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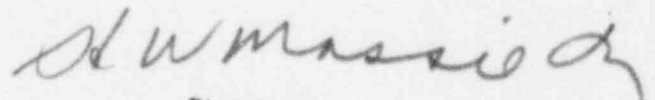
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PRELIMINARY

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NRC Research and Technical
Assistance Report



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December 1, 1980

SP-80-862

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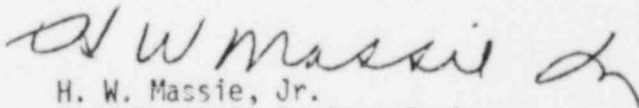
SUBJECT: FLECHT-SEASET PROGRAM
Informal Monthly Progress Report for September, 1980
CONTRACT: NRC-04-77-127, EPRI NO. RP959-1

Gentlemen:

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

Sincerely,

WESTINGHOUSE ELECTRIC CORPORATION


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

hp

Attachment

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CONTRACT NRC-04-77-127
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FLECHT-SEASET PROGRAM
INFORMAL MONTHLY PROGRESS REPORT

SEPTEMBER 1980

PROJECT MANAGEMENT - H. W. Massie, Jr.

Testing was completed on the third FLECHT-SEASET 21 rod bundle which has short, concentric flow blockage sleeves located on all heater rods in a coplanar fashion. The results illustrate that the heat transfer immediately downstream of the blockage sleeves was improved up through and beyond turnaround time, relative to both the second bundle with 9 rods blocked and to the first bundle which was unblocked.

Fabrication was completed on the fourth FLECHT-SEASET 21 rod bundle -- the first with non-coplanar blockage distribution. The fourth bundle was installed into the test facility and shakedown testing was initiated. Matrix testing will be initiated in October.

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. EPRI and NRC comments were incorporated into the text of the report.

The first three chapters of the data analysis and evaluation report have been completed in draft form. The development of the dimensionless skewed power correlation is complete. The writing of the correlation and comparison with the FLECHT data is in progress; this writeup will be incorporated in the evaluation report. Work is continued to evaluate unblocked reflood data and calculate the basic heat transfer components above the quench front. Droplet size and droplet velocity have been measured from FLECHT movies at the three housing window locations (3', 6' and 9'). A program has been written to "back calculate" the corresponding droplet size at the quench front. Droplet velocity is being calculated by two different methods: the first method assumes the drop being accelerated by drag and gravitational forces; the second method assumes the drop to be at the local terminal velocity - and then compare with data obtained from test movies in order to determine the best way to describe the droplet motion.

The statistical study of bundle distortion is being reviewed. It was discovered that results of the calculated standard deviations of the wall temperature rise (maximum wall temperature minus initial wall temperature) results in a very large fluctuation among different reflood tests. No satisfactory explanation has been found.

The steam cooling evaluation report is being reviewed in order to incorporate the comments by NRC and EPRI.

FLECHT-SEASET PROGRAM
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21-Rod Bundle Task (Task 3.2.2)

Testing of the third 21-rod bundle was successfully completed in September. The third bundle had short, concentric flow blockage sleeves located on all heater rods on a coplanar basis. The test results show that the heat transfer immediately downstream of the blockage sleeves was improved up through and past turnaround time relative to both the second bundle with 9 rods blocked and the first bundle which was unblocked. A heat transfer penalty relative to the unblocked bundle, which occurred in the top of the bundle for bundle #2 did not occur for bundle #3.

Data and heat transfer comparisons have been completed for the forced reflooding tests for all three bundles. The ratio of blocked to unblocked heat transfer as a function of time has also been completed for the forced reflood tests for all three bundles.

The data summary package for bundle #3 with all rods blocked was issued to EPRI, NRC and their respective consultants. This data package was also forwarded to KFK of Germany as part of the 21-rod bundle/FEBA data exchange. This package included data on microfiche output for 7 hydraulic characteristics tests, 4 steam cooling tests and 19 reflood tests.

The third bundle was removed from the test facility and it was found that the pin connecting the filler rods at the 6' elevation had broken as in the previous two bundles. However, due to the reduced friction between the grids and the rods in the lower half of the bundle, the fillers had separated only about 0.125" as opposed to the 2" in the previous bundles. There was also minimal bundle distortion in bundle #3 since the fillers did not bow into the bundle. The pin in the filler at the 6' elevation was made solid in bundle #4 to prevent it from shearing.

The QUENCH code for the 21-rod bundle was made operational. The QUENCH code calculates the temperature rise, turnaround time, quench time, and quench temperature for each of the heater rod thermocouples, as well as the quench front velocity. The housing thermal characteristics are presently being incorporated into the QUENCH code.

The computer code utilized in the analysis of the 161-rod unblocked bundle steam cooling tests was revised for use in the 21-rod bundle steam cooling data analysis. This data analysis is presently underway.

A modified COBRA version was made that allows simulation of fluid flow in FEBA tests with 90 percent blockage. The channel areas and gap lengths of the first bundle were measured and COBRA simulation using the measured values are in progress.

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163-Blocked Bundle Task (Task 3.2.3)

The task plan was published and transmitted to the NRC and EPRI. Heater rods will be utilized in place of the guide tube thimble heated in each of the two 21-rod bundle islands in the 151-Blocked Bundle as per the PMG recommendation. This results in a change in the total number of bundle heater rods from 161 to 163.

Systems Effects Natural Circulation and Reflood Tests (Task 3.2.7)

A design review meeting was held at EG&G on the upper plenum air/water flooding test to be conducted at EG&G. Design of the air/water facility was approved and construction was started. Fabrication of the upper plenum test internals, to be provided by W, was initiated at Forest Hills. The ground plate machining is the limiting item because of its 12 to 14 weeks delivery.

Instrumentation of small steam generator was completed. Installation of the steam generators' platform extensions are about 90% completed. Loop piping fabrication was started, and 40% of it is scheduled for delivery by the first week of October. Modifications to the containment tank were completed.

Loop instrumentation drawings for the system effects reflood and natural circulation tests were reviewed and modified. An instrument list for both tests was issued.

The single ended prototype heater rod was tested, under reflood conditions. The results showed that the 40 mil thermocouples' failure rate was less than in the previous prototype tests. The nichrome heater element performed satisfactorily during 90 thermal test cycles. Based on these results, RAMA was authorized to start construction of the single ended rods. Up to date, RAMA has manufactured about 40 non-instrumented rods. Fabrication of 180 heater rods is scheduled to be completed by the end of this year.

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

21 Rod Bundle (Task 3.2.2)

Testing of bundle No. 3 was completed on September 8, 1980 and bundle No. 4 has been installed into the flow housing.

The turbine meter electronics and the computer front end were calibrated. Fourteen heater rods for Bundle No. 5 were electrically inspected.

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163 Rod Blocked Bundle (Task 3.2.3)

Installation of the test section exhaust piping and components was completed this month. Rupture disc and safety relief valve lines are currently being installed.

Two additional heater rods are planned to be added to the bundle, replacing two thimbles. Additional steam probe instrumentation has been added, but only 23 will be hooked to the computer. Fabrication has started on the power patch panel.

System Effects (Task 3.2.7)

The bundle SCR controllers were delivered and installed. The integral wiring between the SCR units and individual rod breakers has also begun. The superheater controller has been mounted and the wiring is in progress. A partial wiring list has been completed so that the computer connectors and patch panel can be wired.

Two additional nozzles and reinforcement rings were added to the containment tank; and it was raised to its new position with the new support stand in place. Piping is estimated to be 20-40% complete with delivery expected shortly.