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January 6, 1993

John W. Bartlett, Director
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy
Washington, D.C. 20585

Dear Dr. Bartlett:

The State of Nevada has reviewed the DOE Study Plan "Effects of Local Site Geology on Surface and Subsurface Motions" (Study Plan 8.3.1.17.3.4) and is providing its comments in this letter and attachment. The State's comments address the adequacy, completeness, and technical accuracy of the Study Plan to meet the Department's purpose in site characterization.

The State has two general comments regarding the subject Study Plan.

1. The model proposed in the study plan is out-dated and does not take into account new technologies. The use of a one-dimensional, linear model may not achieve the desired objectives at the needed level of confidence. It is suggested that this study plan be revised to bring it more up-to-date.

2. This study plan, as with other related study plans, appears to ignore the near-field. Given the 32 presently known faults in the site vicinity, the repository is the near field. How does DOE plan to address the near field effects?

Specific comments are listed in the attachment.

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ADD: Joe Youngblood Ltr. Encl.

We look forward to your response to the State's comments. Should you have any questions, this Office is available to meet with the Department at any time.

Sincerely,

Robert R. Loux
Executive Director

Attachment

cc: Carl Gertz, YMPO
✓Joe Youngblood, NRC
Dade Moeller, NRC-ACNW
John Cantlon, NWTRB
Steve Kraft, EEI
Dwayne Weigel, GAO

SPECIFIC COMMENTS

1. Page 1-1, paragraph 2: The study plan states that methods will be developed to predict ground motion spectra and peak ground motion values that account for the effects of site geology and structure on expected shaking levels. According to the Nuclear Waste Policy Act, DOE is supposed to be using existing techniques and not developing new technology. There is an overabundance of techniques presently in existence to predict ground motion. Development of another technology does not appear to be necessary.

2. Page 1-1, paragraph 2: The study plan states that theoretical models for the observed site effects will be developed to the extent necessary to explain the observations to first order. What is the definition of "first order"?

3. Page 1-1, paragraph 3: The first sentence gives a list of sources of information for effects of site geology on ground shaking. How much of the data on UNEs has been collected under controlled conditions in the near field? How much of this data is from rock types analogous to Yucca Mountain? Shouldn't local mine blasts also be included in this list? Also, which "physical properties" of the soil and rock are meant here?

4. Page 1-1, paragraph 3: The second sentence states that the data collected will be used to "evaluate" the relative levels of ground shaking. The term "predict" would be more appropriate.

5. Page 1-2, paragraph 1: There is no mention of the design and performance of the seals. In fact, there is nothing in this paragraph that indicates that the potential seal problem is recognized.

6. Page 1-2, paragraph 1: The last sentence of this paragraph ignores the topographic effects, which are known to be important.

7. Page 1-2, paragraph 3: The study plan should give a definition of "credible accidents" and include examples.

8. Page 1-2, paragraph 4: There is no basis for still using the 10,000-year cumulative slip earthquake. This has been proposed and rejected on a number of occasions in the past. It is not relevant in dealing with vibratory ground motion. This is one of the many instances in this study plan that indicate its obsolescence.

9. Page 1-3, paragraph 1: What is the basis for the "10-percent chance of being exceeded during 100 years"?

10. Page 2-1, paragraph 1: Will the "additional seismographs" mentioned here be operated separately or as part of the Southern Great Basin Seismic Network? If it is to be operated separately, what QA program will apply?

11. Page 2-1, paragraph 1: What soil and rock properties are to be determined for this study?

12. Page 2-1, paragraph 2: It is stated that the disadvantage of estimating the effects of site geology on strong ground motion using only measurements of low level shaking is that these low level motions may not adequately simulate all aspects of strong shaking, particularly non-linear soil behavior. To our knowledge, there is not any empirical data in the near field around active faults that supports this statement. One aspect that should be considered is the possible cumulative effect of the low level vibratory ground motion on the disturbed zone, seals, and performance of both over the life of the repository.

13. Page 2-1, paragraph 2: The references cited here do not include the most recent and more appropriate information on the subject of using low level shaking to predict strong shaking effects.

14. Page 2-1, paragraph 2: This paragraph gives the general impression that neither alternative accounts for non-linear effects. Since non-linear effects could be extremely important in determining the long-term performance of the repository, how will this issue be addressed? Does DOE plan to develop a new methodology to determine the non-linear effects?

15. Page 2-2, paragraph 1: Will there be any changes necessary to the study plan to accommodate the new design of the ESF? This study plan still discusses the ESF shafts?

16. Page 2-2, paragraph 1: The statement is made that the new sites will be occupied long enough to record at least ten events simultaneously at each station in order to permit adequate statistical development of site effect characteristics. What was the basis for the selection of ten events? In the last ten years of the site studies with the SGBSN, how many events and of what magnitude have been seen simultaneously? How many of these events and of what magnitude would the new proposed have seen? Although the next sentence states that 20 earthquakes per month greater than local magnitude 1.0 are expected to be recorded, and this is probably correct in terms of the entire SGBSN, it is unlikely to be true for the immediate Yucca Mountain site. Almost all of the earthquakes recorded have been less than magnitude 2.0. Compounding the problem will be the possible increased level of background noise generated by the construction of the ESF.

Since the DOE has already stated that there are problems with estimating strong ground motions using measurements from low level shaking, perhaps the plan should be revised to include a commitment to continue recording long enough to obtain useable data.

Also, what is meant by the term "well-recorded" events? How will this selection be made, i.e., what are the criteria for this selection process?

17. Page 2-3, paragraph 1: This paragraph gives a brief discussion of the rationale for selecting the number, location, duration, and timing of the tests. The paragraph ends with a reference to several stochastic and deterministic models of earthquake ground motions that are likely to be used. Although these referenced models may be useful, there are a number of more recent and relevant models that should be considered. At several recent meetings, the DOE and EPRI have stated that the Band-Limited-White-Noise Random Vibration Theory Model would be the basis for the theoretical work. This ambiguity in the study plan needs to be clarified.

18. Page 3-1, paragraph 1: What is meant by "the effects of geometry"? The geometry of what?

19. Page 3-1, paragraph 2: The statement is made that recordings will be obtained at sites underlain by both alluvium and rock and at the top and bottom of boreholes at select locations. The figure 1-2 implies that none of the surface recording stations will be at sites where there is any significant alluvium.

20. Page 3-1, paragraph 2: The study plan states that empirical prediction of strong motion at Yucca Mountain using the world-wide strong motion data set cannot be applied directly because the data set implicitly contains site effects and attenuation properties that may not apply to the southern Great Basin. What makes the Yucca Mountain area any different from any other virgin site in the world where the empirical techniques are commonly used? It is suggested that the study plan include a provision to estimate strong motion using the classical empirical prediction techniques as a basis for comparison with the results from any new prediction techniques that may be developed.

21. Page 3-2, paragraph 3: It is stated that technical procedures for the analytical parts of the study have yet to be prepared. What is the timetable for the development of these procedures?

22. Page 3-2, paragraph 5: The study plan states that the seismographs will be calibrated over the range of frequencies of engineering interest, i.e., 0.2 to 20 Hz. How was this

range of frequencies determined, especially since there is no design yet available? Does this range of frequencies apply to the seals? If so, what are the references for the seal design? Also, +/-10% over the range of frequencies has not been difficult to obtain.

23. Page 3-2, paragraph 6: The discussion of site variability is much too generic. This paragraph should be much more specific given the extensive amount of study that has been done on the Nevada Test Site. In the last sentence of this paragraph, it is stated that the magnitude of the variability is unknown. The author(s) of the study plan may not be aware of the data for the magnitude of the variability, but it is hard to believe that such data is not available for the Nevada Test Site.

23. Page 3-4, paragraph 3: The study plan states that the seismic velocity structure of the site will be determined to crystalline basement and that the structure will be estimated on the basis of the known geology and geophysics. Does the DOE plan at least one borehole to the basement to fulfill this statement?