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U.S. Nuclear Regulatory Commission
ATTN: Deborah A. DeMarco
Office of Nuclear Material Safety and Safeguards
TWF Mail Stop 7 C6
Washington, DC 20555

Subject: Submittal of Abstract titled: *Hydrological Implications of Thermally Induced Geomechanical Response at Yucca Mountain, Nevada*

Dear Mrs. DeMarco:

Attached is an abstract authored by Goodluck I. Ofoegbu for presentation at the 38th U.S. Rock Mechanics Symposium to be held in Washington, DC on July 7–10th, 2001. The abstract is based on the report *Thermal-Mechanical Effects on Long-Term Hydrological Properties at the Proposed Yucca Mountain Nuclear Waste Repository*, which was submitted to NRC on June 22, 2000, in fulfilment of Milestone No. 20.01402.671.040 and was accepted by NRC on July 27, 2000. The abstract presents a summary of the report's main conclusions that significant changes in long-term hydrological properties owing to thermally induced geomechanical response can be expected and that such changes would result in a redistribution of moisture flux at the repository level.

Please advise me of the result of your programmatic review. If you have any questions, please contact Dr. Goodluck Ofoegbu at (210) 522-6641 or me at (210) 522-5252.

Sincerely,

Budhi Sagar
Technical Director

Attachment

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Hydrological Implications of Thermally Induced Geomechanical Response at Yucca Mountain, Nevada

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Geomechanical response to thermal loading at the proposed Yucca Mountain repository for high-level nuclear waste may result in changes in rock-mass hydrological properties. A change in hydrological properties is important because of potential effects on the percolation flux through the repository horizon, which may have significant effects on water influx into emplacement drifts, waste-package corrosion, and waste mobilization and transport to the underlying water table. Analysis results based on drift-scale thermal-mechanical modeling of the proposed waste-emplacement area will be presented to describe the anticipated changes in hydrological properties and the geometrical characteristics of the areas affected by such changes (altered zones). Also, results from a site-scale thermal-hydrological model will be presented to describe potential effects of the altered zones on the distributions of percolation flux at the waste-emplacement horizon. The results suggest the following conclusions: (i) rock-mass permeabilities near the repository horizon can be expected to increase within laterally discontinuous zones centered at the emplacement drifts and in the middle of interdrift pillars, owing to fracture dilation associated with geomechanical response to thermal loading; (ii) the magnitude of permeability increase would be greater around the drift openings than in the pillars, and would depend on thermal loading, rock-mass mechanical properties, and time-dependent mechanical degradation; (iii) altered zones characterized by horizontal-fracture dilation in areas of high rock-mass quality and vertical-fracture dilation in areas of low rock-mass quality can be expected; (iv) fracture closure from thermally induced stresses is likely to be small and insignificant to rock-mass permeability; and (v) lateral flow of moisture can be expected in the altered zones and would be directed down-dip of the site-scale stratigraphy, resulting in elevated vertical percolation flux within and at the downstream end of the altered zones. Therefore, the intensity of potential thermal-mechanical effects on moisture flow at the repository would vary spatially depending on the rock-mass characteristics, thermal loading, and the attitude of the site-scale stratigraphy. Parts of an emplacement drift close to the downstream end of an altered zone can be expected to experience elevated percolation flux.