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July 23, 2002
Contract No. NRC–02–97–009
Account No. 20.01402.661

U.S. Nuclear Regulatory Commission
ATTN: **Mr. Jeffrey Pohle**
Division of Waste Management
TWFN, Mail Stop 7-D13
Washington, DC 20555

SUBJECT: Thermal Effects on Flow KTI Intermediate Milestone 01402.661.230: Cold Trap Experiment and Modeling—Journal Article or Presentation.

Dear Mr. Pohle:

Enclosed please find the abstract titled "The Cold-Trap Process and its Effect on Moisture Distribution and Chemistry of Water in Drifts." This abstract fulfills the requirements for the subject milestone, which is due July 26, 2002.

Based on our earlier discussions with you, it was determined that the best venue for this presentation on the cold trap process would be the session titled "Characterizing Geochemical Processes: When is There Sufficient Information?" at the 2002 Annual Meeting and Exposition of The Geological Society of America (GSA) to be held October 27–30, 2002, Denver, Colorado. This abstract was submitted for NRC approval, by letter of June 13, 2002, prior to submitting the abstract to GSA. Minor editorial revisions were made in the abstract submitted to GSA that did not change the content of the abstract.

The focus of the abstract is in-drift moisture movement and water chemistry, including a discussion of the existing published data, remaining uncertainty, and our preliminary experimental and modeling results. This work is important for understanding the fundamental processes behind moisture movement in the drifts and will assist CNWRA in reviewing Department of Energy submittals pertaining to technical agreements TEF.2.04 and TEF2.05, both of which address the cold trap process.

If you have any questions, please contact Randall Fedors at 210-522-6818 or me at 210-522-5151.

Sincerely yours,
Randall Fedors for A.C.
Asadul H. Chowdhury, Manager
Mining, Geotechnical, and Facility Engineering

AHC/cap
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GSA Session
" Characterizing Geochemical Processes: When is There Sufficient Information?"

The Cold-Trap Process and its Effect on Moisture Distribution and Chemistry of Water in Drifts
Randall Fedors, James Prikryl, Stefan Mayer, Lauren Browning, and Franklin Dodge
The quantity and chemistry of water contacting waste packages (WP) stored underground in drifts are important factors for determining the performance of the proposed high-level radioactive waste repository at Yucca Mountain, Nevada. Elevated temperatures and high concentrations of some halogens are known to enhance or initiate drip shield (DS) and WP corrosion. The cold-trap process describes a mechanism for in-drift water movement, providing localized liquid water that may contact the DS and WP, and after WP failure, providing a liquid water pathway for radionuclide transport away from the drifts.

The cold-trap process involves evaporation from warm areas, movement of vapor driven by thermal gradients, and condensation on cool or hygroscopic surfaces. Predicting moisture movement associated with the cold trap process is complex. Natural convection, when acting in concert with thermal radiation, conduction, and latent heat transfer, is poorly understood. In regard to chemistry, condensate associated with the cold-trap process is essentially pure water with a pH dependent on the atmospheric CO2(g) content. However, mixing of waters from different sources (e.g., condensation and seepage), each of which may have contacted and reacted with different materials (substrate, residues, or dust), makes it difficult to predict chemical compositions of the water in drifts.

The cold trap process was evaluated in a scaled laboratory model of a heated drift using thermocouples, relative humidity probes, and anemometers to measure environmental conditions. Preliminary results from the laboratory test support results from an analytical solution of air flow patterns and condensation rate. A computational fluid dynamics code and a two-phase porous media code were calibrated to expand predictive capabilities beyond the results measured in the laboratory experiment. This presentation will summarize existing published work on the cold trap process, present preliminary results from scaled laboratory experiments and corresponding modeling, and highlight the large data gap that exists for building confidence in a thermal-hydrologic-chemical modeling approach.
This abstract is an independent product of the CNWRA and does not necessarily reflect the views or regulatory position of the NRC.