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INTERIM REPORT

Project Highlights

for

June 1982

PROGRAM: A. SSC Development, Validation and Application (FIN No. A-3015)
B. Generic Balance of Plant Modeling (FIN No. A-3041)

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This is the monthly highlights letter for (A), the Super System Code (SSC) Development, Validation and Application Program and (B) the Generic Balance of Plant (BOP) Modeling Program for the month of June 1982. These programs are covered under the budget activity number 60-19-01-40. The SSC Development, Validation and Application Program is currently focused to provide direct support to the on-going CRBRP licensing activities within NRC.

A. SSC DEVELOPMENT, VALIDATION AND APPLICATION (J.G. Guppy)

I. SSC-L Code (M. Khatib-Rahbar)

1. Loss of Feedwater Transient for CRBRP (W.C. Horak, G.J. Van Tuyle)

To evaluate steam generator dryout time an LOHS test case is being run which simulates total loss of feedwater to the CRBR steam generators. An input deck has been prepared and initial testing begun.

2. Pipe Break Analysis (B.C. Chan, J.G. Guppy)

Test cases for CRBR simulating double-ended pipe breaks in the hot leg between the pump and IHX are being conducted.

3. User Support (T.C. Nepsee)

A number of code revisions have been developed to correct the IBM FORTRAN incompatibility problems existing in the SSC-L Version 3.0 (CY 40) steam generator input processor. The revisions have been tested locally and a copy sent to (GRS/Germany) for installation and testing there. Final installation of the revisions in SSC-L will be made pending concurrence with GRS.

4. IBM Computer Access (T.C. Nepsee)

Access to an IBM 370 computer is available through United Information Services, a time-share computer service located in Pennsylvania. The BNL Nuclear Data Center currently makes regular use of this service for testing its export code versions in an IBM environment. It is recommended that a similar practice be adopted as part of the testing procedure for future versions of SSC.

5. MINET (T.C. Nepsee)

Several code revisions have been made to improve the modularity of the current MINET now embedded in SSC-L, in preparation for the production of a stand-alone version.

II. SSC-P Code (E.G. Cazzoli)

1. Code Maintenance (E.G. Cazzoli)

Due to the focusing of this program to provide direct support for the CRBRP licensing activities, work on the SSC-P code has been slowed. However, modification of SSC-P to maintain its compatibility with the latest cycle of the SSC program library is continuing, but on a reduced level.

III. SSC-S Code (B.C. Chan)

1. Improved Upper Plenum Modeling (B.C. Chan)

A basic, limited scope thermal/hydraulic code is under development and modification. This code will serve as the groundwork for the upper plenum thermal/hydraulic phenomena studies. The mathematical modeling for internal solid structure, from a porosity and distributed resistance viewpoint, is being introduced into the code. The distributed resistance terms are incorporated into the momentum equations to account for the resistance characteristics of the upper plenum flow in the different flow directions. The porosity terms are incorporated into the surfaces of the control volume to account for the mass and heat fluxes across the surfaces.

IV. SSC Validation (W.C. Horak)

1. Simulation of FFTF Natural Circulation Tests (W.C. Horak, R.J. Kennett, E.G. Cazzoli)

With the completion of several long term simulations of the FFTF natural circulation tests, some conservative assumptions are being removed in order to obtain a best estimate simulation. Specifically, the reactor pressure drop was reduced to its nominal value from the 120% of nominal used in the safety model. Additionally, the pump frictional torque characteristic was also changed to a nominal value. The 100% and 75% tests are now being simulated with these changes.

B. GENERIC BALANCE OF PLANT MODELING (J.G. Guppy)

The Generic Balance of Plant (BOP) Modeling Program deals with the development of safety analysis tools for system simulation of nuclear power plants. It provides for the development and validation of models to represent and link together BOP components (e.g., steam generator components, feedwater heaters, turbine/generator, condensers) that are generic to all types of nuclear power plants. This system transient analysis package is designated MINET to reflect the generality of the models and methods, which are based on a momentum integral network method.

1. BALANCE OF PLANT WORKSHOP (G.J. Van Tuyle, J.G. Guppy)

Balance of plant modeling efforts at EPRI, EG&G, LANL, GE, EI, and BNL were discussed at a balance of plant workshop held at INEL (Idaho Falls) on June 3. Computer codes discussed included RELAP5, TRAC-BWR, TRAC-PWR, MMS (EPRI), RETRAN, and MINET. Of the codes discussed, MMS was clearly the furthest along in development. The principal limitation of this code is the use of coarse lumped parameter models that are generally "tuned" to match the correct initial conditions before any transient conditions are simulated. General consensus of the group was that MMS models would be relatively accurate near the initial conditions, but suspect under accident conditions (i.e., when the system state moves away from the initial conditions).

An initial effort to incorporate balance of plant models into RETRAN resulted in very long run times, suggesting that the use of LOCA codes for BOP analysis may be an overkill.

In the RELAP5 presentation, several approaches were postulated for representing the balance of plant. In the short term, they intend to represent the BOP using their control systems options. Since this appears to be an approach with limited potential, another possibility is the use of MINET for the BOP analysis.

With MINET providing greater modeling detail than MMS, and suppressing sonics locally (the cause of the problems with RETRAN), it appears to provide the best opportunity for accurate, real time simulation of the BOP under accident conditions.

2. MINET Input Decks (G.J. Van Tuyle)

MINET Deck C-3, which includes the superheater outlet check valve, was documented and released for general usage. Clinch River one loop data decks that are not documented are now being phased out.

3. MINET Code Improvements (G.J. Van Tuyle, T.C. Nepsee, E.G. Cazzoli)

The new submodule designed to compute pump head for the MINET code was tested satisfactorily. In the process, a new set of coefficients for homologous curves was derived for single-phase, centrifugal pumps with specific speed in the range of 1400 to 2200. The more generalized model now computes the pump head utilizing eight curves.

The process of debugging the three-region accumulator model was suspended when a much simpler approach became apparent. The new approach involves using two of the currently in-place accumulators; one separated and one homogeneous, with a short, stubby pipe in between. Some modifications have to be made to represent the resulting partial cylinders, but they are minor compared to those needed using the old approach.

We are considering using the current heat exchanger model to represent condensers and feedwater heaters, in addition to steam generators. This process will require adjustments/refinements in network and heat exchanger calculations, but has several advantages over developing separate models for these components.

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