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EPA Docket Center (EPA/DC)
Air and Radiation Docket
U.S. Environment Protection Agency
EPA West, Mail Code 6102T
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Attn: Docket ID No. OAR-2005-083

To whom it may concern:

The following supplemental comments are filed by the State of Nevada in response to EPA's notice of proposed rulemaking to revise the standards for the licensing of the proposed Yucca Mountain geologic repository in 40 C.F.R. Part 197. While these comments are being filed after the close of the comment period, there is good cause for considering them fully because they are based on new information not available previously.

The EPA proposed rule provides, with some limited exceptions, that DOE continue to use FEPs (features, events, and processes) selected for compliance with the 10,000 year standard in its 1,000,000 year projections (see proposed 10 C.F.R. § 97.36(c)). Nevada criticized this provision on a variety of grounds in its comments. The attached memo from Sandia National Laboratories, DOE's "Lead Lab" in preparing the Yucca Mountain license application, just recently came to the attention of Nevada. It offers substantial support for Nevada's position. It states in relevant part (at pg. 3) that this provision makes sense for some FEPs, "but does not make as much sense for other FEPs whose exclusion arguments depend on the condition of the engineered barrier at the time of the event." The Lead Lab appears to be relieved that it won't be required to defend EPA's rule before the NRC at the licensing hearing. It would be the essence of arbitrary and capricious decision-making to adopt a rule that its own proponents and beneficiaries concede is of questionable merit, just so the regulated entity would be relieved of making a fool of itself, or committing perjury, trying to defend the same proposition in a licensing hearing.

Also, Nevada has recently been made aware of secret communications among NRC, DOE, and EPA regarding the response to Nevada's comments and the nature of the final rule. Nevada requests that EPA place on the rulemaking record any such communications that are relied on in responding to Nevada's comments and developing the final rule. In this regard, Nevada believes that communications between EPA or NRC and DOE, whether or not relied on, and whether or not OMB or DOJ served as the conduit, are not privileged interagency communications because, with respect to Yucca Mountain, DOE is in the posture of a license applicant subject to the rule like any other private entity, and cannot be treated simply as another federal agency.

Sincerely,

Robert R. Loux
Executive Director

MM/jb
Attachment

**License Defense Issues**
**March 29, 2007**
Laura Price

Here are some issues that the Lead Lab Licensing Department needs to make sure are addressed adequately.

1. Percolation flux at the repository horizon. The distribution of percolation flux that will be used in the compliance case is not loguniformly distributed between 13 and 64 mm/yr, as the NRC expects (10 CFR 63.342 (c)(2) at 70 FR 53320). The current plan is to do an impact analysis, which has not yet been defined, to see how the TSPA results might differ if a closer approximation to the NRC-specified distribution were to be used. We need to make sure the impact analysis gets done and that it is done in a proper fashion. Because of the way the models are set up, it is not possible to use the NRC-specified loguniform distribution in the compliance case or in the PMA. It might be possible to use the NRC-specified loguniform distribution for the NG PA.

   **Licensing action: Make sure the impact analysis gets done and that it is done in a proper fashion.**

2. The RMEI drinking 2 liters of water withdrawn from the part of the plume that has the highest concentration of radionuclides. 10 CFR 63.312 (d) defines the RMEI as someone who drinks 2 liters of water per day from wells drilled into the ground water at a location that is in the accessible environment above the highest concentration of radionuclides in the plume of contamination. Our model of radionuclide transport in the SZ, which is the region from which the water is withdrawn, does not model plumes of contamination. Rather, the model accumulates all the radionuclide mass flux at the 18-km boundary and uses a volume of 3,000 acre-feet to calculate an average radionuclide concentration. Thus, in the current compliance model, the water that the RMEI drinks contains the average concentration of radionuclides, not the highest concentration.

   Some have argued that using the average concentration for the 2-liters/day requirement is sufficient, but such a position does not square with EPA statements: *"As stated above, the method of calculating the RMEI dose is to select average values for most parameters except one or a few of the most sensitive, which are set at their maximum. We believe that an RMEI location above the highest concentration in the plume of contamination in the accessible environment and a consumption rate of two liters per day of drinking water from the plume of contamination represent high-end values for two of these factors."* (66 FR 32093)

   Elsewhere in discussing comments that were made on the draft version of 40 CFR 197, the EPA states that *"Finally, one comment stated that the proposed RMEI concept forces DOE to assume the RMEI will withdraw water from the highest concentration within the plume without consideration of the likelihood. According to this comment, forcing such an assumption neglects the low probability that a well will intersect the highest*

*concentration within the plume."* (66 FR 32094, 32123) The EPA then proceeds to defend its decision, concluding that *"We further believe that prudent public health policy requires that our approach be followed to provide reasonable conservatism....To allow the probability of any particular location being contaminated is not a prudent approach to the ultimate goal of testing acceptable performance."* (66 FR 32094, 32123)

There may be ways that we can approximate what the highest concentration of radionuclides might be, for a given average concentration. We should talk with the SZ transport modelers and find out what is possible. We may also have to convince some folks that use of the average concentration is not acceptable.

**Licensing action: Bring this issue to the attention of the PA team and SZ transport team and try to develop a way to meet the requirement that the RMEI drink 2 liters of water withdrawn from the part of the plume with the highest concentration of radionuclides, given our current models.**

3. Use of a water demand of 3,000 acre-feet in the exposure calculations. I believe the NRC is expecting the dose to the RMEI to be based on an annual water usage of 3,000 acre-feet. We use the 3,000 acre-feet to calculate the radionuclide concentration (total mass flux through the 18-km boundary per year/ 3,000 acre-feet) that is used in the dose calculations, but the actual volume of water that goes into the exposure pathways is never used or calculated in our models. The actual definition of the RMEI in 63.312(c) states: *"Uses well water with average concentrations of radionuclides based on an annual water demand of 3000 acre-feet;"* Thus, we currently use the "average concentration" part of this definition but not the "water demand" part.

   The NRC developed the 3,000 acre-foot annual water demand (the EPA left it to the NRC to specify water demand, which it did) at 66 FR 55734. After discussing how it arrived at 3,000 acre-feet, the NRC concludes: *"This revised approach limits speculation on water demand and provides DOE with a specific value for the water demand that the NRC staff finds acceptable to estimate the RMEI dose."* Based on this statement, I think the NRC does not see the 3,000 acre-feet merely as a dilution volume - it sees it as a quantity that is to be used in the pathway calculations. I believe that it is a problem that we are not meeting the definition of the RMEI because we are not explicitly using 3,000 acre-feet in the pathway calculations.

   I have talked briefly with Maryla about this. From the conversation we had, I believe it might be possible to back-calculate how much water would be needed for the modeled exposure pathways to occur. Perhaps they could then be adjusted to reflect 3,000 acre-feet of annual water usage.

   **Licensing action: Bring this issue to the attention of the PA team and to Maryla. Determine whether there is a way to determine the annual water usage that is associated with the exposure pathways in the current model. Determine whether there is a way to make those pathways consistent with an annual water usage of 3,000 acre-feet.**

4. Which BDCFs to use after 10,000 years to account for climate change? The NRC requires the DOE to account for climate change in its post-10k PA calculations (10 CFR 63.342(c)(2)). The question has come up as to whether present-day BDCFs (which are not consistent with the proposed post-10k climate) should be used to calculate dose to the RMEI for the post-10k period, or whether the BDCFs should reflect climatic conditions that are consistent with the proposed post-10k climate. Many papers have been written in support of each position, and reasonable people still disagree about it. The DOE is in the process of deciding which path to take; I think we need to monitor this process.

   **Licensing action: Monitor the DOE as it decides which path to take.**

5. Recycling of radionuclides into the SZ via irrigation FEP# 1.4.07.03.0A "Recycling of accumulated radionuclides from soils to groundwater" has been screened into the PA, which represents a change from the previous "excluded" disposition. The details of exactly how to model this FEP are being worked out by Bill Arnold and company. They seem to be heading in the right direction, but their progress should be monitored to ensure that they are making reasonable assumptions.

   **Licensing action: Monitor the group working on developing this model, looking primarily for defensible assumptions.**

6. $10^4$ vs $10^6$ FEPs In extending the compliance period from $10^4$ to $10^6$ years, the EPA and the NRC have both proposed that the DOE continue to use the FEPs selected for compliance with the 10,000-year projections in its 1,000,000-year projections (proposed 40 CFR 97.36(c) at 70 FR 49064 and proposed 10 CFR 63.342 (c)(2) at 70 FR 53319). This makes sense for many FEPs (e.g., FEP #1.2.07.01.0A, erosion/denudation), but does not make as much sense for other FEPs whose exclusion arguments depend on the condition of the engineered barrier system at the time of the event (e.g., FEP #2.1.03.07.0B, mechanical impact on drip shield). Some have questioned the defensibility of this proposed position.

   This position taken by the EPA and the NRC does not have to be defended by the DOE; nonetheless, it would be prudent as a part of license defense for the DOE to identify those FEPs for which exclusion based on consequence is reasonable for the 10,000-year projection but not reasonable for the 1,000,000-year projection. This identification has already been started by License Defense, but needs to be completed. I believe the FEPs group in PA is going to do something similar in a more formal fashion, and we should coordinate with them to not replicate effort and provide additional defensibility.

   **Licensing action: Finish identifying those FEPs for which exclusion based on consequence is reasonable for the 10,000-year period but not reasonable for the post-10k year period. Coordinate with the FEPs group in PA.**

7. Ensure that general corrosion of cladding for the post-10k period is included in the PMA The EPA and NRC require that general corrosion of engineered barriers be included in

the post-10k analyses (40 CFR 197.36 (c)(3) at 70 FR 49064 and 10 CFR 63.342 (c)(3) at 70 FR 53320). General corrosion of the drip shield and general corrosion of the waste package are already included FEPs, so no additional work should be needed to meet this requirement for the drip shield and the waste package.

However, general corrosion of cladding was screened out of the 10,000-year analysis based on low consequence. For the compliance case, cladding is assumed not to provide any barrier capability. That is, once a waste package is breached, the cladding does not delay or prevent radionuclide release from the spent fuel rods. Therefore, for the compliance case, it is not necessary to consider general corrosion of cladding because the cladding is not performing as a barrier. For the PMA, however, cladding is assumed to provide some barrier capability; the cladding is breached only if it was degraded prior to disposal (FEP # 2.1.02.12.0A) or if a seismic event occurs. Therefore, to be consistent with the requirement that general corrosion of engineered barriers be included in post-10k analyses, general corrosion of cladding needs to be included in the PMA for the post-10k period.

This raises the issue of what to do when requirements are in conflict: the requirement to include in the post-10k year analyses only those FEPs that were included for the pre-10k analyses directs us to *exclude* general corrosion of cladding for the post-10k year analyses, while the requirement to include general corrosion of engineered barriers for the post-10k year analyses directs us to *include* general corrosion of cladding for the post-10k year analyses. The EPA has made it clear that the requirement to include general corrosion for the post-10k year analyses surpasses the requirement that the same FEPs be considered in the 10k year analyses as in the post-10k year analyses: *"Were we simply to state that FEPs not included in the 10,000-year analyses should not be included in the post-10,000-year analyses, there might be some question as to whether doe would need to consider general corrosion at all. We believe it has been shown potentially to be of sufficient importance that it should be included in those projections. Therefore, we are proposing to remove any ambiguity by specifying that DOE must consider general corrosion in its projections throughout the period of geologic stability."* (70 FR 49051)

The cladding TDIP for the PMA became an issue because one of the reviewers objected to including general corrosion of cladding in the model. I am not sure what the resolution was. We need to find out what the status of the TDIP is and whether it includes general corrosion of cladding after 10k years. If it does not, the appropriate steps should be followed to try to get a model/analysis of general corrosion of cladding included in the PMA.

**Licensing action: Determine whether the cladding TDIP for the PMA includes a model/analysis of general corrosion of the cladding for the post-10k analyses. If it does not, take the appropriate steps to get a model/analysis of general corrosion of cladding included in the PMA.**

8. Inclusion of seismic events in the human intrusion calculations The human intrusion calculations are to exclude unlikely FEPs. That is, they are to exclude FEPs with a

probability of occurrence that is less than 1 x $10^{-5}$ per year (10 CFR 63.342(b) at 70 FR 53319). Some seismic events have a probability of occurrence that is greater than 1 x $10^{-5}$ per year. Therefore, these seismic events must be included in the human intrusion calculations; seismic events are currently not included in the human intrusion calculations.

I have had some discussions with Dave Sevougian and Mike Gross concerning this issue, and right now it looks like the most significant effect that including seismic events could have would be changing the earliest time at which a driller would not be able to recognize a waste package and would thus keep drilling through the waste package, resulting in an intrusion. However, these discussions have been rather preliminary, mostly because Mike needed to get TDIPs done, and so further discussion and examination of the human intrusion calculations is necessary.

The human intrusion calculations are highly stylized, per NRC direction (10 CFR 63.322). These calculations have not been subject to much scrutiny in the last few years, because it was part of the FEIS and was not going to be submitted with the SAR. This is no longer the case, and it would be wise for us to familiarize ourselves with the human intrusion calculations to make sure they are consistent with NRC requirements.

**Licensing action: Continue working on this issue, making sure that the PA calculations fully meet the requirement to include likely events in the human intrusion calculations. Examine the human intrusion calculations to ensure they are consistent with NRC requirements.**

9. Reasonableness of seismic models There has been some discussion in the licensing department (primarily Mary-Alena) that the models that we use to estimate the consequences of a seismic event are ridiculously conservative, ridiculous enough not to pass the "ho-ho" test and to violate fundamental physical principles. Mary-Alena's main concern is that the ground motions that are predicted to occur at repository depth are not observed in other mines and caverns that are at similar depths (e.g., in New Zealand). I have a call into Charles Fairhurst (a recognized mining expert) to discuss this issue, but I haven't heard back from him. This raises serious questions about the validity of the entire seismic modeling case.

   There are some agreements between the NRC and the DOE that govern how we model the occurrence of seismic events. For example, the DOE has agreed to use the mean hazard curve rather than the median hazard curve, at the NRC's insistence. Using the mean hazard curve results in higher peak ground velocities (PGVs) for a given exceedance frequency than does using a median hazard curve. The extent to which the seismic modeling case is governed by agreements between the NRC and the DOE is unknown, but Candie is going to look into it.

   In addition, if the seismic modeling case were not driven by agreements between the NRC and DOE, it is still highly unlikely ($P << 1 \times 10^{-8}$ O) that we could get the seismic modeling case to change to something more reasonable for either the compliance case or

the PMA. There is a chance (P = ?) that something more reasonable could be developed for the NG PA, but I don't have a feel for how possible that would be.

The argument will probably be made that the seismic modeling case is conservative. I'm not sure I agree with that (see next point). Having seismic events occur periodically allows radionuclides to be released over a long period of time. If the seismic events had no effect on radionuclide release, and nothing significant got out of the repository until the engineered barriers failed from slow-acting degradation processes, it is possible that a higher dose would result because of a shorter period of time over which the radionuclides would be released. This is sheer speculation, but it is not unreasonable speculation.

**Licensing action: Investigate the extent to which the seismic modeling case is governed by agreements with the NRC and the DOE. Examine the reasonableness (or unreasonableness) of the current seismic modeling case. If necessary and possible, pursue development of a more reasonable seismic model.**

10. Use of the word "conservative" I keep seeing the word "conservative" in various TDIPs and PASIT Fact Sheets, usually with regard to an assumption or a modeling approach. Whenever I see the word, I stop and think "Why is this conservative? What is the basis for being conservative?" Most of the time (95%), the answer is that there is no basis. Also, most of the time, the claim of conservatism is not needed to support the assumption or modeling approach.

    If we are going to use an argument of "conservative" to support the choice of data or models, the NRC is going to look to see that the value or model results in conservative estimates of risk, that the value or model does not cause unintended results, and the model is conservative relative to alternative conceptual models that are consistent with the available data and current scientific understanding (YMRP Section 2.2.1.3.1, for example). I'm not sure I have ever seen an argument supporting a claim of conservatism that would even come close to meeting what the NRC expects to see.

    In a related issue, there is an underlying assumption that earlier failure or earlier release is "conservative." This is not necessarily true either, as some radionuclides in certain decay chains in some waste types are still increasing in inventory at $10^6$ years.

    I'm not too worried about seeing the word "conservative" in TDIPS and PASIT Fact Sheets that are not Q documents that support the LA, but I'm concerned about seeing in AMR and the SAR, which will support the LA directly.

    **Licensing Action: I'm not sure what to do here.**