

NRC Research and Technical Assistance Report <sup>PRELIMINARY</sup>

Accession No. \_\_\_\_\_

Contract Program or Project Title: FLECNT SEASET

Subject of this Document: December Monthly Status Report

Type of Document: Monthly Status Report

Author(s), Affiliation and Address: H.W. MASSIE, JR. Project Engineer  
Westinghouse Electric Corporation  
P.O. Box 355, Pittsburgh, PA. 15230

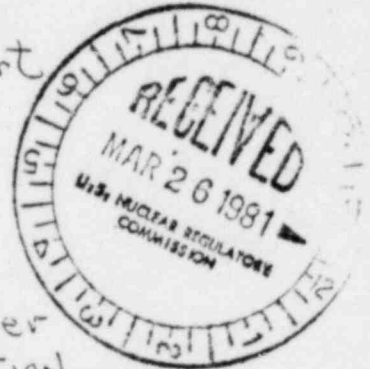
Contract No.: NRC-04-77-127

Date of Document: December 1980

Date Transmitted to NRC: 3-24-81

NRC Individual and NRC Office or Division to Whom Inquiries Should be Addressed:

L.H. SULLIVAN  
REACTOR SAFETY RESEARCH



This document was prepared primarily for preliminary or internal use. It has not received full NRC review and approval. Since there may be substantive changes, this document should not be considered final.

This Document may be made Publicly Available:

*H.W. Massie, Jr.*  
Signature  
(NRC Program or Project Sponsor or  
Authorized Contractor Official)

U.S. Nuclear Regulatory Commission  
Washington, D. C. 20555

PRELIMINARY

NRC Research and Technical  
Assistance Report

8104010780



Westinghouse  
Electric Corporation

Water Reactor  
Divisions

Box 355  
Pittsburgh Pennsylvania 15230

February 9, 1981

(FSS-81-348)

## NRC Research and Technical Assistance Report

Dr. K. H. Sun  
EPRI PMG Member, FLECHT-SEASET Program  
Safety and Analysis Department  
Nuclear Power Division  
Electric Power Research Institute  
3412 Hillview Avenue  
P. O. Box 10412  
Palo Alto, CA 94303

Dr. L. Harold Sullivan  
NRC PMG Member, FLECHT-SEASET Program  
Separate Effects Research Branch  
Division of Reactor Safety Research  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Subject: FLECHT-SEASET PROGRAM  
Informal Monthly Progress Report for December, 1980  
Contract: NRC 04-77-127, EPRI No. RP959-1

Gentlemen:

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

Yours truly,

WESTINGHOUSE ELECTRIC CORPORATION

H. W. Massie, Jr.  
Acting PMG Member  
Technology Development

HWM/sm

Attachment

Dr. K. H. Sun, 12L, 12A  
Dr. Harold Sullivan, 1L, 1A

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  
PROGRESS LETTER

Dr. T. E. Murley, Director  
Div. of Reactor Safety Research  
Nuclear Regulatory Commission  
Washington, D. C. 20555

Mr. R. F. Fraley, Executive Secretary  
ACRS  
Nuclear Regulatory Commission  
Washington, D. C. 20555

Mr. P. Litteneker  
Idaho Operations Office  
P. O. Box 2108  
Idaho Falls, Idaho 83401

Mr. L. Leach, Manager  
Semiscale Program  
INEL  
550 Second Street  
Idaho Falls, Idaho 83401

Mr. G. Sozzi  
General Electric Company  
175 Curtner Avenue  
San Jose, California 95125

Mr. John Blaisdell  
Combustion Engineering, Inc.  
Nuclear Power Department  
P. O. Box 500  
Windsor, Connecticut 06095

Dr. B. Bingham  
Babcock & Wilcox Company  
P. O. Box 1206  
Lynchburg, Virginia 24505

Mr. C. L. Mohr  
Pacific Northwest Laboratory  
Richland, Washington 99352

Mr. P. R. Davis  
Intermountain Technology  
P. O. Box 1604  
Idaho Falls, Idaho 83401

Dr. L. S. Tong, Assistant Dir. for  
Water Reactor Safety Research  
Division of Reactor Safety Research  
Nuclear Regulatory Commission.  
Washington, D. C. 20555

Dr. P. A. Lottes  
Argonne National Laboratory  
9700 South Cass Avenue  
Argonne, Illinois 60439

Dr. J. A. Dearien, Manager  
Code Verification & Applications Program  
EG&G Idaho, Inc.  
P. O. Box 1625  
Idaho Falls, Idaho 83401

Dr. Peter Griffith  
Dept. of Mechanical Engineering  
MIT  
Cambridge, Massachusetts 02139

Dr. D. C. Groeneveld  
Chalk River Nuclear Laboratories  
Chalk River  
Ontario, Canada K0J1J0

Dr. D. A. Powers  
Core Performance Branch  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Professor W. Y. Chon  
Dept. of Engineering Science  
Aerospace Engineering & Nuclear Engineering  
State University of New York  
Buffalo, New York 14214

Mr. Wayne Hodges  
Nuclear Regulatory Commission-RSB  
Washington, D. C. 20555

Mr. E. L. Halman, Director  
Division of Contracts  
Nuclear Regulatory Commission  
Washington, D. C. 20555

Dr. W. V. Johnston  
Core Performance Branch  
Nuclear Regulatory Commission-M&R  
Washington, D. C. 20555

DISTRIBUTION

- Continued -

Dr. James F. Jackson (MS-671)  
Deputy Associate Director  
NRC Programs  
Los Alamos Scientific Laboratory  
P. O. Box 1663  
Los Alamos, New Mexico 87545

Mr. R. Jensen  
Intermountain Technology  
P. O. Box 1604  
Idaho Falls, Idaho 83401

Dr. P. North, Manager  
Code Development & Analysis Program  
EG&G Idaho, Inc.  
P. O. Box 1625  
Idaho Falls, Idaho 83401

Mr. James White, Manager  
PWR BDHT Program  
Oak Ridge National Laboratory  
P. O. Box Y  
Oak Ridge, Tennessee 37830

Mr. W. Kayser  
Exxon Nuclear  
2101 Horn Rapids Road  
Richland, Washington 99352

Mr. Don Ogden  
EG&G Idaho, Inc.  
550 Second Street  
Idaho Falls, Idaho 83401

Mr. L. Phillips  
Core Performance Branch  
Nuclear Regulatory Commission-NRR  
Washington, D.C. 20555

Mr. Joel S. Gilbert (Group Q-9)  
Los Alamos Scientific Laboratory  
P. O. Box 1663  
Mail Stop 553  
Los Alamos, New Mexico 87545

Professor R. A. Seban  
Dept. of Mechanical Engineering  
University of California  
Berkeley, California 94720

Professor I. Catton  
Dept. of Chemical, Nuclear, and Thermal Engr.  
University of California  
Los Angeles, California 90024

Mr. G. F. Brockett  
Intermountain Technologies, Inc.  
P. O. Box 1604  
Idaho Falls, Idaho 83401

Dr. G. E. Dix  
Nuclear Energy Division, M/C 583  
General Electric Company  
175 Curtner Avenue  
San Jose, California 95125

Mr. K. V. Moore  
Energy Incorporated  
P. O. Box 736  
Idaho Falls, Idaho 83401

Mr. T. Charlton  
EG&G Idaho, Inc.  
P. O. Box 1625  
Idaho Falls, Idaho 83401

Dr. S. Fabric  
Nuclear Regulatory Commission-RSR  
Washington, D. C. 20555

Mr. H. Balukjian  
Core Performance Branch  
Nuclear Regulatory Commission-NRR  
Washington, D. C. 20555

#### LEGAL NOTICE

THIS REPORT WAS PREPARED AS AN ACCOUNT OF WORK SPONSORED BY THE U.S. NUCLEAR REGULATORY COMMISSION, THE ELECTRIC POWER RESEARCH INSTITUTE, INC., AND THE WESTINGHOUSE ELECTRIC CORPORATION. NEITHER THE UNITED STATES GOVERNMENT NOR ANY AGENCY THEREOF, NOR THE INSTITUTE OR MEMBERS THEREOF, NOR THE WESTINGHOUSE ELECTRIC CORPORATION, NOR ANY OF THEIR EMPLOYEES, MAKES ANY WARRANTY, EXPRESS OR IMPLIED, OR ASSUMES ANY LEGAL LIABILITY OR RESPONSIBILITY FOR ANY THIRD PARTY'S USE OR THE RESULTS OF SUCH USE OF ANY INFORMATION, APPARATUS, PRODUCT, OR PROCESS DISCLOSED IN THIS REPORT OR REPRESENTS THAT ITS USE BY SUCH THIRD PARTY WOULD NOT INFRINGE PRIVATELY OWNED RIGHTS.

FLECHT-SEASET PROGRAM  
INFORMAL MONTHLY PROGRESS REPORT  
DECEMBER, 1980

PROJECT MANAGEMENT -- H. W. Massie, Jr.

Testing was completed on the fifth FLECHT-SEASET 21-rod bundle; this was a successful result of a year-long intense effort by the Westinghouse personnel involved. The results of the first five 21-rod bundle test series will be used to select blockage sleeve shapes for the first test series of the large blocked bundle (with flow bypass) and for the next 21-rod bundle test series. A meeting for that purpose has been scheduled with NRC, EPRI, and their respective consultants for early February, 1981.

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

Unblocked Bundle Task (3.2.1)

The draft data evaluation report was completed. An unique feature of the analysis was the extensive use of droplet size and velocity data deduced from the high speed movies. Preliminary comparisons of the droplet model with drop velocity data seem to indicate that existing drag force coefficients in the literature all overpredicted the drop velocity in dispersed flow during reflood. A more detailed calculation of this radiation heat exchange in the rod bundle system was included; the results indicate that radiation to droplets was important near the quench front, and surface-to-surface radiation was more important at higher elevations. Using information obtained from the data evaluation as boundary conditions, a mechanistic reflood heat transfer model was proposed to predict the flow conditions and wall temperature transients above the quench front. At lower elevations, the wall temperatures were underpredicted, while at higher elevations, the wall temperatures were overpredicted. Work is continuing to improve the droplet model which is expected to improve heat transfer predictions.

All comments on the steam cooling report and the data report on the unblocked bundle were addressed and these reports were submitted to tech pubs for printing. The draft of the unblocked bundle evaluation report was completed and sent to the PMG.

21-Rod Bundle Task (Task 3.2.2)

Testing of the fifth 21-rod bundle was successfully completed in December. A concerted effort by Westinghouse personnel was required to achieve this objective. The fifth bundle had long, non-concentric flow blockage sleeves on all heater rods distributed on a non-coplanar basis. The valid tests included 7 hydraulic characteristics tests, 4 steam cooling tests, and 16 reflood tests. The test results show that the heat transfer immediately downstream of the blockage sleeves was improved up through and immediately past turnaround time relative to the unblocked configurations.



The data summary package for bundle #5 was prepared for EPRI, NRC, and their respective consultants. This package includes quick-look results and data on microfiche output for all 27 valid tests.

COBRA inputs for Bundle 4 (short sleeve, concentric, non-coplanar) and (long sleeve, non concentric, non-coplanar) were compiled and COBRA calculations for the bundles have been completed. These results were utilized in estimating enhancement factors.

An effort to single out a worse sleeve shape has been started. It included preparation of COBRA inputs and running the code for the large bundle with 21-rod blockage islands using three different sleeve distributions; short sleeve non-coplanar sleeve distributions with higher strains were also studied. COMPARE code has been modified to calculate estimated heat transfer coefficients for the large bundle from the 21-rod bundle test results and COBRA calculations.

#### 163-Blocked Bundle (Task 3.2.3)

No activity this month.

#### Systems Effects Task (Task 3.2.7)

Fabrication of the upper plenum internals for the Air/Water Flooding Test to be performed by EG&G were completed except for the aluminum ground plate. This plate is being machined by an outside vendor who is having problems with his tape controlled boring machine. All the internals will be shipped to EG&G for assembly. EG&G has completed the construction of the Air/Water loop, and shakedown tests will start next month.

The downcomer was finally received from the fabricator and installation of the loop piping and components was started.

Heater rod fabrication by RAMA is in progress. Up to date, 129 non-instrumented and 12 instrumented rods have been fabricated and shipped to ORNL for infrared scanning, inspection. Westinghouse Quality Control has started inspection of 30 non-instrumented rods. Rod fabrication is scheduled to be completed by January, 1981.

Pipe assembly and piping detail drawings were issued to the NRC, EPRI, and their respective consultants.

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

#### 21-Rod Bundle (Task 3.2.2)

Bundle #5 testing was completed 12/17/80. The facility will be inactive for approximately two months while blockage sleeves for bundle #7 are being fabricated and bundle #7 is being assembled.

### 163-Rod Blocked Bundle (Task 3.2.3)

Installation of the downcomer was completed. Installation of the housing lateral brace is currently in progress.

### System Effects (Task 3.2.7)

The computer patch panels have been fabricated and are presently being installed into the control cabinets. The computer connector wiring is approximately 75% complete. The computer software specification has been issued for the Systems Effect Test.

The vertical portion of the downcomer was installed and will be completed when the housing is permanently fixed. The broken hot leg piping is in place and will be field fitted as soon as the work is completed on the downcomer.

Thirty (30) non-instrumented heater rods have been received from ORNL and are presently being inspected.