D1021

PDR-1
LPDR-Wm-10 (2)
Wm-11 (2)
Wm-16 (2)

NOV 18 1987

426.1/D1021/87/11/04

Mr. Mark J. Logsdon, Project Manager
Nuclear Waste Consultants, Inc.
Suite 306
155 South Madison Street
Denver, Colorado 80209-3014

Dear Mr. Logsdon

In reviewing the NNWSI Draft Site Characterization Plan, the NRC will be asked to approve a plan for exploratory shaft designs. Since, construction of the shafts will require long lead times, the DOE will want an early review from the NRC. To aid NRC engineers in making this evaluation, Mr. Ford has prepared a listing of the effects of shaft construction on groundwater at Yucca Mountain (enclosed). This listing is an expansion of effects identified in a review by Water, Waste, and Land Inc. of "Modification of Rock Mass Permeability in the Zone Surrounding a Shaft in Fractured, Welded Tuff" by J.B. Case and C.K. Peter (SAND-7001).

Please review this list of effects for completeness, reasonableness, and technical accuracy. Respond with written comments to W. Ford (301-427-4524) by December 7, 1987.

The action taken by this letter is considered to be within the scope of the current contract NRC-02-85-009. No changes to costs or delivery of contracted products are authorized. Please notify me immediately if you believe this letter would result in a change to costs or delivery of contracted products.

Sincerely,

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ORIGINAL SIGNED BY

Jeffrey A. Pohle, Project Officer
Technical Review Branch
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

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WM Project: WM-10, 11, 16 WM Record File: D-1021
PDR w/encl LPDR w/encl
(Return to WM, 623-SS)

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cc: Lyle Davis, WW&L Inc.

Enclosure: As Stated

WM Record File D1021 WM Project 10, 11, 16
Docket No.
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OFFICIAL CONCURRENCE AND DISTRIBUTION RECORD

LETTER TO: Mr. Mark J. Logsdon, Project Manager
Nuclear Waste Consultants, Inc.
Suite 306
155 South Madison Street
Denver, Colorado 80209-3014

FROM: Jeffrey A. Pohle, Project Officer
Hydrology Section
Technical Review Branch
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards

SUBJECT: HYDROGEOLOGIC EFFECTS OF SHAFT CONSTRUCTION AT YUCCA MOUNTAIN, NEVADA

DATE:

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CONCURRENCES

ORGANIZATION/CONCUREE	INITIALS	DATE CONCURRED
HLTR/WFord		87/11/10
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HLTR/DChery		87/11/16

TEST SHAFT

In reviewing the Draft Site Characterization Plan for Yucca Mountain, the Department of Energy (DOE) will want the Nuclear Regulatory Commission (NRC) to conduct a quick review of the exploratory shaft design. Current design for the shafts at Yucca Mountain specifies the use of drill and blast methodology, which even with a shaft liner, will increase the permeability of the rock surrounding the shaft. It will be the job of the NRC to determine if this increased permeability will result in preferential pathways which could compromise the repository or characterization activities. In support of this activity the Hydrology Section must supply input to the Geotechnical Engineering And Design Section concerning the geohydrologic conditions at the shaft site and the hydrologic consequences of constructing a shaft. As presently planned, the NRC will not have any hydrologic data from proposed shaft locations, prior to making decisions about the shaft. Therefore, the shafts should be designed for a variety of expected hydrologic conditions.

The effects of increasing rock permeability by shaft construction for five hydrologic conditions are discussed below:

(1) Shaft construction would create fractures. If the shafts encountered unsaturated flow conditions with groundwater flow through the matrix and not the fractures, the shaft fractures would act as barriers to flow. Since, most fractures from shaft sinking would be interconnected over the longest distances in the vertical direction, fractures would act most strongly as barriers to horizontal groundwater flow. Vertical flow would probably not be affected and therefore the shaft should not hydrologically impact the repository.

(2) If the shaft encountered unsaturated flow conditions where groundwater flow is in both the matrix and the fractures, groundwater flow would not increase in either the vertical or horizontal directions. This is because an increase in fracturing would not

result in an increased volume of water flowing down the fractures. Therefore the shaft would not hydrologically impact the repository.

(3) If the shaft encountered a perched zone, groundwater would flow into the shaft from the perched zone. If the perched zone does not contain a large volume of water the perched zone would probably be dewatered by shaft sinking activities. After shaft construction the shaft would probably allow water to flow vertically down the shaft below the former perched zone, keeping the former perched zone from reforming while having little effect on groundwater conditions below. However, if the perched zone was not dewatered the shaft would continue to drain the perched zone causing increased groundwater flux beneath. This situation could compromise hydrologic experiments in the shaft and adits.

(4) Should the shaft be flooded by surface flow during or after construction, water could flow down shaft and shaft fractures into the repository. This could compromise the repository and hydrologic experiments in the shaft and adits.

(5) Movement of substances from the repository as a vapor or gas would be increased by shaft construction effects for all types of unsaturated conditions.

For the hydrologic conditions described above the following recommendations are made.

(1) The shaft should be adequately protected against surface flooding and sealed at the surface so the repository is not compromised.

(2) If it is determined that vapor or gas movement from the repository to the surface along fractures between the shaft liner and undisturbed rock will significantly affect the ability of the repository to meet the EPA standard, these fractures should be sealed.

(3) A hole should be drilled prior to shaft construction at each shaft location to determine if any perched zones exist, so that they can be dewatered or some other appropriate engineering method applied during shaft construction.