

April 14, 2003

Joseph D. Ziegler, Acting Director
Office of License Application and Strategy
U.S. Department of Energy
Office of Repository Development
P.O. Box 364629
North Las Vegas, NV 89036-8629

SUBJECT: IGNEOUS ACTIVITY AGREEMENT ITEM 2.02; STATUS: COMPLETE

Dear Mr. Ziegler:

In your letter dated June 27, 2002, the U.S. Department of Energy (DOE) transmitted a report titled, "Particle Size Sensitivity," to provide the information necessary to satisfy Igneous Activity (IA) Agreement Item 2.02. As this report relies almost entirely on information provided in the Supplemental Science and Performance Assessment Report (SSPA), and as the information in the SSPA has not been obtained under an appropriate Quality Assurance (QA) program, the U.S. Nuclear Regulatory Commission (NRC) decided not to take action on this letter on hold until it could be clarified how this type of information was to be used by DOE leading up to submission of a license application.

The NRC and DOE had two separate meetings on the SSPA: August 2, 2001, and September 18-19, 2001. During these meetings DOE indicated that the SSPA is not a quality-related document and that the information in the SSPA does not replace the previous quality-related documentation. Furthermore, DOE indicated that if any supplemental information is deemed to be appropriate for incorporation in a potential license application, the information would be updated and included in an Analysis Model Report, Process Model Report, or other quality-related license application support documentation. Discussions of the QA concerns have been discussed in DOE/NRC Management Meetings (i.e., Meeting of July 30, 2002; October 16, 2002; and January 22, 2003), and have been discussed in the letter on *Sensitivity Studies to Resolve Key Technical Issues (KTI)*, from Ziegler to Schlueter dated December 24, 2002. While this letter is in review, and the NRC will provide comments at a later date, the NRC determined that the letter provided sufficient information to proceed with this agreement item.

In the Particle Size Sensitivity report DOE concluded that, within the range considered in the analysis, calculated annual dose is relatively insensitive to uncertainty in waste particle diameter. This conclusion is also reached in the report *Risk Information to Support Prioritization of Performance Assessment Models*, TDR-WIS-PA-000009, Revision 01, ICN 01. As is stated in the enclosure to this letter, analysis of the information supplied leads the NRC to agree with the conclusion. However, while particle size appears to be an insensitive parameter, it will be used in analysis to support the license application. Therefore, the conclusion that calculated annual dose is relatively insensitive to uncertainty in waste particle diameter needs to be documented in a report which meets the requirements of DOE's QA Program.

J. Ziegler

-2-

The NRC notes that in Paragraph 2 of Section 2.3 of the Particle Size Sensitivity report, DOE describes the development of an ASHPLUME report, and discusses planned activities to justify existing parameter distributions, or update those parameters and integrate ASHPLUME into GoldSim, which "...are intended to ensure that appropriate parameters, such as particle size distribution are used in ASHPLUME and integrated into TSPA-LA." It is the NRC's expectation that the work described should be sufficient to confirm the conclusions reached in the Particle Size Sensitivity report and, as the ASHPLUME report would have to be qualified, would remove any concerns related as to the QA status of the above conclusions. The NRC therefore considers that IA Agreement Item 2.02 is complete.

When it becomes available, the NRC will review the ASHPLUME report to verify that the conclusions reached in this letter are appropriate.

If there are any questions regarding this letter please contact John S. Trapp at 301-415-8063 or by e-mail at jst@nrc.gov.

Sincerely,
/RA/

Janet R. Schlueter, Chief
High-Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure: NRC Review of DOE Document
Pertaining to Igneous Activity Key
Technical Issue Agreement Item 2.02

cc: See attached distribution list

J. Ziegler

-2-

The NRC notes that in Paragraph 2 of Section 2.3 of the Particle Size Sensitivity report, DOE describes the development of an ASHPLUME report, and discusses planned activities to justify existing parameter distributions, or update those parameters and integrate ASHPLUME into GoldSim, which "...are intended to ensure that appropriate parameters, such as particle size distribution are used in ASHPLUME and integrated into TSPA-LA." It is the NRC's expectation that the work described should be sufficient to confirm the conclusions reached in the Particle Size Sensitivity report and, as the ASHPLUME report would have to be qualified, would remove any concerns related as to the QA status of the above conclusions. The NRC therefore considers that IA Agreement Item 2.02 is complete.

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*See previous concurrence

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Letter to J. Ziegler from J. Schlueter, dated: April 14, 2003

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L. Tom, Paiute Indian Tribes of Utah

E. Smith, Chemehuevi Indian Tribe

V. McQueen, Sr., Ely Shoshone Tribe

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R. Quintero, Inter-Tribal Council of NV
(Chairman, Walker River Paiute Tribe)

D. Eddy, Jr., Colorado River Indian Tribes

H. Jackson, Public Citizen

J. Wells, Western Shoshone National Council

R. Henning, BSC

I. Zabarte, Western Shoshone National Council

K. Finfrock, NV Congressional Delegation

NRC On-Site Representatives

NRC Review of DOE Documents Pertaining to Igneous Activity
Key Technical Issue Agreement Item 2.02

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 important, resolution by the NRC staff during pre-licensing does not prejudge 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 2.02. The information submitted for this agreement is discussed below:

1) Igneous Activity Key Technical Issue Agreement Item 2.02

Summary: DOE submitted a letter report titled "Particle Size Sensitivity" to fulfill IA Key Technical Issue (KTI) Agreement Item 2.02. This agreement is for DOE to provide a sensitivity analysis documenting that variations in high-level waste particle-size distributions are not significant in DOE performance calculations of volcanic events. Based on staff review of the letter report and other available information, the information contained in this letter report appears adequate to satisfy IA KTI Agreement Item 2.02. Staff concludes that the information provided in the letter report adequately documents that variations in high-level waste particle-size distributions are not significant in DOE performance calculations of volcanic events.

Wording of the Agreement: "Document results of sensitivity studies for particle size, consistent with (1) [i.e., IA 2.01] above (Eruptive AC-4). DOE agreed and will document the waste particle size sensitivity study in a calculation document. This will be available to the NRC in FY2002."

Review: In the conceptual model for volcanic disruption, a subvolcanic conduit localizes along the trace of an igneous dike and intersects one to several drifts. Waste packages directly intersected by this volcanic conduit are modeled as wholly disrupted due to intense thermal and mechanical loads associated with an erupting volcano (e.g., NRC, 1999). High-level waste within these disrupted package with be subjected to a range of thermal, chemical, and mechanical stress. Although these stresses have not been evaluated explicitly, NRC (NRC, 1999) and DOE (CRWMS M&O, 2000a) agree that these stresses would likely reduce the waste particle size. Available waste particles are assumed to incorporate or adhere to magma particles based on an incorporation ratio between waste and magma particle sizes. The amount of high-density waste incorporated into a tephra particle can affect the resulting transport distance, due to potential increases in particle settling velocity from the modeled

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.

ENCLOSURE

eruption plume. Because waste particle size is a potentially significant parameter in airborne transport models (e.g., CRWMS M&O, 2000c), DOE agreed to conduct a sensitivity analysis on the variation in particle-size distribution.

In the Supplemental Science and Performance Analysis Report (Bechtel SAIC Company, LLC, 2001a, b), DOE conducted sensitivity analyses for a range of waste particle-size distribution. Particle sizes evaluated in Bechtel SAIC Company, LLC (2001a, b) ranged from minimums of 0.0005–0.001 mm [0.00002–0.0000394 in], modes from 0.002–0.2 mm [0.000787–0.0787 in], and maximums from 0.05–1 mm [0.001969–0.03937 in]. Using seven different particle-size distributions from these ranges, probability-weighted annual doses varied by a factor of 1.3 or less relative to analyses in CRWMS M&O (2000b). Thus, a factor of ten decrease in waste particle size, which should enhance transport distance, had a less than a 30 percent change in probability-weighted annual dose. This scale of potential change is not viewed as risk-significant, relative to other uncertainties associated with modeling possible volcanic disruption of a proposed repository site.

The results of the sensitivity study appear reasonable, as the modeled amounts of high-level waste are small compared to the modeled amounts of appropriately-sized tephra particles available for waste incorporation. For example, assume that five waste packages (66 MTU) are disrupted in the volcanic conduit. Using a high-level waste density of $1 \times 10^4 \text{ kg/m}^3$ [624.2 lbm/ft³] results in 33 m³ [1,165 ft³] of waste available to create particles of 0.1 mm [0.00394 in] or less. An average tephra volume for the Yucca Mountain region, however, is of order 10^7 m^3 [$3.532 \times 10^8 \text{ ft}^3$] when corrected to vesicle-free (NRC, 1999). Assuming only 1 percent of the deposit consists of particles 0.1 mm [0.00394 in] or smaller (e.g., NRC, 1996) results in a particle volume of order 10^5 m^3 [$3.532 \times 10^6 \text{ ft}^3$] available to potentially incorporate 33 m³ [1,165 ft³] of waste. Thus, for incorporation ratios of 0.1–1 (NRC, 1999; CRWMS M&O, 2000c), the amount of available tephra particles exceeds by several orders of magnitude the amount of available waste particles. Even if the waste-particle diameter is increased by an order of magnitude, there is still an abundance of magma particles having sufficient size to incorporate the waste.

Status of Agreement:

Analyses presented in the DOE Letter Report on Particle Size, which repeats information in Bechtel SAIC Company, LLC (2001a, b), is considered sufficient to document the expected effects of reasonable variations in high-level waste particle size as modeled in the current DOE performance assessment (e.g., CRWMS M&O, 2000c) and to close this agreement item. IA KTI Agreement Item 2.02 is, therefore, considered complete. However, while particle size appears to be an insensitive parameter, it will be used in analysis to support the license application. Therefore, the conclusion that calculated annual dose is relatively insensitive to uncertainty in waste particle diameter needs to be documented in a report which meets the requirements of DOE's QA Program.

Additional Information Needed:

None at this time. When available, the staff will review the ASHPLUME report, described in Section 2.3 of the DOE letter report, to verify the conclusions reached in this analysis.

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.

———. "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. "Miscellaneous Waste-Form Features, Events, and Processes." ANL-WIS-MD-000009. Revision 00. Las Vegas, Nevada: CRWMS M&O. 2000a.

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

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

NRC. "Issue Resolution Status Report, Key Technical Issue: Igneous Activity." Revision 2. Washington, DC: NRC. 1999.