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NRC Research and Technical
Assistance Report

8101060832

Westinghouse Electric Corporation
Water Reactor Divisions

Nuclear Technology Division
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December 1, 1980

SP-80-863

(FSS-80-324)

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SUBJECT: FLECHT-SEASET PROGRAM
Informal Monthly Progress Report for October 1980
CONTRACT: NRC 04-77-127, EPRI NO. RP959-1

Gentlemen:

Attached is an informal progress report for the month of October 1980, for FLECHT-SEASET.

Sincerely,

WESTINGHOUSE ELECTRIC CORPORATION

H. W. Massie, Jr.
FLECHT-SEASET Project Engineer
Strategic Projects

hp

Attachment

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cc: Mr. Andrew L. M. Hon (NRC)
(See attached list for additional distribution)

NRC Research and Technical Assistance Report

FLECHT-SEASET PROGRAM
CONTRACT NRC-04-77-127
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FLECHT-SEASET PROGRAM

INFORMAL MONTHLY PROGRESS REPORT

OCTOBER, 1980

PROJECT MANAGEMENT - H. W. Massie, Jr.

Testing was completed on the fourth FLECHT-SEASET 21 rod bundle. Fabrication was completed on the fifth FLECHT-SEASET 21 rod bundle -- the first with long nonconcentric blockage sleeves.

TEST PLANNING AND ANALYSIS - L. E. Hochreiter/M. Y. Young

Unblocked Bundle Task (Task 3.2.1)

Work continued in generating data for inclusion into the data report. Approximately 600 data plots have been reproduced to date which represents less than 50 per cent of the required number (approximately 1500 required).

The statistical analysis of the bundle distortion was completed. The results indicate that the test data was significantly affected by the bundle geometry only after test cycle 34610. Effect of geometric distortion before test cycle 34610 was not significant, and data could be used for model and correlation development with confidence. Hence, it is believed that enough data exists to meet the task objectives.

Effort to develop a reflood droplet model and to calculate the basic heat transfer components above the quench is being continued. Preliminary results seem to indicate that a drag force coefficient of 0.45 is appropriate to describe the droplet motions, also using a single drop with diameter equal to the sauter mean drop diameter of the measured spectrum gives satisfactory heat transfer results.

Steam cooling data in the unblocked bundle was re-analyzed using heater rod surface temperature calculated by the DATAR code, and the effect of the housing and the disconnected rod region was studied by repeating the analysis with one and two heater rod rows from the housing and disconnected rods discarded, respectively. The results indicate that heater rods near the housing and disconnected rods have a higher calculated heat transfer coefficient, but all the calculated heat transfer was above that predicted by the Dittus-Boelter correlation.

21-Rod Bundle Task (Task 3.2.2)

Testing of the fourth 21-rod bundle was successfully completed. The fourth bundle had short, concentric flow blockage sleeves on all heater rods distributed on a non-coplanar basis. Hydraulic characteristics, steam cooling and

reflood tests were performed. The test results show that the heat transfer immediately downstream of the blockage sleeves was improved up through and past turnaround time relative to the unblocked configuration. Data and heat transfer comparisons with the first 3 bundles is underway.

The bundle #5 build specifications were completed. Bundle #5 blockage includes long, non-concentric sleeves distributed in all heater rods in a non-coplanar fashion. The bundle build specifications include the heater rod radial locations, and azimuthal orientation, and blockage sleeve and steam probe instrumentation.

Analysis of the 21-rod bundle steam cooling tests showed approximately the same result as the 161-rod unblocked steam cooling tests. For the unblocked 21-rod bundle configuration and the blocked configurations below the blockage elevation, the data yields heat transfer greater than the Dittus-Boelter correlations. The blockage data provides even greater heat transfer and is a function of the distance downstream of the blockage. Evaluation of these results is continuing.

COBRA calculations (single phase steam, isothermal) for the bundles 1, 2 and 3 have been completed. Thermal effect on flow distribution is being studied. COMPARE code is also being modified to calculate blockage enhancement factor using the Hall and Duffey approach.

163-Rod Bundle Task (Task 3.2.3)

No activity this month.

Systems Effects Reflood and Natural Circulation Tests (Task 3.2.7)

Upper plenum internals fabrication for the EG&G Air/Water flooding tests is about 10% complete. To minimize schedular delays in construction of the System Effects test facility, the heater rod nickel conductors, which were originally planned to be loaned to EG&G for the air/water tests, will remain at Westinghouse; brass connectors will be supplied to EG&G instead. EG&G continued construction of the air/water test facility.

Fabrication of heater rods is now scheduled to be completed by 1/20/81 and ORNL infrared scan tests by 2/12/81, which would cause a possible delay of one month in starting the rod bundle assembly. Work continued on the systems

effects tests, with the software requirements being specified and alternate designs being decided upon for the steam probes. One model design will be to use a pulsed heated T/C, which will keep the steam probe dry. A technique utilizing pulsed heater T/Cs has been used by the CEGB of UK. Installation of the steam generator platform extension was completed. Loop construction was started. About 60% of the loop piping fabrication was completed. Delays in the delivery of the downcomer piping has caused a two week delay in assembling the loop piping. Revisions to the original natural circulation and reflux test matrix were initiated.

Other Activities

a) A presentation was made at the water reactor safety information meeting on FLECHT-SEASET.

b) A meeting was held with NRC-RSR, NRC-NRR and the EPRI Washington representative. The purpose of the meeting was to review the goals of the FLECHT-SEASET flow blockage program with NRC relative to the concerns of NUREG-0630, as well as to aid in the transition of NRR program reviewers.

TEST ENGINEERING/TEST OPERATIONS - C. E. Conway/C. E. Fuchs

21 Rod Bundle (Task 3.2.2)

The PDP 11/20 computer has been having intermittent problems, causing the program to bomb during tests. The computer was down for three days (10/24, 10/25 and 10/26) with the same types of failures - two ribbon cables were found defective (these cables interface between the computer and the A/D converters). The problems were repaired and bundle No. 4 testing was completed on October 31, 1980.

163 Rod Blocked Bundle (Task 3.2.3)

Installation of the facility exhaust piping and safety relief lines were completed. The heater rod housing was received and is currently being bolted to the plenums in preparation for hydro and installation in the loop. Completion of the main loop piping installation will be accomplished after receipt of the downcomer section. The downcomer has been shipped and receipt is expected shortly.

The thermocouple and the power patch panel have been fabricated, and wiring will commence. The patch panel boxes and the wireway will be mounted after the housing is in place. The 60 gpm turbine meters and the bidirectional flow monitor have been returned to the manufacturer for calibration.

System Effects (Task 3.2.7)

The 120 volts AC service for all Flecht Set instrumentation cabinets have been installed in a centralized area. In addition, the 480 volts AC, 300 amperes feed from the basement has also been connected to the auxiliary heater power cabinet that was recently relocated. Work is progressing on the control wiring for the SCR power system. Additional conduit and junction boxes have been installed in anticipation of future needs.

Sixty (60) per cent of the piping has been received as of October 27, 1980. The test housing with upper and lower plenums have been installed and is awaiting critical piping in order to install the downcomer. The containment tank has passed hydro test and is ready to be reinsulated. The pipe hangers have been received with the exception of one Stancion support. The piping stress analysis is currently being performed at Power Piping Company.

Fifty-six (56) non-instrumented heater rods have been forwarded to ORNL from RAMA and are presently being I.R. scanned.