

# **CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES**

## **TRIP REPORT**

**SUBJECT:** The Joint Assembly of the European Geophysical Society, American Geophysical Union, and the European Union of Geosciences (20.06002.01.071.002)

**DATE/PLACE:** April 6–11, 2003  
Nice, France

**AUTHOR:** Lauren Browning and David Ferrill

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**PERSONS PRESENT:**

L. Browning and D. Ferrill (CNWRA), and over 3,000 representatives from various countries and organizations.

**BACKGROUND AND PURPOSE OF TRIP:**

The Joint Assembly of the European Geophysical Society, American Geophysical Union, and the European Union of Geosciences is the primary European venue for geologists, geophysicists, hydrologists and geochemists to share recent results of their work. The conference hosts multiple simultaneous technical sessions, committee meetings, and an exhibitor show. The main goals of attending the conference were to:

- Present a paper on reactive transport model of ambient Yucca Mountain hydrochemical system entitled, "Reactive Transport Simulations Of Alternative Flow Pathways In The Ambient Unsaturated Zone At Yucca Mountain, Nevada" by L. Browning, W. Murphy, C. Manepally, and R. Fedors
- Promote and discuss the special issue entitled "Reactive Transport Modeling in the Geosciences", which was edited by L. Browning (CNWRA) and W. Murphy (CNWRA Consultant) and recently published by Elsevier Press in the international journal Computers & Geosciences
- Participate in a technical hydrology session hosted by N. Coleman and C. Zhu entitled, "Nuclear Waste Disposal: Integrating Chemical, Hydraulic, and Thermal Data to Determine Flow and Transport in Variably-Saturated Subsurface Media"
- Enhance visibility of NRC work in the European nuclear waste community by increasing the level of staff participation in international scientific meetings
- Interact with the European scientific community to obtain constructive feedback on the effectiveness of staff efforts to implement the NRC risk-informed performance-based approach
- Participate in Journal of Structural Geology Editor's meeting (Dr. Ferrill's travel was paid by Elsevier to participate in Editor's meeting).

- Provide nonparticipating CNWRA staff with technical information obtained from conference presentations that were relevant to their work for the NRC

#### **MEETING SUMMARY:**

Conference sessions were divided into 14 different program areas that highlighted progress in various scientific disciplines. Conference programs covered a wide range of disciplines, including biogeosciences, climate studies, atmospheric sciences, geodesy, solid earth geosciences, natural hazards, hydrological sciences, and nonlinear processes in geophysics. This trip report summarizes papers in two programs judged to be most relevant to technical issues surrounding the potential disposal of nuclear waste at Yucca Mountain, Nevada—the hydrological sciences and the nonlinear processes in geophysics programs. Additional information about these and other conference programs can be obtained from:

<http://www.copernicus.org/EGS/egsga/nice03/programme/overview.htm>.

Of the 41 sessions convened within the hydrological sciences program, several included papers relevant to technical and review work performed at the CNWRA in support of the NRC's high level waste program. Notably, C. Zhu (University of Pittsburgh), N. Coleman (NRC), and O. Nitzsche hosted a well-attended session on "Nuclear Waste Disposal: Integrating Chemical, Hydraulic, and Thermal Data to Determine Flow and Transport in Variably-Saturated Subsurface Media." This session attracted papers describing successful attempts to incorporate multidisciplinary datasets into numerical groundwater flow models, while highlighting some of the inherent difficulties of quantifying the uncertainties in complex models. Other relevant hydrological sessions emphasized topics such as reactivity and transport of organic compounds and colloids in soils and sediments, parameter estimation and uncertainty assessment in hydrological modeling, soil structural effects on hydraulic and transport processes at different scales, and scaling of reactive transport in heterogeneous domains.

In the session on nuclear waste disposal, Browning et al. discussed how uncertainties in ambient unsaturated zone flow pathways can lead to differences in simulated groundwater compositions and alteration mineralogies. She used MULTIFLO simulations of the ambient hydrogeochemical system at Yucca Mountain, Nevada, to illustrate propagation of uncertainties in specific geochemical parameters to initialize and bound reactive transport models that assume different groundwater flow pathways. N. Coleman used geochemical data to evaluate groundwater flow at Yucca Mountain, Nevada. His presentation discussed how water compositions and other types of geochemical data can be combined with hydraulic data to constrain unsaturated zone flow pathways and large-scale flow patterns in the regional aquifer system, and to identify evidence for changes in paleoclimatic conditions. In the same session, Zhu et al., showed that consideration of climate changes from late Pleistocene to Holocene will affect estimates of groundwater recharge at Yucca Mountain based on the chloride mass balance method.

Several experimental and modeling papers at the conference were aimed at determining the effects of pore-scale transverse mixing on plume migration and biogeochemical reactivity of plumes. In the session on scaling of reactive transport in heterogeneous domains, for example, Rahman (Universität Stuttgart, Germany) used large sandbox experiments to evaluate the effects of pore-scale dispersion in the dilution and mixing of solutes. Knutson and colleagues

from the University of Illinois performed modeling studies on the influence of pore-scale transverse mixing upon biodegradation reactions and biomass growth. Also, L. Ingram (University of Saskatchewan, Canada) and colleagues discussed the scale dependence of effective diffusion coefficients used in contaminant movement studies of diffusion-dominated systems. In related session, K. Culligan (University of Notre Dame) and colleagues, including A. Tompson (Lawrence Livermore National Laboratory) used microtomography to measure fluid-fluid interface areas and saturation during multiphase flow and contaminant transport in porous media to determine the effects on capillary pressure.

In a session on reactivity and transport of organic compounds and colloids in soils and sediments, K. Totsche (Technische Universität München, Germany) presented experimental and modeling results constraining the processes and environmental conditions that may facilitate the transport of radionuclides, and other contaminants, via dissolved and colloidal organic matter. In the same session, Graber and Borisover (Volcani Center, Israel) developed a new sorption isotherm model describing the effects of hydration of organic matter on sorption of organic compounds.

Sessions on nonlinear processes in geophysics covered a variety of topics, including scaling and hydrology, fractals, analysis and treatment of spatiotemporal data, and model predictability. Many processes discussed in these sessions can be used to aid in the development and evaluation of models describing complex thermohydro-geochemical systems, such as those that might be associated with a geologic repository for nuclear waste. Voss (Freiburg Center for Data Analysis and Modeling, Germany) and colleagues, for example, used the statistical method of Kalman filtering to simultaneously estimate parameters and unobserved states from noisy time series and spatiotemporal data sets of nonlinear dynamical systems. Nunnari and Del Negro (Università di Catania) used a Multi-layer perceptron neural network approach to constrain values of magnetic parameters describing a magma-filled dike. Synthetic data were used to depict Mogi's and Okada's volcanic sources. Other presentations in the nonlinear process sessions focused on upscaling and downscaling techniques and applications, as well as subgrid parameterization and the effects of subgrid heterogeneities on model results.

Elsevier Science sponsored the editors of the *Journal of Structural Geology* to travel from their respective countries (USA, Australia, New Zealand, Germany, and Brazil) to attend an editors meeting at the Joint Assembly. The editorial structure of the *Journal of Structural Geology* changed in January 2003, from the previous setup with a single editor-in-chief and a panel of associate editors, to five autonomous editors. To discuss this new structure, introduce editors to one another, discuss journal business, and plan future changes, Elsevier Science's managing editor for the journal agreed to bring the editors together at the Joint Assembly. All but one of the editors (Joao Hippertt, Brazil) were able to attend. The meeting and associated interactions were very successful at accomplishing the goals of the editors meeting, and as the newest editor of the team the meeting was particularly beneficial to Dr. Ferrill. An editorial discussing details from the editors meeting will be prepared by Dr. Ferrill and published in a future issue of the *Journal of Structural Geology*.

## **CONCLUSIONS:**

The conference was well-attended by scientists and engineers from European countries, and provided a useful update on international research activities. In addition, the conference provided a necessary forum for interact with the European scientific community. Many

experimental and modeling techniques and applications discussed at the conference were relevant to the analysis of Yucca Mountain as a potential site for the geologic storage of nuclear waste. Staff interactions with other participants were fruitful, and the goals defined earlier for attending the conference were accomplished.

**PROBLEMS ENCOUNTERED:**

None.


**PENDING ACTIONS:**

None.

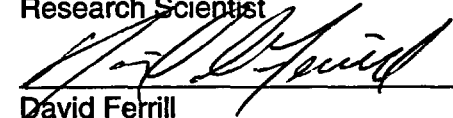
**RECOMMENDATIONS:**

Attendance at future Joint European Geophysical Society, American Geophysical Union, and the European Union of Geosciences Assemblies is highly recommended as well as continued participation in the organization of technical symposium.

**SIGNATURES:**

  
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Lauren Browning  
Research Scientist

5/09/03  
Date

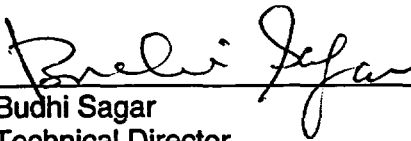
  
\_\_\_\_\_  
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5/09/03  
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