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Author(s), Affiliation and Address:

S. S. Sellew
P. H. Rothe
Creare Incorporated
Box 71
Hanover, NH 03755



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NRC Individual and NRC Office or Division to Whom
Inquiries Should be Addressed: Dr. W. D. Beckner
RSR

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Susan S. Sellew
Paul H. Rothe

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ABSTRACT

This report very briefly highlights progress during the Fourth Quarter of FY80 on the Creare Refill Effects Program. Key activities involved extensive analysis calculations and comparisons with data using CREFIL and running RELAP4/MOD7 to predict our flashing transients. Flashing experiments were completed at 1/5-scale and the Topical Report on flashing transients was completed. Preliminary countercurrent flow experiments were also performed.

TABLE OF CONTENTS

	<u>Page</u>
1 PROGRAM OVERVIEW	1
2 PROGRESS DURING FOURTH QUARTER FY80	2
2.1 Analysis	2
2.2 Experiments	2
2.3 Reporting	2
3 PLANS FOR FIRST QUARTER FY81	3

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 FY80 involves analysis and experiments related to flashing and swelling of fluid contained in scale model PWR vessels during depressurization transients with both large and small breaks. Although emphasis is on refill of a PWR vessel, many of the phenomena studied--such as phase slip in a flashing mixture and non-equilibrium mixing of subcooled water and steam--have broader applications during other phases of a LOCA or during operating transients in PWRs or BWRs. The major goals of these flashing studies are to assist in the development of LOCA analyses by

- 1) identifying the key phenomena,
- 2) organizing and contributing to the data base available for code developers to assess their analyses,
- 3) developing analysis tools which permit rapid, inexpensive calculations and sensitivity studies to assist advanced code development, and
- 4) suggesting scaling relationships and predicting the effects of alternative scaling models at full-scale.

As outlined in NUREG/CR-0257, the general structure of the program has been divided into four tasks with associated subtasks:

- Flashing Analysis and Assessment

Analysis

- a. Identify physical models
- b. Develop CREFIL analysis
- c. Modify and use RELAP

Assessment

- a. Understand data
 - b. Comparisons of analysis with data
 - c. Sensitivity calculations
- Flashing Experiments
 - a. 1/30-scale modeling and flow visualization tests
 - b. 1/15-scale parameter tests
 - c. 1/5-scale scaling tests
 - Reporting
 - Program Coordination

2 PROGRESS DURING FOURTH QUARTER FY80

2.1 Analysis

Extensive analysis calculations and comparisons with data continued during the quarter with results described in the Topical Report. We also performed sensitivity studies targeted mainly to the RIL although initial results are reflected in the Topical Report.

We have been pursuing an effort to run RELAP4/MOD7 at INEL and use it to predict our flashing transients. We have successfully linked with the INEL computer, run RELAP4/MOD7, nodalized the Creare vessels, and compiled comparisons with our data. This effort has shown that MOD7 is able to calculate experiments with ECC injection. We also ran several RELAP4 calculations dealing with downcomer slip modeling for two-phase upflow. We are pleased with results to date and optimistic about the value of this effort which will be increased in October as alternate models in RELAP4 are explored in comparison with our data.

2.2 Experiments

The 1/5-scale flashing experiments for scaling confirmation have been completed. In particular, ECC injection data were obtained in a blowdown from 200 psia. Planned flashing experiments are thus completed.

Countercurrent flow experiments at 1/5-scale have been performed with the lowest subcooling obtainable at each of two ECC flow rates. The subcooling is (0-3°F) at $J_{fin}^* = 0.06$ and (0-7°F) at $J_{fin}^* = 0.11$. Additional data were also obtained for complete bypass at high subcooling. We expect to report the results of these preliminary experiments in October.

2.3 Reporting

The final Topical Report on flashing transients was completed on schedule in September. It is entitled "Analysis of Flashing Transients During Refill", Creare TN-321 (NUREG/CR-1765). This report involved numerous data comparisons and sensitivity studies, similar to those in TN-313, except we have now done many additional tests with ECC injection and at a larger scale.

3 PLANS FOR FIRST QUARTER FY81

The main program effort in the first quarter FY81 is to follow-up on the Topical Report and begin efforts in support of the planned Research Information Letter on Refill Effects. We will continue to use RELAP4/MOD7 to perform calculations for comparisons with our experiments and with LOFT.

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