

April 30, 2001

Stephan Brocoum, Assistant Manager  
Office of Licensing and Regulatory Compliance  
U.S. Department of Energy  
Office of Civilian Radioactive Waste Management  
Yucca Mountain Site Characterization Office  
P.O. Box 30307  
North Las Vegas, NV 89036-0307

SUBJECT: IGNEOUS ACTIVITY AGREEMENTS

Dear Mr. Brocoum:

During the Igneous Activity Technical Exchange and Management Meeting held on August 29-31, 2000, the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE) reached 12 agreements pertaining to the Igneous Activity Key Technical Issue. By letter dated February 2, 2001, DOE provided several documents pertaining to NRC/DOE agreements, including seven documents pertaining to six Igneous Activity agreements. The NRC staff has reviewed these documents as they pertain to the six agreements and, in summary, believe four agreements have been adequately addressed. The other two agreements addressed by these documents pertain to the issue of magma-repository interactions. The NRC and Center for Nuclear Waste Regulatory Analysis have also been looking into this area and believe additional information is needed from DOE to support any future license application. We currently have an Appendix 7 meeting planned on May 18, 2001, to discuss the issue in more detail.

If you have any questions regarding this letter, please contact Mr. James Andersen of my staff. He can be reached at (301) 415-5717.

Sincerely,

/RA/

C. William Reamer, Chief  
High-Level Waste Branch  
Division of Waste Management  
Office of Nuclear Material Safety  
and Safeguards

Enclosure: As stated

cc: See attached distribution list

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Letter to S. Brocoum from C.W. Reamer dated: April 30, 2001

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## **NRC Review of DOE Documents Pertaining to Igneous Activity Key Technical Issue Agreements**

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 it's 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 enclosure addresses several NRC/DOE agreements made during the Igneous Activity Technical Exchange and Management Meeting on August 29-31, 2000 (see letter dated October 23, 2000, "NRC/DOE Technical Exchange and Management Meeting on Igneous Activity (August 29-31, 2000)" which summarized the meeting). By letter dated February 2, 2001, DOE submitted seven documents to address six of the igneous activity agreements. The documents submitted are as follows:

- (1) Total System Performance Assessment for the Site Recommendation (TDR-WIS-PA-000001, Rev 00, ICN 01)
- (2) Igneous Consequence Modeling for Total System Performance Assessment for the Site Recommendation (ANL-WIS-MD-000017, Rev 00, ICN 01)
- (3) Comparison of ASHPLUME Results to TEPHRA (ANL-WIS-MD-000011, Rev 00, ICN 00)
- (4) Values for External Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001, Rev 01, ICN 00)
- (5) Characterize Framework for Igneous Activity (ANL-MGR-GS-000001, Rev 00, ICN 01)
- (6) Dike Propagation Near Drifts (ANL-WIS-MD-000015, Rev 00, ICN 01)
- (7) Number of Waste Packages Hit by Igneous Intrusion (CAL-WIS-PA-000001, Rev 01, ICN 00)

### **1) Igneous Activity Agreement 1.01**

Wording of the Agreement: In addition to DOE's licensing case, include for Site Recommendation and License Application, for information purposes, the results of a single point sensitivity analysis for extrusive and intrusive igneous processes at  $10E-7$ . DOE agreed that the analysis will be included in TSPA-SR Rev. 0 and will be available to the NRC in November 2000. The document includes DOE's response to the NRC staff's request to include for the possible site recommendation and license application (for information purposes) the results of a single point sensitivity analysis for extrusive and intrusive igneous processes at  $10E-7$ .

NRC Review: The NRC staff reviewed the document entitled "Total System Performance Assessment for the Site Recommendation" (TDR-WIS-PA-000001, Rev 00, ICN 01) as it pertains to this agreement and believes that the information provided will be sufficient for the staff to conduct a licensing review in this area if a DOE license application is submitted.

Additional Information Needed: None at this time. DOE has agreed to include the results of the single point sensitivity analysis for extrusive and intrusive igneous processes at 10E-7 in any future license application.

Status of Agreement: Igneous Activity 1.01 is complete.

## **2) Igneous Activity Agreement 2.01**

Wording of the Agreement: Re-examine the ASHPLUME Code to confirm that particle density is appropriately changed when waste particles are incorporated into the ash. (Eruptive AC-1) DOE agreed and will correct the description in the ICN to AMR, Igneous Consequences Modeling for TSPA-SR [ANL-WIS-MD-000017] as needed to address the concern. This will be available to the NRC in January 2001.

NRC Review: The NRC staff has reviewed the document entitled "Igneous Consequence Modeling for Total System Performance Assessment for the Site Recommendation" (ANL-WIS-MD-000017, Rev 00, ICN 01) as it pertains to this agreement. In the document, DOE confirmed that particle density is appropriately changed when waste particles are incorporated into the ash. The NRC staff believes that the information provided will be sufficient for the staff to conduct a licensing review in this area if a DOE license application is submitted.

Additional Information Needed: None at this time.

Status of Agreement: Igneous Activity 2.01 is complete.

## **3) Igneous Activity Agreement 2.04**

Wording of the Agreement: Document that the ASHPLUME model, as used in the DOE performance assessment, has been compared with an analog igneous system. (Eruptive AC-2) DOE agreed and will complete calculation CAL-WIS-MD-000011 that will document a comparison of the ASHPLUME code results to observed data from the 1995 Cerro Negro eruption. This will be available to the NRC in January 2001.

NRC Review: The NRC staff has reviewed the document entitled "Comparison of ASHPLUME Model Results to Representative Tephra Fall Deposits" (ANL-WIS-MD-000011, Rev 00, ICN 00) as it pertains to this agreement and believes that the information provided will be sufficient for the staff to conduct a licensing review in this area if a DOE license application is submitted.

Additional Information Needed: None at this time. DOE has agreed that this information will be carried into the Total System Performance Assessment for the Site Recommendation, Rev. 1.

Status of Agreement: Igneous Activity 2.04 is complete.

#### **4) Igneous Activity Agreement 2.07**

Wording of the Agreement: Document the basis for airborne particle concentrations used in TSPA in Rev. 1 to the Input Values for External and Inhalation Radiation Exposure AMR. (Eruptive AC-5) DOE agreed and will provide documentation for the input values in the Input Parameter Values for External and Inhalation Radiation Exposure Analysis AMR [ANL-MGR-MD-000001] Rev. 1. This will be available to NRC in January 2001.

NRC Review: The NRC staff has reviewed the document entitled "Values for External Inhalation Radiation Exposure Analysis" (ANL-MGR-MD-000001, Rev 01, ICN 00) as it pertains to this agreement and believes that the information provided is not sufficient for NRC to conduct a licensing review. Additional justification is needed for the airborne particle concentrations used in the total system performance assessment.

Additional Information Needed: DOE needs to provide justification for the area discussed above. An Appendix 7 meeting is currently scheduled on May 18, 2001, to discuss this area further.

Status of Agreement: Igneous Activity 2.07 needs additional information to support a licensing review.

#### **5) Igneous Activity Agreement 2.08**

Wording of the Agreement: Provide additional justification on the reasonableness of the assumption that the inhalation of particles in the 10-100 micron range is treated as additional soil ingestion, or change the BDCFs to reflect ICRP-30. (Eruptive AC-5) DOE agreed and will review how 10-100 micron particles are considered in the model for the eruptive scenario. The results will be documented in Input Parameter Values for External and Inhalation Radiation Exposure Analysis AMR [ANL-MGR-MD-000001] Rev. 1. This will be available to the NRC in January 2001.

NRC Review: The NRC staff has reviewed the document entitled "Values for External Inhalation Radiation Exposure Analysis" (ANL-MGR-MD-000001, Rev 01, ICN 00) as it pertains to this agreement and believes that the information provided will be sufficient for the staff to conduct a licensing review in this area if a DOE license application is submitted.

Additional Information Needed: None at this time.

Status of Agreement: Igneous Activity 2.08 is complete.

## 6) Igneous Activity Agreement 2.10

Purpose of the Documents: 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-1 to 4) DOE agreed and will provide ICN 1 of the 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 TSPA-SR, Rev. 1. This will be available to the NRC in June 2001. 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.

NRC Review: NRC has reviewed the documents entitled "Igneous Consequence Modeling for Total System Performance Assessment for the Site Recommendation" (ANL-WIS-MD-000017, Rev 00, ICN 01); "Characterize Framework for Igneous Activity" (ANL-MGR-GS-000001, Rev 00, ICN 01); "Dike Propagation Near Drifts" (ANL-WIS-MD-000015, Rev 00, ICN 01); and "Number of Waste Packages Hit by Igneous Intrusion" (CAL-WIS-PA-000001, Rev 01, ICN 00) as they pertain to this agreement and has determined that the analysis presented is not sufficient for NRC to conduct a licensing review. Thermal, chemical, and physical conditions appropriate for the duration of basaltic igneous events have not been considered and significant credit for waste package resilience during igneous intrusive events has been taken by DOE without appropriate justification. Alternative interpretations of available data indicate that waste package failure is likely upon continued exposure to igneous intrusion conditions, and that an order of magnitude more waste packages may fail than accounted for in the DOE total system performance assessment for the site recommendation calculations. In addition, the Dike Propagation Near Drifts Analysis and Model Report does not adequately address the magnitude and duration of magma flow into repository drifts or how the presence of subsurface drifts may affect igneous eruptive processes.

Additional Information Needed: DOE needs to provide further analysis addressing the areas discussed above. An Appendix 7 meeting is currently scheduled on May 18, 2001, to discuss this area further.

Status of Agreement: Igneous Activity 2.10 needs additional information to support a licensing review.