NRC INTERNATIONAL TRAVEL TRIP REPORT

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Subject:
Participation in the 8th meeting of the Organization for Economic Cooperation and Development (OECD) - Nuclear Energy Agency (NEA) PKL-2 Project held November 8 - 9, 2011.

Dates of Travel and Countries/Organizations Visited:
November 8 - 9, 2011 / Erlangen, Germany / OECD-NEA PKL-2 Project

Desired Outcome:
The traveler anticipated discussing the results of the ROSA-2/PKL-2 counterpart test, providing input on the content of the program's final report, participating in the planning of the program's final analytical workshop, and settling all remaining programmatic and financial issues. The data from the ROSA-2/PKL-2 counterpart test will be a unique addition to the TRACE databank, highlighting the effects of facility design and scale on the test results. The final report will include a chapter authored by the traveler on specific additional lessons learned from the experiments. The final workshop will consist of presentations and discussions on how well TRACE and other thermal-hydraulic codes simulate the counterpart test.

Results Achieved:
The anticipated outcomes from the meeting were achieved.

Summary of Trip:
The 8th and final meeting of the PKL-2 project was well attended and proceeded according to the published agenda. The main topics of discussion were the preliminary results from Test G7.1, the PKL-2 final report, preparations for the 2nd PKL-2 Analytical Workshop, and the follow-on PKL program. Over the course of the two-day meeting, the members acknowledged the success of the 3.5 year endeavor and expressed their satisfaction with the data produced and the collaborative opportunities afforded.

Test G7.1, which simulated a small, hot-leg break loss-of-coolant accident, was performed under both the OECD/ROSA-2 and OECD/PKL-2 Projects. The test, labeled the counterpart test, was designed to investigate the effects of scale, the relationship between maximum cladding temperature and core exit temperature (CET), and the effectiveness of CET thermocouples as indicators for the start of accident management actions.

Because the ROSA large-scale test facility (LSTF) and PKL facility have different design pressures (LSTF ~ 2250 psi, PKL ~ 653 psi), Test G7.1 had to be divided into three phases to

achieve comparable results: a high-pressure phase, a conditioning phase, and a low-pressure phase. Therefore, with the goal of producing a core uncovery and heatup in both facilities, all three phases were conducted in the LSTF, and the conditioning and low-pressure phases were performed in PKL. For the high-pressure phase, the break in the hot leg was opened, the primary system was allowed to depressurize, and the core was allowed to uncover and heat up. From this point in the LSTF, the high-pressure injection system was activated, and the secondary system was manually depressurized down to PKL design conditions. In the PKL facility, the conditioning phase consisted of matching the primary- and secondary-system pressures and the swell level that had been established in the LSTF during the conditioning phase. In the low-pressure phase, the hot-leg break was opened in both facilities (reopened in the LSTF), and again, the primary system was allowed to depressurize, the core was allowed to uncover, and as an accident management action, the secondary system was allowed to depressurize based on a prescribed CET of > 662 F.

The preliminary results from Test G7.1 showed good continuity between the LSTF- and PKL-portions of the test. More specifically, the results showed that the temperatures on the surface of the heater-rods (the peak cladding temperature, PCT) in the respective cores increased faster and achieved a higher value during the low-pressure phase of the test. The results also showed that the measured PCT was about 300 F higher than the measured CET.

One of the products from the PKL-2 program and one of the offerings to the nuclear community is the PKL-2 final report. This report documents the descriptions and results from each experiment, provides interpretations of the test results, evaluates the value of the data for code assessment, and presents specific additional lessons learned from the experiments. The NRC is responsible for providing the specific additional lessons learned. The specific lessons that will appear in the report will consist of information garnered from the boron precipitation test, which provided insight into the rate at which boric acid accumulated in the different regions of the vessel, the acceptability of mixing-volume assumptions in boron-precipitation calculations, and the factors affecting the occurrence of a specific long-term cooling accident scenario. The final report is currently in the final stages of development and is scheduled for inclusion on the PKL-2 final DVD, which is scheduled for release to the members in June 2012. The report is also scheduled for submission to the Committee on the Safety of Nuclear Installations (CSNI) Program Review Group (PRG) in April 2012 for endorsement as a CSNI report.

The PKL-2 analytical workshops give participants the opportunity to demonstrate the capabilities of different systems and computational fluid dynamics (CFD) codes and to discuss modeling issues, all without being encumbered by the usual administrative formalities. The first PKL-2 analytical workshop was conducted in April 2010 in Pisa, Italy, and focused, primarily, on the simulation of Test G3.1, a main steam line break test. The second PKL-2 analytical workshop is scheduled for October 2012 in Paris, France, and will focus on Test G7.1, the counterpart test. Members from both the PKL-2 and ROSA-2 programs will be invited to the 2nd workshop to share the results from modeling their respective portions of the test.

The last major topic discussed during the meeting was the follow-on PKL program. This new program has been discussed during the last two program review meetings, and the members have come to agree that the proposed topics are worth pursuing and will provide useful data. The proposed topics include CET performance, station blackout (SBO) transients, boron

precipitation, a loss-of-feedwater anticipated transient without scram (ATWS) and two open topics. As a result of the members having reached a consensus on the newly proposed topics, the operating agent (OA), AREVA GmbH, will formally present a proposal for the new PKL program to the CSNI PRG during the CSNI meeting to be held around the end of November 2011.

The OA visited the NRC's RES staff in October 2011 and presented the proposal for the new PKL program. The proposal was well received, and the staff expressed interest in participation. Of particular interest are the SBO tests and the boron precipitation test. The new boron test will be a continuation of the boron test conducted under the PKL-2 program. In the PKL-2 boron test, it was discovered that the PKL loop flow resistances were less than prototypical, and thus prevented the simulation of a long-term cooling scenario that could produce a core uncovey and accelerate the increase in boric-acid concentration in the core region. The staff is interested in verifying whether such a scenario can occur in a real plant.

Pending Actions/Planned Next Steps for NRC: The 2nd PKL-2 Analytical Workshop is scheduled for October 15-19, 2012.

Points for Commission Consideration/Interest: None

Attachments: Meeting Agenda