

ACTINIDE SPECIATION IN THE WIPP

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The Waste Isolation Pilot Plant (WIPP) TRU repository remains a cornerstone of the U.S. Department of Energy's (DOE) nuclear waste management effort. Waste disposal operations began at the WIPP on March 26, 1999 but a requirement of the repository license is that the WIPP needs to be recertified every 5 years for its TRU disposal operations. Research to better establish the speciation of key actinides under WIPP-specific conditions is being conducted as part of this ongoing recertification effort by the Los Alamos Actinide Chemistry and Repository Science team at the Carlsbad Environmental Monitoring and Research Center.

The overall ranking of actinides, from the perspective of potential contribution to release from the WIPP, is: Pu ~ Am > U >> Th and Np. Our recent research emphasis has been on WIPP-specific systems in the following areas: 1) the solubility of neodymium as a +3 analog for Am and Pu^{1,2}, 2) the solubility of cerium and thorium as a +4 analog for Pu, 3) the solubility of uranium as a +6 analog for Pu¹, and 4) reduction pathways for higher-valent Am and Pu³. These data extend past understanding of WIPP-specific actinide chemistry to a broader pH range and to brine systems that more closely simulate the expected environment in the WIPP. An integrated view of recent progress toward understanding actinide speciation and solubility in the WIPP will be provided. These data show the WIPP to be a robust repository design from the perspective of actinide containment and immobilization. Demonstrating acceptably low actinide migration and release from the WIPP is a key performance criterion for meeting the regulations that govern the WIPP license.

- (1) J.F. Lucchini, M. Borkowski, M. K. Richmann, S. Ballard, and D. T. Reed, "Solubility of Nd³⁺ and UO₂²⁺ in WIPP Brine as Oxidation-State Invariant Analogs for Plutonium," article in press in *J. Alloys Compd.* (2007).
- (2) M. Borkowski, J.F. Lucchini, M. K. Richmann, S. Ballard, and D. T. Reed, "Solubility of Neodymium as a Redox Invariant Analog for Americium (III) and Plutonium (III) in WIPP Simulated Brine, in preparation for submittal to *Radiochim Acta*, March 2007.
- (3) D. T. Reed, J. F. Lucchini, S. B. Aase, and A. J. Kropf, "Reduction of Plutonium (VI) in Brine under Subsurface Conditions," *Radiochim Acta*, 94 (2006) 591-597.

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