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Hanover, New Hampshire

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FIRST QUARTER FY81 PROGRESS REPORT  
ON REFILL EFFECTS PROGRAM

ABSTRACT

This report very briefly highlights progress during the first quarter of FY81 on the Creare Refill Effects Program. Key activities involved code and model assessment for RELAP4 by comparisons with our data. A memo documenting the 1/5-scale countercurrent flow data was completed. We also assisted the NRC's 2D/3D group with suggestions for the refill tests to be run in the Cylindrical Core Test Facility.

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1 PROGRAM OVERVIEW

This is a quarterly report on the Creare Refill Effects Program. The context of this effort is the blowdown and refill of a Pressurized Water Reactor (PWR) vessel during a postulated LOCA. The primary work in previous years involved analysis and experiments related to flashing, swelling, heat transfer and countercurrent flow of fluid contained in scale model PWR vessels during depressurization transients and steady-state separate effects tests. Although emphasis is on refill of a PWR vessel, many of the phenomena studied--such as phase slip in a flashing mixture, countercurrent flow momentum exchange, and non-equilibrium mixing of subcooled water and steam--have broader applications during other phases of a LOCA or during operating transients in BWRs or PWRs.

The FY81 efforts of the Creare Refill Effects Program are devoted to final documentation of the data, codes and other results together with coordination and application of the program findings to related NRC programs such as the 2D/3D refill tests in CCTF. Expected FY81 results are:

- 1) Preparation of a Research Information Letter by NRC/RSR will be supported by companion reports summarizing our work to date and applications analysis or experiments requested in FY81.
- 2) Technical reports will be prepared to document additional data and codes developed during FY79 and FY80.
- 3) Program coordination will continue to assist other groups, particularly code developers and facility designers, in employing our results.
- 4) The Refill Effects Program will be completed in FY81 as planned.

## 2 PROGRESS DURING FIRST QUARTER FY81

### 2.1 Analysis and RIL Support

To support our examination of the RELAP4/MOD7 non-equilibrium model, the constitutive condensation models from the several general-purpose computer codes (RELAP5, RELAP4/MOD7, and TRAC P1-A) were quickly assessed (as part of the CREFIL analysis) using our experiments. In general, these models all calculate the thermal equilibrium is achieved. Using CREFIL, we also examined the Homogeneous and Separated Component models for two-phase upflow in greater detail.

Excellent progress was made during the quarter in comparing RELAP with Creare data using an accelerated I/O capability together with a post-process plotting routine. Without ECC injection we demonstrated that RELAP4/MOD7 has all the necessary capabilities and that calculations of our baseline data are good. Tests with ECC injection are more challenging, and more important. During the quarter we completed comparisons that gave accurate pressure transients and that stably calculate plenum inventory depletion, end of bypass, and refill. Using RELAP4 "as is" the timing of end of bypass and the refill rates are inconsistent with some of our data, however. Prior sensitivity studies with CREFIL and RELAP identified three areas possibly needing model upgrades (particularly downcomer slip), and these were implemented in the present quarter. Several of the options for physical modeling in MOD7 were evaluated relative to flexibility and numerical accuracy (stability). Input decks were developed for the 1/5-scale experiments (previous RELAP calculations were for 1/15-scale only).

### 2.2 Reporting and Storage

Final corrections to the Flashing Transient Topical Report TN-321 were made. A memo documenting the 1/5-scale countercurrent flow data was completed to form part of the RIL support package.

### 2.3 Management and Program Coordination

We responded to a request from Sandia Laboratories to supply them with the results of a successful calculation done with the MOD7 code. We supplied LASL with information on Creare tests to use in code assessment.

Creare attended the LOFT Review Group Meeting in Idaho and prepared a presentation given at that meeting. During this trip we also reported our code activities to Steve Behling (RELAP4/MOD7) and Vic Ransom (RELAP5). At LASL Creare presented the results of our flashing transients and countercurrent flow studies to LASL's Q-8 and Q-9 divisions and held modeling discussions with TRAC developers.

We responded to a request to assist NRC's 2D/3D group in developing suggestions for refill tests to be performed in the Cylindrical Core Test Facility (CCTF) in Tokai, Japan. During the quarter Creare reviewed test plans, tests results, and facility documents.

### 3 PLANS FOR SECOND QUARTER FY81

Our priority is to meet the schedule on 2D/3D and RIL efforts which calls for their simultaneous completion by the end of March. We expect to produce a memo in January documenting our suggestions for refill tests in the Cylindrical Core Test Facility (CCTF), followed by preparation for and participation in meetings during February and March. During the next quarter, we will also provide a draft of a technical report summarizing our refill studies to support the RIL. At the same time, we will begin drafts of related technical reports on our RELAP4 calculations and on our data.

The program remains on schedule and no problems have been identified.