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Hydrogeology • Mineral Resources Waste Management • Geological Engineering • Mine Hydrology

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Communication No. 162

Mr. Bill Ford
Division of Waste Management
Mail Stop 623-SS
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

RE: NTS

Dear Bill:

Our comments on the list of effects that may result from shaft construction at Yucca Mountain are enclosed. The list has been retyped incorporating our suggested changes. These changes are underlined where they occur.

We suggest also that hydrogeologic conditions 1 and 2 be combined because the shaft will act as a barrier to all unsaturated flow regardless of whether flow occurs in the matrix or through the fractures.

Sincerely,

James L. Osiensky /sl

James L. Osiensky

JLO:sl

cc: D.L. Chery, Jr.

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 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 line, will increase the permeability of the rock surrounding the shaft. The NRC will be required to determine whether this higher permeability will result in preferential ground water flow 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 hydrogeologic data from proposed shaft locations prior to making decisions about the shaft. Therefore, the shafts should be designed for a variety of expected hydrogeologic conditions. The effects of increasing rock permeability by shaft construction for five hydrogeologic conditions are discussed below:

(1) Shaft construction will create fractures. If the shafts encounter unsaturated flow conditions where groundwater flow occurs through the matrix only, the shaft fractures will act as barriers to flow. Since most fractures caused by shaft sinking would be interconnected over the longest distances in the vertical direction, fractures would act most strongly as barriers to horizontal unsaturated groundwater flow. Vertical flow probably

would not be affected; therefore, the shaft should not impact the repository hydrogeologically.

(2) If the shaft encounters unsaturated flow conditions where groundwater flow occurs in both the matrix and the fractures, groundwater flow will not increase in either the vertical or horizontal directions if the flux remains the same. This is because an increase in fracturing will not result in an increased volume of water flowing down the fractures unless fracturing allows more water to infiltrate as saturated flow at the land surface. Therefore the shaft would not impact the repository hydrogeologically.

(3) If the shaft encounters a perched zone, groundwater will flow into the shaft from the perched zone or down vertical fractures created by shaft construction. If the perched zone does not contain a large volume of water, the perched zone probably will be dewatered by shaft sinking activities. After shaft construction the shaft and fractures probably will allow water to flow vertically downward below the former perched zone, thereby keeping the former perched zone from reforming while having little effect on ground water flow conditions below. However, if the perched zone was not dewatered the shaft and fractures 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 the shaft and shaft fractures into the repository. This occurrence could compromise the repository and hydrogeologic 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 would be protected adequately against surface flooding and sealed at the surface in order to assure that the repository is not compromised. Surface sealing also would prevent infiltration of precipitation.

(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 whether any perched zones exist, so that they can be dewatered or some other appropriate engineering method applied during shaft construction.