

102.2
3102/PMO/83/09/29/0

SEP 30 1983 -01

- 1 -

Distribution:
File: 3102 ✓
MHL r/f
NMSS r/f
RE Browning
MJ Bell
DJ Fehringer
PM Ornstein
MR Knapp
HJ Miller
JO Bunting
PS Justus
JT Greeves
NNWSI Review Team

MEMORANDUM FOR: Daniel J. Fehringer
High-Level Waste Licensing
Management Branch
Division of Waste Management

FROM: Peter M. Ornstein
High-Level Waste Licensing
Management Branch
Division of Waste Management

SUBJECT: NNWSI HYDROGEOLOGY WORKSHOP

WM Record File 1102
PDR
PDR (B,S,N)
WM Project 11
Docket No. _____
PDR ✓
LPDR ✓

Distribution:

(Return to WM, 623-SS)

On September 19-20, 1983, I attended the NNWSI hydrogeology workshop in Denver, Colorado. The purpose of the workshop was for DOE, through the USGS, to brief the NRC on the site characterization studies performed, underway, and planned at NNWSI and for DOE to solicit NRC response on these studies. Participants at the workshop were the NRC's NNWSI site review team, the USGS, DOE (including contractors), and the State of Nevada. A list of attendees is provided as an appendix. An official meeting summary along with the meeting minutes are being prepared by the NRC NNWSI review team. Highlights of the information presented by the USGS are given below.

MEETING HIGHLIGHTS

Yucca Mountain Hydrology

- Solitario Canyon on the west side of Yucca Mountain is believed by DOE to be a barrier to water movement. This assumption is supported by water levels west of Solitario Canyon which are almost uniformly 50 meters above water levels east of the canyon. However, the data is not conclusive and may be used to support other interpretations.

Yucca Mountain Well Data

- The majority of wells that penetrate the water table have their most transmissive zones close to the water table. (Exceptions are wells

OFC : WMHL	8311220063 830930	00144
NAME : PMOrnstein	PDR WASTE WM-11	PDR
DATE : 9/2/83		

H
N1831169

USW G-4, UE-25p-1, and USW H-3.) Therefore, the most likely path of radionuclide migration will probably be at or near the water table.

- ° Well UE-25p-1 was completed in paleozoic rocks. The head measured in the paleozoics is approximately 23 meters above the head in the overlying tuffs. Not enough information is known about either the paleozoics or the tuffs to assess the significance of the paleozoics to the local groundwater flow system.

Saturated Flow Modeling

- ° The Cooley-Waddell groundwater flow code, which was previously used to model the regional flow system (USGS WRI 82-4085), is being used to model a subregional domain. The subregional domain is approximately the southwestern quarter of the regional model and uses a much more refined grid. Unlike the regional model which selectively ignored NNWSI data where apparent local discontinuities occurred, the subregional model will incorporate all NNWSI water table data.
- ° Transmissivities used in the subregional model vary somewhat (within an order of magnitude) from values used in the regional model. This is not surprising since the algorithm used (the "inverse method") in both the regional and subregional models is mathematically not well behaved and is therefore highly sensitive to slight changes in input parameters. Changes in the data base may also account for the transmissivity variations.
- ° Unlike the regional model, anisotropic hydraulic conductivities were included in the subregional model to simulate the structural control of groundwater flow by fractures. This use of anisotropy results from applying the equivalent porous media concept to the fractured domain of the saturated zone.

Unsaturated Flow

- ° Field investigations to characterize the unsaturated rock parameters on and near Yucca Mountain are just getting underway and extensive field work is planned. Also, extensive in-situ testing of the host rock from the exploratory shaft is planned.

OFC	:WML	:	:	:	:	:	:
NAME	:PMOrnstein	:	:	:	:	:	:
DATE	:9/ /83	:	:	:	:	:	:

- o Three conceptual models showing post-emplacement vadose water flow through the repository block have been developed.
 - The first assumes that matrix flow will dominate and that recharge penetrating the repository horizon will be vaporized when subjected to repository heat. The repository remains dry. This is the least conservative of the three conceptual models.
 - The second conceptual model also assumes that matrix flow dominates. However, in this model the recharge penetrates through the repository and terminates at the water table. Repository to water table travel time calculations, where average annual recharge was a constant flux boundary, were on the order of thousands of years.
 - The third conceptual model assumes that fracture flow dominates. Recharge is readily transmitted through the repository horizon and down to the water table. This model is the most conservative of the three conceptual models.

- o Analysis of two-phase flow that may be expected near the repository will be performed by the USGS and/or LBL with a computer code developed by LBL. The TOUGH code was not specifically mentioned although it could be inferred that the TOUGH code will be used. Validation of the code is being planned.

- o Responsibility to assess the extent of the disturbed zone will lie with SNL. USGS conceptualizations of the flow system will be used by SNL in the assessment.

Paleohydrology/Paleoclimatology

- o The objective of the paleoclimate work is to understand the historical climatic record, and then extrapolate it into the future. This extrapolation would then be used to determine the expected recharge and subsequently determine expected water levels and flow regimes. Extensive studies are being undertaken to determine the climatic history of the region. So far, these studies seem to indicate that during the Pleistocene pluvials, the region experienced up to 50% more precipitation than it currently receives, and was slightly cooler. The effects of the increased precipitation on water levels have not yet been determined. Larry Benson (USGS) closed the discussion of paleoclimate studies by warning that

OFC :WMHL	:	:	:	:	:	:
-----	-----	-----	-----	-----	-----	-----
NAME :PMOrnstein	:	:	:	:	:	:
-----	-----	-----	-----	-----	-----	-----
DATE :9/ /83	:	:	:	:	:	:

SEP 30 1983

3102/PMO/83/09/29/0

- 4 -

paleoclimate extrapolation might not be valid given potential climatic changes brought on by man (e.g., the greenhouse effect).

GENERAL COMMENTS

The information presented at the meeting seems to indicate that the USGS is attempting to do a conscientious and thorough job in characterizing the site. Due to the complexity of the site, the level of site characterization has not matured to the level where supportable conclusions can be made about the site's hydrogeology. This is especially true of the site's unsaturated zone. Much more data collection and analysis of data will have to be performed before a comprehensive conceptualization of the site hydrogeology can be substantiated.

The USGS seems to recognize the current data limitations and is being very cautious in their interpretations. The conceptual models of the unsaturated zone that were revealed at the workshop were considered as starting points for further conceptual analyses. The regional and subregional models are continually undergoing revision so as to conform with the evolving data base. The apparent reluctance on the part of the USGS to commit to conclusions at this stage of site characterization is commendable for it will help to prevent premature and ill-formed assumptions about the site.

Peter M. Ornstein
High-Level Waste Licensing
Management Branch
Division of Waste Management

Encl not sent to DCS/PDR - contains phone #'s.

OFC :WMHL	:	:	:	:	:	:
NAME :PMOrnstein	:	:	:	:	:	:
DATE :9/ /83	:	:	:	:	:	:

REGISTRATION

NAME	COMPANY	TELEPHONE	NAME	COMPANY	TELEPHONE
Bill Wilson	USGS	FTS 234-2115	Gene Rush	USGS	234-2115
Jim Robison	USGS	" "	James R. Erickson	USGS	"
JOE Willmon	USGS	FTS 234-7277	Tom HENDERSON	USGS	234-2115
Bill Dudley	USGS	" " "	Jean L. Yunker	LLNL	543-1110
Maxwell Blanchard	DOE	FTS 5983662	DAVID SIEFKEN	WESTON	(301) 963-6828
CARL JOHNSON	NEVADA	(702) 885-5050	M D Voegele	SAI (702)	34-3785
Don OAKLEY	Los Alamos	505-667-1310	Schon Levy	Los Alamos	FTS 834-9504
Larry Benson	USGS	234 2115	Graig Bentley	USGS	234-7277
Geof Spaulding	USGS	(206) 543-1166	PHILIP JUSTUS	USNRC	301-427-4677
Don H. Lehner	USGS	234-2115	Harry Smedes	Weston	301-963-6843
Robert W. Craig	USGS	234-2115	Martin Middle	William + AFS	(702) 798882
Jack Hess	William Assoc.	702-645-4503	Michael D Carr	USGS	234-2261
Ben Ross	GeoTrans	703-435-4400	Parviz Montazer	USGS	234-2115
Kurt Wolfson	LANL	FTS 843-7466	Dale Hammermeister	USGS	234-2115
Allen Ogard	LANL	FTS 843-6300	Dave Nichols	USGS	702 882-1388
Peter Ornstein	NRC	FTS 427-4611	Pat Blum	USGS	702 882-1388
Jim Mercer	GeoTrans	703/435-4400	Roy WILLIAMS	NRC CONSULTANT	2088856259
Rick Waddell	USGS	FTS 2342115	Thomas J. Nicholson	USNRC	
John Gameeli	USGS	2342115	Darrell Patten	279-0701	301-427-4585
George A. Dinwiddie	USGS	703-860-2916	Robert Wise	SAI	279.0701
Atef Elzefrawy	NRC		Bob Knecht	SAI	279.0701
Jack Robertson	USGS		Howdy Pratt	SAI	
LINDA LEHMAN	NEVADA	(612) 894-9359	Patrick McKinley	USGS	234 2115
Teek Verma	NRC		Carl Romney	SAI	703 780 4837
JEFFREY FOHLER	NRC	(702) 27-4681	Scott Sinnock	SNL	846-0081
Seth McCoy	NRC	301 427 4275			