

October 24, 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: UNSATURATED AND SATURATED FLOW UNDER ISOTHERMAL
CONDITIONS AGREEMENT 6.04 AND RADIONUCLIDE TRANSPORT
AGREEMENT 3.09

Dear Mr. Ziegler:

In your letter dated July 2, 2002, the U.S. Department of Energy (DOE) enclosed a report, "Saturated Zone C-Wells Hydraulic and Tracer Testing." This report was provided to close key technical issue agreements USFIC.6.04 and RT.3.09. The U.S. Nuclear Regulatory Commission staff has reviewed this information, with respect to the agreements, and the results of the staff's review are enclosed.

NRC staff requested DOE provide documentation on the hydraulic and tracer testing used to derive key input parameters for performance assessment modeling. Based on its review of the report and other available information, NRC staff considers that the information contained in the letter report satisfies the intent of USFIC.6.04 and RT.3.09.

Therefore, NRC staff considers DOE's proposed method of documentation acceptable. Based on the above, USFIC.6.04 and RT.3.09. are complete. If there are any questions regarding this letter, please contact John Bradbury at 301-415-6597 or by e-mail at jwb@nrc.gov.

Sincerely,
/RA/

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

Attachment: NRC Review of DOE Letter Pertaining to USFIC.6.04 and RT.3.09.

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Letter to J. Ziegler from J. Schlueter dated

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J. Birchim, Yomba Shoshone Tribe
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V. Miller, Fort Independence Indian Tribe
A. Bacock, Big Pine Paiute Tribe of
the Owens Valley
R. Quintero, Inter-Tribal Council of Nevada
(Chairman, Walker River Paiute Tribe)
M. Bengochia, Bishop Paiute Indian Tribe
J. Egan, Egan & Associates, PLLC
J. Leeds, Las Vegas Indian Center
K. Tilges, Citizen Alert
J. Triechel, Nuclear Waste Task Force

R. Joseph, Lone Pine Paiute-Shoshone Tribe
L. Tom, Paiute Indian Tribes of Utah
E. Smith, Chemehuevi Indian Tribe
J. Charles, Ely Shoshone Tribe
D. Crawford, Inter-Tribal Council of Nevada
H. Blackeye, Jr., Duckwater Shoshone Tribe
D. Eddy, Jr. Colorado River Indian Tribes
G. Runkle, DOE, Washington, DC
W. Briggs, Ross, Dixon & Bell
H. Jackson, Public Citizen

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NRC Review of DOE Documents Pertaining to Key Technical Issue Agreements USFIC.6.04 and RT3.09

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 the licensing proceedings. Also, and just as importantly, 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 enclosure addresses two agreements, USFIC.6.04 and RT3.09, which were reached between NRC and DOE during two technical exchange and management meetings.^{1,2}

Unsaturated and Saturated Flow Under Isothermal Conditions USFIC.6.04 Radionuclide Transport RT3.09

Wording of the Agreement: “Provide the documentation for the C-Wells testing. Use the field test data or provide justification that the data from the laboratory tests is consistent with the data from the field tests.” “DOE will provide the C-Wells test documentation and will either use the test data or provide a justified reconciliation of the lab and field test data in the C-Wells Analysis and Model Report available in October 2001.”

NRC Review:

Background: As indicated in the agreement language, staff requested DOE to provide documentation from hydraulic and tracer testing conducted at the C-Wells Complex near Yucca Mountain. Several long-term flow and transport tests had been conducted at this site, which is ideally situated for evaluation of flow in the volcanic tuff aquifer system downstream from Yucca Mountain. Staff were concerned that important results of this site characterization activity might go unharvested, as matrix diffusion parameters used in transport calculations for performance assessments were obtained mainly from laboratory tests rather than the available *in situ* tests. The applicability of the type and scale of the transport tests to conceptual models of performance assessments are of significant interest to NRC staff. Staff, therefore, requested that the data from the C-Wells tests be used for parameter estimates in transport calculations, or to show that the laboratory-derived estimates were consistent with the *in situ* flow and transport tests.

¹Reamer, C.W. “U.S. Nuclear Regulatory Commission/U.S. Department of Energy Technical Exchange and Management Meeting on Unsaturated and Saturated Flow Under Isothermal Conditions (October 31–November 2, 2000).” Letter (November 17, 2000) to S. Brocoum, DOE.

²Reamer, C.W. “U.S. Nuclear Regulatory Commission/U.S. Department of Energy Technical Exchange and Management Meeting on Radionuclide Transport (December 5–7, 2000).” Letter (December 12) to S. Brocoum, DOE.

Summary of the Information Provided by DOE

In response to key technical issue agreement USFIC.6.04 and RT3.09, DOE provided by letter³ a report titled "Saturated Zone C-Wells Hydraulic and Tracer Testing" (Reimus and Umari, 2002). This report provides an excellent and detailed summary of all flow and transport tests conducted at the C-Wells Complex between 1995 and 1998. Detailed descriptions of site characteristics, test methods, equipment, data reduction and analytical methods, and resulting parameter estimates are provided. Discussions in Section 3.5.8 of the Reimus and Umari (2002) report explain how the results of the *in situ* tracer tests compare to the conceptual model for radionuclide transport in volcanic tuff and how matrix diffusion and sorption parameters compare to laboratory test results. The report also provides details of the laboratory-based testing designed to support the C-wells field-scale results and interpretations. Laboratory tests described include batch tests of Li⁺ sorption, crushed tuff and fractured rock column experiments, and diffusion cell experiment. The report offers significant discussion of experimental, modeling, and interpretive uncertainties associated with both the hydraulic and transport tests and presents a balanced view of how these uncertainties should be acknowledged in the development of parameters for performance models. The report provides a clear and detailed discussion of the differences in values for parameters, such as matrix diffusion coefficients and Li⁺ sorption coefficients, derived from the C-Wells field-scale and associated laboratory tests. Scaling issues associated with parameters derived from field and laboratory tests are discussed. Figures 115 and 116 of the report (Reimus and Umari, 2002) illustrate the scale dependence of dispersivity in the Yucca Mountain region and show that these values are in agreement with dispersivity values observed worldwide.

Staff Comments:

Although scaling issues are discussed, the purpose of the comparisons of the dispersivity in C-Wells to that in the Yucca Mountain vicinity and around the world provided in Figures 115 and 116 has not been well defined by the authors. For example, it is unclear whether the comparisons are designed solely to show that the C-Wells data are consistent with other field observed data, or to establish a scale dependence relationship that will be used to support fate and transport modeling activities at Yucca Mountain site. A clear indication of the purpose of these comparisons is required to guide possible further analysis. Figure 115 suggests possible universal scaling of the longitudinal dispersivity at the site, but the true nature of this scaling is difficult to determine due to possible reliability and uncertainty concerns associated with the data from the Northern Ghost Dance and Amargosa tracer test sites. For instance, the rock type associated with the Amargosa test site may not have much direct relevance to the fractured volcanic tuffs in the vicinity of Yucca Mountain. It is also interesting to note that only the lower bound values provided in Table 21 of the report appropriately fit the scale dispersivity trend identified in Figure 115. The issue of possible scale dependency on transport parameters has been raised previously in the August 30, 2002 letter from Janet Schlueter to Joseph Ziegler on Radionuclide Transport Agreements 2.03 and 2.04. That letter contained a Request for Additional Information (RAI) justifying the use of parameter values, determined at the field scale of approximately 30 meters, to describe the transport properties of cells, 500 meters on a side, in the Total System Performance Assessment (TSPA). Since an RAI on this issue already exists, an additional RAI associated with this agreement is unwarranted.

³Ziegler, J.D. "Transmittal of Information Addressing Key Technical Issue (KTI) Agreement Items Radionuclide Transport (RT) 3.09 and Unsaturated and Saturated Flow Under Isothermal Conditions (USFIC) 6.04." Letter (July 2, 2002) to J. Schlueter.

The Reimus and Umari (2002) report provides sufficiently complete and detailed information that will allow staff to evaluate whether the conceptual transport model and parameters used in transport calculations for performance assessments are consistent with the *in situ* field testing data collected at the C-Wells. Staff consider that this information provided by DOE sufficiently addresses key technical issue agreements USFIC.6.04 and RT.3.09.

A comment related to the staff review of this report is provided for DOE's consideration; no response to this comment is necessary.

Staff note that some references listed in Section 5.1 do not appear to have been cited in the text (e.g., Ferrill, et al., 1999; Winterle and La Femina, 1999; Farrell, et al., 1999).

Additional information needs:

None. The issue of extrapolating transport parameters to spatial scales that exceed those of field tests will be addressed in the response to the RAI for RT2.03.

Status of Agreements: Agreements USFIC.6.04 and RT.3.09 are considered complete.

References

Reimus, P.W. and M.J. Umari. "Saturated Zone C-Wells Hydraulic and Tracer Testing." Yucca Mountain Project report (CD-rom) provided by letter (July 2, 2002) from J. Ziegler to J. Schlueter. June 5, 2002.