HLWYM HEmails

From: Bret Leslie
Sent: Saturday, November 03, 2001 5:43 PM
To: TWFN#u#DO#c##091#aol.com#093##c#Drjacob@nrc.gov
Subject: concerning your letter

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Dr. Paz,

As per our discussion yesterday here is the results of the review by the technical staff at the Center for Nuclear Waste Regulatory Analyses (CNWRA). They were asked only to comment on issues within the U.S. Nuclear Regulatory Commission's regulatory framework. They commented on your issues 3-5 and 7 in the comments you provided to the Department of Energy. I would be happy to send you copies of any the NRC references cited in the CNWRA's response.

Sincerely,
Bret

Comment 3

This comment is concerned with three issues relating to the possibility that the U.S. Department of Energy (DOE) is underestimating the hazard from contaminants due to uncertainty in sorption parameters. These three points are discussed separately. Note that this response addresses only effects on radionuclide transport. Standards for protection of public health and the environment as promulgated by the U.S. Nuclear Regulatory Commission (NRC) in 10 CFR 63 do not address non-radioactive contaminants.

The first point in the comment is that errors in estimating transport properties may arise when laboratory results are scaled up to field conditions. Staff agrees that this is a concern, and has shared this concern with the DOE in past interactions. For example, the following NRC/DOE agreement was reached concerning use of data from the C-Wells saturated zone field tests:

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 AMR available in October 2001. (Agreement 3.09 in NRC, 2000; the AMR has not yet been received by NRC.)

Furthermore, the DOE has acknowledged in reports associated with TSPA-SR that assumptions concerning extension of laboratory data to the field still need to be verified (e.g., Assumptions 2 and 14 in CRWMS M&O, 2000a). Finally, this issue is implicit in NRC concerns with DOE justification for its choices of transport parameters used in performance assessment, which have resulted in the following NRC/DOE agreement:

Provide additional documentation to explain how transport parameters used for performance assessment were derived in a manner consistent with NUREG-1563, as applicable. Consistent with the less structured approach for informal expert judgment acknowledged in NUREG-1563 guidance and consistent with DOE procedure AP-3.10Q, DOE will document how it derived the transport parameter distributions for performance assessment, in a report expected to be available in FY 2002. (Agreements 1.05 and 2.10 in NRC, 2000.)

In summary, staff believes that the DOE has plans, stated in both its own reports and in agreements reached with the NRC, to address this important issue.

Dr. Paz states that more information on radionuclide sorption is needed, particularly for the alluvial aquifer. This concern is indeed valid, and the staff have been discussing this issue with the DOE in recent interactions. For the more general concern, staff believes that the DOE has not yet demonstrated that radionuclide Kd uncertainty distributions adopted for performance assessment capture potential variability under repository conditions and uncertainty associated with factors such as those raised in the comment (e.g., effects of surface and aqueous complex chemistry, mineral characteristics). Agreements 1.05 and 2.10 of NRC (2000), quoted above, provide the vehicle for NRC staff to obtain the information from DOE needed to determine if transport parameters used in support of any potential license application have an adequate technical basis. For the more specific concern regarding the alluvial aquifer, staff agrees with the comment that "little attention has been given to sorption on alluvial sediments in the far field." The NRC has entered into several agreements with the DOE aimed at ensuring that enough information on the alluvial flow path will be available to allow review of any potential license application (Agreements 2.01 through 2.11 of NRC, 2000). For example, the following agreement reflects specific NRC concerns with how DOE will gather data on alluvial transport properties:

If credit is taken for retardation in alluvium, the DOE should conduct Kd testing for radionuclides important to performance using alluvium samples and water compositions that are representative of the full range of lithologies and water chemistries present within the expected flow paths (or consider alternatives such as testing with less disturbed samples, use of samples from more accessible analog sites (e.g., 40-mile Wash), detailed process level modeling, or other means). DOE will conduct Kd experiments on alluvium using samples from the suite of samples obtained from the existing drilling program; or, DOE will consider supplementing the samples available for testing from the alternatives presented by the NRC. This information will be documented in an update to the SZ In Situ Testing AMR, available in FY 2003. Kd parameter distributions for TSPA will consider the uncertainties that arise from the experimental methods and measurements. (Agreement 2.06 of NRC, 2000.)

The DOE is obtaining new data on the alluvium in cooperation with the Nye County Early Warning Drilling Program. NRC staff will evaluate the data provided in support of radionuclide transport models reported in any potential license application.

Finally, Dr. Paz questions whether the DOE has considered the effects on radionuclide sorption of competition from heavy metal contaminants such as Ni, Co, Cr, and Mo. Staff agrees that competitive sorption is a phenomenon of concern and that DOE has not made clear how its choice of transport parameters does or does not account for any such effects. The DOE claims that its choices of Kd uncertainty distributions account for, among other phenomena, "competitive effects among sorbing constituents" and chemical changes "in a carrier plume" (CRWMS M&O, 2000b, sections 7.2.25 through 7.2.28). NRC staff have challenged this assertion, and DOE agreed (NRC, 2001a; Agreement TSPAI.3.31 and Attachment 2 items J-7 through J-10) that a number of NRC/DOE agreements apply to the general question of chemical effects on sorption in the special repository environment: ENFE.1.04, ENFE.1.07, ENFE.2.06, and ENFE.4.03 (NRC, 2001b), and RT.1.05 and RT.2.10 (NRC, 2000). NRC staff will ensure that sorption competition will remain among the effects DOE addresses in fulfillment of these agreements.

Sorption competition from heavy metals may be most effective within the drift. At present, the DOE is taking no credit for radionuclide sorption in the drift. At a recent technical exchange, NRC made clear to DOE that parameters used in any future model adoption of sorption in the drift will be subject to a high level of scrutiny under the existing agreements on transport properties (NRC, 2001c).

Comment 4

This comment concerns the health hazard from potentially higher chromium mobility in the proposed repository environment. Non-radioactive metal contaminants are not regulated by the NRC under 10 CFR 63.

Comment 5

Dr. Paz raises the concern that the DOE does not, in assessing proposed Yucca Mountain repository risk, incorporate risk from contaminants migrating from the Nevada Test Site. The DOE is not required to do so

under 10 CFR 63. As discussed in the Federal Register Notice for final 10 CFR 63 (66 FR 55749 available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=2001_register&docid=01-27157-filed.pdf), the adoption of a 0.15 mSv/year (15 mrem/year) dose limit for the reasonably maximally exposed individual is designed to ensure that individual dose will remain below the generally applicable 1 mSv/year (100 mrem/year) public dose limit, even if other potential sources of radioactive contamination are present.

Comment 7

This comment concerns potential risk due to mixed irradiation. This effect is not relevant to dose assessments performed for Yucca Mountain for several reasons. First, the synergistic effects of mixed radiation types have been observed only at very high irradiation rates. Suzuki (1997) indicates that there is essentially no synergistic effect for long irradiation times (weeks and longer) at relatively low doses (less than 1 Gy, or 100 rad). In this context, the dose rate limit in 40 CFR 197 (0.15 mSv/year, or 15 mrem/year) would be considered a low dose at long times.

Second, the synergistic effects of mixed radiation types reduce the survival rate of cells exposed to a given dose of radiation (Suzuki, 1997). The low dose rate limit set in 40 CFR 197 is much lower than the dose rate at which any deterministic effects of radiation will be seen. These deterministic effects of radiation are related to the killing of a sufficient fraction of cells that perform a function in the body such that the body has reduced capacity to perform this function (Hall, 1994). The primary health concern at the low dose rates associated with the Yucca Mountain standards is the induction of cancer from cells that are damaged by radiation and repaired incorrectly by the body (Hall, 1994). There are no data to support a claim that this process of cancer induction would be enhanced by the increased efficiency of cell killing of mixed radiation types at high irradiation rates. An alternative viewpoint could suggest that if the mixed radiation was synergistic at low dose rates, it might be reasonable to postulate that it would lower the risk of the radiation inducing a fatal cancer, because a larger fraction of cells exposed to the radiation would be killed instead of being damaged and potentially misrepaired.

Finally, the comment is not applicable under the terms of 40 CFR 197 and 10 CFR 63 because these standards are dose-based rather than risk-based. Dr. Paz's argument is that the effects of mixed irradiation could increase the risk associated with the dose from both radiation types, not that the dose itself would increase. Therefore, this comment is not applicable to the DOE demonstration that the dose limits in the Yucca Mountain standards have been met.

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