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MEMORANDUM TO: C. William Reamer, Chief
HLWB/DWM/NMSS

FROM: Neil Coleman, Hydrogeologist
Philip Justus, Senior Geologist
HLWB/DWM/NMSS

SUBJECT: TRIP REPORT - PARTICIPATION IN SPRING MEETING OF THE AMERICAN GEOPHYSICAL UNION, BOSTON, MA

We participated in the meeting of the American Geophysical Union during the week of June 1, 1999. Abstracts of presentations are published in a supplement to the journal EOS (Transactions, AGU, 1999 Spring Meeting, Vol. 80, No. 17, April 27, 1999). A highlight of this meeting was a Union-level special session titled "Yucca Mountain: The Future High-Level Nuclear Waste Repository." A number of presentations were given in this session by us and by staff and consultants of the Center for Nuclear Waste Regulatory Analyses. These presentations covered results of fieldwork and computer simulations of groundwater flow, and probabilistic risk analyses of seismicity, faulting, and volcanism. Several Department of Energy subcontractors outlined recent analyses of the unsaturated and saturated zone flow and transport, and discussed an approach to total system performance analysis, including the basis for its defense-in-depth analysis. Assessment of Yucca Mountain is trending toward risk-based studies and away from subsystem performance measures. This is the direction taken in our proposed rule, 10 CFR Part 63 and in the presentations we made.

Several press articles were published that highlighted the Szymanski hypothesis which states that future invasion of hot (geothermal) water into a repository is likely. Based on peer reviews by the U.S. Nuclear Waste Technical Review Board and the National Academy of Sciences, we currently consider this to be an unlikely scenario over the next 10,000 years. Evidence was presented from fluid inclusions and calcite crystallography that suggests at least one hydrothermal episode of unknown age occurred. DOE is sponsoring a joint geochemical study by scientists with diverse viewpoints on the upwelling hot water hypothesis to systematically collect and analyze calcites from repository depth. The staff are observers at the joint calcite study group meetings and we await results of isotopic dating for the fluid inclusions.

John Bredehoeft, formerly of the U.S. Geological Survey, gave the Langbein Lecture and advocated the use of relatively simple groundwater models. He feels that most groundwater models are so complex (and expensive) that they become difficult to calibrate. Post-audits have shown that models often did not do well in predicting future states of groundwater systems. Bredehoeft believes that models are most useful (1) to help better understand groundwater systems and how they work, and (2) to explore policy to administer groundwater systems. Models to address these issues do not have to be large and complex - often simpler is better. Bredehoeft is currently a consultant to Inyo County, CA in reviewing data from Yucca Mountain.

Brian Marshall (USGS) presented the idea of using secondary mineral deposits in volcanic lithophysae (cavities) as natural analogs for seepage into underground openings. These secondary deposits could be used to constrain models of liquid flux entering gas-dominated cavities in fractured welded tuffs. We will follow the development of this interesting idea.

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Below is a list of the presentations made by NRC and Center staff. Presenters are underlined:

P. Justus, J. Stamatakos, J. Firth, A. Ghosh, S. Hsiung, and A. Ibrahim. "Incorporation of Tectonic Processes in Probabilistic Risk Assessments of the Proposed High-Level Radioactive Waste Repository at Yucca Mountain, Nevada: Nuclear Regulatory Commission Staff Approach"

S. Stothoff, O. Chadwick, D. Groeneveld, D. Or, R. Fedors, and D. Woolhiser. "Assessing Changes in Deep Percolation Over a Glacial Cycle due to Linked Changes in Climate, Soils, and Vegetation at Yucca Mountain, NV"

A. Armstrong, D. Turner, S. Painter, D. Farrell, and N. Coleman. "Hydrogeological Inferences from Thermal and Chemical Measurements at Yucca Mountain, Nevada"

R. Fedors, D. Or, T. Ghezzehei, and S. Stothoff. "Dripping into Subterranean Cavities from Unsaturated Fractures"

N. Coleman, J. Winterle, D. Farrell, A. Armstrong, C. Connor, P. LaFemina, and S. Sandberg. "Geohydrology of Fortymile Wash, Yucca Mountain, NV"

J. Winterle. "Using Barometric and Earth-Tide Responses in Wells to Infer Vertical Connectivity in the Volcanic Tuff Aquifer Beneath Yucca Mountain, Nevada"

S. Stothoff, D. Hughson, G. Ofoegbu, R. Green, R. Fedors, D. Or, and M. Tuller. "Discrete-Fracture Modeling of Drift-Scale Processes at Yucca Mountain, NV"

D. A. Farrell, C. Connor, P. LaFemina, and R. Fedors. "Geophysical and Hydrogeological Studies Along a Fault Zone"

B. Hill, C. Connor, and J. Trapp. "Understanding Risks from Future Basaltic Volcanic Eruptions at the Proposed Yucca Mountain Repository Site, Nevada"

In a session called "Structural Controls on Subsurface Hydrologic Processes," D. Hughson (coauthors F. Dodge, R. Green, and G. Ofoegbu) presented "The Effect of Cavity Wall Roughness on Seepage Into Underground Openings." L. Browning (coauthors W. Murphy and D. Hughson), in a session called "Innovative Applications of Geochemical Modeling to Groundwater Contamination Problems," presented "Benchmarking and Calibration of a Model for Predicting Coupled Reactive Transport at Yucca Mountain, Nevada." And finally, J. Stamatakos (coauthors D. Ferrill, A. Morris, D. Sims, and R. Chen) presented "Three-Dimensional Geometry of the Bare Mountain Fault (Nevada): Implications for Fault Kinematics and Basin Evolution" in a session titled "Fault Growth and Interaction Over Geologic Time Scales: Mechanisms and Applications."

Continued participation by NRC and Center staff in AGU meetings is recommended because it provides useful interaction with other scientists working in similar areas, and contributes to our issue resolution work.

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