

MODIFICATION NO. 4 TO GRANT NO. NRC-G-04-84-001

BETWEEN

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

AND

THE U.S. NUCLEAR REGULATORY COMMISSION

- A. The purpose of this modification is to change Grantee's proposal in Block No. 9, incorporate Grantee's proposal (attached) and change the dollar amount in Block No. 15 of the Notice of Grant Award.
- B. Specifically, of this Grant No. NRC-G-04-84-001:
1. Block No. 9, Project Will Be Conducted Per Grantee's Proposal, delete the date June 16, 1983 and insert in lieu thereof Grantee's Proposal for the period October 1, 1985 through June 30, 1986.
 2. Block No. 15, Funding Sources, is increased by \$50,000.00 from \$400,000.00 to \$450,000.00.
- C. All other terms and conditions under this Grant remain the same.
- D. In witness whereof, the parties have executed this document.

UNITED STATES OF AMERICA:

Date: 8/27/85

By

Paul J. Edgeworth
Paul J. Edgeworth, Grants Officer
Technical Contracts Branch
Division of Contracts
Office of Administration

GRANTEE:

Date: AUG 14 1985

By

Title

George H. Dummer
George H. Dummer, Director
Office of Sponsored Programs

APPROVED

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PDR CONTR
NRCG-04-84-001 PDR

UPPER PLENUM FLOW MEASUREMENT DURING REFLOOD

A supplementary proposal for

MIT Project No. 94891
(child account for 94443)

Grant No. NRC-G-04-84-001, Mod No. Four (4)

Submitted to:

Nuclear Regulatory Commission
Division of Reactor Safety Research
Mail Stop 1130 SS
Washington, DC 20555

ATTN: Dr. Novak Zuber

Upper Plenum Flow Measurement During Reflood

INTRODUCTION - This is a proposal to continue the flow measurement investigation being pursued by MIT in support of the 2D-3D program. This is an international program with participation by Germany and Japan. It is anticipated that this phase of the program will be complete when the period covered by this supplement has elapsed.

PROGRAM - There are two phases to this work. One is to construct an algorithm which can be used to determine the flow into the upper plenum of the Upper Plenum Test Facility (UPTF) from the measurements obtained from the following instruments

- 1) The turbine meter speed
- 2) The drag body force
- 3) The collapsed liquid level
- 4) The upper tie plate pressure difference
- 5) The water temperature

The data which we shall use to do this includes: MIT air-water data/ORNL data/UPTF data from Germany/Karlstein data from Germany/Hannover data from Germany/ and any relevant measurements from the Japanese facility at JAERI.

We shall also run experiments in the air-water rig at MIT in order to determine how the algorithm is affected by geometry of the upper plenum. These experiments include testing the effect of ECC elevation of injection on the calibration, the effect of angle of injection on the calibration, the effect of slot blockage on the calibration and the effect control^{rod} guide tubes on the calibration.

We shall then write a report summarizing our recommendations for a flow algorithm in which we will document the recommendations with plots showing data from all the sources.

WORK STATEMENT

1. Perform tests in the single bundle air-water rig to assess the effects of liquid injection mode on the accuracy of measuring mass flow rates across the tie-plate.

To this end, liquid should be injected in the end box first at a 90° angle to the tie-plate and then at a 0° angle. Repeat tests by injecting water 3 feet above the end box.

2. Perform a test in the single bundle air-water rig to assess the effects of upper plenum structure on the accuracy of measuring mass flow rates across the tie-plate.

To this end, insert a model of a guide tube above the end box and perform tests in the upflow, countercurrent and downflow regimes for both cold leg and combined injections.

3. Modify, if necessary, the mass flow rate algorithm to account for the above effects.
4. Provide a final report containing the experimental and analytical results.
5. Assist NRC in evaluating and analyzing test data from Karlstein, Hannover, and UPTF facilities.