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RESPONSE TO ADDITONAL INFORMATION NEEDS ASSOCIATED WITH KEY TECHNICAL ISSUE (KTI) AGREEMENTS IGNEOUS ACTIVITY (IA) 2.19 AND 2.20

Reference: Ltr, Kokajko to Ziegler, dtd 3/31/05 (Pre-licensing Evaluation of KTI IA 2.03 AIN, 2.09 AIN, 2.19, and 2.20)

The above reference (Kokajko 2005) provides the results of the U.S. Nuclear Regulatory Commission's (NRC) prelicensing evaluation of responses to information needs associated with KTI Agreements IA 2.03 and 2.09, and Agreements IA 2.19 and 2.20. Sufficient information has been provided to complete the information needs associated with Agreements IA 2.03 and 2.09, but requests for additional information have been identified for Agreements IA 2.19 and 2.20.

The information request associated with Agreement IA 2.19 is related to the flow of volcanic gas following intersection of an emplacement drift by a dike and potential resulting damage to waste packages in drifts not intersected by a dike. The information need is as follows:

> "In any potential license application, DOE should provide analysis which considers a realistic range in rock permeabilities in evaluating gas flow and its affect on canister performance in Zone 2 or demonstrate that the [effect of] accelerated degradation on canister performance in Zone 2 is not significant" (Kokakjo 2005).

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Uncertainties in permeability data from basalt analogs are irrelevant to gas flow calculations because nearly the entire volume of gas exsolves from the magma immediately following intersection of a drift. This is reflected in the analysis described in Section 6.6 of *Dike/Drift Interactions,* Revision 01, which uses a drift instantaneously filled with gas as the source for the volcanic gases. Gas flow modeling uses a dual-permeability modeling approach (Enclosure 2, Section 6.2.1.5, pages 6-10 and Section 6.4.6, item 1) with separate permeabilities for the rock matrix and fractures. Rock matrix porosity is 0.1486 and permeability is $0.448\times10^{-17}/m^2$. Fracture porosity is about 0.0096 and permeability is $0.91\times10^{-12}/m^2$ (Enclosure 2, Table 6.4-1). The fracture porosity input used for analyses described in Enclosure 1 is slightly different than the value shown in Enclosure 2, Table 6.4-1; the difference is attributed to rounding. The value for fracture porosity, 0.00951, is used to generate the mesh volumes in the analysis (Enclosure 1, Section 6.6.3.1) but does not represent actual input to the TOUGHREACT code. Hence, realistic and appropriate permeability values for the host rock are used in the gas-flow modeling described in Enclosure 1, Section 6.6.

The information need for Agreement IA 2.20 is related to transgranular fracturing of the waste form and effects of such fracturing on radionuclide transport. The information need is as follows:

> "DOE should provide information in any potential license application which either, demonstrates that transgranular fracturing will not significantly increase the rate of waste dissolution or, demonstrates that the mechanical effects on the waste form from an intrusive event will not significantly increase transgranular fracturing" (Kokakjo 2005).

The effects of transgranular fracturing have been incorporated in the analysis of magma-waste form interactions (Enclosure 1, Section 6.4.8). As temperatures decrease after initial emplacement and under oxidizing conditions, uranium oxide is expected to fragment, which increases the surface area of the waste. This fragmentation will greatly increase its surface area, potentially making the waste more susceptible to transport under nominal conditions (Enclosure 1, Section 6.4.8.3). However, the secondary mineral phases that might form are expected to be silicate and oxide minerals rather than salts. Since oxide and silicate minerals tend to have low dissolution rates compared to salts, significantly enhanced dissolution rates of minerals resulting from reaction of waste with basalt magma within drifts are not expected (Enclosure 1, pages 6-108). However, for Total System Performance Assessment, waste in damaged waste packages is simulated as degraded and considered immediately available for dissolution and transport because waste packages in drifts intersected by dikes are assumed to provide no protection for the waste (Enclosure 3, Section 5.1).

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A hard copy of Enclosures 1-3 is enclosed. Enclosure 4 is a compact disk (CD) containing .pdf format copies of Enclosures 1-3 to facilitate review of this response; copies can be made publicly available. Titles and file sizes on the CD are:

Dike-Drift Interactions.pdf	15,491,584 KB
Drift-Scale THC Seepage Model.pdf	13,297,664 KB
Number of Waste Packages Hit by Igneous Intrusion.pdf	2,051,072 KB

The U.S. Department of Energy (DOE) considers that the information summarized in this letter and more complete information contained in the enclosures is sufficient to address the information needs associated with Agreements IA 2.19 and 2.20. DOE, therefore, requests that the NRC consider information needs associated with Agreements IA 2.19 and 2.20 complete. If you have any questions about this response, please contact Eric T. Smistad at (702) 794-5073 or e-mail eric_smistad@ymp.gov, or Timothy C. Gunter at (702) 794-1343 or e-mail timothy_gunter@ymp.gov.

Joseph D. Ziegler, Director
Office of License Application and Strategy

OLA&S:TCG-1524

Enclosures:
1. Hard Copy of *Dike/Drift Interactions,* MDL-MGR-GS-000005, Revision 1
2. Hard Copy of *Drift-Scale THC Seepage Model,* MDL-NBS-HS-000001, Revision 4
3. Hard Copy of *Number of Waste Packages Hit by Igneous Intrusion,* ANL-MGR-GS-000003, Revision 01
4. CD containing Enclosures 1-3

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