

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Trip to the Symposium Las Caras del Agua Subterranea (20.01402.861.041)

DATE/PLACE: September 20–21, 2001
Universitat Politècnica de Catalunya, Barcelona, Spain

AUTHORS: Ronald T. Green

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PERSONS PRESENT:

140 participants

BACKGROUND AND PURPOSE OF TRIP:

Present an invited paper titled "Simulating Nonisothermal Flow through Partially Saturated Media Using Dual Continua Models" at the Symposium Las Caras del Agua Subterranea.

SUMMARY OF PERTINENT POINTS AND ACTIVITIES:

On September 21, 2001, I participated in the Symposium Caras del Agua Subterraneas in Barcelona, Spain. The symposium was a special session on groundwater flow organized by the Department of Civil Engineering at the Universitat Politècnica de Catalunya. I was asked to give an invited presentation on dual continua modeling in nonisothermal groundwater systems. The invitation was sent by Dr. Jesus Carrera, the Symposium Chairperson, and Dr. Sebastia Olivella, who is the technical lead for the Spanish High-Level Waste team participating in DECOVALEX. My participation was limited to the last day of the symposium because of modified travel restrictions imposed because of security and safety considerations resulting from the events of September 11, 2001. Dr. Rachid Ababou, Institut de Mechanique des Fluides de Toulouse, graciously switched presentation times with me.

I presented a paper entitled "Simulating Nonisothermal Flow through Partially Saturated Media Using Dual Continua Models." The paper presented the theory and application of using a dual continua conceptual model to simulate nonisothermal groundwater flow through fractured rock. The MULTIFLO code developed at CNWRA was used to perform the simulations. The simulations were compared with observations taken from the Drift-Scale Heater Test at Yucca Mountain. Sensitivity analyses were used to identify those parameters most important to the simulations. The results of these CNWRA analyses were provided in the presentation.

Due to the modified travel, I was only able to attend a limited number of other presentations. An important observation of the symposium was the high level of interest in coupled-process, multi-phase flow modeling. Applications were varied, but most addressed high-level waste issues, such as modeling the FEBEX experiment being conducted by ENRESA. Coupled processes included thermal, hydrological, geochemical, and mechanical. Currently, there are two major coupled-process, multi-phase modeling efforts active in Spain, one at the

Universidad A Coruna and one at the Universitat Politècnica de Catalunya. The Universidad A Coruna effort is headed by Dr. Javier Samper. The Universitat Politècnica de Catalunya is led by Dr. Sebastia Olivella. Dr. Olivella is the author of CODE_BRIGHT, a multi-phase code that couples hydraulic-thermal-mechanical processes. There are efforts to incorporate chemical couplings into the code. Most notable activities of Dr. Francisco Batlle, also at the Universitat Politècnica de Catalunya. Dr. Batlle is currently coupling chemical processes into a new code called RETRASO-CODE_BRIGHT.

Both groups have already incorporated, to some degree, coupling of all four processes. Neither, however, has included a dual continua conceptualization, although both groups intend to include this capability in the near future. Both groups are interested in the efforts by CNWRA to include this capability in MULTIFLO. Positive and constructive comments were received about the dual continua conceptualization presented at the meeting. Interactions at this meeting reinforce confidence that methods used to simulate nonisothermal flow through fractured rock at the proposed Yucca Mountain repository site are generally accepted by the international hydrological community and represent high-quality science.

CONCLUSIONS:

There was a high level of interest in the multi-phase modeling efforts being advanced at CNWRA. Of particular interest, is the dual continua modeling capability offered in MULTIFLO.

PROBLEMS ENCOUNTERED:

A visit to the French CEA research site in Cadarche was canceled and the first two days of the conference were not attended because of travel restrictions.

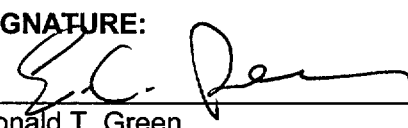
PENDING ACTIONS:

None

RECOMMENDATIONS:

Although the symposium was modest in size, there were a significant number of participants who are active in multi-phase flow. Attendance at the symposium provided an opportunity to solicit discussion on the CNWRA activities in this field, in addition to becoming aware of advances being made by others in multi-phase flow. I recommend that CNWRA and NRC stay active in these types of technical exchanges.

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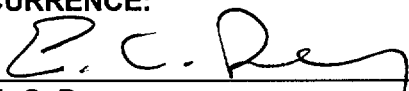


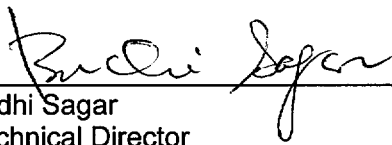
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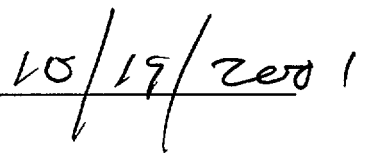
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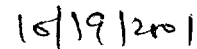
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