July 31, 1997 SECY-97-175

FOR: The Commissioners

FROM: L. Joseph Callan /s/
Executive Director for Operations

SUBJECT: NRC PARTICIPATION IN THE OECD/NEA SPONSORED RASPLAV-PHASE II PROJECT AT THE RUSSIAN RESEARCH CENTER (I.V. KURCHATOV INSTITUTE)

PURPOSE:

To inform the Commission of plans to participate in the follow on RASPLAV-Phase II Project at the Russian Research Center (I.V. Kurchatov Institute).

BACKGROUND

In SECY-97-027, dated February 3, 1997, the Commission was informed of the status and accomplishments of Phase I of the RASPLAV Project, the objectives of Phase II of the project and our intent to participate in Phase II of the project, provided a draft agreement was prepared by OECD/NEA and agreed to by the other project participants. The staff committed to keep the Commission informed of the status of Phase II after the April 1997 RASPLAV Management Board meeting.

Contact:
Thomas L. King, RES
415-5790 The RASPLAV Project is an OECD/NEA sponsored project involving 17 countries with the experimental work being conducted at the Russian Research Center (I.V. Kurchatov Institute) in Moscow, Russia. The key objectives of the project are to perform experiments with prototypic materials (i.e., reactor materials under very high temperature), to measure the heat loads to the reactor pressure vessel (RPV) under severe accident conditions (molten pool natural convection), and to assess the effects of materials interactions under these conditions. This information is critical to the issues associated with the retention of a molten core inside the RPV

cooled from outside. The project consists of small scale experiments to measure the properties of molten core materials (e.g., thermal conductivity) of various compositions, separate effects tests to look at phenomena such as molten core material stratification and interactions with reactor vessel steel, small scale (12 and 40 kg of U02/Zr02/Zr) and large scale (200 kg of U02/Zr02/Zr) integral experiments to simulate in-vessel molten core conditions and integral experiments using molten salts simulating molten core material to extend the molten core material results to reactor vessel scale. Phase I of the project began on July 1, 1994, and ended on June 30, 1997. During Phase I of the project the properties of two compositions of molten core materials were measured, numerous separate effects tests were run, two small integral and two large scale integral tests were performed and 20 tests with molten salt material were conducted. The conduct of the tests with molten core material also involved the development of innovative and unique heating, measurement and confinement techniques to retain molten core material at approximately 2700oC for up to four hours. The total cost of Phase I was $6.9 million of which NRC paid $932,000 over the three year period.

DISCUSSION:

The Phase I tests used a molten core material composition representative of a BWR and indicated that natural convection occurs quickly in a pool of molten core material and also that the Zr02 and Zr stratify quickly and float on top of the molten pool. (The long term impact and extent of this stratification is one of the items to be investigated in Phase II). At the heat fluxes observed in the two large scale integral tests (average 100 kw/m2 and 200 kw/m2 through the simulated RPV wall in the first and second tests, respectively) there was no attack on the steel wall (i.e., a protective crust of core material prevented direct contact between molten core material and the RPV wall). Also, at the heat fluxes observed, their distribution along the RPV wall compared well with prediction and external cooling of the RPV wall was able to maintain its integrity.

Based upon the success and results of the Phase I program, RASPLAV Project participants discussed the benefits of extending the project into Phase II to further

investigate the
phenomena of stratification (between molten U02 and Zr02/Zr) observed in the Phase I tests,
conduct tests with different molten core material compositions and boundary conditions,
continue the salt test program to enable extension of the molten core material tests to reactor
scale and to further explore the potential of molten core material interactions with reactor
pressure vessel material. Such information is directly relevant to severe accident management
approaches being considered in the U.S. and internationally and is the only experimental
program of its kind working with real materials under prototypic conditions. OECD/NEA
prepared a draft agreement for Phase II and presented it to the RASPLAV Management Board
at their April 1997 meeting. The proposed Phase II program consists of three additional large
scale tests with molten core material, several separate effects tests on materials interaction,
additional material properties measurements and up to 30 additional tests with molten salt. All
participating countries agreed to a Phase II program beginning July 1, 1997, and ending June
30, 2000. The total cost of Phase II is to be $5.0 million with NRC's share $678,000 over that
period. Recently, OECD/NEA provided for signature the proposed agreement for Phase II
(copy attached).

As discussed in SECY-97-027, The U.S. Department of Energy (DOE) was interested in joining
the project in Phase II. Terms and conditions were discussed with DOE representatives and
OECD/NEA drafted an agreement for their participation in the project as an associate member
(NRC would be the official U.S. representative on the Management Board, but DOE could
attend all meetings and have access to all project results) at a total cost of $500,000. To date
DOE has not been able to commit to joining the project, and the attached agreement does not
include their participation. If, in the future they elect to join the project under these terms and
conditions, the $500,000 DOE contribution would be used to conduct additional tests.

RESOURCES:

The resources required for NRC to participate in Phase II ($678,000 over 3 years) were lower
than those estimated in SECY-97-027 ($800,000 over a 2.5 year period). Currently, RES has

$140,000 of FY 1997 funds available for Phase II along with $320,000 in its FY 1998 budget and $340,000 in its FY 1999 request. The funds needed are $140,000 in FY 1997, $256,000 in FY 1998 and $282,000 in FY 1999. The excess funds in FY 1998 and FY 1999 will be reprogrammed to other research activities on an as needed basis.

COORDINATION:

This paper has been coordinated with the Office of the Chief Financial Officer (CFO) and the CFO has no objections to the resource estimates. This paper has also been coordinated with the Office of the General Counsel, and they have no legal objection.

CONCLUSION:

Since the proposed Phase II project will provide information directly relevant to severe accident management and confirmatory information related to in-vessel retention in AP-600, it is in the best interest of nuclear safety in the U.S. for the NRC to participate in the RASPLAV-Phase II project. I intend to sign the RASPLAV Phase II Agreement (attachment) with the express understanding that it is subject to the availability of appropriated funds and provide notification to the OECD/NEA.

L. Joseph Callan
Executive Director
for Operations

Attachment:
Agreement on the Second Phase
of the OECD RASPLAV Project