

February 5, 2003

Joseph D. Ziegler, Acting Assistant Manager  
Office of Licensing and Regulatory Compliance  
U.S. Department of Energy  
Office of Repository Development  
P.O. Box 364629  
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SUBJECT: ADDITIONAL INFORMATION NEEDED FOR UNSATURATED AND SATURATED  
FLOW UNDER ISOTHERMAL CONDITIONS (USFIC).5.11 AGREEMENT AND  
COMPLETION OF GENERAL (GEN).1.01, COMMENT 103

Dear Mr. Ziegler:

In your letter dated July 5, 2002, the U.S. Department of Energy (DOE) enclosed a response to Agreement USFIC.5.11 and Agreement GEN.1.01, Comment 103. The July 5<sup>th</sup> letter transmitted the report entitled "Solitario Canyon Fault Alternative Conceptual Model" documenting a saturated zone flow model analysis using an alternative conceptual model of the Solitario Canyon Fault hydrologic properties. The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed this information, with respect to Agreements USFIC.5.11 and GEN.1.01, Comment 103, and the results of the staff's review are enclosed.

The staff requested DOE to examine the alternative conceptual model of a shallow Solitario Canyon Fault to evaluate whether transport pathways from beneath Yucca Mountain could occur within two groundwater flow systems: a shallow flow regime in the upper volcanic aquifer system, and a deep flow regime in the regional Paleozoic carbonate aquifer system. On the east side of Solitario Canyon Fault, a strong upward hydraulic gradient between these two flow systems would act to keep potential contaminant releases relatively close to the water table (see e.g. CRWMS M&O, 2002). On the west side of Solitario Canyon Fault, however, it is not clear that such an upward gradient exists. Thus, it was questioned whether it is possible for contaminants to migrate into the deeper regional aquifer system if the barrier effect of the Solitario Canyon Fault diminishes with depth. This remains a concern unless DOE's final repository design and site characteristics preclude contaminant releases to the west side of the Solitario Canyon Fault.

Agreement GEN.1.01, Comment 103, pertains to a discussion by DOE in the Supplemental Science and Performance Assessment (Bechtel SAIC Company, LLC, 2001, Section 12.3.1.3.2), which refers to an analysis using an alternative conceptualization of the Solitario Canyon Fault but provides no reference for such an analysis. Staff requested DOE to provide the reference for this analysis. The letter report provided by DOE meets the intent of that request, and Comment 103 of General Agreement 1.01 is considered complete.

The DOE letter report did not contain a discussion or illustration of possible changes in the vertical depth of flow paths. Figure 3 of the letter report shows flowpaths of both the calibrated model and the alternate model in plan view, but no cross-sectional view is provided to illustrate possible changes in the depth of flowpaths. Thus, it is not possible to assess whether the shallow Solitario Canyon Fault alternative model resulted in significant changes to the vertical extent of

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flow paths. Additionally, it appears from the discussion in the DOE letter report that the "particles" tracked in the flow path analysis were released on the east side of Solitario Canyon Fault where the upward hydraulic gradient is strong. Thus, the hypothesis that potential contaminant releases on the west side of a shallow Solitario Canyon fault might enter the lower carbonate aquifer is not tested by the analysis provided.

Comment 103 of Agreement GEN.1.01 is considered complete. Agreement USFIC.5.11 is considered partly received pending receipt of additional information. If there are any questions regarding this letter, please contact Bill Dam at 301-415-6710 or by e-mail at wld@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 Documents Pertaining to Key Technical Issue Agreement  
USFIC.5.11

cc: See Attached Distribution

Letter to J. Ziegler from J. Schlueter dated February 5, 2003

cc:

R. Loux, State of Nevada	R. Massey, Lander County, NV
S. Frishman, State of Nevada	L. Stark, Lincoln County, NV
M. Chu, DOE/Washington, DC	M. Baughman, Lincoln County, NV
N. Slater-Thompson, DOE/Washington, DC	A. Funk, Mineral County, NV
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C. Einberg, DOE/Washington, DC	L. Bradshaw, Nye County, NV
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R. Dyer, ORD	D. Chavez, Nye County, NV
C. Newbury, ORD	D. Weigel, GAO
J. Ziegler, ORD	W. Barnard, NWTRB
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W.J. Arthur, III, ORD	A. Collins, NIEC
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A. Gill, ORD	J. Kessler, EPRI
W. Boyle, ORD	W. Booth, Engineering Svcs, LTD
S. Morris, ORD	R. Clark, EPA
E. Opelski, NQS	F. Marcinowski, EPA
K. Hess, BSC	R. Anderson, NEI
D. Krisha, BSC	R. McCullum, NEI
S. Cereghino, BSC	S. Kraft, NEI
N. Williams, BSC	D. Duncan, USGS
M. Voegele, BSC/SAIC	R. Henning, BSC
D. Beckman, BSC/B&A	R. Craig, USGS
F.S. Echols, ECG	D. Hammermeister, Nye County On-Site Rep.
B. Price, Nevada Legislative Committee	N. Rice, NV Congressional Delegation
J. Meder, Nevada Legislative Counsel Bureau	T. Story, NV Congressional Delegation
I. Navis, Clark County, NV	J. Reynoldson, NV Congressional Delegation
E. von Tiesenhausen, Clark County, NV	S. Joya, NV Congressional Delegation
A. Kalt, Churchill County, NV	J. Pegues, City of Las Vegas, NV

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G. McCorkell, Esmeralda County, NV

L. Fiorenzi, Eureka County, NV

A. Johnson, Eureka County, NV

A. Remus, Inyo County, CA

cc: (Continued)

J. Birchim, Yomba Shoshone Tribe

C. Meyers, Moapa Paiute Indian Tribe

R. Bahe, Benton Paiute Indian Tribe

R. Joseph, Lone Pine Paiute-Shoshone Tribe

V. Miller, Fort Independence Indian Tribe

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

D. Crawford, Inte-Tribal Council of Nevada

H. Blackeye, Jr., Duckwater Shoshone Tribe

H. Jackson, Public Citizen

M. Smurr, BNFL, Inc.

B. Bristow, Citizen's Alert

K. Tilges, Nuclear Issues Organizer

D. Feehan, GAO

L. Lehman, T-REG, Inc.

M. Yarbrow, Lander County, NV

I. Zabarte, W.S.N.C.

C. Anderson, Las Vegas Paiute Tribe

L. Jackson, Timbisha Shoshone Tribe

D. Eddy, Jr., Colorado River Indian Tribe

C. Bradley, Kaibab Band of Southern Paiutes

L. Tom, Paiute Indian Tribes of Utah

E. Smith, Chemehuevi Indian Tribe

A. Bacock, Big Pine Paiute Tribe of  
the Owens Valley

J. Charles, Ely Shoshone Tribe

M. Bengochia, Bishop Paiute Indian Tribe

J. Egan, Egan & Associates, PLLC

J. Leeds, Las Vegas Indian Center

J. Triechel, Nuclear Waste Task Force

T. Kingham, GAO

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flow paths. Additionally, it appears from the discussion in the DOE letter report that the "particles" tracked in the flow path analysis were released on the east side of Solitario Canyon Fault where the upward hydraulic gradient is strong. Thus, the hypothesis that potential contaminant releases on the west side of a shallow Solitario Canyon fault might enter the lower carbonate aquifer is not tested by the analysis provided.

Comment 103 of Agreement GEN.1.01 is considered complete. Agreement USFIC.5.11 is considered partly received pending receipt of additional information. If there are any questions regarding this letter, please contact Bill Dam at 301-415-6710 or by e-mail at wld@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 Documents Pertaining to Key Technical Issue Agreement USFIC.5.11

cc: See Attached Distribution

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## NRC Review of DOE Documents Pertaining to 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 licensing application for review. Resolution by the NRC staff during pre-licensing does not prevent anyone from raising any issue for NRC consideration during review of a license application. 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.

In response to Key Technical Issue (KTI) agreement USFIC.5.11, DOE provided a letter report<sup>1</sup> to document a saturated zone flow model analysis using an alternative conceptual model of the Solitario Canyon Fault hydrologic properties. This letter report also addresses Comment 103 of General Agreement GEN.1.01.

### **Wording of the Agreements**

USFIC.5.11 states: “In order to test an alternative conceptual flow model for Yucca Mountain, run the Saturated Zone (SZ) flow and transport code assuming a north-south barrier along the Solitario Canyon Fault whose effect diminishes with depth or provide justification not to. DOE will run the saturated zone flow and transport model assuming the specified barrier and will provide the results in an update to the Calibration of the Site Scale Saturated Zone Flow Model Analysis Model Report (AMR) expected to be available during FY 2002.”

GEN.1.01, Comment 103 states: “The DOE mentions that an alternative study was performed to investigate the appropriateness of the treatment of anisotropy in the parameterization of the Solitario Canyon fault within the site-scale SZ flow model. However, no reference is made to this study. The study is mentioned briefly in the Supplemental Science and Performance Analyses. Detail of the study will be documented in a subsequent revision of the SZ calibrated flow AMR consistent with USFIC 5.11.”

### **NRC Review**

Agreement GEN.1.01, Comment 103, pertains to a discussion by DOE in the Supplemental Science and Performance Assessment (Bechtel SAIC Company, LLC, 2001, Section 12.3.1.3.2), which refers to an analysis using an alternative conceptualization of the Solitario Canyon Fault but provides no reference for such an analysis. Staff requested DOE to provide the reference for this analysis. The letter report provided by DOE meets the intent of that request, and Comment 103 of Agreement GEN.1.01 is considered complete.

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<sup>1</sup>Ziegler, J.D. “Transmittal of Report Addressing Key Technical Issue (KTI) Agreement Item Unsaturated and Saturated Flow Under Isothermal Conditions (USFIC) 5.11.” Letter (July 5, 2002) to J. Schlueter.

## Background:

The staff requested DOE to examine the alternative conceptual model of a shallow Solitario Canyon Fault to evaluate whether transport pathways from beneath Yucca Mountain could occur within two groundwater flow systems: a shallow flow regime in the upper volcanic aquifer system, and a deep flow regime in the regional Paleozoic carbonate aquifer system. On the east side of Solitario Canyon Fault, a strong upward hydraulic gradient between these two flow systems would act to keep potential contaminant releases relatively close to the water table (see e.g. CRWMS M&O, 2002). On the west side of Solitario Canyon Fault, however, it is not clear that such an upward gradient exists. Thus, it was questioned whether it is possible for contaminants to migrate into the deeper regional aquifer system if the barrier effect of the Solitario Canyon Fault diminishes with depth.

## Summary of the Analysis Provided by DOE:

DOE developed and calibrated an alternative saturated zone flow model in which the barrier effect of the Solitario Canyon Fault extends from the water table downward to the top of the Paleozoic carbonate aquifer. The calibrated heads and projected flow paths from the alternative model were then compared to the original model in which the Solitario Canyon Fault extends to the bottom of the model domain. One result was that calibrated heads for the alternative model were generally a few centimeters higher east of the Solitario Canyon Fault. DOE used a particle-tracking algorithm to evaluate flow paths from directly below the proposed repository location at Yucca Mountain. The projected flow paths from the alternative and original models were strikingly similar in plan view, despite the small change to the hydraulic head distribution.

The DOE letter report did not contain a discussion or illustration of possible changes in the vertical depth of flow paths. Figure 3 of the report shows flowpaths of both the calibrated model and the alternate model in plan view, but no cross-sectional view is provided to illustrate possible changes in the depth of flowpaths. It is thus not possible to assess whether the shallow Solitario Canyon Fault alternative model resulted in significant changes to the vertical extent of flow paths. Additionally, it appears from the discussion in the DOE letter report that the “particles” tracked in the flow path analysis were released on the east side of Solitario Canyon Fault where the upward hydraulic gradient is strong. Thus, the hypothesis that potential contaminant releases on the west side of a shallow Solitario Canyon fault might enter the lower carbonate aquifer is not tested by the analysis provided.

## Additional information needs:

1. To examine flow and radionuclide transport in the deeper aquifer system, a vertical cross-sectional figure showing the flowpaths is needed. As an example, the left diagram of Figure 8 in the *Calibration of the Site-Scale Saturated Zone Flow Model* AMR (CRWMS M&O, 2000) shows such a cross-sectional view. Two such particle tracking figures showing distance vs. depth are needed: one for the calibrated model and another for the shallow Solitario Canyon Fault alternative model.
2. To test the hypothesis that potential contaminant releases on the west side of a shallow Solitario Canyon Fault might enter the lower carbonate aquifer, DOE should provide an analysis of flow paths from the west side of a shallow Solitario Canyon Fault. Alternatively,

DOE could provide an explanation of repository design and site characteristics that would preclude contaminant releases to the west side of the Solitario Canyon Fault.

Status of Agreements: Comment 103 of Agreement GEN.1.01 is complete. Agreement USFIC.5.11 is considered partly received, pending receipt of additional information.

## **References**

CRWMS M&O. "Water-Level Data Analysis for the Saturated Zone Site-Scale Flow and Transport Model." ANL-NBS-HS-000034. Revision 01. Las Vegas, Nevada: CRWMS M&O. 2002.

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

CRWMS M&O. "Calibration of the Site-Scale Saturated Zone Flow Model." MDL-NBS-HS-000011. Revision 00. Las Vegas, Nevada: CRWMS M&O. 2000.