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MEMORANDUM FOR: Lake H. Barrett, Chief
Engineering Branch
Division of Waste Management

THRU: Timothy C. Johnson, Leader
Materials Engineering Section
Division of Waste Management, NMSS

FROM: M. Tokar
Materials Engineering Section
Division of Waste Management, NMSS

SUBJECT: TRIP REPORT FOR SALT GEOCHEMISTRY PROGRAM OVERVIEW AT
ONWI, COLUMBUS, OH, AUGUST 22, 1984

On August 22, 1984, I attended the subject meeting along with John Starmer and Walt Kelly of WMEG, Gary Jacobs (ORNL) and three members of WMRP (see attachment 1 for last of attendees). The meeting was billed as a presentation of ONWI's basic approach to SALT geochemistry matters (see attachment 2 for meeting agenda). Generally speaking, the perception by ONWI is that salt geochemistry is driven by waste package and hydrology concerns. In particular their geochemistry program is closely tied to waste package performance assessment. It was, therefore, highly desirable to have a Materials Engineering Section member (and member of the salt review team) present at what was ostensibly a geochemistry meeting.

The information that was presented during the formal meeting, which took place during the morning, paralleled rather closely what has already been provided in the draft EA sections on engineered barriers. I, therefore, learned nothing really new during the morning session, except that there is a potential source of high magnesium brine in the Paradox Basin bedded salt sites. This can have great significance regarding the predicted life of low carbon steel containers at those sites, inasmuch as current ONWI estimates indicate that the corrosion wastage allowance would be expended in well under 300 years under conditions involving large quantities of high-Mg brine. This information is not provided in the draft EA versions that we have seen to date.

In the afternoon we were expecting to be able to examine several draft documents that are referenced in the draft EAs but that are not yet published or available to the public. It turned out that virtually none of the documents were provided, on the grounds that they were still undergoing management review. After pointing out, however, that we had received specific approval to examine a key report by G. Jansen, titled "Expected Waste Package Performance for Nuclear Waste Repositories in Three Salt Formations," which was still in

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preparation (all of the references cited in the EAs are supposed to be available to the public at the time of release of the final draft EAs), I was permitted to see the report and to discuss it with the author. Jansen spent about one-half hour with me going over his report in considerable detail. In my view, this was the most productive part of the meeting because when Jansen's report is released, it will likely become the most significant source of waste package performance-related information for the salt EAs.

In my opinion the main benefit from this meeting was that we were able to establish some personal contact with the ONWI technical staff in the geochemistry and waste package performance assessment areas. We provided some initial feedback, shared some of our technical concerns with ONWI, and informed them of our desire to have a waste package workshop in the near future. However, because of the press of work involving the EAs (their preparation by ONWI and our review), I suspect that we may not be able to schedule a workshop until after the Christmas/New Year holiday season (the EA release date seems to be slipping, perhaps to mid-November).

A meeting summary was prepared and organized by Bob Johnson (WMRP) and DOE lead representatives (see attachment 3). It should be noted that the most significant point regarding waste package performance assessment is that ONWI believes that the waste package will last a very long time (perhaps 10,000 years or more) under expected conditions. We are concerned, however, that ONWI's "understanding" is based upon very limited preliminary data and/or associated assumptions that presently have high uncertainty. Major areas of uncertainty or weakness with regard to supporting data include the following:

1. The assumption that the predominant failure mode for the waste package overpack is uniform corrosion (i.e., that pitting, H-embrittlement, stress/corrosion cracking etc. will not be significant factors).
2. The assumption that the brine contacting the waste package will be uniformly distributed over the waste package surface.
3. The assumption of a certain (limited) mean value of brine that will be available to contact the waste package and transport radionuclides away from waste packages (the potential presence of brine pockets involving localized higher than mean quantities of brine is not currently being modeled).
4. The assumption that the Jenks and Clairborne equation for brine migration can be used for intergranular as well as intragranular migration, although this is a purely empirical equation developed solely from intragranular data.

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5. The assumption that there is a threshold value for thermal gradients, below which brine will not migrate toward the waste packages.
6. The assumption that certain solubility limits (which appear to be mainly hypothetical) for radionuclides are, except for a very limited number, so low that NRC and EPA radionuclide release limits cannot be approached.
7. The belief (based on calculations that are presently controversial) that the peak radiation field at the surface of the waste package overpack will be on the order of 2° R/hr, and that the effect of such radiation levels on corrosion of the overpack is negligible.

We verbally expressed our concern about these uncertainties to ONWI and stated our intent to focus on these matters as part of our waste package review effort. These subjects would be good ones for a waste package workshop.

ORIGINAL SIGNED BY

Michael Tokar
Materials Engineering Section
Division of Waste Management

Enclosure:
as stated

cc: E. Wick
C. Peterson
R. Johnson
J. Starmer
W. Kelly

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ATTACHMENT 1

SEP 1 1984

<u>Organization</u>	<u>Name</u>	<u>Phone Number</u>
DOE/CH	J. Sherwin	(614)424-5916
ONWI	N. Hubbard	(614)424-5242
ONWI	J. Parry	(614)424-5090
ONWI	P. Chen	(614)424-6498
ONWI	J. Kircher	(614)424-4871
ONWI	C. Kuntz	(614)424-5282
ONWI	R. Helgersen	(614)424-4290
USGS	A. LaSala	(614)424-5916
Weston	J. Nelson	(301)963-6800
LA Geological Survey	J. Holmes	(504)342-7466
MS Bureau of Geology	C. Stover	(601)354-6228
NRC/WMRP	L. Peeters	FTS (301)427-4653
NRC/WMGT	J. Starmer	FTS (301)427-4541
NRC/ORNL	G. Jacobs	FTS 626-0567
NRC/WMEG	M. Tokar	FTS 427-4748
NRC/WMGT	W. Kelly	FTS 427-4571
NRC/WMRP	R. Johnson	FTS 427-4785
DOE	W. Sidle	(614)424-5916
Earth Technology	F. Donath	(213)595-6611
NRC/WMRP	S. Grace	FTS 427-4686

ATTACHMENT 2

GEOCHEMISTRY OVERVIEW

- Salt Repository Project -

August 22, 1984

Conference Room "C"

8:30am	Introduction	J. Sherwin/SRPO
8:40am	Introductory Comments	R. Johnson/NRC
9:00am	Site Characterization	N. Hubbard/ONWI
	• Geological and Hydrological Settings: Palo Duro, Paradox, Gulf Coast - location and sizes of aquifers - water chemistry - origin of water chemistry - residence time (groundwater age) - radionuclide retardation • Chemical Composition and Amounts of Brine - fluid inclusion brines: Palo Duro, Paradox, Gulf Coast - brines produced should external ground water intrude the host rock: Palo Duro, Paradox, Gulf Coast	
10:00am	Laboratory Testing of Waste Package Components and Radiation Effects	D. Clark/ONWI
	• Corrosion Rates of Mild Cast Steel in brines, with and without radiation • Effects of Radiolysis on Brines and Salt • Radionuclide Release in the Brine - Overpack - Waste Form System	
10:30am	Performance Assessment	J. Kircher/ONWI
	• Waste Package Lifetimes - expected conditions • brine migration • brine chemistry • radiolysis - breached by groundwater external to the salt • brine chemistry • radiolysis	

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11:30am Natural Analogs
• Salton Sea
• Oklo
• Morro to Ferro

N. Hubbard/ONWI

11:35am Closing Summary

N. Hubbard/ONWI

Major Points:

- Amounts of brine that migrate to waste package are inadequate to breach it;
- Waste package dominates near-field chemistry;
- Brines resulting from breaching are less corrosive than fluid inclusion brines, except perhaps at Paradox;
- No exit from salt under expected conditions;
- Extremely long travel times outside salt, especially at Palo Duro.

12:00 Lunch

SEP 10 1984

Mike,
Signed [unclear]
[unclear]

SRPO GEOCHEMISTRY PROGRAM OVERVIEW FOR NRC

Columbus, Ohio

August 22, 1984

Members of the NRC Salt Project attended a geochemistry meeting on August 22, 1984. The objectives of this meeting were to obtain an overview of the SRPO/ONWI geochemistry program and review selected geochemistry and waste package documents requested by NRC.

Summary of Activities

1. NRC began the meeting by discussing the objectives of this meeting and related it to NRC's EA preparations (Enclosure 1). ONWI staff members then made overview presentations following the topics on the enclosed agenda and viewgraphs (Enclosures 2 and 3). The list of attendees is enclosed (Enclosure 4) and includes NRC staff in the areas of geochemistry, waste package, and performance assessment. Representatives from Louisiana and Mississippi also attended.
2. During the afternoon of August 22, 1984, per a discussion between R. Johnson and L. Casey, a few of the documents requested by NRC in the August 17, 1984, letter from J. Linehan to J. Neff were made available for review only and not retention (Enclosure 5). Copies of additional documents were given to the NRC for retention (Enclosure 5). The status of each of the requested documents ^{was} ~~were~~ summarized by N. Hubbard.
3. As a supplemental item G. Janson reviewed with the NRC the content of item 5 on Enclosure 5.

Observations

1. The presentations by ONWI were very informative and gave NRC staff a perspective that will be useful for planning future meetings around topics which were mentioned by both groups. Some of these topics are identified below.

SRPO GEOCHEMISTRY PROGRAM OVERVIEW FOR NRC

2. NRC anticipates that plans for investigating retardation in the farfield and the rationale (data and assumptions) supporting these plans will be topics of multidisciplinary review and a potential workshop.
3. The current understanding by ONWI concerning preliminary waste package performance as affected by geochemistry-related factors is that the waste package can last a very long time (i.e., perhaps over 10,000 years) under postulated expected conditions. NRC anticipates that the assumptions underlying DOE's choice of expected conditions will be a major topic of review and a potential workshop.
4. NRC recognized, as a result of the rock mechanics data review and the geochemistry meeting, that investigations of brine migration and presentations are divided up within SRP/ONWI into geochemistry, rock mechanics and performance assessment groups. Future meetings between SRPO and NRC that might be planned for discussing brine migration would benefit from including an integrated effort by all those SRPO/ONWI groups involved.
5. No observations were provided for this meeting summary by the representatives of Louisiana and Mississippi.

Action Items

1. SRPO agreed to provide a copy as soon as convenient of those EA references requested in the August 17, 1984 letter from J. Linehan to J. Neff.
2. NRC would like SRPO to identify for NRC those documents supporting the waste package leaching tests referred to in D. Clark's presentation. NRC would also like to receive a copy of these documents (those not published) as soon as convenient.