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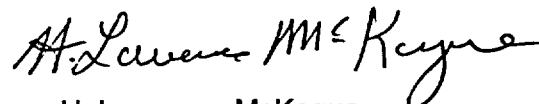
U.S. Nuclear Regulatory Commission
ATTN: Dr. John S. Trapp
Office of Nuclear Material Safety and Safeguards
Two White Flint North, Mail Stop 7 D13
Washington, DC 20555-0001

Subject: Completion of Intermediate Milestone—NRC Review of DOE Documents Pertaining to
Igneous Activity Key Technical Issue Agreement Item 2.10 (IM 01402.461.275)

Dear Dr. Trapp:

Attached is IM 01402.461.275, entitled "NRC Review of DOE Documents Pertaining to Igneous Activity Key Technical Issue Agreement Item 2.10." This review provides a basis for accepting the DOE response to staff questions regarding the relative contribution to probability-weighted dose from different degrees of assumed waste-package damage during intrusive igneous events. Part 2 of this agreement, regarding the basis for assessing waste package damage during potential igneous events, is superseded by Igneous Activity Key Technical Issue Agreement Items 2.18 and 2.19. If you have any questions, please contact Dr. Brittain Hill at 210-522-6087 or me at 210-522-5183.

Sincerely,



H. Lawrence McKague
Element Manager, GLGP

HLM:rae

Attachment

cc:	J. Linehan	D. Riffle	J. Schlueter	R. Codell	CNWRA Dirs/EMs (letter only)
	W. Reamer	B. Meehan	S. Wastler	J. Anderson	B. Hill
	B. Leslie	L. Campbell	C. Trottier	W. Patrick	R. Benke
	D. DeMarco	J. Greeves	K. Stablein	B. Sagar	T. Nagy (SwRI Contracts)

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NRC Review of DOE Documents Pertaining to Igneous Activity
Key Technical Issue Agreement Item 2.10

The U.S. Nuclear Regulatory Commission (NRC) goal of issue resolution during this interim pre-licensing period is to assure that the U.S. Department of Energy (DOE) has assembled enough information on a given issue for NRC to accept a license application for review. Resolution by the NRC staff during pre-licensing does not prevent anyone from raising any issue for NRC consideration during the licensing proceedings. Also, and just as importantly, resolution by the NRC staff during pre-licensing does not prejudice what the NRC staff evaluation of that issue will be after its licensing review. Issues are resolved by the NRC staff during pre-licensing when the staff has no further questions or comments about how DOE is addressing an issue. Pertinent new information could raise new questions or comments on a previously resolved issue.

This attachment addresses one agreement between the NRC and DOE made during the Igneous Activity (IA) Technical Exchange and Management Meeting (see letter,¹ which summarized the meeting). By letter,² DOE submitted information to address IA Agreement 2.10. The information submitted for this agreement is discussed below.

Igneous Activity Key Technical Issue Agreement Item 2.10

Summary

IA KTI Agreement 2.10 contains two parts: (1) calculation of the release from different zones of potential waste package damage, and (2) evaluation of waste package damage processes during possible igneous events. A Letter Report entitled "Relative Contributions of Releases from Zones 1 and 2" was submitted by the U.S. Department of Energy (DOE) to fulfill part 1 of Igneous Activity Key Technical Issue Agreement item 2.10. This agreement is for the DOE to document the relative contribution to probability-weighted dose from different degrees of assumed waste-package damage during intrusive igneous events. Based on staff review of the Letter Report and other available information, the information contained in this Letter Report appears adequate to satisfy part 1 of Igneous Activity Key Technical Issue Agreement item 2.10. Part 2 of this agreement, regarding the basis for assessing waste package damage during potential igneous events, is superseded by Igneous Activity Key Technical Issue Agreement item 2.18 and 2.19.

Wording of the Agreement

"Document the ICNs to the Igneous Consequences AMR and the Dike Propagation AMR regarding the calculation of the number of waste packages hit by the intrusion. Include in these or other documents (1) the intermediate results of the releases from Zone 1 and 2, separately, and (2) the evaluation of thermal and mechanical effects, as well as shock, in assessing the degree of waste package damage in Zone 1 and 2. (Intrusive AC 4) DOE agreed and will provide ICN 1 of the

¹Schlueter, J.R. "U.S. Nuclear Regulatory Commission/U.S. Department of Energy Technical Exchange and Management Meeting on Igneous Activity (August 29-31, 2000)." Letter (October 23) to S. Brocoum, DOE. Washington, DC: NRC. 2000.

²Ziegler, J.D. "Transmittal of Report Addressing Igneous Activity (IA) Key Technical Issue (KTI) Agreement Items 2.02 and 2.09." Letter (June 27) to J.R. Schlueter, NRC. Las Vegas, Nevada: DOE. 2002.

following AMRs: Igneous Consequences Modeling for TSPA-SR AMR [ANL-WIS-MD-000017], the Dike Propagation Near Drifts AMR [ANL-WIS-MD-000015], the Characterize Framework for Igneous Activity at Yucca Mountain, Nevada AMR [ANL-MGR-GS-000001], and the Calculation Number of Waste Packages Hit by Igneous Intrusion [CAL-WIS-PA-000001]. This will be available to the NRC in January 2001. DOE will provide the results showing the relative contributions of releases from Zones 1 and 2 in a calculation document. This will be available to the NRC in FY2002. DOE will provide the evaluation of thermal mechanical effects on waste package damage in Zones 1 and 2 in ICN 1 of the Dike Propagation Near Drifts AMR [ANL-WIS-MD-000015]. This will be available to the NRC in January 2001."

Review

If rising basaltic magma intersected nonbackfilled repository drifts, the pressure difference between the magma and open drift would enable flow into the drift (e.g., Woods et al., 2002). This flow would expose engineered systems to thermal, physical, and chemical loads that are not currently within their design bases (CRWMS M&O, 1999). In CRWMS M&O (2000a), the DOE defined two zones based on the amount of damage assumed for engineered systems located near to and far from the point of magma intersection (CRWMS M&O, 2000b). The extent of these zones controlled the amount of radionuclide release through groundwater transport following the igneous event. For Zone 1, DOE assumed that three waste packages on either side of an intersecting magmatic dike, in addition to one waste package intersected directly by the dike, would be extensively damaged and provide no further protection for the high-level waste. Zone 2 consists of all remaining waste packages in the intersected drift. Damage in Zone 2 consist of the loss of the drip shield, removal of cladding, and a range of end-cap failures (CRWMS M&O, 2000b).

In the CRWMS M&O (2000a), groundwater release following an igneous event had a higher risk in 10,000 years than direct release from a volcanic event. Agreement item 2.10 was created to provide staff with additional information on the relative contribution to risk from releases in each damage zone. This information is needed to focus staff review on risk-significant processes related to the definition of individual damage zones.

Analyses presented in Bechtel SAIC Company, LLC. (2001a, b) show the relative contribution to risk from releases in damage Zone 1 and Zone 2. As discussed in Bechtel SAIC Company, LLC. (2001a, b) and the Letter Report, potential releases from damage Zone 1 dominate risk from the igneous intrusion groundwater release pathway for the first 20,000 years. Potential releases from damage Zone 2 contribute less than about 10 percent to the overall risk from the igneous intrusion groundwater release pathway (Bechtel SAIC Company, LLC., 2001a, b).

The minor contribution to risk from Zone 2 appears reasonable based on the limited damage to the engineered barrier system in that zone during an igneous event. Although drip shield and fuel cladding fail during the postulated igneous event, moisture inflow and outflow is restricted in Zone 2 to an end-cap opening that averages only 10 cm² [1.6 in²] (CRWMS M&O, 1999). In contrast, waste packages in Zone 1 are so extensively damaged that they provide no further restrictions on water flow.

The number of waste packages contained in Zone 1 appears to be a sensitive parameter in DOE performance assessment calculations. Analyses in Bechtel SAIC Company, LLC. (2001a, b) used a median of 197 waste packages in Zone 1, versus a median of 192 waste packages in CRWMS M&O

(2000a). Probability-weighted mean annual dose in Bechtel SAIC Company, LLC. (2001a, b), however, increased by up to a factor of two relative to CRWMS M&O (2000a). Part 2 of Igneous Activity Key Technical Issue Agreement item 2.10 is for the DOE "to provide the evaluation of thermal and mechanical effects, as well as shock, in assessing the degree of waste package damage in Zone 1 and 2." Analyses in the DOE Letter Report continue to demonstrate that information needed to address part 2 of agreement item 2.10 affects staff review of risk-significant processes in the DOE performance calculations. Information related to part 2 of agreement item 2.10 will be addressed by the DOE in Igneous Activity Key Technical Issue Agreement items 2.18 and 2.19, which are expected in FY2003.

Status of Agreement

Staff conclude that the DOE has acceptably addressed staff questions in part 1 of Igneous Activity Key Technical Issue Agreement Item 2.10 regarding the relative contribution to probability-weighted dose from different degrees of assumed waste-package damage during intrusive igneous events. Part 2 of this agreement, regarding the basis for assessing waste package damage during potential igneous events, is superseded by Igneous Activity Key Technical Issue Agreement Items 2.18 and 2.19.

References

Bechtel SAIC Company, LLC. "FY01 Supplemental Science and Performance Analyses." Vol. 1: Scientific Bases and Analyses. TDR-MGR-MD-000007. Revision 00 ICN 01. Las Vegas, Nevada: Bechtel SAIC Company, LLC. 2001a.

Bechtel SAIC Company, LLC. "FY01 Supplemental Science and Performance Analyses." Vol. 2: Performance Analyses. TDR-MGR-PA-000001. Revision 00. Las Vegas, Nevada: Bechtel SAIC Company, LLC. 2001b.

CRWMS M&O. "Waste Package Behavior in Magma." CAL-EBS-ME-000000. Revision 00. North Las Vegas, Nevada: TRW Environmental Safety Systems, Inc. 1999.

CRWMS M&O. "Total System Performance Assessment-Site Recommendation." TDR-WIS-PA-000001. Revision 00 ICN1. North Las Vegas, Nevada: TRW Environmental Safety Systems, Inc. 2000a.

CRWMS M&O. "Igneous Consequence Modeling for Total System Performance Assessment-Site Recommendation." ANL-WIS-MD-000017. Revision 00 ICN 01. Las Vegas, Nevada: CRWMS M&O. 2000b.

Woods, A.W., S. Sparks, O. Bokhove, A-M. LeJeune, C.B. Connor, and B.E. Hill. "Modeling the Explosive Eruption of Basaltic Magma Into The Proposed High-level Radioactive Waste Repository at Yucca Mountain, Nevada, U.S.A." *Geophysical Research Letters* 29(13): 19-1-19-4. 2002.