CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Trip Report for the Society of Industrial and Applied Mathematics Conference on Mathematical and Computational Issues in Geosciences (20.01402.661)

DATE/PLACE: June 11-13, 2001
Boulder, Colorado

AUTHORS: S. Painter, N. Franklin

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LOCATION AND PERSONS PRESENT:

The Society of Industrial and Applied Mathematics Conference on Mathematical and Computational Issues in Geosciences (SIAG) in Boulder, Colorado, was attended by approximately 300 people.

BACKGROUND AND PURPOSE OF TRIP:

The SIAG meeting is held every two years to bring together applied mathematicians, computational scientists, and geoscientists using modeling and simulation to address geoscience issues.

SUMMARY OF PERTINENT POINTS:

This year's SIAG meeting included a two day mini-symposium on the mathematical and computational problems in high-level waste disposal. The invited presentation in this mini-symposium was by D. R. Anderson (Sandia) and J. Helton (Arizona State), who provided an overview of the evolution of the risk-based performance assessment process with particular focus on the WIPP experience. Several of the talks in this mini-symposium described the WIPP applications of complex computer models and/or probabilistic performance assessment. High-level waste programs in Europe were also well represented. Representatives from the Yucca Mountain project were notably absent, as the only scheduled presenter failed to show.

CNWRA staff presented three papers. Scott Painter presented CNWRA simulations of thermal hydrology at Yucca Mountain that included a self-consistent treatment of forced ventilation and thermal radiation in the open emplacement tunnels. He also chaired a session on fractured media and presented a new model for anomalous transport in fracture networks. Nathan Franklin presented CNWRA work on using clustered low-cost computers to simulate volcanic ash deposition.

Other sessions or invited talks addressed fundamental issues that have potential applications to NRC Yucca Mountain activities. In one of the six other invited talks, Max Morris (Iowa State) presented a statistician's view of the broad trend in geosciences toward coupling statistics and complex simulations to quantify uncertainty, a topic that is particularly relevant to NRC performance assessment activities. Several contributed talks from the U.S. and Europe addressed specific methodologies or applications in the same area.

A large percentage of the conference was devoted to numerical algorithm development for multiphase flow or reactive transport. For example, Hammond and Lichtner described work on the use of Newton-Krylov methods instead of the Newton iterative method for reactive transport. Newton-Krylov methods have computational advantages over Newton methods, and also avoid explicit construction of a Jacobian matrix, which is the most complex and error-prone part of nonlinear simulation codes. This method has the potential for reducing the complexity and increasing the maintainability of MULTIFLO. Several speakers from the oil industry described efforts to develop next generation petroleum simulators. The work on finite volume discretization methods for unstructured grids may also be useful for MULTIFLO development.

CONCLUSIONS:

The 2001 SIAG meeting was an excellent opportunity for staff to become acquainted with the latest modeling and simulation techniques and advanced applications in high-level waste disposal. Despite the unusually large number of cancelled talks at the 2001 meeting, the biennial SIAG meeting is the most comprehensive mathematical/computational geosciences conference and an essential conference for staff involved in the development of scientific simulation tools.

PROBLEMS ENCOUNTERED:

None

PENDING ACTIONS:

None

RECOMMENDATIONS:

Continued participation by CNWRA staff at similar focused scientific meetings is necessary to stay familiar with current scientific thinking that may impact Yucca Mountain studies.

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