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INTERIM REPORT

Project Highlights

for

October 1982

PROGRAM: A. SSC Development, Validation and Application (FIN No. A-3015)
B. CRBR 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 CRBR Balance of Plant (BOP) Modeling Program for the month of October 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. CRBRP Accident Analyses (W.C. Horak, M. Khatib-Rahbar, E.G. Cazzoli, R.J. Kennett)

An improved 4-channel, 1-loop input deck was prepared for a proposed confirmatory analysis of F-2 type events, based on WARD-D-0308 information.

Boiling tests were performed for a loss-of-heat-sink transient with a 5-channel, 1-loop heterogeneous core CRBR data deck, with operating check valves and one primary pony motor at 7.5% of rated pump speed. Using extrapolated information on decay power levels, it was shown that the hot blanket channel initiated and sustained boiling after approximately 2-1/2 hours into the transient. This test will be rerun when more accurate decay heat data is available.

Modifications were made to the primary loop piping input data for CRBR on the basis of isometric drawings submitted by the Project Office. The revised input will be used with the new seven channel heterogeneous core deck in the SSC evaluation of WARD-D-0308.

2. Intra/Inter-Assembly Effects (M. Khatib-Rahbar, E.G. Cazzoli)

A small, stand-alone test program is being written for a flow redistribution model inside a rod bundle due to thermal buoyancy. Comparison with the SPAC code will be performed in order to assess the viability of incorporating the model in SSC for intra-assembly effects.

3. Color Graphics Capability (R.J. Kennett)

The new color plotter at BNL has been tested using the stand-alone upper plenum code. These tests have shown color plotting to be useful in the depiction of isotherms and velocity distributions in the upper plenum. Future tests will include evaluation of the plotter's ability to do "snapshot" plots.

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

1. Code Maintenance (E.G. Cazzoli)

Due to the continued focus 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)

The porosity and distributed resistance model for the conservation equations of fluid motion and energy transfer has been completed. Coding will start shortly. Initial testing using the CRBRP upper plenum simulation without internal solid structure has been conducted.

IV. SSC Validation (W.C. Horak)

1. FFTF Natural Circulation Tests (W.C. Horak, R.J. Kennett)

The 5% power, 75% flow FFTF scram to natural circulation test was simulated for a total of 360(s) using a detailed 2-loop, 19 channel model. While the experimental data for this case is relatively sparse compared to the other tests, the FOTA temperature distributions as calculated by SSC were in good agreement with the experimental data. This completes the SSC comparisons for the short term simulations to the FOTA data for the FFTF natural circulation tests. A report covering these SSC simulations of all four natural circulation tests will be issued shortly.

A long term simulation of the 100% power test was extended to 1800(s). Preliminary comparisons with the experimental data indicate that while the primary temperatures and flow rates are in good agreement with the experimental data, secondary loop variables are not. A discrepancy in the time to reach the first temperature peak in the secondary hot leg has been noted. Preliminary analysis indicates that SSC predicts this peak about 200(s) early compared to experimental data. However, the SSC simulation peak time is in good agreement with that expected on the basis of the experimentally measured secondary flow rate (which is in good agreement with the SSC values). Discussions are being held with HEDL staff to resolve this difference.

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

The CRBR 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 of direct application for the CRBRP, but at the same time are also 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 Models (G.J. Van Tuyle, T.C. Nepsee)

Modifications are now being made to the MINET program library to allow feedwater heaters and condensers to be represented, using an extended form of our current heat exchanger model. Modeling improvements are essentially complete, and most of the necessary coding changes have been developed.

The turbine model that we are planning to incorporate in MINET was reviewed to determine what type of code modifications will be involved. At this point, it appears that steam table functions for entropy will have to be acquired and/or developed. In general, it appears that the turbine model can be incorporated without extensive code modifications.

The (water cooled) condenser normally operates at very low pressures, and modeling it involves using our steam table functions at or beyond their fitted ranges. Therefore, we have acquired the latest version of the TRAC code, and are planning to extract its recently developed low pressure steam table functions for incorporation in MINET.

2. MINET Code Improvements (G.J. Van Tuyle, T.C. Nepsee)

The development of coding changes needed to incorporate the feedwater heater and condenser models into MINET is nearly complete. We expect to begin applying these changes to the MINET code library in the near future.

The stand-alone version of MINET has been placed on a separate UPDATE program library and a corresponding LGO file has been compiled. A set of segmented loader directives has been written and a test loading sequence has been performed to verify the absolute core image structure. This process was completed despite the emergence of a CDC loader software error which initially caused difficulties during the loading process.

3. MINET Applications and Validation (G.J. Van Tuyle)

Two test series are being planned for the EBR-II reactor in Idaho. The first test series, scheduled to begin next summer, is a set of approximately 50 natural circulation test transients. The second test series entails long term testing of alternate heat exchanger units, which

will be switched into the EBR-II system in place of existing steam generators. The EBR-II staff in Idaho and at ANL would like to have SSC/MINET pre-test analysis of the natural circulation transients and are considering utilizing the MINET heat exchanger model for the analysis of the alternate heat exchanger units.

With regard to the heat exchanger analysis, the EBR-II staff is interested specifically in the helical coil heat exchanger model in MINET. They are currently developing their own models for these relatively intricate units, but face "critical path" time constraints and are considering extracting the MINET model instead.

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