



U.S. Department of Energy
Office of Civilian Radioactive Waste Management

Response to NRC/DOE Conference Call Regarding QA and Performance Assessment Issues

Presented to:
DOE/NRC Quarterly QA Meeting

Presented by:
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**YUCCA
MOUNTAIN
PROJECT**

Andrews / March - 20

1. Section 6.3.4.2 In-Package Chemistry

1.1 page 265, Table 6-42

- **NRC Finding**

- Calculated pH fell outside of expected range
- pH bounds and pH values, though correct, apply to different time periods
- Potential error in in-package chemistry abstraction for “early” chemistry conditions

- **DOE Response**

- Calculated pH values for CDSP waste packages are correct for calculation times indicated (98,000 and 100,000 years) but are incorrectly labeled as “early” time phase; should be “late” time phase
- Correct pH range for this “late” time should be as follows:

| <u>Seepage environment</u> | <u>pH range</u> |
|-----------------------------------|-----------------|
| Always Drip (t=98,000 yrs) | 8.5 - 9.2 |
| Intermittent Drip (t=100,000 yrs) | 8.5 - 9.2 |
| No Drip (t=98,000 yrs) | 8.6 - 9.2 |

- Calculated and observed values are within this range

1. Section 6.3.4.2 In-Package Chemistry

1.1 page 265, Table 6-42 (cont)

- **DOE Response (cont)**

- **Weighted-/moving-average of in-package chemistry was selected to assure the chemistry was appropriate at times when the rate of waste package failure is increasing; these are of greater significance during the 10,000 year compliance period.**
- **At long times (~100,000 years) this may be a non conservative representation**
- **Further discussion of this is planned for the TSPA I KTI Technical Exchange**
- **Table will be revised with next version of document**

1. Section 6.3.4.2 In-package Chemistry

1.2 page 266, Table 6-43

- **NRC Finding**

- Hand and model predicted total carbonate concentrations are the same, but inconsistent with equation in Table 6-38
- TSPA model input file used the wrong equation
- Equation in Table 6-38 is correct based on input AMR
- Impact to risk is unknown

- **DOE Response**

- Equation used to calculate in-package carbonate concentration in the model input file should be that presented in Table 6-38
- Using correct equation would decrease carbonate concentration by ~ 1,000
- Based on relationship between carbonate concentration and CSNF dissolution rate given in eqn. 6-2, this would decrease the dissolution rate by ~ 10% (~ 0.4 mg/m²/day) - - this is insignificant and conservative
- Correct exponent used in subsequent analyses and will be documented in next revision of report

2. Section 6.3.4.3 Cladding Degradation Model

- **NRC Finding**

- **Triangular distribution noted states minimum, mean and maximum values**
- **GoldSim triangular distribution uses minimum, most likely, and maximum values**
- **Information in the document appears incorrect**

- **DOE Response**

- **Text in the document is incorrect**
- **Input triangular distributions use minimum, most likely and maximum values**
- **Correct terminology will be used in next revision of document**

3. Section 6.3.4.4 Dissolution Rate Model

- **NRC Finding**

- Calculated values of glass dissolution rate in Table 6-54 are not identical to observed values
- Differences cannot be explained by round off error

- **DOE Response**

- Difference is due to fact that R value used in hand calculation was 8.314×10^{-3} kJ/(mol K), while R value in GoldSim is 8.31451×10^{-3} kJ/(mol K); when using the R value to 6 significant figures, the table is correct to 5 significant figures
- Difference is insignificant
- Clarification regarding round off error will be added in next revision of document

4. Section 6.3.4.5 Dissolved Concentration Limits

4.1

- **NRC Finding**

- Calculated concentration limits are not identical to observed values
- Informal hand calculations provided by DOE had different environmental parameters
- Degree of precision required during model component verification is unknown

- **DOE Response**

- Discrepancy is in the 5th significant figure
- Informal hand computations used slightly different water chemistries
- Precision at the 5th significant figures is not required for verification
- Clarification of degree of significance required for verification will be presented in the next revision of the document

4. Section 6.3.4.5 Dissolved Concentration Limits

4.2 page 316, Table 6-60

- **NRC Finding**

- Hand calculations could not be verified

- **DOE Response**

- Informal hand computations provided electronically to NRC used different environmental conditions; they do not correspond to the conditions identified in Table 6-60
- Further examination conducted during the project review reverified the values in Table 6-60 as being correct

5. Volcanic Releases - Table 6-133

- **NRC Finding**

- Values in Table 6-133 could not be verified and are inconsistent with those in Table 6-132

- **DOE Response**

- Table 6-133 is incorrect; it was a remnant of a previous version of the table that was not discovered in the checking process as the document was revised
- Analyses conducted for TSPA-SR correctly weight the risk of volcanic release by probability of occurrence
- Figure 6-193, which contains the probability-weighted doses, correctly shows the probability-weighted dose from the unweighted doses illustrated in Figure 6-192
- Table 6-133 will be revised in next version of document

6. GoldSim Error Messages

- **NRC Finding**

- GoldSim run log file contains numerous error messages that need to be addressed
- Error messages do not appear to be addressed in the TSPA-SR documents

- **DOE Response**

- Run log error messages were known and examined by analysts; however they were not documented
- Some errors relate to slight numerical non-convergence that was evaluated by analysts and determined to be insignificant
- Non-convergence errors create mass and thus, although small, conservatively increase the dose
- Evaluation of the error messages and their significance will be documented in the next revision of the document

7. Use of Conditions Outside of Intended Range

- **NRC Finding**

- Staff identified several cases where model was using physical-chemical conditions outside the range of the observation

- **DOE Response**

- Instances of this were noted in the text and were discussed with the AMR authors to assure the appropriateness of the abstraction, even if not documented in the AMR
- Deficiency documented as BSC-01-D-078
- Supporting AMRs will be revised to extend range of applicability

8. Incorporating Intrusive Event Probability

- **NRC Finding**

- Probability over 50,000 years incorrectly reported as 8×10^{-3} rather than the correct value of 8×10^{-4}
- It is unclear if this is a typographical error or was used to calculate the results

- **DOE Response**

- This is a typographical error
- Correct values were used in the analysis
- Correct values will be included in the next revision of the report
- Incorrect value has not been cited elsewhere