

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: 233rd American Chemical Society National Meeting and Exposition
(AI No. 06002.01.212.704)

DATE/PLACE: March 25–29, 2007; Chicago, Illinois

AUTHOR(S): J. Myers

PERSONS PRESENT: More than 14,000 participants representing all disciplines of chemistry.

BACKGROUND AND PURPOSE OF MEETING/TRIP:

The purpose of this trip was to participate in the 233rd American Chemical Society national meeting and exposition. The national meetings are held semiannually and are international forums for the presentation and discussion of current research in chemistry including the areas of environmental chemistry, geochemistry, and nuclear chemistry and technology. The author attended presentations of research as part of the Division of Nuclear Chemistry and Technology. A large portion of the research presented in this division was sponsored by the U.S. Department of Energy (DOE) and in many cases was directly pertinent to the potential high-level waste repository at Yucca Mountain, Nevada.

SUMMARY OF PERTINENT POINTS AND ACTIVITIES:

The program for the Division of Nuclear Chemistry and Technology consisted of 141 presentations in 10 topic areas over 5 days. The specific topic areas are listed below.

- Nuclear Energy: International Efforts Toward a Sustainable Future
- Actinide and Fission Product Isotope Needs for Energy and National Security Programs
- Modern Nuclear Reactors: Improvements of Existing Technology and Generation IV Developments
- Nuclear Waste Forms: Current Solutions and Future Challenges
- Glenn T. Seaborg Award for Nuclear Chemistry: Symposium in Honor of Norbert G. Trautmann
- Proliferation Issues Related to Advanced Nuclear Fuel Cycles Benefits Versus Proliferation Risks for Advanced Fuel Cycles
- Spent Nuclear Fuel Reprocessing: Future, Present, and Past National and International Experiences

- Understanding Radionuclide Transport in the Environment: Remediation, Nuclear Waste Disposal, and Long-term Stewardship
- Fast Automated Radiochemistry Separations in Fundamental and Applied Nuclear Chemistry Environmental Monitoring
- Fast Automated Radiochemistry Separations in Fundamental and Applied Nuclear Chemistry Heavy Element Research

The technical program for this and other American Chemical Society national meetings can be searched and viewed online at <http://oasys2.confex.com/acs/233nm/techprogram/>. A brief summary of a few of the most pertinent presentations is provided below.

M. Douglas (Pacific Northwest National Laboratory) presented an overview of the thermodynamics of neptunium solid phases for modeling dissolved concentrations. This talk summarized the DOE approach to modeling solubility limits for neptunium. Their current approach is to determine solubility limits for the potential high-level waste repository at Yucca Mountain, Nevada, using thermodynamic modeling and not consider reaction kinetics. According to Douglas, this approach ignores DOE experimental results that indicate that the long-lived metastable Np_2O_5 solid appears to control dissolved neptunium concentrations.

D. Gorman-Lewis (University of Notre Dame) presented the results of experimental studies that are underway investigating the solubilities of three uranium-bearing synthetic minerals: metaschoepite, compreignacite, and becquerilite. Their experiment determined Gibb's free energy of formation values for these minerals fall between values for synthetic minerals and naturally formed minerals reported in the open literature. This work is part of a larger effort including researchers at University of California Davis who are developing a set of internally consistent thermodynamic parameters for these uranium-bearing minerals. Researchers at the University of Notre Dame have recently begun similar solubility experiments with neptunium-substituted uranium minerals.

R.G. Wymer (Oak Ridge National Laboratory) presented an overview of spent nuclear fuel reprocessing in the context of the global nuclear energy partnership (GNEP). Based on the worldwide projected growth of nuclear energy, Wymer sees a clear need for reprocessing. The current plutonium recovery by extraction (PUREX) process is unable to separate the heat-generating radionuclides (strontium and cesium) from the waste stream, and this will limit the amount of waste that can be stored at the potential high-level waste repository at Yucca Mountain, Nevada. The uranium extraction (UREX) process can separate these heat generators from the waste and therefore potentially increase the amount of waste that could safely be emplaced at the potential repository.

D.I. Demirkanli (Clemson University) presented the modeling results of an 11-year field study of plutonium transport at the Savannah River Site in Aiken, South Carolina. The field study used plutonium sources of varying oxidation states. The modeling results were able to effectively model the downward and lateral movement of plutonium in the soils and sediments. However, modeling efforts were less effective at accounting for upward movement. The most effective explanation for upward movement of plutonium was uptake by plant roots. Attempts at modeling this phenomenon did demonstrate upward movement, but not in a manner similar to experimental observations.

T. Sullens (University of Nevada Las Vegas) presented results of neptunium and plutonium sorption on Yucca Mountain tuff. The researchers used tuff samples from the subsurface at Yucca Mountain, Nevada, and water from the J-12 groundwater monitoring well. The basis for the use of groundwater from the saturated zone below the repository was not clear. In addition, iron contamination, attributed to the tunnel boring process, had a significant effect on sorption behavior.

M. Zavarin (Lawrence Livermore National Laboratory) presented some preliminary results of an ongoing effort to model radionuclide transport at the Nevada Test Site using a combination of surface complexation modeling and ion exchange modeling. A component additivity approach was used to model sorption behavior of radionuclides that is dominated by calcite and smectite solid phases. The approach used was effective at matching batch sorption experimental results when the calcite surface area was adjusted to match particle sizes observed using scanning electron microscopy.

R. Ford (U.S. Environmental Protection Agency) presented an overview of site characterization conducted to support conceptual model development for subsurface radionuclide transport. A concern of regulators is the need to be able to scale up microscopic observations and conceptualizations of radionuclide behavior to the site-scale processes. In addition, the U.S. Environmental Protection Agency is working with the National Institute of Standards and Technology to develop a standardized sequential extraction protocol. A summary of these efforts can be found online at <http://nvl.nist.gov/pub/nistpubs/jres/101/5/j5schu.pdf>.

C. Scism (Los Alamos National Laboratory) presented the results of efforts to determine effective partition coefficients for radionuclide transport through saturated zone alluvium at the potential high-level waste repository at Yucca Mountain, Nevada. Results of this research include effective partition coefficients that take into account the much slower rate of desorption compared to rates of adsorption, focusing primarily on the rate of desorption. A conceptual model was developed that consisted of 80-percent fast rate sites and 20-percent slow rate sites. Alluvium used in the study was collected from boring locations 19IM1, 19D, 22S, and 10S. The groundwater used was collected from 19D (Zones 1 and 4) and 10S. To develop an average K_d value, they considered three approaches: (i) weighted average, (ii) arithmetic average of four bins, and (iii) geometric average of four bins. This new approach to K_d values is expected to be incorporated into the DOE abstraction of radionuclide transport in the saturated zone. The approach better accounts for the large fractions of neptunium and uranium that do not desorb during experiments. The current kinetic model does not appear to have been calibrated to account for the large fraction of slow desorbing radionuclides.

IMPRESSIONS/CONCLUSIONS:

The meeting is an effective venue for learning about a large number of current research efforts pertinent to geochemistry at the potential high-level waste repository at Yucca Mountain, Nevada. The American Chemical Society national meetings provide a good opportunity to hear presentations by researchers in the areas of geochemistry, environmental chemistry, and nuclear chemistry. The meetings are well organized despite including more than 14,000 attendees and presentations that span the entire range of chemistry research.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

RECOMMENDATIONS:

The meeting is well worth the time and effort to attend. Center for Nuclear Waste Regulatory Analyses staff should keep the American Chemical Society national meetings in mind when considering venues for the presentation of geochemistry research.