NRC FOREIGN TRIP REPORT

Subject: Fifth Meeting of the Management Board for the OECD/NEA Sorption Project (Phase 2)

Dates of Travel: September 5 - 9, 2004

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Sensitivity: None

Organization Visited: Nuclear Energy Agency of the Organization for Economic Cooperation and Development, Issy-les-Moulineaux, France

Background

Radionuclides released from buried radioactive material at decommissioning and nuclear waste sites often undergo sorption, adsorption onto or desorption from soil and rock surfaces over which they are carried by groundwater. In many transport models used in performance assessments of decommissioning and waste facilities, sorption is represented by a distribution coefficient, an assumed ratio of the concentration of a radionuclide adsorbed to the soil or rock surfaces to its concentration in the transporting groundwater. The effect of using the distribution coefficient in subsurface transport calculations is that sorption appears to make radionuclides still in the groundwater move more slowly than the groundwater when in fact they are moving with the groundwater but in depleted amounts due to the sorption process.

The NEA Sorption Project (Phase 2) is "A 'Benchmarking' Exercise to Interpret Selected Well-Characterized Datasets for Sorption onto Complex Materials of Interest to Safety Assessments of Radioactive Waste Disposal Systems Using Several Different Modeling Approaches in Use at Various Organizations." The objective of the project is to demonstrate the applicability of different chemical thermodynamic modeling approaches as practical and more realistic alternatives to the distribution-coefficient approach.

The NRC is a participant in the sorption project along with organizations from Australia, Belgium, the Czech Republic, Finland, France, Germany, Japan, Spain, Switzerland, and the United Kingdom. Each organization has sponsored modeling teams to analyze sorption problems defined by the project's Technical Direction Team. The NRC sponsored teams at the Center for Nuclear Waste Regulatory Analyses and at the US Geological Survey. During the past year, the project's Technical Direction Team prepared a final report on several modeling exercises testing various chemical thermodynamic models of sorption applied to seven different test cases.

Purpose

The purpose of the September 2004 Management Board meeting was to provide final comments on the final project report for Phase 2 and discuss the possibilities of holding an international workshop on sorption modeling and organizing a Phase 3 for the project.

Abstract: Summary of Pertinent Points and Issues

The Management Board decided to add text to the Phase 2 final report's extended summary explaining the benefit of thermodynamic sorption modeling to performance assessment. With the addition of this text, the report is now suitable for publication. The Management Board decided to proceed with the planning of an international workshop on thermodynamic sorption modeling and to consider ideas for a Phase 3 for the project.

Discussion

The Management Board decided that Phase 2's report, while essentially complete, needed a statement explaining the benefits of thermodynamic sorption modeling to performance assessment. This statement, attached to this trip report, will appear in the final report's extended summary (equivalent to an executive summary). The report is now acceptable to the Management Board for publication by the NEA.

The report summarizes thermodynamic sorption modeling exercises by teams supported by the project's participating organizations. There was a large variation in the teams' apparent degree of understanding of thermodynamic sorption modeling and this is reflected in the presentation of the teams' results in the report. Because the project would not be able to correct any modeling errors or deficiencies identified in a peer review, the Management Board decided to forgo a formal peer review of the report.

There were brief discussions at the meeting of holding an international workshop on thermodynamic sorption modeling, organizing a Phase 3 for the project, and organizing a course on thermodynamic sorption modeling. Although the possibility of not having an international workshop was discussed at the meeting, the Management Board decided to proceed with it. Proposals for the organization and content of the workshop will be circulated by electronic mail to the Management Board and Technical Direction Team members between now and April 2005, when the Management Board plans to hold another meeting.

Two members of the project's Technical Direction Team attended the meeting and suggested possibilities for a Phase 3 of the project. The proposal that was most attractive involves a combined experimental and modeling effort that would focus on complex soils and rocks through which radionuclide transport could take place. The emphasis on complex materials arises because the modeling teams in Phase 2 of the project tended to concentrate their efforts on simpler materials. The details of the proposal have not been worked out. Technical Direction Team members will draft a proposal and circulate it by electronic mail to the Management Board before its next meeting.

The US Geological Survey's James Davis, one of the Technical Direction Team members present at the meeting and a contractor to RES on sorption modeling, is considering organizing a course on thermodynamic sorption modeling. One of the items that he would emphasize in the course is the selection of surface reactions involved in sorption, an area of apparent weakness in some of the modeling exercises conducted in Phase 2. No commitments were made on who would sponsor such a course.

Benefit of the Project to the NRC

RES has been supporting two projects, at Sandia National Laboratories and at the US Geological Survey, to improve sorption modeling beyond the distribution-coefficient approach. The NEA Sorption Project (Phase 2) provides the NRC with an economical way to examine sorption modeling methods and sorbed radionuclides that are not being examined by Sandia and the USGS and will help RES establish practical alternatives to distribution-coefficient-based sorption modeling in subsurface transport calculations used in performance assessments of decommissioning and waste sites.

Pending Actions and Planned Next Steps for the NRC

Between now and April 2005, I will be working with other NRC staff to review and comment on proposals for the international sorption-modeling workshop and a possible Phase 3 of the NEA Sorption Project.

Points for Commission Consideration

There are no actions required from the Commission by the NEA Sorption Project. Based on the outcome of the current phase of the project, the staff may recommend modifications or additions to current methods used in NRC performance-assessment methodologies to estimate the effects of sorption on radionuclide transport.

Attachments

Addition to project report's extended summary explaining the benefit of thermodynamic sorption modeling to performance assessment.

Attachment:

Addition to the extended summary of the final report of the NEA Soprtion Project (Phase 2) explaining the benefit of thermodynamic sorption modeling to performance assessment.