

Sandia National Laboratories

Albuquerque, New Mexico 87185

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to: M. Nataraja WM DOCKET CONTROL CENTER

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LPDR B, N, S

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from: K. K. Wahi

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Distribution:

NATARAJA

(Return to WM, 623-SS)

subject: Comments on the "Disturbed Zone" Write-Up

1 Disturbed Zone and Groundwater Travel Time

- o The last sentence of the second paragraph seems unnecessary. Presumably, the uncertainties in the disturbed zone are a result of the waste emplacement activities and the heat generated by the waste. Once a boundary or extent of these disturbances is established, the uncertainties outside that region are small by definition. Moreover, the definition in the rule does not preclude the disturbed zone from being larger than the controlled area (although that is hoped to be the case).

2. Thermal Effects on Groundwater Flow

- o The decrease in density is not significant as far as a change in its magnitude is concerned in going from 30°C to 80°C. The increase in hydraulic conductivity results from a corresponding decrease in viscosity. The change in the fluid density would only be significant if a phase change were to occur.
- o The phrase "gravitational stability of the water" appears to imply rates and processes that simply don't exist in a repository environment. The movement of water due to buoyancy forces has to involve a convection cell; i.e., a closed loop flow system in which the warmer fluid moves up and the cooler (and heavier) fluid moves down. In any event, the heat transported by such a mechanism would tend to reduce the thermal gradient. This in turn would reduce the buoyancy forces. The point here is that in a repository system the buoyancy mechanism cannot sustain itself for any appreciable period.

- o I take exception to the claim that "the thermo-hydrological effects are fairly predictable" in comparison to other effects. The whole rationale in this paragraph raises, rather than put to rest, certain nagging questions. In my opinion, the extent of the thermohydrologic effects is not nearly as large as suggested (by NRC). If it is, then we cannot "neglect" the buoyancy-induced changes in the quantification of disturbed zone as has been suggested.

3. Thermomechanical Effects

- o In the absence of free surfaces, the displacements will most likely be small (as claimed). However, the thermomechanical stresses can be fairly significant. If the rock is not very competent, the increased stresses may cause failure. Rock strength should, therefore, be compared to the thermomechanical stresses to ascertain that potential permeability changes are limited in their size and extent.

4. Underground Stress Redistribution and Construction Effects

- o For the most part, these effects should only be of concern during the operational phase. The relatively low extraction ratio envisioned in the design of underground repositories would further limit the distance to which stresses are altered significantly.

Editorial Remarks

On page 3, under Chemical Effects, "...mineral occur reaction" should read as " mineral reactions occur".

On page 4, under Conclusions, Item b) should be changed to "fifty meters from the perimeter of the engineered facility (excluding shafts)."

On page 1 of the "Underground Stress..." write-up, insert "due to excavation" after "redistribution" in line 3 of the first paragraph.

On page 2, Item (3) should be replaced with the following: change in elastic properties due to a change in confining stresses.

On page 3, provide a reference in support of the claim that the zone of latered permeability is estimated to be within half the opening diameter.

On page 3, the last line of the Summary should be less specific. For example, the following statement could be included instead: A distance of 50 meters is equivalent to a few tunnel diameters for the proposed opening dimensions.

Conclusions

Some of the arguments in the write-up are very pertinent and convincing. However, there are several that confuse the issues further. In particular, the reasoning given to "neglect" thermohydrological effects in the quantification of the disturbed zone is very weak. The write-up as a whole is not a bad first attempt, but does need a lot of revision.