

RESPONSE TO GOLLER

- 1 - JUN 26 1985

MEMORANDUM FOR: Karl R. Goller, Director  
Division of Radiation Programs  
and Earth Sciences, RES

FROM: Robert E. Browning, Director  
Division of Waste Management, NMSS

SUBJECT: COMMENTS ON HLW PACKAGE POTENTIAL PROBLEM AREAS

In your June 10, 1985 memorandum to me you identified two potential problem areas involving high level waste (HLW) package technology. The first area of concern involved the potential for radiation damage in salt repositories and the possible effects of such on the corrosion of waste package metallic containers. The second area of concern involved the leaching of radionuclides from UO<sub>2</sub> spent fuel pellets that have undergone some degree of desintering; this concern is more generic in the sense that it is applicable to basalt and tuff repositories as well as those in salt. While the technical details that make up these two areas of concern are fairly complex, we believe that the following information summarizes the situation reasonably well.

#### Consequences of Radiation Damage to Salt

The potential problems that might ensue from the formation of colloidal sodium and chlorine gas, concomitant changes in pH in the brine that contacts the waste package container in a salt repository, and resultant effects on corrosion and radionuclide release from the waste package have been recognized for some time. Our contractor personnel at BNL have investigated this and have identified it as a potential problem in their reports (see, for example, NUREG/CR-2482, Vol. 3, dated March, 1983). We also called it out as an item of concern in our comments on the draft EAs. In addition, DOE/ONWI has acknowledged this as an area requiring attention, both in their R&D reports as well as in the most recent report (by G. Jansen) dealing with the performance of waste packages in three salt formations; (this was the primary background document on waste package performance assessment for the salt EAs).

The key question concerning this issue seems to be, "what is the dose rate expected to be at the overpack/salt interface," for if the dose rate is as low as DOE current projections (ranging from 2 to "a few hundred" R/hr) imply, there may, in fact, be no problem. Rough back-of-the-envelope type calculations that we performed at the time of our EA review indicated that the maximum dose rate would be less than  $1 \times 10^3$  R/h at the overpack surface.

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DOE contends that that level of radiation field is not sufficient to result in a significant effect on the rate of corrosion. We are continuing to investigate the experimental evidence on this. As part of this effort, we have asked ONWI to send a copy of a report on the 1982 study that you referred to in your memorandum.

Leaching of Radionuclides from Desintered Fuel

The fact that fission products are released at an increased rate from desintered  $UO_2$  fuel pellets, as compared to intact ones, is well known and is, incidentally, a matter of concern in reactor source term work. The phenomenon results from a number of factors, including the fact that (a) "impurities" (e.g., fission products) tend to have higher concentration at the grain boundaries than in the bulk grains, (b) the total surface area of the  $UO_2$  grains is very large compared to that of the intact pellets, and (c) grain boundary and surface diffusion is much more rapid than bulk diffusion. A key question is, "how rapidly do the  $UO_2$  pellets disintegrate upon exposure to moist atmospheres? This issue is under investigation by DOE, we know, as evidenced by information presented at the Waste Management '85 meeting in Tucson this spring and in reports from the NNWSI program. The evidence so far suggests that exposure of  $UO_2$  to moisture for a year or less will result in significant increases in grain boundary effects, coinciding with increases in the rates of radionuclide release. Thus, this could be of considerable importance in determining whether a spent fuel waste package is a viable concept for a HLW repository.

In summary, there are several pertinent points in your memorandum, and we appreciate your bringing them to our attention. As you may know the purpose of the geologic repository prelicensing consultation and guidance program now being conducted by the NRC and DOE staff's is to fully inform the DOE about the type and amount of information that must be provided in a license application to allow a licensing decision to be made by the NRC. The NRC staff is aware of the subject potential problems and their importance. We are actively engaged in seeking resolution of these issues through technical meetings with DOE and the transmittal of documents such as the Issue-Oriented Site Technical Position (ISTPs). The ISTPs identify issues the NRC staff considers must be addressed at the time of repository licensing. Specifically, both potential problems (issues) have been addressed in the salt draft ISTP. Furthermore, a meeting is scheduled in October 1985 on waste package with the DOE Salt project. We plan to raise these issues with DOE at that time and to learn at least by then of what steps they are taking to address them. The speed with which we can put these matters to rest depends, in large measure,

OFC	:WMEG	:WMRP	:WMEG	:WMEG	:WMRP	:WM	:WM
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on how rapidly we can gain access to the information being generated by DOE and its contractor laboratories. Should we be unable to resolve these issues on the basis (or absence) of information from DOE, it may be necessary for NRC to perform confirmatory research in this area. We encourage RES to attend these upcoming meetings with DOE so that if it becomes necessary for NRC to perform confirmatory research, your staff will have the necessary background to work with us in this area.

Original Signed by  
Robert E. Browning

Robert E. Browning, Director  
Division of Waste Management

\*SEE PREVIOUS CONCURRENCE

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FROM <b>Verla Koller</b>		DATE OF DOCUMENT <b>6/10/85</b>		DATE RECEIVED <b>6/12/85</b>		NO <b>WM-85509</b>	
		LTR		MEMO <b>XX</b>		OTHER	
TO <b>REBrowning</b>		ORIG.		CC <b>XX</b>		OTHER	
		ACTION NECESSARY <input checked="" type="checkbox"/>		CONCURRENCE <input type="checkbox"/>		DATE ANSWERED <b>6/26</b>	
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DESCRIPTION (Must Be Unclassified)		REFERRED TO		DATE		RECEIVED BY	
<b>Potential problem areas for HLW Repository</b>		<b>HM111er</b>		<b>6/12</b>			
				<b>6/13</b>			
				<b>6/14</b>		<b>6/17</b>	
ENCLOSURES							
REMARKS <i>Rec'd 6/16/85 memo to K. Koller from R. Browning</i>							

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