attachment I). The text of the response provides a basis for sorption and transport parameters that includes: (i) an evaluation of the factors that could influence the sorption behavior of the radionuclides of interest; (ii) an evaluation of the potential ranges for these parameters in the Yucca Mountain flow system; (iii) laboratory measurements of sorption coefficients; (iv) and the results of sorption modeling using the PHREEQC Version 2.3 computer code (Bechtel SAIC Company, LLC, 2003a, Appendix H). The response provides a more systematic technical basis for the K_d values and probability distributions of americium, cesium, neptunium, plutonium, protactinium, radium, strontium, thorium, and uranium. The K_d probability distributions are based on experimental data from DOE program, and the effects of variability in geochemistry and mineral surface area are characterized for the long-lived actinides using a surface complexation modeling approach (Bechtel SAIC Company, LLC, 2003c, Attachment I). Separate distributions were derived for the unsaturated zone and the saturated zone. The differences in these distributions include effects caused by differences in water compositions, mineral compositions, and radionuclide concentrations. Probability distributions in the unsaturated zone are adjusted based on results of modeling studies and observed trends in chemistry. For the saturated zone, separate sorption coefficient distributions for volcanic tuff and alluvium are determined. The sorption coefficient distributions for the volcanic tuffs are based on results of experiments on devitrified and zeolitic tuff samples (Bechtel SAIC Company, LLC, 2003c, Attachment I). For the alluvium, only neptunium and uranium have supporting site-specific experimental evidence; the remaining radionuclide distributions are based on data from devitrified tuff samples. The limited range of geochemical conditions examined by the experiments is supplemented with a surface complexation modeling approach that allows for interpolation and extrapolation of sorption coefficients for the range of chemistries applicable to the saturated zone (Bechtel SAIC Company, LLC, 2003c). For some radionuclides (e.g., plutonium and thorium), these laboratory measurements were augmented with those reported in the literature for sorption on pure silica in simple electrolytes or waters similar in composition to water from Wells UE–25p#1 or J–13.

While the upper and lower limits of the K_d cumulative distributions are based on experimental data supported by process modeling, the shapes of the distributions are assigned through expert judgment.

5.1 Relevance to Repository Performance

Agreements RT.1.05, RT.2.10 and GEN.1.01 comments 28 and 34 all pertain to the development of and technical bases for sorption parameters in the saturated zone. The saturated zone is listed as a principal factor in total system performance, chiefly as a component of defense in depth (CRWMS M&O, 2000). Revision 4.0 of CRWMS M&O (2000) describes the degree of radionuclide sorption on mineral surfaces within the rock matrix of the tuff aquifer system and in the alluvial aquifer system as the most important process affecting the ability of the saturated zone to act as a natural barrier by attenuating and delaying potentially released radionuclides. Independent NRC performance assessment sensitivity analyses have also concluded that retardation in the saturated zone is important, based on much higher modeled doses that result from analyses in which the saturated zone was excluded from the model (NRC, 1999; Mohanty, et al., 2002). In particular, neptunium retardation has been shown to have a significant effect on dose calculations (NRC, 1999).

These and other risk insights pertaining to RT in the saturated zone suggest that the most important aspects are those related to sorption in the saturated alluvium, matrix diffusion in the fractured volcanic tuff, and colloid-facilitated RT. The potential delay of radionuclides in the saturated alluvium is primarily controlled by the magnitude of sorption on alluvial minerals and the effective porosity of the alluvium, which also is important for determining travel time of nonsorbing radionuclides. RT in fractured volcanic tuff is retarded through diffusion of radionuclides from the flowing fractures into the porous tuff matrix, where radionuclides may be sorbed. NRC (2004) ranks alluvium sorption as high significance to waste isolation and diffusion and subsequent sorption of radionuclides in the tuffs as medium significance to waste isolation. NRC (2003) identifies agreements RT.1.05 and RT.2.10 as medium-risk significance. The individual comments within GEN.1.01 are not separately categorized within the significance framework.

5.2 NRC Evaluation and Comment

One attribute that makes unsaturated and saturated zones principal factors in DOE’s safety case is their potential to attenuate and delay the transport of radionuclides through sorption processes. Radionuclides can be sorbed onto mineral surfaces of the tuff rock matrix following diffusion from the fractures into the stagnant water in the matrix and can sorb onto the porous alluvium. The DOE estimates of sorption values are primarily derived from experimental measurements, but the range and uncertainty of the sorption values are represented by probability distributions of sorption values that are sampled by the flow and transport model abstraction. Agreements RT.1.05 and RT.2.10 were developed to address the concern that radionuclide sorption parameter probability distributions, and the bases on which the probability distributions were developed, were inadequately supported. These agreements were marked by NRC saff as having medium significance to waste isolation. The DOE sensitivity studies also indicate that predicted neptunium transport times are sensitive to the uncertainties incorporated into the sorption coefficient probability distribution (Bechtel SAIC Company, LLC, 2003c). The DOE's response to Agreements RT.1.05 and RT.2.10 provides a summary of how sorption coefficient probability distributions and other transport parameters distributions were derived from experiments, modeling, and expert judgment. A detailed discussion of experimental analyses, subsequent modeling, and technical bases for developing the sorption coefficient probability distributions for various radionuclides is presented in Bechtel SAIC Company, LLC (2003c, Attachment I) for the saturated zone and Bechtel SAIC Company, LLC (2003d, Attachment I) for the unsaturated zone. The detailed discussions do not include nuclides of actinium, chlorine, lead, selenium, and tin, which are included in DOE TSPA models. Thus, the bases for development of the sorption coefficient probability distributions for these nuclides are not available. Risk insight activities (NRC, 2004) indicate that these radionuclides are not significant to waste isolation performance of the potential repository. Recent DOE documents provide a detailed description of the bases for neptunium sorption values used in the unsaturated and saturated zones and indicate that sorption processes in the engineered barrier system invert are not included in the performance assessment model. Thus, no additional information is required for these comments

6.0 SUMMARY AND STATUS OF THE AGREEMENTS

NRC reviewed the DOE KTI agreement responses within the Saturated Zone Technical Basis Document to determine if sufficient information was provided to close the agreement items. On the basis of this review and notwithstanding new information that could raise new questions or comments concerning the above agreements, DOE has provided the information requested in Agreements RT.1.05, 2.02, 2.10, 3.08 AIN-1, TSPAI.3.32, and GEN.1.01 Comment 45. These agreements are considered closed. NRC staff did not review Agreement GEN.1.01, Comments 28, 34, and 43 since they were not associated with the original agreement. TSPAI 3.31 is considered open. The DOE should provide technical support for concluding that temporal changes in the saturated zone chemistry will not occur or that the effects of these changes on radionuclide concentrations are adequately captured by the ranges and probability distributions of sorption coefficients used in DOE's modeling of saturated zone transport.

7.0 REFERENCES

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