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PROJECT WM-11/SMC/83/04/13/1

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PROJECT WM-11

APR 15 1983 - 1

MEMORANDUM FOR: Hubert J. Miller, Chief
High-Level Waste Technical
Development Branch
Division of Waste Management

FROM: Seth M. Coplan
High-Level Waste Technical
Development Branch
Division of Waste Management

SUBJECT: HYDROGEOLOGY WORKSHOP SUMMARY

Attached is the summary of the NRC-DOE Hydrogeology Workshop.
The workshop was held on January 18-19, 1983 at the office of the U. S.
Geological Survey in Denver, Colorado and was followed by a visit to
the Yucca Mountain site on January 20, 1983. The dual purpose of the
workshop was to identify issues and to consult on what would be
acceptable methods and approaches for issue resolution.

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Seth M. Coplan
High-Level Waste Technical
Development Branch
Division of Waste Management

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CLOSEOUT COMMENTS OF NRC AND DOE ON THE HYDROLOGY WORKSHOP
U.S. GEOLOGICAL SURVEY
Denver, Colorado
January 18-19, 1983

The following are points raised by NRC.

Observations

1. NRC will be in a significantly more knowledgeable position to review the hydrology chapter in the SCR as a result of the detailed and open discussion of the site investigation program.
2. NRC considers the geologic and hydrologic testing program for individual boreholes to be a state-of-the-art testing program.
3. NRC considers the testing program for single boreholes that bases the siting and purpose of the next borehole on the analysis of data from all previous boreholes to be a technically sound approach.
4. Currently available data for hydrologic head in the boreholes does not provide a reasonable understanding of specific flow paths from Yucca Mountain. Data could be interpreted to indicate flow path ranges from a directly east to a southwest direction. NRC thinks that additional determinations of head as a function of depth in one or more existing wells and additional determinations of head and permeability in new wells to the east and west of Yucca Mountain are needed to clarify flow path.
5. Data for transmissivity from single boreholes is inconclusive for establishing a reasonable understanding of the sub-regional flow system and the continuity of flow paths within it. The degree and directionality of fracturing is indicative of a potential for anisotropy in the permeability. NRC thinks that large-scale multiwell tests could be very useful in resolving the questions on path continuity and anisotropy of permeability.
6. Determination of vertical permeability may become necessary if additional measurement of hydrologic head with depth indicates a significant vertical gradient. In making this observation, NRC recognizes that the structural characteristics and stratigraphy which control the hydrological properties of the site may not be compatible with known experimental methods for measurement of vertical permeability. This could indicate that no test in a borehole from the surface will be able to provide reliable measurements of the vertical permeability.
7. Analysis of ground water travel time indicates that experimental determination of the effective porosity will become an important consideration since the calculation of travel time is sensitive to this parameter. NRC thinks that DOE should consider making such a determination in the presumably less fractured rock of the repository block in addition to the planned determination in the more fractured rock of Drill Hole Wash.

8. Discussions of ground water travel times, calculated on currently available but incomplete data, need to be carefully qualified to avoid erroneous conclusions or impressions.

Items for Further Discussion

1. What constitutes proper documentation of ground water flow codes.
2. What is the limit of the "disturbed zone."
3. What will constitute the allowable limit for radioactive tracers that will be used in experimental hydrology work.
4. Unsaturated zone characterization and analysis program with emphasis on the following items:
 - a. What is the source of water above the repository and what are its rate, flux, and direction of movement.
 - b. How much water is contained in the unsaturated zone and how is it distributed in the various formations.
 - c. How does water move through the unsaturated zone and what are the flux and velocity.
5. Paleoclimatology and the impact of pluvial cycle on repository performance.
6. Hydrologic Modeling
 - a. How do the regional hydrological flow model, the subregional hydrological flow model, and the performance assessment complement and supplement one another in the understanding of the Yucca Mountain site.
 - b. What are the rationales behind the specification of the physical boundaries of the models and the quantitative boundary conditions proposed.
7. Review of the existing raw data taken from the boreholes.

Information Requested

1. Map of region showing observed heads presented by R. Waddell.
2. Isotope data map after Thordarsin.
3. Trilinear diagram (Na, K, Ca) of ground water chemistry presented by R. Waddell.
4. Table of ground water chemistry presented by L. Benson.

5. Moisture characteristic curve for cores from H-1 presented by W. Wilson.
6. Tables on properties of unsaturated zone units presented by W. Wilson.
7. References that explain and document the regional hydrological flow model prepared by R. Waddell.
8. Viewgraph showing percent saturation and other data as a function of depth for borehole H-1 presented by W. Wilson.

The following are points raised by DOE.

Observations

1. It provided USGS technical staff supporting the NNWSI Project with a good understanding of the questions important in a regulatory arena and the requirements necessary to address issues of importance.
2. It provided good insight into the logic of NRC personnel on how they will review information important to licensing.
3. The meeting was conducted in a professional and open manner which facilitated an efficient and constructive exchange of information.

Items for Discussion at Future Meetings

1. Technical basis for the definition of the disturbed zone.
2. Alternative approaches that can be utilized to demonstrate the isolation capability of the unsaturated zone.
3. Factors that affect the flow of water through the unsaturated zone.
4. Potential for amending 10CFR60 to more accurately reflect the factors that are critical in making judgments about the location of a repository in the unsaturated zone.

Information Requested

1. The technical requirements NRC believes constitutes proper documentation of computer codes.

2. The identification of an experimental field method for the measurement of "Effective Porosity" in saturated rock.

Donald L. Vieth 2/24/83
Donald L. Vieth (Date)
Director
Waste Management Project Office

Seth M. Coplan 2/22/83
Seth Coplan (Date)
Project Manager
Division of Waste Management

DATA EXAMINED DURING
DOE-NRC HYDROGEOLOGY WORKSHOP
JANUARY 18-19, 1983

1. Regional Map Showing Observed Heads
2. Isotopic data map after Thordarsin
3. Trilinear diagram (Na, K, Ca) of groundwater chemistry
4. Composite water quality data
5. Moisture characteristic curves from H-1
6. Televiewer log and videotape from H-1
7. Pump test curves from H-1
8. Tracer test results from H-1
9. Lithologic log from H-1

Agenda
NNWSI HYDROLOGY BRIEFING FOR NRC
January 18-19, 1983
USGS National Training Center
Conference Rooms A and B
Denver, Colorado

Tuesday, January 18

- | | |
|---|---|
| 0830-0900 | Introductory comments--DOE/NRC/USGS |
| 0900-0930 | Regional geologic framework--USGS (W. Carr) |
| 0930-1100
(includes
15-minute
break) | Regional hydrogeologic setting--USGS (Waddell)

Ground-water flow systems

Regional hydrogeologic units

Regional flow model

Boundaries

Units

Input/output

Code |
| 1100-1200 | Yucca Mountain hydrogeologic framework--USGS (Dixon)

Geologic mapping

Structure

Geothermal gradient |
| 1200-1300 | Lunch |
| 1300-1700
(includes
15-minute
break) | Yucca Mountain geohydrology (saturated zone)--USGS
(Robison/Rush)

Test-drilling program

Head distribution

Potentiometric surface

Vertical heads

Permeability distribution, geohydrologic units

Tracer testing (Benson/Erickson)

Water chemistry, isotopic data (Benson) |

Agenda
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Denver, Colorado

Tuesday, January 18

0830-0900	Introductory comments--DOE/NRC/USGS
0900-0930	Regional geologic framework--USGS (W. Carr)
0930-1100 (includes 15-minute break)	Regional hydrogeologic setting--USGS (Waddell) Ground-water flow systems Regional hydrogeologic units Regional flow model Boundaries Units Input/output Code
1100-1200	Yucca Mountain hydrogeologic framework--USGS (Dixon) Geologic mapping Structure Geothermal gradient
1200-1300	Lunch
1300-1700 (includes 15-minute break)	Yucca Mountain geohydrology (saturated zone)--USGS (Robison/Rush) Test-drilling program Head distribution Potentiometric surface Vertical heads Permeability distribution, geohydrologic units Tracer testing (Benson/Erickson) Water chemistry, isotopic data (Benson)

Wednesday, January 19

0800-1130 (includes 15-minute break)	Unsaturated-zone hydrology--USGS (Wilson) Conceptual models Data needs Status of knowledge Plan of investigation
1130-1230	Lunch
1230-1330	Subregional flow and transport model (saturated zone)--USGS (Waddell, Czarneck) Goals Status of model development Velocity, travel times, and flow paths Plans and issues Code documentation
1330-1415	Performance-assessment hydrologic modeling--SNL/PA (Tyler)
1415-1430	Break
1430-1515	NRC caucus
1515-1600	Feedback and decision-making process-NRC
1600-1630	Wrap-up discussion--All

PLEASE SIGN NAME AND DIVISION AND RETURN COMPLETED LIST TO LUCILLE, ROOM E2302
THANK YOU.

ROOM: CONFERENCE ROOMS A & B

WRD MEETING (B. Dudley)

DATE:

January 18-19, 1983

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