DISTRIBUTION
WM s/f
WMGT r/f
NMSS r/f
REBrowning
MBell
JBunting
MRKnapp
LBarrett
RJStarmer
WRKelly & r/f
RJohnson, WMRP
JLinehan, WMRP
PDR

SEP 04 1984

SALT/WK/84/08/30

NOTE TO: Michael Tokar
Materials Engineering Section
Engineering Branch

FROM: Walton R. Kelly
Geochemistry Section, WMGT
Geotechnical Branch

SUBJECT: SALT EA EARTH SCIENCE MATTERS BEARING ON WASTE PACKAGE PERFORMANCE

The Geochemistry Section of WMGT has taken the lead responsibility in answering the questions regarding salt EA earth science matters forwarded by memo dated August 8, 1984. Many of the questions were dealt with at the ONWI salt geochemistry program overview on August 22 that you attended. Some of the questions deal with significant geochemical issues on which little work has been done, especially brine migration and radiolytic effects. Because of this, it is not possible to give you specific answers to some of the questions. We are actively pursuing information on these issues and will keep you informed of our progress. Responses to each question you raised are provided sequentially in the attachment. Please contact me if you need clarification or have additional questions.

/S/

Walton R. Kelly
Geochemistry Section
Geotechnical Branch
Division of Waste Management, NMSS

WM Record File 106
WM Project 16
Docket No.
PDR ✓
LPDR ✓
Distribution:
(Return to WM, 623-SS)

FC	:WMGT WRK	:	:	:	:	:
AME	:WRKelly;mt	:	:	:	:	:
ATE	:84/09/04	:	:	:	:	:

656

1. As discussed at the meeting, BRINEMIG is an empirical data-fitting code, and as such is limited in its application. A complete understanding of this code would not be time efficient. The physics of brine migration are too poorly understood at this time to model it theoretically. The Jenks and Clairborne equation may be inadequate, but is the best available. We believe intercrystalline may be significant until proven otherwise, and therefore, their brine migration calculations are incomplete. We have the Hohlfelder Salt Block II document, but have not reviewed it yet.

2. Whether or not a threshold gradient exists, we believe ONWI is being conservative by performing calculations of brine migration using no threshold gradient.

3. The data is still inadequate to determine whether the volumes of brine assumed by ONWI are conservative. There are zones found in some salt deposits with volumes greater than 10.0% water. Whether or not such zones can be detected before repository construction is unclear. The low-Mg brine predicted for domes seems to be an error. Hubbard said all brine inclusions are high-Mg, whether found in beds or domes.

4. The assumption of high-Mg brine inclusion chemistry is correct. The assumption of low-Mg intrusive brine chemistry is also correct, except at Paradox, where carnallite and kieserite zones may lead to a higher-Mg brine. Low-Mg brines are those where Mg is a minor cation, probably less than 200 mg/l. High-Mg brines have Mg concentrations about 2 orders of magnitude higher.

5. The McCauley and Raines report is a draft report, so no formal rewiew is planned at this time. An informal review will be performed over the next few weeks.

6. This question has been forwarded to the Hydrology Section, and they will contact you directly.

7. We are unable to satisfactorily answer this question. However, intuitively the assumption seems unreasonable and unconservative since there won't be uniform heat distribution throughout a canister.

8. No. The data is inadequate to make such an assumption. We regard these calculations as "first cut" and should not be used to make any assertions about a site.

9. "Reverse migration" has potential for transport of radionuclides away form the waste package, although it is probably insignificant. Too little is known about this to say. ONWI is not considering this process at present.

10. We are unable to satisfactorily answer this question now.

11. Yes. The amount is quantifiable, although site specific data is lacking at present to make a good approximation.

12. Because the predicted brine accumulations are based on a number of assumptions that may or may not be conservative and data that is generally not site-specific, we cannot comment on the reasonableness of the numbers. ONWI has not demonstrated that these are maximum values, and, as such, should be handled cautiously.

13. The effects of irradiation on mineral stability are not well understood. Some of the minerals may dewater under high thermal conditions (e.g., gypsum, carnallite, kieserite, illite), but halite and anhydrite, the predominant minerals in salt deposits, are stable at expected repository temperatures.

14. We do not accept the WISP solubilities as being realistic or firmly based on theory or experiment. ONWI acknowledged their limitations at the meeting. Redox conditions may significantly affect radionuclide speciation and solubility, and, to a lesser degree, so will pH. The effects of radiolysis

will undoubtedly be important, but little is known about the effects at this time. Jansen answered your question concerning liquid boundary layer effects at the meeting; i.e., that the liquid boundary layer at the surface of a breached waste package will inhibit transport of radionuclides present in very small concentrations from the waste package due to a very small concentration gradient.

15. As discussed under previous questions, the lack of confidence in the conservatism of brine inflow rate calculations and the inadequacy of the solubility values used do not allow for such definite assertions concerning maximum release rates or meeting the NRC limit at this time. We have not reviewed the 10^{-4} fractional release rate as presented in ONWI-462 yet, but it is greater than the often used rate of 10^{-5}.