**CNWRA®**

***A center of excellence in earth sciences and engineering®***

Geosciences and Engineering Division
6220 Culebra Road • San Antonio, Texas, U.S.A. 78238-5166
(210) 522-5160 • Fax (210) 522-5155

June 26, 2012
Contract No. NRC–02–07–006
Account No. 20.14003.01.071
J5562
PROJ0734; PROJ0735

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Mr. Mathews George
Division of Waste Management and Environmental Protection
FSME/DMSSA/NMPD
Two White Flint North; Mail Stop 8–F8
11555 Rockville Pike
Washington, DC 20852

Subject: Letter of Completion for Draft Letter Report, Fiscal Year 2012 Meso- and Intermediate-Scale Grout Monolith Test Bed Experiments: Results and Recommendations (Deliverable 14003.01.007.121)

Dear Mr. George:

This letter transmits the above deliverable. The work was undertaken to better inform the U.S. Nuclear Regulatory Commission (NRC) concerning the temporal evolution of grout shrinkage, permeability, annulus apertures, and crack growth as grout formulations that the U.S. Department of Energy (DOE) has considered for closure of radioactive waste tanks at sites specified in the Ronald W. Reagan National Defense Authorization Act of Fiscal Year 2005 cure and mature. This report presents the results of additional inspections and measurements conducted of seven mesoscale and one intermediate-scale grout monolith, including the results of X-ray diffraction and energy-dispersive X-ray spectroscopy analyses that were run on two grout samples to assess mineralogical heterogeneity that might have contributed to a distinctive color difference between near-surface and deeper- subsurface grout.

Significant findings of these studies are that

- Cracks now are evident on mesoscale drum grout surfaces that were not apparent in 2009, shortly after grout placement
- Grout lobe seams actively conduct fluid
- Injection pipe and annulus apertures and grout permeability generally increase with time due to shrinkage and the development and growth of micro- and macrocracks
- The three-dimensional macrocrack network within the Intermediate-Scale Grout Monolith is complex and cracks and lift interfaces that intersect coreholes have a range of apertures that result in a marked influence on local pneumatic and hydraulic properties

Washington Office
1801 Rockville Pike, Suite 105 • Rockville, Maryland 20852-1633

- Crack growth is generally progressive and can vary from continuous lengthening to episodic growth or termination of growth depending on the evolution of the stress field

- The bulk hydraulic conductivity of the Intermediate-scale Grout Monolith is significantly larger than that of the matrix due to the presence of an extensive network of cracks and lift and grout lobe interfaces

The bulk permeability of the Intermediate-scale Grout Monolith that is due to active cracks and gaps at lift interfaces generally exceeds the grout permeability limit that DOE assumed in its F-Tank Farm performance assessment. Lift and grout lobe interfaces are localized regions that are subject to shrinkage that could create fast pathways for water movement; these interfaces are likely to occur in all grout monoliths. The heterogeneity that will likely develop due to shrinkage of individual grout lobes and crack initiation and growth should not be neglected in performance assessments of cementitious materials.

We look forward to continuing to support NRC work in this important area with additional experiments and related analysis and interpretations.

Note that a flash memory drive containing video files referenced in the report is being delivered overnight along with a hardcopy of the report. Please do not hesitate to contact me (210.522.6418) or Dr. Cynthia Dinwiddie (210.522.6085) with any questions about the subject report.

Sincerely,

Robert J. Lenhard, Ph.D.
Program Manager
Environmental Protection and
Waste Management for
Non-High-Level Radioactive Waste

GRW/RL/ls
enclosure

cc: D. DeMarco, R. Jackson, V. Whipple, G. Suber, D. Esh, C. Barr, C. McKenney, G. Alexander, G. Walter, C. Dinwiddie

email:
W. Patrick
B. Sagar
GED Directors/Managers
M. Padilla
Record Copy B—IQS