



**Department of Energy**  
Office of Civilian Radioactive Waste Management  
Office of Repository Development  
1551 Hillshire Drive  
Las Vegas, NV 89134-6321

QA: N/A  
Project No. WM-00011

**JUL 28 2004**

**OVERNIGHT MAIL**

**ATTN: Document Control Desk**  
Director, Division of High-Level Waste  
Repository Safety  
U.S. Nuclear Regulatory Commission  
11555 Rockville Pike  
Rockville, MD 20852-2738

TRANSMITTAL OF APPENDICES G, I, J, AND K OF *TECHNICAL BASIS DOCUMENT NO. 3: WATER SEEPING INTO DRIFTS* ADDRESSING KEY TECHNICAL ISSUE (KTI) AGREEMENTS REPOSITORY DESIGN AND THERMAL MECHANICAL EFFECTS (RDTME) 3.20, 3.21 AND GENERAL (GEN) 1.01 (COMMENTS 83 AND 97); THERMAL EFFECTS ON FLOW (TEF) 2.10 ADDITIONAL INFORMATION NEED (AIN)-1; TOTAL SYSTEM PERFORMANCE ASSESSMENT AND INTEGRATION (TSPAI) 3.07 AND GEN 1.01 (COMMENTS 13 AND 95), AND TSPAI 3.11 AND GEN 1.01 (COMMENT 82)

Reference: Ltr, Ziegler to Chief, High-Level Waste Branch (NRC), dtd 10/31/03 (Transmittal of TBD # 3: Water Seeping into Drifts)

This letter transmits Appendices G, I, J, and K of *Technical Basis Document No. 3: Water Seeping into Drifts* (enclosures 1-4), a compact disk (CD) of these appendices (enclosure 5), and a document file information sheet for the CD (enclosure 6). The Technical Basis Document contains a summary of the modeling of water seeping into drifts and provides the context within which individual KTI agreements related to seepage are addressed. Appendices A through E were submitted to the U.S. Nuclear Regulatory Commission (NRC) with the referenced letter. The remaining appendices, Appendices F and H, will be transmitted by future correspondence.

Appendix G, *Additional Analysis and Validation of Thermal-Mechanical Effects on Fracture Permeability*, provides a direct response to Agreements RDTME 3.20, 3.21 and GEN 1.01 (Comments 83 and 97). This appendix provides information on additional validation analysis of field tests, sensitivity analysis, and comparison of distinct element and continuum modeling analysis. Revisions and enhancements to coupled thermal-hydrologic-mechanical modeling since 2001 are also included.

Appendix I, *Representing Variability and Uncertainty in Thermal Effects on Flow Simulations*, provides a direct response to KTI Agreement TEF 2.10 AIN-1. This appendix discusses the four major factors responsible for variability in thermal-hydrologic conditions in the repository emplacement drifts. In addition, Appendix I provides a comprehensive account of the effects of twenty engineering design variables and natural system factors on the thermal-hydrologic conditions in the emplacement drifts from multiscale thermal-hydrologic model and associated sensitivity studies.

NIMSS07

JUL 28 2004

Appendix J, *Representation of, or the Neglect of, Dripping from Rock Bolts in the Enhanced Characterization of the Repository Block Cross-Drift*, provides a direct response to KTI Agreement TSPA 3.07 and GEN 1.01 (Comments 13 and 95). This appendix presents information from a refined seepage model, which includes rock bolts, providing a technical basis for the representation of dripping from rock bolts. The effects of rock bolts on chemistry are discussed along with the consequences of the chemical effect of rock bolts and their corrosion products entering the drifts.

Appendix K, *Integration between Three-Dimensional Unsaturated Zone Flow, Multiscale Thermal-Hydrologic, and Drift Seepage Models*, provides a direct response to KTI Agreement TSPA 3.11 and Gen 1.01 (Comment 82). Appendix K presents detailed discussion on the integration between the mountain scale unsaturated zone flow model, the multiscale thermal-hydrologic, and drift scale seepage model. Integration is accomplished by having the percolation flux distribution generated by the mountain scale model to be input to the multiscale model, and by taking into account the effects of flow focusing on the drift scale seepage model.

The U.S. Department of Energy considers the KTI agreements covered in Appendices G, I, J, and K of *Technical Basis Report 3: Water Seeping into Drifts* to be fully addressed, and pending review and acceptance by NRC; they should be closed.

There are no new regulatory commitments in the body or the enclosures to this letter. Please direct any questions concerning this letter and its enclosures to Joe C. Price at (702) 794-1441 or e-mail [joe\\_price@ymp.gov](mailto:joe_price@ymp.gov).

  
Joseph D. Ziegler, Director  
Office of License Application and Strategy

OLA&S:JCP-1511

Enclosures:

1. Appendix G, *Additional Analysis and Validation of Thermal-Mechanical Effects on Fracture Permeability*, Revision 3
2. Appendix I, *Representing Variability and Uncertainty in Thermal Effects on Flow Simulations*, Revision 1
3. Appendix J, *Representation of, or the Neglect of, Dripping from Rock Bolts in the Enhanced Characterization of the Repository Block Cross-Drift*, Revision 1
4. Appendix K, *Integration between Three-Dimensional Unsaturated Zone Flow, Multiscale Thermal-Hydrologic and Drift Seepage Models*, Revision 1
5. CD – Appendices G, I, J & K
6. Document File Information of CD

JUL 28 2004

cc w/encls 1 through 6:

B. J. Garrick, ACNW, Rockville, MD  
W. C. Patrick, CNWRA, San Antonio, TX  
W. D. Barnard, NWTRB, Arlington, VA

cc w/encls 5 & 6:

D. D. Chamberlain, NRC, Arlington, TX  
G. P. Hatchett, NRC, Rockville, MD  
R. M. Latta, NRC, Las Vegas, NV  
J. D. Parrott, NRC, Las Vegas, NV  
D. B. Spitzberg, NRC, Arlington, TX  
H. J. Larson, ACNW, Rockville, MD  
Budhi Sagar, CNWRA, San Antonio, TX  
J. R. Egan, Egan & Associates, McLean, VA  
J. H. Kessler, EPRI, Charlotte, NC  
M. J. Apted, Monitor Scientific, LLC, Denver, CO  
Rod McCullum, NEI, Washington, DC  
R. R. Loux, State of Nevada, Carson City, NV  
Pat Guinan, State of Nevada, Carson City, NV  
Alan Kalt, Churchill County, Fallon, NV  
Irene Navis, Clark County, Las Vegas, NV  
George McCorkell, Esmeralda County, Goldfield, NV  
Ron Damele, Eureka County, Eureka, NV  
Michael King, Inyo County, Edmonds, WA  
Andrew Remus, Inyo County, Independence, CA  
Mickey Yarbrow, Lander County, Battle Mountain, NV  
Spencer Hafen, Lincoln County, Pioche, NV  
Linda Mathias, Mineral County, Hawthorne, NV  
L. W. Bradshaw, Nye County, Pahrump, NV  
Mike Simon, White Pine County, Ely, NV  
R. I. Holden, National Congress of American Indians, Washington, DC

cc w/o encls:

A. C. Campbell, NRC, Rockville, MD  
L. L. Campbell, NRC, Rockville, MD  
N. K. Stablein, NRC, Rockville, MD