

August 30, 2002

Joseph D. Ziegler, Acting Assistant Manager
Office of Licensing and Regulatory Compliance
U.S. Department of Energy
Yucca Mountain Site Characterization Office
P.O. Box 364629
North Las Vegas, NV 89036-8629

SUBJECT: RADIONUCLIDE TRANSPORT AGREEMENT 2.03 AND 2.04

Dear Mr. Ziegler:

During a Technical Exchange and Management Meeting held on December 5-7, 2000, the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE) reached agreement on a number of issues within the Radionuclide Transport (RT) Key Technical Issue (KTI). By letter dated April 30, 2002, DOE provided information pertaining to RT Agreements 2.03 and 2.04. The NRC staff has reviewed this information as it relates to the agreements and the results of the staff's review are enclosed.

In summary, the NRC staff believes that additional information is needed for RT Agreement 2.03. Specifically, DOE should address the potential for scale dependency of total system performance assessment (TSPA) parameters developed from Alluvial Testing Complex (ATC) tests. Therefore, RT Agreement 2.03 is listed as "need additional information." With respect to RT Agreement 2.04, DOE provided the pre-test predictions for the Alluvial Testing Complex. This meets the intent of the agreement, therefore, the NRC staff has listed RT Agreement 2.04 as "complete." With respect to General Agreement 1.01 (#42), the NRC staff has reviewed the initial concern and considers that DOE responses to RT Agreements 2.01 through 2.09 should adequately address issues related to radionuclide transport through the alluvium. Therefore, General Agreement 1.01 (#42) is complete. If you have any questions regarding this matter, please contact Mr. James Andersen of my staff. He can be reached at (301) 415-5717.

Sincerely,
/RA/

Janet Schlueter, 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 J. Ziegler from J. Schlueter dated August 30, 2002

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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 the 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 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 enclosure addresses two NRC/DOE agreements made during the December 5-7, 2000, Radionuclide Transport (RT) Technical Exchange and Management Meeting (see NRC letter dated December 12, 2000, which summarized the meeting). By letter received April 30, 2002, DOE submitted information to address RT Agreements 2.03 and 2.04, and General Agreement 1.01 (#42). The information submitted for these agreements is discussed below.

Radionuclide Transport Agreement 2.03

Wording of the Agreement: Provide a detailed testing plan for alluvial testing (the ATC [Alluvial Testing Complex] and Nye County Drilling Program) to reduce uncertainty (for example, the plan should give details about hydraulic and tracer tests at the well 19 complex and it should also identify locations for alluvium complex testing wells and tests and logging to be performed). NRC will review the plan and provide comments, if any, for DOE's consideration. In support and preparation for the October/November 2000 Saturated Zone meeting, DOE provided work plans for the Alluvium Testing Complex and the Nye County Drilling Program (FWP-SBD-99-002, Alluvial Tracer Testing Field Work Package, and FWP-SBD-99-001, Nye County Early Warning Drilling Program, Phase II and Alluvial Testing Complex Drilling). DOE will provide test plans of the style of the Alcove 8 plan as they become available. The plan will be amended to include laboratory testing. In addition, the NRC On Site Representative attends DOE/Nye County planning meetings and is made aware of all plans and updates to plans as they are made.

Radionuclide Transport Agreement 2.04

Wording of the Agreement: The NRC needs DOE to document the pre-test predictions for the ATC. DOE will document pretest predictions for the Alluvial Testing Complex in the SZ [Saturated Zone] In Situ Testing AMR [Analysis and Model Report] available in October 2001.

General Agreement 1.01 (#42)

Wording of Issue:

NRC Comment: DOE is aware that much more transport relevant alluvium characterization needs to be done, so no specific comments are needed on the discussions of alluvium Np [Neptunium] and U [Uranium] sorption coefficients, bulk density, and effective porosity. Alluvium characterization is the subject of agreements RT.2.01 through RT.2.09.

DOE Response: Np and U sorption experiments in the alluvium are in progress (19D water, 19D alluvium). Results will appear in a revision of the Transport Properties AMR consistent with existing agreements.

NRC Review: In response to RT Agreements 2.03 and 2.04, and Unsaturated and Saturated Flow Under Isothermal Conditions (USFIC) Agreement 5.03, DOE provided a test plan (Reimus and Umari, 2002) for the Alluvial Testing Complex (ATC) single-well, multiple-well, and laboratory studies with a cover letter dated April 30, 2002. By letter dated July 3, 2002, the NRC staff provided its review of the information submitted as it pertained to USFIC Agreement 5.03. This enclosure provides the staff's review of RT Agreements 2.03 and 2.04, and General Agreement 1.01 (#42). As suggested in the original agreements, the test plan includes details about the hydraulic and tracer tests at the Alluvial Testing Complex and identifies locations for the testing wells. The test plan also provides a limited amount of discussion of preliminary results from geochemical sampling and single-well tracer tests that have already been conducted at the Alluvial Testing Complex. Planned single- and multiple-well hydraulic tests and tracer tests are described in greater detail. Pretest calculations and predictions for multiple-well tracer tests are also presented as well as a brief summary of laboratory tests designed to support the tracer tests.

Beyond a generalized lithology (stratigraphy) diagram of boreholes NC-EWDP-19D1 and NC-EWDP-19P, the test plan provides no details or analyses of logging performed during or after borehole construction. The test plan mentions that the locations of screened intervals were selected based on geophysical logs, observations of water production during drilling, and lithologic logs, but provides no information for the basis of the selection of intervals to be tested during the tracer studies.

The test plan reports that results and interpretations of previously conducted (between July 2000 and April 2001) single-well hydraulic and tracer tests will be presented in the Saturated Zone In-Situ Testing Analyses and Model Report. Some results of geochemical sampling of well NC-EWDP-19D1 are presented in the test plan. On page 12 the report states, "Low Eh measurements, low dissolved oxygen concentrations, and high iron concentrations evaluated collectively qualitatively indicated that the upper alluvium intervals (zones 1 and 2) have conditions that are somewhat more reducing than the lower intervals (zones 3 and 4)." It is the NRC staff's understanding that the effect of spatial variations of redox conditions in the saturated zone (alluvium) on flow and transport models used in performance assessment is currently being evaluated by DOE.

The test plan also mentions the possibility that the test intervals within the alluvium behave as confined or unconfined layers and discusses plans to identify this behavior. The variations in water chemistry (such as the redox conditions discussed in the previous paragraph) and head between the screened zones in NC-EWDP-19D1 and between wells NC-EWDP-19D1 and NC-EWDP-19P not only suggest hydraulic isolation of alluvial layers but also suggest isolation between the alluvium and the tuff below zone 4. The relative difference in redox and other geochemical conditions between the lower to upper alluvial zones should fit the overall hydrogeologic conceptual model when final interpretations are made.

Two independent methods are used to generate pretest predictions for the transport of nonreactive and reactive tracers during the tracer tests. The predictions from the two methods appear to be in general agreement. The test plan discusses how results from the tracer tests can provide confidence in sorption parameters derived in laboratory experiments. The test plan does not, however, provide a description of how successful predictions might provide confidence in the current conceptual models used in DOE process and performance assessment abstractions for transport in the alluvium.

The following are general comments for consideration by DOE:

- The measurement of Eh (oxidation-reduction potential) is problematic. According to the USGS National Field Manual for the Collection of Water-Quality Data (Nordstrom and Wilde, 1998), Eh measurements carry inherent difficulties both in theoretical concept and practical measurement. While Eh measurements may show qualitative trends, equilibrium values should not be assumed without specific measurements of known redox couples. Standard USGS procedures call for measuring several redox couples including sulfate/sulfide, arsenic(V)/arsenic(III), etc.
- The test plan indicates that tracer solutions will be equilibrated with respect to the groundwater temperature. It is recommended that chase water and tracer solution chemistry and redox also be maintained for maximum compatibility with the aquifer in-situ geochemical environment.
- The criteria for test completion during Phase I investigations include (i) collection of sufficient information to support a docketable license application, or (ii) expiration of the water discharge waiver. What happens if the water discharge waiver expires before a sufficient amount of information is collected? Are there alternative plans to collect sufficient information?

In summary, the NRC staff believes that additional information, as outlined below, is needed to fully address the intent of RT Agreement 2.03. In addition, since the pre-test predictions for the ATC were provided in DOE's April 30, 2002, letter, the NRC staff believes RT Agreement 2.04 is complete. Finally, the NRC staff has reviewed the initial concern associated with General Agreement 1.01 (#42) and believes that DOE responses to RT Agreements 2.01 through 2.09 should adequately address issues related to radionuclide transport through the alluvium. Therefore, General Agreement 1.01 (#42) is complete.

Additional Information Needed for RT Agreement 2.03:

1) The purpose of the testing is to support the development of a conceptual model of groundwater flow and radionuclide transport in saturated alluvium south of Yucca Mountain, and to quantify flow and transport parameters. The distance between wells is less than 30 meters. The parameters used in performance assessment are applied to cells 500 meters on a side. Provide the justification for the use of parameter values, determined at one scale (30 meters between drill holes of the ATC test), in the total system performance assessment model which uses a different scale.

Status of Agreements:

RT Agreement 2.03 "needs additional information."

RT Agreement 2.04 is "complete."

General Agreement 1.01 (#42) is "complete."

References

Nordstrom, D.K. and F.D. Wilde. Reduction-Oxidation Potential (Electrode Method), *in* "National Field Manual for the Collection of Water-Quality Data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chapter A6.5," updated April 1998 at <http://pubs.water.usgs.gov/twri9A6>

Reimus, P. and M.J. Umari. "Test Plan for Alluvial Testing Complex—Single-well, Multiple-well, and Laboratory Studies." SITP-02-SZ-003 REV 01 ICN 1. North Las Vegas, NV: Bechtel SAIC. April, 2002.