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SSC Project Highlights

for

March 1981

PROGRAM: SSC Code Development, Validation and Application

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Code Development, Validation and Application Group

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NRC Research and Technical Assistance Report

This is the monthly highlights letter of (1) the SSC Code Development and (2) SSC Code Validation Programs, Fast Reactor Safety Assessment, for the month of March 1981. These programs are covered under the budget activity number 60-19-01-40. Only major accomplishments are noted in this letter.

A. CODE DEVELOPMENT (J. G. Guppy)

I. SSC-L Code (G. J. Van Tuyle)

1. In-Vessel Energy Calculations (W. C. Horak)

A banded matrix solver was added to the SSC in-vessel energy calculation package. In tests on long null transients, the fully implicit weighted residuals scheme required approximately half as much computing time as the present finite difference method. When the weighted residuals procedure was tested on a natural circulation transient, mismatches were uncovered with the reactivity feedback calculations from the fuel. The reactivity package is now being updated to make it compatible with the heat conduction calculations.

2. Steam Generator Modeling (G. J. Van Tuyle, T. C. Nepsee)

Debug testing of the revised steady-state calculations, containing the new network solver, has progressed through those areas containing the most extensive revisions. As expected, most problems have been related to data structures carried over from previous versions of the steam generator.

The coding changes required to incorporate the flow reversal modifications into SSC are in the planning stages. The actual models have already been tested on a stand-alone basis. This process will involve three major tasks: (1) deleting the present code and data structure, where appropriate, that implemented the old flow segment calculations, (2) adding the new flow segment package, using efficient matrix techniques, and (3) switching to more generic boundary conditions. Flexibility is being included in all of these modifications to facilitate coupling with the balance-of-plant representations in the near future.

3. LMFBR Accident Progression Analysis (K. M. Jamali)

Work is continuing on categorization of protected transients in LMFBRs. Based on the latest conditional human failure data in the maintenance area, the biggest contributor to the SHRS unavailability comes from dependent maintenance faults.

4. User Support (T. Iwashita - PNC, R. J. Kennett, J. G. Guppy)

The steady-state solution (i.e., overall plant heat balance calculation methods), integration method and timestep control are being investigated in order to modify the straight-tube steam generator representation to helical-coil tube steam generators. After this, those subroutines which need to be modified will be addressed.

II. SSC-P Code (M. Khatib-Rahbar)

1. Low Heat Flux Sodium Boiling (M. Khatib-Rahbar)

An empirical dryout correlation was incorporated into the boiling model. Sample calculations indicate dryout and rewet of the channel during flow oscillation, and permanent dryout at the time of establishment of single-phase superheated vapor flow at the channel outlet.

A draft report describing the boiling model is in preparation.

2. Code Maintenance (R. J. Kennett)

Modification of SSC-P to make it compatible with SSC-L, Cycle 34, is continuing.

III. SSC-S Code (B. Chan)

1. Direct Reactor Auxiliary Cooling System (DRACS) (B. Chan)

Coding work to implement the DRACS model into SSC has been completed. The test data input deck is being prepared. Debug and test runs will start shortly.

B. CODE VALIDATION AND BOP MODELING (J. G. Guppy)

1. FFTF Natural Circulation Tests (J. G. Guppy)

Guppy (BNL) visited at HEDL late this month and obtained the plant data for the first two natural circulation acceptance tests (i.e., from 5% power, 75% flow and 35% power, 75% flow) for many system variables. The data, which have been reduced to engineering units, were supplied in graphical form. A request was made to supply more detailed data from certain flow rates and pump speeds as well as the plant power operating history so that the post scram decay heat can be determined.

It was also learned th . ll four natural circulation tests (i.e., the tests from 75% power, 75% flow and 100% power, 100% flow) have now been completed.

2. Balance of Plant Modeling (G. J. Van Tuyle, W. C. Horak)

The balance of plant (steam cycle) in five plant types: LMFBR, HTGR, GCFR, PWR and BWR have now been reviewed. The BOP in these plants have many components in common, although the linkages differ considerably. It is concluded that while further modeling of certain components, such as the turbine, may be required, the major task seems to lie in providing sufficient flexibility in linkages. For this reason, much of the recent effort involving improvements to the SSC steam generator package, principally in the steady-state network solver and the supporting data structure, have been done with the BOP modeling/linkages in mind.

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