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OVERNIGHT MAIL

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ISSUE RESOLUTION STATUS REPORT (IRSR), REVISION 0, KEY TECHNICAL ISSUE: RADIONUCLIDE TRANSPORT

The U.S. Department of Energy (DOE) has completed our review of Revision 0 of the Radionuclide Transport IRSR. We agree that the Issue Resolution process has benefits for the identification and resolution, at the staff level, of regulatory and key technical issues by informal, pre-licensing consultation. The enclosed comments are directed primarily at the acceptance criteria for the various subissues associated with radionuclide transport.

We note progress has been made in the area of radionuclide transport, as evidenced by resolution of Subissue 1, Radionuclide Transport Through Porous Rock and the U.S. Nuclear Regulatory Commission's (NRC) acceptance of the general methods DOE has used to evaluate sorption. In some cases, particularly for neptunium, most of the investigations that are expected by the NRC to justify the methodology have been completed. We also note the need to continue development of radionuclide transport models.

The enclosure includes three general comments and describes DOE concerns with some acceptance criteria statements, suggesting revisions that DOE believes will improve the usefulness of the criteria under the risk-informed, performance-based approach proposed by the NRC in 10 CFR Part 63. Although we do not expect formal responses to our comments, we have included several comments intended to reflect corrections and clarifications for your consideration in developing the next revision of the Radionuclide Transport IRSR. Again, we appreciate the opportunity to comment on the IRSRs and believe they are valuable tools for issue clarification and resolution.

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If you or your staff have any questions regarding our comments, please contact Deborah L. Barr at (702) 794-1749 or April V. Gil at (702) 794-5578.

April V. Gil

FOR Stephan Brocoum
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OL&RC:AVG-1919

Enclosure:
Comments on Issue Resolution
Status Report Revision 0,
Key Technical Issue: Radionuclide
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ENCLOSURE: COMMENTS on *Issue Resolution Status Report Revision 0, Key Technical Issue: Radionuclide Transport* (NRC 1998b)

Summary

The U. S. Department of Energy (DOE) is encouraged that Revision 0 of the Radionuclide Transport Issue Resolution Status Report (IRSR) indicates that the general methods DOE has used to evaluate sorption are satisfactory. In some cases, particularly for neptunium, most of the investigations that are expected by the NRC to justify the methodology have been completed.

Comments on Individual Acceptance Criteria

1. Subissue 1: Radionuclide Transport Through Porous Rock

   Acceptance Criterion 1a: Determine, through sensitivity analysis, whether radionuclide attenuation processes such as sorption, precipitation, radioactive decay, and colloidal filtration are important to performance.

   The first part of the criterion basically states that if DOE can demonstrate that sorption is unimportant to performance, and assumes a K_d of zero, then criteria 2 and 3 do not need to be met for this subissue. It appears that if a K_d of zero were used, whether or not radionuclide attenuation is important to performance, then nothing else should be required with respect to justification of the treatment of sorption. Mention is made of the fact that charge and size exclusion (primarily for negatively charged dissolved species and colloids, respectively) could result in transport faster than that predicted with a K_d of zero. While true, there is little potential for faster transport because such effects are expected to be very small. Results from some Los Alamos National Laboratory (LANL) crushed tuff column experiments, comparing technetium and tritium transport, do not indicate any effects of charge or size exclusion in that the transport of technetium lags that of tritium (LANL, 1997). Consequently, the DOE believes that the acceptance criteria has been satisfied.

2. Subissue 1: Radionuclide Transport Through Porous Rock

   Acceptance Criterion 2b: Determination of appropriate values of parameters, K_d

   The technical discussion associated with this criterion includes an example of plutonium sorption measurements that did not attain a steady-state condition, and column experiments showing plutonium breakthrough similar to tritium (which does not sorb). The plutonium batch sorption experiments indicate that plutonium sorbs strongly to the tested rock types. Yet the breakthrough behavior in the column experiments suggests otherwise. The description in the IRSR is not clear because the two factors, long sorption time scales and breakthrough behavior, although related, do not demonstrate that sorption measurements need to be carried out to steady-state conditions. In fact, the problem is that at the high flow rates used for the laboratory column tests, the plutonium did not sorb according to the ideal K_d model. Even if the sorption experiments had been carried out to steady-state conditions,

the column experiments would still result in the discrepancy because the flow rates are too high to apply an equilibrium sorption K_d model.

DOE suggests that there is little apparent justification for the constraint that batch sorption experiments be carried out to steady-state conditions. Except for colloids, the batch sorption data taken from experiments that have not reached a steady condition will result in lower, hence, more conservative values for K_d. Therefore, DOE recommends that the criterion be revised to remove the stipulation that batch sorption experiments be carried to steady-state conditions.

General Comments:

3. Page 10 text cites the "Benham event, where plutonium traveled more than a kilometer in 20 years" as an example of colloid formation and transport without providing any reference. For clarification, we recommend a reference be provided for this statement. From the statement, it is not clear whether the plutonium migration is interpreted to be a result of groundwater flow or a result of blast effects from a nuclear detonation below the groundwater table.

4. The K_d results for plutonium have been described inconsistent and problematic (p. 77), even though, according to Table 5-1, this radionuclide has met the required criteria. Clarification is needed for the interpretation of Table 5-1 given other statements made in the IRSR.

5. Section 4.1.1, Page 15, Acceptance Criteria: The IRSR states "For the application of the K_d approach, using the equation $R_f = 1 + \rho K_d/n$, DOE has demonstrated that the flow path acts as an isotropic homogeneous porous medium." As indicated by the unsaturated and saturated zone testing programs to date, the flow path does not act as a classical isotropic homogeneous system. Testing provides evidence that fracture/matrix interaction and not a single continuum govern the flow. Data from the Nye County wells indicate heterogeneous media for the alluvium.

Editorial Comments:

6. On page 9 (and elsewhere), several references cited in the text are not listed in the reference list. Examples include: EPA, 1985 on page 9; Geldin et al., 1997 on page 18; Grenthe et al., 1992 and Silva et al., 1995 on page 28; Sinnock et al., 1984b on page 81; etc. Additionally, in several instances "Triay et al., 1996" are cited (e.g., pages 70, 73, 75, 79) without indicating which one of the three publications by Triay et al. from 1996 (a, b, or c) is being referenced.

7. The text on page 81 states "LANL experiments (ref) show that fracture lining materials are as permeable as the matrix." The reference was missing.

8. Page 11 text mentions J-11 and J-12 being 13 kilometers southeast of the repository. It appears that J-13 rather than J-11 is being discussed.

9. On pages 16, 20, 27, 30, 73 and 75, Kd and KD have been used to represent one parameter, the sorption coefficient. Dimensional analysis shows that both Kd and KD have the same unit of mL/g. To avoid confusion, only one symbol should be used for this parameter.

References

CRWMS M&O (Civilian Radioactive Waste Management System Management and Operating Contractor), 1998. Report on External Criticality of Plutonium Waste Forms in a Geologic Repository, BBA0000000-01717-5705-00018, Revision 01, January 28, 1998. Las Vegas, Nevada, 106 pages. MOL.19980318.0412

LANL (Los Alamos National Laboratory), 1997. Summary and Synthesis Report on Radionuclide Retardation for the Yucca Mountain Site Characterization Project, LA-13262-MS, UC-814, 1997, Milestone Report 3784M. MOL.19971210.0177.

NRC (U.S. Nuclear Regulatory Commission), 1998a. Issue Resolution Status Report (Key Technical Issue: Radionuclide Transport, Revision 0), Letter from C. W. Reamer to S. J. Brocoum, December 23, 1998, 2 pages. MOL.19990105.0074

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