Accession No. _____

Contract Program or Project Title: SSC Code Development & Validation

Subject of this Document: SSC Project Highlights for June 1979

Type of Document: Monthly Highlight Letter

Author(s): A. K. Agrawal/J. G. Guppy
Department of Nuclear Energy
Brookhaven National Laboratory
Upton, New York 11973

Date of Document: July 17, 1979

Responsible NRC Individual and NRC Office or Division: Dr. Robert T. Curtis, Chief
Analytical Advanced RSR Branch
Division of Reactor Safety Research
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Brookhaven National Laboratory
Upton, NY 11973
Associated Universities, Inc.
for the
U.S. Department of Energy

Prepared for
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555
Under Interagency Agreement EY-76-C-02-0016
NRC FIN No. A-3015-8

343

458

INTERIM REPORT

NRC Research and Technical Assistance Report

17

SSC Project Highlights

for

June 1979

PROGRAM: SSC Code Development and Validation

NRC Research and Technical Assistance Report

J. G. Guppy, Acting Group Leader

Code Development and Verification Group
Engineering and Advanced Reactor Safety Division
Department of Nuclear Energy
Brookhaven National Laboratory
Upton, New York 11973

This is the monthly highlights letter for (1) The SSC Code Development and (2) SSC Code Validation Programs, Fast Reactor Safety Assessment, for the month of June, 1979. These programs are covered under the budget activity number 60-10-20-01. Only major accomplishments are noted in this letter.

A. CODE DEVELOPMENT (J. G. Guppy)

I. SSC-L Code (J. G. Guppy)

1. Studies on Piping Model (I. K. Madni)

The influence on the transient outlet temperature response from a piping section of axial nodalization in the coolant, wall model in SSC was examined. Also, established correlations for the calculation of the Nusselt number were compared, and the impact of their uncertainties on overall heat transfer coefficients was evaluated.

2. Effect of Check Valve Operation (I. K. Madni and E. G. Cazzoli)

The influence of check valve operation on system reponse was examined. The transient considered was an electrical bus fault event, which caused trip of pumps in one heat transport loop, followed by delayed scram and trip of the remaining pumps. A working (as opposed to failed, i.e. struck open) valve yields an 18K higher maximum coolant temperature in the fuel zone. However, in both cases, there is ample margin to boiling. For a severe pipe break occurring near reactor vessel inlet, an operating check valve was seen to be unable to mitigate the transient severity.

3. Plant Protection and Control Systems (M. Khatib-Rahbar)

An information exchange meeting was held with the CRBRP project office and WARD staff at Oak Ridge on June 7, 1979 regarding the PPS-PCS design status.

The CRBRP project office will be releasing the reports that we had requested and, furthermore, they agreed to discuss any future problems regarding our efforts at BNL.

4. Multidimensional Effects in LMFBR Piping Systems (M. Khatib-Rahbar)

The pipe thermal transient calculations are now completed. A detailed comparison between the SSC-L type 1-D model and the PNL 3-D calculations show very close agreements for both adiabatic and non-adiabatic pipe wall. Thus, it is concluded that the impact of multidimensional effects in LMFBR piping are rather insignificant and can justifiably be neglected for large system simulation studies.

5. Sodium Boiling (R. Pyare and T. C. Nepsee)

The boiling modules were made current with the latest cycle of SSC-L. The coding modifications to include effects of wire-wrap and hex can structure were partially debugged.

6. User Support (J. G. Guppy, R. J. Kennett, and S. F. Carter)

A staff member from the Gesellschaft fur Reaktorsicherheit in Cologne, West Germany is currently at BNL. Assistance is being given to (1) enable a simulation of the SNR-300 using the SSC-L code and (2) to improve the adaptability of SSC-L on an IBM operating system.

An NRC summer staff member was given a two day briefing on SSC-L usage. This person will be involved in transient simulations for a number of run matrix related cases.

7. Code Management (R. J. Kennett)

During June a major effort was made to consolidate all pending modifications to the 'L' version of SSC and, with these changes, advance the code to CY-31. This cycle of the code will be released shortly under the title SSC-L, VERS-002. It is expected that this code will remain fixed for several months.

II. SSC-P Code (I. K. Madni)

1. Code Development (E. G. Cazzoli and I. K. Madni)

The tank energy balance module has been coded and is ready for debugging with the latest SSC cycle.

2. Code Management (S. F. Carter)

Work was completed to make the SSC-P code modules current with the latest cycle of SSC-L.

III. SSC-W Code (J. G. Guppy)

1. Code Initialization (T. C. Nepsee and J. G. Guppy)

Modifications to the SSC-L code logic in the steady-state segment were completed, which successfully decouple the present LMFBR primary loop and IHX modules. The reactor vessel for the SSC-W code will be connected to the intermediate loop piping logic in the SSC-W code. The deletion of the primary loop HTS in SSC-L was selected as the most expeditious path to pursue, due to complexities in the steam generator sodium-side logic, which are already in place in SSC-L. Also, the pressurizer will be located where the LMFBR secondary pump tank used to be. A steady-state run to test these logic changes (using LMFBR input data) was successfully completed.

458 346

2. PWR Primary Loop Hydraulics (I. K. Madni)

The approach to modeling the PWR primary system hydraulic analysis as a modification of the model in SSC-L was outlined in an internal memo.

3. Pressurizer Model (G. J. Van Tuyle)

A stand-alone pressurizer model has been developed and verified, to a limited degree. While further verification as well as some minor adjustments in the model are required, the current version can be fitted into SSC without extensive modification.

4. Steam Generator Modeling (W. L. Weaver and R. K. Kennett)

Much work was expended in determining all of the changes which will be required in order to simulate the B&W steam generator. Two memos were written describing these changes. The first was a general summary of all the changes which would be required while the second discussed some of these changes in more detail.

The changes which place the primary fluid on the tube side of the heat exchanger have been coded and tested for a CRBR type once-thru steam generator. A data deck for the B&W steam generator is being prepared and will be tested shortly.

5. Plant Data (R. Pyare and E. S. Srinivasan)

Collection of data for the TMI-2 plant was continued. The data for reactor vessel, steam generator, pressurizer, primary loop and secondary loop are mostly completed. Primary pump characteristics are being curve fitted.

IV. SSC-S Code (W. L. Weaver)

1. Inter-Assembly Heat Transfer (G. J. Van Tuyle)

The American Nuclear Society Meeting in Atlanta provided an opportunity to review other efforts in this area and to converse extensively with Dr. Ehsan Khan (PNL), the original developer of the ENERGY code series. It became clear that the SSC-S work is very much on the frontier of the LMFBR core transient modeling effort when we consider inter-assembly heat transfer at low flow conditions. Again, it appears that efforts using the porous body models are the most promising in this area.

Dr. Khan has requested, and has received, access to the SPAC code (steady-state porous-body assembly code), which was derived from the ENERGY-III code. He is particularly interested in the matrix equation solution algorithm which is approximately thirty-five times (for a 42 channel case) faster than his original scheme. We hope to receive, in exchange, access to some of the LMFBR assembly-and core-transient codes that he is working on.

B. CODE VALIDATION (J. G. Guppy)

I. FFTF Simulations (L. G. Epel, R. J. Kennett and W. L. Weaver)

The input deck used until now to debug the DHX coding in the FFTF version of SSC-L has been completely updated and refined. The development of the new input deck is in preparation for simulations of the acceptance test series 5A008, i.e., loss of electric power transients starting from various reactor power and flow rate combinations.

In order to do meaningful comparisons between anticipated test data and the results of the simulations, a rather detailed 19 channel representation of the core is being used instead of the 2 channel model that has been utilized up until now. Also, the description of the primary and secondary heat transport systems has been improved, particularly, with respect to elevations of the various pipes and components. Testing of the new input deck is proceeding.

The FFTF version of SSC-L was brought up to CY30 and was used to generate the initial steady-state conditions for the natural circulation acceptance tests. The agreement between the specified and calculated conditions was good. A summary discussing this work was prepared and submitted for the ANS Winter Meeting

DISTRIBUTION

R. T. Curtis, NRC	
W. Gammill, NRC	3 copies
W. Y. Kato, BNL - 1B	5 copies
C. N. Kelber, NRC*	
H.J.C. Kouts, BNL	
P. M. Wood, NRC	3 copies
RSP Division Heads, BNL	
RSP Group Leaders, BNL	
Division of Technical Information and Document Control*	2 copies

*via W. Y. Kato's Office

458 349