NUREG/IA–0144

International Agreement Report

Assessment of RELAP5/MOD3.2 With the Semiscale Natural Circulation Experiment, S–NC–8B

Prepared by
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Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
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Prepared as part of
The Agreement on Research Participation and Technical Exchange
under the International Thermal-Hydraulic Code Assessment and Maintenance Program (CAMP)

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Abstract

The predictability of RELAP5/MOD3.2 code is assessed for the natural circulation induced by small break loss of coolant accident in the pressurized water reactor by using Semiscale experiment S-NC-8B. The major thermal-hydraulic phenomena observed in the experiment are investigated to evaluate the code predictability for SBLOCA specific thermal-hydraulic phenomena. The Semiscale Mod-2A facility is modeled, as a base case, by using single core channel model. The base case calculation is executed, the result is compared with the experiment data and code predictability on the important thermal-hydraulic phenomena is discussed.

Sensitivity calculations are attempted to figure out the problems in base case prediction, and to find out the effects of two core channel model and ECCMIX component model on the improvement code predictability. The important thermal-hydraulic phenomena include system depressurization, break flow in saturated and stratified conditions, natural circulation in two-phase mode and reflux mode, loop seal behavior at crossover legs, and accumulator injection behavior. The base calculation shows the RELAP5/MOD3.2 can predict the overall thermal-hydraulic behavior such as system depressurizarion, with the exception of underprediction of saturated break flow, deviation of loop seal behavior, and resultant discrepancy in core thermal response. Two core channel model can improve the predictability on loop seal behavior.

ECCMIX component can improve an early accumulator injection behavior and core thermal response. However, discontinuous accumulator injection is one of the problems in two core channel model calculation. To resolve the accumulator injection problem, the extensive modeling study and/or code model improvement are needed.

Executive Summary

This document describes an assessment of RELAP5/MOD3.2 code with the Semiscale experiment S-NC-8B. The S-NC-8B experiment simulated a small break loss-of-coolant accident (SBLOCA) without pumped emergency core cooling flow and with recovery procedure using steam generator feed-and-bleed and pressurizer power-operated-relief-valve. The natural circulation flow was a main cooldown mechanism before the recovery procedure.

To evaluate the code predictability for SBLOCA specific thermal-hydraulic phenomena, the major thermal-hydraulic phenomena observed in the experiment were firstly investigated. Those phenomena included the blowdown depressurization in subcooled mode and two-phase mode, the break flow in single, two-phase, and transitional regime, under stratified condition, the natural circulation in single, two-phase, and reflux mode, the loop seal formation and clearing, the associated core heat-up, etc.

The Semiscale Mod-2A facility was modeled as suitable for simulating the experiment, based on the available information on the design and test and on the existing experiences. In preparing the base case input, single core channel model, a stem leak model during steam generator isolation period, a realistic break model using motor valve, etc. were implemented.

The base case calculation was executed, the result was compared with the experiment data, and the code predictability on the important thermal-hydraulic phenomena was discussed. Sensitivity calculations were attempted to identify the problems in prediction, and to find out the effects of two core channel model (Case T01) and ECCMIX component model (Case E01) on the improvement of code predictability. The analysis result are summarized as follows :

1) System depressurization, break flow in saturated and stratified condition, loop seal behavior, natural circulation in two-phase mode and reflux mode, core thermal response, and accumulator injection behavior were selected as the important thermal-hydraulic phenomena in this assessment.

2) As a base case, one RELAP5 calculation input was developed with adopting single core channel model, steam leak model, etc. And for investigating nodalization sensitivity, additional two RELAP5 calculation input were developed using two core channel model

and ECCMIX component model, respectively.

3) RELAP5/MOD3.2 can predict well the overall thermal-hydraulic behavior such as system depressurization and natural circulation through the loops during S-NC-8B experiment, using base case modeling. However, some discrepancies were observed in underprediction of saturated break flow, deviation of loop seal behavior, and resultant discrepancy in core thermal response.

4) Two core channel model can improve, especially, loop seal behavior and resultant core thermal response. However, it was found that discontinuous accumulator injection was yet one of the most challengible problem in two core channel model calculation.

5) ECCMIX component, to some extent, can also improve an early accumulator injection behavior and core thermal response. However, it cannot basically resolve the accumulator injection problem in this slowly-depressurizing transient.

6) Based on the base case calculation and sensitivity study, the current RELAP5/MOD3.2 code with two core channel model and ECCMIX component model has a capability to predict SBLOCA specific phenomena with some consideration on modeling. However, accumulator injection problem should be resolved through the extensive modeling study and/or code model improvement.

List of Content

List of Tables

List of Figures

I. Introduction

The RELAP5/MOD3 [1] code has been extensively used for various areas in reactor safety research since it was developed under the auspices of United States Nuclear Regulatory Commission (USNRC) and by the international effort through the International Code Assessments and Applications Program (ICAP) and Code Applications and Maintenance Program (CAMP). Korea, as one of the CAMP member countries since August 1993, has a responsibility to conduct and report code assessments, as specified in the Agreement on CAMP between USNRC and Korea Institute of Nuclear Safety (KINS).

This report describes an RELAP5 code assessment conducted in KINS, as an in-kind contribution in accordance with the Agreement. The RELAP5/MOD3.2 [2] code was assessed by using the Experiment S-NC-8B [3] of the Semiscale Mod-2A facility [4].

The RELAP5/MOD3.2 code was developed by Idaho National Engineering Laboratory (INEL) and released to CAMP member countries in 1994. It is reported that the RELAP5/MOD3.2 was improved in some thermal-hydraulic(TH) models including condensation model, when compared to the previous versions of RELAP5/MOD3 [5]. It is, however, likely that, the up-to-date validations of the current RELAP5/MOD3.2 were not sufficient to confirm the reliability of the code. And it is still questionable that the major problems reported for the previous version of code are resolved during the development of the current code.

The present study aims to assess the capability of RELAP5/MOD3.2 in predicting the major TH phenomena specific to Small Break Loss-Of-Coolant Accident (SBLOCA) in pressurized water reactor (PWR), using the S-NC-8B experiment.

The experiment S-NC-8B was conducted at the Semiscale facility to simulate a transient natural circulation induced by 0.4 % equivalent SBLOCA at decay heat power level. Besides natural circulation, the various TH phenomena such as heat removal by steam generator (SG) feed-and-bleed operation and cooldown of primary system by opening pressurizer power operated relief valve (PORV), were observed, which might be occurred at typical PWR in this kind of accident. Since there were so many complicated TH phenomena observed in the experiment [3], the important TH phenomena to be focused in this study were defined. Those phenomena included the blowdown depressurization in subcooled and two-phase

mode, the break flow in single-phase, two-phase, and transitional regime under stratified flow condition, the natural circulation in single-phase, two-phase, and reflux mode, the loop seal formation and clearing, the associated core heat-up, and the effect of accumulator injection. The code predictability will be discussed for the selected TH phenomena.

The S-NC-8B experiment has ever been simulated with RELAP5/MOD1 by Wong and Kmetyk [6] and Loomis and Kulberg [2]. The predictions in both simulations were limited to *2000 sec* from the initiation of the test. Therefore, the code predictability could not be evaluated for the major thermal-hydraulic phenomena after *2000 sec* such as loop seal clearing, core heat-up and quenching, accumulator behavior, etc. In this study, the prediction on those phenomena was also discussed.

A RELAP5 input model from Wong and Kmetyk's study [6] was adopted in this study as a base case, which employed a single core channel model. And then some modifications were made to the input deck, which included a steam leak model incorporation, which was discussed in Kmetyk's study [6], a realistic break model using motor valve, etc., as well as changes for RELAP5/MOD3 syntax.

Sensitivity calculations are attempted to figure out the problems in base case prediction, and to find out the effects of two core channel model (Case T01) and ECCMIX component model (Case E01) on the improvement of code predictability.

The Chapter II of this document includes the description of the Semiscale Mod-2A facility and S-NC-8B experiment. The modeling of the facility and experiment sequence were described in Chapter III. The Chapter IV was devoted to present and discuss the results from the base calculation and sensitivity study. The run statistics was also described in Chapter IV. The conclusions obtained through the present study were summarized in Chapter V. The Appendice to this document contain RELAP5 input listings for the cases calculated in this assessment.

II. Description on Facility and Experiment

II.1 Facility Description

The Semiscale Mod-2A facility was an experimental facility with a volume-scale of *1/1600* relative to a typical Westinghouse type four loop PWR [4]. Overall configuration was shown in Figure 1. The system incorporates the major components of a PWR including steam generators, vessel, pumps, pressurizer and loop piping. One loop (intact loop) is scaled to simulate the three intact loops in a PWR, while the other (broken loop) simulate the single loop which a break is assumed to occur. Geometric similarity has been maintained between a PWR and the facility, most notably in the design of a full length (*3.66 m*) electrically heated core with *25* rods, full length upper head and upper plenum, component layout, and relative elevations of various components. The scaling philosophy followed in the design of Mod-2A system preserves most of the first order effects considered important to small break loss of coolant accident (SBLOCA). To achieve this philosopy, the *1:1* elevation scaling of the system was kept in the design, which is an important criterion preserving the factors influencing natural circulation phenomena.

The important features Semiscale Mod-2A facility for the natural circulation (NC) tests are as follows :

1) The broken loop pump was installed, but it was used only for heat-up purpose and the pump rotor was locked during test.
2) Normally, the Semiscale Mod-2A system includes an intact loop pump; however, this was removed and replaced with a special instrument spool piece. This spool piece was orificed to represent the scaled hydraulic resistance of a PWR primary pump in the locked rotor situation.
3) The vessel was modified from the normal Mod-2A configuration for the test S-NC-8 by removing the vessel upper head. A bypass line between the upper plenum and downcomer was installed with the properly scaled hydraulic resistance. This was necessary to ensure a uniform heat-up of the entire system and to avoid condensation on upper head structures.
4) The vessel core consists of a *5x5* array of internally heated electric rods, *23* of which were equally powered. The heated length and outer diameter of the rods were *3.66 m* and *1.072 cm*, respectively.

5) The broken loop also contains a break assembly that is designed to simulate a centerline break. It includes an orifice plate which provides a break area of *0.009 cm^2* (*0.4 %* break).

6) The intact loop steam generator has two short, two medium and two long tubes representative of the range of bend elevations in a typical PWR steam generator For the volume scaling of the secondary side, the arrangement of tubes were designed to be "off-center."

7) The broken loop steam generator has a long tube and a short tube. The tube stock is *2.22 cm* OD, *0.124 cm* thickness wall and tube spacing is *3.175 cm* triangular pitch, which was identical to a typical PWR.

8) Elevations of steam generator nozzles, plenum and tubes are similar to those of a PWR; however, the steam dome is shorter than PWR steam dome.

9) External heaters were installed on vessel and loop piping to compensate environmental heat loss and controlled to maintain fluid temperature.

10) For measuring the unique characteristics such as low flow in natural circulation test, turbine meters and drag screen were ranged as low as reasonably possible. And several thermocouples was provided to instrument extensively the steam generators both of the intact loop and the broken loop.

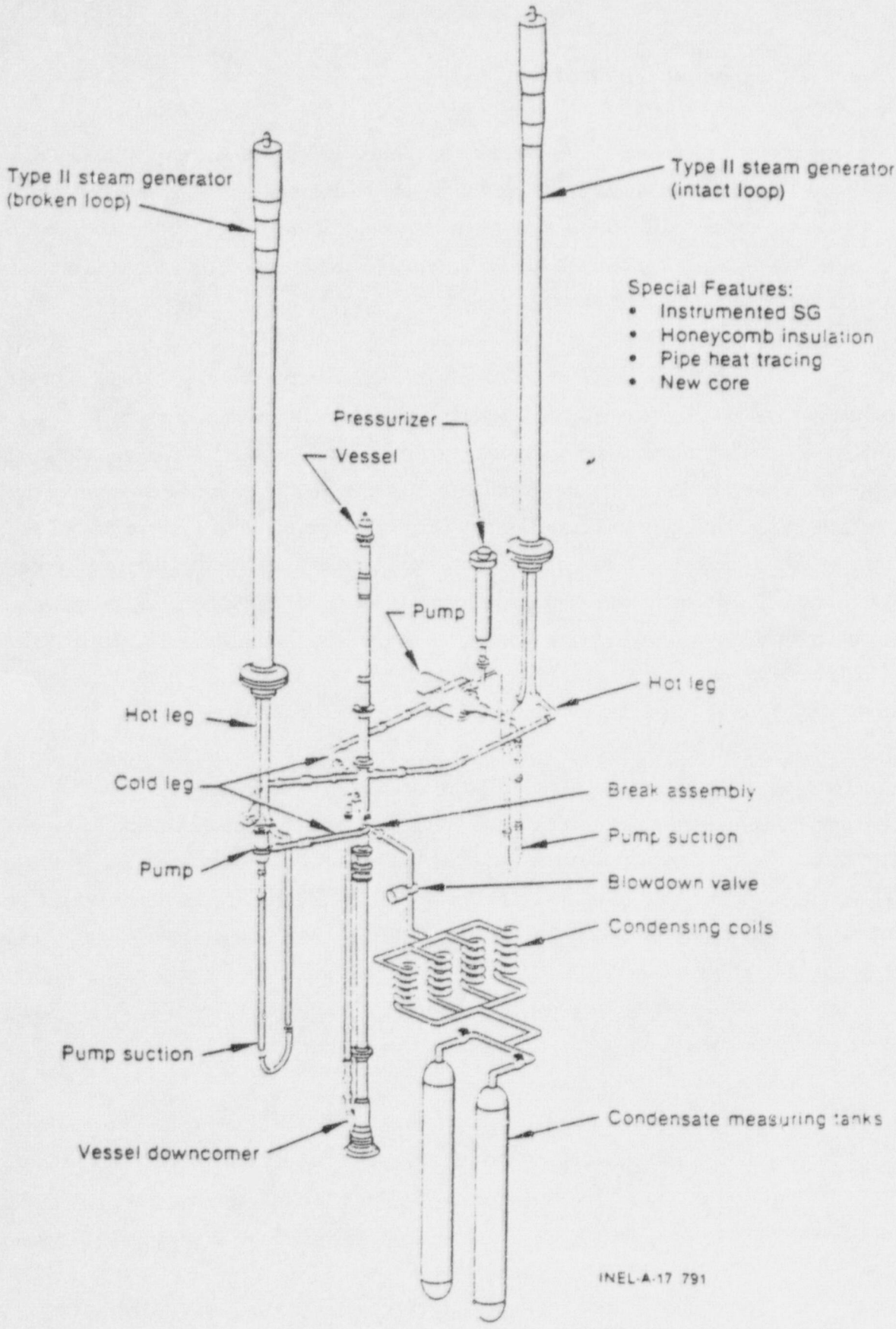

Figure 1 Configuration of Semiscale Mod-2A Facility

II.2 Experiment Description

The primary objective of the Natural Circulation test series in the Semiscale Mod-2A facility is to provide data that can be used to develop and assess computer models, which are to be used to predict SBLOCA or operational transients involving loss of primary pumping. To achieve this objective, both steady-state, separate effects type experiments and transient small break experiments have been performed.

The experiment S-NC-8B was one of the experiment simulating transient natural circulation during the ultra small break accident. Two independent experiments, S-NC-8A and S-NC-8B were conducted under the single experiment entitled by S-NC-8. Both tests were designed to provide data on natural circulation during a SBLOCA transient without pumped emergency core cooling (ECC) flow (high pressure injection and low pressure injection). The primary difference between two tests is core recovery procedure. The recovery procedure during test S-NC-8A included steam generator (SG) bleed, accumulator injection, and primary coolant vent through power operated relief valve (PORV), while the S-NC-8B experiment included SG auxiliary feed and bleed, accumulator injection, and primary coolant vent through PORV as a recovery procedure.

Prior to initiation of test S-NC-8B, the Semiscale Mod-2A system was filled with pressurized water. The system was heated using core power. Natural circulation flow was used to establish the thermal-hydraulic initial condition of the system specified in reference [7]. Initial conditions are listed in Table 1. The core differential temperature was similar to conditions which would be obtained with the full-scaled *2 MW* core power and pumped flow. Since the initial flow rate was lower than for a pumped flow case, the core power was much lower initially to achieve the req[illegible] core differential temperature, i.e., *95 kW*, as shown in Table 1. Figure 2 shows core axial [illegible]er distribution in S-NC-8B test.

Test was initiated by blowdowning the system through the blowdown valve downstream of the break orifice. Table 2 contains the sequence of event for the test. At the time when the primary system pressure reduced to *12.5 MPa*, the reactor scram occurred (low pressure trip). As mentioned above, since the initial core power was much lower than *2 MW*, this initial value of the power was allowed to remain after scram until it intersected the nominal *2 MW* power decay curve, and then the normal *2 MW* decay power curve was followed. At the reactor trip, the steam generator steam valves were closed.

As a result of blowdown, the primary system experienced a rapid subcooled depressurization for about *200 sec* after transient, and then a much slower saturated depressurization. The core was gradually uncovered since no high pressure ECC water was injected into the core.

Following core uncovery and heat-up, an attempt was made to reduce the system pressure to low pressure safety injection (LPSI) setpoint. At *2100 sec*, SG steam valves was opened and SG auxiliary feedwater injection was initiated. Those recovery action reduced the system pressure to the accumulator injection setpoint (*4.2 MPa*) at *2160 sec*. The core heat-up and uncovery were terminated by accumulator water.

To increase the depressurization rate such that the LPSI setpoint could be achieved earlier the PORV valve was opened at *7550 sec*. This operation discharged out the primary coolant, as a result, the core collapsed level was decreased and the second core heat-up was observed. The PORV was closed and SG secondary "dump and fill" was started at *8098 sec* to prevent the core heat-up. Due to this operation the core heat-up was stopped and temperature was dropped. At *10700 sec*, the core power was tripped and the test was terminated.

Table 1 Initial Conditions for Experiment S-NC-8B

Parameters	*Experiment*	*Calculated (Base Case)*
Pressurizer Pressure (MPa)	15.4 ± 0.1	15.41
Core Power (kW)	95.0 ± 1.0	95.0
Intact Loop Hot Leg Temperature (K)	581 ± 2.0	580.6
Intact Loop Cold Leg Temperature (K)	545.0 ± 2.0	547.7
Broken Loop Hot Leg Temperature (K)	580.0 ± 2.0	580.6
Broken Loop Cold Leg Temperature (K)	538 ± 2.0	547.9
Intact Loop Mass Flow Rate (kg/s)	0.396 ± 0.05	0.4158
Broken Loop Mass Flow Rate (kg/s)	0.121 ± 0.05	0.1313
Vessel Downcomer Mass Flow Rate (kg/s)	0.532 ± 0.3	0.590
Pressurizer Liquid Volume (m^3)	0.0215	0.0214
Intact Loop SG Steam Pressure (MPa)	5.85 ± 0.1	5.85
Broken Loop SG Steam pressure (MPa)	5.89 ± 0.1	5.88
Intact Loop SG Liquid Level (m)	10.74 ± 0.1	10.533
Broke Loop SG Liquid Level (m)	10.94 ± 0.1	10.649

Table 2. Timing of Events and Phenomena for Experiment S-NC-8B

Event	*Experiment*	*Calculated (Base Case)*
Blowdown Initiation *	0 sec	0 sec
High Pressure Trip (12.5 MPa) *	103	103
SG Steam Valves Closed *	117	117
Core Power Starts to Decay *	131	131
Hot Leg Flashing	175	220
Vessel Level Reached Hot Leg, 2-ϕ NC Begin	280	270
Peak 2-ϕ Natural Circulation Flow at Intact Loop	340	320
Cold Leg Flashing	400	400
Peak 2-ϕ Natural Circulation Flow at Broken Loop	640	490
First Break Uncovery (visual)	824	---
Reflux in Intact Loop Steam Generator	825	655
Final Break Uncovery	1500	1305
Core Heat-up First Observed	1920	----
Steam Generator Feed-and-Bleed Begins *	2100	2100
Accumulator Setpoint Reached	2460	2500
First Broken Loop Seal Cleared Partially	2650	---
Second Broken Loop Seal Clearing, Core Quenched	3150	---
Broken Loop Accumulator Tank Depleted	3975	---
Intact Loop Accumulator Tank Depleted	4800	---
Calculation Termination	---	5000
Pressurizer PORV Opened	7550	
Second Heat-up Observed	8025	
PORV Closed	8098	
Start Fill and Dump of Steam Generators	8160	

Note * : Described as Boundary Conditions

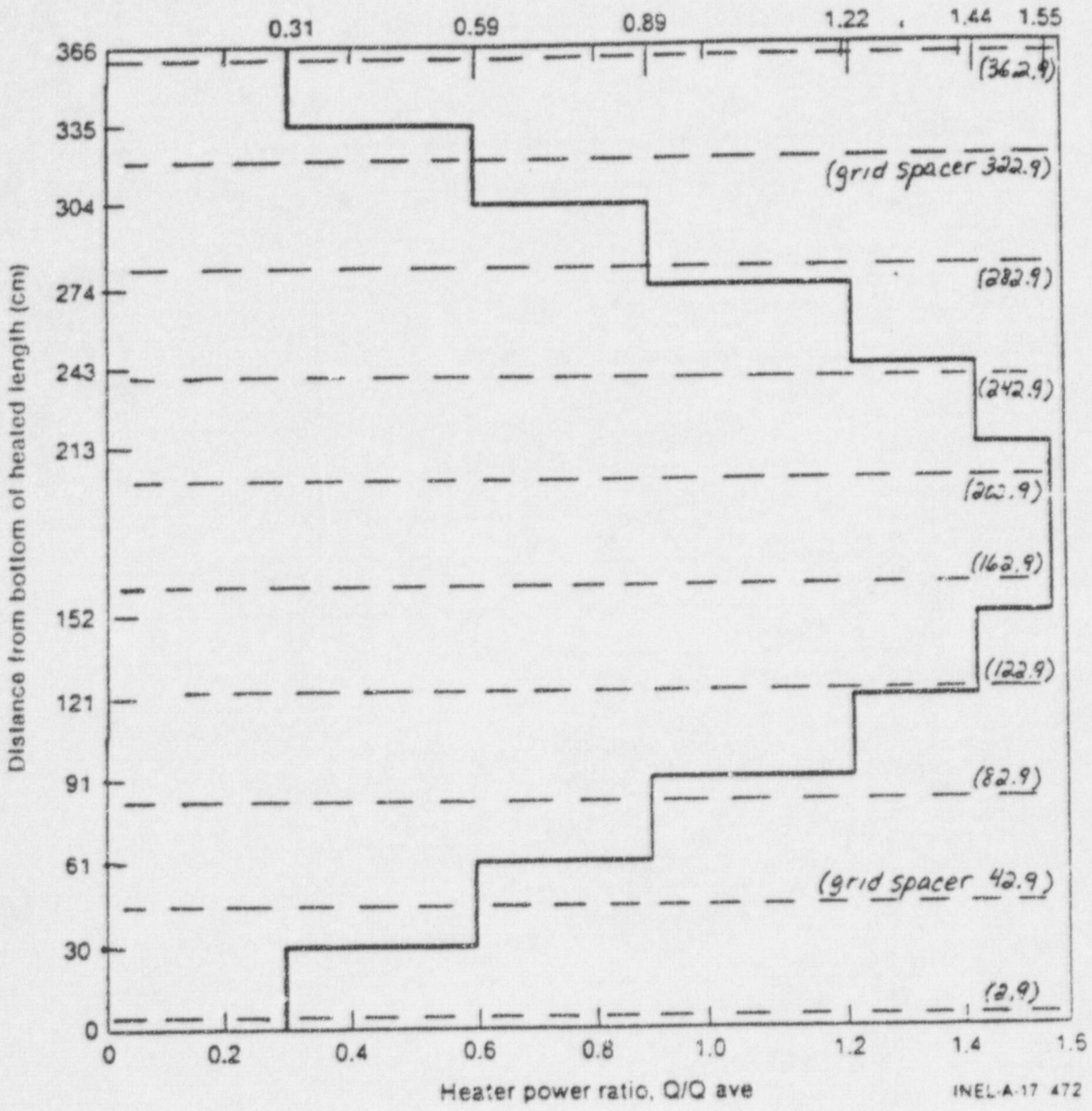

Figure 2 Axial Power Distribution of the Semiscale Mod-2A

II.3 Major Thermal-hydraulic Phenomena

During the experiment S-NC-8B, the various thermal-hydraulic phenomena were observed at the various components of the facility, due to core decay heat, loss of primary inventory, various operations of safety equipment, etc. The document [3] addressed the important thermal-hydraulic phenomena, the causes for the various phenomena, and their influences during the test in detail. Since it is not possible to predict all the phenomena using the RELAP5 code, it is necessary to select and categorize the some important phenomena for assessment purpose. Thermal-hydraulic phenomena observed in the Experiment S-NC-8B are as follows :

1. System Depressurization
    1) Rapid subcooled depressurization
    2) Increase in depressurization rate due to core decay heat curve
    3) Hot leg saturation
    4) Slower saturated blowdown due to hot leg flashing
    5) Increase in depressurization rate due to the vessel level down to hot leg elevation
    6) Cold leg flashing
    7) Decrease in depressurization rate due to cold leg saturation
    8) Increase in depressurization rate due to SG feed and bleed
2. Break Flow
    9) Single phase subcooled break flow
    10) Saturated break flow under stratified condition
    11) Uncovery of break
3. Natural Circulation
    12) Single phase natural circulation
    13) Two-phase natural circulation flow behavior and peak natural circulation flow
    14) Reflux condensation at SG and hot leg
4. Loop Seal Behavior
    15) Loop seal formation at intact loop and broken loop
    16) Partial loop seal clearing at intact loop
    17) Increase in liquid level at SG side loop seal of the intact loop due to SG feed-and-bleed operation
    18) Manometric level decrease at SG side loop seal
    19) First loop seal clearing at SG side of the broken loop

20) Re-buildup of vessel side loop seal at the broken loop due to the injected accumulator water

21) Second loop seal clearing at vessel side of the broken loop

5. Core Heat-up

22) First core clad heat up due to core uncovery

23) Decrease of heat-up rate due to the first loop seal blowout

24) Core clad quenching at the second loop seal blowout

25) Second core clad heat-up due to PORV opening

6. Accumulator Injection Behavior

26) Condensation and mixing

7. PORV open

27) Inventory redistribution

28) Second core heatup

Among the phenomena above, some individual phenomena can be discussed by using the calculation result, directly. However, since the causes and impacts of one phenomenon were linked to those of another phenomenon in complicated mechanism for the most thermal-hydraulic process, the predictability of individual phenomenon cannot be discussed separately, without discussing all the related processes simultaneously. Therefore, instead of a discussion on individual phenomenon, a discussion is provided on the globally-categorized phenomena as follows :

1) System depressurization

2) Break flow

3) Loop seal behavior

4) Natural circulation

5) Core thermal response

6) Accumulator injection behavior

III. Code and Modeling

III.1 Code Description

A standard frozen version of RELAP5/MOD3.2 code without any modification was used for the present calculation. The version of code has been available for KINS since December 1995. The RELAP5/MOD3.2 code was developed by Idaho National Engineering Laboratory (INEL) under auspicies of CAMP. The code was known to improve some deficiencies and errors from the previous version, RELAP5/MOD3.1, in wall condensation model, transport of non-condensible gas, level tracking model, crossflow model, choking model, etc. [5] :

III.2 Modeling Description

The RELAP5 modeling for simulation of the experiment S-NC-8B was shown in Figure 3. This nodalization represents the intact/broken loop piping, the broken loop pump, the reactor vessel, the steam generators at both the intact loop and the broken loop, the pressurizer, the intact/broken loop accumulators and ECCS (emergency core cooling system) piping, the pressurizer PORV, and the auxiliary feedwater line at intact/broken loop steam generators. This model is regarded as a base case, which was basically the same as one from Kmetyk's one [6] For the base case calculation, the input deck developed by Sandia National Laboratory was modified to be worked with RELAP5/MOD3 and some corrections were made as follows :

1) Separator component was changed to work with RELAP5/MOD3 (volumes 203 and 703).
2) Initial conditions at steam dome were changed to be close to the experimental condition (volumes 207 and 707).
3) Initial conditions at pressurizer vessel were changed to be close to the experimental condition (volume 301)
4) Area of broken loop pump outlet junction was corrected to $0.0009\ m^2$ for considering the correct geometry (volume 450).
5) Rod bundle interfacial drag options were specified at reactor vessel core (volumes 505 and 506).
6) Additional boundary condition input of left and right boundaries for all of the heat structures were changed to work with RELAP5/MOD3.

7) For heat structures representing the outer wall of steam generator vessel at broken loop, ambient temperature boundary conditions were changed to heat transfer coefficient (HTC) boundary conditions, which was to implement the same boundary conditions as intact loop (heat structures 7053 and 7054).
8) Steam leak from both steam generators at broken loop and at intact loop after closing the steam control valve was modeled (junctions 211 and 711).
9) Steam pressure boundary condition was corrected for realistic model (volumes 240 and 740).
10) Junction area and junction loss factor at upper head bypass line were changed to improve the calculation accuracy (junction 535).
11) Break model was changed from a trip valve to motor valve for considering the realistic valve opening behavior (junction 422)
12) Feedwater temperature was changed to maintain *330 K* (volumes 206 and 706).
13) Pressure boundary condition at break downstream was changed for considering the experiment behavior (volume 499)
14) Standard (default) model options were used at each volume, junction, and heat structure.

The base case model contains 206 volumes, 206 junctions and 265 heat structures. The RELAP5 input deck for base case was listed in Appendix A. One of the important feature in this modeling is to establish the natural circulation flow path. There is no special modeling scheme deviated from the RELAP5 User Guideline [2].

Besides the base case model, additional two modeling schemes were attempted to improve the calculation predictability. One is to use two parallel flow channels for active core of reactor vessel (Figure 4) and another is to use ECCMIX component for ECCS injection volumes at intact loop and broken loop (Figure 5), as shown in Table 3.

Table 3 Comparison of Input Modes

Item\Run	B01	T01	E01
Description	Base case	Two core channel	ECCMIX testing
Reactor Vessel Core	single channel	double channel	double channel
ECCS injection point	branch	branch	ECCMIX
Others	same as Ref. [5]	same as B01	same as B01

Reactor Vessel

The reactor vessel was modeled with external downcomer (volumes 531, 516, 517, 518 and 519), lower plenum (volumes 502, 503 and 504), lower head (volume 501), active core (volume 505), upper plenum (506, 507, 508, 509 and 510), upper head bypass line (volume 531 and junction 535), simulated guide tubes and support column (volumes 514 and 513). The active core was modeled by a single flow channel and the axial level of the core volumes selected to be same as the axial power profile shown in Figure 2, which is different from the location of the grid spacers in the core. This modeling scheme resulted in avoiding interpolation problems to determine power sources at each heat structure for fuel rods. Besides the core rod heat structures, additional heat structures are used to consider the most of the major vessel structures. Those are pressure vessel itself, the downcomer piping walls, the simulated guide tubes, support column and bypass line piping.

The upper head bypass line (Junction 535) plays an important role to provide a flow path between cold leg and hot leg. In the present calculation, the junction area and loss coefficient were selected to be $1.62x10^{-5}\ m^2$ and *300.0*, respectively.

The base case calculation result, which will be discussed at next chapter, revealed deviations in some thermal-hydraulic phenomena such as loop seal behavior. Since those phenomena may be dependent on steam generation behavior from the core, and steam pressure may be determined by flow in core, two core channel modeling was attempted to improve the calculation predictability (T01). In this case, active core was divided by two parallel channels which contains eight vertically stacked volumes (components 505 and 550). Each channel was connected by multiple junction component (J555). Area ratio of each channel was set to *50:50*, while power source ratio was set to *60:40*. Figure 4 shows a comparison of reactor vessel core modeling. The RELAP5 input deck for the case T01 was listed in Appendix B.

Intact Loop

The intact loop was modeled with a hot leg (volumes 101, 102, 103, and 104), a crossover leg (volume 105), a pump spool piece (volume 106), and a cold leg (volume 107 and 108). This intact loop hot leg is connected to reactor vessel upper plenum volume 508 and cold leg is connect to the volume at reactor vessel downcomer (volume 517). The pressurizer surge line is connected to volume 103, an intact loop ECCS line is connected to the volume 107

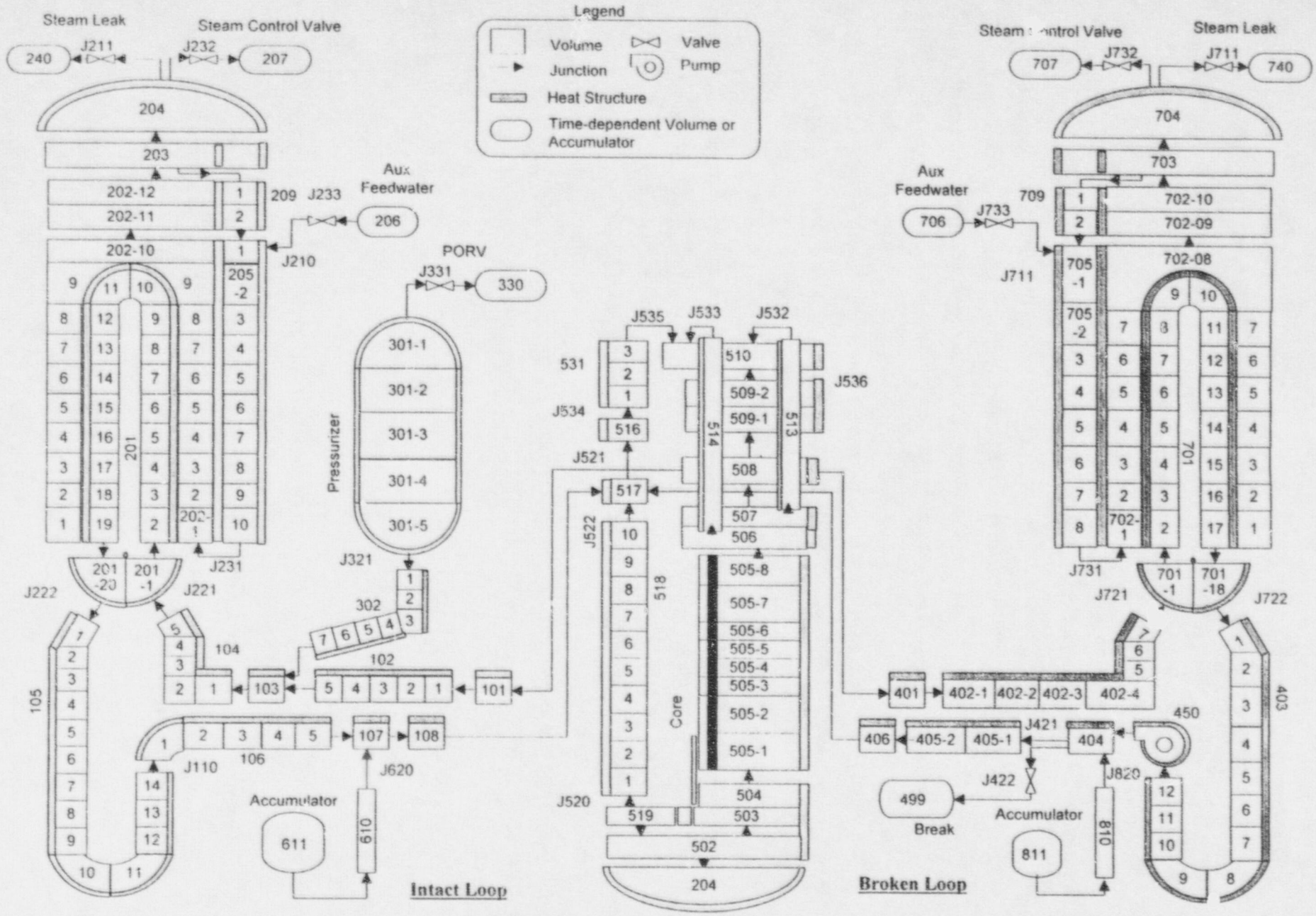

Figure 3 RELAP5 Nodalization of Semiscale Mod-2A for Assessment of Experiment S-NC-8

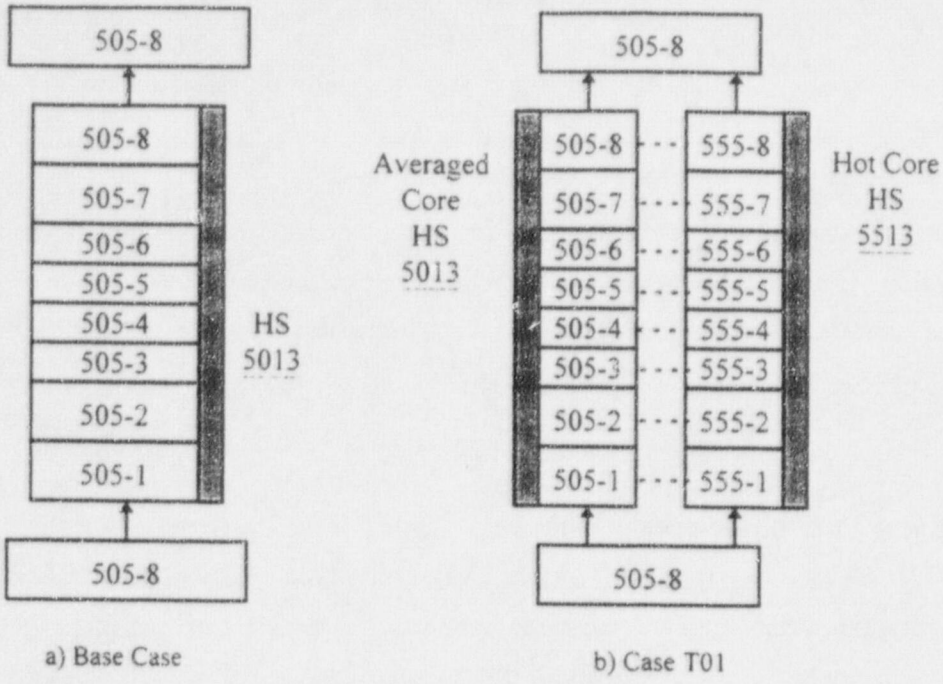

Figure 4. Comparison of Reactor Vessel Core Model

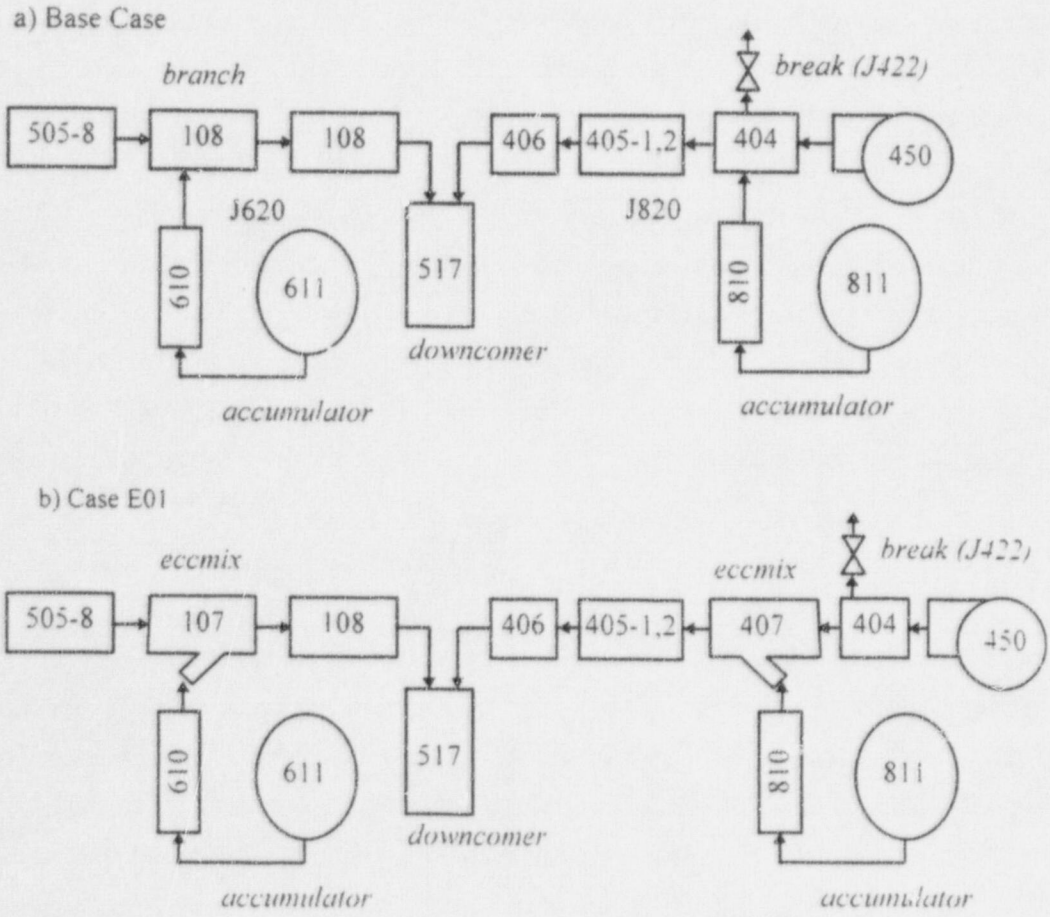

Figure 5. ECCMIX component model

through the junction 620. The intact loop steam generator is connected to hot leg and crossover leg by junctions 221 and 222, respectively.

In nodalization sensitivity study, ECCMIX component was used at intact loop cold leg and broken loop cold leg to improve accumulator injection behavior. Figure 5 shows a comparison of cold leg and ECCS modeling. The RELAP5 input deck for the case E01 was listed in Appendix C.

Broken Loop

The broken loop was modeled with a hot leg (volumes 401 and 402), a crossover leg (volume 403), a broken loop pump (volume 450), and a cold leg (volumes 404, 405 and 406). This broken loop hot leg is connected to reactor vessel upper plenum volume 508 and cold leg is connect to the volume at reactor vessel downcomer (volume 517). The broken loop ECCS line is connected to the volume 404 through the junction 820. The intact loop steam generator is connected to hot leg and crossover leg by junctions 721 and 722, respectively.

The break junction (J422) was originally modeled by trip valve component [5]. However, the break model was changed from a trip valve to motor valve for considering the realistic valve opening behavior, as mentioned previously. The motor valve was attached to the downstream of the volume 404. The valve open area is set to $9.0 \times 10^{-3}\ cm^2$, which simulated *0.1 %* equivalent break. The discharge coefficients both for subcooled and for two-phase were set to *1.0*. The broken loop pump homologous curves were specified bases on the facility design [4]. As similar to the intact loop, an extensive modeling of heat structure was adopted. The environmental heat loss at broken loop cold leg pipe, which was proved to be important in break flow prediction , was not modeled in the present model.

In the ECCMIX component modeling, a ECCMIX component was inserted at the downstream of the volume 404, and volume of adjacent component were changed to achieve a total volume.

Pressurizer

The pressurizer vessel and surgeline were modeled by volumes 301 and 302, respectively. The top of the pressurizer vessel was linked to the time-dependent volume (C330) which represent the relief tank. Junction J331, which simulated a pressurizer PORV, was to link those two volumes. The valve open area of the PORV is set to *1.267* cm^2 according to the facility design. The presurizer heater was also modeled by 2 heat structures. All the vessel walls and piping walls were also modeled by heat structures.

Steam Generators

The intact loop steam generator primary side was modeled with component 201 with 20 volumes. The heat transfer between primary and secondary side was modeled by 18 heat structures. The secondary side was modeled with feedwater downcomer (volume 205), boiling space (volume 202), a separator (volume 203), a liquid return path (volume 209), steam dome (volume 204), a steam leak path (junction 211 and volume 240), a normal steam discharge (junction 232 and volume 207), and a auxiliary feedwater source (junction 233 and volume 206).

The broken loop steam generator primary side was modeled with component 701 with 18 volumes. The heat transfer between primary and secondary side was modeled by 16 heat structures. The secondary side was modeled with feedwater downcomer (volume 705), boiling space (volume 702), a separator (volume 703), a liquid return path (volume 709), steam dome (volume 704), a steam leak path (junction 711 and volume 740), a normal steam discharge (junction 732 and volume 707), and a auxiliary feedwater source (junction 733 and volume 706).

Steam leak from both steam generators at broken loop and at intact loop after closing the steam control valve was modeled (junctions 211 and 711). The junction area was set to $0.3 \times 10^{-5}\ m^2$ and loss coefficient to *0.0* for both steam generators.

ECCS

The accumulators of intact loop and broken loop (volumes 611 and 811) and their flow path were modeled (volume 610 and junction 620, volume 810 and junction 820). The accumulator setting pressure was *4.24 MPa* at *300 K*.

Heat Structures

During the hydrodynamic modeling of the facility, all the loop piping walls are represented as heat structures, but environment heat loss, pipe insulation, tape and band heaters for tracing heating, are ignored. The exterior piping heat structure are assumed to be adiabatic on their outer surfaces. According to the experiment document [3], there was a heat loss from the broken loop cold leg piping to the environment in the experiment. However, for simplicity, such an environmental heat loss was not considered in the present modeling. Table 4 summarizes the input modeling for heat structures.

Table 4. Summary of Heat Structure Modeling

HS #	Description	NH	NA	Left Bndry	Right Bndry
1011	Intact Loop Hot Leg Nozzle	1	5	101-01	Symmetric
1021	Intact Loop Hot Leg Piping	4	5	101-01~04	Symmetric
1022	Intact Loop Hot Leg Piping	2	5	102-05	Symmetric
1032	Intact Loop Hot Leg Piping	1	5	103-01	Symmetric
1042	Piping from Intact Loop Hot Leg to SG Inlet	5	5	104-01~05	Symmetric
1052	Upper Part of Downflow Side of Intact Loop Seal Piping	6	5	105-01~06	Symmetric
1051	U-shaped Bend of Intact Loop Seal Piping	8	5	105-07~14	Symmetric
1063	Intact Loop Cold Leg Piping	4	5	106-01~04	Symmetric
1061	Intact Loop Cold Leg Piping	1	5	106-05	Symmetric
1071	Intact Loop Cold Leg Piping with ECC Nozzle	1	5	107-01	Symmetric
1081	Intact Loop Cold Leg Nozzle	1	5	108-01	Symmetric
2001	Intact Loop Steam Generator U-tube	18	5	201-02~19	202-01~09
2012	Riser Part Shield Structure of Intact Loop SG	10	5	202-01~10	202-01~10
2022	Lower Shroud Wall of Intact Loop Steam Generator	10	5	202-01~10	205-10~01
2032	Internals of Intact Loop Steam Generator Downcomer	10	5	205-01~10	205-01~10
2042	Upper Shroud Wall of Intact Loop Steam Generator	3	5	202-11, 12, 203-01	209-02, 01, 203-01
2053	Lower Part of Intact Loop Steam Generator Outer Wall	10	5	205-01~10	GT205 HTC
2054	Upper Part of Intact Loop Steam Generator Outer Wall	4	5	204, 203, 209	GT204 HTC
2055	Outer Wall of Intact Loop Steam Generator Steam Dome	1	5	204-01	Symmetric
3011	Inner Wall of Pressurizer Vessel	6	5	301-01~05	Symmetric
3012	Pressurizer Heater	2	5	Symmetric	301-05
3022	Inner Wall of Pressurizer Vessel Top	1	3	302-01	Symmetric
3023	Inner Wall of Presseurizer Vessel	6	5	302-02~04	Symmetric
4011	Broken Loop Hot Leg Nozzle	1	5	401-01	Symmetric
4021	Broken Loop Hot Leg Piping	7	5	402-01~07	Symmetric
4031	Broken Loop Loop Seal Piping	12	5	403-01~12	Symmetric

Table 4. Summary of Heat Structure Modeling (continued)

HS #	Description	NH	NA	Left Bndry	Right Bndry
4041	Broken Loop Cold Leg Piping	3	5	404-01, 405	Symmetric
4051	Broken Loop Cold Leg Nozzle	1	5	406-01	Symmetric
5011	Reactor Vessel Lower Plenum Wall	1	5	501-01	Symmetric
5012	Reactor Vessel Lower Part Outer Wall	4	5	Symmetric	501, 502, 503, 504
5013	Active Core Fuel Rods	16	11	Symmetric	505-01~08
5021	Reactor Vessel Lower Part Inner Wall	1	5	501-01	Symmetric
5022	Reactor Vessel Lower Part Inner Wall	1	5	502-01	Symmetric
5023	Reactor Vessel Lower Downcomer Inner Wall	1	5	519-01	Symmetric
5031	Reactor Vessel Downcomer Wall	10	5	518-01~10	Symmetric
5024	Reactor Vessel Downcomer-to-Lower Core Wall	10	5	503-01	519-01
5025	Reactor Vessel Lower Core Support Structure	2	5	504, 505	Symmetric
5014	Reactor Vessel Core Fuel Assembly Structure	8	5	505-01~08	Symmetric
5015	Reactor Vessel Downcomer Upper Annulus Wall	1	5	516-01	Symmetric
5016	Reactor Vessel Cold Leg Nozzle Wall (Half)	2	5	Symmetric	516, 517
5017	Reactor Vessel Cold Leg Nozzle Wall (Half)	2	5	516, 517	Symmetric
5041	Reactor Vessel Upper Plenum Outer Wall	1	5	Symmetric	506-01
5042	Reactor Vessel Upper Plenum Outer Wall	1	5	506-01	Symmetric
5043	Reactor Vessel Upper Plenum Outer Wall	1	5	507-01	Symmetric
5044	Reactor Vessel Upper Plenum Outer Wall	1	5	508-01	Symmetric
5045	Reactor Vessel Upper Plenum Outer Wall	3	5	509, 510	Symmetric
5046	Reactor Vessel Upper Head Outer Wall	4	5	510-01	Symmetric
5062	Reactor Vessel Guide Thimble Tube Wall	4	5	513-01	510, 509, 508
5063	Reactor Vessel Guide Thimble Tube Wall	5	5	514-01	510, 509, 508, 507
5064	Reactor Vessel Downcomer Upper Annulus Wall	3	5	531-01~03	Symmetric
7001	Broken Loop Steam Generator U-tube	16	5	701-02~17	702-01~08
7012	Riser Part Shield Structure of Broken Loop Steam Generator	8	5	702-01~08	702-01~08

Table 4. Summary of Heat Structure Modeling (continued)

HS #	Description	NH	NA	Left Bndry	Right Bndry
7022	Lower Shroud Wall of Broken Loop Steam Generator	8	5	702-01~08	705-01~08
7032	Internals of Broken Loop Steam Generator Downcomer	8	5	705-01~08	705-01~08
[illegible]	Upper Shroud Wall of Broken Loop Steam Generator	3	5	702-09, 10, 703	709-02, 01, 703
7053	Lower Part of Broken Loop Steam Generator Outer Wall	8	5	705-01~08	GT205 HTC
7054	Upper Part of Broken Loop Steam Generator Outer Wall	4	5	704, 703, 709	GT204 HTC
7055	Outer Wall of Broken Loop Steam Generator Steam Dome	1	5	704-01	Symmetric

Note GT : General Table

HTC : Heat Transfer Coefficient

III.3 Initial Conditions

A RELAP5 steady state run was carried out to provide the thermal-hydraulic initial condition appropriate to the test for all of the volumes and junctions. The calculated results using the base case input at *800 sec* was listed in Table 1, which compared the calculation result with the experimental initial condition. Although the message "steady state reached" was not available at *800 sec* of the steady state run, the calculation result at *800 sec* was acceptable when compared with the measured values. The difference in fluid temperature at broken loop cold leg between calculation and experiment was about *10 K*, which was considered due to neglecting the environmental heat loss [3].

For the cases T01 and E01, the almost similar condition was obtained through steady state calculation, not listed in the table.

III.4 Boundary Conditions

The sequence of event for S-NC-8B experiment was described at earlier chapter. This section describes the RELAP5 modeling scheme to calculate the sequence of the experiment. Six trips were designed to describe the sequence as follows :

Trip 510 : Initiate the blowdown
Trip 511 : Close steam valves at *117 sec* after transient
Trip 512 : Open steam valves at *2100 sec* after transient
Trip 513 : Open pressurizer PORV at *7550 sec* after transient
Trip 514 : Close pressurizer PORV at *8098 sec* after transient
Trip 650 : Open SG steam leak valve during *117 sec* to *2100 sec*

The trips above activate the boundary condition appropriate to the sequence as follows:

1) The junctions 232 and 732, i.e., steam outlet valves, were set to open and close under trips 511 and 512.
2) The break valve (422) was open by the trip 510 with a ratio *1 %/sec*
3) The SG steam leak valve was open by trip 650 during *117 sec* to *2100 sec*. The steam leak downstream pressure was identical to the experimental pressure (Figure 6).

4) The auxiliary feed water was set to re-supplied to the SG's after the steam valve opening. The feed water flow rate during the transient was modeled at the junctions J233 and J733 by the time-dependent function with the argument of steam generator liquid level. The curve of flow rate with respect to level was shown at Figure 7, which directly simulated the test condition..

5) The variation of thermodynamic state at the tank downstream the pressurizer PORV was modeled. The curve of pressure with respect to time was shown at Figure 8, which realistically simulated the test condition.

6) The variation of thermodynamic state at the tank downstream the break was modeled. The curve of pressure with respect to time was shown at Figure 9, which simulated the test condition realistically.

7) The variation of reactor core power was modeled, which realistically simulated the test result. The curve of power with respect to time was shown in Figure 10.

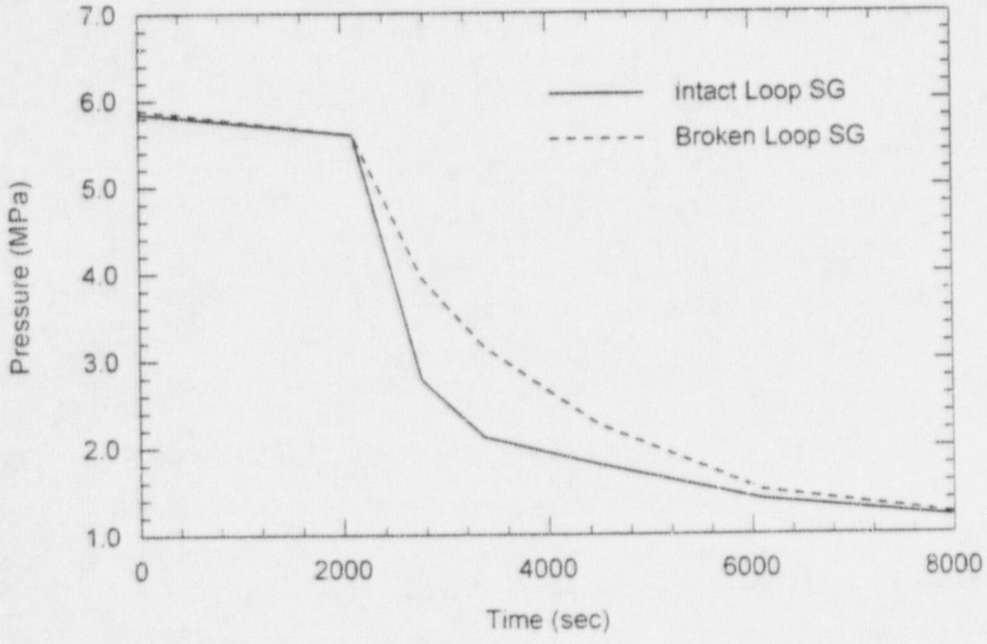

Figure 6 Pressure Boundary Condition at Steam Leak Downstream

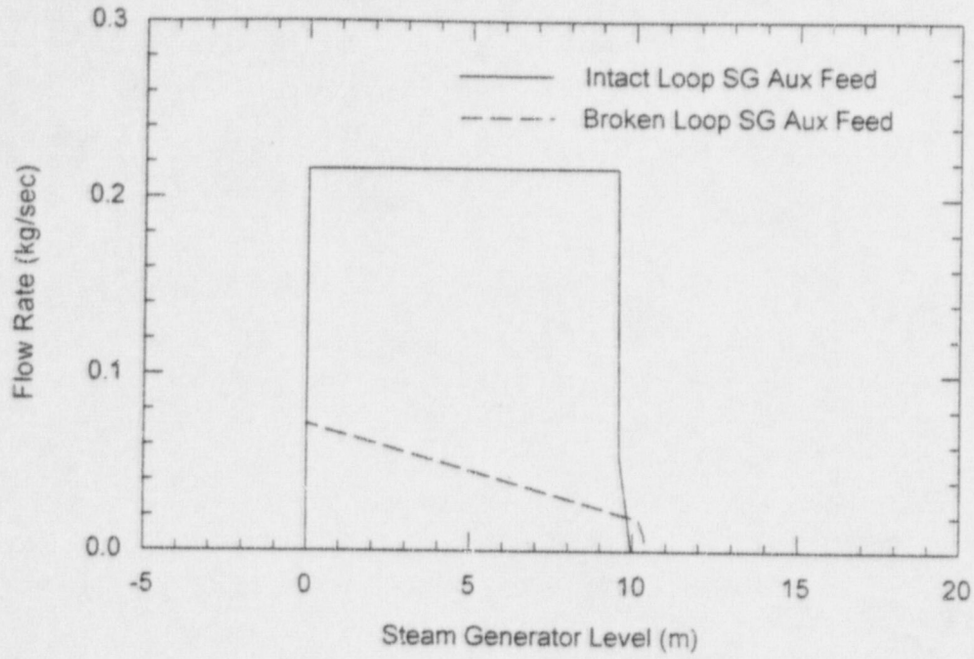

Figure 7 Flow Rate of Auxiliary Feedwater

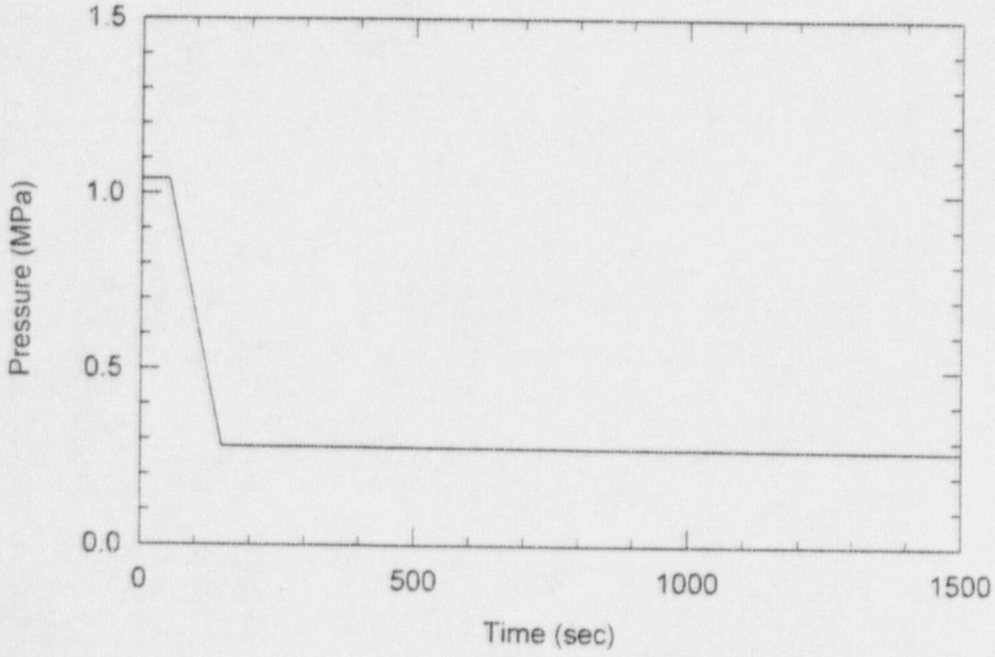

Figure 8 Pressure at Pressurizer PORV Downstream Tank in S-NC-8B Experiment

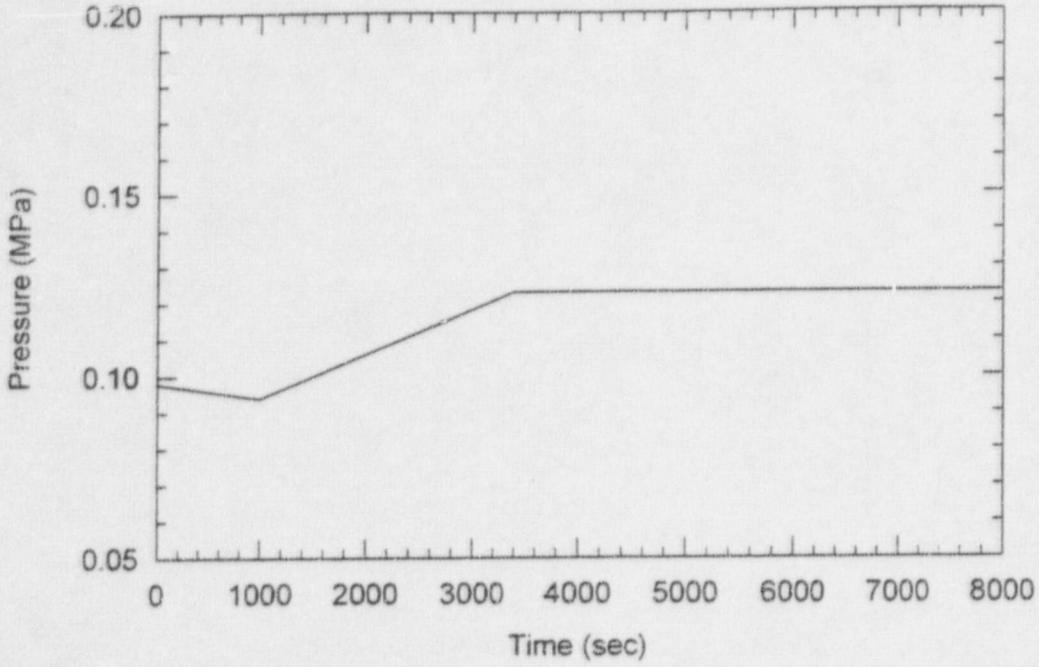

Figure 9 Pressure at Break Downstream Tank in S-NC-8B Experiment

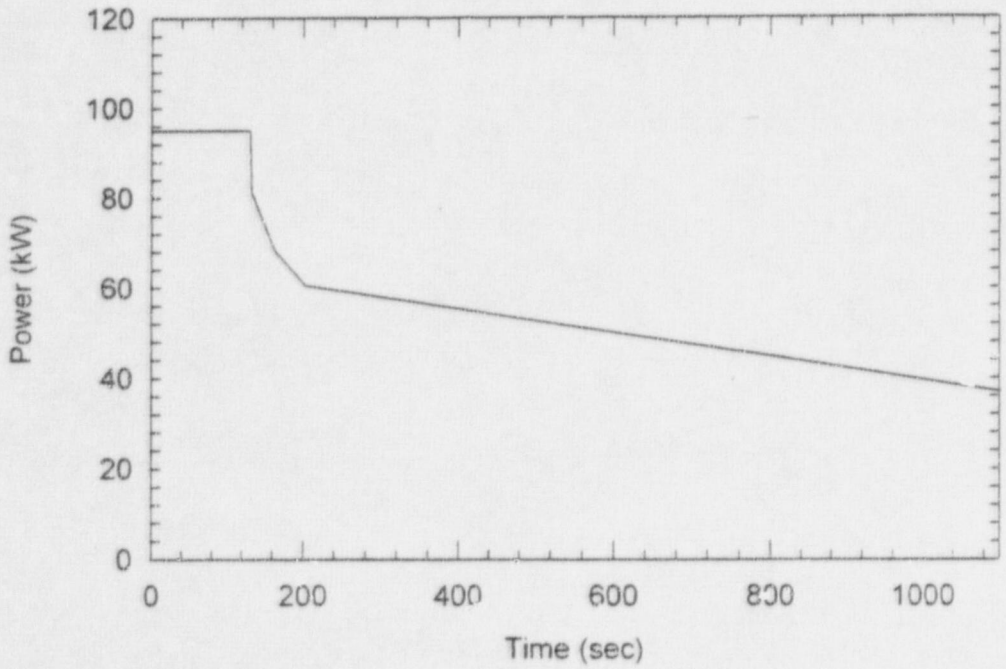

Figure 10 Reactor Core Power in S-NC-8B Experiment

IV. Results and Discussions

This chapter describes the result of the RELAP5 calculation and the comparison with the experiment data. As mentioned earlier, a result from a base case calculation is described for the major thermal-hydraulic phenomena and the predictability of RELAP5 on those phenomena is discussed. And then some discussions are given for the result from sensitivity studies, which were attempted to find out the effects of modeling at rector vessel core and of ECCMIX component on the improvement of predictability. Among the various thermal-hydraulic phenomenon, an emphasis was given to an overall depressurization behavior, a break flow, a loop seal behavior, a natural circulation, an accumulator injection behavior, and a thermal response. The run statistics data is also described in this chapter.

The thermal-hydraulics in the experiment data is first described, the result from the calculation is addressed, and then, the predictability, discrepancy and/or causes for the discrepancy considered are explained for each phenomena.

Table 5. lists the calculated parameters and the corresponding experiment data channels selected to explain the thermal-hydraulic phenomena. The uncertainty for each experiment data channel is also listed in the table, which was based on the reference [6].

IV. 1 Base Case Calculation

IV.1.1 Depressurization

Figure 11 shows a comparison of the primary system pressure transient between the RELAP5 calculation result and the experiment data up to *3000 sec* after break initiation. As shown in the experimental behavior of Figure 8, the following phenomena were observed :

1) A rapid subcooled depressurization following the break initiation
2) A slight decrease of depressurization rate due to a core power level change from 95 kW to decay power level (at *131 sec*)
3) A decrease of depressurization rate due to a hot leg flashing (at *175 sec*)
4) An increase of depressurization rate due to an increase of heat transfer to secondary side by peak natural circulation flow along the loops (at *280 sec*)
5) A significant decrease of depressurization rate due to a cold leg flashing (at *400 sec*)

6) A slow depressurization until initiation of secondary side feed-and-bleed operation (up to *2100 sec*)

7) A noticeable depressurization by secondary side feed-and-bleed (*2100 to 2500 sec*)

8) A slight change in depressurization rate due to accumulator injection (at *2460 sec*)

Table 5. Description of the Measured Parameters and the Calculated Parameters

Description	Measurement ID.	Uncertainty/ Units	RELAP5 Parameter
Primary System Pressure	PV*UP-13	± 0.1 Mpa	p-508010000
Intact Loop SG Secondary Pressure	PIS+1117	± 0.05 MPa	p-204010000
Broken Loop SG Secondary pressure	PBS+1117	± 0.05 M[illegible]	p-704010000
Break Mass Flow Rate	Q*BRK*FLOW	a)	mflowj-422000000
Integrated Break Mass	BRMASS	a)	cntrlvar-30
Intact Loop Hot Leg Mass Flow Rate	ILHMFR	a)	mflowj-101020000
Broken Loop Hot Leg Mass Flow Rate	BLHMR	a)	mflowj-402020000
Intact Loop Cold Leg Mass Flow Rate	ILCMFR	± 0.03 kg/s	mflowj-107010000
Broken Loop Cold Leg Mass Flow Rate	BLCMFR	± 0.01 kg/s	mflowj-405010000
Vessel Downcomer Mass Flow Rate	MDOWN9A	± 0.03 kg/s	mflowj-518010000
Broken Loop Cold Leg Fluid Density	RB*79M	± 2 kg/m^3	rho-405010000
Intact Loop Hot Leg Fluid Temp.	TFI*1	± 2.0 K	tempf-101010000
Intact Loop Cold Leg Fluid Temp.	TFI*9	± 2.0 K	tempf-107010000
Broken Loop Hot Leg Fluid Temp.	TFB*57	± 2.0 K	tempf-401010000
Broken Loop Cold Leg Fluid Temp.	TFB*79	± 2.0 K	tempf-405010000
Rod Surface Temperature	THV*A3+291	a)	httemp-501300711
Vessel Collapsed Liquid Level	LV-501-105	a)	cntrlvar-218
IL Pump Suction SG side Level	DPI*14*PBA	a)	cntrlvar-214
IL Pump Suction Pump side Level	DPI*9*14	a)	cntrlvar-215
BL Pump Suction SG side Level	DB*64*65	a)	cntrlvar-216
BL Pump Suction Pump side Level	DB*65*79	a)	cntrlvar-217

Note a) Data uncertainty was not described in reference [3].

The RELAP5 calculation result is well-agreed to the experiment behavior, especially in depressurization rate at each event such as a decay heat curve activation, a hot leg flashing, a peak natural circulation, a cold leg flashing, a SG feed-and-bleed initiation, and a accumulator injection, although there were some deviations in timing of each phenomena.

Figures 12 and 13 show comparisons of steam pressure at each steam generator in intact loop and broken loop between RELAP5 calculation and experiment data. In experiment steam pressure was increased from at *117 sec* due to closure of steam control valves of both steam generators, however there were leaks in both valves, steam pressure was slowly decreased until re-opening the steam control valves for feed-and-bleed operation. The RELAP5 calculation shows an overall agreement with the experiment data for both steam pressure.

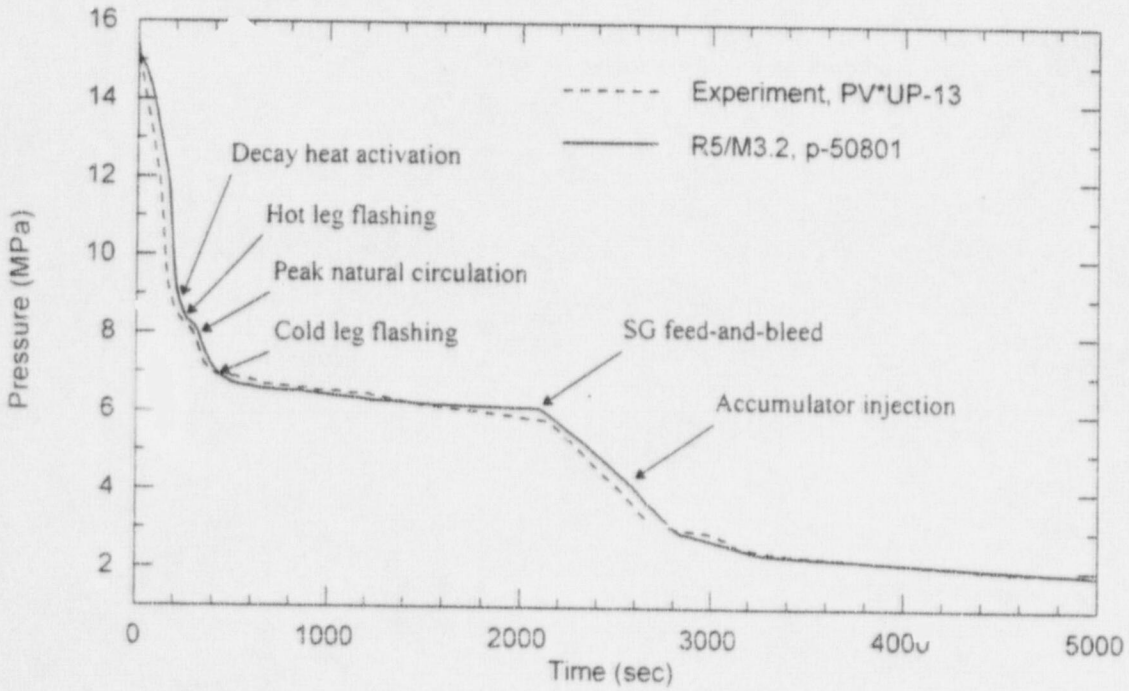

Fig. 11 Comparison of Primary System Pressure

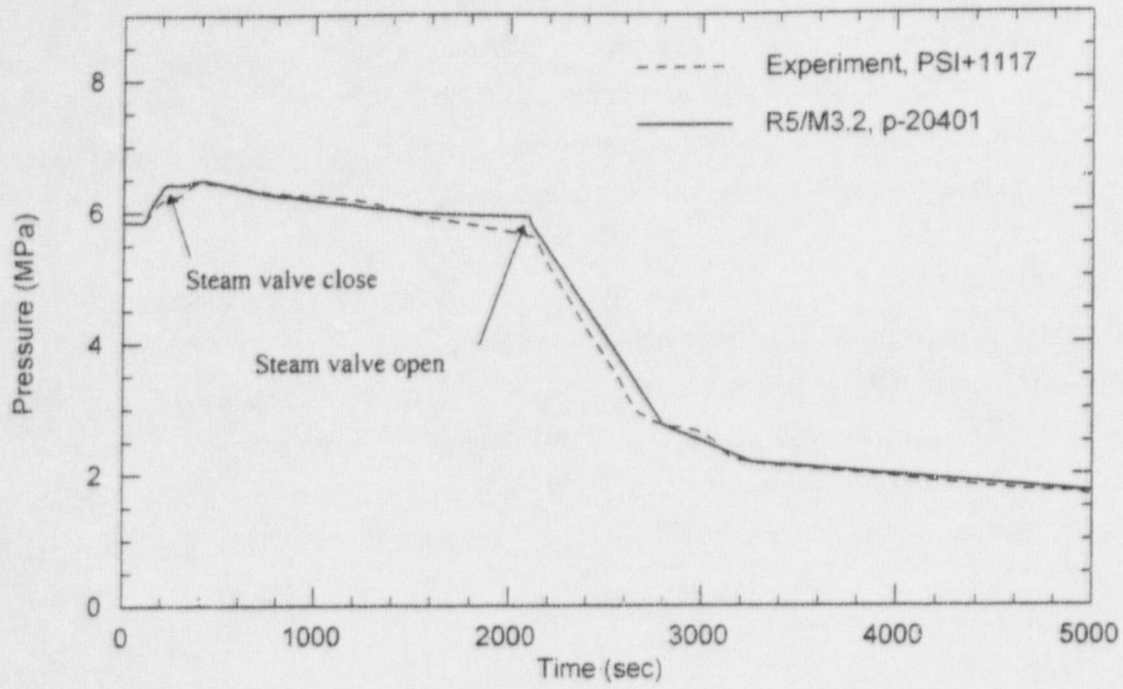

Fig.12 Comparison of Steam Pressure at Intact Loop SG

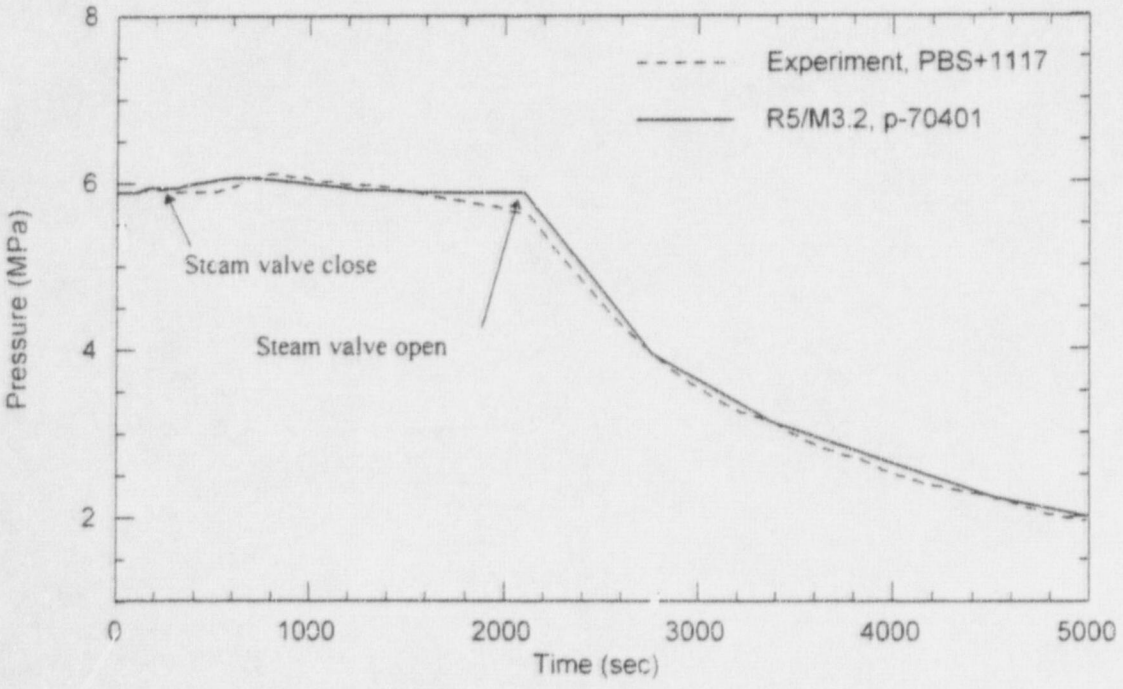

Fig.13 Comparison of Steam Pressure at Broken Loop SG

IV.1.2 Break Flow

Figure 14 shows a comparison of break flow. In the experiment, the following phenomena were found :

1) Upon the break valve open, the subcooled water discharged out, whose amount exceeded *0.1 kg/sec*.
2) As the primary system pressure decreased, the break flow rate was also reduced, and then, the discharged flow rate remained almost constant (approximately *0.065 kg/sec*) at the timing of cold leg flashing (*400 sec*).
3) The first uncovery of break was found at about *824 sec*. At this time, the liquid level in broken loop cold leg decreased to the break nozzle elevation. And then, the liquid level was oscillated, and the break nozzle was repeated to be covered and uncovered by liquid level in several times. The final uncovery was observed at about *1500 sec*.
4) After the complete break uncovery, the discharge flow rate was sharply reduced, however, there was a still steam-water mixture flow more than *0.02 kg/sec*.
5) After *2500 sec*, there was a sharp increase of break flow, which was due to the accumulator injection. Such a discharge of the injected water was terminated at *4700 sec* approximately, when the accumulators were exhausted.

The RELAP5 calculation shows a general agreement with experiment data in initial break flow and in phenomenological trend with the experiment data. However there are some discrepancies as follows :

1. Underprediction of two-phase break flow (approximately *100 to 700 sec* and *1200 to 2200 sec*)
2. Delay in break uncovery and difference in oscillatory behavior
3. Underprediction of break flow after accumulator injection (after *2500 sec*)

The reason for underprediction of break flow during *100 to 700 sec* was considered as due to a heat loss to the environment through the broken loop cold leg piping. The effect of environmental heat loss can be explained in Figure 15, which shows a comparison of fluid temperature at broken loop cold leg. As shown in this figure, the predicted coolant temperature was initially lower than the measured data by *10 K*, which was due to environmental heat loss through the cold leg piping. And the difference was continued until

700 sec (break upstream conditions becoming two-phase). The cooler fluid temperature resulted in a larger fluid density and thus larger break flow. Presented in Figure 16 are the measured and calculated fluid density at broken loop cold leg. The existence of cooler fluid can be found during the period, as shown in that figure.

The larger measured break flow resulted in the measured break upstream conditions becoming two-phase at *700 sec* while *1100 sec* in the calculation, i.e. delay in break uncovery.

The underprediction of break flow during *1200 to 2200 sec* (i.e., saturated break flow under stratified condition) was considered as due to code model deficiency on saturated break flow and/or due to break modeling inaccuracy. Figure 16 indicated that there existed much more water in the cold leg volume in calculation than that in experiment, however the calculated break flow was less than the measured one during the period.

Oscillations in break flow during *800 to 1400 sec*, were induced by cold leg liquid level oscillations upstream of the break, and they were found in both calculation and experiment. However, the oscillation in prediction has smaller amplitude and shorter frequency than those in experiment. This may due to the code model inaccuracy in simulating the liquid level behavior at broken loop cold leg under stratified saturated flow.

The underprediction in break flow after *2500 sec* was due to inaccurate prediction of accumulator injection flow, which will be discussed later.

An integrated break flow was shown in Figure 17. The amount of water discharged from the break was *100 kg* in experiment, while it was *80 kg* in calculation until *2000 sec*. Such a difference in discharged water has little effect on system depressurization but has a significant effect especially on loop seal behavior and core thermal response.

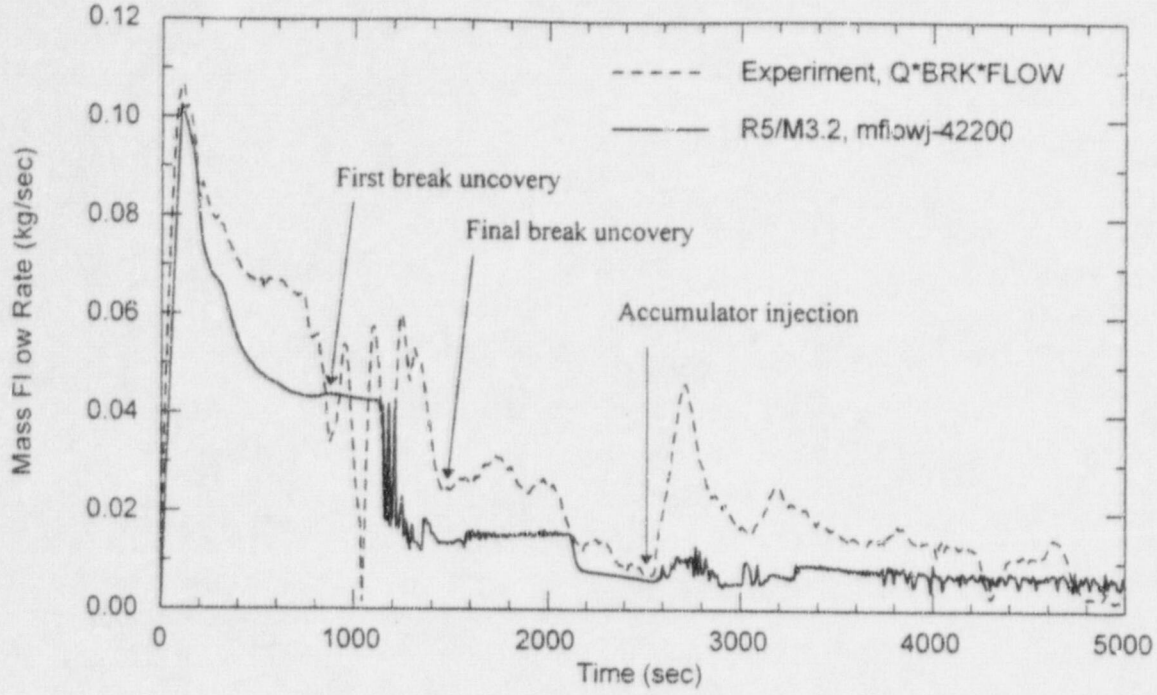

Fig.14 Comparison of Break Flow

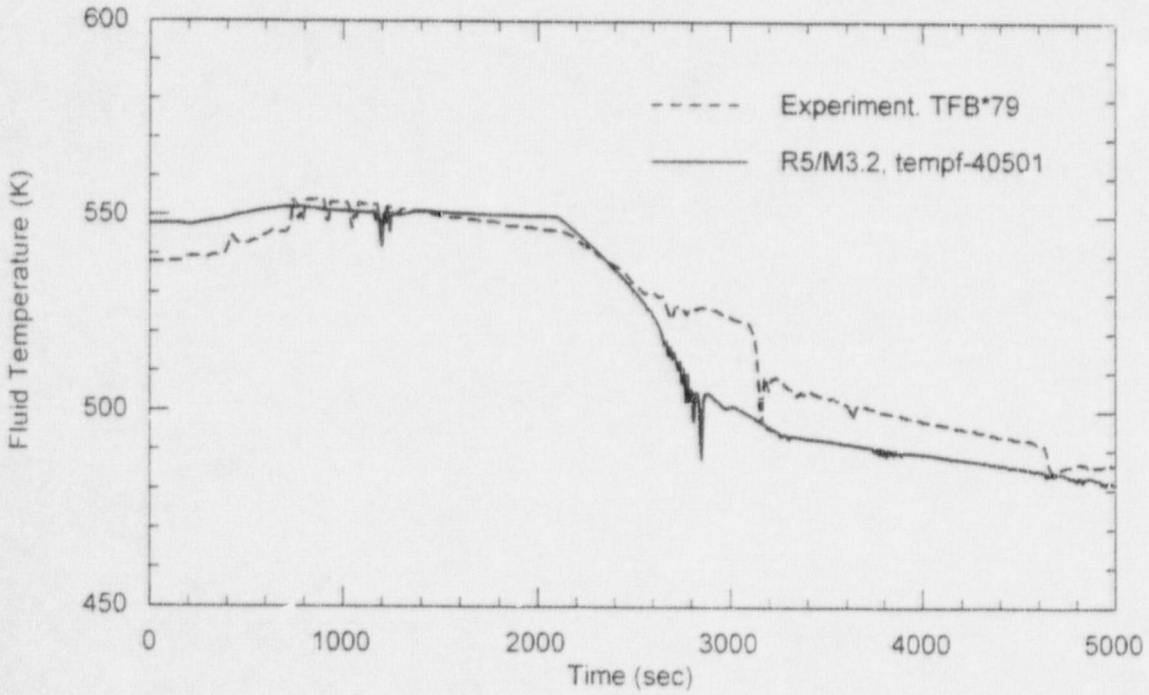

Fig.15 Comparison of Fluid Temperature at Broken Loop Cold Leg

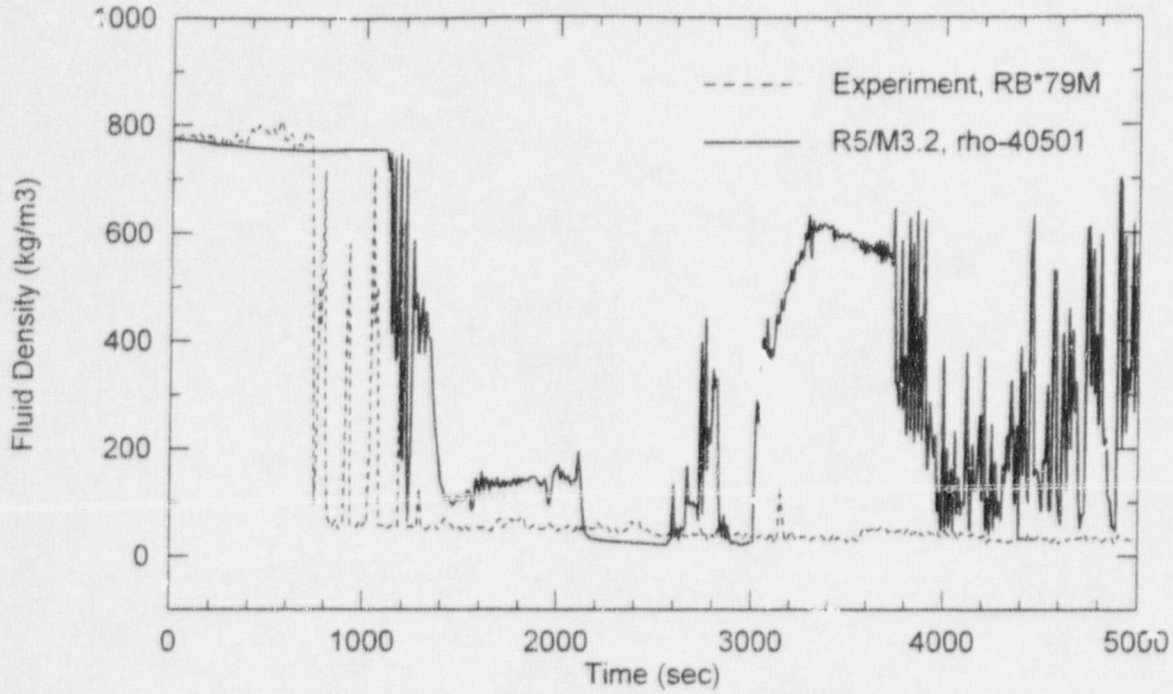

Fig.16 Comparison of Fluid Density at Broken Loop Cold Leg

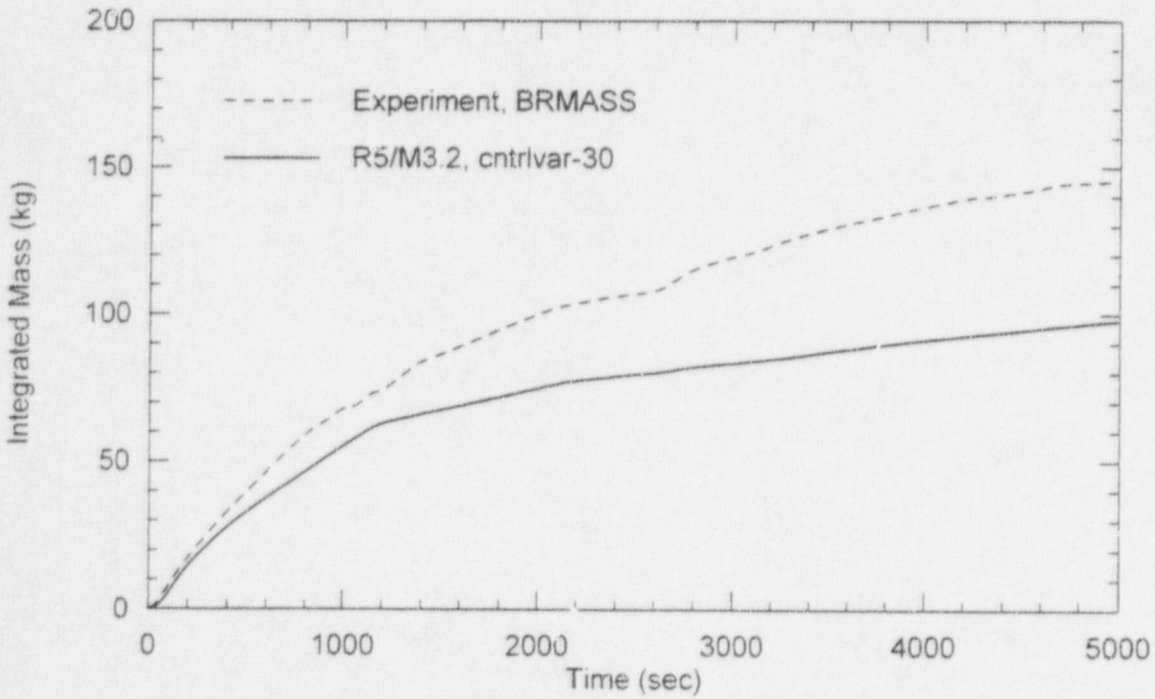

Fig.17 Comparison of Integrated Break Mass Flow

IV.1.3 Loop Seal Behavior

Figures 18 to 21 show a comparisons of differential pressure at SG-side and pump-side piping of crossover leg in intact loop and broken loop, respectively. The differential pressure at reactor vessel core was shown in Figure 22. The loop seal behavior observed in experiment are as follows :

1) As blowdown continued, the coolant inventory decreased to the point at which the water seal of U-shaped pipe in the intact loop crossover leg was formed (*500 sec*) as shown in Figures 18 and 20.
2) As the steam generating from the reactor core was blocked by pump suction water seal, the resultant steam pressure acted on and pushed the liquid surfaces of the SG-side crossover leg of intact loop (*1100* to *2100 sec*), which led a level decrease, as shown in Figure 18.
3) As the water level in SG-side pipe decreased, the water level in pump-side increased a little. However, some of the water pushed from the pump-side pipe was moved to the cold leg and downcomer, as a result, the pump-side level was dropped in a short time, the pump-side water level was recovered by the SG-side water. Such an oscillatory behavior was repeated in several times with pump-side level decrease, i.e., manometric level decrease.
4) At *2000 sec*, the pump-side liquid level started to decrease, since the hydrostatic pressure in pump-side pipe was larger than that at SG-side pipe.
5) At *2100 sec* the steam generator feed-and-bleed operation was initiated, which caused an enhancement of SG heat transfer, an increase of steam condensation in U-tubes, and buildup of liquid in the SG-side crossover leg of the intact loop, as shown in Figure 18.
6) At *2650 sec*, some water collapsed at SG-side crossover leg was swept into the cold leg and core, i.e., partial loop seal clearing. By this phenomena, the SG-side liquid level was dropped and re-increased. After that, pump-side liquid level was increase by such a partial loop seal clearing.
7) Loop seal behavior at the broken loop was quite similar to that at the intact loop (Figures 20 and 21). However, timings of loop seal formation and beginning of level decrease were *750 sec* and *1800 sec*, respectively, which were later than those of intact loop behavior.
8) Liquid in broken loop pump-side pipe was not cleared completely at *2650 sec*, since steam flow was not blocked because of break flow. The second loop seal clearing was

observed at *3150 sec* at the broken loop pump-side crossover leg.

9) The behavior of core liquid level was quite similar to that of intact loop pump-side crossover leg in start of level decrease and loop seal clearing.

Figures 18 and 19 indicate that RELAP5 did not predict the intact loop seal behavior correctly. Liquid level at SG-side crossover leg was not dropped below the cold leg centerline elevation in calculation. The predicted liquid level at pump-side crossover leg also shows a deviation from the experiment, although a loop seal formation, a level drop at *2100 sec*, and a sharp increase at *2500 sec* were close to the experimental behavior.

As shown in Figures 20 and 21, the predicted loop seal behavior at broken loop was much closer to the experimental behavior than that at intact loop, especially in loop seal formation both SG-side and pump-side pipes, level decrease due to steam pressure, level increase behavior at SG feed-and-bleed, and final loop seal clearing in SG-side piping. However, the final complete loop seal blowout at pump-side pipe was not predicted, which was due to a re-establishment of water seal at broken loop pump-side pipe. It was considered as a result from underestimation of break flow and over-estimation of water inventory at broken loop cold leg.

Predicted loop seal behavior indicates that the pressure difference between hot leg and cold leg was not accurately predicted, although overall depressurization behavior was well predicted in both legs. That pressure difference was primarily determined by steam generation from the core because cold leg was isolated by water seal at core and at crossover leg. However, there was another one communication path between cold leg and hot leg, a upper head bypass line (Junction 535). Differential pressure between the cold leg and hot leg may be affected by flow through this path. Since the detailed geometry of the bypass line was not known, the calculated timing and depth of loop seal behavior may be dependent of loss coefficient and area of the junction. However, it was found in the base case calculation, i.e., single core channel model, that the loop seal behavior explained above was not basically changed with varying the junction loss coefficient and junction area. It was also found to be effective in the case of two core channel model (T01), which will be discussed at the next section.

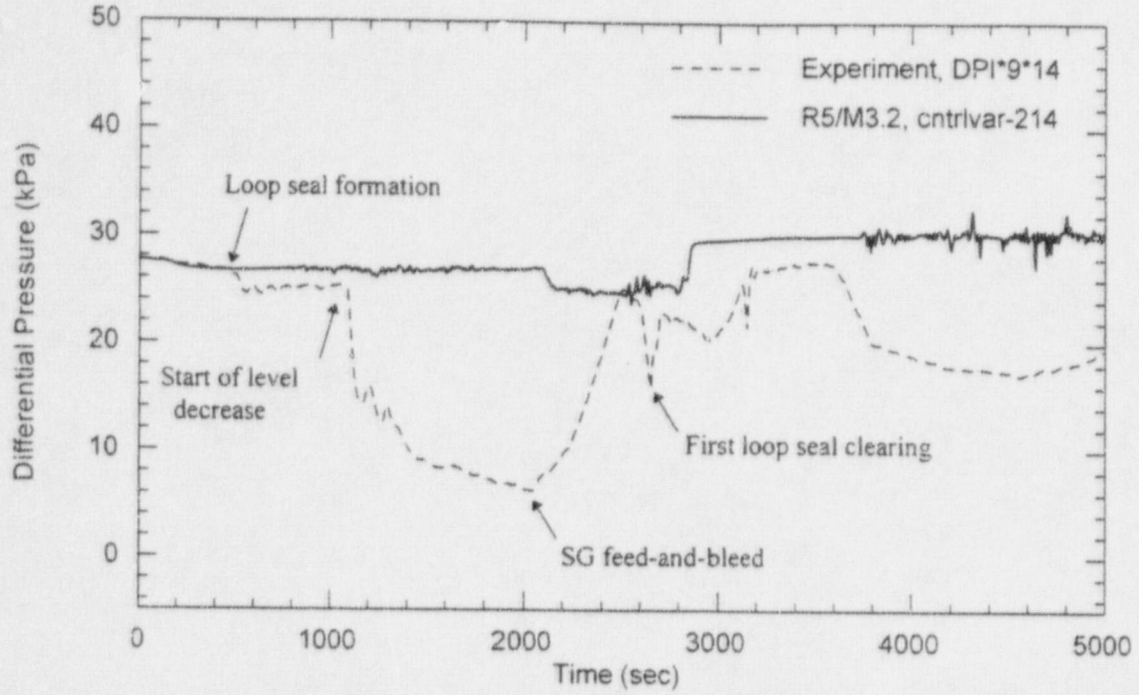

Fig.18 Comparison of Differential Pressure at Intact Loop SG side Crossover Leg

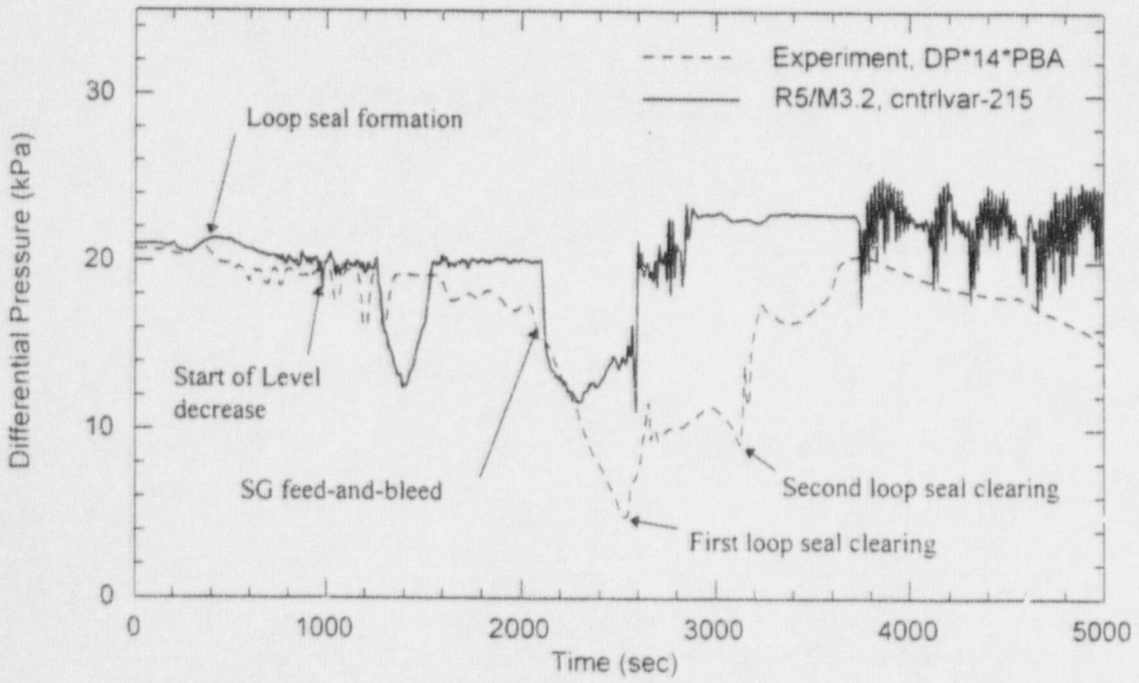

Fig.19 Comparison of Differential Pressure at Intact Loop Pump side Crossover Leg

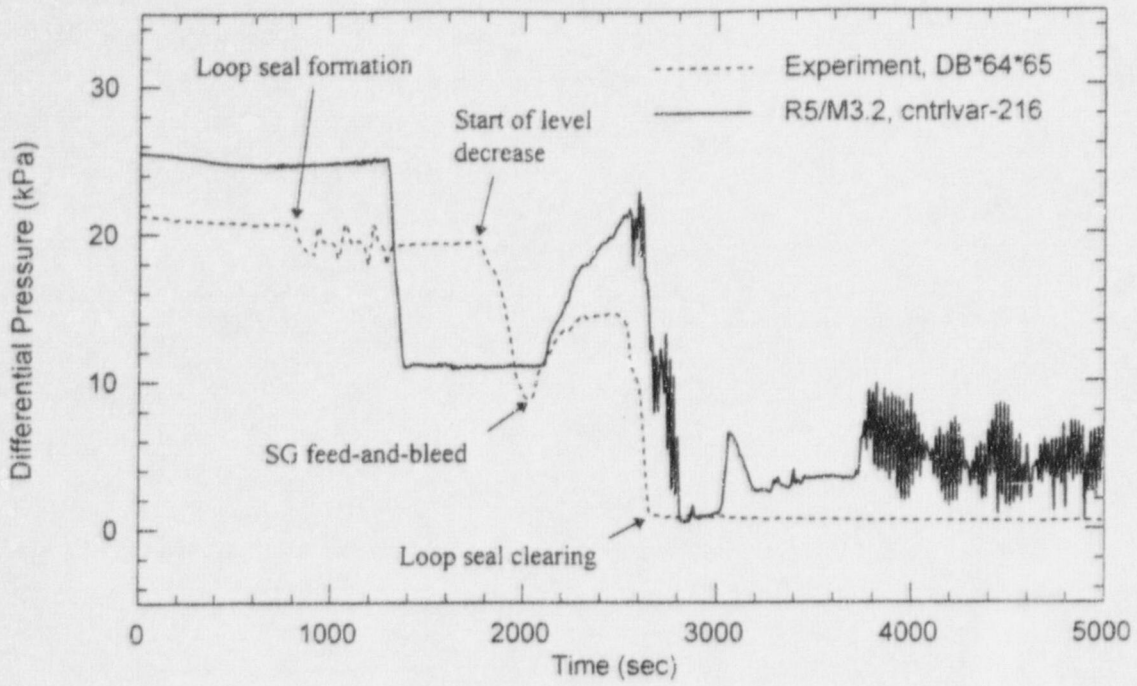

Fig.20 Comparison of Differential Pressure at Broken Loop SG side Crossover Leg

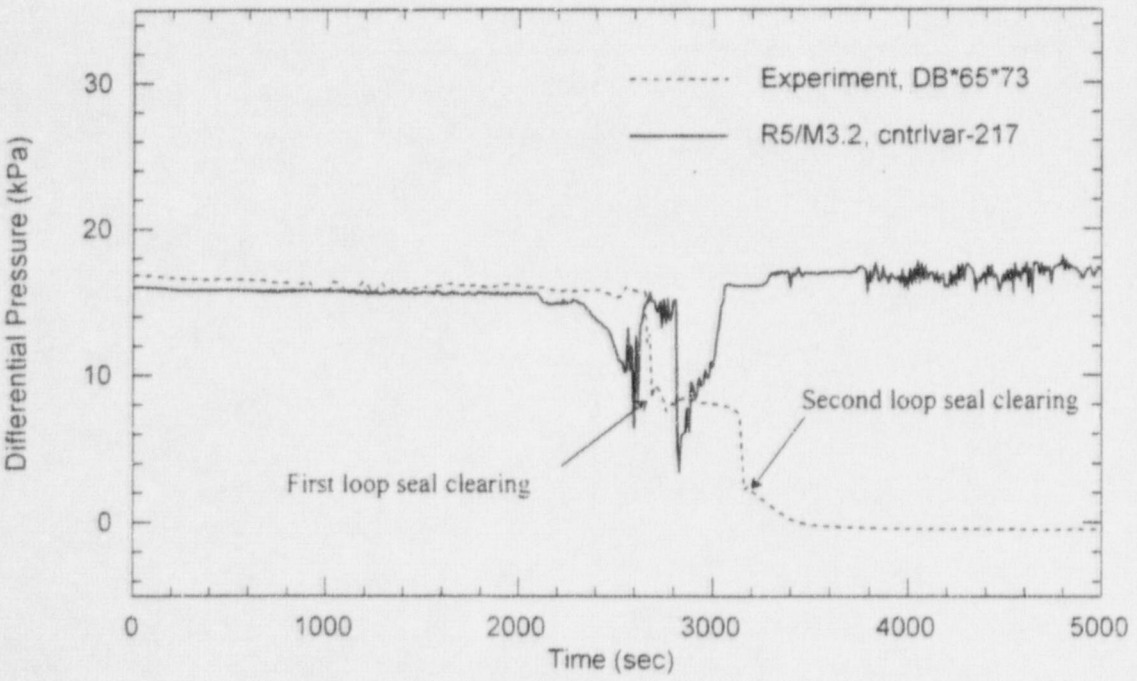

Fig.21 Comparison of Differential Pressure at Broken Loop Pump side Crossover Leg

The RELAP5 calculation on core liquid level behavior (Figure 22) also shows the same deviation as the level behavior of the intact loop, i.e., no level decrease and recovery. It is clear that core level behavior was not correctly predicted with single core channel model.

Based on comparisons above, deviation of prediction in loop seal behavior may be limitation of the code, because the range of differential pressure during the loop seal behavior was less than *20 kPa* in experiment, which required an accurate calculation in accuracy range of *10 kPa*.

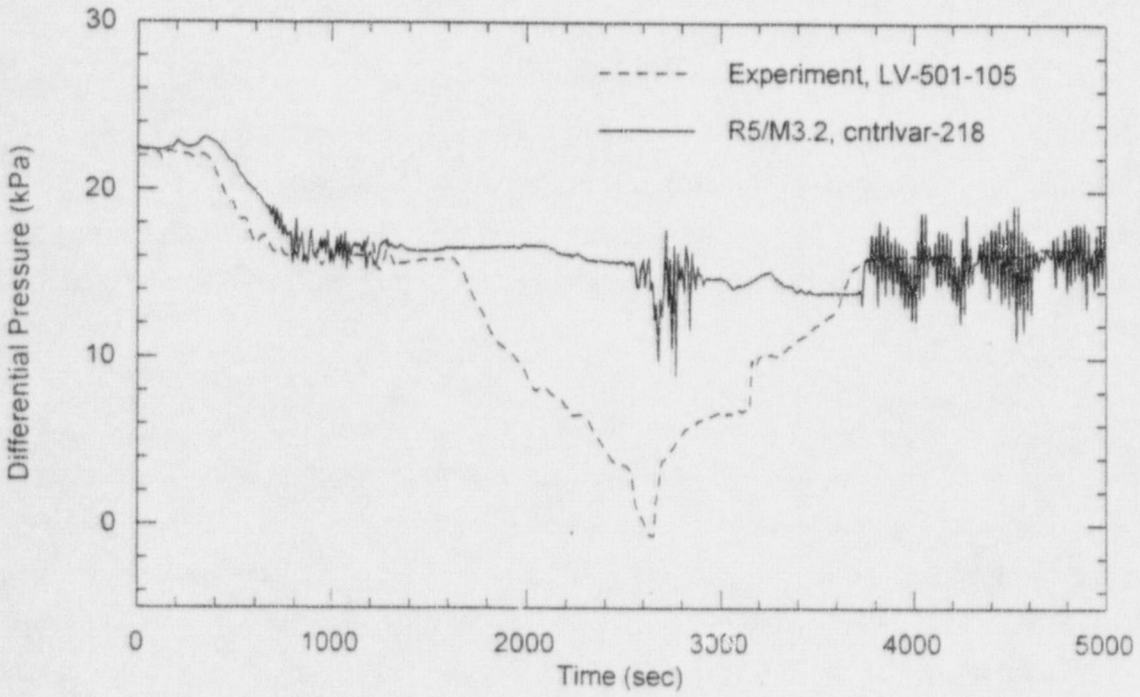

Fig.22 Comparison of Differential Pressure between Core Inlet and Outlet

IV.1.4 Natural Circulation

Figure 23 shows comparisons of mass flow rates at downcomer outlet. In experiment, the initial mass flow rate through the downcomer was *0.578 kg/sec* in a single phase natural circulation mode and remained at about the initial value until the hot legs uncovered at about *280 sec*. As more coolant was discharged out, the density gradient between fluid in the upside of steam generator and downcomer increased due to a formation of void, which increased the natural circulation driving force. As a result, the flow in the loop increased and eventually peaked at about *350 sec*. As further mass was expelled out the break, the fluid in the intact loop SG U-tube eventually depleted, which led to a reflux condition in the intact loop. In experiment, the reflux condition was visually observed at about *825 sec* in the intact loop, but was not observed until *1900 sec* in the broken loop.

The RELAP5 calculation result shows a generally good agreement with the experiment data. However, the calculation shows some differences in magnitude of peak flow, timing of peak flow occurrence, and duration of two-phase natural circulation flow. And a deviation was also found after *2500 sec*, i.e., accumulator injection period, which will be described at next section.

The difference in peak flow is considered to be due to a broken loop n , flow, and the difference in peaking time due to intact loop mass flow, as shown in Figures 24, which shows comparisons of mass flow rates at intact loop cold leg and broken loop cold leg. From this figure, one can find that the broken loop cold leg experienced more and longer flow at than the experiment. This difference resulted in overprediction of downcomer mass flow rate and duration of natural circulation. This fact indicates that there was more water inventory in the broken loop during this period and that it was due to underprediction of break flow.

Comparison of downcomer mass flow rate as a function of primary system mass inventory was shown in Figure 25. This figure shows there were two peaks in mass flow rate at about *89 %* and *80 %* inventory both in experiment data and in calculation result. The peak at *89 %* inventory corresponds to the point in time when pressurizer empties of fluid. It is possible that steam from the pressurizer entered the hot leg and steam generator U-tubes thus inducing a large density gradient in the loop which led to a momentary peaking in downcomer flow. The peak at *89 %* inventory can be regarded as the maximum mass flow rate due to the maximum density gradient during the two-phase natural circulation. From this figure, the natural

circulation flow rate with change in primary system inventory was well predicted for a range from *100 %* to *80 %* of the normal inventory (single and two-phase regimes). However, there was an little overprediction and oscillations for a less inventory, which was due to broken loop flow rate, as already mentioned.

The flow rate at intact loop hot leg was compared with the corresponding experimental data in Figure 26. In that figure, one can find a beginning of negative hot leg flow at *620 sec* in experiment, i.e., reflux condensation. In calculation, the reflux behavior was found after *800 sec*, which may due to more primary coolant inventory than the experiment. The highly oscillatory behavior in calculation was due to a excessive condensation in SG-U-tube. A sudden increase after *2600 sec* in calculation was due to accumulator injection. It was over-estimated when compared to the experimental behavior.

The flow at broken loop hot leg was compared in Figure 27. The figure shows that reflux in was predicted at 1170 sec. The calculation shows a more and larger flow that the experiment, which was consistent with the prediction of cold leg flow. The effect of accumulator was not found in the broken loop cold leg due to break.

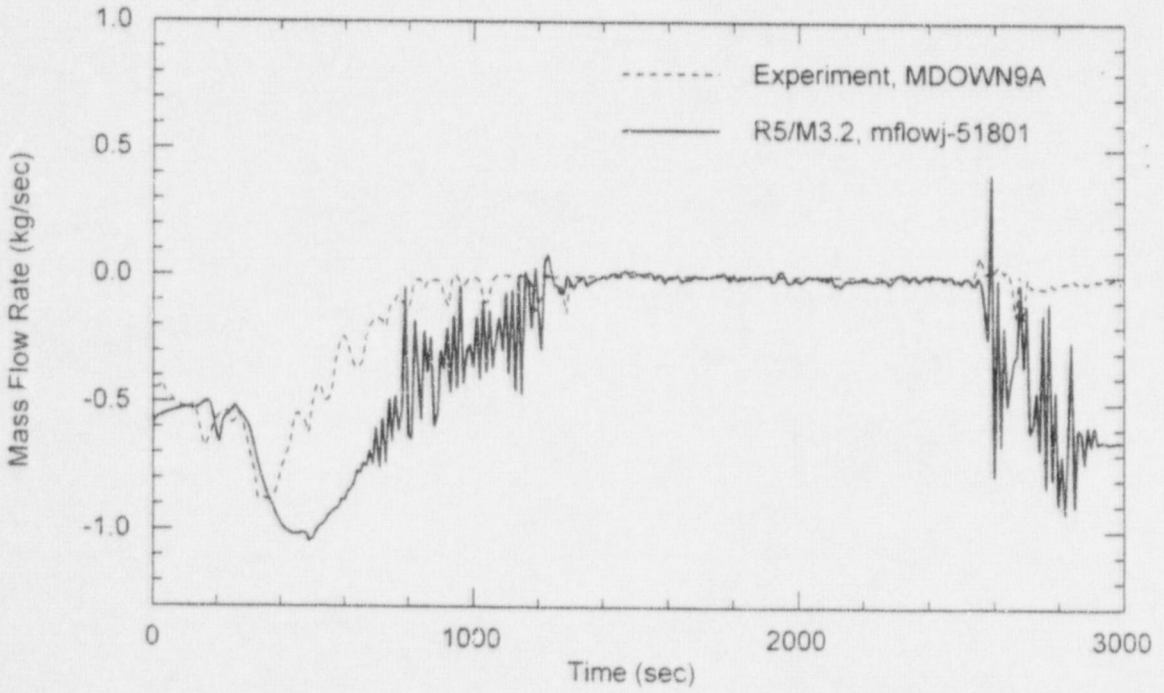

Fig.23 Comparison of Downcomer Mass Flow

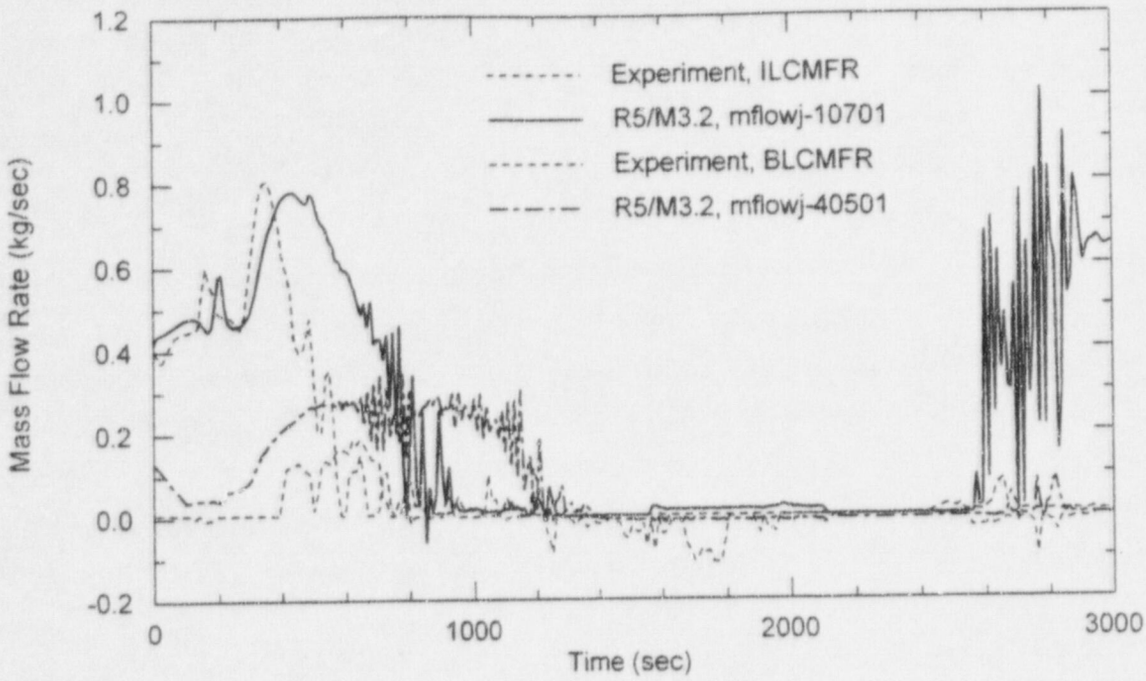

Fig.24 Comparison of Mass Flow Rate at Intact Loop Cold Leg and Broken Loop Cold Leg

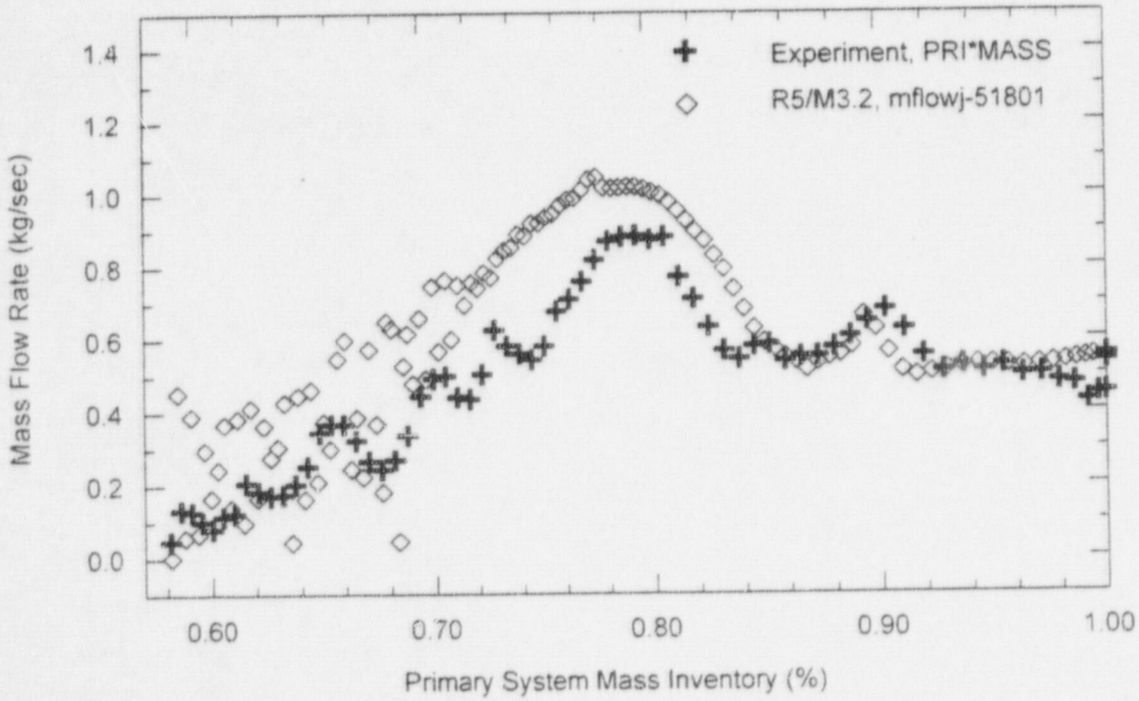

Fig. 25 Comparison of Downcomer Mass Flow Rate versus Primary System Inventory

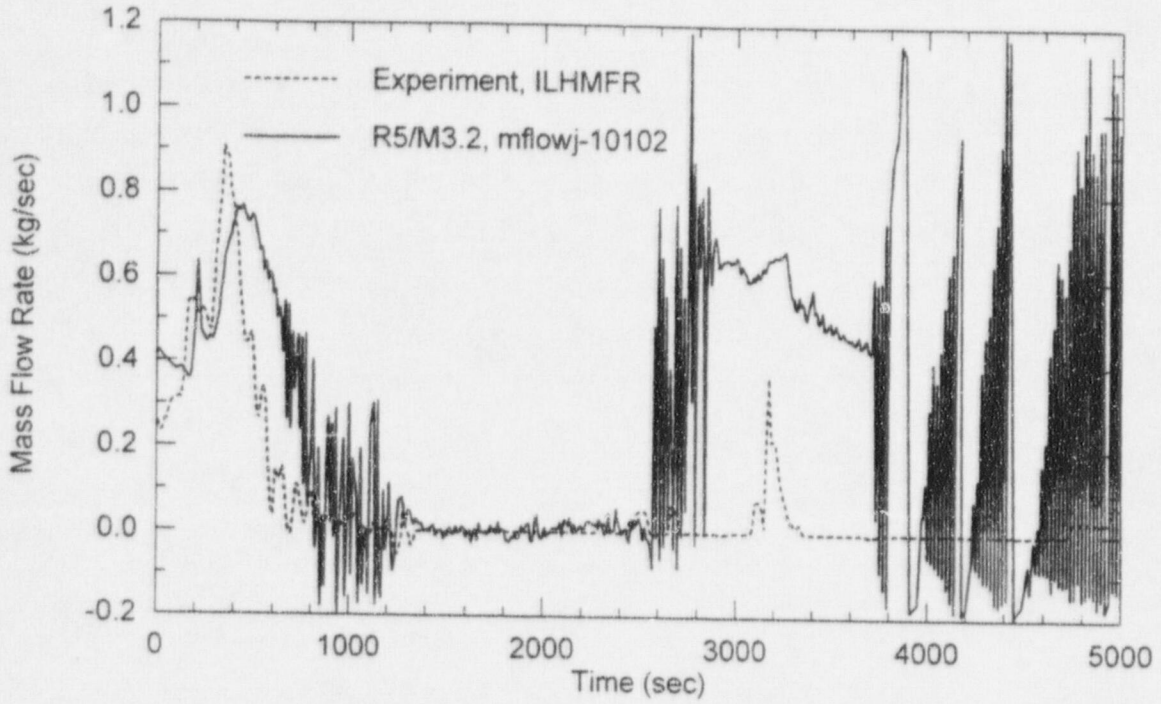

Fig.26 Comparison of Mass Flow Rate at Intact Loop Hot Leg

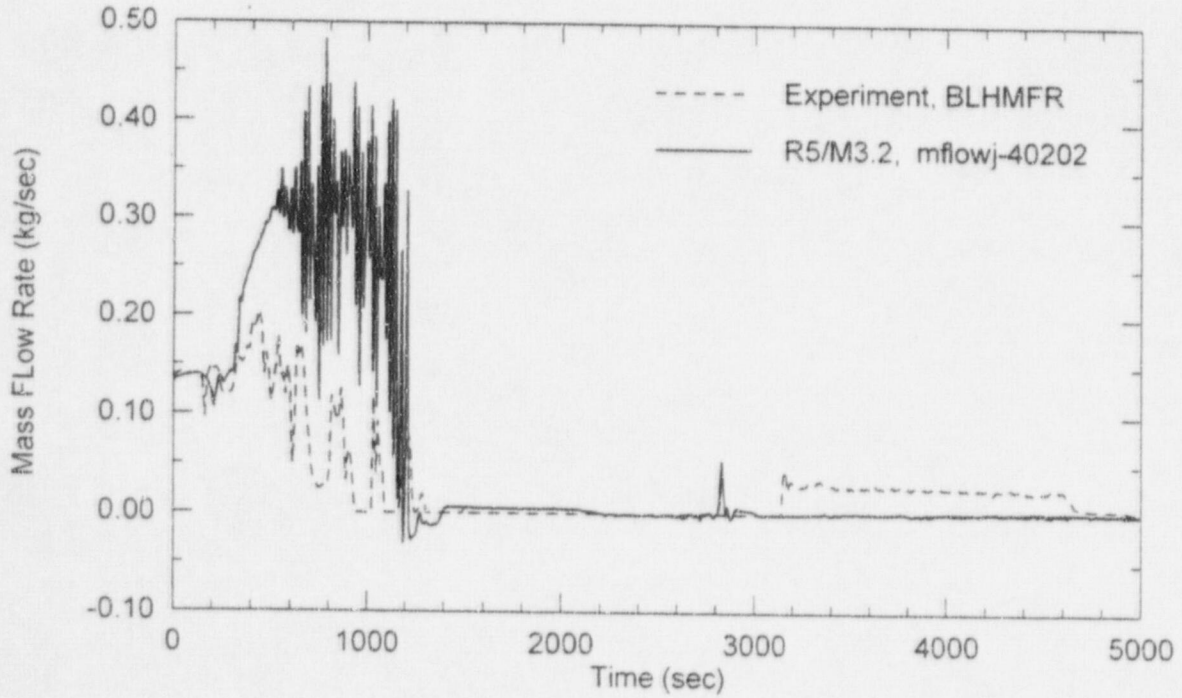

Fig.27 Comparison of Mass Flow Rate at Broken Loop Hot Leg

IV.1.5 Accumulator Injection Behavior

Figures 28 shows accumulator injection flows both at intact loop cold and at broken loop cold leg. The RELAP5 calculation shows drastic peaks at the beginning of injection and then oscillatory and discontinuous behavior due to condensation effect. Since the experimental data on accumulator flow was not available, predictability could not be discussed. However, it was believed that the current calculation result was not realistic because loop flow was highly over-estimated after accumulator injection, as mentioned previously. The effect of inaccurate accumulator injection behavior will be discussed at the next section.

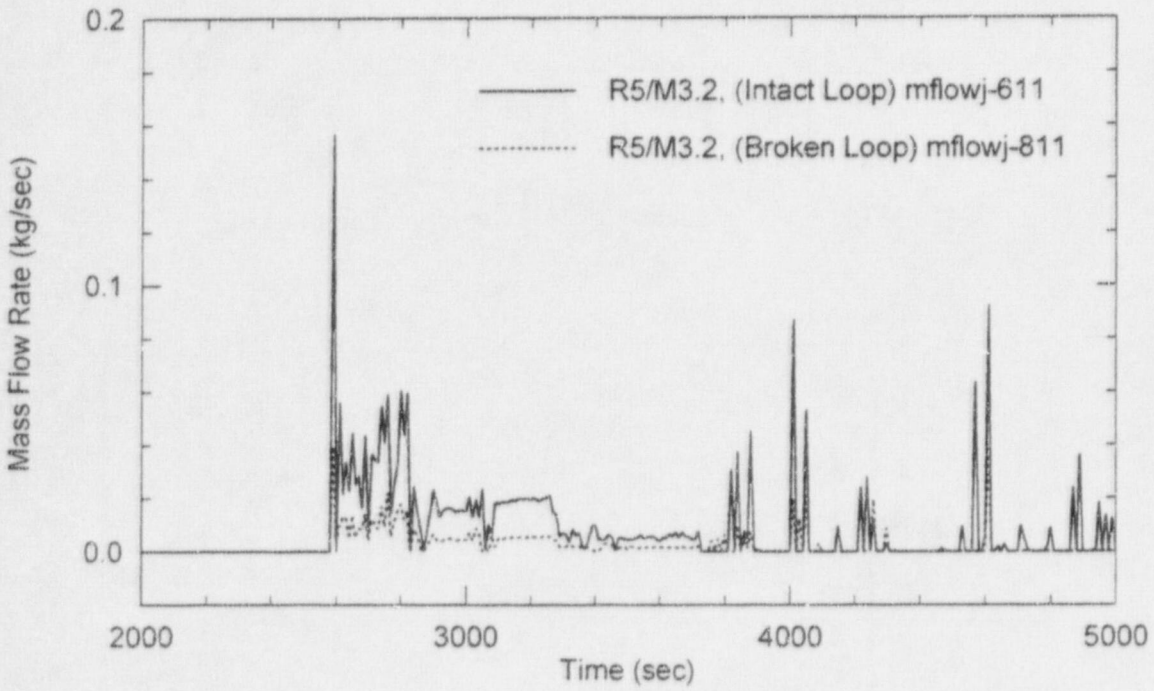

Fig.28 Comparison of Accumulator Injection Flow Rate

IV.1.6 Thermal Response

Figures 29 shows a comparison of fluid temperature at the intact loop hot leg between the prediction and the measurement. Prior to the experiment, the intact loop fluid was circulated by a natural convection mechanism. As the break open, a void was formed, the core power reduced to the decay heat level, and then the difference in temperature between hot leg and cold leg was also reduced. After cold leg flashing, the coolant temperature remained almost constant or reduced slightly due to secondary side steam leak. At *2100 sec*, the SG feed-and-bleed operation caused the fluid to cooldown.

The RELAP5 prediction shows a good agreement with the experiment data. The small deviation after *2100 sec* were believed a difference in data channel. The experiment data was measured at the centerline of hot leg pipe, i.e., mixture temperature, in which a water level behavior was included. However, the calculation result was for averaged liquid temperature.

Figure 30 shows a comparison of fluid temperature at intact loop cold leg. The predicted temperature was well-agreed with the experimental data. Some oscillatory behavior after *2500 sec* was due to accumulator injection.

Figures 31 shows comparison of fluid temperatures at broken loop hot leg. This figure shows the broken loop hot leg experienced an almost identical behavior to that at the intact loop. The predicted temperature was well-agreed with the experimental data before *2600 sec*. The underprediction after *2600 sec* was believed a difference in measurement location, as explained above (i.e. centerline measurement in experiment versus liquid temperature in calculation).

The coolant temperature at broken loop cold leg was already mentioned at Figure 15, which also showed the overall behavior was well predicted.

Figures 32 shows comparison of the core rod temperatures between the prediction and the experiment at elevation of *291 cm*. The experiment data shows an initiation of rod heat-up at *2000~2500 sec*. Also the experiment data shows a turnaround of rod temperature and quenching at the timing of loop seal clearing of the broken loop. However, in the RELAP5 prediction, no heat-up and quenching were found.

As already mentioned at loop seal behavior and core level behavior, due to the small differential pressure between hot leg and cold leg, the predicted core level was not decreased at *1800 sec*, as shown in Figure 22, therefore, the core rod was covered with water, the rod surface temperature remained constant. Also, the calculation did not show a loop seal clearing and the related core level recovery, therefore, no quenching.

Based on the analysis above, it is found that the improvement of loop seal behavior prediction is necessary to predict the core thermal response accurately.

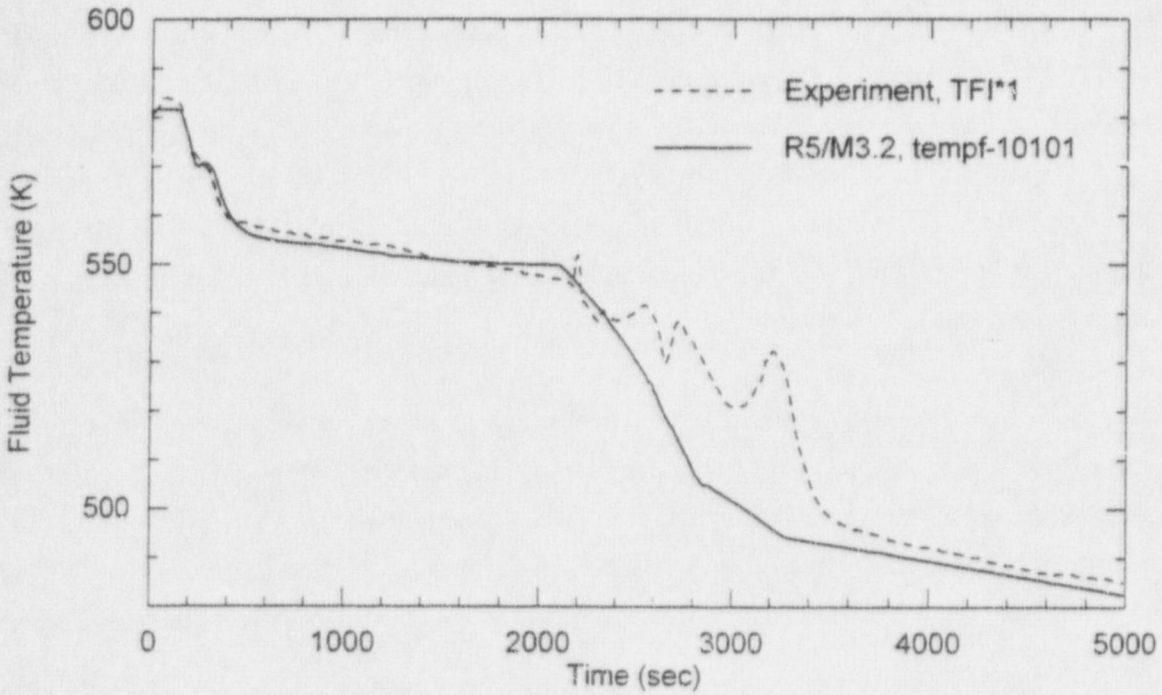

Fig.29 Comparison of Fluid Temperature at Intact Loop Hot Leg

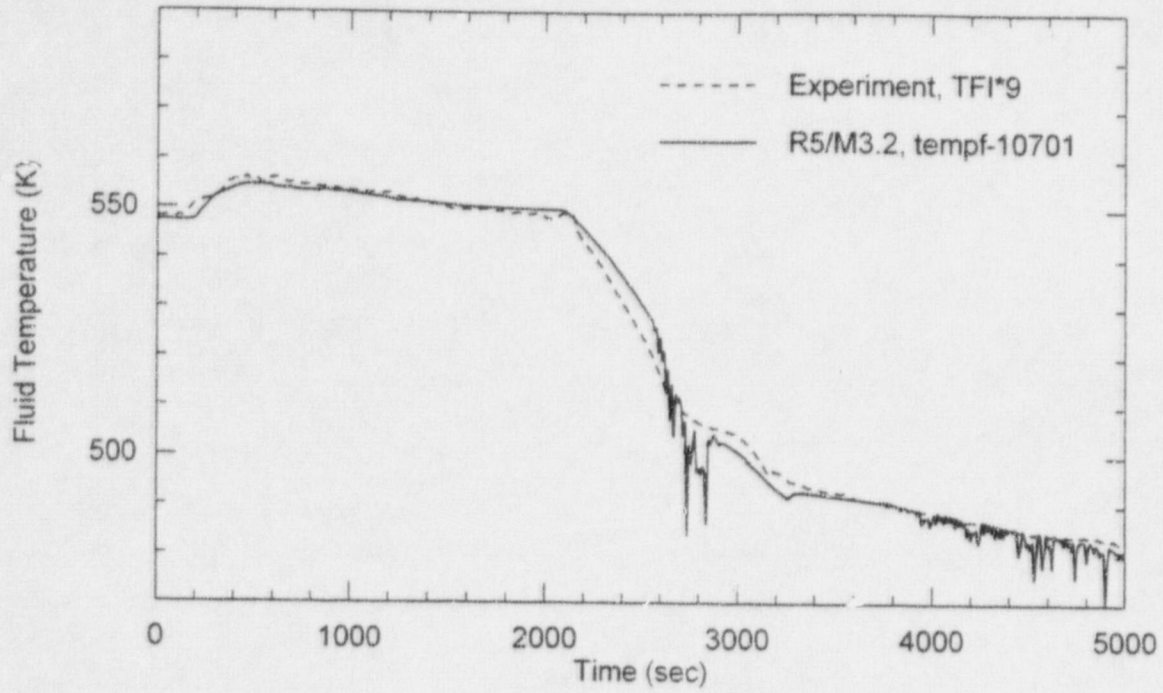

Fig.30 Comparison of Fluid Temperature at Intact Loop Cold Leg

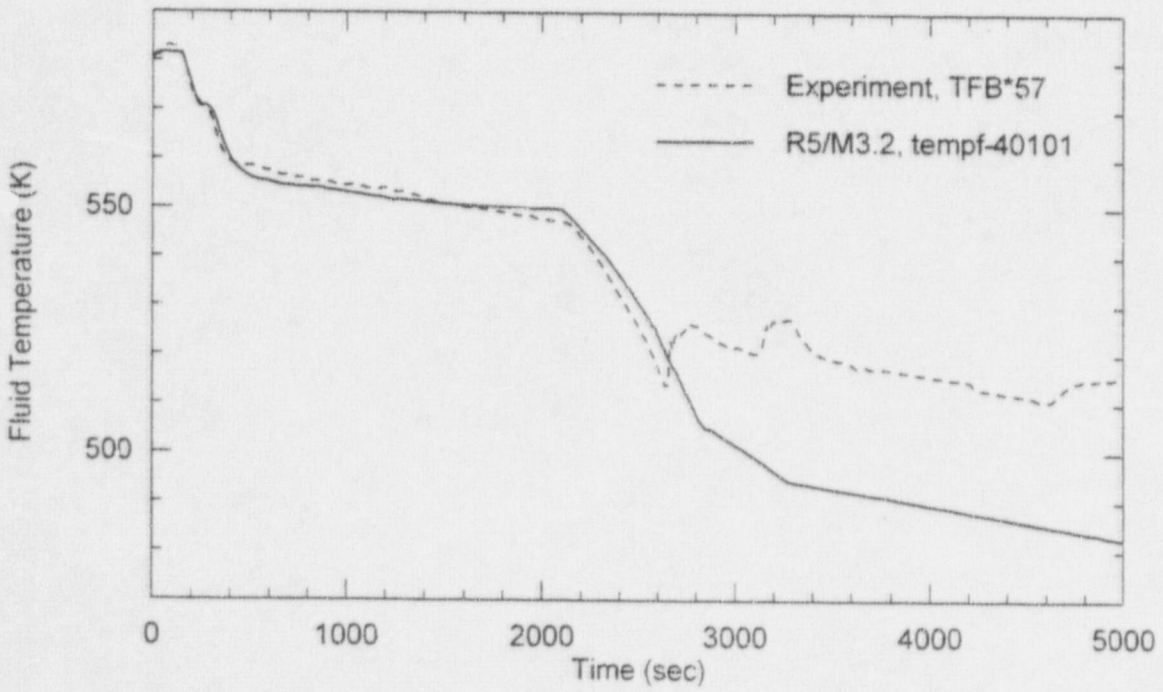

Fig.31 Comparison of Fluid Temperature at Broken Loop Hot Leg

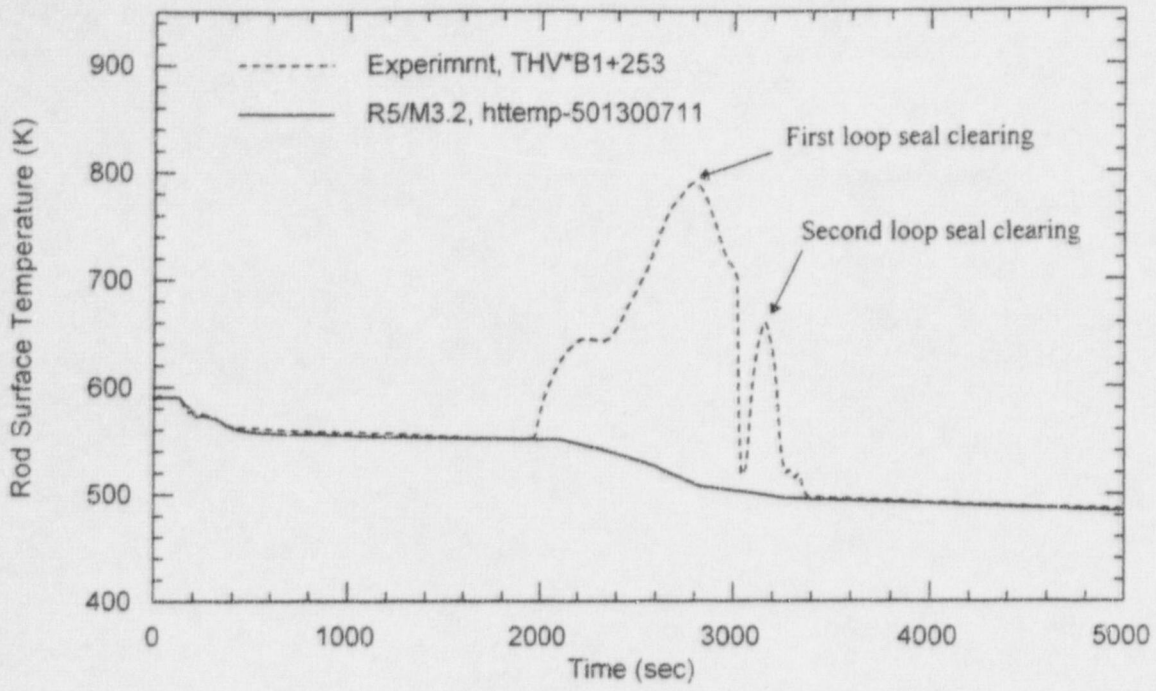

Fig.32 Comparison of Rod Surface Temperature at Elevation of 253 cm

IV. 2 Sensitivity Study

As mentioned previously, two calculations were additionally attempted to find out effects of reactor vessel core modeling (T01) and of ECCMIX component (E01) on the improvement of code prediction. Each calculation result is described, compared with the base case result, and discussed in this section.

IV.2.1 Effect of Two Core Channel Model (T01)

The case T01 adopted two parallel flow channels for reactor vessel core, in which crossflow junctions were used to link each channel as shown in Figure 4. This approach is based on that the two parallel channels and crossflow junctions may result in natural circulation flow path in reactor vessel core, which was not considered in single channel model.

Figure 33 shows a comparision of the calculated differential pressure between hot leg and cold leg of the intact loop. Two differential pressures were almost identical until *900 sec*, approximately, and then diverged. Even if the difference did not exceed *10 kPa*, it had significant effect on loop seal behavior because loop seal behavior was sensitive for differential pressure range of *10~20 kPa*.

The difference after *900 sec* was considered due to an effect of two core channel model. In single channel model, there was a little difference between hot leg pressure and cold leg pressure, therefore, it was not sufficient to move the fluid in loop seal. However, in two-core channel model, there may exist natural circulation flow path in the core. Those natural circulation flow may enlarge the difference between hot leg and cold leg, due to phase separation within the core. And it is believed as a physical phenomena.

Such an effect can be clearly found in loop seal behavior. Figure 34 shows a comparison of differential pressure at SG-side pipe in the intact loop crossover leg between the base case and the case T01. It is shown that the two core channel model can predict the formation of loop seal, loop seal level decrease due to steam pressure, level re-increase at SG feed-and-bleed, and loop seal clearing much better than the single core channel.

Of course, there were some discrepancies even in two core channel model result such as timing of loop seal formation and depth of loop seal level decrease. However, it is believed

such differences are within allowance limit of accuracy (less than *5 kPa*). Also it was found that the timing and depth loop seal behavior can be adjusted through tuning the junction area and loss coefficient at J535, although the result were not presented in this report.

The Case T01 shows a noticeable discrepancy after *2500 sec*, i.e., accumulator injection. It may be related not only with accumulator injection behavior, but also with code model such as condensation, and interfacial drag model in the code.

Figure 35 shows a comparison of core liquid level, in which the improvement of level behavior prediction by using two core channel model can be clearly observed. Especially, it is emphasized that the core uncovery, which was clearly observed in the experiment, can be predicted by the two core channel model not by single core channel model. And the problem of accumulator injection can be also found in core level behavior.

Figure 34 shows a comparison of core heater rod surface temperature at *253 cm* elevation between the base case and the case T01. As mentioned previously, in accordance with core level behavior, core heatup was predicted by two core channel model.

Even in two core channel model result, there were some differences in rod heatup prediction such as the first small peak in rod surface temperature, the overprediction during the second peak, and no quenching in the second peak, which were due to inaccuracy of code prediction of core liquid level behavior. Especially in the second peak, the rod temperature exceed *1200 K*, which resulted in calculation failure at *3980 sec*.

The failure of two core channel model calculation was due to stop of accumulator injection from *3000 sec* as shown in Figure 37. The reason for the stop of accumulator injection was a sudden excursion of primary system pressure from *2960 sec*, as shown in Figure 38, which was not currently understood.

Based on the discussion above, the two core channel model can predict a more realistic loop seal behavior than the single core channel model. However, the pressure response problem related to the accumulator injection behavior should be resolved to improve the realistic core heatup prediction.

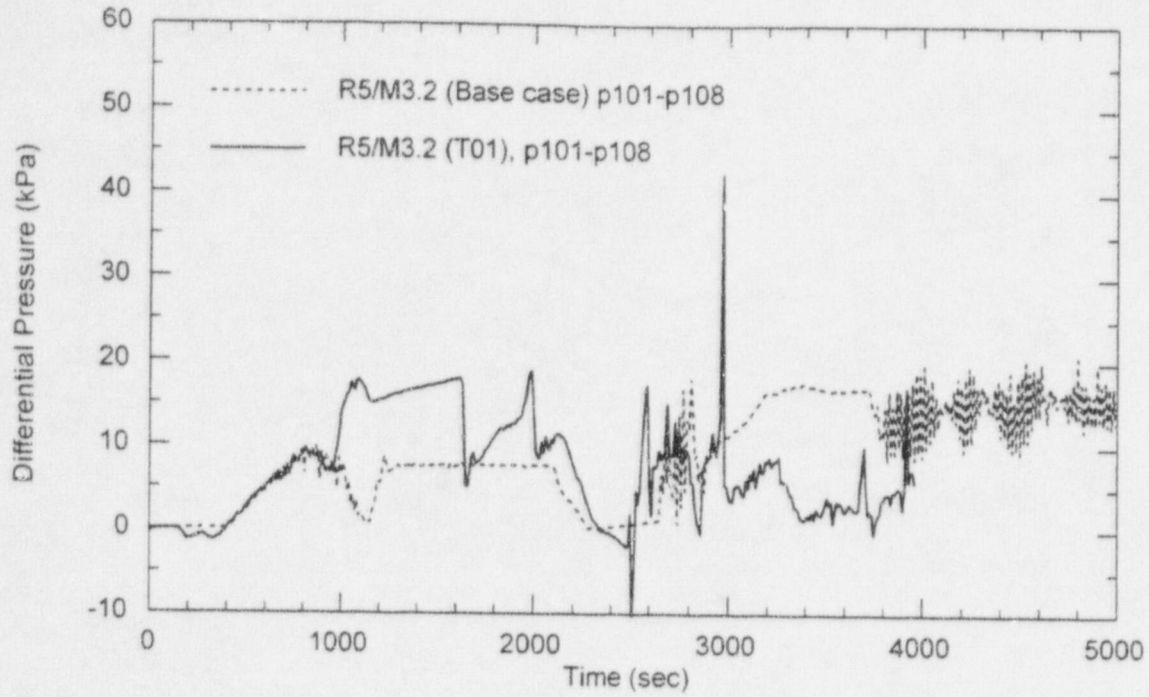

Fig33 Comparison of Hot Leg-to-Cold Leg Differential Pressure Between Base Case and Case T01

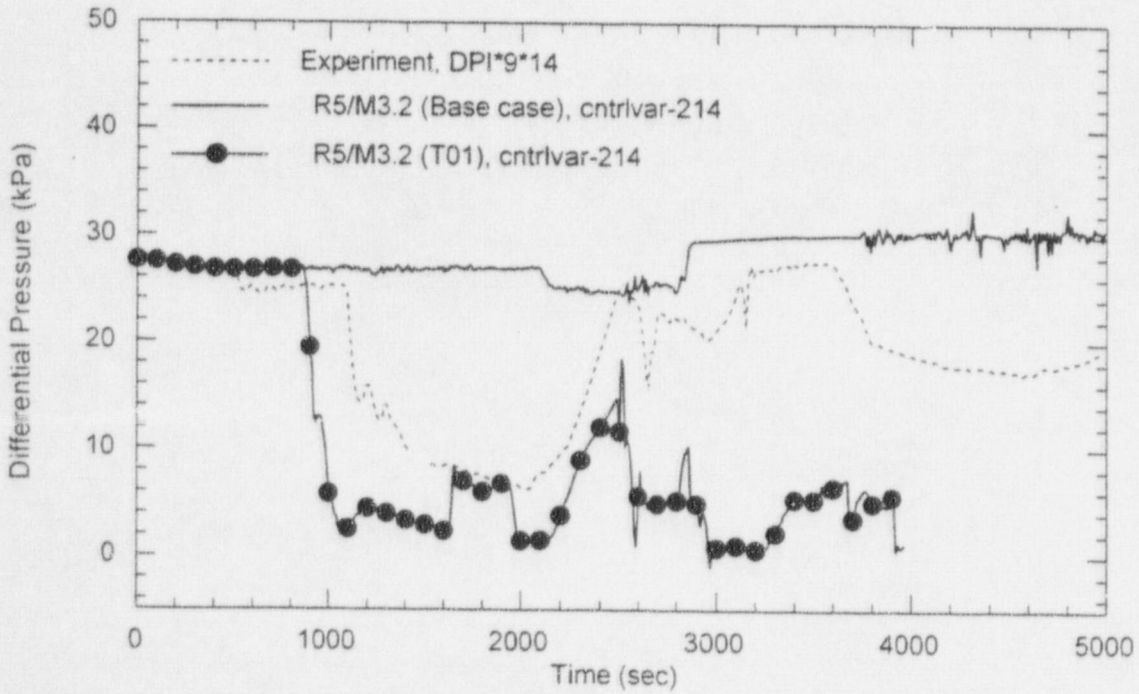

Fig.34 Comparison of Differential Pressure at Intact Loop SG side Crossover Between Base case and Case T01

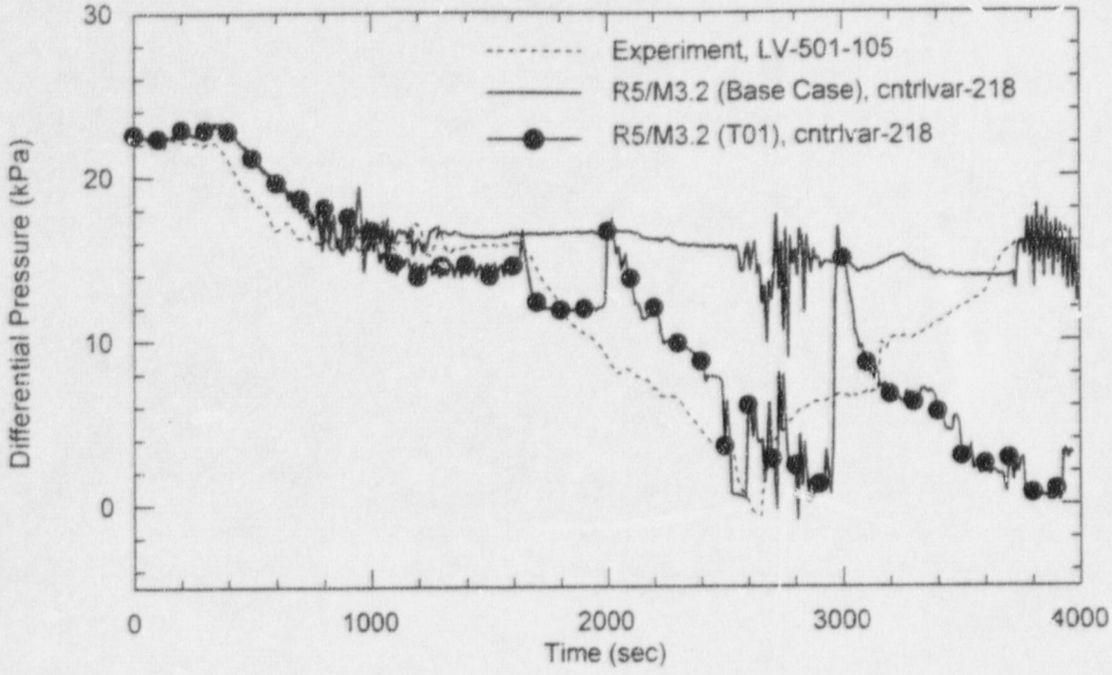

Fig.35 Comparison of Core Liquid Level Between Base Case and Case T01

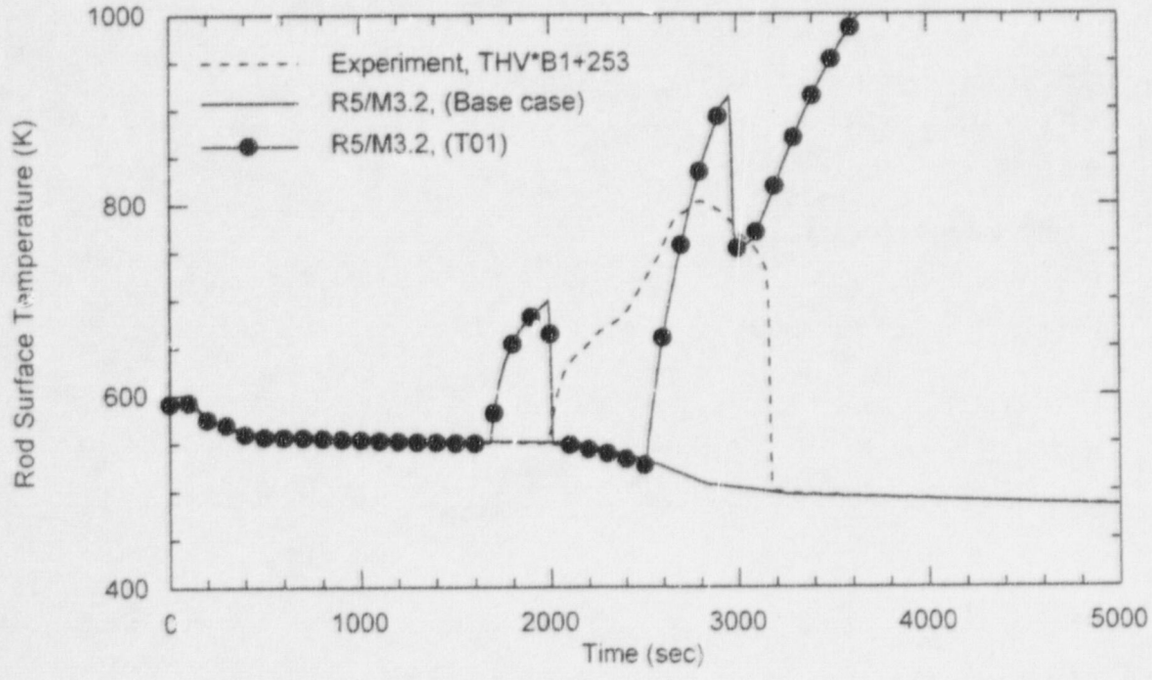

Fig. 36 Comparison of Rod Surface Temperature at Elevation 253 Between Base Case and Case T01

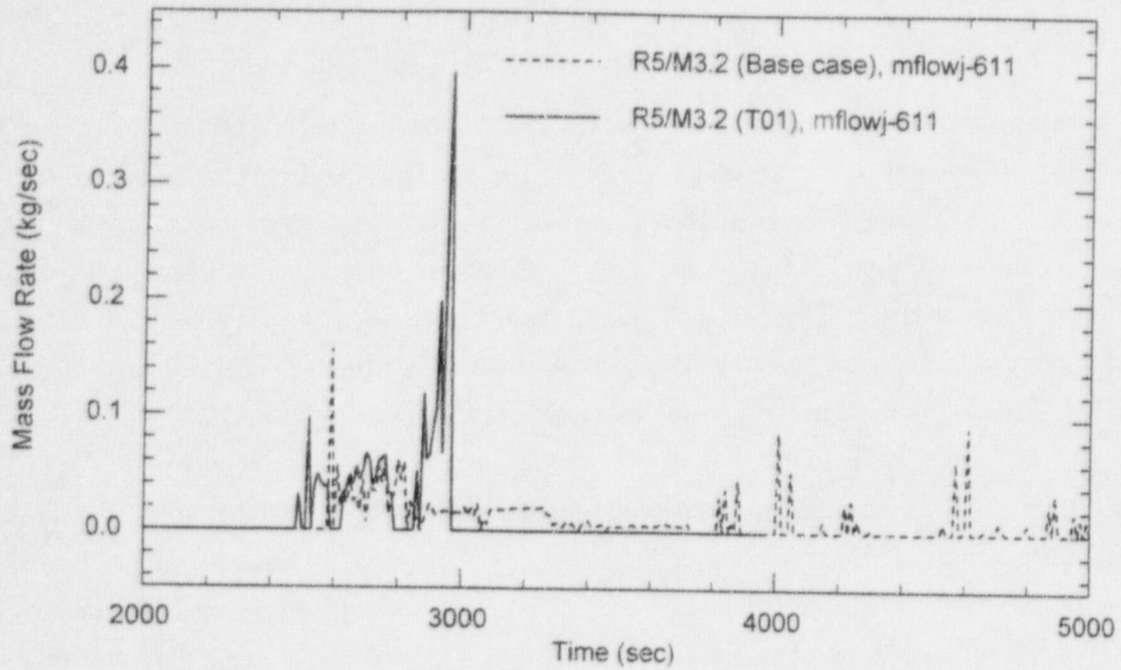

Fig.37 Comparison of Accumulator Injection Flow Rate Between Base Case and Case T01

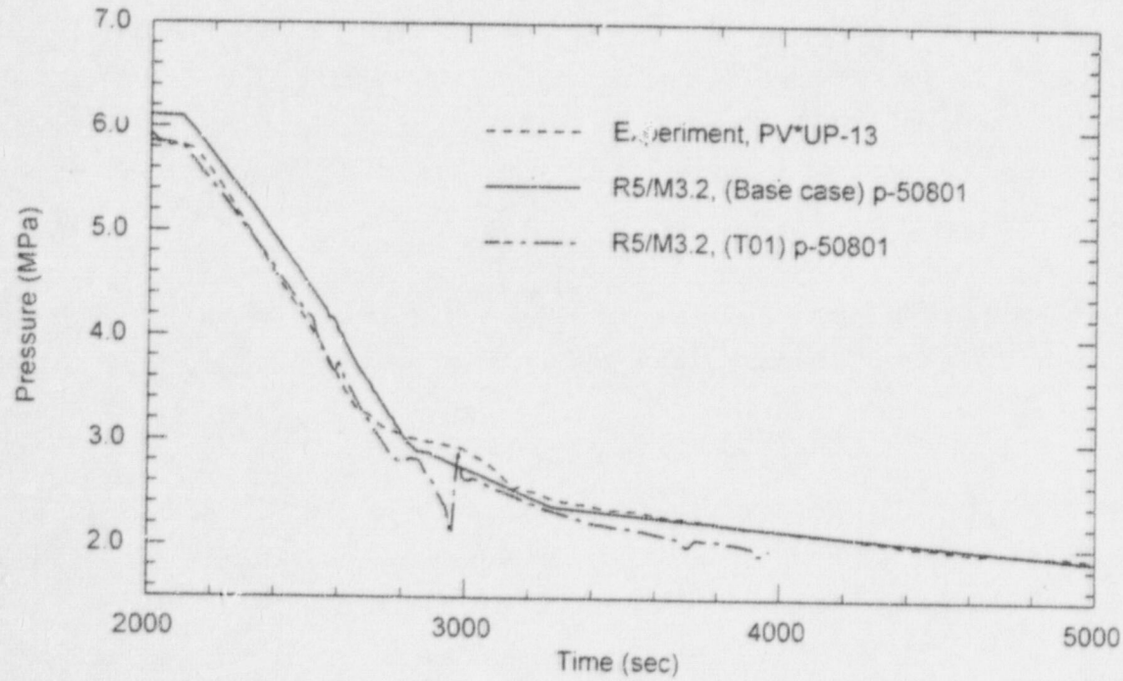

Fig. 38 Comparison of Primary System Pressure Between Base case and Case T01

IV.2.2 Effect of ECCMIX Component Model (E01)

To investigate a possibility of improvement in accumulator injection behavior, ECCMIX component was attempted both in intact loop cold leg and in broken loop cold leg. In intact loop cold leg, the ECCMIX component replaced the branch component (volume 107), while a ECCMIX component was added at the outlet of volume 404, and volumes of adjacent components were adjusted. The ECCMIX component has its own flow regime map and the related closure correlations, therefore, it is expected that the different result can be obtained using ECCMIX component on the accumulator injection behavior.

Figures 39 shows a comparison of accumulator injection flow rate between two cases adopting two core channel model (Case T01 and E01). Compared to the case T01, the result of the case E01 shows a more injection water delivery to the core at initial injection stage (*2500 to 2700 sec*). And the peak injection flow of the case E01 was larger than that of the case T01.

Figures 40 and 41 show comparisons of core liquid level behavior and rod surface temperature for two cases, respectively. In core level behavior (Figure 36), big difference between the case E01 and the case T01 is not shown. In Figure 37, the case E01 did not predict an early heatup in rod surface temperature, while the case T01 did. And it was also identified in core level behavior during the same time period. Currently, the reason for the difference was not understood, it can be interpreted the ECCMIX component may change a different inventory distribution.

Figure 42 shows a comparison of differential pressure at intact loop SG side crossover leg. The result from the case E01 shows a more realistic level behavior when compared to T01 case.

As mentioned above, there were more injected water in the case E01 than the case T01, as a result, the case E01 predicted a temporary level increase at *2600 sec* (Figure 40). Consequently, the heatup time was delayed when compared to the case T01.

In the case E01, there was a sudden peak injection (*0.7 kg/sec*) at *3100 sec*, the resultant core heatup was likely to be stopped, and core rod heatup behavior was much close to the experiment one. However, since the case E01 calculation was failed at *3160 sec* due to water

property failure at volume 407 (broken loop ECCMIX component), the upcoming behavior cannot be expected. A additional calculation was attempted with reducing the maximum time step to *0.001 sec*, to avoid the failure, which was not presented this report, the result was almost the same as the case E01.

Based on above discussion, the ECCMIX component model still provided a discontinuous injection behavior, however, a instantaneous injection flow rate was large when compared to the cases not adopting the ECCMIX component. As a result, core heatup behavior could be improved. It can be expected that the use of ECCMIX component may improve core heatup behavior prediction if other TH phenomena was correctly predicted.

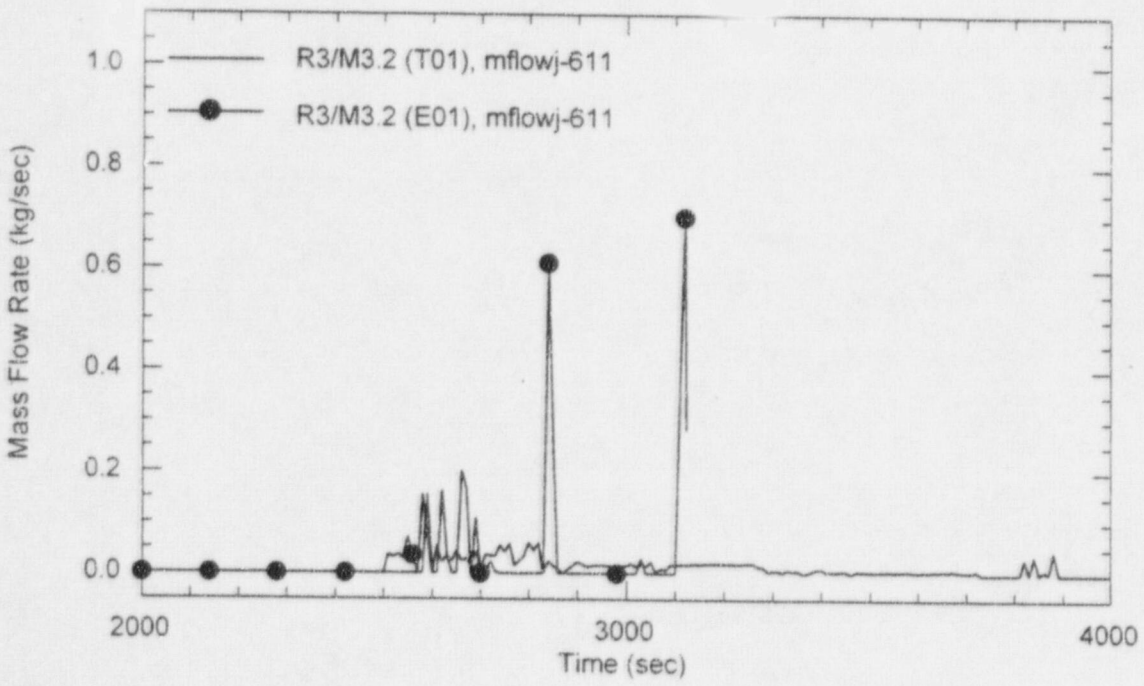

Fig. 39 Comparison of Accumulator Injection Flow Rate (Case T01 and Case E01)

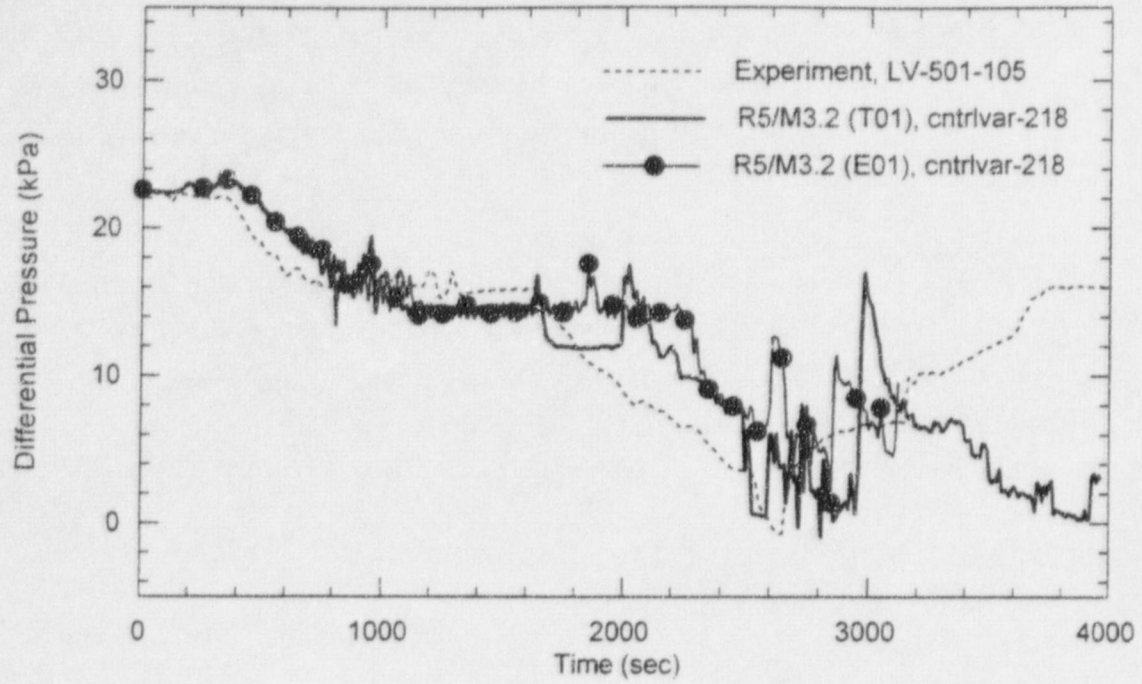

Fig. 40 Comparison of Core Liquid Level (Case T01 and Case E01)

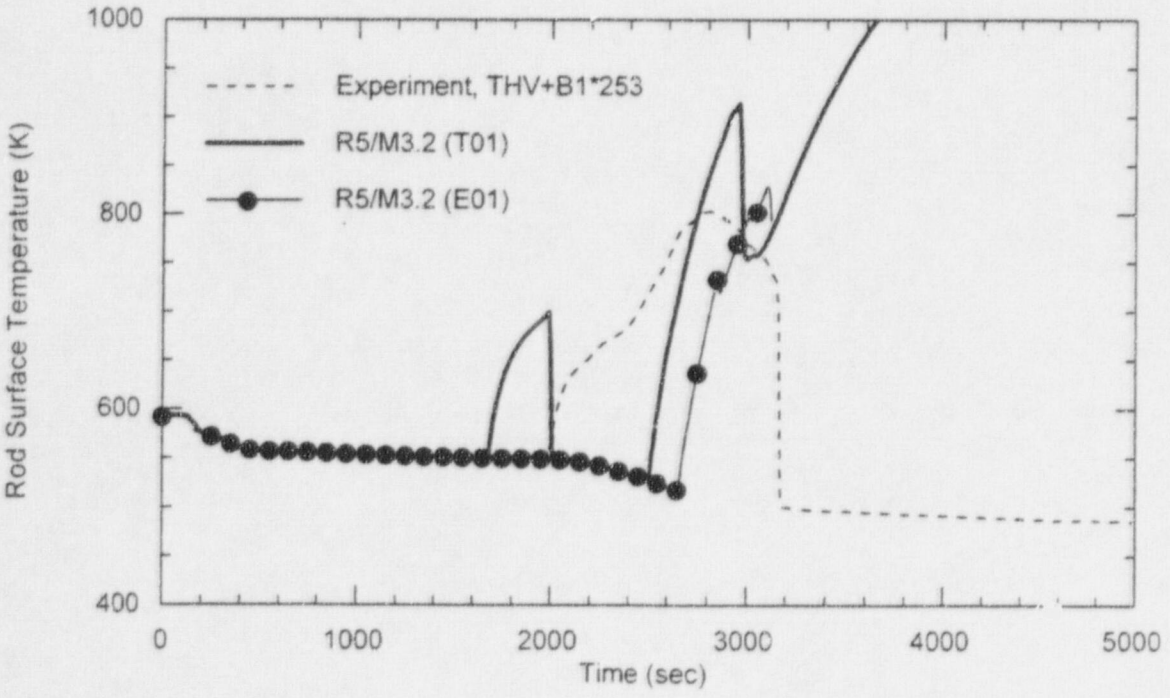

Fig.41 Comparison of Rod Surface Temperature at Elevation 253 (Case T01 and Case E01)

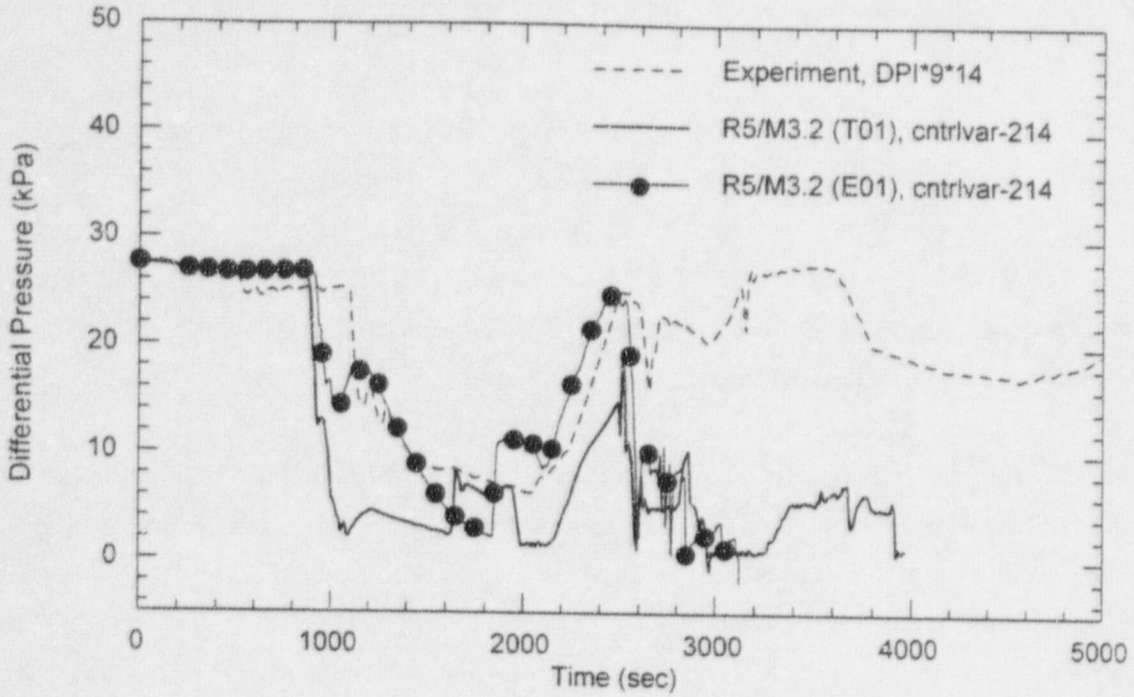

Fig.42 Comparison of Differential Pressure at Intact Loop SG side Crossover (Case T01 and Case E01)

IV. 3 Rur Statistics

A HP-715/50 workstation with operating system of HP-UX Version 9.0a was mainly used for the present calculations. The workstation has 32 MB main memory.

All the calculation were attempted to *5000 sec*. The base case run was successfully terminated at *5000 sec*, while the case T01 run was terminated at *3965 sec* due to the material temperature exceeding *1200 K* and the case E01 was terminated at *3122 sec* due to water property failure with minimum time step.

Figure 43 shows a comparison of the required CPU time. Figure 44, 45, and 46 shows a comparison of time step size and Courant time step with respect to the real transient time for three runs. As shown in the figures, the required CPU time was doubled by adopting two core channel model and much increased by using ECCMIX component. The slope of CPU time became steep from *800 sec*, i.e. cold leg flashing for both cases T01 and E01, however. it was not changed for the base case.

The time step size was reduced from the initial value *0.05 sec* down to *0.01 sec* for both cases T01 and E01, however, it was not changed for the base case. All the case, the time step size were less than the Courant time step.

The base case run was terminated at *5000 sec*, the required CPU time in HP workstation was *35722.0 sec* including *4.56 sec* for input processing, and the attempted advancement was 100192 time steps. Therefore, the grind time for the base case can be calculated as follows :

CPU Time, $CP = 35722 - 4.56 = 35717.44$

Number of Time Step, $DT = 100192$

Number of Volume, $C = 206$

Transient Real Time, $RT = 5000$

Grind Time, $GT = (CP \times 1000)/(C \times DT) = 35717.44 \times 1000/(206 \times 100192)$

$= 1.73$ *m CPU sec/(vol-step)*

Since the case T01 and E01 required much more CPU time and time steps. the resultant grind time is similar to the base case one.

Figure 47 shows a comparison of mass error for three cases. The mass error for both cases T01 and E01 was rapidly increased from *800 sec*. i.e. cold leg flashing. and they exceeded *70*

kg at *4000 sec*. However, for the base case, it remained constant (less than *3 kg*). Such a big difference in mass error indicated that there were much more flip-flop changes such as a rapid change in velocity during loop seal behavior, for two core channel case than for single core channel case.

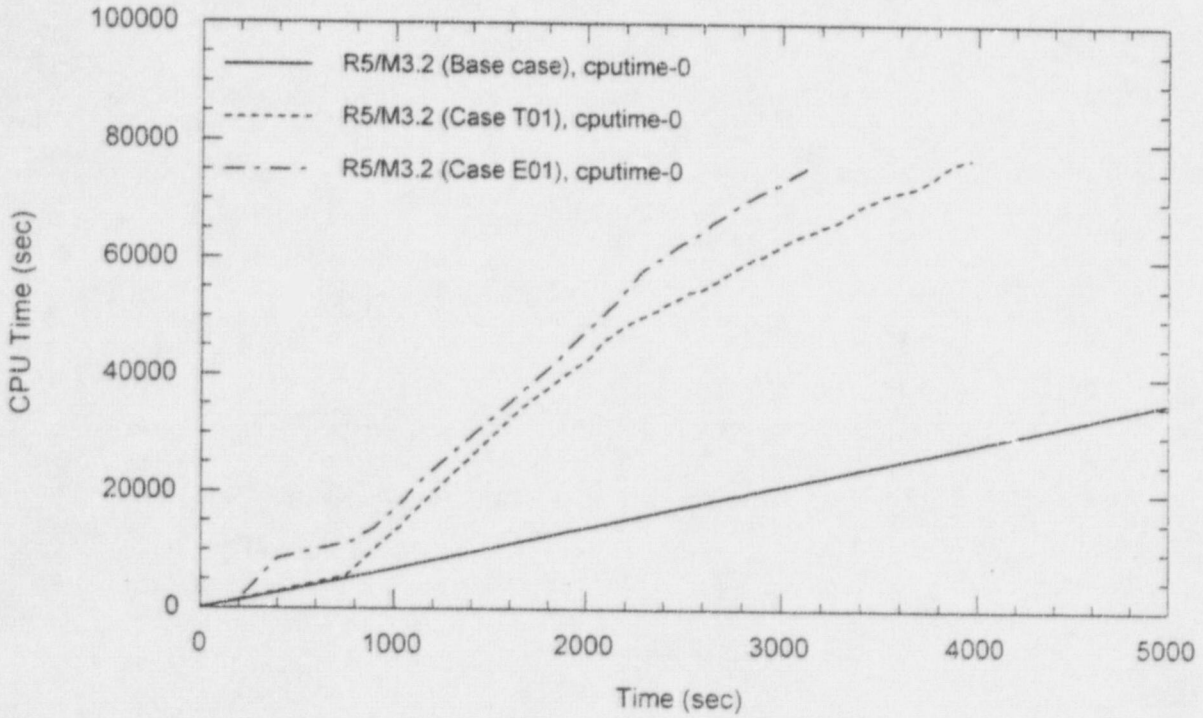

Fig. 43 Comparison of Calculational CPU

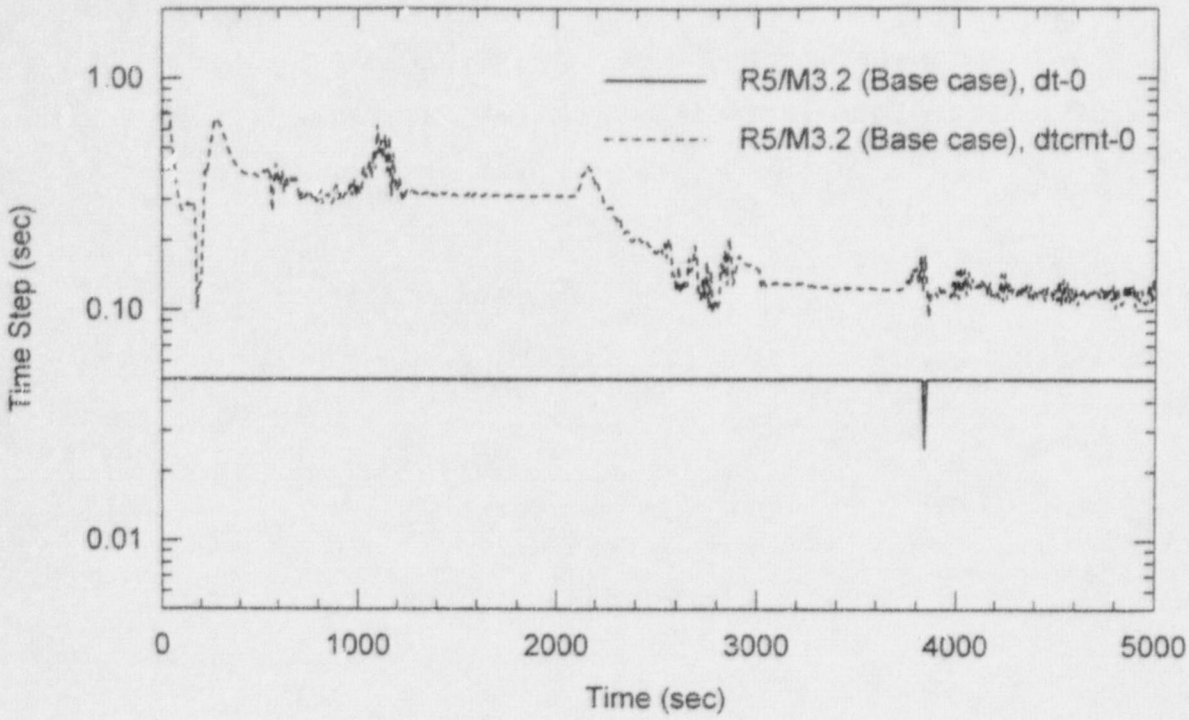

Fig. 44 Comparison of Time Step Size And Courant Time Step (Base Case)

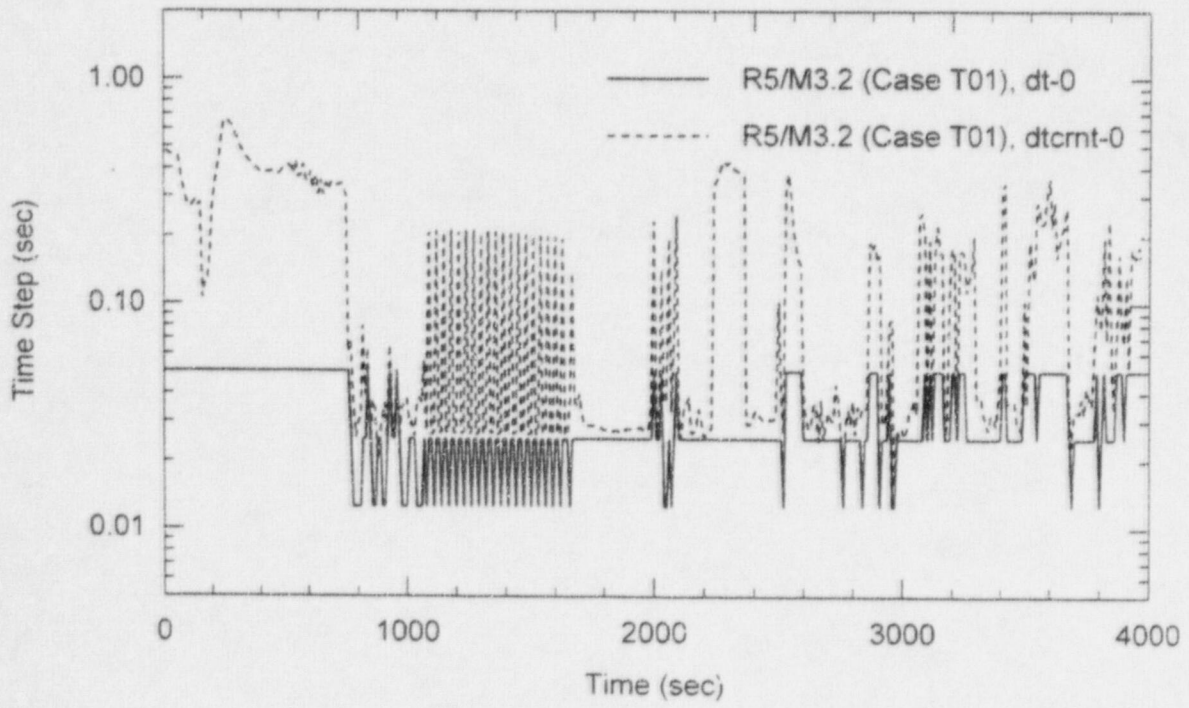

Fig. 45 Comparison of Time Step Size And Courant Time Step (Case T01)

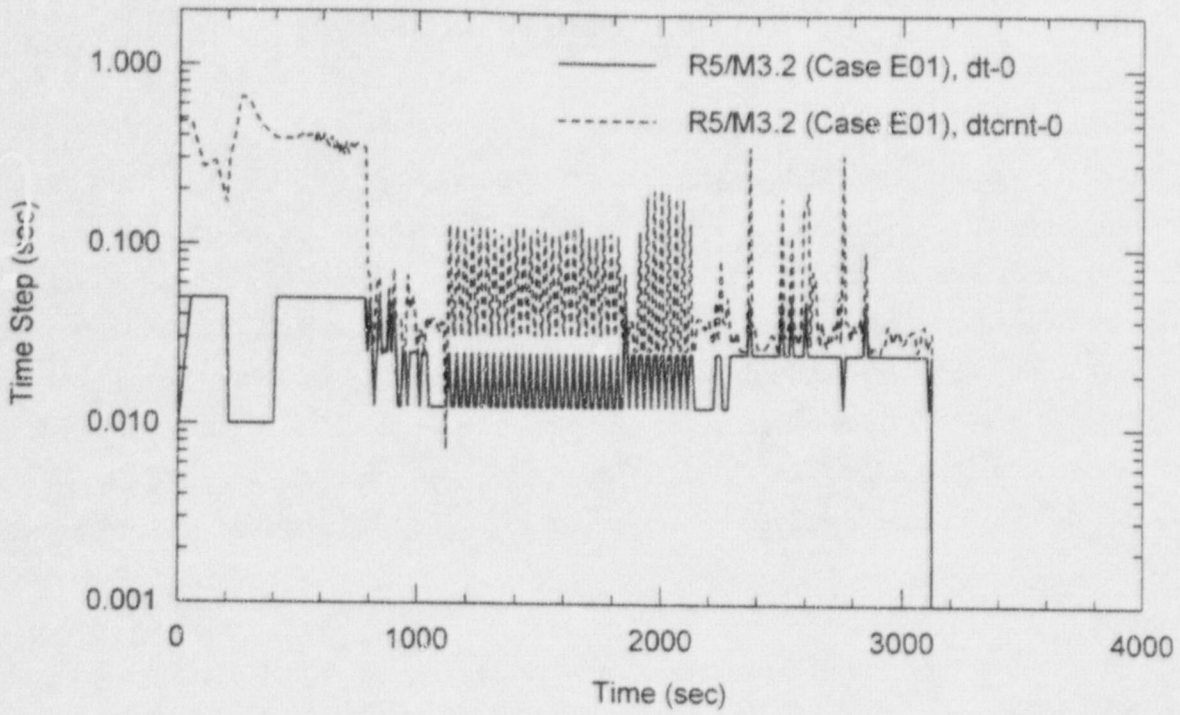

Fig. 46 Comparison of Time Step Size And Courant Time Step (Case E01)

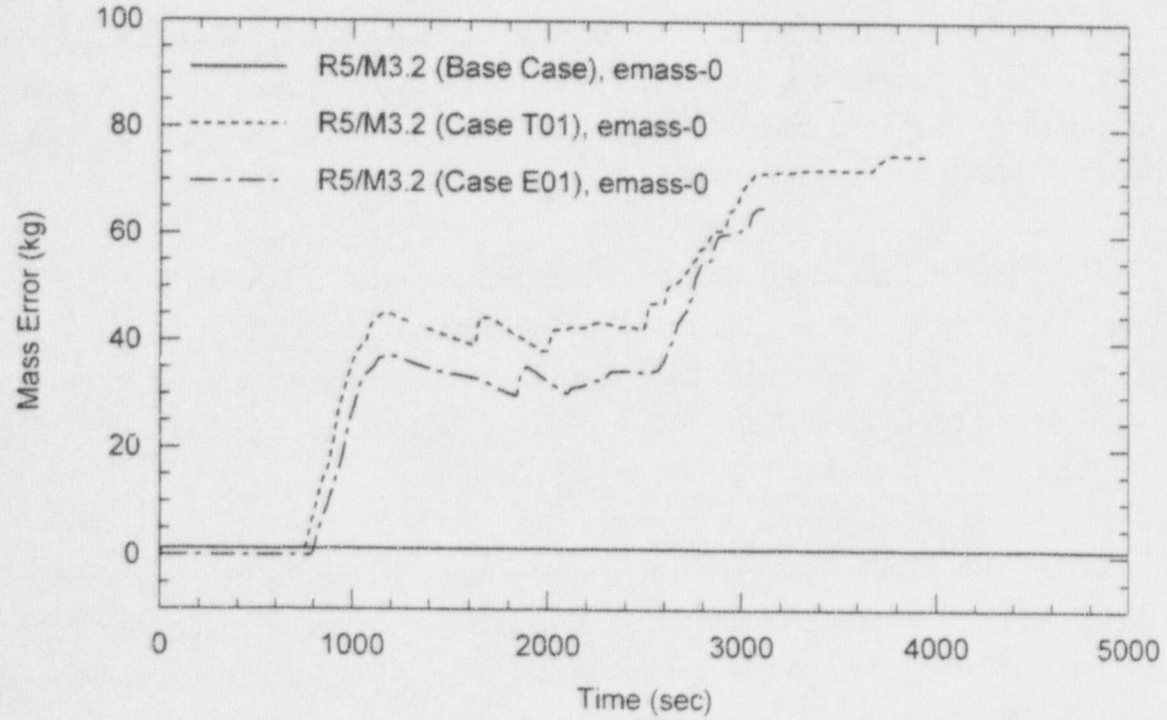

Fig. 47 Comparison of Mass Errors in Calculations

V. Summary and Conclusions

RELAP5/MOD3.2 code was assessed with the Semiscale experiment S-NC-8B, which simulated the natural circulation induced by small break LOCA in PWR. The major thermal-hydraulic phenomena important to SBLOCA and related natural circulation were addressed. The Semiscale Mod-2A facility was modeled as suitable for simulating the experiment. The base case calculation was executed, the prediction result was compared with the experiment data, and the code predictability on the important thermal-hydraulic phenomena was discussed. Sensitivity calculations were attempted to investigate the problems identified in base case calculation and to find out the effects of two core channel model and of ECCMIX component model on the improvement of predictability. The followings are obtained from this study:

1) The important thermal-hydraulic phenomena in this kind of SBLOCA and related natural circulation were identified as system depressurization, break flow in saturated and stratified condition, loop seal behavior, natural circulation in two-phase mode and reflux mode, core thermal response, and accumulator injection behavior.

2) As a base case a RELAP5 calculation input was developed with adopting single core channel model, steam leak model, etc. And for investigating nodalization sensitivity, additional two RELAP5 calculation input were developed using two core channel model and ECCMIX component model, respectively.

3) RELAP5 MOD3.2 can predict well the overall thermal-hydraulic behavior such as system depressurization and natural circulation through the loops during S-NC8B experiment, using base case modeling. However, some discrepancies were identified in underprediction of saturated break flow, deviation of loop seal behavior, and resultant discrepancy in core thermal response were identified.

4) Two core channel model can provide an improvement in prediction of major thermal-hydraulic phenomena, especially of loop seal behavior and resultant core thermal response. However, it was found that discontinuous accumulator injection was yet one of the most challengible problem in two core channel model calculation.

5) ECCMIX component, to some extent, can also improve an early accumulator injection

behavior and core thermal response. However, it cannot basically resolve the accumulator injection problem in this slowly-depressurizing transient.

6) Based on the base case calculation and sensitivity study, the current RELAP5/MOD3.2 code with two core channel model and ECCMIX component model has an general capability to predict SBLOCA specific phenomena. However, accumulator injection problem should be resolved through the extensive modeling study and/or appropriate code model improvement.

References

[1] K.E. Carlson, et.al., *RELAP5/MOD3 Code Manual (Draft)*, June 1990.

[2] The RELAP5 Development Team, *RELAP5/MOD3 Code Manual*, NUREG/CR-5535, January 1992.

[3] G.G.Loomis, et.al., *Quick-Look-Report for Semiscale Mod-2A Tests S-NC-8A and S_NC-8B*, EGG-SENI-5678, December 1981.

[4] M.T.Leonard, *RELAP5 Standard Model Description for the Semisclae Mod-2A System*, EGG-SEMI-5692, December 1981

[5] Gary Johnsen, *RELAP5 Code Development Status*, Spring CAMP Meeting, Madrid, May 1996

[6] C.C.Wang and L.N.Kmetyk, *RELAP5 Assessment : Semiscale Natural Circulation S-NC-3, S-NC-4 and S-NC-8*, NUREG/CR-3690, May 1984

[7] G.G.Loomis, K.Soda, *Experimental Operating Specification for the Natural Circulation Test Series (Series NC) Semiscale Mod-2A*, EGG-SEMI-5427, April 1981.

Appendix A
RELAP5 Input Listing for Base Case

Steady State Input Deck for Base Case Run

```
= semiscale mod 2a -- nc8 configuration (2-loop)
0000100  new  stdy-st
0000101  run
0000105  30.0  32.0
0000110   nitrogen
*0000201  1.0  1.0e-06  0.01  2  10  250  4000
0000202  800.0  1.0e-06  0.1  2  8000  8000  8000
0000501  time  0  ge  null  0  -1.0  1  * always true
0000502  time  0  lt  null  0  -1.0  n  * always false
*
*     steady state trip : alway true
*
0000599   time  0   ge  null  0   0.0   1   *always true
************************************************************
***
*
*   intact loop piping
*
************************************************************
***
*
*301  cntrlvar  917     * pzr liquid volume
*302  cntrlvar  918     * pzr liquid volume error
*303  cntrlvar  921     * letdown error
*304  cntrlvar  937     * intact loop hot temperatur error
*305  cntrlvar  947     * broken loop hot temp error
*306  cntrlvar  961     * intact loop sg level
*307  cntrlvar  971     * broken loop sg level
*308  cntrlvar  962     * IL SG Level error
*309  cntrlvar  963     * BL SG Level error
310  mflowj  101020000    * intact loop mass flow
311  mflowj  401020000    * broken loop mass flow
312  p 301010000    * pressurizer top pressure
313  p 204010000    * IL SG steam pressure
314  p 704010000    * BL SG steam pressure
315  cntrlvar  101   *  intact loop hot leg mass
316  cntrlvar  102   *  intact loop crossover leg mass
317  cntrlvar  103   *  intactloop cold leg mass
318  cntrlvar  104   *  intact loop s/g primary mass
319  cntrlvar  105   *  broken loop hot leg mass
320  cntrlvar  106   *  broken loop sg primary mass
321  cntrlvar  107   *  broken loop crossover leg mass
322  cntrlvar  108   *  broken loop cold leg mass
323  cntrlvar  109   *  rector vessel core and etc mass
324  cntrlvar  110   *  reactor downcomer mass
325  cntrlvar  201   *  intact loop secondary mass
326  cntrlvar  202   *  broken loop secondary mass
327  cntrlvar  301   *  pressurizer mass
328  cntrlvar  111   * total primary mass
329  cntrlvar  205   *  total secondary mass
**
1010000  hotleg  branch
1010001  2   1
1010101  0.00420  0.21971  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  00000
1010200  3  15.4e06  581.4   * 0.0   0.0  0.0
1011101  508010000  101000000  0.0  0.5  1.0  0100
1012101  101010000  102000000  0.0  0.0  0.0  0100
1011201  0.26  0.0  0.0
1012201  0.26  0.0  0.0
*
1020000  pc1a18  pipe
1020001  6
1020101  0.00349,4
1020102  0.00229,6
1020301  0.57074,1
1020302  0.17145,3
1020303  0.22504,4
1020304  0.38748,6
1020601  0.0,6
1020801  4.0e-05,0.0,6
1020901  0.0,0.0,1
1020902  0.288,0.288,2
1020903  0.0,0.0,3
1020904  0.0,0.0,5
1021001  00,6
1021101  0000,3
1021102  0100,4
1021103  0000,5
1021201  3     15.4e06  518.4  0.0  0.0     0.0  06
1021300  1
1021301  0.260  0.0  0.0  05
*
1030000  newspol  branch
1030001  3   1
1030101  0.00229  0.55880  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  00
1030200  3   15.4e06  581.4
1031101  102010000  103000000  0.0  0.18  0.18  0000
1032101  103010000  104000000  0.0  0.18  0.18  0000
1033101  302010000  103000000  0.0  0.90  0.90  0100
1031201  0.2e0  0.0  0.0
1032201  0.260  0.0  0.0
1033201  0.260  0.0  0.0
*
1040000  newspol  pipe
1040001  5
1040101  0.00229,5
1040301  0.23825,1
1040302  0.42494,2
```

```
1040303  0.35560,4
1040304  0.64808,5
1040601  0.0,1
1040602  90.0,4
1040603  55.0,5
1040701  0.0,1
1040702  0.42494,2
1040703  0.35560,4
1040704  0.52680,5
1040801  4.0e-05,0.0,5
1040901  0.540,0.540,1
1040902  0.0,0.0,3
1040903  0.288,0.288,4
1041001  00,5
1041101  0000,4
1041201  3  15.4e06  581.4  0.0  0.0  0.0  05
1041300  1
1041301  0.260  0.0  0.0  04
*
1050000  pmpsuc  pipe
1050001  14
1050101  0.00229,6
1050102  0.00349,14
1050301  0.44488,1
1050302  0.40640,2
1050303  0.35560,5
1050304  0.49301,6
1050305  0.58572,7
1050306  0.78740,9
1050307  0.26200,11
1050308  0.78740,13
1050309  0.58572,14
1050601  -55.0,1
1050602  -90.0,9
1050603  -45.0,10
1050604  45.0,11
1050605  90.0,14
1050701  -0.36068,1
1050702  -0.40640,2
1050703  -0.35560,5
1050704  -0.49301,6
1050705  -0.58572,7
1050706  -0.78740,9
1050707  -0.1968,10
1050708  0.1968,11
1050709  0.78740,13
1050710  0.58572,14
1050801  4.0e-05,0.0,14
1050901  0.288,0.288,1
1050902  0.0,0.0,9
1050903  0.450,0.450,11
1050904  0.0,0.0,13
1051001  00,14
1051101  0000,5
1051102  0100,6
1051103  0000,13
1051201  3  15.4e05  545.0  0.0  0.0  0.0  14
1051300  1
1051301  0.260  0.0  0.0  13
*
1060000  pmpsiml  pipe
1060001  5
1060101  0.00091,4
1060102  0.00349,5
1060201  0.00091,1
1060202  0.00030,2
1060203  0.00091,4
1060301  0.44805,1
1060302  1.14808,2
1060303  0.60046,3
1060304  0.74320,4
1060305  0.75565,5
1060601  90.0,1,
1060602  0.0,5
1060801  4.0e-05,0.0,5
1060901  0.966,0.966,1
1060902  1.260,1.260,2
1060903  0.0,0.0,4
1061001  00,5
1061101  0000,1
1061102  0100,2
1061103  0000,3
1061104  0100,4
1061201  3  15.4e06  545.0  0.0  0.0  0.0  05
1061300  1
1061301  0.260  0.0  0.0  04
*
1070000  pc19-3  branch
1070001  2
1070101  0.00349  0.79126  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  00
1070200  3  15.4e06 545.0
1071101  106010000  107000000  0.0  0.288  0.288  0000
1072101  107010000  108000000  0.0  0.0  0.0  0100
1071201  0.260  0.0  0.0
1072201  0.260  0.0  0.0
*
1080000  dcmrinl  branch
1080001  1
1080101  0.00420  0.18161  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  00
1080200  3  15.4e06  545.0
1081101  108010000  517010000  0.0  0.0  0.0  0100
1081201  0.260  0.0  0.0
*
1100000  pmpsimi  sngljun
```

```
1100101  105010000  106000000  0.0  0.0  0.0  0100
1100201  1  0.260 0.0 0.0
*
*******************************************************
*
*  steam  generator
*
*******************************************************
*
*
2010000  sgprim  pipe
2010001  20
2010101  0.00783,1
2010102  0.00184,19
2010103  0.00783,20
2010301  0.20955,1
2010302  1.21831,2
2010303  1.20561,8
2010304  0.48578,9
2010305  0.34411,11
2010306  0.48578,12
2010307  1.20561,18
2010308  1.21831,19
2010309  0.20955,20
2010601  90.0,9
2010602  70.0,10
2010603  -70.0,11
2010604  -90.0,20
*  andy modified 4/21/83 roughness from 4.0e-05 to 5.0e-05
2010801  4.0e-05,0.08386,1
2010802  4.0e-05,0.01974,19
2010803  4.0e-05,0.08386,20
2010901  0.0,0.0,8
2010902  0.3375,0.3375,9
2010903  0.675,0.675,10
2010904  0.3375,0.3375,11
2010905  0.0,0.0,19
2011001  00,20
2011101  0100,1
2011102  0000,18
2011103  0100,19
2011201  3  15.4e06  563.2  0.0  0.0  0.0  20
2011300  1
2011301  0.260  0.0  0.0  19
*
2020000  sgshr  pipe
2020001  12
2020101  0,0,12
2020201  0.00399,6
2020202  0.00371,7
* andy modified  2020203  4/21/83
2020203  0.00477,8
2020204  0.00555,9
2020205  0.01342,10
2020206  0.03515,11
*2020207  0.05502,12
2020301  1.21831,1
2020302  1.20561,7
2020303  0.48578,8
2020304  0.58737,9
2020305  0.41891,10
2020306  0.37827,11
2020307  0.50635,12
* andy modified  2020401  to  2020413  4/21/83
2020401  0.014264,1
2020402  0.016574,2
2020403  0.013183,3
2020404  0.016789,4
2020405  0.013532,5
2020406  0.012870,6
2020407  0.012850,7
2020408  0.005849,8
2020409  0.009278,9
2020410  0.007631,10
2020411  0.015420,11
2020412  0.026025,12
*2020413  0.028815,13
2020601  90.0,12
2020801  5.0e-06,0.03108,7
2020802  5.0e-06,0.04063,8
2020803  5.0e-06,0.05956,9
2020804  5.0e-06,0.06729,10
2020805  5.0e-06,0.0,12
2021001  00,12
2021101  0100,9
2021102  0000,11
2021201  2  5.85e06  0.0  0.0  0.0  0.0  12
2021300  1
2021301  0.0  0.0  0.0  11
*
*2030000  separatr  separatr
*2030001  3  0
*2030101  0.0  0.50635  0.030848  0.0  -90.0  -0.50635  5.0e-
06  0.1365  00
*2030200  2  5.85e06  0.0
*2031101  203000000  204000000  0.0  0.0  0.0  0100
*2032101  202010000  203000000  0.0  0.0  0.0  0100
*2033101  203010000  209000000  0.0  0.0  0.0  0100
*2031201  0.0  0.0  0.0
*2032201  0.0  0.0  0.0
*2033201  0.0  0.0  0.0
*
2030000  separatr  separatr
2030001  3,0
2030101  0.0  0.50635  0.059663  0.0  90.0  0.50635  5.0e-6
0.1365  00
```

```
2030200   2     5.85e+6    0.9
*2030200   2    5.85e+6   0.0
*
*      modified by ysbang at 93/9/6
*      to match test initial condition
*
2031101   203010000   204000000   0.06729   0.0   0.0   00100
2032101   203000000   209000000   0.058963   0.0   0.0   00100
2033101   202010000   203000000   0.05139    0.0   0.0   00100
2031201   0.0     0.0     0.0
2032201   0.0     0.0     0.0
2033201   0.0     0.0     0.0
*
2040000   steamdom   snglvol
2040101   0.0   0.40005   0.03390    0.0   90.0   0.40005   5.0-6
+     0.32849   00
2040200   2   5843600.0      1.0
*
2050000   stdome   pipe
2050001   10
2050101   0.0,10
2050301   0.41891,1
2050302   0.58737,2
2050303   0.48578.3
2050304   1.20561.9
2050305   1.21831.10
* a. modified 2050101.   2050401   to   2050405    4/21/83
2050401   0.006337.1
2050402   0.003252.2
2050403   0.001322.3
2050404   0.003279.9
2050405   0.003314.10
2050601   -90.0.10
2050801   5.0e-06.0.01023.10
2051001   00.10
2051101   0000.9
2051201   2   5.85e06   0.0   0.0   0.0      0.0     10
2051300   1
2051301   0.0   0.0   0.0   09
*
2060000   feedinl   tmdpvol
2060101   0.00114   1.0   0.0   0.0   0.0   0.0   5.0e-06   0.0   00
2060200   3
2060201   0.0   5.85e06   495.0
*
2070000   steamout   tmdpvol
2070101   1.0   1.0   0.0   0.0   90.0   1.0   5.0e-06   0.0   00
2070200   2     * 1
*2070201   0.0   546.98   1.0
2070201   0.0     5.85e+6     1.0
*
*   modified by ysbang at 93/9/6
*     to match test initial condition
*
2090000   sepbyps   pipe
2090001   2
2090101   0.0.2
2090301   0.50635.1
2090302   0.37827.2
* andy modified volumes 2090401 to 2090402   4/21/63
2090401   0.029856.1
2090402   0.020686.2
2090601   -90.0,2
2090801   5.0e-06,0.13170.1
2090802   5.0e-06,0.08490.2
2091001   00,2
2091101   0000.1
*2091201   2   5.85e06   0.0   0.0   0.0      0.0   02
2091201    2 5.85e+06   0.01      0.0     0.0     0.0      02
*
*      modified by ysbang at 93/9/6
*      to match test initial condition
*
2091300   1
2091301   0.0   0.0   0.0   01
*
2100000   sepbyps   sngljun
2100101   209010000   205000000   0.0   0.0   0.0   0000
2100201   1     0.260   0.0   0.0
*
2210000   sginlp   sngljun
2210101   104010000   201000000   0.00229   0.288   0.288   0100
2210201   1     0.260   0.0   0.0
*
2220000   sgout-p   sngljun
2220101   201010000   105000000   0.00229   0.288   0.288   0100
2220201   1     0.260   0.0   0.0
*
2310000   demrout   sngljun
2310101   205010000   202000000   0.0   0.0   0.0   0100
2310201   1     0.0   0.0   0.0
*
2320000   steamout   sngljun
2320101   204010000   207000000   0.0   0.0   0.0   0100
2320201   1     0.0   0.0   0.0
2330000   feedinlp   tmdpjun
2330101   206000000   205000000   0.00043
*2330200   1   501   cntrlvar   2
2330201   -1.0   0.0   0.0   0.0
2330202   0.0   2.0   0.0   0.0
2330203   10.0   0.0   0.0   0.0
2330204   20.0   0.0   0.0   0.0
*
**********************************************************
**********
*
```

```
*  pressurizer
*
**********
**********
*
3010000  preizer  pipe
3010001  6
3010101  0.0,6
3010201  2.69125e-02,2
3010202  6.72832e-03,2
3010203  2.69125e-02,5
3010301  0.240915,2
3010302  0.21967,5
3010303  0.066294,6
3010401  0.0064825,2
3010402  0.0059118,5
3010403  0.001136,6
3010601  -90.0,6
3010801  4.0e-05,0.0,6
3011001  00,6
3011101  0000,2
3011102  0100,3
3011103  0000,5
3011201  2  15.4e06  1.0 0.0  0.0  0.0  01
*3011202  2  15.4e06  0.1728  0.0  0.0  0.0  02
3011202  2  15.4e06  0.15  0.0  0.0  0.0  02
*
*  Modified by ysbang at 93/9/6
*  to match test initial condition
*
3011203  2  15.4e06  0.0 0.0  0.0  0.0  06
3011300  1
3011301  0.0  0.0  0.0  05
*
3020000  pzrsurge  pipe
3020001  7
3020101  0.0,7
3020301  0.20574,1
3020302  0.17780,2
3020303  0.48895,3
3020304  0.67310,7
3020401  7.1837-04,1
3020402  2.32141-04,2
3020403  1.64577-04,3
3020404  4.4046-05,7
3020601  -90.0,3
3020602  -45.0,7
3020701  -0.20574,1
3020702  -0.17780,2
3020703  -0.48895,3
3020704  -0.16380,7
3020801  4.0e-05,0.0,7
3020901  502.8,502.8,1
3020902  33.42,33.42,2
3020903  0.0,0.0,3
3020904  1.42,1.42,5
3020905  0.0,0.0,6
3021001  00,7
3021101  0000,6
3021201  3  15.4e06  581.4  0.0  0.0  0.0  07
3021300  1
3021301  0.0  0.0  0.0  06
*
3210000  pzrout  sngljun
3210101  301010000  302000000  0.00349  0.0  0.0  0100
3210201  1  0.0  0.0 0.0
*
*  need  to  modify  this
*
3300000  pcontrl  tmdpvol
3300101  10.0  10.0  0.0  0.0  0.0  0.0  5.0e-06  0.0  00
3300200  2
3300201  0.0  15.4e06  1.0
*
3310000  pcontvlv  sngljun
3310101  301000000  330000000  0.005  0.0  0.0  0100
3310201  1  0.0 0.0  0.0
*
**********
*
* broken  loop  piping
*
**********
*
*
4010000  vsslout  branch
4010001  2  1
4010101  0.00349  0.40818  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  00
4010200  3  15.4e06  581.4
4011101  508010000  401000000  0.0  0.5  1.0  0100
4012101  401010000  402000000  0.0  0.0  0.0  0100
4011201  0.260  0.0  0.0
4012201  0.260  0.0  0.0
*
4020000  hotleg  pipe
4020001  7
4020101  0.00091,7
4020301  0.60985,1
4020302  0.40860,2
4020303  0.98579,3
4020304  0.41783,4
4020305  0.35235,5
4020306  0.34925,6
4020307  0.60879,7
4020601  0.0,3
```

```
4020602  90.0,6
4020603  50.0,7
4020701  0.0,3
4020702  0.41783,4
4020703  0.35235,5
4020704  0.34925,6
4020705  0.46711,7
4020801  4.0e-05,0.0,7
4020901  0.0,0.0,1
4020902  0.525,0.525,2
4020903  0.630,0.630,3
4020904  0.0,0.0,5
4020905  0.336,0.336,6
4021001  00000  7
4021101  0000,6
4021201  3  15.4e06  581.4  0.0  0.0  0.0  07
4021300  1
4021301  0.260  0.0  0.0  06
*
4030000  pmpsucn  pipe
4030001  12
4030101  0.00091,12
4030301  0.49424,1
4030302  0.34925,2
4030303  0.35235,3
4030304  0.34925,4
4030305  1.08318,5
4030306  0.78512,7
4030307  0.48944,9
4030308  0.78512,11
4030309  0.70002,12
4030601  -60.0,1
4030602  -90.0,7
4030603  -45.0,8
4030604  45.0,9
4030605  90.0,12
4030701  -0.39980,1
4030702  -0.34925,2
4030703  -0.35235,3
4030704  -0.34925,4
4030705  -1.08318,5
4030706  -0.78512,7
4030707  -0.376936,8
4030708  0.376936,9
4030709  0.78512,11
4030710  0.70002,12
4030801  4.0e-05,0.0,12
4030901  0.336,0.336,1
4030902  0.0,0.0,6
4030903  0.525,0.525,8
4030904  0.0,0.0,11
4031001  00,12
4031101  0000,11
4031201  3  15.4e06  545.0  0.0  0.0  0.0  12
4031300  1
4031301  0.260  0.0  0.0  11
*
4040000  bleldsb  snglvol
4040101  0.00091  0.83083  0.0  0.0  0.0  0.0  4.0e-05  0.0
+     0.0
4040200  3  15.4e06  545.0
*
4050000  coldleg  pipe
4050001  2
4050101  0.00091,2
4050301  0.27178,1
4050302  0.71145,2
4050601  0.0,2
4050801  4.0e-05,0.0,2
4050901  0.138,0.138,1
4051001  00,2
4051101  0000,1
4051201  3  15.4e06  545.0  0.0  0.0  0.0  02
4051300  1
4051301  0.260  0.0  0.0  01
*
4060000  vsslinlt  branch
4060001  2  1
4060101  0.00349  0.38898  0.0  0.0  0.0  0.0  4.0e-05  0.0
00
4060200  3  15.4e06  545.0
4061101  405010000  406000000  0.0  0.0  0.0  0100
4062101  406010000  517010000  0.0  1.0  0.5  0100
4061201  0.260  0.0  0.0
4062201  0.260  0.0  0.0
*
4500000  brkppmp  pump
4500101  0.0  0.59847  0.00086  0.0  90.0  0.03137  00
4500108  403010000  0.00090  0.0  0.0  000100
*4500109  404000000  0.00010  0.0  0.0  000000
*
*  Junction Area Modified by ysbang at April 8, 1996
*  to correct unbalance of void distribution
*
4500109  404000000 0.00090  0.0  0.0  000000
*
*  end of modification
*
4500200  3  15.4e06  545.0
4500201  1  0.26  0.0  0.0
4500202  1  0.26  0.0  0.0
4500301  0  0  0  -1  0  501.0
4500302      1597.0000      0.1      .003240000      79.553000
2.9810000  .00925000
4500303  998.400  .00000  .0000  2.4800  .00000  .00000
*
```

```
4210000  blcl-lg  sngljun
4210101  404010000  405000000  0.00091  0.0  0.0  0000
4210201  1  0.260  0.0  0.0
*
************************************************************
******
*
*  vessel
*
************************************************************
******
*
5010000  lowpln1  snglvol
5010101  0.0  0.14224  0.00674  0.0  90.0  0.14224  4.0e-05
+  0.1162  00
5010200  3  15.4e06  545.0
*
5020000  lowpln2 branch
5020001  3  1
5020101  0.0  0.22004  0.00659  0.0  90.0  0.22004  4.0e-05
+  0.0699  00
5020200  3  15.4e06  545.0
5021101  501010000  502000000  0.0  0.0  0.0  0000
5022101  502010000  503000000  0.00431  0.0  0.0  0100
5023101  502010000  519000000  0.0  0.5  1.0  0100
5021201  0.0 0.0 0.0
5022201  0.52  0.0 0.0
5023201  0.52  0.0 0.0
*
5030000  lowpln3  snglvol
5030101  0.0  0.31725  0.00296  0.0  90.0  0.31725  4.0e-05
0.0101  00
5030200  3  15.4e06  545.0
*
5040000  lowpln4  branch
5040001  2  1
5040101  0.0  0.18136  0.00052  0.0  90.0  0.18136  4.0e-05
+  0.0101  00
5040200  3  15.4e06  545.0
5041101  503010000  504000000  0.0  0.0  0.0  0100
5042101  504010000  505000000  0.0  0.0  0.0  0100
5041201  0.52  0.0  0.0
5042201  0.52  0.0  0.0
*
5050000  core pipe
5050001  8
5050101  0.00286.8
5050301  0.6096.2
5050302  0.3048.6
5050303  0.6096.8
5050601  90.0.8
* andy modified volume 5050801 to 5.0e-05  5/4/83
5050801  2.0e-05.0.01.8
5050901  1.5.1.5.7
5051001  00.8
*5051101  0000,7
*  rod bundle interfacial drag option by ysbang
5051101  00100  7
5051201  3  15.4e06  563.2  0.0  0.0  0.0  08
5051300  1
5051301  0.520  0.0  0.0  7
*
5060000  upprpln1  branch
5060001  2  1
5060101  0.0  0.30505  0.00164  0.0  90.0  0.30505  2.0e-05
+  0.023  00
5060200  3  15.4e06  581.4
5061101  505010000  506000000  0.0  0.0  0.0  0100
5062101  506010000  507000000  0.00321  0.0  0.0  0100
5061201  0.520  0.0 0.0
5062201  0.520  0.0 0.0
*
5070000  upprpln2 snglvol
5070101  0.0  0.68910  0.00281  0.0  90.0  0.68910  4.0e-05
+  0.0401  00
5070200  3  15.4e06  581.4
*
5080000  upprpln3 branch
5080001  2  1
5080101  0.0  0.52070  0.00218  0.0  90.0  0.52070  4.0e-05
+  0.483  00
5080200  3  15.4e06  581.4
5081101  507010000  508000000  0.00277  0.0  0.0  0100
5082101  508010000  509000000  0.00415  0.0  0.0  0100
5081201  0.520  0.0  0.0
5082201  0.0 0.0  0.0
*
5090000  upprpln4  pipe
5090901  2
5090101  0.0.2
5090301  0.2761.1
5090302  0.7786.2
5090401  0.00143.1
5090402  0.004047.2
5090601  90.0.2
5090801  4.0e-05.0.04.1
5090802  4.0e-05.0.0509.2
5091001  00.2
5091101  0000.1
5091201  3  15.4e06  581.4  0.0  0.0  0.0  02
5091301  0.0 0.0  0.0  01
*
5100000  upprpln5  snglvol
5100101  0.0  0.0756  0.000393  0.0  90.0  0.0756  4.0e-05
+  0.0509  00
5100200  3  15.4e06  581.4
```

```
*
5130000  guidtub   branch
5130001  1   0
5130101  0.0   1.651   0.00034   0.0   90.0   1.651   5.0e-06
+     0.0160   00
5130200  3   15.4e06   581.4
5131101  507010000   513000000   0.0   0.0   0.0   0100
5131201  0.0   0.0   0.0
*
5140000  sufcoln   branch
5140001  1   0
5140101  0.0   2.3401   0.00034525   0.0   90.0   2.3401   5.0e-06
+     0.00975   00
5141101  506010000   514000000   0.0   0.0   0.0   0100
5140200  0    15415300.0   1356030.0   0.0   0.0
5141201  0.0   0.0   0.0
*
5160000  upprdcm1 annulus
5160001  1
5160101  0.00982.1
5160301  0.26670,1
5160601  90.0.1
5160801  4.0e-05.0.004351.1
5161001  00.1
5161201  3   15.4e06   560.0   0.0   0.0    0.0   1
*
5170000  upprdcm2 annulus
5170001   1
5170101  0.00982.1
5170301  0.38418.1
5170601  90.0.1
5170801  4.0e-05.0.04351.1
5171001  00.1
5171201  3   15.4e06   560.0   0.0   0.0   0.0    1
*
5180000  lowdcmr   pipe
5180001  10
5180101  0.00242.10
5180301  0.4890.9
5180302  0.37661   10
5180601  90.0.10
5180801  4.0e-05.0.0.10
5180901  0.3.0.3.1
5180902  0.0.0.0.8
5180903  0.114.0.114.9
5181001  00.10
5181101  0000.9
5181201  3   15.4e06   550.0   0.0   0.0    0.0   10
5181300  1
5181301  -0.26.0.0.0.0.9
*
5190000  lowdcm   annulus
5190001  1
5190101  0.00708.1
5190301  0.29337.1
5190601  90.0.1
5190801  4.0e-05   0.0341.1
5191001  00.1
5191201  3   15.4e06   550.0   0.0   0.0   0.0    1
*
5200000  dcmrann   sngljun
5200101  519010000   518000000   0.0   0.3   0.3   0100
5200201  1   -0.26   0.0   0.0
*
5210000  upprdcmr   sngljun
5210101  517010000   516000000   0.0   0.0   0.0   0100
5210201  1   0.0   0.0   0.0
*
5220000  uplowcm   sngljun
5220101  518010000   517000000   0.0   0.0   0.0   0100
5220201  1   -0.26   0.0   0.0
*
5310000  bypsline   pipe
5310001  3
5310101  0.00007.3
5310301  0.38247.3
5310601  90.0.2
5310602  55.33.3
5310701  0.38247.2
5310702  0.31456.3
5310801  5.0e-06.0.0094.3
5310901  0.0.0.0.2
5311001  00.3
5311101  0000.2
5311201  3   15.4e06   550.0   0.0   0.0   0.0   3
5311300  1
5311301  0. 0.0.   0.0. 2
*
5320000  gt-up   sngljun
5320101  513010000   510010000   0.0   0.0   0.0   0100
5320201  0   0.0   0.0   0.0
*
5330000  sc-up   sngljun
5330101  514010000   510010000   0.0   0.0   0.0   0100
5330201  0   0.0   0.0   0.0
*
5340000  dc-byps   sngljun
5340101  516010000   531000000   0.0   0.0   0.0   0100
5340201  0   0.0   0.0   0.0
*
5350000  byps-up   sngljun
5350101  531010000   510010000   0.0   0.0   0.0   0100
5350201  0   0.0   0.0   0.0
*
5360000  up-cnct   sngljun
5360101  509010000   510000000   0.0   0.0   0.0   0100
```

```
5360201  0  0.0  0.0  0.0
*
*****************************************************
*  broken  loop  steam  generator
*
*****************************************************
*
7010000  bripsign  pipe
7010001  18
7010101  0.00516,1
7010102  0.00951,17
7010103  0.00516,18
7010301  0.26035,1
7010302  1.19609,2
7010303  1.23101,3
7010304  1.15481,4
7010305  1.23101,5
7010306  1.25641,6
7010307  1.15481,7
7010308  1.06591,8
7010309  0.98206,10
7010310  1.06591,11
7010311  1.15481,12
7010312  1.25641,13
7010313  1.23101,14
7010314  1.15481,15
7010315  1.23101,16
7010316  1.19609,17
7010317  0.26035,18
7010601  90.0,8
7010602  77.0,9
7010603  -77.0,10
7010604  -90.0,18
* andy modified roughness to 5.0e-05  4/21/84
7010801  4.0e-05,0.07797,1
7010802  4.0e-05,0.01974,17
7010803  4.0e-05,0.07797,18
7010901  0.0,0.0,7
7010902  0.3375,0.3375,8
7010903  0.675,0.675,9
7010904  0.3375,0.3375,10
7010905  0.0,0.0,17
7011001  00,18
7011101  0100,1
7011102  0000,16
7011103  0100,17
7011201  3     15.4e06  581.4  0.0    0.0    0.0  18
7011300  1
7011301  0.260  0.0  0.0  17
*
7020000  sgroud  pipe
*7020001  11
7020001  10
7020101  0 0,10
7020201  0,00462,7
7020202  0,0,9
7020301  1,19609,1
7020302  1,23101,2
7020303  1 15481,3
7020304  1,23101,4
7020305  1,25641,5
7020306  1,15481,6
7020307  1,06591,7
7020308  1,65398,8
7020309  0,37827,9
7020310  0,50635,10
* andy modified volumes 7020401 to 7020411  4/21/83
7020401  0,013509,1
7020402  0,009036,2
7020403  0,008470,3
7020404  0,010739,4
7020405  0,009615,5
7020406  0,008474,6
7020407  0,008425,7
7020408  0,015782,8
7020409  0,016807,9
7020410  0,025882,10
*7020411  0,025882,11
7020601  90,0,10
7020801  5,0e-06,0,1999,8
7020802  5,0e-06,0,0,10
7021001  00,10
7021101  0100,7
7021102  0000,9
7021201  2  5.89e06    0.0  0.0    0.0    0.0  10
7021300  1
7021301  0.0  0.0  0.0  9
*
*7030000  separatr  separatr
*7030001  3    0
** modified 4/21/83
*7030101  0.0  0.50635  0.030854  0.0  -90.0  0.50635
*+  5.0e-  06  0.13650  00
*7030200  2    5.89e06  0.0
*7031101  703000000  704000000  0.0  0.0  0.0  0100
*7032101  702010000  703000000  0.0  0.0  0.0  0100
*7033101  703010000  709000000  0.0  0.0  0.0  0100
*7031201  0.0 0.0 0.0
*7032201  0.0 0.0 0.0
*7033201  0.0 0.0 0.0
*
7030000  separatr  separatr
7030001  3  0
7030101  0.0  0.50635  0.050736  0.0  90.0  0.50635  5.0e-6
*+  0.1365  00
*7030200  2  5.89e+6  0.0
```

```
7030200    2    5.89e+6   0.9
*
*   modified by ysbang at 93/9/6
*   to match test initial condition
*
7031101    703010000   704000000   0.0547542   0.0   0.0   00100
7032101      703000000     709000000     0.05299024     0.0     0.0
00100
7033101      702010000     703000000     0.04593079     0.0     0.0
00100
7031201    0.0    0.0    0.0
7032201    0.0    0.0    0.0
7033201    0.0    0.0    0.0
*
*
7040000   steamdom snglvol
7040101   0.0   0.40005   0.03390   0.0   90.0   0.40005   5.0e-06
+     0.32849   00
7040200   2    5.89e06   1.
*
7050000   sgdcomer pipe
7050001   8
* andy deleted this input ;   7050101   0.00164.8
7050101   0.0.8
7050301   1.65398.1
7050302   1.06591.2
7050303   1.15481.3
7050304   1.25641.4
7050305   1.23101.5
7050306   1.15481.6
7050307   1.23101.7
7050308   1.19609.8
* andy modified volumes   7050401   to   7050408   4/21/83
7050401   0.014458.1
7050402   0.002241.2
7050403   0.002435.3
7050404   0.002639.4
7050405   0.002589.5
7050406   0.002431.6
7050407   0.002593.7
7050408   0.002514.8
7050601   -90.0.8
7050801   5.0e-06.0.01016.8
7051001   00.8
7051101   0000.7
7051201   2 5.89e06   0.0 0.0      0.0   0.0   08
7051300   1
7051301   0.0   0.0   0.0   07
*
7060000   feedinle      tmdpvol
7060101   0.00114   1.0   0.0   0.0   0.0   0.0   5.0e-06   0.0   00
7060200   3
7060201   0.0   5.89e06   495.0
*
7070000   steamotl   tmdpvol
7070101   1.0   1.0   0.0   0.0   90.0   .0   5.0e-06   0.0   00
7070200   1
7070201   0.0      547.4245     1.0
*
7090000   sepbyps   pipe
7090001   2
7090101   0.0,2
7090301   0.50635,1
7090302   0.37827,2
* andy modified volumes   7090401   to   7090402   4/21/83
7090401   0.029860,1
7090402   0.020686,2
7090601   -90.0,2
7090801   5.0e-06,0.13170,1
7090802   5.0e-06,0.08490,2
7091001   00,2
7091101   0000,1
*7091201   2   5.89e06   0.0 0.0   0.0   0.0   02
7091201    2   5.89e+06   0.01     0.0      0.0     0.0      02
*
*    modified by ysbang at 93/9/6
*    to match test initial condition
*
7091300   1
7091301   0.0   0.0   0.0   01
*
7100000   sepbyps   sngljun
7100101   709010000   705000000   0.0   0.0   0.0   0000
7100201   1   0.26   0.0   0.0
*
7210000   sgnlt   sngljun
7210101   402010000   701000000   0.00091   0.336   0.336   0100
7210201   1    0.26   0.0   0.0
*
7220000   sg-ouri   sngljun
7220101   701010000   403000000   0.00091   0.336   0.336   0100
7220201   1   0.26   0.0   0.0
*
7310000   dcomeut   sngljun
7310101   705010000   702000000   0.0   0.0   0.0   0100
7310201   1   0.0    0.0   0.0
*
7320000   steamuts   sngljun
7320101   704010000      707000000   0.0   0.0   0.0   0100
7320201   1   0.0   0.0   0.0
*
7330000   feed-ltp   tmdpjun
7330101   706000000   705000000   0.00043
7330200   1   501    cntrlvar   12
7330201   -1.0   0.0   0.0   0.0
7330202    0.0   2.0   0.0   0.0
```

```
7330203  10.0  0.0  0.0  0.0
7330204  20.0  0.0  0.0  0.0
*
*9000000  envirnmt  tmdpvol
*9000101  1.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0  00
*9000200  3
*9000201  0.0  8.48e05  310.0
*
**********************************************************
*
*  heat  structures
*
**********************************************************
*
11011000  1  5  2  1  0.03625
11011100  0  2
11011101  0.00278,4
11011201  0001,4
11011301  0.0,4
11011401  568.0,5
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*12054803  0.0.0.0.0.0.37827.4
*12054901  0.0.0.0.0.0.40005.1
*12054902  0.0.0.0.0.0.50635.3
*12054903  0.0.0.0.0.0.37827.4
12054801  0.  10.  10.  0.  0.  0.  0.  1.4
12054901  0.  10.  10.  0.  0.  0.  0.  1.4
*
12055000  1  5  1  1  0.0
12055100  0  2
12055101  0.00596.4
12055201  0001.4
12055301  0.0.4
12055401  543.0.5
12055501  204010000.0.1.0.0.13174.1
12055601  0.0.0.0.0.13174.1
12055701  0.0.0.0.0.0.0.1
*12055801  0.0.0.0.0.0.40955.1
*12055901  0.0.0.0.0.0.40955.1
12055801  0.  10.  10.  0.  0.  0.  0.  1.1
12055901  0.  10.  10.  0.  0.  0.  0.  1.1
*
*  pressurizer  walls
*
13011000 6  5  2  1  1.0795e-01
13011100  0  2
13011101  0.007144.4
13011201  0001.4
13011301  0.0.4
13011401  600.0.5
13011501  301010000.0.1.1.0.183565.1
13011502  301020000.10000.1.1.0.2549.5
13011503  301050000.0.1.1.0.00686.6
13011601  0.0.0.1.0.183565.1
13011602  0.0.0.1.0.2549.5
13011603  0.0.0.1.0.00686.6
13011701  0.0.0.0.0.0.0.6
*13011801  0.0.0.0.0.0.183564.2
*13011802  0.0.0.0.0.0.2549.5
*13011803  0.0.0.0.0.0.00686.6
*13011901  0.0.0.0.0.0.183564.2
*13011902  0.0.0.0.0.0.2549.5
*13011903  0.0.0.0.0.0.00686.6
13011801  0.  10.  10.  0.  0.  0.  0.  1.6
13011901  0.  10.  10.  0.  0.  0.  0.  1.6
*
13012000 2  5  2  1  0.0
13012100  0  2
13012101  0.00210.4
13012201  0001.4
13012301  1.0.1
13012302  0.0.4
13012401  615.0.5
13012501  0.0.0.1.5.91312.2
13012601  301050000.-10000.1.1.5.91312.2
13012701  300.0.5.0.0.0.0.2
*13012901  0.0.0.0.0168.0.24638.2
13012801  0.  10.  10.  0.  0.  0.  0.  1.2
13012901  0.  10.  10.  0.  0.  0.  0.  1.2
*
13022000 1  5  2  1  1.560000e-02
13022100  0  2
13022101  0.00178.4
13022201  0001.4
13022301  0.0.4
13022400  3011
13022501  302010000.0.1.1.0.36713.1
13022601  0.0.0.1.0.36713.1
13022701  0.0.0.0.0.0.0.1
*13022801  0.0.0.0.0.0.22860.1
*13022901  0.0.0.0.0.0.22860.1
13022801  0.  10.  10.  0.  0.  0.  0.  1.1
13022901  0.  10.  10.  0.  0.  0.  0.  1.1
*
13023000 6  5  2  1  4.70000e-03
13023100  0  2
13023101  0.00098.4
13023201  0001.4
13023301  0.0.4
13023400  3011
13023501  302020000.0.1.1.0.1778.1
13023502  302030000.0.1.1.0.48895.2
13023503  302040000.10000.1.1.0.6731.6
13023601  0.0.0.1.0.1778.1
13023602  0.0.0.1.0.48895.2
13023603  0.0.0.1.0.6731.6
13023701  0.0.0.0.0.0.0.6
*13023801  0.0.0.0.0.0.1778.1
*13023802  0.0.0.0.0.0.48895.2
*13023803  0.0.0.0.0.0.6731.6
*13023901  0.0.0.0.0.0.1778.1
*13023902  0.0.0.0.0.0.48895.2
*13023903  0.0.0.0.0.0.6731.6
13023801  0.  10.  10.  0.  0.  0.  0.  1.6
```

```
13023901  0.  10.  10.  0.  0.  0.  0.  1.6
*
*  broken  loop  piping  walls
*
14011000  1  5  2  1  0.03332
*14011100  1021
14011100  0  2
14011101  0.00278,4
14011201  0001,4
14011301  0.0,4
14011401  568.0,5
14011501  401010000.0,1,1,0.40818,1
14011601  0,0,0,1.0.40818,1
14011701  0.0.0.0.0.0.0,1
*14011801  0.0.0,0.0.0.40818,1
*14011901  0,0.0.0.0.0.40818,1
14011801  0.  10.  10.  0.  0.  0.  0.  1.1
14011901  0.  10.  10.  0.  0.  0.  0.  1.1
*
14021000  7  5  2  1  0.01699
14021100  0  2
14021101  0.00178,4
14021201  0001,4
14021301  0.0,4
14021401  568.0,5
14021501  402010000.0,1,1,0.60985,1
14021502  402020000.0,1,1,0.40860,2
14021503  402030000.0,1,1,0.98572,3
14021504  402040000.0,1,1,0.41783,4
14021505  402050000.0,1,1,0.35235,5
14021506  402060000.0,1,1,0.34925,6
14021507  4J2070000.0,1,1,0.60879,7
14021601  0.0.0,1.0.60985,1
14021602  0.0.0,1.0.40860,2
14021603  0.0.0,1.0.98572,3
14021604  0.0.0,1.0.41783,4
14021605  0.0.0,1.0.35235,5
14021606  0.0.0,1.0.34925,6
14021607  0.0.0,1.0.60879,7
14021701  0.0.0.0.0  0.7
*14021801  0,0.0.0.0.0.60985,1
*14021802  0.0.0.0.0.0.40860,2
*14021803  0.0.0.0.0.0.98572,3
*14021804  0.0.0.0.0.0.41783,4
*14021805  0.0.0.0.0.0.35235,5
*14021806  0.0.0.0.0.0.34925,6
*14021807  0.0.0.0.0.0.60879,7
*14021901  0.0.0.0.0.0.60985,1
*14021902  0.0.0.0.0.0.40860,2
*14021903  0.0.0.0.0.0.98572,3
*14021904  0.0.0.0.0.0.41783,4
*14021905  0.0.0.0.0.0.35235,5
*14021906  0.0.0.0.0.0.34925,6
*14021907  0.0.0.0.0.0.60879,7
14021801  0.  10.  10.  0.  0.  0.  0.  1.7
14021901  0.  10.  10.  0.  0.  0.  0.  1.7
*
*14031000  1  5  2  1  0.01699
14031000  12 5  2  1  0.01699
*14031100  4021
14031100  0  2
14031101  0.00178,4
14031201  0001,4
14031301  0.0,4
14031401  557.0,5
14031501  403010000.0,1,1,0.49424,1
14031502  403020000.0,1,1,0.34925,2
14031503  403030000.0,1,1,0.35235,3
14031504  403040000.0,1,1,0.34925,4
14031505  403050000.0,1,1,1.08318,5
14031506  403060000.10000,1,1,0.78512,7
14031507  403080000.10000,1,1,0.48944,9
14031508  403100000.10000,1,1,0.78512,11
14031509  403120000.0,1,1,0.70002,12
14031601  0.0.0,1.0.49424,1
14031602  0.0.0,1.0.34925,2
14031603  0.0.0,1.0.35235,3
14031604  0.0.0,1.0.34925,4
14031605  0.0.0,1,1.08318,5
14031606  0.0.0,1.0.78512,7
14031607  0.0.0,1.0.48944,9
14031608  0.0.0,1.0.78512,11
14031609  0.0.0,1.0.70002,12
14031701  0.0.0.0.0.0.0.12
*14031801  0.0.0.0.0.0.49424,1
*14031802  0.0.0.0.0.0.34925,2
*14031803  0.0.0.0.0.0.35235,3
*14031804  0.0.0.0.0.0.34925,4
*14031805  0.0.0.0.0,1.08318,5
*14031806  0.0.0.0.0.0.78512,7
*14031807  0.0.0.0.0.0.48944,9
*14031808  0.0.0.0.0.0.78512,11
*14031809  0.0.0.0.0.0.70002,12
*14031901  0.0.0.0.0.0.49424,1
*14031902  0.0.0.0.0.0.34925,2
*14031903  0.0.0.0.0.0.35235,3
*14031904  0.0.0.0.0.0.34925,4
*14031905  0.0.0.0.0,1.08318,5
*14031906  0.0.0.0.0.0.78512,7
*14031907  0.0.0.0.0.0.48944,9
*14031908  0.0.0.0.0.0.78512,11
*14031909  0.0.0.0.0.0.70002,12
14031801  0.  10.  10.  0.  0.  0.  0.  1.12
14031901  0.  10.  10.  0.  0.  0.  0.  1.12
*
14041000 3  5  2  1  1.699000e-02
```

```
*14041100  4021
14041100  0  2
14041101  0.00178,4
14041201  0001,4
14041301  0.0,4
*14041400  4031
14041401  557.0  5
14041501  404010000,0.1,1,0.60046,1
14041502  405010000,0.1,1,0.50216,2
14041503  405020000,0.1,1,0.71145,3
14041601  0.0,0,1,0.60046,1
14041602  0.0.0,1,0.50216,2
14041603  0,0,0,1,0.71145,3
14041701  0.0.0,0.0,0.0,3
*14041801  0.0.0,0.0.0 60046,1
*14041802  0.0.0,0.0,0.50216,2
*14041803  0.0.0,0.0.0.71145,3
*14041901  0,0.0,0.0,0.60046,1
*14041902  0.0.0,0.0.0.50216,2
*14041903  0.0.0.0.0.0.71145,3
14041801  0.  10.  10.  0.  0.  0.  0.  1.3
14041901  0.  10.  10.  0.  0.  0.  0.  1.3
*
14051000  1  5  2  1  0.03332
*14051100  1021
14051100  0  2
14051101  0.00278,4
14051201  0001,4
14051301  0.0,4
14051401  557.  5
14051501  406010000  0  1  1  0.47168  1
14051601  0  0  0  1  0.47168  1
14051701  0  0.0  0.0  0.0  1
*14051801  0  0.0  0.0  0.47168  1
*14051901  0  0.0  0.0  0.47168  1
14051801  0.  10.  10.  0.  0.  0.  0.  1.1
14051901  0.  10.  10.  0.  0.  0.  0.  1.1
*
*  vessel structure
*
15011000  1  5  1  1  0
15011100  0  2
15011101  0.0370  4
15011201  0001,4
15011301  0.0, 4
15011401  557.0  5
15011501  501010000.  0.  1.  0.  0.05200.  1
15011601  0.  0.  0.  0.  0.05200.  1
15011701  0.  0.0  0.0  0.0  1
*15011801  0.  0.  0.0.0.0.25730.  1
*15011901  0.  0.  0.0.0.0.27730.  1
15011801  0.  10.  10.  0.  0.  0.  0.  1.1
15011901  0.  10.  10.  0.  0.  0.  0.  1.1
*
15012000  4  5  2  1  0
15012100  0  2
15012101  0.00134,  4
15012201  0003,  4
15012301  0.0, 4
15012400  5011
15012501  0, 0, 0, 1, 3.556, 1
15012502  0, 0, 0, 1, 5.501, 2
15012503  0, 0, 0, 1, 7.93125, 3
15012504  0, 0, 0, 1, 4.534, 4
15012601  501010000, 0, 1, 1, 3.556, 1
15012602  502010000, 0, 1, 1, 5.501, 2
15012603  503010000, 0, 1, 1, 7.93125, 3
15012604  504010000, 0, 1, 1, 4.534, 4
15012701  0, 0.0, 0.0, 0.0, 4
*15012901  0, 0.0, 0.0, 0, 0.14224, 1
*15012902  0, 0.0, 0.0, 0, 0.22004, 2
*15012903  0, 0.0, 0.0, 0, 0.31725, 3
*15012904  0, 0.0, 0.0, 0, 0.18136, 4
15012801  0.  10.  10.  0  0.  0.  0.  1.4
15012901  0  10.  10.  0  0.  0.  0  1.4
*
15013000  16  11  2  1  0
15013100  0  2
15013101  0.000529  3
15013102  0.000406  5
15013103  0.000656  8
15013104  0.000495 10
15013201  0004.  3
15013202  0005.  5
15013203  0004.  8
15013204  0001.  10
15013301  0.0, 3
15013302  1.0, 5
15013303  0.0.  10
15013401  557.0.  11
15013501  0, 0, 0, 0, 0.0, 16
15013601  505010000, 10000, 1, 1, 13.4112, 2
15013602  505030000, 10000, 1, 1, 6.7056.  6
15013603  505070000, 10000, 1, 1, 13.4112, 8
15013604  505010000, 10000, 1, 1, 1.8288, 10
15013605  505030000, 10000, 1, 1, 0 9144, 14
15013606  505070000, 10000, 1, 1, 1.8288, 16
15013701  500, 0.07500, 0.0, 0.0, 1
15013702  500, 0.17583, 0.0, 0.0, 2
15013703  500, 0.12000, 0.0, 0.0, 3
15013704  500, 0.12917, 0.0, 0.0, 4
15013705  500, 0.12917, 0.0, 0.0, 5
15013706  500, 0.12000, 0.0, 0.0, 6
15013707  500, 0.17583, 0.0, 0.0, 7
15013708  500, 0.07500, 0.0, 0.0, 8
15013709  0.  0.0.  0.0, 0.0, 16
```

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*15013901    0, 0.0, 0.01357, 0.6096, 2
*15013902    0, 0.0, 0.01357, 0.3048, 6
*15013903    0, 0.0, 0.01357, 0.6096,10
*15013904    0, 0.0, 0.01357, 0.3048,14
*15013905    0, 0.0, 0.01357, 0.6096,16
15013801  0.  10.  10.  0.  0.  0.  0.  1. 16
15013901  0.  10.  10.  0.  0  0.  0.  1. 16
*
15021000    1    5    2    1    1.286500e-01
15021100  0    2
15021101  0.01568   4
15021201  0001,  4
15021301  0.0, 4
15021401  557.0   5
15021501  501010000. 0.    1.   1.   0.14224, 1
15021601  0,   0, 0, 1,   0.14224, 1
15021701  0,   0.0. 0.0. 0.0.  1
*15021801   0,   0.0, 0.0. 0.0.  1
*15021901   0,   0.0, 0.0. 0.0.  1
15021801  0.  10.  10.  0.  0.  0.  0.  1. 1
15021901  0.  10.  10.  0.  0.  0.  0.  1. 1
*
15022000    1    5    2    1    9.771000e-02
15022100  0    2
15022101  0.01588   4
15022201  0001.  4
15022301  0.0. 4
15022401  557.0   5
15022501  502010000. 0.    1.   1.   0.22004. 1
15022601  0.    0.  0. 1.   0.22004. 1
15022701  0.   0.0. 0.0. 0.0.  1
*15022801   0.   0.0. 0.0. 0.22004. 1
*15022901   0.   0.0. 0.0. 0.22004. 1
15022801  0.  10.  10.  0.  0.  0.  0.  1. 1
15022901  0.  10.  10.  0.  0.  0.  0.  1. 1
*
15023000    1    5    2    1    7.621000e-02
15023100  0    2
15023101  0.01588   4
15023201  0001.  4
15023301  0.0. 4
15023401  557.0   5
15023501  519010000. 0.    1.   1.   0.29337. 1
15023601  0. 0.   0. 1.   0.29337. 1
15023701  0.   0.0. 0.0. 0.0.  1
*15023801   0.   0.0. 0.0. 0.29337. 1
*15023901   0.   0.0. 0.0. 0.29337. 1
15023801  0.  10.  10.  0.  0.  0.  0.  1. 1
15023901  0.  10.  10.  0.  0.  0.  0.  1. 1
*
15031000   10    5    2    1    0.02775
15031100  0    2
15031101  0.00471   4
15031201  0001,  4
15031301  0.0, 4
15031401  557.0   5
15031501  518010000, 10000. 1. 1.   0.4890,  9
15031502  518100000, 0,   1. 1.   0.37661,10
15031601  0,   0,  0, 1,   0.4890,  9
15031602  0,   0,  0, 1,   0.37661,10
15031701  0,   0.0, 0.0, 0.0,    10
*15031801   0,   0.0, 0.0, 0.4890,  9
*15031802   0,   0.0, 0.0, 0.37661,10
*15031901   0,   0.0, 0.0, 0.4890,  9
*15031902   0,   0.0, 0.0, 0.37661,10
15031801  0.  10.  10.  0.  0.  0.  0.  1. 10
15031901  0.  10.  10.  0.  0.  0.  0.  1. 10
*
*15024000   10    5    2    1    0.05121
15024000  1    5    2    1    0.05121
15024100  0    2
15024101  0.00169   4
15024201  0001,  4
15024301  0.0. 4
15024401  557.0   5
15024501  503010000. 0.    1.   1.   0.31725.  1
15024601  519010000. 0.    1.   1.   0.31725.  1
15024701  0.   0.0. 0.0. 0.0.  1
*15024801   0.   0.0. 0.0. 0.31725. 1
*15024901   0.   0.0. 0.0. 0.31725. 1
15024801  0.  10.  10.  0.  0.  0.  0.  1. 1
15024901  0.  10.  10.  0.  0.  0.  0.  1. 1
*
15025000    2    5    2    1    4.041000e-02
15025100  0    2
15025101  0.01765   4
15025201  0001.  4
15025301  0.0. 4
15025401  557.0   5
15025501  504010000. 0.    1.   1.   0.18136.  1
15025502  505010000. 0.    1.   1.   0.0762.   2
15025601  0. 0. 0. 1. 0.18136. 1
15025602  0. 0. 0. 1. 0.0762.  2
15025701  0.   0.0. 0.0. 0.0.  2
*15025801   0. 0.0. 0.0. 0.18136. 1
*15025802   0. 0.0. 0.0. 0.0762.  2
*15025901   0. 0.0. 0.0. 0.18136. 1
*15025902   0. 0.0. 0.0. 0.0762.  2
15025801  0.  10.  10.  0.  0.  0.  0.  1. 2
15025901  0.  10.  10.  0.  0.  0.  0.  1. 2
*
15014000    8    5    2    1    4.041000e-02
15014100  0    2
15014101  0.01093   4
15014201  0001.  4
15014301  0.0. 4
```

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15014401    575.5, 5
15014501    505010000, 0, 1,    1,  0.5334,    1
15014502    505020000, 0, 1,    1,  0.6096,    2
15014503    505030000, 10000,   1,  1,  0.3048,    6
15014504    505070000, 10000,   1,  1,  0.6096,    8
15014601    0,  0,  0,  1,  0.5334,    1
15014602    0,  0,  0,  1,  0.6096,    2
15014603    0,  0,  0,  1,  0.3048,    6
15014604    0,  0,  0,  1,  0.6096,    8
15014701    0,  0.0,0.0, 0.0,  8
*15014801   0,  0.0,0.0,  0.5334,    1
*15014802   0,  0.0,0.0,  0.6096,    2
*15014803   0,  0.0,0.0,  0.3048,    6
*15014804   0,  0.0,0.0,  0.6096,    8
*15014901   0,  0.0,0.0,  0.5334,    1
*15014902   0,  0.0,0.0,  0.6096,    2
*15014903   0,  0.0,0.0,  0.3048,    6
*15014904   0,  0.0,0.0,  0.6096,    8
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*
*15015000    1   5   2   1   0.
*15015100    0   2
*15015101    0.02858    4
*15015201    0001.  4
*15015301    0.0. 4
*15015400    5011
*15015501    516010000, 0, 1,    1,  0.3765,    1
*15015601    0,  0,  0,  1,  0.3765,    1
*15015701    0,  0.0,0.0, 0.0,  1
**15015801   0,  0.0,0.0,  0.54381,   1
**15015901   0,  0.0,0.0,  0.54381,   1
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*
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15016100    0   2
15016101    0.00572    4
15016201    0001.  4
15016301    0.0, 4
15016400    5011
15016501    0.  0.  0.1, 0.26670.  1
15016502    0.  0.  0.1, 0.38418.  2
15016601    516010000, 0, 1,    1,  0.26670,   1
15016602    517010000, 0, 1,    1,  0.38418,   2
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*15016801   0,  0.0,0.0,  0.26670,   1
*15016802   0,  0.0,0.0,  0.38418,   2
*15016901   0,  0.0,0.0,  0.26670,   1
*15016902   0,  0.0,0.0,  0.38418,   2
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15016901    0.  10.  10.  0.  0.  0.  0.  1.2
*
15017000    2   5   2   1   0.08272
15017100    0   2
15017101    0.00671    4
15017201    0001.  4
15017301    0.0. 4
15017400    5011
15017501    516010000, 0, 1,    1,  0.26670,   1
15017502    517010000, 0, 1,    1,  0.38418    2
15017601    0,  0.  0.  1,  0.26670,   1
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*15017801   0,  0.0,0.0,  0.26670,   1
*15017802   0,  0.0,0.0,  0.38418,   2
*15017901   0,  0.0,0.0,  0.26670,   1
*15017902   0,  0.0,0.0,  0.38418,   2
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15017901    0.  10.  10.  0.  0.  0.  0.  1.2
*
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*15041100   5012
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15041101    0.00134.   4
15041201    0003.4
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15041401    594.0. 5
15041501    0.  0.  0.  1.  5.08.  1
15041601    506010000, 0, 1,    1,  5.08.  1
15041701    0,  0.0,0.0, 0.0,  1
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*15041901   0,  0.0,0.0,  0.2032.   1
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15041901    0.  10.  10.  0.  0.  0.  0.  1.1
*
15042000    1   5   2   1   0.04166
15042100    0   2
15042101    0.01816    4
15042201    0001.  4
15042301    0.0. 4
15042400    5041
15042501    506010000, 0, 1,    1,  0.30505.   1
15042601    0.  0.  0.  1.  0.30505.   1
15042701    0.  0.0,0.0, 0.0,  1
*15042801   0,  0.0,0.0,  0.30505,   1
*15042901   0,  0.0,0.0,  0.30505,   1
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15042901    0.  10.  10.  0.  0.  0.  0.  1.1
*
15043000    1   5   2   1   4.299000e-02
15043100    0   2
15043101    0.01153    4
15043201    0001.  4
15043301    0.0. 4
15043400    5041
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*15043901   0.  0.0.0.0.  0.68910.  1
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15043901  0.  10.  10.  0.  0.  0.  0.  1.1
*
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15044101   0.01742    4
15044201   0001.  4
15044301   0.0. 4
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15044701   0.  0.0.0.0. 0.0.  1
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15044901  0.  10.  10.  0.  0.  0.  0.  1.1
*
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15045101  0.01153.4
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15045301  0.0.4
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15045502   509020000. 0. 1.    1.  0.7786.  2
15045503   510010000. 0. 1.    1.  0.0756.  3
15045601   0.  0.  0.  1.  0.2761.  1
15045602   0.  0.  0.  1.  0.7786.  2
15045603   0.  0.  0.  1.  0.0756.  3
15045701   0.  0.0.0.0. 0.0.  3
*15045801   0.  0.0.0.0.  0.2761.  1
*15045802   0.  0.0.0.0.  0.7786.  2
*15045803   0.  0.0.0.0.  0.0756.  3
*15045901   0.  0.0.0.0.  0.2761.  1
*15045902   0.  0.0.0.0.  0.7786.  2
*15045903   0.  0.0.0.0.  0.0756.  3
15045801  0.  10.  10.  0.  0.  0.  0.  1.3
15045901  0.  10.  10.  0.  0.  0.  0.  1.3
*
15046000    1    5    1    1    0.
15046100   0    2
15046101   0.04976    4
15046201   0001.  4
15046301   0.0. 4
15046400   5043
15046501   510010000. 0. 1.    0.  0.00575.  1
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*15046901   0.  0.0.0.0.  0.26670.  1
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*
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15062100   0    2
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15062201   0001.  4
15062301   0.0. 4
15062401   568.0. 5
15062501   513010000. 0. 1.    1.  0.0756.  1
15062502   513010000. 0. 1.    1.  0.7786.  2
15062503   513010000. 0. 1.    1.  0.2761.  3
15062504   513010000. 0. 1.    1.  0.5207.  4
15062601   510010000. 0. 1.    1.  0.0756.  1
15062602   509020000. 0. 1.    1.  0.7786.  2
15062603   509010000. 0. 1.    1.  0.2761.  3
15062604   508010000. 0. 1.    1.  0.5207.  4
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*15062803   0.  0.0.0.0.  0.2761.  3
*15062804   0.  0.0.0.0.  0.5207.  4
*15062901   0.  0.0.0.0.  0.0756.  1
*15062902   0.  0.0.0.0.  0.7786.  2
*15062903   0.  0.0.0.0.  0.2761.  3
*15062904   0.  0.0.0.0.  0.5207.  4
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15062901  0.  10.  10.  0.  0.  0.  0.  1.4
*
*
15063000    5    5    2    1    4.880000e-03
15063100   0    2
15063101   0.00037    4
15063201   0001.  4
15063301   0.0. 4
15063401   568.0. 5
15063501   514010000. 0. 1.    1.  0.1512.  1
15063502   514010000. 0. 1.    1.  0.5572.  2
15063503   514010000. 0. 1.    1.  0.5522.  3
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15063505   514010000. 0. 1.    1.  1.3782.  5
15063601   510010000. 0. 1.    1.  0.1512.  1
15063602   509020000. 0. 1.    1.  0.5572.  2
15063603   509010000. 0. 1.    1.  0.5522.  3
15063604   508010000. 0. 1.    1.  1.0414.  4
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*15063803   0.  0.0.0.0.  0.2761.  3
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*15063903   0.   0.0,0.0.   0.2761.   3
*15063904   0.   0.0,0.0.   0.5207.   4
*15063905   0.   0.0,0.0.   0.6891.   5
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*
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15064100    0    2
15064101    0.00041    4
15064201    0001.   4
15064301    0.0, 4
15064401    557.0    5
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15064601    0.    0. 0,    1.   0.38247,   3
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15064901  0.  10.  10.  0.  0.  0.  0.  1.3
*
* broken-loop steam generator
*
17001000   16    5    2    1    0.00987
17001100   0    2
17001101   0.00031    4
17001201   0002.   4
17001301   0.0. 4
17001401   495.0. 5
17001501   701020000. 0. 1.    1.   2.39218.   1
17001502   701030000. 0. 1.    1.   2.46202.   2
17001503   701040000. 0. 1.    1.   2.30962.   3
17001504   701050000. 0. 1.    1.   2.46202.   4
17001505   701060000. 0. 1.    1.   2.51282.   5
17001506   701070000. 0. 1.    1.   2.30962.   6
17001507   701080000. 0. 1.    1.   2.13182.   7
17001508   701100000. 10000.    1.    1.   1.96412.   9
17001509   701110000. 0. 1.    1.   2.13182. 10
17001510   701120000. 0. 1.    1.   2.30962. 11
17001511   701130000. 0. 1.    1.   2.51282. 12
17001512   701140000. 0. 1.    1.   2.46202. 13
17001513   701150000. 0. 1.    1.   2.30962. 14
17001514   701160000. 0. 1.    1.   2.46202. 15
17001515   701170000. 0. 1.    1.   2.39218. 16
17001601   70201000( 9. 0. 1.    1.   2.39218.   1
17001602   702020000. 0. 1.    1.   2.46202.   2
17001603   702030000. 0. 1.    1.   2.30962.   3
17001604   702040000. 0. 1.    1.   2.46202.   4
17001605   702050000. 0. 1.    1.   2.51282.   5
17001606   702060000. 0. 1.    1.   2.30962.   6
17001607   702070000. 0. 1.    1.   2.13182.   7
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17001610   702060000. 0. 1.    1.   2.30962. 11
17001611   702050000. 0. 1.    1.   2.51282. 12
17001612   702040000. 0. 1.    1.   2.46202. 13
17001613   702030000. 0. 1.    1.   2.30962. 14
17001614   702020000. 0. 1.    1.   2.46202. 15
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*17001811   0.   0.01974. 0.01974. 1.25641. 12
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*17001914   0.   0.00635. 0.00635. 1.23101. 15
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*
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17012100    0    2
17012101    0.01403    4
17012201    0006.   4
17012301    0.0. 4
17012400    7001
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17012502   702020000. 0. 1.    1.   1.23101.   2
17012503   702030000. 0. 1.    1.   1.15481.   3
17012504   702040000. 0. 1.    1.   1.23101.   4
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17012508  702080000. 0. 1.   1.  1.65398.  8
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17012603  702030000. 0. 1.   1.  1.15481.  3
17012604  702040000. 0. 1.   1.  1.23101.  4
17012605  702050000. 0. 1.   1.  1.25641.  5
17012606  702060000. 0. 1.   1.  1.15481.  6
17012607  702070000. 0. 1.   1.  1.06591.  7
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*17012904  0.  0.0. 0.0.  1.23101.  4
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*17012906  0.  0.0. 0.0.  1.15481.  6
*17012907  0.  0.0. 0.0.  1.06591.  7
*17012908  0.  0.0. 0.0.  1.65398.  8
17012801  0.  10.  10.  0.  0.  0.  0.  1.8
17012901  0.  10.  10.  0.  0.  0.  0.  1.8
*
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17022100  0   2
17022101  0.00094   4
17022201  0001.  4
17022301  0.0. 4
17022400  7001
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17022502  702020000. 0. 1.   1.  1.23101.  2
17022503  702030000. 0. 1.   1.  1.15481.  3
17022504  702040000. 0. 1.   1.  1.23101.  4
17022505  702050000. 0. 1.   1.  1.25641.  5
17022506  702060000. 0. 1.   1.  1.15481.  6
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17022508  702080000. 0. 1.   1.  1.65398.  8
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*17022603  702030000. 0. 1.   1.  1.15481.  3
*17022604  702040000. 0. 1.   1.  1.23101.  4
*17022605  702050000. 0. 1.   1.  1.25641.  5
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*17022608  702080000. 0, 1,   1,  1.65298.  8
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17022603  705030000. 0. 1,   1.  1.15481,  3
17022604  705040000, 0. 1,   1.  1.23101,  4
17022605  705050000. 0. 1,   1,  1.25641,  5
17022606  705060000, 0, 1,   1,  1.15481,  6
17022607  705070000. 0, 1,   1,  1.06591.  7
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*17022806  0.  0.01999,  0.05963,  1.15481.  6
*17022807  0.  0.01999,  0.05963,  1.06591.  7
*17022808  0.  0.01999,  0.05963,  1.65398.  8
*17022901  0.  0.0. 0.0.  1.19609.  1
*17022902  0.  0.0. 0.0.  1.23101.  2
*17022903  0.  0.0. 0.0.  1.15481.  3
*17022904  0.  0.0. 0.0.  1.23101.  4
*17022905  0.  0.0. 0.0.  1.25641.  5
*17022906  0.  0.0. 0.0.  1.15481.  6
*17022907  0.  0.0. 0.0.  1.06591.  7
*17022908  0.  0.0. 0.0.  1.65398.  8
17022801  0.  10.  10.  0.  0.  0.  0.  1.8
17022901  0.  10.  10.  0.  0.  0.  0.  1.8
*
17032000   8   5   2   1   0.11074
17032100  0   2
17032101  0.00238   4
17032201  0001.  4
17032301  0.0. 4
17032400  7001
17032501  705010000. 0. 1.   1.  1.33972.  1
17032502  705020000. 0. 1.   1.  0.86339.  2
17032503  705030000. 0. 1.   1.  0.93540.  3
17032504  705040000. 0. 1.   1.  1.01769.  4
17032505  705050000. 0. 1.   1.  0.99712.  5
17032506  705060000. 0. 1.   1.  0.93540.  6
17032507  705070000. 0. 1.   1.  0.99712.  7
17032508  705080000. 0. 1.   1.  0.96883.  8
17032601  705010000. 0. 1.   1.  1.33972.  1
17032602  705020000. 0. 1.   1.  0.86339.  2
17032603  705030000. 0. 1.   1.  0.93540.  3
17032604  705040000. 0. 1.   1.  1.01769.  4
17032605  705050000. 0. 1.   1.  0.99712.  5
17032606  705060000. 0. 1.   1.  0.93540.  6
17032607  705070000. 0. 1.   1.  0.99712.  7
17032608  705080000. 0. 1.   1.  0.96883.  8
17032701  0.  0.0. 0.0. 0.0.  8
*17032801  0.  0.0. 0.0.  1.65398.  1
```

```
*17032802    0,   0.0, 0.0,   1.06591,   2
*17032803    0,   0.0, 0.0,   1.25481,   3
*17032804    0,   0.0, 0.0,   1.25641,   4
*17032805    0,   0.0, 0.0,   1.23101,   5
*17032806    0,   0.0, 0.0,   1.15481,   6
*17032807    0,   0.0, 0.0,   1.23101,   7
*17032808    0,   0.0, 0.0,   1.19609,   8
*17032901    0,   0.0, 0.0,   1.65398,   1
*17032902    0,   0.0, 0.0,   1.06591,   2
*17032903    0,   0.0, 0.0,   1.25481,   3
*17032904    0,   0.0, 0.0,   1.25641,   4
*17032905    0,   0.0, 0.0,   1.23101,   5
*17032906    0,   0.0, 0.0,   1.15481,   6
*17032907    0,   0.0, 0.0,   1.23101,   7
*17032908    0,   0.0, 0.0,   1.19609,   8
17032801  0.  10.  10.  0.  0.  0.  0.  1.8
17032901  0.  10.  10.  0.  0.  0.  0.  1.8
*
17042000    3    5    2    1    0.23233
17042100  0    2
17042101  0.00105   4
17042201  0001,  4
17042301  0.0, 4
17042400  7001
17042501  702090000. 0. 1.   1.  0.37827.  1
17042502  702100000. 0. 1.   1.  0.30635.  2
*17042503  702110000. 0. 1.   1.  0.30635.  3
17042503  703010000.  0. 1.   1.  0.30635.  3
17042601  709010000. 0. 1.   1.  0.37827.  1
17042602  709010000. 0. 1.   1.  0.30635.  2
17042603  703010000. 0. 1.   1.  0.30635.  3
17042701  0.  0.0. 0.0. 0.0.  3
*17042801   0.  0.0. 0.0.  0.37827.  1
*17042802   0.  0.0. 0.0.  0.50635.  2
*17042901   0.  0.0. 0.0.  0.37827.  1
*17042902   0.  0.0. 0.0.  0.50635.  2
17042801  0.  10.  10.  0.  0.  0.  0.  1.3
17042901  0.  10.  10.  0.  0.  0.  0.  1.3
*
17053000    8    5    2    1    0.12146
17053100  0    2
17053101  0.00377   4
17053201  0001,  4
17053301  0.0, 4
17053400  7001
17053501  705010000. 0. 1.   1.  1.65398.  1
17053502  705020000. 0. 1.   1.  1.10659.  2
17053503  705030000. 0. 1.   1.  1.15481.  3
17053504  705040000. 0. 1.   1.  1.25641.  4
17053505  705050000. 0. 1.   1.  1.23101.  5
17053506  705060000. 0. 1.   1.  1.15481.  6
17053507  705070000. 0. 1.   1.  1.23101.  7
17053508  705080000. 0. 1.   1.  1.19609.  8
*
*    Modify Right Boundary Condition identical to
*    Intact Loop S/G
*
*17053601   -200. 0. 1000,   1.  1.65398.  1
*17053602   -200. 0. 1000,   1.  1.10659.  2
*17053603   -200, 0, 1000,   1.  1.15481.  3
*17053604   -200, 0, 1000,   1.  1.25641.  4
*17053605   -200, 0, 1000,   1.  1.23101.  5
*17053606   -200, 0, 1000,   1.  1.15481.  6
*17053607   -200, 0, 1000,   1.  1.23101.  7
*17053608   -200, 0, 1000,   1.  1.19609.  8
*
17053601   -200. 0, 3205,   1.  1.65398.  1
17053602   -200. 0. 3205,   1.  1.10659.  2
17053603   -200, 0, 3205,   1.  1.15481.  3
17053604   -200. 0. 3205,   1.  1.25641.  4
17053605   -200. 0. 3205,   1.  1.23101.  5
17053606   -200, 0, 3205,   1.  1.15481.  6
17053607   -200. 0, 3205,   1.  1.23101.  7
17053608   -200. 0, 3205,   1.  1.19609.  8
*
*   End of modification by Y.S Bnag at Aug 31, 1994
*
17053701   0.  0.0, 0.0, 0.0.  8
*17053801   0.  0.0. 0.0.  1.65398.  1
*17053802   0.  0.0. 0.0.  1.06591.  2
*17053803   0.  0.0. 0.0.  1.15481.  3
*17053804   0.  0.0. 0.0.  1.25641.  4
*17053805   0.  0.0. 0.0.  1.23101.  5
*17053806   0.  0.0. 0.0.  1.15481.  6
*17053807   0.  0.0. 0.0.  1.23101.  7
*17053808   0.  0.0. 0.0.  1.19609.  8
*17053901   0.  0.0. 0.0.  1.65398.  1
*17053902   0.  0.0. 0.0.  1.06591.  2
*17053903   0.  0.0. 0.0.  1.15481.  3
*17053904   0.  0.0. 0.0.  1.25641.  4
*17053905   0.  0.0. 0.0.  1.23101.  5
*17053906   0.  0.0. 0.0.  1.15481.  6
*17053907   0.  0.0. 0.0.  1.23101.  7
*17053908   0.  0.0. 0.0.  1.19609.  8
17053801  0.  10.  10.  0.  0.  0.  0.  1.8
17053901  0.  10.  10.  0.  0.  0.  0.  1.8
*
17054000    4    5    2    1    0.20477
17054100  0    2
17054101  0.00596   4
17054201  0001,  4
17054301  0.0, 4
17054400  7001
17054501  704010000. 0. 1.   1.  0.40005.  1
17054502  703010000. 0. 1.   1.  0.50635.  2
17054503  709010000. 0. 1.   1.  0.50635.  3
```

```
17054504    709020000. 0. 1.    1.  0.37827.  4
*17054601    -200. 0. 1000.     1.  0.40005.  1
*17054602    -200. 0. 1000.     1.  0.50635.  2
*17054603    -200. 0. 1000.     1.  0.50635.  3
*17054604    -200. 0. 1000.     1.  0.37827.  4
*
*   modify right boundary condition
*   identical to intact loop sg
*   by ysbang at 94.9.6
*
17054601    -200. 0. 3204.     1.  0.40005.  1
17054602    -200. 0. 3204.     1.  0.50635.  2
17054603    -200. 0. 3204.     1.  0.50635.  3
17054604    -200. 0. 3204.     1.  0.37827.  4
*
17054701    0.   0.0. 0.0. 0.0.  4
*17054801    0.   0.0. 0.0.  0.40005.  1
*17054802    0.   0.0. 0.0.  0.50635.  3
*17054803    0.   0.0. 0.0.  0.37827.  4
*17054901    0.   0.0. 0.0.  0.40005.  1
*17054902    0.   0.0. 0.0.  0.50635.  3
*17054903    0.   0.0. 0.0.  0.37827.  4
17054801  0.  10.  10.  0.  0.  0.  0.  1.4
17054901  0.  10.  10.  0.  0.  0.  0.  1.4
*
17055000     1    5   1    1     0.0
17055100    0     2
17055101    0.00596    4
17055201    0001.  4
17055301    0.0. 4
17055400    7001
17055501    704010000. 0. 1.    0.  0.13174.  1
17055601    0.     0.     0. 0.    0.13174.  1
17055701    0.   0.0. 0.0. 0.0.  1
*17055801    0.   0.0. 0.0.  0.40955.  1
*17055901    0.   0.0. 0.0.  0.49055.  1
17055801  0.  10.  10.  0.  0.  0.  0.  1.1
17055901  0.  10.  10.  0.  0.  0.  0.  1.1
*
**************************************************
*   heat structure thermal property data (si units)
**************************************************
*
20100100   tbl/fctn    1    1     * s-steel
20100200   tbl/fctn    1    1     * incoly 600
20100300   tbl/fctn    1    1     * copper
20100400   tbl/fctn    1    1     * boron nitride
20100500   tbl/fctn    1    1     * inconel 600
20100600   tbl/fctn    1    1     * filler pieces
*
*
*   thermal conductivity S-Steel
*
20100101    273.15   12.98
20100102   1199.82   25.1
*
* thermal conductivity incoloy 600
*
20100201    366.5    13.85
20100202    477.6    15.92
20100203    588.7    18.17
20100204    700.0    20.42
20100205    810.9    22.50
20100206    922.0    24.92
20100207   1033.2    26.83
20100208   1144.3    29.42
20100209   1477.6    36.06
*
* thermal conductivity copper
*
20100301     273.15    387.546
20100302     373.15    377.577
20100303     573.15    366.985
20100304     773.15    358.262
20100305    2477.60    358.262
*
* thermal conductivity boron nitride
*
20100401    273.15    15.888
20100402    366.48    15.016
20100403    533.15    13.458
20100404    810.93    10.841
20100405   1088.71     8.287
20100406   1366.48     5.664
20100407   1644.26     3.059
20100408   1922.04     0.461
20100409   2199.82     0.461
20100410   2477.602    0.461
*
* thermal conductivity inconel 600
*
20100501    273.15    14.7043
20100502    310.93    14.7043
20100503    422.04    16.6358
20100504    533.15    18.3181
20100505    644.26    20.0627
20100506    755.37    21.8073
20100507    866.48    23.5518
20100508   2477.60    23.5518
*
* thermal conductivity fillers (air)
*
20100601    300.0   0.02622
20100602    400.0   0.03362
20100603    500.0   0.04035
20100604    600.0   0.04565
```

```
20100605    700.0   0.05227
*
* volumetric heat capacity s-steel
*
20100151    273.15      3.830e6
20100152    366.5   3.830e6
20100153   1466.5   5.376e6
*
* volumetric heat capacity incoloy 600
*
20100251    366.5   3.908e5
20100252    477.6   4.084e5
20100253    588.7   4.260e5
20100254    700.0   4.436e5
20100255    810.9   4.665e5
20100256    922.0   4.929e5
20100257   1033.2   5.105e5
20100258   1477.6   5.727e5
*
* volumetric heat capacity copper
*
20100351    273.15      3.6429e06
20100352   2477.60      3.4429e06
*
* volumetric hrat capacity boron nitride
*
20100451    273.15      2.5150e06
20100452    477.59      2.515e06
20100453    699.82      3.2393e06
20100454    922.04      3.661e06
20100455   1144.26      3.9100e06
20100456   1366.48      4.0240e06
20100457   1588.71      4.1172e06
20100458   2144.26      4.1916e06
20100459   2477.60      4.1916e06
*
* vloumetric heat capacity inconel 600
*
20100551    273.15      3.50253e06
20100552   2477.60      3.50253e06
*
* volumetric heat capacity fiers
*
20100651    200.0   1.1595e06
20100652   1000.0   1.1595e06
*
************************************************
* tabulat data
************************************************
*
* power for pressurizer
*
20230000    power   502
20230001    -1.0 0.0
20230002     0.0 0.0
20230003     0.0   12000.
20230004 1.0e06   12000.
*
* reactor core power
*
20250000    power
20250001     0.0   95.0e03
*
20220000    temp
20220001     0.0   300.
*
20270500    htc-t
20270501     0.0     6.086
*
20220500    htc-t
20220501     0.0     6.086
*
20220400    htc-t
20220401     0.0   5.98
*
20270400    htc-t
20270401     0.0   5.98
*
************************************************
*
* homogeneous pump curves
*
************************************************
*
* broken loop single-phase head curves
*
4501100     1 1
4501101     0.0   1.7821
4501102     0.2845   1.7059
4501103     0.569    1.627
4501104     0.8535   1.1878
4501105     1.0   1.0
*
4501200     1 2
4501201     0.0   -1.6359
4501202     0.713     0.0
4501203     0.8271    0.2959
4501204     1.0 1.0
*
4501300     1 3
4501301     -1.0      1.5
4501302     -0.8      1.275
4501303     -0.6      1.375
4501304     -0.4      1.375
4501305   0.0       1.2
*
```

```
4501400    1 4
4501401    -1.0    1.5
4501402    -0.8    1.15
4501403    -0.6    0.95
4501404    -0.4    0.83
4501405    -0.2    0.775
4501406  0.0     0.725
*
4501500    1 5
4501501  0.0     0.975
4501502  0.5     1.33
4501503  1.0     1.95
*
4501600    1  6
4501601     0.0  0.725
4501602     0.2  0.725
4501603     0.4  0.8
4501604     0.6  1.025
4501605     1.0  1.95
*
4501700    1  7
4501701    -1.0  0.175
4501702    -0.5  0.65
4501703     0.0  0.975
*
4501800    1  8
4501801    -1.0  0.175
4501802    -0.75   -0.15
4501803    -0.55   -0.3
4501804    -0.275  -0.4
4501805     0.0    -0.35
*
* broken loop single-phase torque curves
*
4501900    2 1
4501901    0.0  0.54
4501902    0.2  0.59
4501903    0.4  0.65
4501904    0.6  0.77
4501905    0.8  0.95
4501906    0.9  0.98
4501907    0.95    0.96
4501908    1.0  0.87
*
4502000    2 2
4502001    0.0  -0.15
4502002    0.2 0.02
4502003    0.4 0.22
4502004    0.6 0.46
4502005    0.8 0.71
4502006    0.9 0.81
4502007    0.95  0.85
4502008    1.0 0.87
*
4502100    2 3
4502101    -1.0  0.62
4502102    -0.8  0.68
4502103    -0.6  0.53
4502104    -0.4  0.46
4502105    -0.2  0.49
4502106     0.0  0.54
*
4502200    2 4
4502201    -1.0    0.62
4502202    -0.8    0.53
4502203    -0.6    0.46
4502204    -0.4    0.42
4502205    -0.2    0.39
4502206  0.0     0.36
*
4502300    2 5
4502301    0.0  -0.63
4502302    0.2  -0.51
4502303    0.4  -0.39
4502304    0.6  -0.29
4502305    0.8  -0.16
4502306    1.0  -0.13
*
4502400    2 6
4502401    0.0 0.36
4502402    0.2 0.32
4502403    0.4 0.27
4502404    0.6 0.18
4502405    0.8 0.05
4502406    1.0  -0.13
*
4502500    2 7
4502501    -1.0    -1.44
4502502    -0.8    -1.25
4502503    -0.6    -1.08
4502504    -0.4    -0.92
4502505    -0.2    -0.77
4502506  0.0     -0.63
*
4502600    2 8
4502601    -1.0    -1.44
4502602    -0.8    -1.12
4502603    -0.6    -0.79
4502604    -0.4    -0.52
4502605    -0.2    -0.31
4502606  0.0     -0.15
*
* two-phase head multiplier
*
4503000    0
4503001    0.0  0.0
```

```
4503002     0.1   0.0
4503003     0.15      0.05
4503004     0.24      0.8
4503005     0.3   0.96
4503006     0.4   0.98
4503007     0.6   0.97
4503008     0.8   0.90
4503009     0.9   0.8
4503010     0.96      0.5
4503011     1.0   0.0
*
* two-phase torque multiplier
*
4503100     0
4503101     0.0   -0.17
4503102     0.0001    -0.17
4503103     0.006     0.0
4503104     0.1 0.0
4503105     0.15  0.05
4503106     0.24  0.56
4503107     0.8 0.56
4503108     0.96  0.45
4503109     1.0 0.0
*
* two-phase head difference curves
*
4504100     1 1
4504101     0.0   0.0
4504102     0.1   0.85
4504103     0.2   1.09
4504104     0.5   1.02
4504105     0.7   1.01
4504106     0.9   0.94
4504107     1.0   1.0
*
4504200     1 2
4504201     0.0   0.0
4504202     0.1   -0.04
4504203     0.2   0.0
4504204     0.3   0.1
4504205     0.4   0.21
4504206     0.8   0.67
4504207     0.9   0.8
4504208     1.0   1.0
*
4504300     1 3
4504301     -1.0      -1.16
4504302     -0.9      -1.24
4504303     -0.8      -1.77
4504304     -0.7      -2.36
4504305     -0.6      -2.79
4504306     -0.5      -2.91
4504307     -0.4      -2.67
4504308     -0.25     -1.69
4504309     -0.1      -0.5
4504310     0.0       0.0
*
4504400     1 4
4504401     -1.0      -1.16
4504402     -0.9      -0.78
4504403     -0.8      -0.5
4504404     -0.7      -0.31
4504405     -0.6      -0.17
4504406     -0.5      -0.08
4504407     -0.35     0.0
4504408     -0.2      0.05
4504409     -0.1      0.08
4504410     0.0       0.11
*
4504500     1 5
4504501     0.0       0.0
4504502     0.2       -0.34
4504503     0.4       -0.65
4504504     0.6       -0.93
4504505     0.8       -1.19
4504506     1.0       -1.47
*
4504600     1 6
4504601     0.0       0.11
4504602     0.1       0.13
4504603     0.25      0.15
4504604     0.4       0.13
4504605     0.5       0.07
4504606     0.6       -0.04
4504607     0.7       -0.23
4504608     0.8       -0.51
4504609     0.9       -0.91
4504610     1.0       -1.47
*
4504700     1 7
4504701     -1.0      0.0
4504702     0.0       0.0
*
4504800     1 8
4504801     -1.0      0.0
4504802     0.0       0.0
*
* two-phase torque difference curves
*
4504900     2 1
4504901     0.0       0.54
4504902     0.2       0.59
4504903     0.4       0.65
4504904     0.6       0.77
4504905     0.8       0.95
4504906     0.9       0.98
```

```
4504907     0.95    0.96
4504908     1.0     0.87
*
4505000     2 2
4505001     0.0     -0.15
4505002     0.2     0.02
4505003     0.4     0.22
4505004     0.6     0.46
4505005     0.8     0.71
4505006     0.9     0.81
4505007     0.95    0.85
4505008     1.0     0.87
*
4505100     2 3
4505101     -1.0    0.62
4505102     -0.8    0.68
4505103     -0.6    0.53
4505104     -0.4    0.46
4505105     -0.2    0.49
4505106   0.0     0.54
*
4505200     2 4
4505201     -1.0    0.62
4505202     -0.8    0.53
4505203     -0.6    0.46
4505204     -0.4    0.42
4505205     -0.2    0.39
4505206   0.0     0.36
*
4505300     2 5
4505301     0.0     -0.63
4505302     0.2     -0.51
4505303     0.4     -0.39
4505304     0.6     -0.29
4505305     0.8     -0.20
4505306     0.9     -0.16
4505307     1.0     -0.13
*
4505400     2 6
4505401     0.0     0.36
4505402     0.2     0.32
4505403     0.4     0.27
4505404     0.6     0.18
4505405     0.8     0.05
4505406     1.0     -0.13
*
4505500     2 7
4505501     -1.0    -1.44
4505502     -0.8    -1.25
4505503     -0.6    -1.08
4505504     -0.4    -0.92
4505505     -0.2    -0.77
4505506   0.0     -0.63
*
4505600     2 8
4505601     -1.0    -1.44
4505602     -0.8    -1.12
4505603     -0.6    -0.79
4505604     -0.4    -0.52
4505605     -0.2    -0.31
4505606   0.0     -0.15
*
4506100     501
4506101     0.0     0.0
4506102     1.0e06 0.0
*
**********************************************************
*
* control components
*
**********************************************************
*
*
20500100   sgdc-lvl   sum   1.0   0.0   1
20500101   0.0   1.21831   voidf   205100000
20500102 1.20561   voidf   205090000
20500103 1.20561   voidf   205080000
20500104 1.20561   voidf   205070000
20500105 1.20561   voidf   205060000
20500106 1.20561   voidf   205050000
20500107 1.20561   voidf   205040000
20500108 0.48578   voidf   205030000
20500109 0.58737   voidf   205020000
20500110 0.41891   voidf   205010000
20500111 0.37827   voidf   209020000
20500112 0.50633   voidf   209010000
20500113 0.50635   voidf   203010000
20500114 0.40005   voidf   204010000
*
20500200   sgsd-lvl   sum   1.0   0.0   1
20500201   0.0   1.21831   voidf   202010000
20500202 1.20561   voidf   202020000
20500203 1.20561   voidf   202030000
20500204 1.20561   voidf   202040000
20500205 1.20561   voidf   202050000
20500206 1.20561   voidf   202060000
20500207 1.20561   voidf   202070000
20500208 0.48578   voidf   202080000
20500209 0.58737   voidf   202090000
20500210 0.41891   voidf   202100000
20500211 0.37827   voidf   202110000
20500212 0.50635   voidf   202120000
20500213 0.50635   voidf   203010000
20500214 0.40005   voidf   204010000
*
*20500300   il-mass   sum   1.0   0.0   1
```

```
*20500301   0.0   1.0   cmpmass   101
*20500302 1.0   cmpmass   102
*20500303 1.0   cmpmass   103
*20500304 1.0   cmpmass   104
*20500305 1.0   cmpmass   105
*20500306 1.0   cmpmass   106
*20500307 1.0   cmpmass   107
*20500308 1.0   cmpmass   108
*20500309 1.0   cmpmass   201
*20500310 1.0   cmpmass   301
*20500311 1.0   cmpmass   302
*
*20500400   vsslmass   sum   1.0   0.0   1
*20500401   0.0   1.0   cmpmass   501
*20500402 1.0   cmpmass   502
*20500403 1.0   cmpmass   503
*20500404 1.0   cmpmass   504
*20500405 1.0   cmpmass   505
*20500406 1.0   cmpmass   506
*20500407 1.0   cmpmass   507
*20500408 1.0   cmpmass   508
*20500409 1.0   cmpmass   509
*20500410 1.0   cmpmass   51.
*20500411 1.0   cmpmass   514
*20500412 1.0   cmpmass   516
*20500413 1.0   cmpmass   517
*20500414 1.0   cmpmass   518
*20500415 1.0   cmpmass   519
*20500416 1.0   cmpmass   531
*20500417 1.0   cmpmass   510
*
*20500500   bl-mass   sum   1.0   0.0   1
*20500501   0.0   1.0   cmpmass   401
*20500502 1.0   cmpmass   402
*20500503 1.0   cmpmass   403
*20500504 1.0   cmpmass   404
*20500505 1.0   cmpmass   405
*20500506 1.0   cmpmass   406
*20500507 1.0   cmpmass   450
*20500508 1.0   cmpmass   701
*
*20500600   totmass   sum   1.0   0.0   1
*20500601   0.0   1.0   cntrlvar   3
*20500602 1.0   cntrlvar   4
*20500603 1.0   cntrlvar   5
*
20500700   g-delt   sum   1.0   20.0   1
20500701   0.   1.   tempf   201010000
20500702   -1.   tempf   201200000
*
*    calculate system inventory
*   the first number on the following card is the full system mass
*20500800   invn   div   144.   1.   0
*20500801   cntrlvar 6
*20500900   invent   div   1.   1.   1
*20500901   cntrlvar 8
*
*    calculate the core liquid collapsed height
*
20501000   cord-lvl   sum   1.   0.   1
20501001   0.   .6096   voidf   505010000
20501002 .6096   voidf   505020000
20501003 .3048   voidf   505030000
20501004 .3048   voidf   505040000
20501005 .3048   voidf   505050000
20501006 .3048   voidf   505060000
20501007 .6096   voidf   505070000
20501008 .6096   voidf   505080000
*
20501100   sgsr-lvl   sum   1.0   0.0   1
20501101   0.0 1.9609   voidf   702010000
20501102 1.23101   voidf   702020000
20501103 1.15481   voidf   702030000
20501104 1.23101   voidf   702040000
20501105 1.25641   voidf   702050000
20501106 1.15481   voidf   702060000
20501107 1.06591   voidf   702070000
20501108 1.65398   voidf   702080000
20501109 1.37827   voidf   702090000
20501110 0.50635   voidf   702100000
20501111 0.50635   voidf   703010000
20501112 0.40005   voidf   704010000
*
20501200   sgdc-lvl   sum   1.0   0.0   1
20501201   0.0 1.19009   voidf   705080000
20501202 1.25101   voidf   705070000
20501203 1.15481   voidf   705060000
20501204 1.23101   voidf   705050000
20501205 1.25641   voidf   705040000
20501206 1.13481   voidf   705030000
20501207 1.06591   voidf   705020000
20501208 1.65398   voidf   705010000
20501209 0.37827   voidf   709020000
20501210 0.50635   voidf   709010000
20501211 0.50635   voidf   703010000
20501212 0.40005   voidf   704010000
*
*    calculate the broken leg generator upflow collapsed liquid level
*20501300   blgucl sum 1.   9.532   0
*20501301   0.   1.   voidf   701010000
*20501302 1.   voidf   701020000
*20501303 1.   voidf   701030000
*20501304 1.   voidf   701040000
*20501305 1.   voidf   701050000
*20501306 1.   voidf   701060000
*20501307 1.   voidf   701070000
```

```
*20501308 1.   voidf   701080000
*20501309 1.   voidf   701090000
*
*   calculate the broken leg generator downflow collapsed liquid
*   level
*20501400 blgdgl sum 1. 9.53 0
*20501401   0.   1.   voidf   701100000
*20501402 1.   voidf   701110000
*20501403 1.    voidf   701120000
*20501404 1.    voidf   701130000
*20501405 1.    voidf   701140000
*20501406 1.    voidf   701150000
*20501407 1.    voidf   701160000
*20501408 1.    voidf   701170000
*20501409 1.    voidf   701180000
*
20502300   przrlvl   sum   1.0   0.0   1
20502301   0.0   0.3671   voidf   301010000
20502302 0.2549   voidf   301020000
20502303 0.2549   voidf   301030000
20502304 0.2549   voidf   301040000
20502305 0.0663   voidf   301050000
*
*   heat losses to environment - pl sg
*
20502400   blsgpl sum 1. 0. 0
20502401 0.   1.41896 htmr 705300101
20502402   0.91445 htmr 705300201
20502403   0.99072 htmr 705300301
20502404   0.07788 htmr 705300401
20502405   0.05609 htmr 705300501
20502406   0.99072 htmr 705300601
20502407   0.05609 htmr 705300701
20502408   0.02613 htmr 705300801
20502409   0.57463 htmr 705400101
20502410   0.72732 htmr 705400201
20502411   0.72732 htmr 705400301
20502412   0.54335 htmr 705400401
*
* power losses to environment - il sg
*
20502500   ilsgpl   sum   1.   0.   0
20502501   0.   .35939   htmr   205300101
20502502 .50391   htmr   205300201
20502503 .41675   htmr   205300301
20502504 1.03430 htmr   205300401
20502505 1.03430 htmr   205300501
20502506 1.03430 htmr   205300601
20502507 1.03430 htmr   205300701
20502508 1.03430 htmr   205300801
20502509 1.03430 htmr   205300901
20502510 1.04520 htmr   205301001
20502511 .57463   htmr   205400101
20502512 .72732   htmr   205400201
20502513 .72732   htmr   205400301
20502514 .54335   htmr   205400401
*
*   energy loss to environment - il sg
*
20502600 blsgel integral 1. 0. 0
20502601   cntrlvar 24
*
*   energy loss to environment - il sg
20502700   ilsgel integral 1. 0. 0
20502701   cntrlvar 25
*
*   power loss to environment from sg
*
20502800 sgfl sum 1. 0. 0
20502801 0. 1. cntrlvar 24
20502802      1. cntrlvar 25
*
*   energy loss to environment from sg
*
20502900 sgel sum 1. 0. 0
20502901 0. 1. cntrlvar 26
20502902      1. cntrlvar 27
*
*   integ of bl hot leg mass flow
*
20503000   blm integral 1. 0. 0
20503001 mflowj 402010000
*
*   integ of il hot leg mass flow
*
20503100   ilm integral 1. 0. 0
20503101 mflowj 102020000
*
*
*
*
20510100   ilhimass   sum   1.0   0.0   1
20510101   0.0   9.2278200-04 rho 101010000
20510102   1.9918830-03 rho 102010000
20510103   5.9836050-04 rho 102020000
20510104   5.9836050-04 rho 102030000
20510105   7.8538960-04 rho 102040000
20510106   8.8732920-04 rho 102050000
20510107   8.8732920-04 rho 102060000
20510108   1.2796520-03 rho 103010000
20510109   5.4559250-04 rho 104010000
20510110   9.7311260-04 rho 104020000
20510111   8.1432400-04 rho 104030000
20510112   8.1432400-04 rho 104040000
20510113   1.4841030-03 rho 104050000
*
```

```
20510200   crossms  sum   1.0  0.0   1
20510201   0.0  1.0187750-03 rho 105010000
20510202  9.3065600-04 rho 105020000
20510203  8.1432400-04 rho 105030000
20510204  8.1432400-04 rho 105040000
20510205  8.1432400-04 rho 105050000
20510206  1.1289930-03 rho 105060000
20510207  2.0441630-03 rho 105070000
20510208  2.7480260-03 rho 105080000
20510209  2.7480260-03 rho 105090000
20510210  9.1438000-04 rho 105100000
20510211  9.1438000-04 rho 105110000
20510212  2.7480260-03 rho 1051200000
20510213  2.7480260-03 rho 105130000
20510214  2.0441630-03 rho 105140000
*
20510300   ilclmass  sum   1.0  0.0   1
20510301 0.0      4.0772550-04 rho 106010000
20510302  1.0447530-03 rho 106020000
20510303  5.4641860-04 rho 106030000
20510304  6.7631200-04 rho 106040000
20510305  2.6372190-03 rho 106050000
20510306  2.7614970-03 rho 107010000
20510307  7.6276200-04 rho 108010000
*
20510400   ilsgp.  sum   1.0  0.0   1
20510401 0.0      1.6407770-03 rho 201010000
20510402  2.2416900-03 rho 201020000
20510403  2.2183220-03 rho 201030000
20510404  2.2183220-03 rho 201040000
20510405  2.2183220-03 rho 201050000
20510406  2.2183220-03 rho 201060000
20510407  2.2183220-03 rho 201070000
20510408  2.2183220-03 rho 201080000
20510409  8.9383520-04 rho 201090000
20510410  6.3316240-04 rho 201100000
20510411  6.3316240-04 rho 201110000
20510412  8.9383520-04 rho 201120000
20510413  2.2183220-03 rho 201130000
20510414  2.2183220-03 rho 201140000
20510415  2.2183220-03 rho 201150000
20510416  2.2183220-03 rho 201160000
20510417  2.2183220-03 rho 201170000
20510418  2.2183220-03 rho 201180000
20510419  2.2416900-03 rho 201190000
20510420  1.6407770-03 rho 201200000
*
20520100   blsgpr  sum   1.0  0.0   1
20520101  0.0      1.4264000-02 rho 202010000
20520102  1.6574000-02 rho 202020000
20520103  1.3183000-02 rho 202030000
20520104  1.6789000-02 rho 202040000
20520105  1.3532000-02 rho 202050000
20520106  1.2870000-02 rho 202060000
20520107  1.2850000-02 rho 202070000
20520108  5.8490000-03 rho 202080000
20520109  9.2780000-03 rho 202090000
20520110  7.6310000-03 rho 202100000
20520111  1.5420000-02 rho 202110000
20520112  2.6025000-02 rho 202120000
20520113  5.9663000-02 rho 203010000
20520114  3.3900000-02 rho 204010000
*
20520300   ilsgsec  sum   1.0  0.0   1
20520301   0.0  6.3370000-03 rho 205010000
20520302  3.2520000-03 rho 205020000
20520303  1.3220000-03 rho 205030000
20520304  3.2790000-03 rho 205040000
20520305  3.2790000-03 rho 205050000
20520306  3.2790000-03 rho 205060000
20520307  3.2790000-03 rho 205070000
20520308  3.2790000-03 rho 205080000
20520309  3.2790000-03 rho 205090000
20520310  3.3140000-03 rho 205100000
20520311  1.1400000-03 rho 206010000
20520312  2.9856000-02 rho 209010000
20520313  2.0686000-02 rho 209020000
*
20530100   pressms  sum   1.0  0.0   1
20530101   0.0  6.4825000-03 rho 301010000
20530102  6.4825000-03 rho 301020000
20530103  5.9118000-03 rho 301030000
20530104  5.9118000-03 rho 301040000
20530105  5.9118000-03 rho 301050000
20530106  1.1360000-03 rho 301060000
20530107  7.1837000-04 rho 302010000
20530108  2.3214100-04 rho 302020000
20530109  1.6457700-04 rho 302030000
20530110  4.4046000-05 rho 302040000
20530111  4.4046000-05 rho 302050000
20530112  4.4046000-05 rho 302060000
20530113  4.4046000-05 rho 302070000
*
20510500   blhlmss  sum   1.0  0.0   1
20510501  0.0      1.4245480-03 rho 401010000
20510502  5.5496350-04 rho 402010000
20510503  3.7182600-04 rho 402020000
20510504  8.9706890-04 rho 402030000
20510505  3.8022530-04 rho 402040000
20510506  3.2063850-04 rho 402050000
20510507  3.1781750-04 rho 402060000
20510508  5.5399890-04 rho 402070000
*
20510700   blcross  sum   1.0  0.0   1
20510701  0.0      4.4975840-04 rho 403010000
20510702  3.1781750-04 rho 403020000
```

```
20510703  3.2063850-04 rho 403030000
20510704  3.1781750-04 rho 403040000
20510705  9.8569380-04 rho 403050000
20510706  7.1445920-04 rho 403060000
20510707  7.1445920-04 rho 403070000
20510708  4.4539040-04 rho 403080000
20510709  4.4539040-04 rho 403090000
20510710  7.1445920-04 rho 403100000
20510711  7.1445920-04 rho 403110000
20510712  6.3701820-04 rho 403120000
*
20510800   blclmass  sum   1.0  0.0   1
20510801  0.0    7.5605530-04 rho 404010000
20510802  2.4731980-04 rho 405010000
20510803  6.4741950-04 rho 405020000
20510804  1.3575400-03 rho 406010000
20510805  8.6000000-04 rho 450010000
*
20510900   rvcore  sum   1.0  0.0   1
20510901  0.0    6.7400000-03 rho 501010000
20510902  6.5900000-03 rho 502010000
20510903  2.9600000-03 rho 503010000
20510904  5.2000000-04 rho 504010000
20510905  1.7434560-03 rho 505010000
20510906  1.7434560-03 rho 505020000
20510907  8.7172800-04 rho 505030000
20510908  8.7172800-04 rho 505040000
20510909  8.7172800-04 rho 505050000
20510910  8.7172800-04 rho 505060000
20510911  1.7434560-03 rho 505070000
20510912  1.7434560-03 rho 505080000
20510913  1.6400000-03 rho 506010000
20510914  2.8100000-03 rho 507010000
20510915  2.1800000-03 rho 508010000
20510916  1.4300000-03 rho 509010000
20510917  4.0470000-03 rho 509020000
20510918  3.9300000-04 rho 510010000
20510919  3.4000000-04 rho 513010000
20510920  3.4525000-04 rho 514010000
*
20511000   rvdcnr  sum   1.0  0.0   1
20511001 0.0    2.6189940-03 rho 516010000
20511002  3.7726480-03 rho 517010000
20511003  1.1833800-03 rho 518010000
20511004  1.1833800-03 rho 518020000
20511005  1.1833800-03 rho 518030000
20511006  1.1833800-03 rho 518040000
20511007  1.1833800-03 rho 518050000
20511008  1.1833800-03 rho 518060000
20511009  1.1833800-03 rho 518070000
20511010  1.1833800-03 rho 518080000
20511011  1.1833800-03 rho 518090000
20511012  9.1139620-04 rho 518100000
20511013  2.0770600-03 rho 519010000
20511014  2.6772900-05 rho 531010000
20511015  2.6772900-05 rho 531020000
20511016  2.6772900-05 rho 531030000
*
20510600   blsgpr  sum   1.0  0.0   1
20510601  0.0    1.3434060-03 rho 701010000
20510602  7.2961490-04 rho 701020000
20510603  7.5091610-04 rho 701030000
20510604  7.0443410-04 rho 701040000
20510605  7.5091610-04 rho 701050000
20510606  7.6641010-04 rho 701060000
20510607  7.0443410-04 rho 701070000
20510608  6.5020510-04 rho 701080000
20510609  5.9905660-04 rho 701090000
20510610  5.9905660-04 rho 701100000
20510611  6.5020510-04 rho 701110000
20510612  7.0443410-04 rho 701120000
20510613  7.6641010-04 rho 701130000
20510614  7.5091610-04 rho 701140000
20510615  7.0443410-04 rho 701150000
20510616  7.5091610-04 rho 701160000
20510617  7.2961490-04 rho 701170000
20510618  1.3434060-03 rho 701180000
*
20520200   blsgsec  sum   1.0  0.0   1
20520201  0.0    1.3509000-02 rho 702010000
20520202  9.0360000-03 rho 702020000
20520203  8.4700000-03 rho 702030000
20520204  1.0739000-02 rho 702040000
20520205  9.6150000-03 rho 702050000
20520206  8.4740000-03 rho 702060000
20520207  8.4250000-03 rho 702070000
20520208  1.5782000-02 rho 702080000
20520209  1.6807000-02 rho 702090000
20520210  2.5882000-02 rho 702100000
20520211  5.6736000-02 rho 703010000
20520212  3.3900000-02 rho 704010000
*
20520400   blsgsec  sum   1.0  0.0   1
20520401  0.0    1.4458000-02 rho 705010000
20520402  2.2410000-03 rho 705020000
20520403  2.4350000-03 rho 705030000
20520404  2.6390000-03 rho 705040000
20520405  2.5890000-03 rho 705050000
20520406  2.4310000-03 rho 705060000
20520407  2.5930000-03 rho 705070000
20520408  2.5140000-03 rho 705080000
20520409  2.9860000-02 rho 709010000
20520410  2.0686000-02 rho 709020000
*
*  total primary inventory
*
```

```
20511100   totalpr   sum   1.0   0.0   1
20511101   0.0 1.0   cntrlvar   101
20511102   1.0   cntrlvar   102
20511103   1.0   cntrlvar   103
20511104   1.0   cntrlvar   104
20511105   1.0   cntrlvar   105
20511106   1.0   cntrlvar   106
20511107   1.0   cntrlvar   107
20511108   1.0   cntrlvar   108
20511109   1.0   cntrlvar   109
20511110   1.0   cntrlvar   110
20511111   1.0   cntrlvar   301
*
*    total secondary inventory
*
20520500   totalsec   sum   1.0   0.0   1
20520501   0.0 1.0   cntrlvar   201
20520502   1.0   cntrlvar   202
20520503   1.0   cntrlvar   203
20520504   1.0   cntrlvar   204
*
*    core heat
*
20505000   thcore   sum   1.0   0.0   1
20505001   0.0   13.4112   htrnr   501300101
20505002   13.4112   htrnr   501300201
20505004 6.7056   htrnr   501300301
20505005 6.7056   htrnr   501300401
20505006 6.7056   htrnr   501300501
20505007 6.7056   htrnr   501300601
20505008   13.4112   htrnr   501300701
20505009   13.4112   htrnr   501300801
20505010 1.8288   htrnr   501300901
20505011 1.8288   htrnr   501301001
20505012 0.9144   htrnr   501301101
20505013 0.9144   htrnr   501301201
20505014 0.9144   htrnr   501301301
20505015 0.9144   htrnr   501301401
20505016 1.8288   htrnr   501301501
20505017 1.8288   htrnr   501301601
*
*      Intact Loop SG Heat Transfer
*
20505100   isgheat   sum   1.0   0.0   1
20505101   0.0   7.30986   htrnr   200100100
20505102   7.23366   htrnr   200100200
20505103   7.23366   htrnr   200100300
20505104   7.23366   htrnr   200100400
20505105   7.23366   htrnr   200100500
20505106   7.23366   htrnr   200100600
20505107   7.23366   htrnr   200100700
20505108   2.91468   htrnr   200100800
20505109   2.06466   htrnr   200100900
20505110   2.06466   htrnr   200101000
20505111   2.91468   htrnr   200101100
20505112   7.23366   htrnr   200101200
20505113   7.23366   htrnr   200101300
20505114   7.23366   htrnr   200101400
20505115   7.23366   htrnr   200101500
20505116   7.23366   htrnr   200101600
20505117   7.23366   htrnr   200101700
20505118   7.30986   htrnr   200101800
*
*      Broken Loop SG Heat Transfer
*
20505200   bsgheat   sum   1.0   0.0   1
20505201   0.0   2.39218   htrnr   700100100
20505202   2.46202   htrnr   700100200
20505203   2.30962   htrnr   700100300
20505204   2.46202   htrnr   700100400
20505205   2.51282   htrnr   700100500
20505206   2.30962   htrnr   700100600
20505207   2.13182   htrnr   700100700
20505208   1.96412   htrnr   700100800
20505209   1.96412   htrnr   700100900
20505210   2.13182   htrnr   700101000
20505211   2.30962   htrnr   700101100
20505212   2.51282   htrnr   700101200
20505213   2.46202   htrnr   700101300
20505214   2.30962   htrnr   700101400
20505215   2.46202   htrnr   700101500
20505216   2.39218   htrnr   700101600
*
    * end of deck
```

Transient Input Deck for Base Case Run

```
*        the next input deck is for the transient calculation
*        of the semiscale natural circulation experiment 8.  *
= semiscale mod 2a -- nc8 configuration (2-loop)
0000100  restart  transnt
0000101  run
0000103  8001
*0000104  none
0000105  10.0  12.0
0000201  1.0       1.0e-06  0.01  2  50   250    1000
0000201  5000.0  1.0e-06  0.05  2  200  20000 20000
*
20800001  dt   0
20800002  dtcrnt  0
20800003  cputime
20800004  tmass   0
20800005  emass   0
20800006  cntrlvar    211     * primary system pressure
20800007  cntrlvar    212     * ilsg pressure
20800008  cntrlvar    213     * blsg pressure
20800009  cntrlvar    214     * ilcrossoverleg sg side dp
20800010  cntrlvar    215     * ilcrossover leg pump
sideJp
20800011  cntrlvar    216     * blcrossover leg sg side dp
20800012  cntrlvar    217     * blcrossover leg pump side
dp
20800013  cntrlvar    218     * ector vessel core dp
*20800014  cntrlvar    228     * total acculator flow
(intact)
*20800015  cntrlvar    229     * total accumulator flow
(broken)
20800016  cntrlvar    101     * ilhl mass
20800017  cntrlvar    102     * ilcrl mass
20800018  cntrlvar    103     * ilcl mass
20800019  cntrlvar    104     * ilsg primary mass
20800020  cntrlvar    105     * blhl mass
20800021  cntrlvar    106     * blsg primary mass
20800022  cntrlvar    107     * blcrl mass
20800023  cntrlvar    108     * blcl mass
20800024  cntrlvar    109     * rv core mass
20800025  cntrlvar    110     * rv downcomer mass
20800026  cntrlvar    111     * total primary side
inventory
20800027  cntrlvar    201     * ilsg secondary side mass
20800028  cntrlvar    202     * blsg secondary side mass
20800029  cntrlvar    203     * ilsg secondary mass
20800030  cntrlvar    204     * blsg secondary mass
20800031  cntrlvar    205     * total seconady mass
20800032  mflowj   101010000
20800033  mflowj   107010000
20800034  mflowj   401010000
20800035  mflowj   405010000
20800036  mflowj   518010000
20800037  mflowj   233000000
20800038  mflowj   733000000
20800039  mflowj   232000000
20800040  mflowj   732000000
20800041  mflowj   620000000
20800042  mflowj   820000000
*
20800043  tempf    101010000
20800044  tempf    107010000
20800045  tempf    401010000
20800046  tempf    405010000
20800047  httemp   501300711
20800048  httemp   501300811
*
*
0000501  time  0  ge  null  0   -1.0  1  * always true
0000502  time  0  lt  null  0   -1.0  n  * always false
0000510  time  0  ge  null  0    0.0  1  * induce
blowdown after 0 s
0000511  time  0  ge  null  0  117.0  1  * close steam
valve after 117 s
0000512  time  0  ge  null  0 2100.0  1  * open steam
valve after 2100 s
0000513  time  0  ge  null  0 7550.0  1  * open porv
valve after 7550 s
0000514  time  0  ge  null  0 8098.0  1  * close porv
valve after 8098 s
*
0000601  -511   or   512   n
0000602   513  and   514   n
0000610  -510  and   -510  n
*
*    modified by ysbang at 96/1/19
*    to implement sg steam leak both at iSG bSG
*
0000550   time  0  gt  null  0  117.0  n
0000551   time  0  le  null  0  2100.0  n
*
0000650   550  and  551  n
*
*    insert bypass steam junction 211 and 711
*
2110000   isteaml  valve
2110101    204010000   210000000   0.3-5   0.0   0.0
0100 1. 1.
2110201   0   0.0   0.0
2110300   trpvlv
2110301   650
```

```
*
7110000   isteaml   valve
7110101     704010000    710000000    0.3-5    0.0    0.0
0100 1. 1.
7110201   0    0.0    0.0
7110300   trpvlv
7110301   650
*
*    insert tmdpvol 210 and 710
*
2100000   envir   tmdpvol
2100101   1.0   1.0   0.0   0.0   90.0   1.0   5.-6 0.0   00
2100200   2
2100201   0.0        5.89e06      1.0
2100202   2100.0     5.89e06      1.0
2100203   2763.0     3.96e06      1.0
2100204   3380.0     3.15e06      1.0
2100205   4500.0     2.26e06      1.0
2100206   6110.0     1.50e06      1.0
2100207   8000.0     1.25e06      1.0
*
7100000   envir   tmdpvol
7100101   1.0   1.0   0.0   0.0   90.0   1.0   5.-6 0.0   00
7100200   2
7100201   0.0        5.89e06      1.0
7100202   2100.0     5.89e06      1.0
7100203   2763.0     3.96e06      1.0
7100204   3380.0     3.15e06      1.0
7100205   4500.0     2.26e06      1.0
7100206   6110.0     1.50e06      1.0
7100207   8000.0     1.25e06      1.0
*
*   end of modification by ysbang
*
*    intact loop steam generator steam outlet junction
*
2320000   steamout        valve
2320101   204010000    207000000   0.0   0.0   0.0   0100
*2320201   0              -2.166700 .01040770 0.0
*
*    modified by ysbang at 94/9/14
*    to implement the steady state result
*
2320201    0          0.0379918     0.0139507   0.0
2320300   trpvlv
2320301   601
*
2330000   feedint         tmdpjun
2330101   206000000   205000000   0.00043
2330200   1   512   cntrlvar   1
2330201   -1.0       0.0       0.0    0.0
2330202   0.0        0.0       0.0    0.0
2330203   0.0        0.216     0.0    0.0
2330204   9.5        0.216     0.0    0.0
2330205   9.58       0.054     0.0    0.0
2330206   9.7149     0.036     0.0    0.0
2330207   9.7800     0.027     0.0    0.0
2330208   9.8500     0.0       0.0    0.0
2330209   20.0       0.0       0.0    0.0
*
*
*   pressurizer porv downstream tank
*
3300000   presssup        tmdpvol
3300101   1.0   10.0   0.0   0.0   0.0   0.0   0.0   0.0   00
3300200   3
3300201        0.0     1.041e06     455.
3300202       49.0     1.041e06     455.
3300203       50.0     1.041e06     455.
3300204      150.0     0.280e06     406.
3300205     1500.0     0.270e06     403.
*
3310000   porv              valve
3310101   301000000   330000000   0.0001267   0.0   0.0
0100   1.0   1.0
3310201   0      0.0     0.0     0.0
3310300   trpvlv
3310301   602
*
*    broken loop break junction
*
*4220000   brk-jun     valve
*4220101    404010000    499000000    9.0e-07    0.0    0.0
0100   1.0   1.0
*4220201   0      0.0     0.0     0.0
*4220300   trpvlv
*4220304   510
*
*
*      modified by ysbang to model smooth open
*      of break valve for 100 sec. Sep.30. 1996
*
4220000   brk-jun     valve
4220101    404010000    499000000    9.0e-07    0.0    0.0
0100   1.0   1.0
*4220101   404010000    499000000    9.0e-07    0.0    0.0
0100   1.5   1.5
*
4220201   0      0.0     0.0     0.0
4220300   mtrvlv
4220304   510    610   0.01    0.0   0
*
4990000   presssup    tmdpvol
4990101   1.0   10.0   0.0   0.0   0.0   0.0   0.0   0.0   00
4990200   3
*4990201        0.0     1.041e06     455.
*4990202       49.0     1.041e06     455.
*4990203       50.0     1.041e06     455.
```

```
*4990204     150.0     0.280e06    404.
*4990205     1500.0    0.270e06    403.
*
*   modified by y.s.bang for realistic modeling
*     of condensate tank pressure
*
4990201      0.0     0.098e06   455.
4990202   1000.0   0.094e06   455.
4990203   3400.0   0.123e06   455.
4990204   8000.0   0.123e06   455.
*
*
5350000   byps-up        snglJun
5350101   531010000   510010000   1.62-5   300. 300. 0100
5350201   0   0.0   0.0   0.0
*
*
**********************************************
*
* ecc system
*
**********************************************
*
6100000   ilcl-ecc       pipe
6100001   1
6100101   0.000464   1
6100301   3.048          1
6100401   0.0            1
6100601   0.0            1
6100701   0.0            1
6100801   5.0e-04        0.0      1
6101001   00             1
6101201   1      300.0      0.0   0.0   0.0   0.0 1
*
6110000   ilcl-acc       accum
6110101   0.0    1.08032   0.071142    0.0    90.0    1.08032
5.0-04   0.0   00000
6110200   4.240e06     300.0
6111101   610000000     4.66e-04     0.0   0.0     0000
6112200   0.049043    0.0   9.144    0.0      1.45e-03   0   0
0   0
*
6200000   ilcl-fcc       snglJun
6200101   610010000        107000000   4.64e-04   0.0   0.0
0000
6200201   0   0.0   0.0   0.0
*
8100000   ilcl-ecc       pipe
8100001   1
8100101   0.000250       1
8100301   3.048          1
8100401   0.0            1
8100601   0.0            1
8100701   0.0            1
8100801   5.0e-04        0.0      1
8101001   00             1
8101201   1      300.0   0.0     0.0   0.0   0.0   1
*
8110000   ilcl-acc       accum
8110101   0.0    0.36027    0.02371      0.0    90.0    0.36027
5.0-04   0.0 00000
8110200   4.240e06     300.0
8111101   810000000     2.50e-04     0.0   0.0     0000
8112200   0.01776     0.0   6.096    0.0      1.45e-03   0   0
0   0
*
8200000   ilcl-ecc       snglJun
8200101   810010000        404000000   4.64e-04   0.0   0.0
0000
8200201   0   0.0   0.0   0.0
*
*    broken loop steam generator steam outlet junction
*
7320000   steamou        valve
7320101   704010000   707000000   0.0   0.0   0.0   0100
*
*7320201   0              -.0599056 .333999-3 0.0
*
*      modified by ysbang at 94/9/14
*      to implement the steady state resut
*
7320201    0        0.02012     0.001473   0.0
7320300   trpvlv
7320301   601
*
7330000   feedin         tmdpJun
7330101   706000000   705000000   0.00043
7330200   1   512   cntrlvar   12
7330201   -1.0      0.0        0.0   0.0
7330202    0.0      0.0        0.0   0.0
7330203    0.0      0.072      0.0   0.0
7330204   10.17     0.018      0.0   0.0
7330205   10.28     0.012      0.0   0.0
7330206   10.34     0.009      0.0   0.0
7330207   10.40     0.0        0.0   0.0
7330208   20.00     0.0        0.0   0.0
*
*9000000   envirnmt       tmdpvol
*9000101   1.0   1.0   0.0   0.0   0.0   0.0   0.0   0.0   00
*9000200   3
*9000201   0.0     8.48e05     310.0
**
**********************************************
*
* general table   data
*
**********************************************
*
```

```
* power   for   pressurizer
*
20230000   power          502
20230001   -1.0           0.0
20230002   0.0            0.0
20230003   0.0            12000.
20230004   1.0e06         12000.
*
* reactor   core   power
*
20250000   power
20250001   0.0            95.000e03
20250002   131.0          95.000e03
20250003   133.0          81.320e03
20250004   163.0          68.305e03
20250005   203.0          60.610e03
20250006   1103.0         36.955e03
20250007   10103.0        17.575e03
*
20220000   temp
20220001   0.0            300.
*
20270500   htc-t
20270501   0.0            6.806
*
20220500   htc-t
20220501   0.0            6.806
*
20220400   htc-t
20220401   0.0            5.98
*
20270400   htc-t
20270401   0.0            5.98
*
*********************************************
*
* control   components
*
*********************************************
*
*
20500100   sgdclvl   sum   1.0   0.0   1
20500101   0.0   1.21831   voidf   205100000
20500102         1.20561   voidf   205090000
20500103         1.20561   voidf   205080000
20500104         1.20561   voidf   205070000
20500105         1.20561   voidf   205060000
20500106         1.20561   voidf   205050000
20500107         1.20561   voidf   205040000
20500108         0.48578   voidf   205030000
20500109         0.58737   voidf   205020000
20500110         0.41891   voidf   205010000
20500111         0.37827   voidf   209020000
20500112         0.50635   voidf   209010000
20500113         0.50635   voidf   203010000
20500114         0.40005   voidf   204010000
*
20500200   sgsrlvl   sum   1.0   0.0   1
20500201   0.0   1.21831   voidf   202010000
20500202         1.20561   voidf   202020000
20500203         1.20561   voidf   202030000
20500204         1.20561   voidf   202040000
20500205         1.20561   voidf   202050000
20500206         1.20561   voidf   202060000
20500207         1.20561   voidf   202070000
20500208         0.48578   voidf   202080000
20500209         0.58737   voidf   202090000
20500210         0.41891   voidf   202100000
20500211         0.37827   voidf   202110000
20500212         0.50635   voidf   202120000
*20500213        0.50635   voidf   202130000
20500214         0.40005   voidf   204010000
*
*20500300   fi-mass   sum   1.0   0.0   1
*20500301   0.0   1.0   cmpmass   101
*20500302         1.0   cmpmass   102
*20500303         1.0   cmpmass   103
*20500304         1.0   cmpmass   104
*20500305         1.0   cmpmass   105
*20500306         1.0   cmpmass   106
*20500307         1.0   cmpmass   107
*20500308         1.0   cmpmass   108
*20500309         1.0   cmpmass   201
*20500310         1.0   cmpmass   301
*20500311         1.0   cmpmass   301
**
*20500400   vssl-mass   sum   1.0   0.0   1
*20500401   0.0   1.0   cmpmass   501
*20500402         1.0   cmpmass   502
*20500403         1.0   cmpmass   503
*20500404         1.0   cmpmass   504
*20500405         1.0   cmpmass   505
*20500406         1.0   cmpmass   506
*20500407         1.0   cmpmass   507
*20500408         1.0   cmpmass   508
*20500409         1.0   cmpmass   509
*20500410         1.0   cmpmass   513
*20500411         1.0   cmpmass   514
*20500412         1.0   cmpmass   516
*20500413         1.0   cmpmass   517
*20500414         1.0   cmpmass   518
*20500415         1.0   cmpmass   519
*20500416         1.0   cmpmass   531
*20500417         1.0   cmpmass   510
**
*20500500   bi-mass   sum   1.0   0.0   1
*20500501   0.0   1.0   cmpmass   401
*20500502         1.0   cmpmass   402
```

```
*20500503          1.0    cmpmass    403
*20500504          1.0    cmpmass    404
*20500505          1.0    cmpmass    405
*20500506          1.0    cmpmass    406
*20500507          1.0    cmpmass    450
*20500508          1.0    cmpmass    701
**
*20500600  tot-p-mass   sum    1.0    0.0   1
*20500601  0.0  1.0    cntrvar   3
*20500602          1.0    cntlvar   4
*20500603          1.0    cntlvar   5
**
*205007600  sg-delt    sum    1.0   20.0   1
*205007601  0.   1.    temp    201010000
*205007602        -1.   temp    201200000
*
*       calculate   system   inventory
*       the first number on the following card is the full system
mass
*20500800    invn   div   144.   1.   0
*20500801    cntrlvar 6
*20500900    invext   div   1.   1.   1
*20500901    cntrlvar 8
*
* calculate the core liquid collapsed   height
*
20501000  core-lvl    sum    1.      0.    1
20501001  0.   .6096    voidf     505010000
20501002          .6096    voidf     505020000
20501003          .3048    voidf     505030000
20501004          .3048    voidf     505040000
20501005          .3048    voidf     505050000
20501006          .3048    voidf     505060000
20501007          .6096    voidf     505070000
20501008          .6096    voidf     505080000
*
20501100  sgshlvl    sum    1.0    0.0   1
20501101  0.0          1.9609     voidf     702010000
20501102               1.23101    voidf     702020000
20501103               1.15481    voidf     702030000
20501104               1.23101    voidf     702040000
20501105               1.25641    voidf     702050000
20501106               1.15481    voidf     702060000
20501107               1.06591    voidf     702070000
20501108               0.65398    voidf     702080000
20501109               0.37827    voidf     702090000
20501110               0.50635    voidf     702100000
*20501111              0.50635    voidf     702110000
20501112               0.40005    voidf     704010000
*
20501200  sgdclvl    sum    1.0    0.0   1
20501201  0.0          1.9609     voidf     705080000
20501202               1.23101    voidf     705070000
20501203               1.15481    voidf     705060000
20501204               1.23101    voidf     705050000
20501205               1.25641    voidf     705040000
20501206               1.15481    voidf     705030000
20501207               1.06591    voidf     705020000
20501208               0.65398    voidf     705010000
20501209               0.37827    voidf     709020000
20501210               0.50635    voidf     709010000
20501211               0.50635    voidf     703010000
20501212               0.40005    voidf     704010000
*
* calculate the broken leg generator upflow collapsed liquid
level
*
20501300  blgu-cl sum   1.   9.532      0
20501301  0.   1.19609     voidf     701020000
20501302          1.23101     voidf     701030000
20501303          1.15481     voidf     701040000
20501304          1.23101     voidf     701050000
20501305          1.25641     voidf     701060000
20501306          1.15481     voidf     701070000
20501307          1.06591     voidf     701080000
20501308          0.98206     voidf     701090000
*
* calculate the broken leg generator downflow collapsed liquid
level
*
20501400  slgd-cl   sum    1.      9.532    0
20501401  0.   0.98206     voidf     701100000
20501402          1.06591     voidf     701110000
20501403          1.15481     voidf     701120000
20501404          1.25641     voidf     701130000
20501405          1.23101     voidf     701140000
20501406          1.15481     voidf     701150000
20501407          1.23101     voidf     701160000
20501408          0.19609     voidf     701170000
*
* calculate the intact leg generator upflow collapsed liquid
level
*
20501500  ileu-cl sum   1.0 9.525      1
20501501  0.   1.21831     voidf   201020000
20501502          1.20561     voidf   201030000
20501503          1.20561     voidf   201040000
20501504          1.20561     voidf   201050000
20501505          1.20561     voidf   201060000
20501506          1.20561     voidf   201070000
20501507          1.20561     voidf   201080000
20501508          0.48578     voidf   201090000
20501509          0.34411     voidf   201100000
*
* calculate the intact leg generator downflow collapsed liquid
level
*
20501600  ilgd-cl sum   1.0 9.525   1
```

```
20501601  0.   0.34411    voidf  201110000
20501602        0.48578    voidf  201120000
20501603        1.20561    voidf  201130000
20501604        1.20561    voidf  201140000
20501605        1.20561    voidf  201150000
20501606        1.20561    voidf  201160000
20501607        1.20561    voidf  201170000
20501608        1.20561    voidf  201180000
20501609        1.21381    voidf  201190000
*
20502300  pzrlevel    sum   1.0   0.0   1
20502301  0.0   0.3671     voidf   301010000
20502302          0.2549     voidf   301020000
20502303          0.2549     voidf   301030000
20502304          0.2549     voidf   301040000
20502305          0.0663     voidf   301050000
*
* heat losses to environment - bl sg
*
20502400   blsgpl sum 1. 0. 0
20502401  0.   1.41896 htmr 705300101
20502402        0.91455 htmr 705300201
20502403        0.99072 htmr 705300301
20502404        1.07788 htmr 705300401
20502405        1.05609 htmr 705300501
20502406        0.99072 htmr 705300601
20502407        1.05609 htmr 705300701
20502408        1.02613 htmr 705300801
20502409        0.57463 htmr 705400101
20502410        0.72732 htmr 705400201
20502411        0.72732 htmr 705400301
20502412        0.54335 htmr 705400401
*
* power losses to environment - il sg
*
20502500  ilsgpl   sum 1. 0. 0
20502501  0.   .35939   htmr   205300101
20502502        .50391   htmr   205300201
20502503        .41679   htmr   205300301
20502504       1.03430   htmr   205300401
20502505       1.03430   htmr   205300501
20502506       1.03430   htmr   205300601
20502507       1.03430   htmr   205300701
20502508       1.03430   htmr   205300801
20502509       1.03430   htmr   205300901
20502510       1.04520   htmr   205301001
20502511        .57463   htmr   205400101
20502512        .72732   htmr   205400201
20502513        .72732   htmr   205400301
20502514        .54335   htmr   205400401
*
* energy losses to environment - bl sg
*
20502600   blsgel integral 1. 0. 0
20502601    cntrlvar 24
*
* energy losses to environment - il sg
*
20502700   ilsgel integral 1. 0. 0
20502701    cntrlvar 25
*
* power losses to environment from sg
*
20502800   sgpl sum 1. 0. 0
20502801   0. 1. cntrlvar 24
20502802        1. cntrlvar 25
*
* energy losses to environment from sg
*
20502900   blsgel sum   1. 0. 0
20502901   0. 1. cntrlvar 26
20502902        1. cntrlvar 27
*
* integ of bl hot leg mass flow
*
20503000   blm integral 1.   0. 0
20503001   mflowj 402010000
*
* integ of il hot leg mass flow
*
20503000   ilm integral 1.   0. 0
20503001   mflowj 102020000
*
* integ of break mass flow
*
20503000   brm integral 1.   0. 0
20503001   mflowj 422000000
*
20510100    ilhlmass   sum    1.0   0.0    1
20510101    0.0   9.2278200-04 rho 101010000
20510102          1.9918830-03 rho 102010000
20510103          5.9836050-04 rho 102020000
20510104          5.9836050-04 rho 102030000
20510105          7.8538960-04 rho 102040000
20510106          8.8732920-04 rho 102050000
20510107          8.8732920-04 rho 102060000
20510108          1.2796520-03 rho 103010000
20510109          5.4559250-04 rho 104010000
20510110          9.7311260-04 rho 104020000
20510111          8.1432400-04 rho 104030000
20510112          8.1432400-04 rho 104040000
20510113          1.4841030-03 rho 104050000
*
20510200    crossmis   sum    1.0   0.0    1
20510201    0.0   1.0187750-03 rho 105010000
20510202          9.3065600-04 rho 105020000
20510203          8.1432400-04 rho 105030000
20510204          8.1432400-04 rho 105040000
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20510205          8.1432400-04 rho 105050000
20510206          1.1289930-03 rho 105060000
20510207          2.0441630-03 rho 105070000
20510208          2.7480260-03 rho 105080000
20510209          2.7480260-03 rho 105090000
20510210          9.1438000-04 rho 105100000
20510211          9.1438000-04 rho 105110000
20510212          2.7480260-03 rho 105120000
20510213          2.7480260-03 rho 105130000
20510214          2.0441630-03 rho 105140000
*
20510300   ilclmass  sum    1.0   0.0    1
20510301 0.0      4.0772550-04 rho 106010000
20510302          1.0447530-03 rho 106020000
20510303          5.4641860-04 rho 106030000
20510304          6.7631200-04 rho 106040000
20510305          2.6372190-03 rho 106050000
20510306          2.7614970-03 rho 107010000
20510307          7.6276200-04 rho 108010000
*
20510400   ilsgpr   sum    1.0   0.0    1
20510401 0.0      1.6407770-03 rho 201010000
20510402          2.2416900-03 rho 201020000
20510403          2.2183220-03 rho 201030000
20510404          2.2183220-03 rho 201040000
20510405          2.2183220-03 rho 201050000
20510406          2.2183220-03 rho 201060000
20510407          2.2183220-03 rho 201070000
20510408          2.2183220-03 rho 201080000
20510409          8.9383520-04 rho 201090000
20510410          6.3316240-04 rho 201100000
20510411          6.3316240-04 rho 201110000
20510412          8.9383520-04 rho 201120000
20510413          2.2183220-03 rho 201130000
20510414          2.2183220-03 rho 201140000
20510415          2.2183220-03 rho 201150000
20510416          2.2183220-03 rho 201160000
20510417          2.2183220-03 rho 201170000
20510418          2.2183220-03 rho 201180000
20510419          2.2416900-03 rho 201190000
20510420          1.6407770-03 rho 201200000
*
20520100   bisgpr   sum    1.0   0.0    1
20520101  0.0     1.4264000-02 rho 202010000
20520102          1.6574000-02 rho 202020000
20520103          1.3183000-02 rho 202030000
20520104          1.6789000-02 rho 202040000
20520105          1.3532000-02 rho 202050000
20520106          1.2870000-02 rho 202060000
20520107          1.2850000-02 rho 202070000
20520108          5.8490000-03 rho 202080000
20520109          9.2780000-03 rho 202090000
20520110          7.6310000-03 rho 202100000
20520111          1.5420000-02 rho 202110000
20520112          2.6025000-02 rho 202120000
20520113          5.9663000-02 rho 203010000
20520114          3.3900000-02 rho 204010000
*
20520300   ilsgsec   sum    1.0   0.0    1
20520301  0.0     6.3370000-03 rho 205010000
20520302          3.2520000-03 rho 205020000
20520302          1.3220000-03 rho 205030000
20520304          3.2790000-03 rho 205040000
20520305          3.2790000-03 rho 205050000
20520306          3.2790000-03 rho 205060000
20520307          3.2790000-03 rho 205070000
20520308          3.2790000-03 rho 205080000
20520309          3.2790000-03 rho 205090000
20520310          3.3140000-03 rho 205100000
20520311          1.1400000-03 rho 206010000
20520312          2.9856000-02 rho 209010000
20520313          2.0686000-02 rho 209020000
*
20530100   pressms   sum    1.0   0.0    1
20530101  0.0     6.4825000-03 rho 301010000
20530102          6.4825000-03 rho 301020000
20530103          5.9118000-03 rho 301030000
20530104          5.9118000-03 rho 301040000
20530105          5.9118000-03 rho 301050000
20530106          1.1360000-03 rho 301060000
20530107          7.1837000-04 rho 302010000
20530108          2.3214100-04 rho 302020000
20530109          1.6457700-04 rho 302030000
20530110          4.4046000-05 rho 302040000
20530111          4.4046000-05 rho 302050000
20530112          4.4046000-05 rho 302060000
20530113          4.4046000-05 rho 302070000
*
20510500   blhlmss   sum    1.0   0.0    1
20510501  0.0     1.4245480-03 rho 401010000
20510502          5.5496350-04 rho 402010000
20510503          3.7182600-04 rho 402020000
20510504          8.9706890-04 rho 402030000
20510505          3.8022530-04 rho 402040000
20510506          3.2063850-04 rho 402050000
20510507          3.1781750-04 rho 402060000
20510508          5.5399890-04 rho 402070000
*
20510700   blcross   sum    1.0   0.0    1
20510701  0.0     4.4975840-04 rho 403010000
20510702          3.1781750-04 rho 403020000
20510703          3.2063850-04 rho 403030000
20510704          3.1781750-04 rho 403040000
20510705          9.8569380-04 rho 403050000
20510706          7.1445920-04 rho 403060000
20510707          7.1445920-04 rho 403070000
20510708          4.4539040-04 rho 403080000
20510709          4.4539040-04 rho 403090000
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20510710          7.1445920-04 rho 403100000
20510711          7.1445920-04 rho 403110000
20510712          6.3701820-04 rho 403120000
*
20510800   blclmass  sum    1.0   0.0    1
20510801  0.0     7.5605530-04 rho 404010000
20510802          2.4731980-04 rho 405010000
20510803          6.4741950-04 rho 405020000
20510804          1.3575400-03 rho 406010000
20510805          8.6000000-04 rho 450010000
*
20510900   rvcore  sum    1.0   0.0    1
20510901  0.0     6.7400000-03 rho 501010000
20510902          6.5900000-03 rho 502010000
20510903          2.9600000-03 rho 503010000
20510904          5.2000000-04 rho 504010000
20510905          1.7434560-03 rho 505010000
20510906          1.7434560-03 rho 505020000
20510907          8.7172800-04 rho 505030000
20510908          8.7172800-04 rho 505040000
20510909          8.7172800-04 rho 505050000
20510910          8.7172800-04 rho 505060000
20510911          1.7434560-03 rho 505070000
20510912          1.7434560-03 rho 505080000
20510913          1.6400000-03 rho 506010000
20510914          2.8100000-03 rho 507010000
20510915          2.1800000-03 rho 508010000
20510916          1.4300000-03 rho 509010000
20510917          4.0470000-03 rho 509020000
20510918          3.9300000-04 rho 510010000
20510919          3.4000000-04 rho 513010000
20510920          3.4525000-04 rho 514010000
*
20511000   rvdcnr  sum    1.0   0.0    1
20511001 0.0      2.6189940-03 rho 516010000
20511002          3.7726480-03 rho 517010000
20511003          1.1833800-03 rho 518010000
20511004          1.1833800-03 rho 518020000
20511005          1.1833800-03 rho 518030000
20511006          1.1833800-03 rho 518040000
20511007          1.1833800-03 rho 518050000
20511008          1.1833800-03 rho 518060000
20511009          1.1833800-03 rho 518070000
20511010          1.1833800-03 rho 518080000
20511011          1.1833800-03 rho 518090000
20511012          9.1139620-04 rho 518100000
20511013          2.0770600-03 rho 519010000
20511014          2.6772900-05 rho 531010000
20511015          2.6772900-05 rho 531020000
20511016          2.6772900-05 rho 531030000
*
20510600   blsgpr  sum    1.0   0.0    1
20510601  0.0     1.3434060-03 rho 701010000
20510602          7.2961490-04 rho 701020000
20510603          7.5091610-04 rho 701030000
20510604          7.0443410-04 rho 701040000
20510605          7.5091610-04 rho 701050000
20510606          7.6641010-04 rho 701060000
20510607          7.0443410-04 rho 701070000
20510608          6.5020510-04 rho 701080000
20510609          5.9905660-04 rho 701090000
20510610          5.9905660-04 rho 701100000
20510611          6.5020510-04 rho 701110000
20510612          7.0443410-04 rho 701120000
20510613          7.6641010-04 rho 701130000
20510614          7.5091610-04 rho 701140000
20510615          7.0443410-04 rho 701150000
20510616          7.5091610-04 rho 701160000
20510617          7.2961490-04 rho 701170000
20510618          1.3434060-03 rho 701180000
*
20520200   blsgsec  sum    1.0   0.0    1
20520201  0.0     1.3509000-02 rho 702010000
20520202          9.0360000-03 rho 702020000
20520203          8.4700000-03 rho 702030000
20520204          1.0739000-02 rho 702040000
20520205          9.6150000-03 rho 702050000
20520206          8.4740000-03 rho 702060000
20520207          8.4250000-03 rho 702070000
20520208          1.5782000-02 rho 702080000
20520209          1.6807000-02 rho 702090000
20520210          2.5882000-02 rho 702100000
20520211          5.6736000-02 rho 703010000
20520212          3.3900000-02 rho 704010000
*
20520400   blsgsec  sum    1.0   0.0    1
20520401  0.0     1.4458000-02 rho 705010000
20520402          2.2410000-03 rho 705020000
20520403          2.4350000-03 rho 705030000
20520404          2.6390000-03 rho 705040000
20520405          2.5890000-03 rho 705050000
20520406          2.4310000-03 rho 705060000
20520407          2.5930000-03 rho 705070000
20520408          2.5140000-03 rho 705080000
20520409          2.9860000-02 rho 709010000
20520410          2.0686000-02 rho 709020000
*
*  total primary inventory
*
20511100   totalpr  sum    1.0   0.0    1
20511101  0.0           1.0   cntrlvar   101
20511102                1.0   cntrlvar   102
20511103                1.0   cntrlvar   103
20511104                1.0   cntrlvar   104
20511105                1.0   cntrlvar   105
20511106                1.0   cntrlvar   106
20511107                1.0   cntrlvar   107
20511108                1.0   cntrlvar   108
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20511109              1.0  cntrlvar   109
20511110              1.0  cntrlvar   110
20511111              1.0  cntrlvar   301
*
*    total secondary inventory
*
20520500   totalsec  sum    1.0    0.0    1
20520501   0.0         1.0  cntrlvar   201
20520502              1.0  cntrlvar   202
20520503              1.0  cntrlvar   203
20520504              1.0  cntrlvar   204
*
2060000   feedinl     tmdpvol
2060101   0.00114   1.0   0.0   0.0   0.0   0.0   5.0e-06
0.0 00
2060200   1
*
*   modified by y.s.bang
*   maintaining 310 K
*
2060201   0.0   310.0   0.0
*2060201  0.0     460.0       0.0
*2060202  2100.0  460.0       0.0
*2060203  3000.0  400.0       0.0
*2060204  4500.0  300.0       0.0
*2060205  6000.0  220.0       0.0
*2060206  8000.0  130.0       0.0
*
2070000   steamout     tmdpvol
2070101   1.0   1.0   0.0   0.0   90.0   1.0   5.0e-06   0.0 00
2070200   2
2070201   0.0       5.85e06     1.0
2070202   2100.0    5.85e06     1.0
2070203   2800.0    2.75e06     1.0
2070204   3260.0    2.18e06     1.0
2070205   5600.0    1.58e06     1.0
2070206   8000.0    1.25e06     1.0
*
7060000   feedinle     tmdpvol
7060101   0.00114   1.0   0.0   0.0   0.0   0.0   5.0e-06
0.0 00
7060200   1
*
*   modified by y.s.bang
*   maintaining 310 K
*
7060201   0.0   310.0   0.0
*7060201  0.0     460.0       0.0
*7060202  2100.0  460.0       0.0
*7060203  3000.0  400.0       0.0
*7060204  4500.0  300.0       0.0
*7060205  6000.0  220.0       0.0
*7060206  8000.0  130.0       0.0
*
7070000   steamou     tmdpvol
7070101   1.0   1.0   0.0   0.0   90.0   1.0   5.0e-06   0.0 00
7070200   2
7070201   0.0       5.89e06     1.0
7070202   2100.0    5.89e06     1.0
7070203   2763.0    3.96e06     1.0
7070204   3380.0    3.15e06     1.0
7070205   4500.0    2.26e06     1.0
7070206   6110.0    1.50e06     1.0
7070207   8000.0    1.25e06     1.0
*
*   following items added to make easy postprocessing
*   at june 17, 1995 by ysbang.
*
*    control variables
*
* pressure in mpa
*
20521100   ppre   mult   0.000001   0.0   1
20521101     p      508010000
*
20521200   isgp   mult   0.000001   0.0   1
20521201     p      204010000
*
20521300   bsgp   mult   0.000001   0.0   1
20521301     p      704010000
*
20503000   ibrfw integral   1.   0.0   1
20503001   mflowj   422000000
*
*   differntial pressure in kpa
*
20521400   icrsg    sum    0.001    0.0    1
20521401   0.       1.     p      10510000
20521402            -1.     p      105030000
*
20521500   icrpm    sum    0.001    0.0    1
20521501   0.       1.     p      105110000
20521502            -1.     p      106020000
*
20521600   bcrsg    sum    0.001    0.0    1
20521601   0.       1.     p      403080000
20521602            -1.     p      403120000
*
20521700   bcrpm    sum    0.001    0.0    1
20521701   0.       1.     p      403080000
20521702            -1.     p      403120000
*
20521800   cordif   sum    0.001    0.0    1
20521801   0.       1.     p      505010000
20521802            -1.     p      505080000
*
*20523000   isglvl   sum    0.001    0.0    1
```

```
*20523001  0.     1.    p     202010000
*20523002         -1.   p     202120000
*
*20523100  bsglvl  sum   0.001   0.0   1
*20523101  0.     1.    p     702010000
*20523102         -1.   p     702100000
*
*    heat flus total
*
*20522800  tihf    sum     1.0    0.0    1
*20522801  0.   1.0    htmr    201010101
*20522802        1.0    htmr    201010201
*20522803        1.0    htmr    201010301
*20522804        1.0    htmr    201010401
*20522805        1.0    htmr    201010501
*20522806        1.0    htmr    201010601
*20522807        1.0    htmr    201010701
*20522808        1.0    htmr    201010801
*20522809        1.0    htmr    201010901
*20522810        1.0    htmr    201010001
*20522811        1.0    htmr    201010101
*20522812        1.0    htmr    201010201
*20522813        1.0    htmr    201010301
*20522814        1.0    htmr    201010401
*20522815        1.0    htmr    201010501
*20522816        1.0    htmr    201010601
*20522817        1.0    htmr    201010701
*20522818        1.0    htmr    201010801
*
*20522900   tbff  sum    1.0    0.0    1
*20522901  0.   1.0    htmr    701010101
*20522902        1.0    htmr    701010201
*20522903        1.0    htmr    701010301
*20522904        1.0    htmr    701010401
*20522905        1.0    htmr    701010501
*20522906        1.0    htmr    701010601
*20522907        1.0    htmr    701010701
*20522908        1.0    htmr    701010801
*20522909        1.0    htmr    701010901
*20522910        1.0    htmr    701010001
*20522911        1.0    htmr    701010101
*20522912        1.0    htmr    701010201
*20522913        1.0    htmr    701010301
*20522914        1.0    htmr    701010401
*20522915        1.0    htmr    701010501
*20522916        1.0    htmr    701010601
*
20523000  tilacc integral  1   0.0   1
20523001  mflowj  620000000
*
20523100  tbacc integral  1   0.0   1
20523101  mflowj  820000000
*
*
```

```
20531300  totpow   function  1.0   9.5+04   1
20531301  time   0     500
*
20548100  stgen   sum     1.0    0.0    1
20548101   0.0   1.7434560-03 gammaw 505010000
20548102         1.7434560-03 gammaw 505020000
20548103         8.7172800-04 gammaw 505030000
20548104         8.7172800-04 gammaw 505040000
20548105         8.7172800-04 gammaw 505050000
20548106         8.7172800-04 gammaw 505060000
20548107         1.7434560-03 gammaw 505070000
20548108         1.7434560-03 gammaw 505080000
*
20548200  stgen   sum     1.0    0.0    1
20548201   0.0   1.7434560-03 vapgen 505010000
20548202         1.7434560-03 vapgen 505020000
20548203         8.7172800-04 vapgen 505030000
20548204         8.7172800-04 vapgen 505040000
20548205         8.7172800-04 vapgen 505050000
20548206         8.7172800-04 vapgen 505060000
20548207         1.7434560-03 vapgen 505070000
20548208         1.7434560-03 vapgen 505080000
*
*    end of transient input deck
```

Appendix B
RELAP5 Input Listing for Case T01

Steady State Input Deck for Case T01

```
= semiscale mod 2a -- nc8 configuration (2-loop)
*
*   implementing 2-core channel model at may 18, 1996
*
0000100   new   stdy-st
0000101   run
0000105   30.0   32.0
0000110    nitrogen
*0000201   1.0   1.0e-06   0.01   2   10   250   4000
*0000202   800.0   1.0e-06   0.1   2   10   2000   4000
*
0000202   800.0   1.0e-06   0.1   2   200    8000   8000
*
0000501   time   0   ge   null   0   -1.0   1   * always true
0000502   time   0   lt   null   0   -1.0   n   * always false
*
*      steady state trip : alway true
*
0000599    time   0    ge   null   0    0.0    1    *always true
*************************************************************
***
*
*   intact loop piping
*
*************************************************************
***
*
*301   cntrlvar   917      * pzr liquid volume
*302   cntrlvar   918      * pzr liquid volume error
*303   cntrlvar   921      * letdown error
*304   cntrlvar   937      * intact loop hot temperatur error
*305   cntrlvar   947      * broken loop hot temp error
*306   cntrlvar   961      * intact loop sg level
*307   cntrlvar   971      * broken loop sg level
*308   cntrlvar   962      * IL SG Level error
*309   cntrlvar   963      * BL SG Level error
310   mflowj   101020000      * intact loop mass flow
311   mflowj   401020000      * broken loop mass flow
312   p 301010000     * pressurizer top pressure
313   p 204010000     * IL SG steam pressure
314   p 704010000     * BL SG steam pressure
315   cntrlvar   101    *    intact loop hot leg mass
316   cntrlvar   102    *    intact loop crossover leg mass
317   cntrlvar   103    *    intactloop cold leg mass
318   cntrlvar   104    *    intact loop s/g primary mass
319   cntrlvar   105    *    broken loop hot leg mass
320   cntrlvar   106    *    broken loop sg primary mass
321   cntrlvar   107    *    broken loop crossover leg mass
322   cntrlvar   108    *    broken loop cold leg mass
323   cntrlvar   109    *    rector vessel core and etc mass
324   cntrlvar   110    *    reactor downcomer mass
325   cntrlvar   201    *    intact loop secondary mass
326   cntrlvar   202    *    broken loop secondary mass
327   cntrlvar   301    *    pressurizer mass
328   cntrlvar   111    * total primary mass
329   cntrlvar   205    *    total secondary mass
**
1010000   hotleg       branch
1010001   2 1
1010101   0.00420   0.21971   0.0   0.0   0.0   0.0   4.0e-05   0.0
+     00000
1010200   3 15.4e06   581.4     * 0.0     0.0   0.0
1011101   508010000   101000000   0.0   0.5   1.0   0100
1012101   101010000   102000000   0.0   0.0   0.0   0100
1011201   0.26   0.0   0.0
1012201   0.26   0.0   0.0
*
1020000   pc1a18       pipe
1020001   6
1020101   0.00349.4
1020102   0.00229.6
1020301   0.57074.1
1020302   0.17145.3
1020303   0.22504.4
1020304   0.38748.6
1020601   0.0.6
1020801   4.0e-05.0.0.6
1020901   0.0.0.0.1
1020902   0.288.0.288.2
1020903   0.0.0.0.3
1020904   0.0.0.0.5
1021001   00.6
1021101   0000.3
1021102   0100.4
1021103   0000.5
1021201   3      15.4e06   518.4   0.0   0.0      0.0   06
1021300   1
1021301   0.260   0.0   0.0   05
*
1030000   newspol       branch
1030001   3 1
1030101   0.00229   0.55880   0.0   0.0   0.0   0.0   4.0e-05   0.0
+     00
1030200   3 15.4e06   581.4
1031101   102010000   103000000   0.0   0.18   0.18   0000
1032101   103010000   104000000   0.0   0.18   0.18   0000
1033101   302010000   103000000   0.0   0.90   0.90   0100
1031201   0.260        0.0        0.0
1032201   0.260        0.0        0.0
1033201   0.260        0.0        0.0
```

```
*
1040000  newspol      pipe
1040001  5
1040101  0.00229,5
1040301  0.23825,1
1040302  0.42494,2
1040303  0.35560,4
1040304  0.64808,5
1040601  0.0,1
1040602  90.0,4
1040603  55.0,5
1040701  0.0,1
1040702  0.42494,2
1040703  0.35560,4
1040704  0.52680,5
1040801  4.0e-05,0.0,5
1040901  0.540,0.540,1
1040902  0.0,0.0,3
1040903  0.288,0.288,4
1041001  00,5
1041101  0000,4
1041201  3 15.4e06  581.4     0.0      0.0  0.0   05
1041300  1
1041301  0.260      0.0      0.0      04
*
1050000  pmpsuc      pipe
1050001  14
1050101  0.00229,6
1050102  0.00349,14
1050301  0.44488,1
1050302  0.40640,2
1050303  0.35560,5
1050304  0.49301,6
1050305  0.58572,7
1050306  0.78740,9
1050307  0.26200,11
1050308  0.78740,13
1050309  0.58572,14
1050601  -55.0,1
1050602  -90.0,9
1050603  -45.0,10
1050604  45.0,11
1050605  90.0,14
1050701  -0.36068,1
1050702  -0.40640,2
1050703  -0.35560,5
1050704  -0.49301,6
1050705  -0.58572,7
1050706  -0.78740,9
1050707  -0.1968,10
1050708  0.1968,11
1050709  0.78740,13
1050710  0.58572,14
1050801  4.0e-05,0.0,14
1050901  0.288,0.288,1
1050902  0.0,0.0,9
1050903  0.450,0.450,11
1050904  0.0,0.0,13
1051001  00,14
1051101  0000,5
1051102  0100,6
1051103  0000,13
1051201  3 15.4e06  545.0     0.0      0.0  0.0   14
1051300  1
1051301  0.260      0.0      0.0      13
*
1060000  pmpsiml     pipe
1060001  5
1060101  0.00091,4
1060102  0.00349,5
1060201  0.00091,1
1060202  0.00030,2
1060203  0.00091,4
1060301  0.44805,1
1060302  1.14808,2
1060303  0.60046,3
1060304  0.74320,4
1060305  0.75565,5
1060601  90.0,1.
1060602  0.0,5
1060801  4.0e-05,0.0,5
1060901  0.966,0.966,1
1060902  1.260,1.260,2
1060903  0.0,0.0,4
1061001  00,5
1061101  0000,1
1061102  0100,2
1061103  0000,3
1061104  0100,4
1061201  3 15.4e06  545.0     0.0      0.0  0.0   05
1061300  1
1061301  0.260      0.0      0.0      04
*
1070000  pc19-3      branch
1070001  2
1070101  0.00349  0.79126  0.0  0.0  0.0  0.0  4.0e-05  0.0
+    00
1070200  3 15.4e06  545.0
1071101  106010000  107000000  0.0  0.288  0.288  0000
1072101  107010000  108000000  0.0  0.0  0.0  0100
1071201  0.260      0.0      0.0
1072201  0.260      0.0      0.0
*
1080000  dcmrinl     branch
1080001  1
1080101  0.00420  0.18161  0.0  0.0  0.0  0.0  4.0e-05  0.0
```

```
+     00
1080200   3 15.4e06        545.0
1081101   108010000   517010000   0.0   0.0   0.0   0100
1081201   0.260   0.0   0.0
*
1100000   pmpsimi        sngljun
1100101   105010000   106000000   0.0   0.0   0.0   0100
1100201   1 0.260   0.0   0.0

*
************************************************************
***********
*
*   steam   generator
*
************************************************************
***********
*
2010000   sgprim        pipe
2010001   20
2010101   0.00783,1
2010102   0.00184,19
2010103   0.00783,20
2010301   0.20955,1
2010302   1.21831,2
2010303   1.20561,8
2010304   0.48578,9
2010305   0.34411,11
2010306   0.48578,12
2010307   1.20561,18
2010308   1.21831,19
2010309   0.20955,20
2010601   90.0,9
2010602   70.0,10
2010603   -70.0,11
2010604   -90.0,20
*   andy modified 4/21/83 roughness from 4.0e-05 to 5.0e-05
2010801   4.0e-05,0.08386,1
2010802   4.0e-05,0.01974,19
2010803   4.0e-05,0.08386,20
2010901   0.0,0.0,8
2010902   0.3375,0.3375,9
2010903   0.675,0.675,10
2010904   0.3375,0.3375,11
2010905   0.0,0.0,19
2011001   00,20
2011101   0100,1
2011102   0000,18
2011103   0100,19
2011201   3 15.4e06   563.2        0.0   0.0   0.0     20
2011300   1
2011301   0.260        0.0        0.0        19
*
2020000   sgshr        pipe
2020001    12
2020101   0.0,12
2020201   0.00399,6
2020202   0.00371,7
* andy modified   2020203     4/21/83
2020203   0.00477,8
2020204   0.00555,9
2020205   0.01342,10
2020206   0.03515,11
*2020207   0.05502,12
2020301   1.21831,1
2020302   1.20561,7
2020303   0.48578,8
2020304   0.58737,9
2020305   0.41891,10
2020306   0.37827,11
2020307   0.50635,12
* andy modified   2020401   to   2020413   4/21/83
2020401   0.014264,1
2020402   0.016574,2
2020403   0.013183,3
2020404   0.016789,4
2020405   0.013532,5
2020406   0.012870,6
2020407   0.012850,7
2020408   0.005849,8
2020409   0.009278,9
2020410   0.007631,10
2020411   0.015420,11
2020412   0.026025,12
*2020413   0.028815,13
2020601   90.0,12
2020801   5.0e-06,0.03108,7
2020802   5.0e-06,0.04063,8
2020803   5.0e-06,0.05956,9
2020804   5.0e-06,0.06729,10
2020805   5.0e-06,0.0,12
2021001   00,12
2021101   0100,9
2021102   0000,11
2021201   2        5.85e06   0.0        0.0        0.0   0.0   12
2021300   1
2021301   0.0        0.0        0.0        11
*
*2030000   separatr        separatr
*2030001   3 0
*2030101   0.0   0.50635   0.030848   0.0   -90.0   -0.50635   5.0e-
*+      06   0.1365   00
*2030200   2        5.85e06        0.0
*2031101   203000000   204000000   0.0   0.0   0.0   0100
*2032101   202010000   203000000   0.0   0.0   0.0   0100
*2033101   203010000   209000000   0.0   0.0   0.0   0100
```

```
*2031201  0.0      0.0      0.0
*2032201  0.0      0.0      0.0
*2033201  0.0      0.0      0.0
*
2030000  separatr     separatr
2030001  3 0
2030101  0.0  0.50635   0.059663  0.0  90.0  0.50635  5.0e-6
+     0.1365  00
2030200  2     5.85e+6   0.9
*2030200  2     5.85e+6  0.0
*
*     modified by ysbang at 93/9/6
*     to match test initial condition
*
2031101   203010000  204000000  0.06729  0.0  0.0  00100
2032101   203000000  209000000  0.058963  0.0  0.0  00100
2033101   202010000  203000000  0.05139   0.0  0.0  00100
2031201   0.0      0.0      0.0
2032201   0.0      0.0      0.0
2033201   0.0      0.0      0.0
*
2040000  steamdom     snglvol
2040101  0.0  0.40005   0.03390    0.0   90.0   0.40005   5.0-6
0.32849  00
2040200  2  5843600.0     1.0
*
2050000  stdome   pipe
2050001  10
2050101  0.0.10
2050301  0.41891.1
2050302  0.58737.2
2050303  0.48578.3
2050304  1.20561.9
2050305  1.21831.10
* a. modified 2050101,  2050401  to  2050405   4/21/83
2050401  0.006337.1
2050402  0.003252.2
2050403  0.001322.3
2050404  0.003279.9
2050405  0.003314.10
2050601  -90.0.10
2050801  5.0e-06.0.01023.10
2051001  00.10
2051101  0000.9
2051201  2       5.85e06  0.0       0.0  0.0      0.0    10
2051300  1
2051301  0.0       0.0       0.0       09
*
2060000  feedinl      tmdpvol
2060101  0.00114  1.0  0.0  0.0  0.0  0.0  5.0e-06  0.0  00
2060200  3
2060201  0.0  5.85e06  495.0
*
2070000  steamout      tmdpvol
2070101  1.0  1.0  0.0  0.0  90.0  1.0  5.0e-06  0.0  00
2070200  2    * 1
*2070201  0.0  546.98  1.0
2070201  0.0    5.85e+6    1.0
*
*   modified by ysbang at 93/9/6
*    to match test initial condition
*
2090000  sepbyps       pipe
2090001  2
2090101  0.0.2
2090301  0.50635.1
2090302  0.37827.2
* andy modified volumes 2090401 to 2090402       4/21/63
2090401  0.029856.1
2090402  0.020686.2
2090601  -90.0.2
2090801  5.0e-06.0.13170.1
2090802  5.0e-06.0.08490.2
2091001  00.2
2091101  0000.1
*2091201  2 5.85e06  0.0       0.0  0.0      0.0       02
2091201    2 5.85e+06  0.01      0.0    0.0    0.0      02
*
*     modified by ysbang at 93/9/6
*     to match test initial condition
*
2091300  1
2091301  0.0       0.0       0.0       01
*
2100000  sepbyps       sngljun
2100101  209010000  205000000  0.0  0.0  0.0  0000
2100201  1 0.260       0.0       0.0
*
2210000  sginlp       sngljun
2210101  104010000  201000000  0.00229  0.288  0.288  0100
2210201  1 0.260       0.0       0.0
*
2220000  sgout-p       sngljun
2220101  201010000  105000000  0.00229  0.288  0.288  0100
2220201  1 0.260       0.0       0.0
*
2310000  dcmrout       sngljun
2310101  205010000  202000000  0.0  0.0  0.0  0100
2310201  1 0.0       0.0       0.0
*
2320000  steamout       sngljun
2320101  204010000  207000000  0.0  0.0  0.0  0100
2320201  1 0.0       0.0       0.0
2330000  feedinlp       tmdpjun
2330101  206000000  205000000  0.00043
*2330200  1  501  cntrlvar  2
```

```
2330201  -1.0  0.0  0.0  0.0
2330202  0.0  2.0  0.0  0.0
2330203  10.0  0.0  0.0  0.0
2330204  20.0  0.0  0.0  0.0
*
**********************************************************
**********
*
*  pressurizer
*
**********************************************************
**********
*
3010000  preizer      pipe
3010001  6
3010101  0.0,6
3010201  2.69125e-02,2
3010202  6.72832e-03,3
3010203  2.69125e-02,5
3010301  0.240915,2
3010302  0.21967,5
3010303  0.066294,6
3010401  0.0064825,2
3010402  0.0059118,5
3010403  0.001136,6
3010601  -90.0,6
3010801  4.0e-05,0.0,6
3011001  00,6
3011101  0000,2
3011102  0100,3
3011103  0000,5
3011201  2      15.4e06  1.0 0.0      0.0    0.0    01
*3011202  2      15.4e06  0.1728     0.0      0.0    0.0      02
3011202  2      15.4e06  1.0    0.0  0.0  0.0  02
*
*  Modified by ysbang at 96/9/18
*  to match test initial condition
*
3011203  2      15.4e06  0.0 0.0    0.0    0.0    06
3011300  1
3011301  0.0      0.0      0.0      05
*
3020000  pzrsurge      pipe
3020001  7
3020101  0.0,7
3020301  0.20574,1
3020302  0.17780,2
3020303  0.48895,3
3020304  0.67310,7
3020401  7.1837-04,1
3020402  2.32141-04,2
3020403  1.64577-04,3
3020404  4.4[illegible]46-05,7
3020601  -90.0,3
3020602  -45.0,7
3020701  -0.20574,1
3020702  -0.17780,2
3020703  -0.48895,3
3020704  -0.16380,7
3020801  4.0e-05,0.0,7
3020901  502.8,502.8,1
3020902  33.42,33.42,2
3020903  0.0,0.0,3
3020904  1.42,1.42,5
3020905  0.0,0.0,6
3021001  00,7
3021101  0000,6
3021201  3      15.4e06  581.4  0.0    0.0      0.0      07
3021300  1
3021301  0.0      0.0      0.0      06
*
3210000  pzrout      sngljun
3210101  301010000  302000000  0.00349  0.0  0.0  0100
3210201  1 0.0 0.0  0.0
*
*  need  to  modify  this
*
3300000  pcontrl      tmdpvol
3300101  10.0  10.0  0.0  0.0  0.0  0.0  5.0e-06  0.0  00
3300200  2
3300201  0.0  15.4e06  1.0
*
3310000  pcontvlv      sngljun
3310101  301000000  330000000  0.005  0.0  0.0  0100
3310201  1 0.0 0.0      0.0
*
**********************************************************
*******
*
* broken  loop  piping
*
**********************************************************
*******
*
4010000  vsslout      branch
4010001  2 1
4010101  0.00349  0.40818  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  00
4010200  3 15.4e06      581.4
4011101  508010000  401000000  0.0  0.5  1.0  0100
4012101  401010000  402000000  0.0  0.0  0.0  0100
4011201  0.260      0.0      0.0
4012201  0.260      0.0      0.0
*
4020000  hotleg      pipe
4020001  7
```

```
4020101  0.00091,7
4020301  0.60985,1
4020302  0.40860,2
4020303  0.98579,3
4020304  0.41783,4
4020305  0.35235,5
4020306  0.34925,6
4020307  0.60879,7
4020601  0.0,3
4020602  90.0,6
4020603  50.0,7
4020701  0.0,3
4020702  0.41783,4
4020703  0.35235,5
4020704  0.34925,6
4020705  0.46711,7
4020801  4.0e-05,0.0,7
4020901  0.0,0.0,1
4020902  0.525,0.525,2
4020903  0.630,0.630,3
4020904  0.0,0.0,5
4020905  0.336,0.336,6
4021001  00000  7
4021101  0000,6
4021201  3  15.4e06  581.4  0.0  0.0  0.0  07
4021300  1
4021301  0.260  0.0  0.0  06
*
4030000  pmpsucn      pipe
4030001  12
4030101  0.00091,12
4030301  0.49424,1
4030302  0.34925,2
4030303  0.35235,3
4030304  0.34925,4
4030305  1.08318,5
4030306  0.78512,7
4030307  0.48944,9
4030308  0.78512,11
4030309  0.70002,12
4030601  -60.0,1
4030602  -90.0,7
4030603  -45.0,8
4030604  45.0,9
4030605  90.0,12
4030701  -0.39980,1
4030702  -0.34925,2
4030703  -0.35235,3
4030704  -0.34925,4
4030705  -1.08318,5
4030706  -0.78512,7
4030707  -0.376936,8
4030708  0.376936,9
4030709  0.78512,11
4030710  0.70002,12
4030801  4.0e-05,0.0,12
4030901  0.336,0.336,1
4030902  0.0,0.0,6
4030903  0.525,0.525,8
4030904  0.0,0.0,11
4031001  00,12
4031101  0000,11
4031201  3  15.4e06  545.0  0.0  0.0  0.0  12
4031300  1
4031301  0.260  0.0  0.0  11
*
4040000  blcldsb      snglvol
4040101  0.00091  0.83083  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  0.0
4040200  3  15.4e06  545.0
*
4050000  coldleg      pipe
4050001  2
4050101  0.00091,2
4050301  0.27178,1
4050302  0.71145,2
4050601  0.0,2
4050801  4.0e-05,0.0,2
4050901  0.138,0.138,1
4051001  00,2
4051101  0000,1
4051201  3  15.4e06  545.0  0.0  0.0  0.0  02
4051300  1
4051301  0.260  0.0  0.0  01
*
4060000  vsslinlt      branch
4060001  2 1
4060101  0.00349  0.38898  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  00
4060200  3  15.4e06  545.0
4061101  405010000  406000000  0.0  0.0  0.0  0100
4062101  406010000  517010000  0.0  1.0  0.5  0100
4061201  0.260  0.0  0.0
4062201  0.260  0.0  0.0
*
4500000  brkppmp      pump
4500101  0.0  0.59847  0.00086  0.0  90.0  0.03137  00
4500108  403010000  0.00090  0.0  0.0  000100
*4500109  404000000  0.00010  0.0  0.0  000000
*
*  Junction Area Modified by ysbang at April 8, 1996
*  to correct unbalance of void distribution
*
4500109  404000000 0.00090  0.0  0.0  000000
*
*  end of modification
```

```
*
4500200  3  15.4e06  545.0
4500201  1  0.26  0.0  0.0
4500202  1  0.26  0.0  0.0
4500301     0  0  0     -1     0     501  0
4500302  1597.0000  0.1  .003240000  79.553000
+   2.9810000  .00925000
4500303  998.400  .00000  .0000  2.4800  .00000  .00000
*
4210000  blcl-lg  sngljun
4210101  404010000  405000000  0.00091  0.0  0.0  0000
4210201  1  0.260  0.0  0.0
*
************************************************************
******
*
*  vessel
*
************************************************************
******
*
5010000  lowpln1  snglvol
5010101  0.0  0.14224  0.00674  0.0  90.0  0.14224  4.0e-05
+   0.1162  00
5010200  3 15.4e06  545.0
*
5020000  lowpln2  branch
5020001  3 1
5020101  0.0  0.22004  0.00659  0.0  90.0  0.22004  4.0e-05
+   0.0699  00
5020200  3 15.4e06  545.0
5021101  501010000  502000000  0.0  0.0  0.0  0000
5022101  502010000  503000000  0.00431  0.0  0.0  0100
5023101  502010000  519000000  0.0  0.5  1.0  0100
5021201  0.0  0.0 0.0
5022201  0.52  0.0 0.0
5023201  0.52  0.0 0.0
*
5030000  lowpln3  snglvol
5030101  0.0  0.31725  0.00296  0.0  90.0  0.31725  4.0e-05
+   0.0101  00
5030200  3 15.4e06  545.0
*
5040000  lowpln4  branch
*5040001  2 1
*  modified by ysbang at may 18, 1996
*  to implement two core channel model
*
5040001  3  1
5040101  0.0  0.18136  0.00052  0.0  90.0  0.18136  4.0e-05
+   0.0101  00
5040200  3 15.4e06  545.0
5041101  503010000  504000000  0.0  0.0  0.0  0100
5042101  504010000  505000000  0.0  0.0  0.0  0100
5043101  504010000  555000000  0.0  0.0  0.0  0100
5041201  0.52  0.0  0.0
5042201  0.52  0.0  0.0
5043201  0.52  0.0  0.0
*
*  average core channel
*
*  two-core channel model area ratio=50:50
*
5050000  core pipe
5050001  8
*5050101  0.00286.8
*  modified by ysbang at may 18, 1996
* to implement two core channel model
*
5050101  0.00143  8
*
5050301  0.6096.2
5050302  0.3048.6
5050303  0.6096.8
5050601  90.0.8
* andy modified volume 5050801 to 5.0e-05  5/4/83
5050801  2.0e-05.0.01.8
5050901  1.5.1.5.7
5051001  00.8
5051101  00100.7
*
*  modified by ysbang at may 18, 1996
*  to use rod bundle interfacial drag corr.
5051201  3  15.4e06  563.2  0.0  0.0  0.0  08
5051300  1
5051301  0.520  0.0  0.0  7
*
*  hot core channel
*
5550000  core pipe
5550001  8
5550101  0.00143  8
*
5550301  0.6096.2
5550302  0.3048.6
5550303  0.6096.8
5550601  90.0.8
* andy modified volume 5050801 to 5.0e-05  5/4/83
5550801  2.0e-05.0.01.8
5550901  1.5.1.5.7
5551001  00.8
5551101  00100.7
5551201  3  15.4e06  563.2  0.0  0.0  0.0  08
5551300  1
5551301  0.520  0.0  0.0  7
*
```

```
*
*    multiple junction connetion between hot and
*    average channel core volume by crossflow
*
5600000  corecros      mtpljun
5600001    8 1
5600011  505010003    555010004  0.0  0.0  0.0  000003
+       1.0  1.0  1.0  10000 10000  0  8
*5600211  505020003    555020004  0.0  0.0  0.0  000003
*5600311  505030003    555030004  0.0  0.0  0.0  000003
*5600411  505040003    555040004  0.0  0.0  0.0  000003
*5600511  505050003    555050004  0.0  0.0  0.0  000003
*5600611  505060003    555060004  0.0  0.0  0.0  000003
*5600711  505070003    555070004  0.0  0.0  0.0  000003
*5600811  505080003    555080004  0.0  0.0  0.0  000003
5601011  0.0  0.0    8
*5601012  0.0  0.0    2
*5601013  0.0  0.0    3
*5601014  0.0  0.0    4
*5601015  0.0  0.0    5
*5601016  0.0  0.0    6
*5601017  0.0  0.0    7
*5601018  0.0  0.0    8
*
*
5060000  upprpln1        branch
*5060001  2 1
*   modified by ysbang at may 18, 1996
*   to use rod bundle interfacial drag corr.
5060001  3       1
5060101  0.0  0.30505  0.00164  0.0  90.0  0.30505  2.0e-05
+      0.023  00
5060200  3 15.4e06    581.4
5061101  505010000  506000000  0.0  0.0  0.0  0100
5062101  555010000  506000000  0.0  0.0  0.0  0100
5063101  506010000  507000000  0.00321  0.0  0.0  0100
5061201  0.520       0.0  0.0
5062201  0.520       0.0  0.0
5063201  0.52   0.0  0.0
*
5070000  upprpln2  sngl vol
5070101  0.0  0.68910  0.00281  0.0  90.0  0.68910  4.0e-05
+      0.0401  00
5070200  3 15.4e06      581.4
*
5080000  upprpln3 branch
5080001  2 1
5080101  0.0  0.52070  0.00218  0.0  90.0  0.52070  4.0e-05
+    0.483  00
5080200  3 15.4e06      581.4
5081101  507010000  508000000  0.00277  0.0  0.0  0100
5082101  508010000  509000000  0.00415  0.0  0.0  0100
5081201  0.520       0.0       0.0
5082201  0.0 0.0       0.0
*
5090000  upprpln4        pipe
5090001  2
5090101  0.0,2
5090301  0.2761,1
5090302  0.7786,2
5090401  0.00143,1
5090402  0.004047,2
5090601  90.0,2
5090801  4.0e-05,0.04,1
5090802  4.0e-05,0.0509,2
5091001  00,2
5091101  0000,1
5091201  3 15.4e06  581.4    0.0      0.0       0.0       02
5091301  0.0  0.0       0.0       01
*
5100000  upprpln5        sngl vol
5100101  0.0  0.0756  0.000393  0.0  90.0  0.0756  4.0e-05
+    0.0509  00
5100200  3 15.4e06  581.4
*
5130000  guidtub         branch
5130001  1  0
5130101  0.0  1.651  0.00034  0.0  90.0  1.651  5.0e-06
+      0.0160  00
5130200  3  15.4e06  581.4
5131101  507010000  513000000  0.0  0.0  0.0  0100
5131201  0.0  0.0  0.0
*
5140000  sufcoln         branch
5140001  1  0
5140101  0.0  2.3401  0.00034525  0.0  90.0  2.3401  5.0e-06
+       0.00975  00
5141101  506010000  514000000  0.0  0.0  0.0  0100
5140200  0    15415300.0  1356030.0  0.0  0.0
5141201  0.0  0.0  0.0
*
5160000  upprdcm1   annulus
5160001  1
5160101  0.00982,1
5160301  0.26670,1
5160601  90.0,1
5160801  4.0e-05,0.004351,1
5161001  00,1
5161201  3  15.4e06  560.0  0.0  0.0    0.0  1
*
5170000  upprdcm2 annulus
5170001    1
5170101  0.00982,1
5170301  0.38418,1
5170601  90.0,1
5170801  4.0e-05,0.04351,1
```

```
5171001  00,1
5171201  3  15.4e06  560.0  0.0  0.0  0.0  1
*
5180000  lowdcmr      pipe
5180001  10
5180101  0.00242,10
5180301  0.4890,9
5180302  0.37661  10
5180601  90.0,10
5180801  4.0e-05,0.0,10
5180901  0.3,0.3,1
5180902  0.0,0.0,8
5180903  0.114,0.114,9
5181001  00,10
5181101  0000,9
5181201  3  15.4e06  550.0  0.0  0.0  0.0  10
5181300  1
5181301  -0.26,0.0,0.0,9
*
5190000  lowdcm      annulus
5190001  1
5190101  0.00708,1
5190301  0.29337,1
5190601  90.0,1
5190801  4.0e-05  0.0341,1
5191001  00,1
5191201  3  15.4e06  550.0  0.0  0.0  0.0  1
*
5200000  dcmrann     sngljun
5200101  519010000  518000000  0.0  0.3  0.3  0100
5200201  1  -0.26  0.0  0.0
*
5210000  upprdcmr    sngljun
5210101  517010000  516000000  0.0  0.0  0.0  0100
5210201  1  0.0  0.0  0.0
*
5220000  uplowcm     sngljun
5220101  518010000  517000000  0.0  0.0  0.0  0100
5220201  1  -0.26  0.0  0.0
*
5310000  bypsline    pipe
5310001  3
5310101  0.00007,3
5310301  0.38247,3
5310601  90.0,2
5310602  55.33,3
5310701  0.38247,2
5310702  0.31456,3
5310801  5.0e-06,0.0094,3
5310901  0.0,0.0,2
5311001  00,3
5311101  0000,2
5311201  3  15.4e06  550.0  0.0  0.0  0.0  3
5311300  1
5311301  0, 0.0,  0.0, 2
*
5320000  gt-up sngljun
5320101  513010000  510010000  0.0  0.0  0.0  0100
5320201  0  0.0  0.0  0.0
*
5330000  sc-up sngljun
5330101  514010000  510010000  0.0  0.0  0.0  0100
5330201  0  0.0  0.0  0.0
*
5340000  dc-byps     sngljun
5340101  516010000  531000000  0.0  0.0  0.0  0100
5340201  0  0.0  0.0  0.0
*
5350000  byps-up     sngljun
5350101  531010000  510010000  0.0  0.0  0.0  0100
5350201  0  0.0  0.0  0.0
*
5360000  up-cnct     sngljun
5360101  509010000  510000000  0.0  0.0  0.0  0100
5360201  0  0.0  0.0  0.0
*
************************************************************
***********
*
*  ecc  system
*
************************************************************
************
*
************************************************************
************
*
*  broken  loop  steam  generator
*
************************************************************
************
*
7010000  brlpsign    pipe
7010001  10
7010101  0.00516,1
7010102  0.00061,17
7010103  0.00516,18
7010301  0.26035,1
7010302  1.19609,2
7010303  1.23101,3
7010304  1.15481,4
7010305  1.23101,5
7010306  1.25641,6
7010307  1.15481,7
7010308  1.06591,8
7010309  0.98206,10
```

```
7010310  1.06591,11
7010311  1.15481,12
7010312  1.25641,13
7010313  1.23101,14
7010314  1.15481,15
7010315  1.23101,16
7010316  1.19609,17
7010317  0.26035,18
7010601  90.0,8
7010602  77.0,9
7010603  -77.0,10
7010604  -90.0,18
* andy modified roughness to 5.0e-05   4/21/84
7010801  4.0e-05,0.07797,1
7010802  4.0e-05,0.01974,17
7010803  4.0e-05,0.07797,18
7010901  0.0,0.0,7
7010902  0.3375,0.3375,8
7010903  0.675,0.675,9
7010904  0.3375,0.3375,10
7010905  0.0,0.0,17
7011001  00,18
7011101  0100,1
7011102  0000,16
7011103  0100,17
7011201  3 15.4e06   581.4   0.0    0.0    0.0       18
7011300  1
7011301  0.260       0.0       0.0       17
*
7020000  sgroud      pipe
*7020001  11
7020001   10
7020101  0.0,10
7020201  0.00462,7
7020202  0.0,9
7020301  1.19609,1
7020302  1.23101,2
7020303  1.15481,3
7020304  1.23101,4
7020305  1.25641,5
7020306  1.15181,6
7020307  1.06591,7
7020308  1.65398,8
7020309  0.37827,9
7020310  0.50635,10
* andy modified volumes 7020401 to 7020411   4/21/83
7020401  0.013509,1
7020402  0.009036,2
7020403  0.008470,3
7020404  0.010739,4
7020405  0.009615,5
7020406  0.008474,6
7020407  0.008425,7
7020408  0.015782,8
7020409  0.016807,9
7020410  0.025882,10
*7020411   0.025882,11
7020601  90.0,10
7020801  5.0e-06,0.1999,8
7020802  5.0e-06,0.0,10
7021001  00,10
7021101  0100,7
7021102  0000,9
7021201  2 5.89e06    0.0       0.0    0.0    0.0   10
7021300  1
7021301  0.0       0.0       0.0       9
*
*7030000  separatr      separatr
*7030001  3 0
** modified 4/21/83
*7030101  0.0   0.50635   0.030854   0.0   -90.0   0.50635   5.0e-6
*+   0.13650   00
*7030200  2 5.89e06       0.0
*7031101  703000000   704000000   0.0   0.0   0.0   0100
*7032101  702010000   703000000   0.0   0.0   0.0   0100
*7033101  703010000   709000000   0.0   0.0   0.0   0100
*7031201  0.0   0.0 0.0
*7032201  0.0   0.0 0.0
*7033201  0.0   0.0 0.0
*
7030000   separatr    separatr
7030001   3 0
7030101   0.0   0.50635   0.056736   0.0   90.0   0.50635   5.0e-6
+    0.1365   00
*7030200    2    5.89e+6   0.0
7030200     2    5.89e+6   0.9
*
*   modified by ysbang at 93/9/6
*   to match test initial condition
*
7031101    703010000   704000000   0.0547542   0.0   0.0   00100
7032101    703000000   709000000   0.05299024   0.0   0.0
+    00100
7033101    702010000   703000000   0.04593079   0.0   0.0
+    00100
7031201    0.0    0.0    0.0
7032201    0.0    0.0    0.0
7033201    0.0    0.0    0.0
*
*
7040000   steamdom   snglvol
7040101   0.0   0.40005   0.03390   0.0   90.0   0.40005   5.0e-06
+      0.32849   00
7040200   2 5.89e06   1.
*
7050000   sgdcomer pipe
```

```
7050001  8
* andy deleted this input ;  7050101  0.00164.8
7050101  0.0,8
7050301  1.65398,1
7050302  1.06591,2
7050303  1.15481,3
7050304  1.25641,4
7050305  1.23101,5
7050306  1.15481,6
7050307  1.23101,7
7050308  1.19609,8
* andy modified volumes  7050401  to  7050408  4/21/83
7050401  0.014458,1
7050402  0.002241,2
7050403  0.002435,3
7050404  0.002639,4
7050405  0.002589,5
7050406  0.002431,6
7050407  0.002593,7
7050408  0.002514,8
7050601  -90.0,8
7050801  5.0e-06,0.01016,8
7051001  00,8
7051101  0000,7
7051201  2  5.89e06  0.0 0.0  0.0  0.0  08
7051300  1
7051301  0.0  0.0  0.0  07
*
7060000  feedinle  tmdpvol
7060101  0.00114  1.0  0.0  0.0  0.0  0.0  5.0e-06  0.0  00
7060200  3
7060201  0.0  5.89e06  495.0
*
7070000  steamotl  tmdpvol
7070101  1.0  1.0  0.0  0.0  90.0  1.0  5.0e-06  0.0  00
7070200  1
7070201  0.0  547.4245  1.0
*
7090000  sepbyps  pipe
7090001  2
7090101  0.0,2
7090301  0.50635,1
7090302  0.37827,2
* andy modified volumes  7090401  to  7090402  4/21/83
7090401  0.029860,1
7090402  0.020686,2
7090601  -90.0,2
7090801  5.0e-06,0.13170,1
7090802  5.0e-06,0.08490,2
7091001  00,2
7091101  0000,1
*7091201  2 5.89e06  0.0 0.0  0.0  0.0  02
7091201  2 5.89e+06  0.01  0.0  0.0  0.0  02
*
*  modified by ysbang at 93/9/6
*  to match test initial condition
*
7091300  1
7091301  0.0  0.0  0.0  01
*
7100000  sepbyps  sngljun
7100101  709010000  705000000  0.0  0.0  0.0  0000
7100201  1 0.26  0.0  0.0
*
7210000  sgnlt  sngljun
7210101  402010000  701000000  0.00091  0.336  0.336  0100
7210201  1 0.26  0.0  0.0
*
7220000  sg-ouri  sngljun
7220101  701010000  403000000  0.00091  0.336  0.336  0100
7220201  1 0.26 0.0  0.0
*
7310000  dcomeut  sngljun
7310101  705010000  702000000  0.0  0.0  0.0  0100
7310201  1 0.0 0.0  0.0
*
7320000  steamuts  sngljun
7320101  704010000  707000000  0.0  0.0  0.0  0100
7320201  1  0.0 0.0 0.0
*
7330000  feed-ltp  tmdpjun
7330101  706000000  705000000  0.00043
7330200  1  501  cntrlvar  12
7330201  -1.0  0.0  0.0  0.0
7330202  0.0  2.0  0.0  0.0
7330203  10.0  0.0  0.0  0.0
7330204  20.0  0.0  0.0  0.0
*
*9000000  envirnmt  tmdpvol
*9000101  1.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0  00
*9000200  3
*9000201  0.0  8.48e05  310.0
*
**********
**********
*
*  heat  structures
*
**********
**********
*
11011000  1  5  2  1  0.03625
11011100  0  2
11011101  0.00278,4
11011201  0001,4
11011301  0.0,4
```

```
11011401  568.0,5
11011501  101010000.  0,  1,  1,  0.21971,  1
11011601  0,0,  0,  1,  0.21971,  1
11011701  0,0,0,0,0,0,1
11011801  0.  10.  10.  0.  0.  0.  0.  1.1
11011901  0.  10.  10.  0.  0.  0.  0.  1.1
*11011801  0,  0.0,  0.0,  0.21971,  1
*11011901  0,  0.0,  0.0,  0.21971,  1
*
11021000  4  5  2  1  0.03332
11021100  0  2
11021101  0.00278,4
11021201  0001,4
11021301  0.0,4
11021401  568.0,5
11021501  102010000,  0,  1,  1,  0.57074,  1
11021502  102020000,  0,  1,  1,  0.17145,  2
11021503  102030000,  0,  1,  1,  0.17145,  3
11021504  102040000,  0,  1,  1,  0.22504,  4
11021601  0,  0,  0,  1,  0.57074,  1
11021602  0,  0,  0,  1,  0.17145,  2
11021603  0,  0,  0,  1,  0.17145,  3
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11022201  0001,4
11022301  0.0,4
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11022601  0.0,0,1,0.38748,2
11022701  0.0,0,0,0,0,0,2
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*
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11032101  0.00238  4
11032201  0001  4
11032301  0.0  4
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11032701  0,0.0,0,0,0.0,1
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*
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11042601  0.0,0,1,0.23825,1
11042602  0.0,0,1,0.42494,2
11042603  0.0,0,1,0.35560,4
11042604  0.0,0,1,0.64808,5
11042701  0.0,0,0,0,0,0,5
11042801  0.  10.  10.  0.  0.  0.  0.  1.5
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*11042804  0.0,0,0,0,0,0.64808,5
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11052502  105020000.0,1,1,0.40640,2
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11052604  0.0,0,1,0.49301,6
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11051604  0,0.0,1,0.78740,7
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*11051803  0,0.0,0.0,0.0,0.26200,5
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*11051805  0,0.0,0.0,0.0,0.58572,8
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*11051903  0,0.0,0.0,0.0,0.26200,5
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11051901  0.  10.  10.  0.  0.  0.  0.  1.8
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11063301  0.0,4
11063401  550.0,5
11063501  106010000,0,1,1,0.44805,1
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11063503  106030000,0,1,1,0.60046,3
11063504  106040000,0,1,1,0.74320,4
11063601  0,0,0,1,0.44805,1
11063602  0,0,0,1,1.14808,2
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11063604  0,0,0,1,0.74320,4
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*11063803  0,0,0,0,0,0.60046,3
*11063804  0,0,0,0,0,0.74320,4
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*11063902  0,0,0,0,0,1.14808,2
*11063903  0,0,0,0,0,0.60046,3
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11061101  0.00278,4
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*11061901  0,0,0,0,0,0.75565,1
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11071301  0.0,4
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11071701  0,0,0,0,0,0,0,1
*11071801  0,0,0,0,0,0.79126,1
*11071901  0,0,0,0,0,0.79126,1
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11071901  0.  10.  10.  0.  0.  0.  0.  1.1
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* intact  loop  sg  piping
*
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12001101  0.00031,  4
12001201  0002, 4
12001301  0.0, 4
12001401  550.0,  5
*
* left bndry  incre  B.C typ factor  no
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12001501  201020000. 0,  1,  1,  7.30986,  1
12001502  201030000,  10000,  1,  1,  7.23366,  7
12001503  201090000. 0,  1,  1,  2.91468,  8
12001504  201100000,  10000,  1,  1,  2.06466. 10
12001505  201120000. 0,  1,  1,  2.91468. 11
12001506  201130000,  10000,  1,  1,  7.23366. 17
12001507  201190000. 0,  1,  1,  7.30986. 18
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* rightbndry  incre  B.C typ factor  no
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12001602  202020000,  10000,  1,  1,  7.23366,  7
12001603  202080000. 0,  1,  1,  2.91468,  8
12001604  202090000. 0,  1,  1,  2.06466. 10
12001605  202080000. 0,  1,  1,  2.91468. 11
12001606  202070000,  -10000,  1,  1,  7.23366. 17
12001607  202010000. 0  1,  1,  7.30986. 18
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*12001802  0,  0.01974,  0.01974,  1.20561,  7
*12001803  0,  0.01974,  0.01974,  0.48578,  8
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*12001806  0,  0.01974,  0.01974,  1.20561. 17
*12001807  0,  0.01974,  0.01974,  1.21831. 18
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*12001902  0,  0.00635,  0.00635,  1.20561,  7
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*12001906  0,  0.00635,  0.00635,  1.20561. 17
*12001907  0,  0.00635,  0.00635,1.21831,18
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12012201  0006,4
12012301  0.0,4
12012400  2001
12012501  202010000,  0,  1,  1,  1.21831,  1
12012502  202020000, 10000,  1,  1,  1.20561,  7
12012503  202080000,  0,  1,  1,  0.48578,  8
12012504  202090000,  0,  1,  1,  0.58737,  9
12012505  202100000,  0,  1,  1,  0.41891. 10
12012601  202010000,  0,  1,  1,  1.21831,  1
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12012603  202080000,  0,  1,  1,  0.48578,  8
12012604  202090000,  0,  1,  1,  0.58737,  9
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*12012804  0.0.0.0.0.0.58737.9
*12012805  0.0.0.0.0.0.41891.10
*12012901  0.0.0.0.0.1.21831.1
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*12012903  0.0.0.0.0.0.48578.8
*12012904  0.0.0.0.0.0.58737.9
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12022301  0.0.4
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12022502  202020000.10000,1.1.1.20561,7
12022503  202080000.0.1.1.0.48578.8
12022504  202090000.0.1.1.0.58737.9
12022505  202100000.0.1.1.0.41891.10
12022601  205100000.0.1.1.1.21831.1
12022602  205090000.-10000.1.1.1.20561.7
12022603  205030000.0.1.1.0.48578.8
12022604  205020000.0.1.1.0.58737.9
12022605  205010000.0.1.1.0.41891.10
12022701  0.0.0.0.0.0.0.10
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*12022802  0.0.03108.0.04968.1.20561.7
*12022803  0.0.04063.0.07265.0.48578.8
*12022804  0.0.05956.0.11346.0.58737.9
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12032301  0.0,4
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12032503  205030000,0,1,1,0.41561,3
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12032603  205030000,0,1,1,0.41561,3
12032604  205040000,10000,1.1,1.03147,9
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*12032804  0,0.0,0.0,0.1,20561,9
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12032901  0.  10.  10.  0.  0.  0.  0.  1.10
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12042301  0.0,4
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12042502  202120000,0.1,1,0.50635,2
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12042503  203010000,0.1,1,0.50635,3
12042601  209020000,0.1,1,0.37827,1
12042602  209010000,0.1,1,0.50635,2
12042603  203010000,0.1,1,0.50635,3
12042701  0.0,0.0,0.0,0.0,3

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12053501  205010000,0.1,1,0.41891,1
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12053503  205030000,0.1,1,0.48578,3
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12053603  -200,0.3205,1,0.48578,3
12053604  -200,0.3205,1,1.20561,9
12053605  -200,0.3205,1,1.21831,10
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*12053903  0,0.0,0.0,0.0,0.48578,3
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12054100  0  2
12054101  0.00596,4
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12054603  -200.  0.  3204.  1.0.50635,3
12054604  -200.  0.  3204.  1.0.37827,4
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*12054803  0,0.0,0.0,0.37827,4
*12054901  0,0.0,0.0,0.40005,1
*12054902  0,0.0,0.0,0.50635,3
*12054903  0,0.0,0.0,0.37827,4
12054801  0.  10.  10.  0.  0.  0.  0.  1.4
12054901  0.  10.  10.  0.  0.  0.  0.  1.4
*
12055000  1  5  1  1  0.0
12055100  0  2
12055101  0.00596,4
12055201  0001,4
12055301  0.0,4
12055401  543.0,5
12055501  204010000,0,1,0,0.13174,1
12055601  0,0,0,0,0.13174,1
12055701  0,0.0,0.0,0.0,1
*12055801  0.0.0.0.0,0.40955,1
*12055901  0.0.0.0.0,0.40955,1
12055801  0.  10.  10.  0.  0.  0.  0.  1.1
12055901  0.  10.  10.  0.  0.  0.  0.  1.1
*
*  pressurizer  walls
*
13011000  6  5  2  1  1.0795e-01
13011100  0  2
13011101  0.007144,4
13011201  0001,4
13011301  0.0,4
13011401  600.0,5
13011501  301010000.0.1.1.0.183565,1
13011502  301020000.10000.1.1.0.2549,5
13011503  301050000.0.1.1.0.00686,6
13011601  0.0.0.1.0.183565,1
13011602  0.0.0.1.0.2549,5
13011603  0.0.0.1.0.00686,6
13011701  0.0.0.0.0.0.6
*13011801  0.0.0.0.0.0.183564,2
*13011802  0.0.0.0.0.0.2549,5
*13011803  0.0.0.0.0.0.00686,6
*13011901  0.0.0.0.0.0.183564,2
*13011902  0.0.0.0.0.0.2549,5
*13011903  0.0.0.0.0.0.00686,6
13011801  0.  10.  10.  0.  0.  0.  0.  1.6
13011901  0.  10.  10.  0.  0.  0.  0.  1.6
*
13012000  2  5  2  1  0.0
13012100  0  2
13012101  0.00210,4
13012201  0001,4
13012301  1.0,4
13012302  0.0,4
13012401  615.0,5
13012501  0,0.0,1,5.91312,2
13012601  301050000,-10000,1.1,5.91312,2
13012701  300,0.5,0.0,0.0,2
*13012901  0,0.0,0.0168,0.24638,2
13012801  0.  10.  10.  0.  0.  0.  0.  1.2
13012901  0.  10.  10.  0.  0.  0.  0.  1.2
*
13022000  1  5  2  1  1.560000e-02
13022100  0  2
13022101  0.00178,4
13022201  0001,4
13022301  0.0,4
13022400  3011
13022501  302010000.0.1.1,0.36713,1
13022601  0.0.0,1,0.36713,1
13022701  0.0.0.0.0.0.0.1
*13022801  0,0.0,0.0,0.22860,1
*13022901  0,0.0,0.0,0.22860,1
13022801  0.  10.  10.  0.  0.  0.  0.  1.1
13022901  0.  10.  10.  0.  0.  0.  0.  1.1
*
13023000  6  5  2  1  4.70000e-03
13023100  0  2
13023101  0.00098,4
13023201  0001,4
13023301  0.0,4
13023400  3011
13023501  302020000.0.1.1.0.1778,1
13023502  302030000.0.1.1,0.48895,2
13023503  302040000.10000.1.1.0.6731,6
13023601  0.0.0.1.0.1778,1
13023602  0.0.0.1.0.48895,2
13023603  0.0.0.1.0.6731,6
13023701  0.0.0.0.0.0.6
*13023801  0.0.0.0.0.0.1778,1
*13023802  0.0.0.0.0.0.48895,2
*13023803  0.0.0.0.0.0.6731,6
*13023901  0.0.0.0.0.0.1778,1
*13023902  0.0.0.0.0.0.48895,2
*13023903  0.0.0.0.0.0.6731,6
13023801  0.  10.  10.  0.  0.  0.  0.  1.6
13023901  0.  10.  10.  0.  0.  0.  0.  1.6
*
*  broken  loop  piping  walls
*
14011000  1  5  2  1  0.03332
*14011100  1021
14011100  0  2
14011101  0.00278,4
14011201  0001,4
14011301  0.0,4
14011401  568.0,5
14011501  401010000.0.1.1.0.40818,1
```

```
14011601  0,0,0,1,0.40818,1
14011701  0,0,0,0,0,0,1
*14011801  0,0,0,0,0,0,40818,1
*14011901  0,0,0,0,0,0,40818,1
14011801  0.  10.  10.  0.  0.  0.  0.  1.1
14011901  0.  10.  10.  0.  0.  0.  0.  1.1
*
14021000  7  5  2  1  0.01699
14021100  0  2
14021101  0.00178,4
14021201  0001,4
14021301  0.0,4
14021401  568.0,5
14021501  402010000,0,1,1,0.60985,1
14021502  402020000,0,1,1,0.40860,2
14021503  402030000,0,1,1,0.98572,3
14021504  402040000,0,1,1,0.41783,4
14021505  402050000,0,1,1,0.35235,5
14021506  402060000,0,1,1,0.34925,6
14021507  402070000,0,1,1,0.60879,7
14021601  0,0,0,1,0.60985,1
14021602  0,0,0,1,0.40860,2
14021603  0,0,0,1,0.98572,3
14021604  0,0,0,1,0.41783,4
14021605  0,0,0,1,0.35235,5
14021606  0,0,0,1,0.34925,6
14021607  0,0,0,1,0.60879,7
14021701  0,0,0,0,0,0,7
*14021801  0,0,0,0,0,0,60985,1
*14021802  0,0,0,0,0,0,40860,2
*14021803  0,0,0,0,0,0,98572,3
*14021804  0,0,0,0,0,0,41783,4
*14021805  0,0,0,0,0,0,35235,5
*14021806  0,0,0,0,0,0,34925,6
*14021807  0,0,0,0,0,0,60879,7
*14021901  0,0,0,0,0,0,60985,1
*14021902  0,0,0,0,0,0,40860,2
*14021903  0,0,0,0,0,0,98572,3
*14021904  0,0,0,0,0,0,41783,4
*14021905  0,0,0,0,0,0,35235,5
*14021906  0,0,0,0,0,0,34925,6
*14021907  0,0,0,0,0,0,60879,7
14021801  0.  10.  10.  0.  0.  0.  0.  1.7
14021901  0.  10.  10.  0.  0.  0.  0.  1.7
*
*14031000  1  5  2  1  0.01699
14031000  12 5  2  1  0.01699
*14031100  4021
14031100  0  2
14031101  0.00178,4
14031201  0001,4
14031301  0.0,4
14031401  557.0,5
14031501  403010000,0,1,1,0.49424,1
14031502  403020000,0,1,1,0.34925,2
14031503  403030000,0,1,1,0.35235,3
14031504  403040000,0,1,1,0.34925,4
14031505  403050000,0,1,1,1.08318,5
14031506  403060000,10000,1,1,0.78512,7
14031507  403080000,10000,1,1,0.48944,9
14031508  403100000,10000,1,1,0.78512,11
14031509  403120000,0,1,1,0.70002,12
14031601  0,0,0,1,0.49424,1
14031602  0,0,0,1,0.34925,2
14031603  0,0,0,1,0.35235,3
14031604  0,0,0,1,0.34925,4
14031605  0,0,0,1,1.08318,5
14031606  0,0,0,1,0.78512,7
14031607  0,0,0,1,0.48944,9
14031608  0,0,0,1,0.78512,11
14031609  0,0,0,1,0.70002,12
14031701  0,0,0,0,0,0,12
*14031801  0,0,0,0,0,0,49424,1
*14031802  0,0,0,0,0,0,34925,2
*14031803  0,0,0,0,0,0,35235,3
*14031804  0,0,0,0,0,0,34925,4
*14031805  0,0,0,0,0,1,08318,5
*14031806  0,0,0,0,0,0,78512,7
*14031807  0,0,0,0,0,0,48944,9
*14031808  0,0,0,0,0,0,78512,11
*14031809  0,0,0,0,0,0,70002,12
*14031901  0,0,0,0,0,0,49424,1
*14031902  0,0,0,0,0,0,34925,2
*14031903  0,0,0,0,0,0,35235,3
*14031904  0,0,0,0,0,0,34925,4
*14031905  0,0,0,0,0,1,08318,5
*14031906  0,0,0,0,0,0,78512,7
*14031907  0,0,0,0,0,0,48944,9
*14031908  0,0,0,0,0,0,78512,11
*14031909  0,0,0,0,0,0,70002,12
14031801  0.  10.  10.  0.  0.  0.  0.  1.12
14031901  0.  10.  10.  0.  0.  0.  0.  1.12
*
14041000 3  5  2  1  1.699000e-02
*14041100  4021
14041100  0  2
14041101  0.00178,4
14041201  0001,4
14041301  0.0,4
*14041400  4031
14041401  557.0  5
14041501  404010000,0,1,1,0.60046,1
14041502  405010000,0,1,1,0.50216,2
14041503  405020000,0,1,1,0.71145,3
14041601  0,0,0,1,0.60046,1
14041602  0,0,0,1,0.50216,2
```

```
14041603  0,0.0,1,0.71145,3
14041701  0,0.0,0.0,0.0,3
*14041801  0,0.0,0.0,0.60046,1
*14041802  0,0.0,0.0,0.50216,2
*14041803  0,0.0,0.0,0.71145,3
*14041901  0,0.0,0.0,0.60046,1
*14041902  0,0.0,0.0,0.50216,2
*14041903  0,0.0,0.0,0.71145,3
1404180   0.  10.  10.  0.  0.  0.  0.  1.3
140419 1  0.  10.  10.  0.  0.  0.  0.  1.3
*
14051000  1  5  2  1  0.03332
*14051100  1321
14051100  0  2
14051101  0.00278,4
14051201  0001,4
14051301  0.0,4
14051401  557.  5
14051501  406010000  0  1  1  0.47168  1
14051601  0  0  0  1  0.47168  1
14051701  0  0.0  0.0  0.0  1
*14051801  0  0.0  0.0  0.47168  1
*14051901  0  0.0  0.0  0.47168  1
14051801  0.  10.  10.  0.  0.  0.  0.  1.1
14051901  0.  10.  10.  0.  0.  0.  0.  1.1
*
*  vessel structure
*
15011000  1  5  1  1  0
15011100  0  2
15011101  0.0370  4
15011201  0001,4
15011301  0.0, 4
15011401  557.0  5
15011501  501010000.  0.  1.  0.  0.05200.  1
15011601  0, 0.  0.  0.  0.05200.  1
15011701  0.  0.0  0.0  0.0  1
*15011801  0, 0.  0.0.0.0.0.25730.  1
*15011901  0, 0.  0.0.0.0.0.25730.  1
15011801  0.  10.  10.  0.  0.  0.  0.  1.1
15011901  0.  10.  10.  0.  0.  0.  0.  1.1
*
15012000  4  5  2  1  0
15012100  0  2
15012101  0.00134.  4
15012201  0003.  4
15012301  0.0.  4
15012400  5011
15012501  0. 0. 0. 1. 3.556. 1
15012502  0. 0. 0. 1. 5.501. 2
15012503  0. 0. 0. 1. 7.93125. 3
15012504  0. 0. 0. 1. 4.534. 4
15012601  501010000. 0. 1. 1. 3.556. 1
15012602  502010000, 0, 1, 1, 5.501, 2
15012603  503010000, 0, 1, 1, 7.93125, 3
15012604  504010000, 0, 1, 1, 4.534, 4
15012701  0, 0.0, 0.0, 0.0, 4
*15012901  0, 0.0, 0.0, 0, 0.14224, 1
*15012902  0, 0.0, 0.0, 0, 0.22004, 2
*15012903  0, 0.0, 0.0, 0, 0.31725, 3
*15012904  0, 0.0, 0.0, 0, 0.18136, 4
15012801  0.  10.  10.  0.  0.  0.  0.  1.4
15012901  0.  10.  10.  0.  0.  0.  0.  1.4
*
*  Implementing two core channel model
*  power ratio avg:hot=60:40
*
*  average core
*
15013000  16  11  2  1  0
15013100  0  2
15013101  0.000529  3
15013102  0.000406  5
15013103  0.000656  8
15013104  0.000495 10
15013201  0004,  3
15013202  0005,  5
15013203  0004,  8
15013204  0001,  10
15013301  0.0,  3
15013302  1.0,  5
15013303  0.0,  10
15013401  557.0,  11
15013501  0, 0. 0. 0. 0.0, 16
*15013601  505010000. 10000. 1. 1. 13.4112. 2
*15013602  505030000. 10000. 1. 1. 6.7056.  6
*15013603  505070000. 10000. 1. 1. 13.4112. 8
*15013604  505010000. 10000. 1. 1. 1.8288. 10
*15013605  505030000. 10000. 1. 1. 0.9144. 14
*15013606  505070000. 10000. 1. 1. 1.8288. 16
*
*  implement 50:50 heat transfer area
*
15013601  505010000. 10000. 1. 1. 6.70560. 2
15013602  505030000. 10000. 1. 1. 3.35280  6
15013603  505070000. 10000. 1. 1. 6.70560. 8
15013604  505010000. 10000. 1. 1. 0.91440 10
15013605  505030000. 10000. 1. 1. 0.45720 14
15013606  505070000. 10000. 1. 1. 0.91440 16
15013701  500. 0.07500. 0.0. 0.0. 1
15013702  500. 0.17583. 0.0. 0.0. 2
15013703  500. 0.12000. 0.0. 0.0. 3
15013704  500. 0.12917. 0.0. 0.0. 4
15013705  500. 0.12917. 0.0. 0.0. 5
15013706  500. 0.12000. 0.0. 0.0. 6
15013707  500. 0.17583. 0.0. 0.0. 7
```

```
15013708   500, 0.07500, 0.0, 0.0, 8
15013709   0,    0.0,       0.0, 0.0, 16
*15013901   0, 0.0, 0.01357, 0.6096, 2
*15013902   0, 0.0, 0.01357, 0.3048, 6
*15013903   0, 0.0, 0.01357, 0.6096,10
*15013904   0, 0.0, 0.01357, 0.3048,14
*15013905   0, 0.0, 0.01357, 0.6096,16
15013801  0.  10.  10.  0.  0.  0.  0.  1. 16
15013901  0.  10.  10.  0.  0.  0.  0.  1. 16
*
*     hot channel core
*
15513000   16   11   2    1    0
15513100   0    2
15513101   0.000529  3
15513102   0.000406  5
15513103   0.000656  8
15513104   0.000495 10
15513201   0004.       3
15513202   0005.       5
15513203   0004.       8
15513204   0001.      10
15513301   0.0.   3
15513302   1.0.   5
15513303   0.0.       10
15513401   557.0.     11
15513501   0. 0. 0. 0. 0.0. 16
15513601   555010000. 10000. 1. 1. 6.70560. 2
15513602   555030000. 10000. 1. 1. 3.35280   6
15513603   555070000. 10000. 1. 1. 6.70560. 8
15513604   555010000. 10000. 1. 1. 0.91440 10
15513605   555030000. 10000. 1. 1. 0.45720 14
15513606   555070000. 10000. 1. 1. 0.91440 16
*
15513701   550. 0.07500. 0.0. 0.0. 1
15513702   550. 0.17583. 0.0. 0.0. 2
15513703   550. 0.12000. 0.0. 0.0. 3
15513704   550. 0.12917. 0.0. 0.0. 4
15513705   550. 0.12917. 0.0. 0.0. 5
15513706   550. 0.12000. 0.0. 0.0. 6
15513707   550. 0.17583. 0.0. 0.0. 7
15513708   550. 0.07500. 0.0. 0.0. 8
15513709   0.    0.0.       0.0. 0.0. 16
*15513901   0. 0.0. 0.01357. 0.6096. 2
*15513902   0. 0.0. 0.01357. 0.3048. 6
*15513903   0. 0.0. 0.01357. 0.6096.10
*15513904   0. 0.0. 0.01357. 0.3048.14
*15513905   0. 0.0. 0.01357. 0.6096.16
15513801  0.  10.  10.  0.  0.  0.  0.  1. 16
15513901  0.  10.  10.  0.  0.  0.  0.  1. 16
*
15021900    1    5    2    1    1.286500e-01
15021100   0    2
15021101   0.01568   4
15021201   0001.       4
15021301   0.0.   4
15021401   557.0    5
15021501   501010000. 0.    1.    1.    0.14224. 1
15021601   0. 0. 0. 1.    0.14224. 1
15021701   0. 0.0. 0.0. 0.0.       1
*15021801   0. 0.0. 0.0. 0.0.       1
*15021901   0. 0.0. 0.0. 0.0.       1
15021801  0.  10.  10.  0.  0.  0.  0.  1. 1
15021901  0.  10.  10.  0.  0.  0.  0.  1. 1
*
15022000    1    5    2    1    9.771000e-02
15022100   0    2
15022101   0.01588   4
15022201   0001.       4
15022301   0.0.   4
15022401   557.0    5
15022501   502010000. 0.    1.    1.    0.22004. 1
15022601   0.    0.   0. 1.    0.22004. 1
15022701   0. 0. 0. 0. 0. 0.       1
*15022801   0. 0. 0. 0. 0.22004. 1
*15022901   0. 0. 0. 0. 0.22004. 1
15022801  0.  10.  10.  0.  0.  0.  0.  1. 1
15022901  0.  10.  10.  0.  0.  0.  0.  1. 1
*
15023000    1    5    2    1    7.621000e-02
15023100   0    2
15023101   0.01588   4
15023201   0001.       4
15023301   0.0.   4
15023401   557.0    5
15023501   519010000. 0.    1.    1.    0.29337. 1
15023601   0. 0.   0. 1.    0.29337. 1
15023701   0. 0. 0. 0. 0. 0.       1
*15023801   0. 0. 0. 0. 0.29337. 1
*15023901   0. 0. 0. 0. 0.29337. 1
15023801  0.  10.  10.  0.  0.  0.  0.  1. 1
15023901  0.  10.  10.  0.  0.  0.  0.  1. 1
*
15031000   10    5    2    1    0.02775
15031100   0    2
15031101   0.00471   4
15031201   0001.       4
15031301   0.0.   4
15031401   557.0   5
15031501   518010000. 10000. 1. 1.    0.4890.   9
15031502   518100000. 0.       1. 1.    0.37661.10
15031601   0.    0.   0. 1.    0.4890.   9
15031602   0.    0.   0. 1.    0.37661.10
15031701   0. 0. 0. 0. 0. 0.       10
*15031801   0. 0. 0. 0. 0.4890.   9
*15031802   0. 0. 0. 0. 0.37661.10
```

```
*15031901    0, 0.0, 0.0, 0.4890,   9
*15031902    0, 0.0, 0.0, 0.37661,10
15031801  0.   10.   10.   0.   0.   0.   0.   1. 10
15031901  0.   10.   10.   0.   0.   0.    0.   1. 10
*
*15024000    10     5    2     1      0.05121
15024000    1     5    2     1      0.05121
15024100    0     2
15024101    0.00160    4
15024201    0001,      4
15024301    0.0,   4
15024401    557.0    5
15024501    503010000. 0.    1.    1.   0.31725.   1
15024601    519010000. 0.    1.    1.   0.31725.   1
15024701    0, 0.0, 0.0, 0.0.        1
*15024801    0, 0.0, 0.0, 0.31725, 1
*15024901    0, 0.0, 0.0, 0.31725, 1
15024801  0.   10.   10.   0.   0.   0.   0.   1. 1
15024901  0.   10.   10.   0.   0.   0.    0.   1. 1
*
15025000     2     5    2     1      4.041000e-02
15025100    0     2
15025101    0.01765    4
15025201    0001.      4
15025301    0.0.   4
15025401    557.0   5
15025501    504010000. 0.    1.    1.   0.18136.   1
15025502    505010000. 0.    1.    1.   0.0762.    2
15025601    0. 0. 0. 1. 0.18136. 1
15025602    0. 0. 0. 1. 0.0762.  2
15025701    0. 0.0. 0.0. 0.0.        2
*15025801    0. 0.0. 0.0. 0.18136. 1
*15025802    0. 0.0. 0.0. 0.0762.  2
*15025901    0. 0.0. 0.0. 0.18136. 1
*15025902    0. 0.0. 0.0. 0.0762.  2
15025801  0.   10.   10.   0.   0.   0.   0.   1. 2
15025901  0.   10.   10.   0.   0.   0.    0.   1. 2
*
15014000     8     5    2     1      4.041000e-02
15014100    0     2
15014101    0.01093    4
15014201    0001.      4
15014301    0.0.   4
15014401    575.5, 5
15014501    505010000. 0. 1.    1.   0.5334.    1
15014502    505020000. 0. 1.    1.   0.6096.    2
15014503    505030000. 10000.    1.    1.   0.3048.    6
15014504    505070000. 10000.    1.    1.   0.6096.    8
15014601    0.   0.   0.        1.   0.5334.    1
15014602    0.   0.   0.        1.   0.6096.    2
15014603    0.   0.   0.        1.   0.3048.    6
15014604    0.   0.   0.        1.   0.6096.    8
15014701    0.   0 0.0.0. 0.0.   8
*15014801    0,   0.0,0.0,   0.5334,    1
*15014802    0,   0.0.0.0,   0.6096,    2
*15014803    0,   0.0.0.0,   0.3048,    6
*15014804    0,   0.0,0.0,   0.6096,    8
*15014901    0,   0.0,0.0,   0.5334,    1
*15014902    0,   0.0,0.0,   0.6096,    2
*15014903    0,   0.0,0.0,   0.3048,    6
*15014904    0,   0.0,0.0,   0.6096,    8
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15014901  0.   10.   10.   0.   0.   0.    0.   1. 8
*
*15015000     1     5    2     1      0.
*15015100    0     2
*15015101    0.02858    4
*15015201    0001.      4
*15015301    0.0.   4
*15015400    5011
*15015501    516010000. 0. 1.    1.   0.3765,    1
*15015601    0.   0.   0.        1.   0.3765,    1
*15015701    0.   0.0.0.0. 0.0.   1
**15015801    0.   0.0.0.0.   0.54381,   1
**15015901    0,   0.0.0.0.   0.54381,   1
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*15015901  0.   10.   10.   0.   0.   0.    0.   1. 1
*
15016000     2     5    2     1      3.810000e-02
15016100    0     2
15016101    0.00572    4
15016201    0001.      4
15016301    0.0.   4
15016400    5011
15016501    0.   0.   0. 1. 0.26670.   1
15016502    0.   0.   0. 1. 0.38418.   2
15016601    516010000. 0. 1.    1.   0.26670.   1
15016602    517010000. 0. 1.    1.   0.38418.   2
15016701    0.   0.0.0.0. 0.0.   2
*15016801    0.   0.0.0.0.   0.26670.   1
*15016802    0.   0.0.0.0.   0.38418.   2
*15016901    0.   0.0.0.0.   0.26670.   1
*15016902    0.   0.0.0.0.   0.38418.   2
15016801  0.   10.   10.   0.   0.   0.   0.   1. 2
15016901  0.   10.   10.   0.   0.   0.    0.   1. 2
*
15017000     2     5    2     1      0.08272
15017100    0     2
15017101    0.00671    4
15017201    0001.      4
15017301    0.0.   4
15017400    5011
15017501    516010000. 0. 1.    1.   0.26670.   1
15017502    517010000. 0. 1.    1.   0.38418    2
15017601    0.   0.   0.        1.   0.26670.   1
15017602    0.   0.   0.        1.   0.38418.   2
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*15017802   0,   0.0,0.0,   0.38418,   2
*15017901   0,   0.0,0.0,   0.26670,   1
*15017902   0,   0.0,0.0,   0.38418,   2
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15017901  0.  10.  10.  0.  0.  0.   0.  1.2
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15041000    1    5    2    1    0.
*15041100   5012
15041100  0  2
15041101  0.00134,   4
15041201  0003,4
15041301  0.0,4
15041401   594.0, 5
15041501   0,   0,   0,   1,   5.08,   1
15041601   506010000. 0, 1,   1,   5.08,      1
15041701   0,   0.0,0.0, 0.0,   1
*15041801   0,   0.0,0.0,   0.2032,   1
*15041901   0,   0.0,0.0,   0.2032,   1
15041801  0.  10.  10.  0.  0.  0.  0.  1.1
15041901  0.  10.  10.  0.  0.  0.   0.  1.1
*
15042000    1    5    2    1    0.04166
15042100   0    2
15042101   0.01816   4
15042201   0001,      4
15042301   0.0,  4
15042400   5041
15042501   506010000. 0, 1.   1.  0.30505.  1
15042601   0.  0.  0.      1.  0.30505.  1
15042701   0.  0.0.0.0. 0.0,  1
*15042801   0.  0.0.0.0.  0.30505.  1
*15042901   0.  0.0.0.0.  0.30505.  1
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15042901  0.  10.  10.  0.  0.  0.   0.  1.1
*
15043000    1    5    2    1    4.299000e-02
15043100   0    2
15043101   0.01153   4
15043201   0001,      4
15043301   0.0,  4
15043400   5041
15043501   507010000. 0, 1.   1.  0.68910.  1
15043601   0.  0.  0.      1.  0.68910.  1
15043701   0.  0.0.0.0. 0.0,  1
*15043801   0.  0.0.0.0.  0.68910.  1
*15043901   0.  0.0.0.0.  0.68910.  1
15043801  0.  10.  10.  0.  0.  0   0.  1.1
15043901  0.  10.  10.  0.  0.  0.   0.  1.1
*
15044000    1    5    2    1    3.826000e-02
15044100   0    2
15044101   0.01742   4
15044201   0001,      4
15044301   0.0,  4
15044400   5041
15044501   508010000. 0, 1.   1,  0.52070.  1
15044601   0,   0,   0,      1,  0.52070.  1
15044701   0,   0.0,0.0, 0.0,   1
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*15044901   0,   0.0,0.0,   0.52070,   1
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15044901  0.  10.  10.  0.  0.  0.   0.  1.1
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*15045100   5043
15045100  0  2
15045101  0.01153,4
15045201  0001,4
15045301  0.0,4
15045400   5041
15045501   509010000. 0, 1.   1,  0.2761.   1
15045502   509020000. 0, 1.   1,  0.7786.   2
15045503   510010000. 0, 1.   1,  0.0756.   3
15045601   0,   0,   0,      1,  0.2761.   1
15045602   0,   0,   0,      1.  0.7786.   2
15045603   0.  0.  0.      1.  0.0756.   3
15045701   0.  0.0.0.0. 0.0.  3
*15045801   0,   0.0.0.0.  0.2761.   1
*15045802   0.  0.0.0.0.  0.7786.   2
*15045803   0.  0.0.0.0.  0.0756.   3
*15045901   0.  0.0.0.0.  0.2761.   1
*15045902   0.  0.0.0.0.  0.7786.   2
*15045903   0.  0.0.0.0.  0.0756.   3
15045801  0.  10.  10.  0.  0.  0.  0.  1.3
15045901  0.  10.  10.  0.  0.  0.   0.  1.3
*
15046000    1    5    1    1    0.
15046100   0    2
15046101   0.04976   4
15046201   0001,      4
15046301   0.0,  4
15046400   5043
15046501   510010000. 0. 1.   0.  0.00575.  1
15046601   0.  0.  0.      0.  0.00575.  1
15046701   0.  0.0.0.0. 0.0.  1
*15046801   0.  0.0.0.0.  0.26670.  1
*15046901   0.  0.0.0.0.  0.26670.  1
15046801  0.  10.  10.  0.  0.  0.  0.  1.1
15046901  0.  10.  10.  0.  0.  0.   0.  1.1
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15062100   0    2
15062101   0.00037   4
15062201   0001.      4
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15062401    568.0, 5
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15062502    513010000, 0, 1,    1,  0.7786,   2
15062503    513010000, 0, 1,    1,  0.2761,   3
15062504    513010000, 0, 1,    1,  0.5207,   4
15062601    510010000, 0, 1,    1,  0.0756,   1
15062602    509020000, 0, 1,    1,  0.7786,   2
15062603    509010000, 0, 1,    1,  0.2761,   3
15062604    508010000, 0, 1,    1,  0.5207,   4
15062701    0,  0.0,0.0, 0.0,  4
*15062801   0,  0.0,0.0,  0.0756,   1
*15062802   0,  0.0,0.0,  0.7786,   2
*15062803   0,  0.0,0.0,  0.2761,   3
*15062804   0,  0.0,0.0,  0.5207,   4
*15062901   0,  0.0,0.0,  0.0756,   1
*15062902   0,  0.0,0.0,  0.7786,   2
*15062903   0,  0.0,0.0,  0.2761,   3
*15062904   0,  0.0,0.0,  0.5207,   4
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15062901  0.  10.  10.  0.  0.  0.  0.  1.4
*
*
15063000    5    5   2    1    4.880000e-03
15063100    0    2
15063101    0.00037   4
15063201    0001.     4
15063301    0.0,  4
15063401    568.0, 5
15063501    514010000, 0, 1,    1,  0.1512,   1
15063502    514010000, 0, 1,    1,  0.5572,   2
15063503    514010000, 0, 1,    1,  0.5522,   3
15063504    514010000, 0, 1,    1,  1.0414,   4
15063505    514010000, 0, 1,    1,  1.3782,   5
15063601    510010000, 0, 1,    1,  0.1512,   1
15063602    509020000, 0, 1,    1,  0.5572,   2
15063603    509010000, 0, 1,    1,  0.5522,   3
15063604    508010000, 0, 1,    1,  1.0414,   4
15063605    507010000, 0, 1,    1,  1.3782,   5
15063701    0,  0.0,0.0, 0.0,  5
*15063801   0,  0.0,0.0,  0.0756,   1
*15063802   0,  0.0,0.0,  0.7786,   2
*15063803   0,  0.0,0.0,  0.2761,   3
*15063804   0,  0.0,0.0,  0.5207,   4
*15063805   0,  0.0,0.0,  0.6891,   5
*15063901   0,  0.0,0.0,  0.0756,   1
*15063902   0,  0.0,0.0,  0.7786,   2
*15063903   0,  0.0,0.0,  0.2761,   3
*15063904   0,  0.0,0.0,  0.5207,   4
*15063905   0,  0.0,0.0,  0.6891,   5
15063801  0.  10.  10.  0.  0.  0.  0.  1.5
15063901  0.  10.  10.  0.  0.  0.  0.  1.5
*
15064000    3    5   2    1    0.00470
15064100    0    2
15064101    0.00041   4
15064201    0001.     4
15064301    0.0,  4
15064401    557.0  5
15064501    531010000, 0, 1,    1,  0.38247,  3
15064601    0, 0, 0,    1,  0.38247,  3
15064701    0,  0.0,0.0, 0.0,  3
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*15064901   0,  0.0,0.0,  0.38247,  3
15064801  0.  10.  10.  0.  0.  0.  0.  1.3
15064901  0.  10.  10.  0.  0.  0.  0.  1.3
*
*  broken-loop steam generator
*
17001000    16    5   2    1    0.00987
17001100    0    2
17001101    0.00031   4
17001201    0002.     4
17001301    0.0,  4
17001401    495.0, 5
17001501    701020000, 0, 1,    1,  2.39218,  1
17001502    701030000, 0, 1,    1,  2.46202,  2
17001503    701040000, 0, 1,    1,  2.30962,  3
17001504    701050000, 0, 1,    1,  2.46202,  4
17001505    701060000, 0, 1,    1,  2.51282,  5
17001506    701070000, 0, 1,    1,  2.30962,  6
17001507    701080000, 0, 1,    1,  2.13182,  7
17001508    701100000, 10000.    1.   1.  1.96412,  9
17001509    701110000, 0, 1,    1,  2.13182, 10
17001510    701120000, 0, 1,    1,  2.30962, 11
17001511    701130000, 0, 1,    1,  2.51282, 12
17001512    701140000, 0, 1,    1,  2.46202, 13
17001513    701150000, 0, 1,    1,  2.30962, 14
17001514    701160000, 0, 1,    1,  2.46202, 15
17001515    701170000, 0, 1,    1,  2.39218, 16
17001601    702010000, 0, 1,    1,  2.39218,  1
17001602    702020000, 0, 1,    1,  2.46202,  2
17001603    702030000, 0, 1,    1,  2.30962,  3
17001604    702040000, 0, 1,    1,  2.46202,  4
17001605    702050000, 0, 1,    1,  2.51282,  5
17001606    702060000, 0, 1,    1,  2.30962,  6
17001607    702070000, 0, 1,    1,  2.13182,  7
17001608    702080000, 10000.    1.   1.  1.96412,  9
17001609    702070000, 0, 1,    1,  2.13182, 10
17001610    702060000, 0, 1,    1,  2.30962, 11
17001611    702050000, 0, 1,    1,  2.51282, 12
17001612    702040000, 0, 1,    1,  2.46202, 13
17001613    702030000, 0, 1,    1,  2.30962, 14
17001614    702020000, 0, 1,    1,  2.46202, 15
17001615    702010000, 0, 1,    1,  2.39218, 16
17001701    0.    0.0.    0.0.    0.0.    16
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*17001802   0,   0.01974, 0.01974, 1.23101,   2
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*17001804   0,   0.01974, 0.01974, 1.23101,   4
*17001805   0,   0.01974, 0.01974, 1.25641,   5
*17001806   0,   0.01974, 0.01974, 1.15481,   6
*17001807   0,   0.01974, 0.01974, 1.06591,   7
*17001808   0,   0.01974, 0.01974, 0.98206,   9
*17001809   0,   0.01974, 0.01974, 1.06591,  10
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*17001811   0,   0.01974, 0.01974, 1.25641,  12
*17001812   0,   0.01974, 0.01974, 1.23101,  13
*17001813   0,   0.01974, 0.01974, 1.15481,  14
*17001814   0,   0.01974, 0.01974, 1.23101,  15
*17001815   0,   0.01974, 0.01974, 1.19609,  16
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*17001905   0,   0.00635, 0.00635, 1.25641,   5
*17001906   0,   0.00635, 0.00635, 1.15481,   6
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*17001908   0,   0.00635, 0.00635, 0.98206,   9
*17001909   0,   0.00635, 0.00635, 1.06591,  10
*17001910   0,   0.00635, 0.00635, 1.15481,  11
*17001911   0,   0.00635, 0.00635, 1.25641,  12
*17001912   0,   0.00635, 0.00635, 1.23101,  13
*17001913   0,   0.00635, 0.00635, 1.15481,  14
*17001914   0,   0.00635, 0.00635, 1.23101,  15
*17001915   0,   0.00635, 0.00635, 1.19609,  16
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17001901  0.  10.  10.  0.  0.  0.  0.  1.16
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17012100  0    2
17012101  0.01403   4
17012201  0006.     4
17012301  0.0,  4
17012400  7001
17012501  702010000, 0, 1.   1.  1.19609,  1
17012502  702020000, 0, 1.   1.  1.23101,  2
17012503  702030000, 0, 1.   1.  1.15481,  3
17012504  702040000, 0, 1.   1.  1.23101,  4
17012505  702050000, 0, 1.   1.  1.25641,  5
17012506  702060000, 0, 1.   1.  1.15481,  6
17012507  702070000, 0, 1.   1.  1.06591,  7
17012508  702080000, 0, 1.   1.  1.65398,  8
17012601  702010000, 0, 1.   1.  1.19609,  1
17012602  702020000, 0, 1.   1.  1.23101,  2
17012603  702030000, 0, 1.   1.  1.15481,  3
17012604  702040000, 0, 1.   1.  1.23101,  4
17012605  702050000, 0, 1.   1.  1.25641,  5
17012606  702060000, 0, 1.   1.  1.15481,  6
17012607  702070000, 0, 1.   1.  1.06591,  7
17012608  702080000, 0, 1.   1.  1.65398,  8
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*17012802   0,   0.0, 0.0,   1.23101,  2
*17012803   0,   0.0, 0.0,   1.15481,  3
*17012804   0,   0.0, 0.0,   1.23101,  4
*17012805   0,   0.0, 0.0,   1.25641,  5
*17012806   0,   0.0, 0.0,   1.15481,  6
*17012807   0,   0.0, 0.0,   1.06591,  7
*17012808   0,   0.0, 0.0,   1.65398,  8
*17012901   0,   0.0, 0.0,   1.19609,  1
*17012902   0,   0.0, 0.0.   1.23101,  2
*17012903   0.   0.0, 0.0,   1.15481,  3
*17012904   0,   0.0, 0.0,   1.23101,  4
*17012905   0,   0.0, 0.0,   1.25641,  5
*17012906   0,   0.0, 0.0,   1.15481,  6
*17012907   0.   0.0, 0.0,   1.06591,  7
*17012908   0.   0.0, 0.0,   1.65398,  8
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17012901  0.  10.  10.  0.  0.  0.  0.  1.8
*
17022000    8    5    2    1    0.10578
17022100  0    2
17022101  0.00094   4
17022201  0001.     4
17022301  0.0.  4
17022400  7001
17022501  702010000, 0, 1.   1.  1.19609,  1
17022502  702020000, 0, 1.   1.  1.23101,  2
17022503  702030000, 0, 1.   1.  1.15481,  3
17022504  702040000, 0, 1.   1.  1.23101,  4
17022505  702050000, 0, 1.   1.  1.25641,  5
17022506  702060000, 0, 1.   1.  1.15481,  6
17022507  702070000, 0, 1.   1.  1.06591,  7
17022508  702080000, 0, 1.   1.  1.65398,  8
*17022601   702010000, 0, 1.   1.  1.19609,  1
*17022602   702020000, 0, 1.   1.  1.23101,  2
*17022603   702030000, 0, 1.   1.  1.15481,  3
*17022604   702040000, 0, 1.   1.  1.23101,  4
*17022605   702050000, 0, 1.   1.  1.25641,  5
*17022606   702060000, 0, 1.   1.  1.15481,  6
*17022607   702070000, 0, 1.   1.  1.06591,  7
*17022608   702080000, 0, 1.   1.  1.65398,  8
17022601  705010000, 0, 1.   1.  1.19609,  1
17022602  705020000, 0, 1.   1.  1.23101,  2
17022603  705030000, 0, 1.   1.  1.15481,  3
17022604  705040000, 0, 1.   1.  1.23101,  4
17022605  705050000, 0, 1.   1.  1.25641,  5
17022606  705060000, 0, 1.   1.  1.15481,  6
17022607  705070000, 0, 1.   1.  1.06591,  7
17022608  705080000, 0, 1.   1.  1.65398,  8
17022701  0.  0.0, 0.0, 0.0,  8
```

```
*17022801   0,  0.01999,  0.05963,  1.19609,  1
*17022802   0,  0.01999,  0.05963,  1.23101,  2
*17022803   0,  0.01999,  0.05963,  1.15481,  3
*17022804   0,  0.01999,  0.05963,  1.23101,  4
*17022805   0,  0.01999,  0.05963,  1.25641,  5
*17022806   0,  0.01999,  0.05963,  1.15481,  6
*17022807   0,  0.01999,  0.05963,  1.06591,  7
*17022808   0,  0.01999,  0.05963,  1.65398,  8
*17022901   0,  0.0, 0.0,  1.19609,  1
*17022902   0,  0.0, 0.0,  1.23101,  2
*17022903   0,  0.0, 0.0,  1.15481,  3
*17022904   0,  0.0, 0.0,  1.23101,  4
*17022905   0,  0.0, 0.0,  1.25641,  5
*17022906   0,  0.0, 0.0,  1.15481,  6
*17022907   0,  0.0, 0.0,  1.06591,  7
*17022908   0,  0.0, 0.0,  1.65398,  8
17022801  0.  10.  10.  0.  0.  0.  0.  1.8
17022901  0.  10.  10.  0.  0.  0.  0.  1.8
*
17032000    8    5    2    1    0.11074
17032100  0    2
17032101  0.00238   4
17032201  0001.      4
17032301  0.0.  4
17032400  7001
17032501  705010000, 0, 1.   1.  1.33972.  1
17032502  705020000, 0, 1.   1.  0.86339.  2
17032503  705030000, 0, 1.   1.  0.93540.  3
17032504  705040000, 0, 1.   1.  1.01769.  4
17032505  705050000, 0, 1.   1.  0.99712.  5
17032506  705060000, 0, 1.   1.  0.93540.  6
17032507  705070000, 0, 1.   1.  0.99712.  7
17032508  705080000, 0, 1.   1.  0.96883.  8
17032601  705010000, 0, 1.   1.  1.33972.  1
17032602  705020000, 0, 1.   1.  0.86339.  2
17032603  705030000, 0, 1.   1.  0.93540.  3
17032604  705040000, 0, 1.   1.  1.01769.  4
17032605  705050000, 0, 1.   1.  0.99712.  5
17032606  705060000, 0, 1.   1.  0.93540.  6
17032607  705070000, 0, 1.   1.  0.99712.  7
17032608  705080000, 0, 1.   1.  0.96883.  8
17032701  0.  0.0, 0.0, 0.0.  8
*17032801   0.  0.0, 0.0.  1.65398.  1
*17032802   0.  0.0, 0.0.  1.06591.  2
*17032803   0.  0.0, 0.0.  1.25481.  3
*17032804   0.  0.0, 0.0.  1.25641.  4
*17032805   0.  0.0, 0.0.  1.23101.  5
*17032806   0.  0.0, 0.0.  1.15481.  6
*17032807   0.  0.0, 0.0.  1.23101.  7
*17032808   0.  0.0, 0.0.  1.19609.  8
*17032901   0.  0.0, 0.0.  1.65398.  1
*17032902   0.  0.0, 0.0.  1.06591.  2
*17032903   0.  0.0, 0.0.  1.25481.  3
*17032904   0.  0.0, 0.0.  1.25641.  4
*17032905   0.  0.0, 0.0.  1.23101.  5
*17032906   0.  0.0, 0.0.  1.15481.  6
*17032907   0.  0.0, 0.0.  1.23101.  7
*17032908   0.  0.0, 0.0.  1.19609.  8
17032801  0.  10.  10.  0.  0.  0.  0.  1.8
17032901  0.  10.  10.  0.  0.  0.  0.  1.8
*
17042000    3    5    2    1    0.23233
17042100  0    2
17042101  0.00105   4
17042201  0001,      4
17042301  0.0,  4
17042400  7001
17042501  702090000, 0, 1.   1,  0.37827,  1
17042502  702100000, 0, 1.   1,  0.30635,  2
*17042503   702110000, 0, 1,   1,  0.30635,  3
17042503  703010000,  0,  1,   1,  0.30635,  3
17042601  709010000, 0, 1.   1,  0.37827,  1
17042602  709010000, 0, 1.   1,  0.30635,  2
17042603  703010000, 0, 1,   1,  0.30635,  3
17042701  0.  0.0, 0.0, 0.0.  3
*17042801   0.  0.0, 0.0.  0.37827.  1
*17042802   0.  0.0, 0.0.  0.50635.  2
*17042901   0.  0.0, 0.0.  0.37827.  1
*17042902   0.  0.0, 0.0.  0.50635.  2
17042801  0.  10.  10.  0.  0.  0.  0.  1.3
17042901  0.  10.  10.  0.  0.  0.  0.  1.3
*
17053000    8    5    2    1    0.12146
17053100  0    2
17053101  0.00377   4
17053201  0001,      4
17053301  0.0.  4
17053400  7001
17053501  705010000, 0, 1.   1.  1.65398.  1
17053502  705020000, 0, 1.   1.  1.10659.  2
17053503  705030000, 0, 1.   1.  1.15481.  3
17053504  705040000, 0, 1.   1.  1.25641.  4
17053505  705050000, 0, 1.   1.  1.23101.  5
17053506  705060000, 0, 1.   1.  1.15481.  6
17053507  705070000, 0, 1.   1.  1.23101.  7
17053508  705080000, 0, 1.   1.  1.19609.  8
*
*       Modify Right Boundary Condition identical to
*       Intact Loop S/G
*
*17053601   -200.  0, 1000.   1.  1.65398.  1
*17053602   -200.  0, 1000.   1.  1.10659.  2
*17053603   -200.  0, 1000.   1.  1.15481.  3
*17053604   -200.  0, 1000.   1.  1.25641.  4
*17053605   -200.  0, 1000.   1.  1.23101.  5
*17053606   -200.  0, 1000.   1.  1.15481.  6
```

```
*17053607   -200.   0, 1000.    1.   1.23101.   7
*17053608   -200.   0, 1000.    1.   1.19609.   8
*
17053601   -200.   0, 3205.    1.   1.65398.   1
17053602   -200.   0, 3205.    1.   1.10659.   2
17053603   -200.   0, 3205.    1.   1.15481.   3
17053604   -200.   0, 3205.    1.   1.25641.   4
17053605   -200.   0, 3205.    1.   1.23101.   5
17053606   -200.   0, 3205.    1.   1.15481.   6
17053607   -200.   0, 3205.    1.   1.23101.   7
17053608   -200.   0, 3205.    1.   1.19609.   8
*
*   End of modification by Y.S Bnag at Aug 31, 1994
*
17053701   0.   0.0, 0.0, 0.0,   8
*17053801   0.   0.0, 0.0,   1.65398.   1
*17053802   0.   0.0, 0.0,   1.06591.   2
*17053803   0.   0.0, 0.0,   1.15481.   3
*17053804   0.   0.0, 0.0,   1.25641.   4
*17053805   0.   0.0, 0.0,   1.23101.   5
*17053806   0.   0.0, 0.0,   1.15481.   6
*17053807   0.   0.0, 0.0,   1.23101.   7
*17053808   0.   0.0, 0.0,   1.19609.   8
*17053901   0.   0.0, 0.0,   1.65398.   1
*17053902   0.   0.0, 0.0,   1.06591.   2
*17053903   0.   0.0, 0.0,   1.15481.   3
*17053904   0.   0.0, 0.0,   1.25641.   4
*17053905   0.   0.0, 0.0,   1.23101.   5
*17053906   0.   0.0, 0.0,   1.15481.   6
*17053907   0.   0.0, 0.0,   1.23101.   7
*17053908   0.   0.0, 0.0,   1.19609.   8
17053801   0.   10.   10.   0.   0.   0.   0.   1.8
17053901   0.   10.   10.   0.   0.   0.   0.   1.8
*
17054000    4    5    2    1    0.20477
17054100    0    2
17054101    0.00596    4
17054201    0001,      4
17054301    0.0,   4
17054400    7001
17054501    704010000, 0, 1.    1.   0.40005.   1
17054502    703010000, 0, 1.    1.   0.50635.   2
17054503    709010000, 0, 1.    1.   0.50635.   3
17054504    709020000, 0, 1.    1.   0.37827.   4
*17054601   -200.   0, 1000.    1.   0.40005.   1
*17054602   -200.   0, 1000.    1.   0.50635.   2
*17054603   -200.   0, 1000.    1.   0.50635.   3
*17054604   -200.   0, 1000.    1.   0.37827.   4
*
*    modify right boundary condition
*    identical to intact loop sg
*    by ysbang at 94.9.6
*
17054601   -200.   0, 3204.    1.   0.40005.   1
17054602   -200.   0, 3204.    1.   0.50635.   2
17054603   -200.   0, 3204.    1.   0.50635.   3
17054604   -200.   0, 3204.    1.   0.37827.   4
*
17054701   0.   0.0, 0.0, 0.0,   4
*17054801   0.   0.0, 0.0,   0.40005.   1
*17054802   0.   0.0, 0.0,   0.50635.   3
*17054803   0.   0.0, 0.0,   0.37827.   4
*17054901   0.   0.0, 0.0,   0.40005.   1
*17054902   0.   0.0, 0.0,   0.50635.   3
*17054903   0.   0.0, 0.0,   0.37827.   4
17054801   0.   10.   10.   0.   0.   0.   0.   1.4
17054901   0.   10.   10.   0.   0.   0.   0.   1.4
*
17055000    1    5    1    1    0.0
17055100    0    2
17055101    0.00596    4
17055201    0001,      4
17055301    0.0,   4
17055400    7001
17055501    704010000, 0, 1.    0.   0.13174.   1
17055601    0.    0.    0.   0.   0.13174.   1
17055701    0.   0.0, 0.0, 0.0,   1
*17055801   0.   0.0, 0.0,   0.40955.   1
*17055901   0.   0.0, 0.0,   0.49055.   1
17055801   0.   10.   10.   0.   0.   0.   0.   1.1
17055901   0.   10.   10.   0.   0.   0.   0.   1.1
*
**************************************************
*   heat structure thermal property data (si units)
**************************************************
*
20100100   tbl/fctn    1    1     * s-steel
20100200   tbl/fctn    1    1     * incoly 600
20100300   tbl/fctn    1    1     * copper
20100400   tbl/fctn    1    1     * boron nitride
20100500   tbl/fctn    1    1     * inconel 600
20100600   tbl/fctn    1    1     * filler pieces
*
*
*   thermal conductivity S-Steel
*
20100101    273.15   12.98
20100102   1199.82   25.1
*
* thermal conductivity incoloy 600
*
20100201    366.5    13.85
20100202    477.6    15.92
20100203    588.7    18.17
20100204    700.0    20.42
20100205    810.9    22.50
```

```
20100206    922.0    24.92
20100207    1033.2   26.83
20100208    1144.3   29.42
20100209    1477.6   36.06
*
* thermal conductivity copper
*
20100301     273.15    387.546
20100302     373.15    377.577
20100303     573.15    366.985
20100304     773.15    358.262
20100305    2477.60    358.262
*
* thermal conductivity boron nitride
*
20100401    273.15    15.888
20100402    366.48    15.016
20100403    533.15    13.458
20100404    810.93    10.841
20100405   1088.71     8.287
20100406   1366.48     5.664
20100407   1644.26     3.059
20100408   1922.04     0.461
20100409   2199.82     0.461
20100410   2477.602    0.461
*
* thermal conductivity inconel 600
*
20100501    273.15    14.7043
20100502    310.93    14.7043
20100503    422.04    16.6358
20100504    533.15    18.3181
20100505    644.26    20.0627
20100506    755.37    21.8073
20100507    866.48    23.5518
20100508   2477.60    23.5518
*
* thermal conductivity fillers (air)
*
20100601    300.0      0.02622
20100602    400.0      0.03362
20100603    500.0      0.04035
20100604    600.0      0.04565
20100605    700.0      0.05227
*
* volumetric heat capacity s-steel
*
20100151    273.15     3.830e6
20100152    366.5      3.830e6
20100153   1466.5      5.376e6
*
* volumetric heat capacity incoloy 600
*
20100251    366.5      3.908e5
20100252    477.6      4.084e5
20100253    588.7      4.260e5
20100254    700.0      4.436e5
20100255    810.9      4.665e5
20100256    922.0      4.929e5
20100257   1033.2      5.105e5
20100258   1477.6      5.727e5
*
* volumetric heat capacity copper
*
20100351    273.15     3.6429e06
20100352   2477.60     3.4429e06
*
* volumetric hrat capacity boron nitride
*
20100451    273.15     2.5150e06
20100452    477.59     2.515e06
20100453    699.82     3.2393e06
20100454    922.04     3.661e06
20100455   1144.26     3.9100e06
20100456   1366.48     4.0240e06
20100457   1588.71     4.1172e06
20100458   2144.26     4.1916e06
20100459   2477.60     4.1916e06
*
* vloumetric heat capacity inconel 600
*
20100551    273.15     3.50253e06
20100552   2477.60     3.50253e06
*
* volumetric heat capacity filers
*
20100651    200.0      1.1595e06
20100652   1900.0      1.1595e06
*
************************************************
* tabulat data
************************************************
*
* power for pressurizer
*
20230000    power      502
20230001    -1.0   0.0
20230002     0.0   0.0
20230003     0.0   12000.
20230004 1.0e06   12000.
*
* reactor core power
*
*   power ratio of aver/hot = 70/30
*
*20250000    power
```

```
*20250001      0.0   66.5e03
*
*20255000     power
*20255001      0.0   28.5e03
*
*   modified by ysbang at Sep. 18, 1996
*   to adjusting rod temp increase
*
*   power ratio of aver/hot = 60/40
*
20250000     power
20250001      0.0   57.0e03
*
20255000     power
20255001      0.0   38.0e03
*
20220000     temp
20220001      0.0        300.
*
20270500     htc-t
20270501      0.0       6.086
*
20220500     htc-t
20220501      0.0       6.086
*
20220400     htc-t
20220401      0.0       5.98
*
20270400     htc-t
20270401      0.0       5.98
*
**********************************************
*
* homogeneous pump curves
*
**********************************************
*
* broken loop single-phase head curves
*
4501100     1 1
4501101     0.0       1.7821
4501102     0.2845    1.7059
4501103     0.569     1.627
4501104     0.8535    1.1878
4501105     1.0       1.0
*
4501200     1 2
4501201     0.0       -1.6359
4501202     0.713      0.0
4501203     0.8271     0.2959
4501204     1.0   1.0
*
4501300     1 3
4501301     -1.0      1.5
4501302     -0.8      1.275
4501303     -0.6      1.375
4501304     -0.4      1.375
4501305      0.0      1.2
*
4501400     1 4
4501401     -1.0      1.5
4501402     -0.8      1.15
4501403     -0.6      0.95
4501404     -0.4      0.83
4501405     -0.2      0.775
4501406      0.0      0.725
*
4501500     1 5
4501501      0.0      0.975
4501502      0.5      1.33
4501503      1.0      1.95
*
4501600     1 6
4501601      0.0      0.725
4501602      0.2      0.725
4501603      0.4      0.8
4501604      0.6      1.025
4501605      1.0      1.95
*
4501700     1 7
4501701     -1.0      0.175
4501702     -0.5      0.65
4501703      0.0      0.975
*
4501800     1 8
4501801     -1.0      0.175
4501802     -0.75     -0.15
4501803     -0.55     -0.3
4501804     -0.275    -0.4
4501805      0.0      -0.35
*
* broken loop single-phase torque curves
*
4501900     2 1
4501901      0.0      0.54
4501902      0.2      0.59
4501903      0.4      0.65
4501904      0.6      0.77
4501905      0.8      0.95
4501906      0.9      0.98
4501907      0.95     0.96
4501908      1.0      0.87
*
4502000     2 2
4502001      0.0      -0.15
4502002      0.2   0.02
```

```
4502003     0.4   0.22
4502004     0.6   0.46
4502005     0.8   0.71
4502006     0.9   0.81
4502007     0.95      0.85
4502008     1.0   0.87
*
4502100     2 3
4502101    -1.0       0.62
4502102    -0.8       0.68
4502103    -0.6       0.53
4502104    -0.4       0.46
4502105    -0.2       0.49
4502106     0.0       0.54
*
4502200     2 4
4502201    -1.0       0.62
4502202    -0.8       0.53
4502203    -0.6       0.46
4502204    -0.4       0.42
4502205    -0.2       0.39
4502206     0.0       0.36
*
4502300     2 5
4502301     0.0       -0.63
4502302     0.2       -0.51
4502303     0.4       -0.39
4502304     0.6       -0.29
4502305     0.8       -0.16
4502306     1.0       -0.13
*
4502400     2 6
4502401     0.0   0.36
4502402     0.2   0.32
4502403     0.4   0.27
4502404     0.6   0.18
4502405     0.8   0.05
4502406     1.0       -0.13
*
4502500     2 7
4502501    -1.0       -1.44
4502502    -0.8       -1.25
4502503    -0.6       -1.08
4502504    -0.4       -0.92
4502505    -0.2       -0.77
4502506     0.0       -0.63
*
4502600     2 8
4502601    -1.0       -1.44
4502602    -0.8       -1.12
4502603    -0.6       -0.79
4502604    -0.4       -0.52
4502605    -0.2       -0.31
4502606     0.0       -0.15
*
* two-phase head multiplier
*
4503000     0
4503001     0.0       0.0
4503002     0.1       0.0
4503003     0.15      0.05
4503004     0.24      0.8
4503005     0.3       0.96
4503006     0.4       0.98
4503007     0.6       0.97
4503008     0.8       0.90
4503009     0.9       0.8
4503010     0.96      0.5
4503011     1.0       0.0
*
* two-phase torque multiplier
*
4503100     0
4503101     0.0       -0.17
4503102     0.0001    -0.17
4503103     0.006     0.0
4503104     0.1   0.0
4503105     0.15      0.05
4503106     0.24      0.56
4503107     0.8   0.56
4503108     0.96      0.45
4503109     1.0   0.0
*
* two-phase head difference curves
*
4504100     1 1
4504101     0.0       0.0
4504102     0.1       0.85
4504103     0.2       1.09
4504104     0.5       1.02
4504105     0.7       1.01
4504106     0.9       0.94
4504107     1.0       1.0
*
4504200     1 2
4504201     0.0       0.0
4504202     0.1       -0.04
4504203     0.2       0.0
4504204     0.3       0.1
4504205     0.4       0.21
4504206     0.8       0.67
4504207     0.9       0.8
4504208     1.0       1.0
*
4504300     1  3
4504301    -1.0      -1.16
```

```
4504302    -0.9    -1.24
4504303    -0.8    -1.77
4504304    -0.7    -2.36
4504305    -0.6    -2.79
4504306    -0.5    -2.91
4504307    -0.4    -2.67
4504308    -0.25   -1.69
4504309    -0.1    -0.5
4504310     0.0     0.0
*
4504400    1   4
4504401    -1.0    -1.16
4504402    -0.9    -0.78
4504403    -0.8    -0.5
4504404    -0.7    -0.31
4504405    -0.6    -0.17
4504406    -0.5    -0.08
4504407    -0.35    0.0
4504408    -0.2     0.05
4504409    -0.1     0.08
4504410     0.0     0.11
*
4504500    1   5
4504501    0.0     0.0
4504502    0.2     -0.34
4504503    0.4     -0.65
4504504    0.6     -0.93
4504505    0.8     -1.19
4504506    1.0     -1.47
*
4504600    1   6
4504601    0.0     0.11
4504602    0.1     0.13
4504603    0.25    0.15
4504604    0.4     0.13
4504605    0.5     0.07
4504606    0.6     -0.04
4504607    0.7     -0.23
4504608    0.8     -0.51
4504609    0.9     -0.91
4504610    1.0     -1.47
*
4504700    1   7
4504701    -1.0    0.0
4504702     0.0    0.0
*
4504800    1   8
4504801    -1.0    0.9
4504802     0.0    0.0
*
* two-phase torque difference curves
*
4504900    2   1
4504901    0.0     0.54
4504902    0.2     0.59
4504903    0.4     0.65
4504904    0.6     0.77
4504905    0.8     0.95
4504906    0.9     0.98
4504907    0.95    0.96
4504908    1.0     0.87
*
4505000    2   2
4505001    0.0     -0.15
4505002    0.2      0.02
4505003    0.4      0.22
4505004    0.6      0.46
4505005    0.8      0.71
4505006    0.9      0.81
4505007    0.95     0.85
4505008    1.0      0.87
*
4505100    2   3
4505101    -1.0    0.62
4505102    -0.8    0.68
4505103    -0.6    0.53
4505104    -0.4    0.46
4505105    -0.2    0.49
4505106     0.0    0.54
*
4505200    2   4
4505201    -1.0    0.62
4505202    -0.8    0.53
4505203    -0.6    0.46
4505204    -0.4    0.42
4505205    -0.2    0.39
4505206     0.0    0.36
*
4505300    2   5
4505301    0.0     -0.63
4505302    0.2     -0.51
4505303    0.4     -0.39
4505304    0.6     -0.29
4505305    0.8     -0.20
4505306    0.9     -0.16
4505307    1.0     -0.13
*
4505400    2   6
4505401    0.0     0.36
4505402    0.2     0.32
4505403    0.4     0.27
4505404    0.6     0.18
4505405    0.8     0.05
4505406    1.0     -0.13
*
4505500    2   7
```

```
4505501     -1.0    -1.44
4505502     -0.8    -1.25
4505503     -0.6    -1.08
4505504     -0.4    -0.92
4505505     -0.2    -0.77
4505506      0.0    -0.63
*
4505600     2   8
4505601     -1.0    -1.44
4505602     -0.8    -1.12
4505603     -0.6    -0.79
4505604     -0.4    -0.52
4505605     -0.2    -0.31
4505606      0.0    -0.15
*
4506100     501
4506101     0.0     0.0
4506102     1.0e06 0.0
*
************************************************
*
* control components
*
************************************************
*
*
20500100  sgdc-lvl  sum  1.0  0.0  1
20500101  0.0  1.21831  voidf  205100000
20500102 1.20561  voidf  205090000
20500103 1.20561  voidf  205080000
20500104 1.20561  voidf  205070000
20500105 1.20561  voidf  205060000
20500106 1.20561  voidf  205050000
20500107 1.20561  voidf  205040000
20500108 0.48578  voidf  205030000
20500109 0.58737  voidf  205020000
20500110 0.41891  voidf  205010000
20500111 0.37827  voidf  209020000
20500112 0.50633  voidf  209010000
20500113 0.50635  voidf  203010000
20500114 0.40005  voidf  204010000
*
20500200  sgsd-lvl  sum  1.0  0.0  1
20500201  0.0  1.21831  voidf  202010000
20500202 1.20561  voidf  202020000
20500203 1.20561  voidf  202030000
20500204 1.20561  voidf  202040000
20500205 1.20561  voidf  202050000
20500206 1.20561  voidf  202060000
20500207 1.20561  voidf  202070000
20500208 0.48578  voidf  202080000
20500209 0.58737  voidf  202090000
20500210 0.41891  voidf  202100000
20500211 0.37827  voidf  202110000
20500212 0.50635  voidf  202120000
20500213 0.50635  voidf  203010000
20500214 0.40005  voidf  204010000
*
*20500300  il-mass  sum  1.0  0.0  1
*20500301  0.0  1.0  cmpmass  101
*20500302 1.0  cmpmass  102
*20500303 1.0  cmpmass  103
*20500304 1.0  cmpmass  104
*20500305 1.0  cmpmass  105
*20500306 1.0  cmpmass  106
*20500307 1.0  cmpmass  107
*20500308 1.0  cmpmass  108
*20500309 1.0  cmpmass  201
*20500310 1.0  cmpmass  301
*20500311 1.0  cmpmass  302
*
*20500400  vssimass  sum  1.0  0.0  1
*20500401  0.0  1.0  cmpmass  501
*20500402 1.0  cmpmass  502
*20500403 1.0  cmpmass  503
*20500404 1.0  cmpmass  504
*20500405 1.0  cmpmass  505
*20500406 1.0  cmpmass  506
*20500407 1.0  cmpmass  507
*20500408 1.0  cmpmass  508
*20500409 1.0  cmpmass  509
*20500410 1.0  cmpmass  513
*20500411 1.0  cmpmass  514
*20500412 1.0  cmpmass  516
*20500413 1.0  cmpmass  517
*20500414 1.0  cmpmass  518
*20500415 1.0  cmpmass  519
*20500416 1.0  cmpmass  531
*20500417 1.0  cmpmass  510
*
*20500500  bl-mass  sum  1.0  0.0  1
*20500501  0.0  1.0  cmpmass  401
*20500502 1.0  cmpmass  402
*20500503 1.0  cmpmass  403
*20500504 1.0  cmpmass  404
*20500505 1.0  cmpmass  405
*20500506 1.0  cmpmass  406
*20500507 1.0  cmpmass  450
*20500508 1.0  cmpmass  701
*
*20500600  totmass  sum  1.0  0.0  1
*20500601  0.0  1.0  cntrlvar  3
*20500602 1.0  cntrlvar  4
*20500603 1.0  cntrlvar  5
*
20500700  sg-delt  sum  1.0  20.0  1
```

```
20500701  0.  1.  tempf  201010000
20500702     -1.  tempf  201200000
*
*    calculate system inventory
*   the first number on the following card is the full system mass
*20500800  invn  div  144.  1.  0
*20500801  cntrlvar 6
*20500900  invent  div  1.  1.  1
*20500901  cntrlvar 8
*
*    calculate the core liquid collapsed height
*
20501000  cord-lvl  sum  1.  0.  1
20501001  0.  .6096  voidf  505010000
20501002  .6096  voidf  505020000
20501003  .3048  voidf  505030000
20501004  .3048  voidf  505040000
20501005  .3048  voidf  505050000
20501006  .3048  voidf  505060000
20501007  .6096  voidf  505070000
20501008  6096  voidf  505080000
*
20501100  sgsr-lvl  sum  1.0  0.0  1
20501101  0.0 1.9609     voidf  702010000
20501102   1.23101    voidf  702020000
20501103   1.15481    voidf  702030000
20501104   1.23101    voidf  702040000
20501105   1.25641    voidf  702050000
20501106   1.15481    voidf  702060000
20501107   1.06591    voidf  702070000
20501108   1.65398    voidf  702080000
20501109   1.37827    voidf  702090000
20501110   0.50635    voidf  702100000
20501111   0.50635    voidf  703010000
20501112   0.40005    voidf  704010000
*
20501200  sgdc-lvl  sum  1.0  0.0  1
20501201  0.0 1.19009    voidf  705080000
20501202   1.25101    voidf  705070000
20501203   1.15481    voidf  705060000
20501204   1.23101    voidf  705050000
20501205   1.25641    voidf  705040000
20501206   1.13481    voidf  705030000
20501207   1.06591    voidf  705020000
20501208   1.65398    voidf  705010000
20501209   0.37827    voidf  709020000
20501210   0.50635    voidf  709010000
20501211   0.50635    voidf  703010000
20501212   0.40005    voidf  704010000
*
*   calculate the broken leg generator upflow collapsed liquid level
*20501300  blguel sum 1.  9.532  0
*20501301  0.  1.  voidf  701010000
*20501302  1.  voidf  701020000
*20501303  1.  voidf  701030000
*20501304  1.  voidf  701040000
*20501305  1.  voidf  701050000
*20501306  1.  voidf  701060000
*20501307  1.  voidf  701070000
*20501308  1.  voidf  701080000
*20501309  1.  voidf  701090000
*
*    calculate the broken leg generator downflow collapsed liquid
*    level
*20501400 blgdgl sum 1. 9.53 0
*20501401  0.  1.  voidf  701100000
*20501402  1.  voidf  701110000
*20501403  1.  voidf  701120000
*20501404  1.  voidf  701130000
*20501405  1.  voidf  701140000
*20501406  1.  voidf  701150000
*20501407  1.  voidf  701160000
*20501408  1.  voidf  701170000
*20501409  1.  voidf  701180000
*
20501600  hotchlvl  sum  1.  0.  1
20501601  0.  .6096  voidf  555010000
20501602  .6096  voidf  555020000
20501603  .3048  voidf  555030000
20501604  .3048  voidf  555040000.
20501605  .3048  voidf  555050000
20501606  .3048  voidf  555060000
20501607  .6096  voidf  555070000
20501608  .6096  voidf  555080000
*
20502300  przrlvl  sum  1.0  0.0  1
20502301  0.0  0.3671  voidf  301010000
20502302 0.2549  voidf  301020000
20502303 0.2549  voidf  301030000
20502304 0.2549  voidf  301040000
20502305 0.0663  voidf  301050000
*
*   heat losses to environment - pl sg
*
20502400  hlsgpl sum 1. 0. 0
20502401 0.  1.41896 htrnr 705300101
20502402     0.91445 htrnr 705300201
20502403     0.99072 htrnr 705300301
20502404     0.07788 htrnr 705300401
20502405     0.05609 htrnr 705300501
20502406     0.99072 htrnr 705300601
20502407     0.05609 htrnr 705300701
20502408     0.02613 htrnr 705300801
20502409     0.57463 htrnr 705400101
20502410     0.72732 htrnr 705400201
20502411     0.72732 htrnr 705400301
```

```
20502412        0.54335 htmr 705400401
*
* power losses to environment - il sg
*
20502500   ilsgpl   sum   1.   0.   0
20502501   0.   .35939   htmr   205300101
20502502   .50391   htmr   205300201
20502503   .41675   htmr   205300301
20502504   1.03430 htmr   205300401
20502505   1.03430 htmr   205300501
20502506   1.03430 htmr   205300601
20502507   1.03430 htmr   205300701
20502508   1.03430 htmr   205300801
20502509   1.03430 htmr   205300901
20502510   1.04520 htmr   205301001
20502511   .57463   htmr   205400101
20502512   .72732   htmr   205400201
20502513   .72732   htmr   205400301
20502514   .54335   htmr   205400401
*
*   energy loss to environment - il sg
*
20502600 blsgel integral 1. 0. 0
20502601   cntrlvar 24
*
*   energy loss to environment - il sg
20502700   ilsgel integral 1. 0. 0
20502701   cntrlvar 25
*
*   power loss to environment from sg
*
20502800 sgfl sum 1. 0. 0
20502801 0. 1. cntrlvar 24
20502802        1. cntrlvar 25
*
*   energy loss to environment from sg
*
20502900 sgel sum 1. 0. 0
20502901 0. 1. cntrlvar 26
20502902        1. cntrlvar 27
*
*       integ of bl hot leg mass flow
*
20503000   blm integral 1. 0. 0
20503001 mflowj 402010000
*
*       integ of il hot leg mass flow
*
20503100   ilm integral 1. 0. 0
20503101 mflowj 102020000
*
*
*
*
20510100   ilhlmass   sum   1.0   0.0   1
20510101   0.0   9.2278200-04 rho 101010000
20510102 1.9918830-03 rho 102010000
20510103 5.9836050-04 rho 102020000
20510104 5.9836050-04 rho 102030000
20510105 7.8538960-04 rho 102040000
20510106 8.8732920-04 rho 102050000
20510107 8.8732920-04 rho 102060000
20510108 1.2796520-03 rho 103010000
20510109 5.4559250-04 rho 104010000
20510110 9.7311260-04 rho 104020000
20510111 8.1432400-04 rho 104030000
20510112 8.1432400-04 rho 104040000
20510113 1.4841030-03 rho 104050000
*
20510200   crossms   sum   1.0   0.0   1
20510201   0.0   1.0187750-03 rho 105010000
20510202 9.3065600-04 rho 105020000
20510203 8.1432400-04 rho 105030000
20510204 8.1432400-04 rho 105040000
20510205 8.1432400-04 rho 105050000
20510206 1.1289330-03 rho 105060000
20510207 2.0441630-03 rho 105070000
20510208 2.7480260-03 rho 105080000
20510209 2.7480260-03 rho 105090000
20510210 9.1438000-04 rho 105100000
20510211 9.1438000-04 rho 105110000
20510212 2.7480260-03 rho 105120000
20510213 2.7480260-03 rho 105130000
20510214 2.0441630-03 rho 105140000
*
20510300   ilclmass   sum   1.0   0.0   1
20510301 0.0       4.0772550-04 rho 106010000
20510302 1.0447530-03 rho 106020000
20510303 5.4641860-04 rho 106030000
20510304 6.7631200-04 rho 106040000
20510305 2.6372190-03 rho 106050000
20510306 2.7614970-03 rho 107010000
20510307 7.6276200-04 rho 108010000
*
20510400   ilsgpr   sum   1.0   0.0   1
20510401 0.0       1.6407770-03 rho 201010000
20510402 2.2416900-03 rho 201020000
20510403 2.2183220-03 rho 201030000
20510404 2.2183220-03 rho 201040000
20510405 2.2183220-03 rho 201050000
20510406 2.2183220-03 rho 201060000
20510407 2.2183220-03 rho 201070000
20510408 2.2183220-03 rho 201080000
20510409 8.9383520-04 rho 201090000
20510410 6.3316240-04 rho 201100000
20510411 6.3316240-04 rho 201110000
```

```
20510412 8.9383520-04 rho 201120000
20510413 2.2183220-03 rho 201130000
20510414 2.2183220-03 rho 201140000
20510415 2.2183220-03 rho 201150000
20510416 2.2183220-03 rho 201160000
20510417 2.2183220-03 rho 201170000
20510418 2.2183220-03 rho 201180000
20510419 2.2416900-03 rho 201190000
20510420 1.6407770-03 rho 201200000
*
20520100    blsgpr   sum    1.0   0.0    1
20520101   0.0     1.4264000-02 rho 202010000
20520102 1.6574000-02 rho 202020000
20520103 1.3183000-02 rho 202030000
20520104 1.6789000-02 rho 202040000
20520105 1.3532000-02 rho 202050000
20520106 1.2870000-02 rho 202060000
20520107 1.2850000-02 rho 202070000
20520108 5.8490000-03 rho 202080000
20520109 9.2780000-03 rho 202090000
20520110 7.6310000-03 rho 202100000
20520111 1.5420000-02 rho 202110000
20520112 2.6025000-02 rho 202120000
20520113 5.9663000-02 rho 203010000
20520114 3.3900000-02 rho 204010000
*
20520300    ilsgsec    sum    1.0    0.0    1
20520301    0.0   6.3370000-03 rho 205010000
20520302 3.2520000-03 rho 205020000
20520303 1.3220000-03 rho 205030000
20520304 3.2790000-03 rho 205040000
20520305 3.2790000-03 rho 205050000
20520306 3.2790000-03 rho 205060000
20520307 3.2790000-03 rho 205070000
20520308 3.2790000-03 rho 205080000
20520309 3.2790000-03 rho 205090000
20520310 3.3140000-03 rho 205100000
20520311 1.1400000-03 rho 206010000
20520312 2.9856000-02 rho 209010000
20520313 2.0686000-02 rho 209020000
*
20530100    pressms   sum    1.0   0.0    1
20530101   0.0     6.4825000-03 rho 301010000
20530102 6.4825000-03 rho 301020000
20530103 5.9118000-03 rho 301030000
20530104 5.9118000-03 rho 301040000
20530105 5.9118000-03 rho 301050000
20530106 1.1360000-03 rho 301060000
20530107 7.1837000-04 rho 302010000
20530108 2.3214100-04 rho 302020000
20530109 1.6457700-04 rho 302030000
20530110 4.4046000-05 rho 302040000
20530111 4.4046000-05 rho 302050000
20530112 4.4046000-05 rho 302060000
20530113 4.4046000-05 rho 302070000
*
20510500    blhlmss   sum    1.0   0.0    1
20510501   0.0     1.4245480-03 rho 401010000
20510502 5.5496350-04 rho 402010000
20510503 3.7182600-04 rho 402020000
20510504 8.9706890-04 rho 402030000
20510505 3.8022530-04 rho 402040000
20510506 3.2063850-04 rho 402050000
20510507 3.1781750-04 rho 402060000
20510508 5.5399890-04 rho 402070000
*
20510700    blcross   sum    1.0   0.0    1
20510701   0.0     4.4975840-04 rho 403010000
20510702 3.1781750-04 rho 403020000
20510703 3.2063850-04 rho 403030000
20510704 3.1781750-04 rho 403040000
20510705 9.8569380-04 rho 403050000
20510706 7.1445920-04 rho 403060000
20510707 7.1445920-04 rho 403070000
20510708 4.4539040-04 rho 403080000
20510709 4.4539040-04 rho 403090000
20510710 7.1445920-04 rho 403100000
20510711 7.1445920-04 rho 403110000
20510712 6.3701820-04 rho 403120000
*
20510800    blclmass   sum    1.0   0.0    1
20510801   0.0     7.5605530-04 rho 404010000
20510802 2.4731980-04 rho 405010000
20510803 6.4741950-04 rho 405020000
20510804 1.3575400-03 rho 406010000
20510805 8.6000000-04 rho 450010000
*
20510900    rvcore   sum    1.0   0.0    1
20510901   0.0     6.7400000-03 rho 501010000
20510902 6.5900000-03 rho 502010000
20510903 2.9600000-03 rho 503010000
20510904 5.2000000-04 rho 504010000
20510905 1.7434560-03 rho 505010000
20510906 1.7434560-03 rho 505020000
20510907 8.7172800-04 rho 505030000
20510908 8.7172800-04 rho 505040000
20510909 8.7172800-04 rho 505050000
20510910 8.7172800-04 rho 505060000
20510911 1.7434560-03 rho 505070000
20510912 1.7434560-03 rho 505080000
20510913 1.6400000-03 rho 506010000
20510914 2.8100000-03 rho 507010000
20510915 2.1800000-03 rho 508010000
20510916 1.4300000-03 rho 509010000
20510917 4.0470000-03 rho 509020000
20510918 3.9300000-04 rho 510010000
```

```
20510919 3.4000000-04 rho 513010000
20510920 3.4525000-04 rho 514010000
*
20511000   rvdcnr   sum   1.0   0.0   1
20511001 0.0      2.6189940-03 rho 516010000
20511002 3.7726480-03 rho 517010000
20511003 1.1833800-03 rho 518010000
20511004 1.1833800-03 rho 518020000
20511005 1.1833800-03 rho 518030000
20511006 1.1833800-03 rho 518040000
20511007 1.1833800-03 rho 518050000
20511008 1.1833800-03 rho 518060000
20511009 1.1833800-03 rho 518070000
20511010 1.1833800-03 rho 518080000
20511011 1.1833800-03 rho 518090000
20511012 9.1139620-04 rho 518100000
20511013 2.0770600-03 rho 519010000
20511014 2.6772900-05 rho 531010000
20511015 2.6772900-05 rho 531020000
20511016 2.6772900-05 rho 531030000
*
20510600   blsgpr   sum   1.0   0.0   1
20510601   0.0      1.3434060-03 rho 701010000
20510602 7.2961490-04 rho 701020000
20510603 7.5091610-04 rho 701030000
20510604 7.0443410-04 rho 701040000
20510605 7.5091610-04 rho 701050000
20510606 7.6641010-04 rho 701060000
20510607 7.0443410-04 rho 701070000
20510608 6.5020510-04 rho 701080000
20510609 5.9905660-04 rho 701090000
20510610 5.9905660-04 rho 701100000
20510611 6.5020510-04 rho 701110000
20510612 7.0443410-04 rho 701120000
20510613 7.6641010-04 rho 701130000
20510614 7.5091610-04 rho 701140000
20510615 7.0443410-04 rho 701150000
20510616 7.5091610-04 rho 701160000
20510617 7.2961490-04 rho 701170000
20510618 1.3434060-03 rho 701180000
*
20520200   blsgsec   sum   1.0   0.0   1
20520201   0.0      1.3509000-02 rho 702010000
20520202 9.0360000-03 rho 702020000
20520203 8.4700000-03 rho 702030000
20520204 1.0739000-02 rho 702040000
20520205 9.6150000-03 rho 702050000
20520206 8.4740000-03 rho 702060000
20520207 8.4250000-03 rho 702070000
20520208 1.5782000-02 rho 702080000
20520209 1.6807000-02 rho 702090000
20520210 2.5882000-02 rho 702100000
20520211 5.6736000-02 rho 703010000
20520212 3.3900000-02 rho 704010000
*
20520400   blsgsec   sum   1.0   0.0   1
20520401   0.0      1.4458000-02 rho 705010000
20520402 2.2410000-03 rho 705020000
20520403 2.4350000-03 rho 705030000
20520404 2.6390000-03 rho 705040000
20520405 2.5890000-03 rho 705050000
20520406 2.4310000-03 rho 705060000
20520407 2.5930000-03 rho 705070000
20520408 2.5140000-03 rho 705080000
20520409 2.9860000-02 rho 709010000
20520410 2.0686000-02 rho 709020000
*
*   total primary inventory
*
20511100   totalpr   sum   1.0   0.0   1
20511101   0.0 1.0   cntrlvar   101
20511102   1.0   cntrlvar   102
20511103   1.0   cntrlvar   103
20511104   1.0   cntrlvar   104
20511105   1.0   cntrlvar   105
20511106   1.0   cntrlvar   106
20511107   1.0   cntrlvar   107
20511108   1.0   cntrlvar   108
20511109   1.0   cntrlvar   109
20511110   1.0   cntrlvar   110
20511111   1.0   cntrlvar   301
*
*   total secondary inventory
*
20520500   totalsec   sum   1.0   0.0   1
20520501   0.0 1.0   cntrlvar   201
20520502   1.0   cntrlvar   202
20520503   1.0   cntrlvar   203
20520504   1.0   cntrlvar   204
*
*   core heat
*
20505000   thcore   sum   1.0   0.0   1
20505001   0.0      13.4112   htrnr   501300101
20505002   13.4112   htrnr   501300201
20505004   6.7056   htrnr   501300301
20505005   6.7056   htrnr   501300401
20505006   6.7056   htrnr   501300501
20505007   6.7056   htrnr   501300601
20505008   13.4112   htrnr   501300701
20505009   13.4112   htrnr   501300801
20505010   1.8288   htrnr   501300901
20505011   1.8288   htrnr   501301001
20505012   0.9144   htrnr   501301101
20505013   0.9144   htrnr   501301201
20505014   0.9144   htrnr   501301301
```

```
20505015   0.9144   htrnr   501301401
20505016   1.8288   htrnr   501301501
20505017   1.8288   htrnr   501301601
*
*      Intact Loop SG Heat Transfer
*
20505100   isgheat   sum   1.0   0.0    1
20505101    0.0        7.30986   htrnr   200100100
20505102   7.23366   htrnr   200100200
20505103   7.23366   htrnr   200100300
20505104   7.23366   htrnr   200100400
20505105   7.23366   htrnr   200100500
20505106   7.23366   htrnr   200100600
20505107   7.23366   htrnr   200100700
20505108   2.91468   htrnr   200100800
20505109   2.06466   htrnr   200100900
20505110   2.06466   htrnr   200101000
20505111   2.91468   htrnr   200101100
20505112   7.23366   htrnr   200101200
20505113   7.23366   htrnr   200101300
20505114   7.23366   htrnr   200101400
20505115   7.23366   htrnr   200101500
20505116   7.23366   htrnr   200101600
20505117   7.23366   htrnr   200101700
20505118   7.30986   htrnr   200101800
*
*      Broken Loop SG Heat Transfer
*
20505200   bsgheat   sum   1.0   0.0    1
20505201    0.0        2.39218   htrnr   700100100
20505202   2.46202   htrnr   700100200
20505203   2.30962   htrnr   700100300
20505204   2.46202   htrnr   700100400
20505205   2.51282   htrnr   700100500
20505206   2.30962   htrnr   700100600
20505207   2.13182   htrnr   700100700
20505208   1.96412   htrnr   700100800
20505209   1.96412   htrnr   700100900
20505210   2.13182   htrnr   700101000
20505211   2.30962   htrnr   700101100
20505212   2.51282   htrnr   700101200
20505213   2.46202   htrnr   700101300
20505214   2.30962   htrnr   700101400
20505215   2.46202   htrnr   700101500
20505216   2.39218   htrnr   700101600
*
*      * end of deck
```

Transient Input Deck for Case T01

```
*        the next input deck is for the transient calculation
*        of the semiscale natural circulation experiment 8.   *
= semiscale mod 2a -- nc8 configuration (2-loop)
*
*     two core channel modeling implemented
*
0000100  restart  transnt
0000101  run
0000103  8001
*0000104  none
0000105  10.0  12.0
0000201  1.0       1.0e-06  0.01  2  50   250    1000
0000201  5000.0 1.0e-06  0.05  2  200  20000 20000
*
20800001  dt   0
20800002  dtcrnt  0
20800003  cputime
20800004  tmass   0
20800005  emass   0
20800006  cntrlvar    211    * primary system pressure
20800007  cntrlvar    212    * ilsg pressure
20800008  cntrlvar    213    * blsg pressure
20800009  cntrlvar    214    * ilcrossoverleg sg side dp
20800010  cntrlvar    215    * ilcrossover leg pump sideJp
20800011  cntrlvar    216    * blcrossover leg sg side dp
20800012  cntrlvar    217    * blcrossover leg pump side dp
20800013  cntrlvar    218    * ector vessel core dp
*20800014  cntrlvar    228    * total acculator flow (intact)
*20800015  cntrlvar    229    * total accumulator flow (broken)
20800016  cntrlvar    101    * ilhl mass
20800017  cntrlvar    102    * ilcrl mass
20800018  cntrlvar    103    * ilcl mass
20800019  cntrlvar    104    * ilsg primary mass
20800020  cntrlvar    105    * blhl mass
20800021  cntrlvar    106    * blsg primary mass
20800022  cntrlvar    107    * blcrl mass
20800023  cntrlvar    108    * blcl mass
20800024  cntrlvar    109    * rv core mass
20800025  cntrlvar    110    * rv downcomer mass
20800026  cntrlvar    111    * total primary side inventory
20800027  cntrlvar    201    * ilsg secondary side mass
20800028  cntrlvar    202    * blsg secondary side mass
20800029  cntrlvar    203    * ilsg secondary mass
20800030  cntrlvar    204    * blsg secondary mass
20800031  cntrlvar    205    * total seconady mass
20800032  mflowj   101010000
20800033  mflowj   107010000
20800034  mflowj   401010000
20800035  mflowj   405010000
20800036  mflowj   518010000
20800037  mflowj   233000000
20800038  mflowj   733000000
20800039  mflowj   232000000
20800040  mflowj   732000000
20800041  mflowj   620000000
20800042  mflowj   820000000
*
20800043  tempf   101010000
20800044  tempf   107010000
20800045  tempf   401010000
20800046  tempf   405010000
20800047  httemp  501300711
20800048  httemp  501300811
*
*
0000501  time  0  ge  null  0   -1.0  1  * always true
0000502  time  0  lt  null  0   -1.0  n  * always false
0000510  time  0  ge  null  0    0.0  1  * induce blowdown
+  after 0 s
0000511  time  0  ge  null  0  117.0  1  * close steam valve
+    after 117 s
0000512  time  0  ge  null  0 2100.0  1  * open steam valve
+  after 2100 s
0000513  time  0  ge  null  0 7550.0  1  * open porv valve after
+    7550 s
0000514  time  0  ge  null  0 8098.0  1  * close porv valve after
+    8098 s
*
0000601  -511   or   512   n
0000602   513  and   514   n
0000610  -510  and  -510   n
*
*    modified by ysbang at 96/1/19
*    to implement sg steam leak both at iSG bSG
*
0000550   time  0  gt  null  0  117.0  n
0000551   time  0  le  null  0  2100.0  n
*
0000650   550  and  551  n
*
*    insert bypass steam junction 211 and 711
*
2110000   isteaml  valve
2110101   204010000  240000000  0.3-5  0.0  0.0  0100 1. 1.
2110201   0   0.0   0.0
2110300   trpvlv
2110301   650
*
7110000   isteaml  valve
7110101   704010000  740000000  0.3-5  0.0  0.0  0100 1. 1.
7110201   0   0.0   0.0
7110300   trpvlv
```

```
7110301    650
*
*    insert tmdpvol 240 and 740
*
2400000    envir   tmdpvol
2400101    1.0  1.0  0.0   0.0   90.0   1.0   5.-6 0.0   00
2400200    2
*2400201   0.0        5.89e06      1.0
*2400202   2100.0     5.89e06      1.0
*2400203   2763.0     3.96e06      1.0
*2400204   3380.0     3.15e06      1.0
*2400205   4500.0     2.26e06      1.0
*2400206   6110.0     1.50e06      1.0
*2400207   8000.0     1.25e06      1.0
*
*    modified by ysbang at Sep 3, 1996 to
*    implement an exact boundary condition
*
2400201   0.0        5.85e06      1.0
2400202   2100.0     5.6e06       1.0
2400203   2763.0     2.78e06      1.0
2400204   3380.0     2.12e06      1.0
2400205   4500.0     1.80e06      1.0
2400206   6110.0     1.40e06      1.0
2400207   8000.0     1.20e06      1.0
*
7400000    envir   tmdpvol
7400101    1.0  1.0  0.0   0.0   90.0   1.0   5.-6 0.0   00
7400200    2
*7400201   0.0        5.89e06      1.0
*7400202   2100.0     5.89e06      1.0
*7400203   2763.0     3.96e06      1.0
*7400204   3380.0     3.15e06      1.0
*7400205   4500.0     2.26e06      1.0
*7400206   6110.0     1.50e06      1.0
*7400207   8000.0     1.25e06      1.0
*
*    modified by ysbang at Sep 3, 1996 to
*    implement an exact boundary condition
*
7400201   0.0        5.89e06      1.0
7400202   2100.0     5.60e06      1.0
7400203   2763.0     3.95e06      1.0
7400204   3380.0     3.15e06      1.0
7400205   4500.0     2.25e06      1.0
7400206   6110.0     1.50e06      1.0
7400207   8000.0     1.23e06      1.0
*
*   end of modification by ysbang
*
*    intact loop steam generator steam outlet junction
*
*    upper head bypass junction modify
*    modified by ysbang at Sep 16, 1996
*
5350000   byps-up       snglju n
5350101   531010000    510010000    1.62-5   300. 300. 0100
5350201   0   0.0   0.0   0.0
*
*
2320000   steamout       valve
2320101   204010000    207000000   0.0   0.0   0.0   0100
*2320201   0              -2.166700 .01040770 0.0
*
*    modified by ysbang at 94/9/14
*    to implement the steady state result
*
2320201    0         0.0379918     0.0139507    0.0
2320300   trpvlv
2320301   601
*
2330000   feedint       tmdpjun
2330101   206000000   205000000   0.00043
2330200   1   512   cntrlvar   1
2330201   -1.0      0.0      0.0   0.0
2330202   0.0       0.0      0.0   0.0
2330203   0.0       0.216    0.0   0.0
2330204   9.5       0.216    0.0   0.0
2330205   9.58      0.054    0.0   0.0
2330206   9.7149    0.036    0.0   0.0
2330207   9.7800    0.027    0.0   0.0
2330208   9.8500    0.0      0.0   0.0
2330209   20.0      0.0      0.0   0.0
*
*   pressurizer porv downstream tank
*
3300000   presssup        tmdpvol
3300101   1.0   10.0   0.0   0.0   0.0   0.0   0.0   0.0   00
3300200   3
3300201        0.0     1.041e06     455.
3300202       49.0     1.041e06     455.
3300203       50.0     1.041e06     455.
3300204      150.0     0.280e06     406.
3300205     1500.0     0.270e06     403.
*
3310000   porv              valve
3310101   301000000   330000000   0.0001267   0.0   0.0   0100
+       1.0   1.0
3310201   0      0.0     0.0     0.0
3310300   trpvlv
3310301   602
*
*    broken loop break junction
*
*4220000   brk-jun     valve
*4220101   404010000   499000000   9.0e-07   0.0   0.0   0100
```

```
+    1.0   1.0
*4220101   404010000   499000000   9.0e-07   0.0   0.0   0100
+    1.5   1.5
*
*4220201   0      0.0    0.0    0.0
*4220300   trpvlv
*4220304   510
*
*      modified by ysbang to model smooth open
*      of break valve for 100 sec, Sep.30, 1996
*
4220000   brk-jun    valve
4220101   404010000   499000000   9.0e-07   0.0   0.0   0100   1.0
1.0
*4220101   404010000   499000000   9.0e-07   0.0   0.0   0100
*+    1.5   1.5
*
4220201   0      0.0    0.0    0.0
4220300   mtrvlv
4220304   510    610   0.01    0.0   0
*
4990000   presssup    tmdpvol
4990101   1.0   10.0   0.0   0.0   0.0   0.0   0.0   0.0   00
4990200   3
*4990201        0.0     1.041e06     455.
*4990202       49.0     1.041e06     455.
*4990203       50.0     1.041e06     455.
*4990204      150.0     0.280e06     404.
*4990205     1500.0     0.270e06     403.
*
*   modified by y.s.bang for realistic modeling
*     of condensate tank pressure
*
4990201      0.0    0.098e06   455.
4990202   1000.0    0.094e06   455.
4990203   3400.0    0.123e06   455.
4990204   8000.0    0.123e06   455.
*
**************************************************
*
* ecc system
*
**************************************************
*
6100000   ilcl-ecc      pipe
6100001   1
6100101   0.000464   1
6100301   3.048          1
6100401   0.0            1
6100601   0.0            1
6100701   0.0            1
6100801   5.0e-04        0.0      1
6101001   00             1
6101201   1      300.0      0.0   0.0   0.0   0.0 1
*
6110000   ilcl-acc      accum
6110101   0.0   1.08032   0.071142   0.0   90.0   1.08032   5.0-04
0.0   00000
6110200   4.240e06    300.0
6111101   610000000    4.66e-04    0.0   0.0    0000
6112200   0.049043   0.0   9.144   0.0    1.45e-03   0   0   0   0
*
6200000   ilcl-fcc      sngljun
6200101   610010000      107000000   4.64e-04   0.0   0.0   0000
6200201   0   0.0   0.0   0.0
*
8100000   blcl-ecc      pipe
8100001   1
8100101   0.000250       1
8100301   3.048          1
8100401   0.0            1
8100601   0.0            1
8100701   0.0            1
8100801   5.0e-04        0.0      1
8101001   00             1
8101201   1      300.0   0.0      0.0   0.0   0.0   1
*
8110000   blcl-acc      accum
8110101   0.0   0.36027   0.02371     0.0   90.0   0.36027   5.0-04
0.0 00000
8110200   4.240e06    300.0
8111101   810000000    2.50e-04    0.0   0.0    0000
8112200   0.01776    0.0   6.096   0.0    1.45e-03   0   0   0   0
*
8200000   blcl-ecc      sngljun
8200101   810010000      404000000   4.64e-04   0.0   0.0   0000
8200201   0   0.0   0.0   0.0
*
*    broken loop steam generator steam outlet junction
*
7320000   steamou       valve
7320101   704010000   707000000   0.0   0.0   0.0   0100
*
*7320201   0             -.0599056 .333999-3 0.0
*
*      modified by ysbang at 94/9/14
*      to implement the steady state resut
*
7320201    0       0.02012     0.001473   0.0
7320300   trpvlv
7320301   601
*
7330000   feedin        tmdpjun
7330101   706000000   705000000   0.00043
7330200   1   512   cntrlvar   12
7330201   -1.0      0.0        0.0   0.0
```

```
7330202   0.0     0.0     0.0   0.0
7330203   0.0     0.072   0.0   0.0
7330204   10.17   0.018   0.0   0.0
7330205   10.28   0.012   0.0   0.0
7330206   10.34   0.009   0.0   0.0
7330207   10.40   0.0     0.0   0.0
7330208   20.00   0.0     0.0   0.0
*
*9000000  envirnmt        tmdpvol
*9000101  1.0  1.0  0.0  0.0  0.0  0.0  0.0  0.0  0.0  00
*9000200  3
*9000201  0.0    8.48e05    310.0
**
*****************************************
*
* general table   data
*
*****************************************
*
* power   for   pressurizer
*
20230000  power       502
20230001  -1.0        0.0
20230002  0.0         0.0
20230003  0.0         12000.
20230004  1.0e06      12000.
*
* reactor   core   power
*
*20250000  power
*20250001  0.0         95.000e03
*20250002  131.0       95.000e03
*20250003  133.0       81.320e03
*20250004  163.0       68.305e03
*20250005  203.0       60.610e03
*20250006  1103.0      36.955e03
*20250007  10103.0     17.575e03
*
* reactor   core   power
*   power ratio hot/average = 60/40
*
*   hot channel : volume 500
*
20250000  power
20250001  0.0         57.000e03
20250002  131.0       57.000e03
20250003  133.0       48.792e03
20250004  163.0       40.983e03
20250005  203.0       36.366e03
*20250006  1103.0      36.955e03
20250006  1103.0      22.173e03
20250007  10103.0     10.545e03
*
*   average channel : volume 550
*
20255000  power
20255001  0.0         38.000e03
20255002  131.0       38.000e03
20255003  133.0       32.585e03
20255004  163.0       27.322e03
20255005  203.0       24.244e03
20255006  1103.0      14.782e03
20255007  10103.0     7.0100e03
*
20220000  temp
20220001  0.0         300.
*
20270500  htc-t
20270501  0.0         6.806
*
20220500  htc-t
20220501  0.0         6.806
*
20220400  htc-t
20220401  0.0         5.98
*
20270400  htc-t
20270401  0.0         5.98
*
*****************************************
*
* control   components
*
*****************************************
*
*
20500100  sgdclv    sum   1.0   0.0   1
20500101  0.0   1.21831   voidf   205100000
20500102        1.20561   voidf   205090000
20500103        1.20561   voidf   205080000
20500104        1.20561   voidf   205070000
20500105        1.20561   voidf   205060000
20500106        1.20561   voidf   205050000
20500107        1.20561   voidf   205040000
20500108        0.48578   voidf   205030000
20500109        0.58737   voidf   205020000
20500110        0.41891   voidf   205010000
20500111        0.37827   voidf   209020000
20500112        0.50635   voidf   209010000
20500113        0.50635   voidf   203010000
20500114        0.40005   voidf   204010000
*
20500200  sgsrlvl   sum   1.0   0.0   1
20500201  0.0   1.21831   voidf   202010000
20500202        1.20561   voidf   202020000
20500203        1.20561   voidf   202030000
```

```
20500204        1.20561   voidf    202040000
20500205        1.20561   voidf    202050000
20500206        1.20561   voidf    202060000
20500207        1.20561   voidf    202070000
20500208        0.48578   voidf    202080000
20500209        0.58737   voidf    202090000
20500210        0.41891   voidf    202100000
20500211        0.37827   voidf    202110000
20500212        0.50635   voidf    202120000
*20500213       0.50635   voidf    202130000
20500214        0.40005   voidf    204010000
*
*20500300  fi-mass   sum   1.0   0.0   1
*20500301  0.0  1.0   cmpmass   101
*20500302       1.0   cmpmass   102
*20500303       1.0   cmpmass   103
*20500304       1.0   cmpmass   104
*20500305       1.0   cmpmass   105
*20500306       1.0   cmpmass   106
*20500307       1.0   cmpmass   107
*20500308       1.0   cmpmass   108
*20500309       1.0   cmpmass   201
*20500310       1.0   cmpmass   301
*20500311       1.0   cmpmass   301
**
*20500400  vssl-mass   sum   1.0   0.0   1
*20500401  0.0  1.0   cmpmass   501
*20500402       1.0   cmpmass   502
*20500403       1.0   cmpmass   503
*20500404       1.0   cmpmass   504
*20500405       1.0   cmpmass   505
*20500406       1.0   cmpmass   506
*20500407       1.0   cmpmass   507
*20500408       1.0   cmpmass   508
*20500409       1.0   cmpmass   509
*20500410       1.0   cmpmass   513
*20500411       1.0   cmpmass   514
*20500412       1.0   cmpmass   516
*20500413       1.0   cmpmass   517
*20500414       1.0   cmpmass   518
*20500415       1.0   cmpmass   519
*20500416       1.0   cmpmass   531
*20500417       1.0   cmpmass   510
**
*20500500  bi-mass   sum   1.0   0.0   1
*20500501  0.0  1.0   cmpmass   401
*20500502       1.0   cmpmass   402
*20500503       1.0   cmpmass   403
*20500504       1.0   cmpmass   404
*20500505       1.0   cmpmass   405
*20500506       1.0   cmpmass   406
*20500507       1.0   cmpmass   450
*20500508       1.0   cmpmass   701
**
*20500600  tot-p-mass   sum   1.0   0.0   1
*20500601  0.0  1.0   cntrvar   3
*20500602       1.0   cntlvar   4
*20500603       1.0   cntlvar   5
**
*205007600  sg-delt   sum   1.0   20.0   1
*205007601  0.   1.   temp   201010000
*205007602      -1.   temp   201200000
*
*       calculate   system   inventory
*       the first number on the following card is the full system mass
*20500800   invn   div   144.   1.   0
*20500801   cntrlvar 6
*20500900   invext   div   1.   1.   1
*20500901   cntrlvar 8
*
* calculate the core liquid collapsed   height
*
20501000  core-lvl   sum   1.   0.   1
20501001  0.   .6096   voidf   505010000
20501002       .6096   voidf   505020000
20501003       .3048   voidf   505030000
20501004       .3048   voidf   505040000
20501005       .3048   voidf   505050000
20501006       .3048   voidf   505060000
20501007       .6096   voidf   505070000
20501008       .6096   voidf   505080000
*
20501100  sgshlvl   sum   1.0   0.0   1
20501101  0.0        1.9609   voidf   702010000
20501102              1.23101   voidf   702020000
20501103              1.15481   voidf   702030000
20501104              1.23101   voidf   702040000
20501105              1.25641   voidf   702050000
20501106              1.15481   voidf   702060000
20501107              1.06591   voidf   702070000
20501108              0.65398   voidf   702080000
20501109              0.37827   voidf   702090000
20501110              0.50635   voidf   702100000
*20501111             0.50635   voidf   702110000
20501112              0.40005   voidf   704010000
*
20501200  sgdclvl   sum   1.0   0.0   1
20501201  0.0        1.9609   voidf   705080000
20501202              1.23101   voidf   705070000
20501203              1.15481   voidf   705060000
20501204              1.23101   voidf   705050000
20501205              1.25641   voidf   705040000
20501206              1.15481   voidf   705030000
20501207              1.06591   voidf   705020000
20501208              0.65398   voidf   705010000
20501209              0.37827   voidf   709020000
```

```
20501210              0.50635   voidf    709010000
20501211              0.50635   voidf    703010000
20501212              0.40005   voidf    704010000
*
* calculate the broken leg generator upflow collapsed liquid level
*
20501300  blgu-cl sum  1.  9.532    0
20501301  0.  1.19609   voidf    701020000
20501302      1.23101   voidf    701030000
20501303      1.15481   voidf    701040000
20501304      1.23101   voidf    701050000
20501305      1.25641   voidf    701060000
20501306      1.15481   voidf    701070000
20501307      1.06591   voidf    701080000
20501308      0.98206   voidf    701090000
*
* calculate the broken leg generator downflow collapsed liquid level
*
20501400  slgd-cl  sum   1.    9.532   0
20501401  0.  0.98206   voidf    701100000
20501402      1.06591   voidf    701110000
20501403      1.15481   voidf    701120000
20501404      1.25641   voidf    701130000
20501405      1.23101   voidf    701140000
20501406      1.15481   voidf    701150000
20501407      1.23101   voidf    701160000
20501408      0.19609   voidf    701170000
*
* calculate the intact leg generator upflow collapsed liquid level
*
20501500  ileu-cl sum  1.0 9.525    1
20501501  0.  1.21831   voidf   201020000
20501502      1.20561   voidf   201030000
20501503      1.20561   voidf   201040000
20501504      1.20561   voidf   201050000
20501505      1.20561   voidf   201060000
20501506      1.20561   voidf   201070000
20501507      1.20561   voidf   201080000
20501508      0.48578   voidf   201090000
20501509      0.34411   voidf   201100000
*
* calculate the intact leg generator downflow collapsed liquid level
*
20501600  ilgd-cl sum  1.0 9.525   1
20501601  0.  0.34411   voidf   201110000
20501602      0.48578   voidf   201120000
20501603      1.20561   voidf   201130000
20501604      1.20561   voidf   201140000
20501605      1.20561   voidf   201150000
20501606      1.20561   voidf   201160000
20501607      1.20561   voidf   201170000
20501608      1.20561   voidf   201180000
20501609      1.21381   voidf   201190000
*
20502300  pzrlevel     sum   1.0   0.0   1
20502301  0.0   0.3671    voidf    301010000
20502302        0.2549    voidf    301020000
20502303        0.2549    voidf    301030000
20502304        0.2549    voidf    301040000
20502305        0.0663    voidf    301050000
*
* heat losses to environment - bl sg
*
20502400   blsgpl sum 1. 0. 0
20502401  0.  1.41896 htmr 705300101
20502402      0.91455 htmr 705300201
20502403      0.99072 htmr 705300301
20502404      1.07788 htmr 705300401
20502405      1.05609 htmr 705300501
20502406      0.99072 htmr 705300601
20502407      1.05609 htmr 705300701
20502408      1.02613 htmr 705300801
20502409      0.57463 htmr 705400101
20502410      0.72732 htmr 705400201
20502411      0.72732 htmr 705400301
20502412      0.54335 htmr 705400401
*
* power losses to environment  il sg
*
20502500  ilsgpl   sum 1. 0. 0
20502501  0.  .35939  htmr  205300101
20502502      .50391  htmr  205300201
20502503      .41679  htmr  205300301
20502504      1.03430 htmr  205300401
20502505      1.03430 htmr  205300501
20502506      1.03430 htmr  205300601
20502507      1.03430 htmr  205300701
20502508      1.03430 htmr  205300801
20502509      1.03430 htmr  205300901
20502510      1.04520 htmr  205301001
20502511      .57463  htmr  205400101
20502512      .72732  htmr  205400201
20502513      .72732  htmr  205400301
20502514      .54335  htmr  205400401
*
* energy losses to environment - bl sg
*
20502600  blsgei integral 1. 0. 0
20502601    cntrlvar 24
*
* energy losses to environment - il sg
*
20502700  ilsgei integral 1. 0. 0
20502701    cntrlvar 25
*
* power losses to environment from sg
```

```
*
20502800   sgpl sum 1. 0. 0
20502801   0. 1. cntrlvar 24
20502802        1. cntrlvar 25
*
* energy losses to environment from sg
*
20502900   blsgel sum   1. 0. 0
20502901   0. 1. cntrlvar 26
20502902        1. cntrlvar 27
*
* integ of bl hot leg mass flow
*
20503000   blm integral 1.   0. 0
20503001   mflowj 402010000
*
* integ of il hot leg mass flow
*
20503000   ilm integral 1.   0. 0
20503001   mflowj 102020000
*
* integ of break mass flow
*
20503000   brm integral 1.   0. 0
20503001   mflowj 422000000
*
20510100   ilhlmass  sum    1.0   0.0    1
20510101   0.0   9.2278200-04 rho 101010000
20510102         1.9918830-03 rho 102010000
20510103         5.9836050-04 rho 102020000
20510104         5.9836050-04 rho 102030000
20510105         7.8538960-04 rho 102040000
20510106         8.8732920-04 rho 102050000
20510107         8.8732920-04 rho 102060000
20510108         1.2796520-03 rho 103010000
20510109         5.4559250-04 rho 104010000
20510110         9.7311260-04 rho 104020000
20510111         8.1432400-04 rho 104030000
20510112         8.1432400-04 rho 104040000
20510113         1.4841030-03 rho 104050000
*
20510200   crossms  sum    1.0   0.0    1
20510201   0.0   1.0187750-03 rho 105010000
20510202         9.3065600-04 rho 105020000
20510203         8.1432400-04 rho 105030000
20510204         8.1432400-04 rho 105040000
20510205         8.1432400-04 rho 105050000
20510206         1.1289930-03 rho 105060000
20510207         2.0441630-03 rho 105070000
20510208         2.7480260-03 rho 105080000
20510209         2.7480260-03 rho 105090000
20510210         9.1438000-04 rho 105100000
20510211         9.1438000-04 rho 105110000
20510212         2.7480260-03 rho 105120000
20510213         2.7480260-03 rho 105130000
20510214         2.0441630-03 rho 105140000
*
20510300   ilclmass  sum    1.0   0.0    1
20510301 0.0     4.0772550-04 rho 106010000
20510302         1.0447530-03 rho 106020000
20510303         5.4641860-04 rho 106030000
20510304         6.7631200-04 rho 106040000
20510305         2.6372190-03 rho 106050000
20510306         2.7614970-03 rho 107010000
20510307         7.6276200-04 rho 108010000
*
20510400   ilsgpr  sum    1.0   0.0    1
20510401 0.0     1.6407770-03 rho 201010000
20510402         2.2416900-03 rho 201020000
20510403         2.2183220-03 rho 201030000
20510404         2.2183220-03 rho 201040000
20510405         2.2183220-03 rho 201050000
20510406         2.2183220-03 rho 201060000
20510407         2.2183220-03 rho 201070000
20510408         2.2183220-03 rho 201080000
20510409         8.9383520-04 rho 201090000
20510410         6.3316240-04 rho 201100000
20510411         6.3316240-04 rho 201110000
20510412         8.9383520-04 rho 201120000
20510413         2.2183220-03 rho 201130000
20510414         2.2183220-03 rho 201140000
20510415         2.2183220-03 rho 201150000
20510416         2.2183220-03 rho 201160000
20510417         2.2183220-03 rho 201170000
20510418         2.2183220-03 rho 201180000
20510419         2.2416900-03 rho 201190000
20510420         1.6407770-03 rho 201200000
*
20520100   blsgpr  sum    1.0   0.0    1
20520101   0.0   1.4264000-02 rho 202010000
20520102         1.6574000-02 rho 202020000
20520103         1.3183000-02 rho 202030000
20520104         1.6789000-02 rho 202040000
20520105         1.3532000-02 rho 202050000
20520106         1.2870000-02 rho 202060000
20520107         1.2850000-02 rho 202070000
20520108         5.8490000-03 rho 202080000
20520109         9.2780000-03 rho 202090000
20520110         7.6310000-03 rho 202100000
20520111         1.5420000-02 rho 202110000
20520112         2.6025000-02 rho 202120000
20520113         5.9663000-02 rho 203010000
20520114         3.3900000-02 rho 204010000
*
20520300   ils2sec   sum    1.0   0.0    1
20520301   0.0   6.3370000-03 rho 205010000
```

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20520302          3.2520000-03 rho 205020000
20520302          1.3220000-03 rho 205030000
20520304          3.2790000-03 rho 205040000
20520305          3.2790000-03 rho 205050000
20520306          3.2790000-03 rho 205060000
20520307          3.2790000-03 rho 205070000
20520308          3.2790000-03 rho 205080000
20520309          3.2790000-03 rho 205090000
20520310          3.3140000-03 rho 205100000
20520311          1.1400000-03 rho 206010000
20520312          2.9856000-02 rho 209010000
20520313          2.0686000-02 rho 209020000
*
20530100   pressms   sum    1.0   0.0    1
20530101  0.0     6.4825000-03 rho 301010000
20530102          6.4825000-03 rho 301020000
20530103          5.9118000-03 rho 301030000
20530104          5.9118000-03 rho 301040000
20530105          5.9118000-03 rho 301050000
20530106          1.1360000-03 rho 301060000
20530107          7.1837000-04 rho 302010000
20530108          2.3214100-04 rho 302020000
20530109          1.6457700-04 rho 302030000
20530110          4.4046000-05 rho 302040000
20530111          4.4046000-05 rho 302050000
20530112          4.4046000-05 rho 302060000
20530113          4.4046000-05 rho 302070000
*
20510500   blhimss   sum    1.0   0.0    1
20510501  0.0     1.4245480-03 rho 401010000
20510502          5.5496350-04 rho 402010000
20510503          3.7182600-04 rho 402020000
20510504          8.9706890-04 rho 402030000
20510505          3.8022530-04 rho 402040000
20510506          3.2063850-04 rho 402050000
20510507          3.1781750-04 rho 402060000
20510508          5.5399890-04 rho 402070000
*
20510700   blcross   sum    1.0   0.0    1
20510701  0.0     4.4975840-04 rho 403010000
20510702          3.1781750-04 rho 403020000
20510703          3.2063850-04 rho 403030000
20510704          3.1781750-04 rho 403040000
20510705          9.8569380-04 rho 403050000
20510706          7.1445920-04 rho 403060000
20510707          7.1445920-04 rho 403070000
20510708          4.4539040-04 rho 403080000
20510709          4.4539040-04 rho 403090000
20510710          7.1445920-04 rho 403100000
20510711          7.1445920-04 rho 403110000
20510712          6.3701820-04 rho 403120000
*
20510800   blcimass   sum    1.0   0.0    1
20510801  0.0     7.5605530-04 rho 404010000
20510802          2.4731980-04 rho 405010000
20510803          6.4741950-04 rho 405020000
20510804          1.3575400-03 rho 406010000
20510805          8.6000000-04 rho 450010000
*
20510900   rvcore   sum    1.0   0.0    1
20510901  0.0     6.7400000-03 rho 501010000
20510902          6.5900000-03 rho 502010000
20510903          2.9600000-03 rho 503010000
20510904          5.2000000-04 rho 504010000
20510905          1.7434560-03 rho 505010000
20510906          1.7434560-03 rho 505020000
20510907          8.7172800-04 rho 505030000
20510908          8.7172800-04 rho 505040000
20510909          8.7172800-04 rho 505050000
20510910          8.7172800-04 rho 505060000
20510911          1.7434560-03 rho 505070000
20510912          1.7434560-03 rho 505080000
20510913          1.6400000-03 rho 506010000
20510914          2.8100000-03 rho 507010000
20510915          2.1800000-03 rho 508010000
20510916          1.4300000-03 rho 509010000
20510917          4.0470000-03 rho 509020000
20510918          3.9300000-04 rho 510010000
20510919          3.4000000-04 rho 513010000
20510920          3.4525000-04 rho 514010000
*
20511000   rvdcnr   sum    1.0   0.0    1
20511001 0.0     2.6189940-03 rho 516010000
20511002          3.7726480-03 rho 517010000
20511003          1.1833800-03 rho 518010000
20511004          1.1833800-03 rho 518020000
20511005          1.1833800-03 rho 518030000
20511006          1.1833800-03 rho 518040000
20511007          1.1833800-03 rho 518050000
20511008          1.1833800-03 rho 518060000
20511009          1.1833800-03 rho 518070000
20511010          1.1833800-03 rho 518080000
20511011          1.1833800-03 rho 518090000
20511012          9.1139620-04 rho 518100000
20511013          2.0770600-03 rho 519010000
20511014          2.6772900-05 rho 531010000
20511015          2.6772900-05 rho 531020000
20511016          2.6772900-05 rho 531030000
*
20510600   blsgpr   sum    1.0   0.0    1
20510601  0.0     1.3434060-03 rho 701010000
20510602          7.2961490-04 rho 701020000
20510603          7.5091610-04 rho 701030000
20510604          7.0443410-04 rho 701040000
20510605          7.5091610-04 rho 701050000
20510606          7.6641010-04 rho 701060000
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20510607          7.0443410-04 rho 701070000
20510608          6.5020510-04 rho 701080000
20510609          5.9905660-04 rho 701090000
20510610          5.9905660-04 rho 701100000
20510611          6.5020510-04 rho 701110000
20510612          7.0443410-04 rho 701120000
20510613          7.6641010-04 rho 701130000
20510614          7.5091610-04 rho 701140000
20510615          7.0443410-04 rho 701150000
20510616          7.5091610-04 rho 701160000
20510617          7.2961490-04 rho 701170000
20510618          1.3434060-03 rho 701180000
*
20520200   blsgsec   sum    1.0  0.0    1
20520201  0.0     1.3509000-02 rho 702010000
20520202          9.0360000-03 rho 702020000
20520203          8.4700000-03 rho 702030000
20520204          1.0739000-02 rho 702040000
20520205          9.6150000-03 rho 702050000
20520206          8.4740000-03 rho 702060000
20520207          8.4250000-03 rho 702070000
20520208          1.5782000-02 rho 702080000
20520209          1.6807000-02 rho 702090000
20520210          2.5882000-02 rho 702100000
20520211          5.6736000-02 rho 703010000
20520212          3.3900000-02 rho 704010000
*
20520400   blsgsec    sum    1.0    0.0     1
20520401  0.0     1.4458000-02 rho 705010000
20520402          2.2410000-03 rho 705020000
20520403          2.4350000-03 rho 705030000
20520404          2.6390000-03 rho 705040000
20520405          2.5890000-03 rho 705050000
20520406          2.4310000-03 rho 705060000
20520407          2.5930000-03 rho 705070000
20520408          2.5140000-03 rho 705080000
20520409          2.9860000-02 rho 709010000
20520410          2.0686000-02 rho 709020000
*
*   total primary inventory
*
20511100   totalpr    sum    1.0    0.0     1
20511101  0.0          1.0   cntrlvar   101
20511102               1.0   cntrlvar   102
20511103               1.0   cntrlvar   103
20511104               1.0   cntrlvar   104
20511105               1.0   cntrlvar   105
20511106               1.0   cntrlvar   106
20511107               1.0   cntrlvar   107
20511108               1.0   cntrlvar   108
20511109               1.0   cntrlvar   109
20511110               1.0   cntrlvar   110
20511111               1.0   cntrlvar   301
*
*   total secondary inventory
*
20520500   totalsec   sum    1.0    0.0     1
20520501  0.0          1.0   cntrlvar   201
20520502               1.0   cntrlvar   202
20520503               1.0   cntrlvar   203
20520504               1.0   cntrlvar   204
*
2060000   feedinl     tmdpvol
2060101  0.00114  1.0  0.0  0.0  0.0  0.0  5.0e-06  0.0 00
2060200  1
*
*   modified by y.s bang
*   maintaining 330 K
*
2060201   0.0    330.0    0.0
*2060201  0.0     460.0     0.0
*2060202  2100.0  460.0     0.0
*2060203  3000.0  400.0     0.0
*2060204  4500.0  300.0     0.0
*2060205  6000.0  220.0     0.0
*2060206  8000.0  130.0     0.0
*
2070000   steamout     tmdpvol
2070101  1.0  1.0  0.0  0.0  90.0  1.0  5.0e-06  0.0 00
2070200  2
*
2070201  0.0      5.85e06     1.0
2070202  2100.0   5.6e06      1.0
2070203  2763.0   2.78e06     1.0
2070204  3380.0   2.12e06     1.0
2070205  4500.0   1.80e06     1.0
2070206  6110.0   1.40e06     1.0
2070207  8000.0   1.20e06     1.0
*
*
7060000   feedinle     tmdpvol
7060101  0.00114  1.0  0.0  0.0  0.0  0.0  5.0e-06  0.0 00
7060200  1
*
*   modified by y.s bang
*   maintaining 330 K
*
7060201   0.0    330.0    0.0
*7060201  0.0     460.0     0.0
*7060202  2100.0  460.0     0.0
*7060203  3000.0  400.0     0.0
*7060204  4500.0  300.0     0.0
*7060205  6000.0  220.0     0.0
*7060206  8000.0  130.0     0.0
*
*
```

```
7070000  steamou     tmdpvol
7070101  1.0  1.0  0.0  0.0  90.0  1.0  5.0e-06  0.0 00
7070200  2
*
7070201  0.0        5.89e06      1.0
7070202  2100.0     5.60e06      1.0
7070203  2763.0     3.95e06      1.0
7070204  3380.0     3.15e06      1.0
7070205  4500.0     2.25e06      1.0
7070206  6110.0     1.50e06      1.0
7070207  8000.0     1.23e06      1.0
*
*
*   following items added to make easy postprocessing
*   at june 17, 1995 by ysbang.
*
*     control variables
*
* pressure in mpa
*
20521100  ppre  mult   0.000001  0.0  1
20521101   p    508010000
*
20521200  isgp  mult   0.000001  0.0  1
20521201   p    204010000
*
20521300  bsgp  mult   0.000001  0.0  1
20521301   p    704010000
*
20503000  ibrfw integral  1.  0.0  1
20503001  mflowj  422000000
*
*   differntial pressure in kpa
*
20521400  icrsg   sum   0.001   0.0   1
20521401  0.      1.    p     105100000
20521402          -1.   p     105030000
*
20521500  icrpm   sum   0.001   0.0   1
20521501  0.      1.    p     105110000
20521502          -1.   p     106020000
*
20521600  bcrsg   sum   0.001   0.0
20521601  0.      1.    p     403010000
20521602          -1.   p     403120000
*
20521700  bcrpm   sum   0.001   0.0   1
20521701  0.      1.    p     403080000
20521702          -1.   p     403120000
*
20521800  cordif  sum   0.001   0.0   1
20521801  0.      1.    p     505010000
20521802          -1.   p     505080000
*
*20523000  isglvl  sum   0.001   0.0   1
*20523001  0.      1.    p     202010000
*20523002          -1.   p     202120000
*
*20523100  bsglvl  sum   0.001   0.0   1
*20523101  0.      1.    p     702010000
*20523102          -1.   p     702100000
*
*   heat flus total
*
*20522800  tihf   sum   1.0   0.0   1
*20522801  0.  1.0   htrnr  201010101
*20522802      1.0   htrnr  201010201
*20522803      1.0   htrnr  201010301
*20522804      1.0   htrnr  201010401
*20522805      1.0   htrnr  201010501
*20522806      1.0   htrnr  201010601
*20522807      1.0   htrnr  201010701
*20522808      1.0   htrnr  201010801
*20522809      1.0   htrnr  201010901
*20522810      1.0   htrnr  201010001
*20522811      1.0   htrnr  201010101
*20522812      1.0   htrnr  201010201
*20522813      1.0   htrnr  201010301
*20522814      1.0   htrnr  201010401
*20522815      1.0   htrnr  201010501
*20522816      1.0   htrnr  201010601
*20522817      1.0   htrnr  201010701
*20522818      1.0   htrnr  201010801
*
*20522900   tbff  sum   1.0   0.0   1
*20522901  0.  1.0   htrnr  701010101
*20522902      1.0   htrnr  701010201
*20522903      1.0   htrnr  701010301
*20522904      1.0   htrnr  701010401
*20522905      1.0   htrnr  701010501
*20522906      1.0   htrnr  701010601
*20522907      1.0   htrnr  701010701
*20522908      1.0   htrnr  701010801
*20522909      1.0   htrnr  701010901
*20522910      1.0   htrnr  701010001
*20522911      1.0   htrnr  701010101
*20522912      1.0   htrnr  701010201
*20522913      1.0   htrnr  701010301
*20522914      1.0   htrnr  701010401
*20522915      1.0   htrnr  701010501
*20522916      1.0   htrnr  701010601
*
20523000  tilacc integral  1.  0.0  1
20523001  mflowj  620000000
*
20523100  tbacc integral  1.  0.0  1
```

```
20523101  mflowj  820000000
*
*
20510900   rvcore   sum    1.0   0.0    1
20510901  0.0     6.7400000-03 rho 501010000
20510902          6.5900000-03 rho 502010000
20510903          2.9600000-03 rho 503010000
20510904          5.2000000-04 rho 504010000
20510905          0.8717280-03 rho 505010000
20510906          0.8717280-03 rho 505020000
20510907          4.3586400-04 rho 505030000
20510908          4.3586400-04 rho 505040000
20510909          4.3586400-04 rho 505050000
20510910          4.3586400-04 rho 505060000
20510911          0.8717280-03 rho 505070000
20510912          0.8717280-03 rho 505080000
20510913          1.6400000-03 rho 506010000
20510914          2.8100000-03 rho 507010000
20510915          2.1800000-03 rho 508010000
20510916          1.4300000-03 rho 509010000
20510917          4.0470000-03 rho 509020000
20510918          3.9300000-04 rho 510010000
20510919          3.4000000-04 rho 513010000
20510920          3.4525000-04 rho 514010000
*
20540900   hcmass  sum    1.0   0.0    1
20540901  0.0   0.8717280-03 rho 555010000
20540902          0.8717280-03 rho 5550200[illegible]
20540903          4.3586400-04 rho 555030000
20540904          4.3586400-04 rho 555040000
20540905          4.3586400-04 rho 555050000
20540906          4.3586400-04 rho 555060000
20540907          0.8717280-03 rho 555070000
20540908          0.8717280-03 rho 555080000
*
*  total primary inventory
*
20511100   totalpr    sum    1.0    0.0     1
20511101  0.0          1.0   cntrlvar    101
20511102               1.0   cntrlvar    102
20511103               1.0   cntrlvar    103
20511104               1.0   cntrlvar    104
20511105               1.0   cntrlvar    105
20511106               1.0   cntrlvar    106
20511107               1.0   cntrlvar    107
20511108               1.0   cntrlvar    108
20511109               1.0   cntrlvar    109
20511110               1.0   cntrlvar    110
20511111               1.0   cntrlvar    301
20511112               1.0   cntrlvar    409
*
*  implementation of reactor vessel dp
*
20548800   rvdp       sum   0.001 1.0    1
20548801  0.0          1.0   p    502010000
20548802               -1.0  p    508010000
*
*
20531000   hotpow    function   1.0   5.7+04   1
20531001   time   0     500
*
20531200   avepow    function   1.0   3.8+04   1
20531201   time   0     550
*
20531300   totpow    sum        1.0   9.5+04   1
20531301   0.0        1.0      cntrlvar    310
20531302              1.0      cntrlvar    312
*
*   steam generation from core
*
20547100   stem    sum    1.0    0.0    1
20547101   0.0   0.8717280-03 gammaw 505010000
20547102         0.8717280-03 gammaw 505020000
20547103         4.3586400-04 gammaw 505030000
20547105         4.3586400-04 gammaw 505040000
20547106         4.3586400-04 gammaw 505050000
20547107         4.3586400-04 gammaw 505060000
20547108         0.8717280-03 gammaw 505070000
20547109         0.8717280-03 gammaw 505080000
*
20547200   hsteam   sum    1.0   0.0    1
20547201   0.0   0.8717280-03 gammaw 555010000
20547202         0.8717280-03 gammaw 555020000
20547203         4.3586400-04 gammaw 555030000
20547204         4.3586400-04 gammaw 555040000
20547205         4.3586400-04 gammaw 555050000
20547206         4.3586400-04 gammaw 555060000
20547207         0.8717280-03 gammaw 555070000
20547208         0.8717280-03 gammaw 555080000
*
*
20547300   stem    sum    1.0    0.0    1
20547301   0.0   0.8717280-03 vapgen 505010000
20547302         0.8717280-03 vapgen 505020000
20547303         4.3586400-04 vapgen 505030000
20547305         4.3586400-04 vapgen 505040000
20547306         4.3586400-04 vapgen 505050000
20547307         4.3586400-04 vapgen 505060000
20547308         0.8717280-03 vapgen 505070000
20547309         0.8717280-03 vapgen 505080000
*
20547400   hsteam   sum    1.0   0.0    1
20547401   0.0   0.8717280-03 vapgen 555010000
20547402         0.8717280-03 vapgen 555020000
20547403         4.3586400-04 vapgen 555030000
20547404         4.3586400-04 vapgen 555040000
```

```
20547405          4.3586400-04 vapgen 555050000
20547406          4.3586400-04 vapgen 555060000
20547407          0.8717280-03 vapgen 555070000
20547408          0.8717280-03 vapgen 555080000
*
20548100 totsteam  sum  1.0  0.0  1
20548101 0.0  1.0   cntrlvar  471
20548102          1.0   cntrlvar  472
*
20548200 totsteam  sum  1.0  0.0  1
20548201 0.0  1.0   cntrlvar  473
20548202          1.0   cntrlvar  474
*
*    end of transient input deck
```

Appendix C
RELAP5 Input Listing for Case E01

Steady State Input Deck for Case E01

```
= Semiscale Mod 2a, S-NC-8 Experiment Configuration (2-loop)
*
**********************************************************
*
*   Implementing 2-core channel model at may 18, 1996
*   ECCMIX component installation at Nov. 26, 1996
*
**********************************************************
*
0000100   new   stdy-st
0000101   run
0000105   30.0   32.0
0000110    nitrogen
*
0000201   800.0   1.0e-06   0.1   2   200    8000   8000
*
* Minor Edit Variables
*
*301   cntrlvar   917   * pzr liquid volume
*302   cntrlvar   918   * pzr liquid volume error
*303   cntrlvar   921   * letdown error
*304   cntrlvar   937   * intact loop hot temperatur error
*305   cntrlvar   947   * broken loop hot temp error
*306   cntrlvar   961   * intact loop sg level
*307   cntrlvar   971   * broken loop sg level
*308   cntrlvar   962   * IL SG Level error
*309   cntrlvar   963   * BL SG Level error
310   mflowj   101020000    * intact loop mass flow
311   mflowj   401020000    * broken loop mass flow
312   p 301010000    * pressurizer top pressure
313   p 204010000    * IL SG steam pressure
314   p   704010000    * BL SG steam pressure
315   cntrlvar   101    *   intact loop hot leg mass
316   cntrlvar   102    *   intact loop crossover leg mass
317   cntrlvar   103    *   intactloop cold leg mass
318   cntrlvar   104    *   intact loop s/g primary mass
319   cntrlvar   105    *   broken loop hot leg mass
320   cntrlvar   106    *   broken loop sg primary mass
321   cntrlvar   107    *   broken loop crossover leg mass
322   cntrlvar   108    *   broken loop cold leg mass
323   cntrlvar   109    *   rector vessel core and etc mass
324   cntrlvar   110    *   reactor downcomer mass
325   cntrlvar   201    *   intact loop secondary mass
326   cntrlvar   202    *   broken loop secondary mass
327   cntrlvar   301    *   pressurizer mass
328   cntrlvar   111    * total primary mass
329   cntrlvar   205    *   total secondary mass
*
*     Trips
*
0000501   time   0   ge   null   0   -1.0   1   * always true
0000502   time   0   lt   null   0   -1.0   n   * always false
*
*   steady state trip : alway true
*
0000599    time   0    ge   null   0    0.0    1    *always true
**********************************************************
**
*
*   intact loop piping
*
**********************************************************
**
* ILHL Nozzle
*-------------------------
1010000   hotleg branch
1010001   2   1
1010101   0.00420   0.21971   0.0   0.0   0.0   0.0   4.0e-05   0.0
+    00000
1010200   3   15.4e06   581.4    * 0.0    0.0   0.0
1011101   508010000   101000000   0.0   0.5   1.0   0100
1012101   101010000   102000000   0.0   0.0   0.0   0100
1011201   0.26   0.0   0.0
1012201   0.26   0.0   0.0
*-------------------------
*   ILHL piping to Pzr surgeline
*-------------------------
1020000   pc1a18 pipe
1020001   6
1020101   0.00349.4
1020102   0.00229.6
1020301   0.57074.1
1020302   0.17145.3
1020303   0.22564.4
1020304   0.38748.6
1020601   0.0.6
1020801   4.0e-05,0.0.6
1020901   0.0.0.0.1
1020902   0.288.0.288.2
1020903   0.0.0.0.3
1020904   0.0.0.0.5
1021001   00.6
1021101   0000.3
1021102   0100.4
1021103   0000.5
1021201   3   15.4e06   518.4   0.0   0.0   0.0   06
1021300   1
1021301   0.260   0.0   0.0   05
*-------------------------
*   Pzr surgrline connection point
*-------------------------
1030000   newspol branch
```

```
1030001  3    1
1030101  0.00229   0.55880   0.0   0.0   0.0   0.0   4.0e-05   0.0
+  00
1030200  3    15.4e06   581.4
1031101  102010000   103000000   0.0   0.18   0.18   0000
1032101  103010000   104000000   0.0   0.18   0.18   0000
1033101  302010000   103000000   0.0   0.90   0.90   0100
1031201  0.260 0.0 0.0
1032201  0.260 0.0 0.0
1033201  0.260 0.0 0.0
*-------------------------------
*  ILHL piping upto SG inlet plenum
*-------------------------------
1040000  newspol pipe
1040001  5
1040101  0.00229,5
1040301  0.23825,1
1040302  0.42494,2
1040303  0.35560,4
1040304  0.64808,5
1040601  0.0,1
1040602  90.0,4
1040603  55.0,5
1040701  0.0,1
1040702  0.42494,2
1040703  0.35560,4
1040704  0.52680,5
1040801  4.0e-05,0.0,5
1040901  0.540,0.540,1
1040902  0.0,0.0,3
1040903  0.288,0.288,4
1041001  00,5
1041101  0000,4
1041201  3   15.4e06   581.4 0.0 0.0   0.0    05
1041300  1
1041301  0.260 0.0 0.0 04
*-------------------------------
* Intact Loop Crossover Leg
*-------------------------------
1050000  pmpsuc pipe
1050001  14
1050101  0.00229,6
1050102  0.00349,14
1050301  0.44488,1
1050302  0.40640,2
1050303  0.35560,5
1050304  0.49301,6
1050305  0.58572,7
1050306  0.78740,9
1050307  0.26200,11
1050308  0.78740,13
1050309  0.58572,14
1050601  -55.0,1
1050602  -90.0,9
1050603  -45.0,10
1050604  45.0,11
1050605  90.0,14
1050701  -0.36068,1
1050702  -0.40640,2
1050703  -0.35560,5
1050704  -0.49301,6
1050705  -0.58572,7
1050706  -0.78740,9
1050707  -0.1968,10
1050708  0.1968,11
1050709  0.78740,13
1050710  0.58572,14
1050801  4.0e-05,0.0,14
1050901  0.288,0.288,1
1050902  0.0,0.0,9
1050903  0.450,0.450,11
1050904  0.0,0.0,13
1051001  00,14
1051101  0000,5
1051102  0100,6
1051103  0000,13
1051201  3   15.4e06   545.0 0.0 0.0   0.0    14
1051300  1
1051301  0.260 0.0 0.0 13
*-------------------------------
*  ILCL Piping including pump simulator
*-------------------------------
1060000  pmpsiml pipe
1060001  5
1060101  0.00091,4
1060102  0.00349,5
1060201  0.00091,1
1060202  0.00030,2
1060203  0.00091,4
1060301  0.44805,1
1060302  1.14808,2
1060303  0.60046,3
1060304  0.74320,4
1060305  0.75565,5
1060601  90.0,1.
1060602  0.0,5
1060801  4.0e-05,0.0,5
1060901  0.966,0.966,1
1060902  1.260,1.260,2
1060903  0.0,0.0,4
1061001  00,5
1061101  0000,1
1061102  0100,2
1061103  0000,3
1061104  0100,4
1061201  3   15.4e06   545.0   0.0 0.0   0.0    05
```

```
1061300  1
1061301  0.260 0.0 0.0 04
*---------------------------------
*  ECCS piping connection point
*---------------------------------
*1070000  pc19-3 branch
*1070001  2
*1070101  0.00349  0.79126  0.0  0.0  0.0  0.0  4.0e-05  0.0
*+   00
*1070200  3   15.4e06  545.0
*1071101  106010000  107000000  0.0  0.288  0.288  0000
*1072101  107010000  108000000  0.0  0.0  0.0  0100
*1071201  0.260 0.0 0.0
*1072201  0.260 0.0 0.0
*
*  Insatallation of ECCMIX component at Nov. 26, 1996
*
1070000  inclg  eccmix
1070001  3  0
1070101  0.00349  0.79626  0.0  0.0  0.0  0.0
1070102  4.0e-5  0.0  00000
1070200  0  1.5416e+07  0.11853e+07  0.24499e+07  0.0
1071101  610010000  107000000  4.64e-04  0.  0. 000000 *30
1072101  106010000  107000000  0.0 0.288 0.288  000000  *0.
1073101  107010000  108000000  0.0 0.0 0.0  000100  *0.
1071201  0.0  0.0  0.0
1072201  0.15395  0.15395  0.0
1073201  0.15395  0.15395  0.0
*---------------------------------
*  ILCL nozzle to reactor vessel
*---------------------------------
1080000  dcmrinl branch
1080001  1
1080101  0.00420  0.18161  0.0  0.0  0.0  0.0  4.0e-05  0.0
+   00
1080200  3  15.4e06 545.0
1081101  108010000  517010000  0.0  0.0  0.0  0100
1081201  0.260  0.0  0.0
*---------------------------------------------
*  junction between crossoverleg out let and ILCL piping
*---------------------------------------------
1100000  pmpsimi sngljun
1100101  105010000  106000000  0.0  0.0  0.0  0100
1100201  1  0.260  0.0  0.0
*************************************************************
**********
*  Intact loop steam  generator
*************************************************************
**********
*  ILSG U-tubes
*-------------------------------
2010000  sgprim pipe
2010001  20
2010101  0.00783,1
2010102  0.00184,19
2010103  0.00783,20
2010301  0.20955,1
2010302  1.21831,2
2010303  1.20561,8
2010304  0.48578,9
2010305  0.34411,11
2010306  0.48578,12
2010307  1.20561,18
2010308  1.21831,19
2010309  0.20955,20
2010601  90.0,9
2010602  70.0,10
2010603  -70.0,11
2010604  -90.0,20
*  andy modified 4/21/83 roughness from 4.0e-05 to 5.0e-05
2010801  4.0e-05,0.08386,1
2010802  4.0e-05,0.01974,19
2010803  4.0e-05,0.08386,20
2010901  0.0,0.0,8
2010902  0.3375,0.3375,9
2010903  0.675,0.675,10
2010904  0.3375,0.3375,11
2010905  0.0,0.0,19
2011001  00,20
2011101  0100,1
2011102  0000,18
2011103  0100,19
2011201  3  15.4e06  363.2 0.0  0.0  0.0  20
2011300  1
2011301  0.260 0.0 0.0 19
*-------------------------------
*  ILSG secondary side boiler section
*-------------------------------
2020000  sgshr pipe
2020001  12
2020101  0.0,12
2020201  0.00399,6
2020202  0.00371,7
* andy modified  20202U3   4/21/83
2020203  0.00477,8
2020204  0.00555,9
2020205  0.01342,10
2020206  0.03515,11
*2020207  0.05502,12
2020301  1.21831,1
2020302  1.20561,7
2020303  0.48578,8
2020304  0.58737,9
2020305  0.41891,10
2020306  0.37827,11
2020307  0.50635,12
```

```
* andy modified  2020401  to  2020413  4/21/83
2020401  0.014264,1
2020402  0.016574,2
2020403  0.013183,3
2020404  0.016789,4
2020405  0.013532,5
2020406  0.012870,6
2020407  0.012850,7
2020408  0.005849,8
2020409  0.009278,9
2020410  0.007631,10
2020411  0.015420,11
2020412  0.026025,12
*2020413  0.028815,13
2020601  90.0,12
2020801  5.0e-06,0.03108,7
2020802  5.0e-06,0.04063,8
2020803  5.0e-06,0.05956,9
2020804  5.0e-06,0.06729,10
2020805  5.0e-06,0.0,12
2021001  00.12
2021101  0100.9
2021102  0000.11
2021201  2 5.85e06  0.0 0.0 0.0  0.0  12
2021300  1
2021301  0.0 0.0 0.0 0.0 11
*-----------------------------------------
*  separator
*-----------------------------------------
*2030000  separatr separatr
*2030001  3  0
*2030101  0.0  0.50635  0.030848  0.0  -90.0  -0.50635  5.0e-
06  0.1365  00
*2030200  2 5.85e06 0.0
*2031101  203000000  204000000  0.0  0.0  0.0  0100
*2032101  202010000  203000000  0.0  0.0  0.0  0100
*2033101  203010000  209000000  0.0  0.0  0.0  0100
*2031201  0.0 0.0 0.0
*2032201  0.0 0.0 0.0
*2033201  0.0 0.0 0.0
*
2030000  separatr  separatr
2030001  3 0
2030101  0.0  0.50635  0.059663  0.0  90.0  0.50635  5.0e-6
+  0.1365  00
2030200  2  5.85e+6  0.9
*2030200  2  5.85e+6  0.0
*
*  modified by ysbang at 93/9/6
*  to match test initial condition
*
2031101  203010000  204000000  0.06729  0.0  0.0  00100
2032101  203000000  209000000  0.058963  0.0  0.0  00100
2033101  202010000  203000000  0.05139  0.0  0.0  00100
2031201  0.0  0.0  0.0
2032201  0.0  0.0  0.0
2033201  0.0  0.0  0.0
*-----------------------------------------
*  ILSG steam dome
*-----------------------------------------
2040000  steamdom snglvol
2040101  0.0  0.40005  0.03390  0.0  90.0  0.40005  5.0-6
+  0.32849  00
2040200  2  5843600.0  1.0
*-----------------------------------------
*  ILSG downcomer
*-----------------------------------------
2050000  stdome  pipe
2050001  10
2050101  0.0,10
2050301  0.41891,1
2050302  0.58737,2
2050303  0.48578,3
2050304  1.20561,9
2050305  1.21831,10
* a. modified 2050101,  2050401  to  2050405  4/21/83
2050401  0.006337.1
2050402  0.003252.2
2050403  0.001322.3
2050404  0.003279.9
2050405  0.003314.10
2050601  -90.0,10
2050801  5.0e-06.0.01023.10
2051001  00.10
2051101  0000.9
2051201  2 5.85e06  0.0 0.0  0.0  0.0  10
2051300  1
2051301  0.0 0.0 0.0 0.0 09
*-----------------------------------------
*  Auxiliary Feedwater Source
*-----------------------------------------
2060000  feedinl tmdpvol
2060101  0.00114  1.0  0.0  0.0  0.0  0.0  5.0e-06  0.0  00
2060200  3
2060201  0.0  5.85e06  495.0
*-----------------------------------------
*  Secondary side steam condenser
*-----------------------------------------
2070000  steamout tmdpvol
2070101  1.0  1.0  0.0  0.0  90.0  1.0  5.0e-06  0.0  00
2070200  2  * 1
*2070201  0.0  546.98  1.0
2070201  0.0  5.85e+6  1.0
*
*  modified by ysbang at 93/9/6
*  to match test initial condition
```

```
*
*-----------------------------------------
*   separator bypass part
*-----------------------------------------
2090000   sepbyps pipe
2090001   2
2090101   0.0,2
2090301   0.50635,1
2090302   0.37827,2
* andy modified volumes 2090401 to 2090402 4/21/63
2090401   0.029856,1
2090402   0.020686,2
2090601   -90.0,2
2090801   5.0e-06,0.13170,1
2090802   5.0e-06,0.08490,2
2091001   00,2
2091101   0000,1
*2091201   2   5.85e06   0.0 0.0   0.0   0.0 02
2091201    2 5.85e+06   0.01   0.0    0.0    0.0   02
*
*   modified by ysbang at 93/9/6
*   to match test initial condition
*
2091300   1
2091301   0.0 0.0 0.0 01
*
*-----------------------------------------
*   Junction between bypass part to downcomer
*-----------------------------------------
2100000   sepbyps sngljun
2100101   209010000   205000000   0.0   0.0   0.0   0000
2100201   1    0.260 0.0 0.0
*-----------------------------------------
*   Junction between ILHL and SG inlet plenum
*-----------------------------------------
2210000   sginlp sngljun
2210101   104010000   201000000   0.00229   0.288   0.288   0100
2210201   1    0.260 0.0 0.0
*-----------------------------------------
*   Junction between SG oulet plenum and Crossover leg
*-----------------------------------------
2220000   sgout-p sngljun
2220101   201010000   105000000   0.00229   0.288   0.288   0100
2220201   1    0.260 0.0 0.0
*-----------------------------------------
*   Junction between downcomer and boiler section
*-----------------------------------------
2310000   dcmrout sngljun
2310101   205010000   202000000   0.0   0.0   0.0   0100
2310201   1    0.0 0.0 0.0
*-----------------------------------------
*   SG steam outlet junction
*-----------------------------------------
2320000   steamout sngljun
2320101   204010000   207000000   0.0   0.0   0.0   0100
2320201   1    0.0 0.0 0.0
2330000   feedinlp tmdpjun
2330101   206000000   205000000   0.00043
*2330200   1   501   cntrlvar   2
2330201   -1.0   0.0   0.0   0.0
2330202   0.0   2.0   0.0   0.0
2330203   10.0   0.0   0.0   0.0
2330204   20.0   0.0   0.0   0.0
*************************************************************
**********
*   pressurizer
*************************************************************
**********
*   Pressurizer Vessel
*-----------------------------------------
3010000   preizer pipe
3010001   6
3010101   0.0,6
3010201   2.69125e-02,2
3010202   6.72832e-03,3
3010203   2.69125e-02,5
3010301   0.240915,2
3010302   0.21967,5
3010303   0.066294,6
3010401   0.0064825,2
3010402   0.0059118,5
3010403   0.001136,6
3010601   -90.0,6
3010801   4.0e-05,0.0,6
3011001   00,6
3011101   0000,2
3011102   0100,3
3011103   0000,5
3011201   2 15.4e06   1.0 0.0 0.0   0.0   01
*3011202   2 15.4e06   0.1728   0.0 0.0   0.0 02
3011202   2 15.4e06   1.0   0.0   0.0   0.0   02
*
*   Modified by ysbang at 96/9/18
*   to match test initial condition
*
3011203   2 15.4e06   0.0 0.0   0.0   0.0 06
3011300   1
3011301   0.0 0.0 0.0 05
*-----------------------------------------
*   Pressurizer Surgeline
*-----------------------------------------
3020000   pzrsurge pipe
3020001   7
3020101   0.0,7
3020301   0.20574,1
3020302   0.17780,2
```

```
3020303  0.48895,3
3020304  0.67310,7
3020401  7.1837-04,1
3020402  2.32141-04,2
3020403  1.64577-04,3
3020404  4.4046-05,7
3020601  -90.0,3
3020602  -45.0,7
3020701  -0.20574,1
3020702  -0.17780,2
3020703  -0.48895,3
3020704  -0.16380,7
3020801  4.0e-05,0.0,7
3020901  502.8,502.8,1
3020902  33.42,33.42,2
3020903  0.0,0.0,3
3020904  1.42,1.42,5
3020905  0.0,0.0,6
3021001  00,7
3021101  0000,6
3021201  3  15.4e06  581.4  0.0  0.0 0.0 07
3021300  1
3021301  0.0 0.0 0.0 06
*-------------------------------------------------------
*   Junction between Pressurizer Vessel and Surgeline
*-------------------------------------------------------
3210000  pzrout sngljun
3210101  301010000  302000000  0.00349  0.0  0.0  0100
3210201  1  0.0  0.0  0.0
*
*  need  to  modify  this
*-------------------------------------------------------
*   Pressurizer downstream
*-------------------------------------------------------
3300000  pcontrl tmdpvol
3300101  10.0  10.0  0.0  0.0  0.0  0.0  5.0e-06  0.0  00
3300200  2
3300201  0.0  15.4e06  1.0
*-------------------------------------------------------
*      Pressurizer control valve
*-------------------------------------------------------
3310000  pcontvlv sngljun
3310101  301000000  330000000  0.005  0.0  0.0  0100
3310201  1  0.0 0.0 0.0
*
**********************************************************
*******
* broken  loop  piping
**********************************************************
*******
*  Broken Loop Hot Leg Nozzle
*-------------------------------------------------------
4010000  vsslout branch
4010001  2  1
4010101  0.00349  0.40818  0.0  0.0  0.0  0.0  4.0e-05  0.0
+  00
4010200  3  15.4e06  581.4
4011101  508010000  401000000  0.0  0.5  1.0  0100
4012101  401010000  402000000  0.0  0.0  0.0  0100
4011201  0.260 0.0 0.0
4012201  0.260 0.0 0.0
*-------------------------------------------------------
*   BLHL Piping
*-------------------------------------------------------
4020000  hotleg pipe
4020001  7
4020101  0.00091,7
4020301  0.60985,1
4020302  0.40860,2
4020303  0.98579,3
4020304  0.41783,4
4020305  0.35235,5
4020306  0.34925,6
4020307  0.60879,7
4020601  0.0,3
4020602  90.0,6
4020603  50.0,7
4020701  0.0,3
4020702  0.41783,4
4020703  0.35235,5
4020704  0.34925,6
4020705  0.46711,7
4020801  4.0e-05,0.0,7
4020901  0.0,0.0,1
4020902  0.525,0.525,2
4020903  0.630,0.630,3
4020904  0.0,0.0,5
4020905  0.336,0.336,6
4021001  00000  7
4021101  0000,6
4021201  3  15.4e06  581.4  0.0  0.0  0.0  07
4021300  1
4021301  0.260  0.0  0.0  06
*-------------------------------------------------------
*  BL crossover leg
*-------------------------------------------------------
4030000  pmpsucn pipe
4030001  12
4030101  0.00091,12
4030301  0.49424,1
4030302  0.34925,2
4030303  0.35235,3
4030304  0.34925,4
4030305  1.08318,5
4030306  0.78512,7
4030307  0.48944,9
```

```
4030308  0.78512,11
4030309  0.70002,12
4030601  -60.0,1
4030602  -90.0,7
4030603  -45.0,8
4030604  45.0,9
4030605  90.0,12
4030701  -0.39980,1
4030702  -0.34925,2
4030703  -0.35235,3
4030704  -0.34925,4
4030705  -1.08318,5
4030706  -0.78512,7
4030707  -0.376936,8
4030708  0.376936,9
4030709  0.78512,11
4030710  0.70002,12
4030801  4.0e-05,0.0,12
4030901  0.336,0.336,1
4030902  0.0,0.0,6
4030903  0.525,0.525,3
4030904  0.0,0.0,11
4031001  00,12
4031101  0000,11
4031201  3   15.4e06   545.0   0.0   0.0   0.0   0.0   12
4031300  1
4031301  0.260   0.0   0.0   11
*-----------------------------------------------------
*    BLCL piping & ECC Injection point
*-----------------------------------------------------
* Installation of ECCMIX component at Nov. 26, 1996
*
*4040000  blcldsb snglvol
*4040101  0.00091   0.83083   0.0   0.0   0.0   0.0   4.0e-05   0.0
*+   0.0
*4040200  3   15.4e06   545.0
*
4070000  brclg    eccmix
4070001  3         0
4070101  0.00091 0.5303    0.0   0.0   0.0   0.0
4070102  4.0e-05 0.0    00000
4070200  0       1.5416e+07   0.11868e+07 0.24497e+07   0.0
4071101  810010000 407000000 4.64e+04   0.0   0.0 000000 *30.
4072101  404010000 407000000 0.00091    0.0   0.0 000000 *0.
4073101  407010000 405000000 0.00091    0.0   0.0 000000 *0.
4071201  0.0   0.0   0.0
4072201  0.1535   0.1535   0.0
4073201  0.1535   0.1535   0.0
*-----------------------------------------------------
*    BL ECC Injection point
*-----------------------------------------------------
4040000  brclg1   snglvol
4040101  0.00091 0.30   0.0   0.0   0.0   0.0
4040102  4.0e-05 0.0    000000
4040200  0    1.5416e+07 0.11868e+07 0.24497e+07   0.0
*-----------------------------------------------------
*    BLCL Piping
*-----------------------------------------------------
4050000  coldleg pipe
4050001  2
4050101  0.00091,2
4050301  0.27178,1
4050302  0.71145,2
4050601  0.0,2
4050801  4.0e-05,0.0,2
4050901  0.138,0.138,1
4051001  00,2
4051101  0000,1
4051201  3   15.4e06   545.0   0.0   0.0   0.0   02
4051300  1
4051301  0.260   0.0   0.0   01
*-----------------------------------------------------
*    BLCL Nozzle to RV
*-----------------------------------------------------
4060000  vsslinlt branch
4060001  2   1
4060101  0.00349   0.38898   0.0   0.0   0.0   0.0   4.0e-05   0.0
+   00
4060200  3   15.4e06   545.0
4061101  405010000   406000000   0.0   0.0   0.0   0100
4062101  406010000   517010000   0.0   1.0   0.5   0100
4061201  0.260   0.0   0.0
4062201  0.260   0.0   0.0
*-----------------------------------------------------
*    BL Pump
*-----------------------------------------------------
4500000  brkppmp pump
4500101  0.0   0.59847   0.00086   0.0   90.0   0.03137   00
4500108  403010000   0.00090   0.0   0.0   000100
*4500109  404000000   0.00010   0.0   0.0   000000
*
*    Junction Area Modified by ysbang at April 8, 1996
*    to correct unbalance of void distribution
*
4500109  404000000 0.00090   0.0     0.0     000000
*
*    end of modification
*
4500200  3   15.4e06   545.0
4500201  1   0.26   0.0   0.0
4500202  1   0.26   0.0   0.0
4500301 0   0   0 -1 0 501   0
4500302  1597.0000   0.1   .003240000   79.553000
+    2.9810000   .00925000
4500303  998.400   .00000   .0000   2.4800   .00000   .00000
*-----------------------------------------------------
```

```
*    BLCL junction for normal flow
*-------------------------------------------------------
*4210000   bicl-lg   sngljun
*4210101   404010000   405000000   0.00091   0.0   0.0    0000
*4210201   1    0.260   0.0   0.0
*
*************************************************************
******
*   Reactor Vessel
*************************************************************
******
*   Lower Plenum
*-------------------------------------------------------
5010000   lowpln1 snglvol
5010101   0.0   0.14224   0.00674   0.0   90.0   0.14224   4.0e-05
+    0.1162   00
5010200   3    15.4e06   545.0
*-------------------------------------------------------
*   Lower Plenum
*-------------------------------------------------------
5020000   lowpln2   branch
5020001   3   1
5020101   0.0   0.22004   0.00659   0.0   90.0   0.22004   4.0e-05
0.0699   00
5020200   3    15.4e06   545.0
5021101   501010000   502000000   0.0   0.0   0.0   0000
5022101   502010000   503000000   0.00431   0.0   0.0   0100
5023101   502010000   519000000   0.0    0.5   1.0   0100
5021201   0.0   0.0 0.0
5022201   0.52 0.0 0.0
5023201   0.52 0.0 0.0
*-------------------------------------------------------
*   Lower Core Support Structure
*-------------------------------------------------------
5030000   lowpln3 snglvol
5030101   0.0   0.31725   0.00296   0.0   90.0   0.31725   4.0e-05
+    0.0101   00
5030200   3    15.4e06   545.0
*-------------------------------------------------------
*   Core Inlet
*-------------------------------------------------------
5040000   lowpln4 branch
*5040001   2   1
*   modified by ysbang at may 18, 1996
*   to implement two core channel model
*
5040001    3   1
5040101   0.0   0.18136   0.00052   0.0   90.0   0.18136   4.0e-05
+   0.0101   00
5040200   3    15.4e06   545.0
5041101   503010000   504000000   0.0   0.0   0.0   0100
5042101   504010000   505000000   0.0   0.0   0.0   0100
5043101   504010000   555000000   0.0   0.0   0.0   0100
5041201   0.52 0.0 0.0
5042201   0.52 0.0 0.0
5043201   0.52 0.0 0.0
*-------------------------------------------------------
*      Active Core
*-------------------------------------------------------
*   average core channel
*   ( two-core channel model area ratio=50:50 )
*-------------------------------------------------------
5050000   core pipe
5050001   8
*5050101   0.00286,8
*     modified by ysbang at may 18, 1996
* to implement two core channel model
5050101    0.00143    8
*
5050301   0.6096,2
5050302   0.3048,6
5050303   0.6096,8
5050601   90.0,8
* andy modified volume 5050801 to 5.0e-05     5/4/83
5050801   2.0e-05,0.0,1.8
5050901   1.5,1.5,7
5051001   00,8
5051101   00100,7
*
*   modified by ysbang at may 18, 1996
*   to use rod bundle interfacial drag corr.
5051201   3 15.4e06   563.2 0.0   0.0    0.0 08
5051300   1
5051301   0.520 0.0 0.0    7
*-------------------------------------------------------*
*   hot core channel
*-------------------------------------------------------
5550000   core pipe
5550001   8
5550101   0.00143   8
5550301   0.6096,2
5550302   0.3048,6
5550303   0.6096,8
5550601   90.0,8
* andy modified volume 5050801 to 5.0e-05     5/4/83
5550801   2.0e-05,0.0,1.8
5550901   1.5,1.5,7
5551001   00,8
5551101   00100,7
5551201   3 15.4e06   563.2 0.0   0.0    0.0 08
5551300   1
5551301   0.520 0.0 0.0    7
*-------------------------------------------------------
*     multiple junction connection between hot and
*     average channel core volume by crossflow
*-------------------------------------------------------
```

```
5600000  corecros  mtpljun
5600001  8 1
5600011  505010003  555010004  ...  0.0  0.0  000003
+ 1.0  1.0  1.0  10000 10000  0  8
5601011  0.0  0.0  8
*----------------------------------------------------------
*  Core Outlet
*----------------------------------------------------------
5060000  upprpin1 branch
*5060001  2  1
*  modified by ysbang at may 18, 1996
*  to use rod bundle interfacial drag corr.
5060001  3 1
5060101  0.0  0.30505  0.00164  0.0  90.0  0.30505  2.0e-05
+  0.023  00
5060200  3  15.4e06  581.4
5061101  505010000  506000000  0.0  0.0  0.0  0100
5062101  555010000  506000000  0.0  0.0  0.0  0100
5063101  506010000  507000000  0.00321  0.0  0.0  0100
5061201  0.520 0.0  0.0
5062201  0.520 0.0  0.0
5063201  0.52  0.0  0.0
*----------------------------------------------------------
*  Upper Plenum
*----------------------------------------------------------
5070000  upprpin2  snglvol
5070101  0.0  0.68910  0.00281  0.0  90.0  0.68910  4.0e-05
+  0.0401  00
5070200  3  15.4e06  581.4
*----------------------------------------------------------
* Upper Plenum
*----------------------------------------------------------
5080000  upprpin3 branch
5080001  2  1
5080101  0.0  0.52070  0.00218  0.0  90.0  0.52070  4.0e-05
+  0.483  00
5080200  3  15.4e06  581.4
5081101  507010000  508000000  0.00277  0.0  0.0  0100
5082101  508010000  509000000  0.00415  0.0  0.0  0100
5081201  0.520 0.0 0.0
5082201  0.0 0.0 0.0
*----------------------------------------------------------
* Upper Part of Upper Plenum
*----------------------------------------------------------
5090000  upprpin4 pipe
5090001  2
5090101  0.0.2
5090301  0.2761.1
5090302  0.7786.2
5090401  0.00143.1
5090402  0.004047.2
5090601  90.0.2
5090701  4.0e-05.0.04.1
5090802  4.0e-05.0.0509.2
5091001  00.2
5091101  0000.1
5091201  3  15.4e06  581.4  0.0  0.0 0.0 02
5091301  0.0  0.0 0.0 01
*----------------------------------------------------------
*  Upper Part of Plenum
*----------------------------------------------------------
5100000  upprpin5 snglvol
5100101  0.0  0.0756  0.000393  0.0  90.0  0.0756  4.0e-05
+  0.0509  00
5100200  3  15.4e06  581.4
*----------------------------------------------------------
*  Guid Tube Thimble
*----------------------------------------------------------
5130000  guidtub branch
5130001  1  0
5130101  0.0  1.651  0.00034  0.0  90.0  1.651  5.0e-06
+  0.0160  00
5130200  3  15.4e06  581.4
5131101  507010000  513000000  0.0  0.0  0.0  0100
5131201  0.0  0.0  0.0
*----------------------------------------------------------
*  Guide Tube Thimble
*----------------------------------------------------------
5140000  sufcoin branch
5140001  1  0
5140101  0.0  2.3401  0.00034525  0.0  90.0  2.3401  5.0e-06
+  0.00975  00
5141101  506010000  514000000  0.0  0.0  0.0  0100
5140200  0  15415300.0  1356030.0  0.0  0.0
5141201  0.0  0.0  0.0
*----------------------------------------------------------
*  Upper Part of Cold Leg Nozzle/Downcomer
*----------------------------------------------------------
5160000  upprdcm1  annulus
5160001  1
5160101  0.00982.1
5160301  0.26670.1
5160601  90.0.1
5160801  4.0e-05.0.004351.1
5161001  00.1
5161201  3  15.4e06  560.0  0.0  0.0  0.0  1
*----------------------------------------------------------
*  Downcomer Annulus
*----------------------------------------------------------
5170000  upprdcm2 annulus
5170001  1
5170101  0.00982.1
5170301  0.38418.1
5170601  90.0.1
5170801  4.0e-05.0.04351.1
5171001  00.1
```

```
5171201  3  15.4e06  560.0  0.0  0.0  0.0  1
*-----------------------------------------------------
*   Downcomer Annulus
*-----------------------------------------------------
5180000  lowdcmr pipe
5180001  10
5180101  0.00242,10
5180301  0.4890,9
5180302  0.37661  10
5180601  90.0,10
5180801  4.0e-05,0.0,10
5180901  0.3,0.3,1
5180902  0.0,0.0,8
5180903  0.114,0.114,9
5181001  00,10
5181101  0000,9
5181201  3  15.4e06  550.0  0.0  0.0  0.0  10
5181300  1
5181301  -0.26,0.0,0.0,9
*-----------------------------------------------------
*   Connection Volume to Lower Plenum
*-----------------------------------------------------
5190000  lowdcm annulus
5190001  1
5190101  0.00708,1
5190301  0.29337,1
5190601  90.0,1
5190801  4.0e-05  0.0341,1
5191001  00,1
5191201  3  15.4e06  550.0  0.0  0.0  0.0  1
*-----------------------------------------------------
*   Junction between Downcomer and Volume
*-----------------------------------------------------
5200000  dcmrann sngljun
5200101  519010000  518000000  0.0  0.3  0.3  0100
5200201  1  -0.26  0.0  0.0
*-----------------------------------------------------
*   Junction between Downcomer and Upper part
*-----------------------------------------------------
5210000  upprdcmr sngljun
5210101  517010000  516000000  0.0  0.0  0.0  0100
5210201  1  0.0  0.0  0.0
*-----------------------------------------------------
*   Junction between Downcomer and Lower Volume
*-----------------------------------------------------
5220000  uplowcm sngljun
5220101  518010000  517000000  0.0  0.0  0.0  0100
5220201  1  -0.26  0.0  0.0
*-----------------------------------------------------
*   Upper Annulus of Downcomer
*-----------------------------------------------------
5310000  bypsline pipe
5310001  3
5310101  0.00007,3
5310301  0.38247,3
5310601  90.0,2
5310602  55.33,3
5310701  0.38247,2
5310702  0.31456,3
5310801  5.0e-06,0.0094,3
5310901  0.0,0.0,2
5311001  00,3
5311101  0000,2
5311201  3  15.4e06  550.0  0.0  0.0  0.0  3
5311300  1
5311301  0, 0.0,  0.0, 2
*-----------------------------------------------------
*   Junction between Guide Tube and Upper Penum Volume
*-----------------------------------------------------
5320000  gt-up  sngljun
5320101  513010000  510010000  0.0  0.0  0.0  0100
5320201  0  0.0  0.0  0.0
*-----------------------------------------------------
*   Junction between Guide Tube and Upper Penum Volume
*-----------------------------------------------------
5330000  sc-up  sngljun
5330101  514010000  510010000  0.0  0.0  0.0  0100
5330201  0  0.0  0.0  0.0
*-----------------------------------------------------
*   Junction between Upper Annulus and Lower Annulus
*-----------------------------------------------------
5340000  dc-byps sngljun
5340101  516010000  531000000  0.0  0.0  0.0  0100
5340201  0  0.0  0.0  0.0
*-----------------------------------------------------
*   Junction between Upper Penum and Upper Annulus
*-----------------------------------------------------
5350000  byps-up sngljun
5350101  531010000  510010000  1.62-5  300.  300.  0100
5350201  0  0.0  0.0  0.0
*-----------------------------------------------------
*   Junction between Upper Plenum Volumes
*-----------------------------------------------------
5360000  up-cnct sngljun
5360101  509010000  510000000  0.0  0.0  0.0  0100
5360201  0  0.0  0.0  0.0
*
*******************************************************
*  ecc  system
*******************************************************
* ECCS line from accumulator to cold leg
*-----------------------------------
6100000  ilcl-ecc  pipe
6100001  1
6100101  0.000464  1
6100301  3.048  1
```

```
6100401  0.0          1
6100601  0.0          1
6100701  0.0          1
6100801  5.0e-04     0.0    1
6101001  00           1
6101201  1    300.0    0.0  0.0  0.0  0.0 1
*-------------------------------
*   intact loop accumulator
*-------------------------------
6110000  ilcl-acc     accum
6110101  0.0  1.08032  0.071142  0.0  90.0  1.08032  5.0-04
0.0  00000
6110200  4.240e06    300.0
6111101  610000000   4.66e-04   0.0  0.0   0000
6112200  0.049043  0.0  9.144  0.0   1.45e-03  0  0  0  0
*-------------------------------
* ECCS line from accumulator to cold leg
*-------------------------------
8100000  blcl-ecc     pipe
8100001  1
8100101  0.000250     1
8100301  3.048        1
8100401  0.0          1
8100601  0.0          1
8100701  0.0          1
8100801  5.0e-04     0.0    1
8101001  00           1
8101201  1    300.0  0.0   0.0  0.0  0.0  1
*-------------------------------
*   broken loop accmulator
*-------------------------------
8110000  blcl-acc     accum
8110101  0.0  0.36027  0.02371   0.0  90.0  0.36027  5.0-04
+    0.0 00000
8110200  4.240e06    300.0
8111101  810000000   2.50e-04   0.0  0.0   0000
8112200  0.01776   0.0  6.096  0.0   1.45e-03  0  0  0  0
*
*****************************************************
*   broken   loop   steam   generator
*****************************************************
*    Broken Loop SG U-tubes
*-------------------------------
7010000  brlpsign pipe
7010001  18
7010101  0.00516,1
7010102  0.00061,17
7010103  0.00516,18
7010301  0.26035,1
7010302  1.19609,2
7010303  1.23101,3
7010304  1.15481,4
7010305  1.23101,5
7010306  1.25641,6
7010307  1.15481,7
7010308  1.06591,8
7010309  0.98206,10
7010310  1.06591,11
7010311  1.15481,12
7010312  1.25641,13
7010313  1.23101,14
7010314  1.15481,15
7010315  1.23101,16
7010316  1.19609,17
7010317  0.26035,18
7010601  90.0,8
7010602  77.0,9
7010603  -77.0,10
7010604  -90.0,18
* andy modified roughness to 5.0e-05   4/21/84
7010801  4.0e-05,0.07797,1
7010802  4.0e-05,0.01974,17
7010803  4.0e-05,0.07797,18
7010901  0.0,0.0,7
7010902  0.3375,0.3375,8
7010903  0.675,0.675,9
7010904  0.3375,0.3375,10
7010905  0.0,0.0,17
7011001  00,18
7011101  0100,1
7011102  0000,16
7011103  0100,17
7011201  3   15.4e06   581.4   0.0    0.0    0.0 18
7011300  1
7011301  0.260 0.0 0.0 17
*-------------------------------------------------------
*    Broken Loop SG Boiler Section
*-------------------------------------------------------
7020000  sgroud pipe
*7020001  11
7020001   10
7020101  0.0,10
7020201  0.00462,7
7020202  0.0,9
7020301  1.19609,1
7020302  1.23101,2
7020303  1.15481,3
7020304  1.23101,4
7020305  1.25641,5
7020306  1.15481,6
7020307  1.06591,7
7020308  1.65398,8
7020309  0.37827,9
7020310  0.50635,10
* andy modified volumes 7020401 to 7020411   4/21/83
7020401  0.013509,1
```

```
7020402   0.009036,2
7020403   0.008470,3
7020404   0.010739,4
7020405   0.009615,5
7020406   0.008474,6
7020407   0.008425,7
7020408   0.015782,8
7020409   0.016807,9
7020410   0.025882,10
*7020411   0.025882,11
7020601   90.0,10
7020801   5.0e-06,0.1999,8
7020802   5.0e-06,0.0,10
7021001   00,10
7021101   0100,7
7021102   0000,9
7021201   2   5.89e06    0.0 0.0    0.0    0.0   10
7021300   1
7021301   0.0 0.0 0.0 9
*-------------------------------------------------
*    Separator
*-------------------------------------------------
*7030000   separatr separatr
*7030001   3    0
** modified 4/21/83
*7030101   0.0   0.50635   0.030854   0.0   -90.0   0.50635   5.0e-
*+   06   0.13650   00
*7030200   2    5.89e06 0.0
*7031101   703000000   704000000   0.0   0.0   0.0   0100
*7032101   702010000   703000000   0.0   0.0   0.0   0100
*7033101   703010000   709000000   0.0   0.0   0.0   0100
*7031201   0.0   0.0 0.0
*7032201   0.0   0.0 0.0
*7033201   0.0   0.0 0.0
*
7030000    separatr    separatr
7030001    3   0
7030101    0.0   0.50635   0.056736   0.0   90.0   0.50635   5.0e-6
+    0.1365   00
*7030200    2    5.89e+6   0.0
7030200   2    5.89e+6   0.9
*
*   modified by ysbang at 93/9/6
*   to match test initial condition
*
7031101    703010000   704000000   0.0547542   0.0   0.0   00100
7032101    703000000   709000000   0.05299024   0.0   0.0
+    00100
7033101      702010000    703000000    0.04593079    0.0    0.0
00100
7031201    0.0    0.0    0.0
7032201    0.0    0.0    0.0
7033201    0.0    0.0    0.0
*-------------------------------------------------
*    Broken Loop Steam Dome
*-------------------------------------------------
7040000   steamdom   snglvol
7040101   0.0   0.40005   0.03390   0.0   90.0   0.40005   5.0e-06
+    0.32849   00
7040200   2    5.89e06   1.
*-------------------------------------------------
*    Broken Loop SG Downcomer
*-------------------------------------------------
7050000   sgdcomer pipe
7050001   8
* andy deleted this input ;   7050101   0.00164,8
7050101   0.0,8
7050301   1.65398,1
7050302   1.06591,2
7050303   1.15481,3
7050304   1.25641,4
7050305   1.23101,5
7050306   1.15481,6
7050307   1.23101,7
7050308   1.19609,8
* andy modified volumes   7050401   to   7050408   4/21/83
7050401   0.014458.1
7050402   0.002241.2
7050403   0.002435.3
7050404   0.002639.4
7050405   0.002589.5
7050406   0.002431.6
7050407   0.002593.7
7050408   0.002514.8
7050601   -90.0,8
7050801   5.0e-06.0.01016.8
7051001   00.8
7051101   0000.7
7051201   2   5.89e06   0.0 0.0   0.0 0.0 08
7051300   1
7051301   0.0 0.0 0.0 07
*-------------------------------------------------
*    Broken Loop Auxiliary Feedwater Source
*-------------------------------------------------
7060000   feedinlc   tmdpvol
7060101   0.00114   1.0   0.0   0.0   0.0   0.0   5.0e-06   0.0   00
7060200   3
7060201   0.0   5.89e06   495.0
*-------------------------------------------------
*    Broke Loop Steam Condenser
*-------------------------------------------------
7070000   steamotl tmdpvol
7070101   1.0   1.0   0.0   0.0   90.0   1.0   5.0e-06   0.0   00
7070200   1
7070201   0.0   547.4245    1.0
*-------------------------------------------------
```

```
*    Separator Bypass Volume
*-------------------------------------------------------
7090000   sepbyps pipe
7090001   2
7090101   0.0,2
7090301   0.50635,1
7090302   0.37827,2
* andy modified volumes   7090401   to   7090402   4/21/83
7090401   0.029860,1
7090402   0.020686,2
7090601   -90.0,2
7090801   5.0e-06,0.13170,1
7090802   5.0e-06,0.08490,2
7091001   00,2
7091101   0000,1
*7091201   2   5.89e06   0.0 0.0 0.0 0.0 02
7091201    2   5.89e+06   0.01    0.0   0.0    0.0   02
*
*    modified by ysbang at 93/9/6
*    to match test initial condition
*
7091300   1
7091301   0.0 0.0 0.0 01
*-------------------------------------------------------
*    Junction Between Separator Bypass Volume and Downcomer
*-------------------------------------------------------
7100000   sepbyps sngljun
7100101   709010000   705000000   0.0   0.0   0.0   0000
7100201   1   0.26 0.0 0.0
*-------------------------------------------------------
*    Junction between BLHL to SG Inlet Plenm
*-------------------------------------------------------
7210000   sgnlt sngljun
7210101   402010000   701000000   0.00091   0.336   0.336   0100
7210201   1    0.26 0.0 0.0
*-------------------------------------------------------
*    Junction between SG Outlet Plenum and Crossover Leg
*-------------------------------------------------------
7220000   sg-ouri sngljun
7220101   701010000   403000000   0.00091   0.336   0.336   0100
7220201   1   0.26   0.0 0.0
*-------------------------------------------------------
*    Junction between Downcomer and Boiler
*-------------------------------------------------------
7310000   dcomeut sngljun
7310101   705010000   702000000   0.0   0.0   0.0   0100
7310201   1   0.0    0.0 0.0
*-------------------------------------------------------
*    Junction Steam Discharge
*-------------------------------------------------------
7320000   steamuts sngljun
7320101   704010000   707000000   0.0   0.0   0.0   0100
7320201   1 0.0   0.0   0.0
*-------------------------------------------------------
*    Junction for Auxliary Feedwater
*-------------------------------------------------------
7330000   feed-ltp tmdpjun
7330101   706000000   705000000   0.00043
7330200   1   501    cntrlvar   12
7330201   -1.0   0.0   0.0   0.0
7330202    0.0   2.0   0.0   0.0
7330203   10.0   0.0   0.0   0.0
7330204   20.0   0.0   0.0   0.0
*
*******************************************************
*    heat   structures
*******************************************************
*    ILHL Piping
*-------------------------------------------------------
11011000   1   5   2   1   0.03625
11011100   0   2
11011101   0.00278,4
11011201   0001,4
11011301   0.0,4
11011401   568.0,5
11011501   101010000,   0,   1,    1,    0.21971,   1
11011601   0,   0,   0,    1,    0.21971,   1
11011701   0.0.0.0.0.0.0.1
11011801   0.   10.   10.   0.   0.   0.   0.   1.1
11011901   0.   10.   10.   0.   0.   0.   0.   1.1
*11011801   0.   0.0.    0.0.    0.21971,   1
*11011901   0.   0.0.    0.0,    0.21971,   1
*-------------------------------------------------------
*    ILHL Piping
*-------------------------------------------------------
11021000   4   5   2   1   0.03332
11021100   0   2
11021101   0.00278,4
11021201   0001,4
11021301   0.0,4
11021401   568.0,5
11021501   102010000,   0,   1,    1,    0.57074,   1
11021502   102020000,   0,   1,    1,    0.17145,   2
11021503   102030000,   0,   1,    1,    0.17145,   3
11021504   102040000,   0,   1,    1,    0.22504,   4
11021601   0. 0.    0.    1.    0.57074,   1
11021602   0. 0.    0.    1.    0.17145,   2
11021603   0. 0.    0.    1.    0.17145,   3
11021604   0. 0.    0.    1.    0.22504,   4
11021701   0.    0.0. 0.0. 0.0.   4
11021801   0   10.   10.   0.   0.   0.   0.   1.4
11021901   0   10.   10.   0.   0.   0.   0.   1.4
*11021801   0.0.0.0.0.0.57074,1
*11021802   0.0.0.0.0.0.17145,2
*11021803   0.0.0.0.0.0.17145,3
*11021804   0.0.0.0.0.0.22504,4
```

```
*11021901  0,0.0,0.0,0.57074,1
*11021902  0,0.0,0.0,0.17145,2
*11021903  0,0.0,0.0,0.17145,3
*11021604  0,0.0,0.0,0.22504,4
*-----------------------------------------------------
*   ILHL Piping
*-----------------------------------------------------
11022000  2  5  2  1  0.02699
11022100  0  2
11022101  0.00238,4
11022201  0001,4
11022301  0.0,4
11022401  568.0.5
11022501  102050000,10000,1.1,0.38748,2
11022601  0,0,0,1.0.38748,2
11022701  0,0.0,0,0.0,0,2
11022801  0.  10.  10.  0.  0.  0.  0.  1.2
11022901  0.  10.  10.  0.  0.  0.  0.  1.2
*11022801  0,0.0.0.0,0.38748.2
*11022901  0,0.0.0.0.0.38748.2
*-----------------------------------------------------
*   ILHL Piping
*-----------------------------------------------------
11032000  1  5  2  1  0.02699
*11032100  1022
11032100  0  2
11032101  0.00238  4
11032201  0001  4
11032301  0.0  4
11032401  568.0.5
11032501  103010000.0.1.1.0.55880.1
11032601  0.0.0.1.0.55880.1
11032701  0.0.0.0.0.0.0.1
11032801  0.  10.  10.  0.  0.  0.  0.  1.1
11032901  0.  10.  10.  0.  0.  0.  0.  1.1
*11032801  0.0.0.0.0.0.55880.1
*11032901  0.0.0.0.0.0.55880.1
*-----------------------------------------------------
*   ILHL Piping to SG Inlet Plenum
*-----------------------------------------------------
11042000  5  5  2  1  0.02699
*11042100  1022
11042100  0  2
11042101  0.00238.4
11042201  0001.4
11042301  0.0.4
11042401  568.0.5
11042501  104010000.0.1.1.0.23825.1
11042502  104020000.0.1.1.0.42494.2
11042503  104030000.10000.1.1.0.35560.4
11042504  104050000.0.1.1.0.64808.5
11042601  0.0.0.1.0.23825.1
11042602  0.0.0.1.0.42494.2
11042603  0,0,0,1,0.35560.4
11042604  0,0,0,1,0.64808.5
11042701  0,0.0,0,0,0.0.5
11042801  0.  10.  10.  0.  0.  0.  0.  1.5
11042901  0.  10.  10.  0.  0.  0.  0.  1.5
*11042801  0,0.0.0.0,0.23825.1
*11042802  0,0.0,0.0,0.42494,2
*11042803  0,0.0,0.0,0.35560,4
*11042804  0,0.0.0.0,0.64808.5
*11042901  0,0.0,0.0,0.23825.1
*11042902  0,0.0,0.0,0.42494,2
*11042903  0,0.0.0.0,0.35560,3
*11042904  0.0.0.0.0.0.64808.5
*-----------------------------------------------------
*   IL Corssover Leg Piping (1 to 6)
*-----------------------------------------------------
11052000  6  5  2  1  0.02699
*11052100  1022
11052100  0  2
11052101  0.00238.4
11052201  0001.4
11052301  0.0.4
11052401  350.0.5
11052501  105010000.0.1.1.0.44488.1
11052502  105020000.0.1.1.0.40640.2
11052503  105030000.10000.1.1.0.35560.5
11052504  105060000.0.1.1.0.49301.6
11052601  0.0.0.1.0.44488.1
11052602  0.0.0.1.0.40640.2
11052603  0.0.0.1.0.35560.5
11052604  0.0.0.1.0.49301.6
11052701  0.0.0.0.0.0.0.6
11052801  0.  10.  10.  0.  0.  0.  0.  1.6
11052901  0.  10.  10.  0.  0.  0.  0.  1.6
*11052801  0.0.0.0.0.0.44488.1
*11052802  0.0.0.0.0.0.40640.2
*11052803  0.0.0.0.0.0.35560.5
*11052804  0.0.0.0.0.0.49301.6
*11052901  0.0.0,0.0.0.44488.1
*11052902  0.0.0.0.0.0.40640.2
*11052903  0.0.0.0.0.0.35560.5
*11052904  0.0.0.0.0.0.49301.6
*-----------------------------------------------------
*   IL Crossover Leg Piping (7 to 14)
*-----------------------------------------------------
11051000  8  5  2  1  0.03332
*11051100  1021
11051100  0  2
11051101  0.00278.4
11051201  0001.4
11051301  0.0.4
11051401  550.0.5
11051501  105070000.0.1.1.0.58572.1
```

```
11051502  105080000,0,1,1,0.78740,3
11051503  105100000,0,1,1,0.26200,5
11051504  105120000,10000,1,1,0.78740,7
11051505  105140000,0,1,1,0.58572,8
11051601  0,0,0,1,0.58572,1
11051602  0,0,0,1,0.78740,3
11051603  0,0,0,1,0.26200,5
11051604  0,0,0,1,0.78740,7
11051605  0,0,0,1,0.58572,8
11051701  0,0,0,0,0,0,0,8
*11051801  0,0,0,0,0,0,58572,1
*11051802  0,0,0,0,0,0,78740,3
*11051803  0,0,0,0,0,0,26200,5
*11051804  0,0,0,0,0,0,78740,7
*11051805  0,0,0,0,0,0,58572,8
*11051901  0,0,0,0,0,0,58572,1
*11051902  0,0,0,0,0,0,78740,3
*11051903  0,0,0,0,0,0,26200,5
*11051904  0,0,0,0,0,0,78740,7
*11051905  0,0,0,0,0,0,58572,8
11051801  0.  10.  10.  0.  0.  0.  0.  1.8
11051901  0.  10.  10.  0.  0.  0.  0.  1.8
*-----------------------------------------------------
*    ILCL Piping (1 to 4)
*-----------------------------------------------------
11063000  4  5  2  1  0.01699
11063100  0  2
11063101  0.00178,4
11063201  0001,4
11063301  0.0,4
11063401  550.0,5
11063501  106010000,0,1,1,0.44805,1
11063502  106020000,0,1,1,1.14808,2
11063503  106030000,0,1,1,0.60046,3
11063504  106040000,0,1,1,0.74320,4
11063601  0,0,0,1,0.44805,1
11063602  0,0,0,1,1.14808,2
11063603  0,0,0,1,0.60046,3
11063604  0,0,0,1,0.74320,4
11063701  0,0,0,0,0,0,0,4
*11063801  0,0,0,0,0,0,44805,1
*11063802  0,0,0,0,0,1,14808,2
*11063803  0,0,0,0,0,0,60046,3
*11063804  0,0,0,0,0,0,74320,4
*11063901  0,0,0,0,0,0,44805,1
*11063902  0,0,0,0,0,1,14808,2
*11063903  0,0,0,0,0,0,60046,3
*11063904  0,0,0,0,0,0,74320,4
11063801  0.  10.  10.  0.  0.  0.  0.  1.4
11063901  0.  10.  10.  0.  0.  0.  0.  1.4
*-----------------------------------------------------
*    ILCL Piping (5)
*-----------------------------------------------------
11061000  1  5  2  1  0.03332
*11061100  1021
11061100  0  2
11061101  0.00278,4
11061201  0001,4
11061301  0.0,4
11061401  550.0,5
11061501  106050000,0,1,1,0.75565,1
11061601  0,0,0,1,0.75565,1
11061701  0,0,0,0,0,0,0,1
*11061801  0,0,0,0,0,0,75565,1
*11061901  0,0,0,0,0,0,75565,1
11061801  0.  10.  10.  0.  0.  0.  0.  1.1
11061901  0.  10.  10.  0.  0.  0.  0.  1.1
*-----------------------------------------------------
*    Injection Nozzle Piping
*-----------------------------------------------------
11071000  1  5  2  1  3.332000e-02
*11071100  1021
11071100  0  2
11071101  0.00278,4
11071201  0001,4
11071301  0.0,4
11071401  550.0,5
11071501  107010000,0,1,1,0.79126,1
11071601  0,0,0,1,0.79126,1
11071701  0,0,0,0,0,0,0,1
*11071801  0,0,0,0,0,0,79126,1
*11071901  0,0,0,0,0,0,79126,1
11071801  0.  10.  10.  0.  0.  0.  0.  1.1
11071901  0.  10.  10.  0.  0.  0.  0.  1.1
*-----------------------------------------------------
*    ILCL Nozzle (to RV) Piping
*-----------------------------------------------------
11081000  1  5  2  1  0.03625
*11081100  1011
11081100  0  2
11081101  0.00238,4
11081201  0001,4
11081301  0.0,4
11081401  550.0,5
11081501  108010000,0,1,1,0.18161,1
11081601  0,0,0,1,0.18161,1
11081701  0,0,0,0,0,0,0,1
*11081801  0,0,0,0,0,0,18161,1
*11081901  0,0,0,0,0,0,18161,1
11081801  0.  10.  10.  0.  0.  0.  0.  1.1
11081901  0.  10.  10.  0.  0.  0.  0.  1.1
*-----------------------------------------------------
*    IL SG U-tubes
*-----------------------------------------------------
12001000  18  5  2  1  0.00987
12001100  0  2
```

```
12001101  0.00031,  4
12001201  0002, 4
12001301  0.0,  4
12001401  550.0,  5
*
*    left bndry    incre    B.C typ factor    no
*
12001501  201020000, 0,  1,  1,  7.30986,  1
12001502  201030000,    10000,  1,  1,  7.23366,  7
12001503  201090000, 0,  1,  1,  2.91468,  8
12001504  201100000,    10000,  1,  1,  2.06466, 10
12001505  201120000, 0,  1,  1,  2.91468, 11
12001506  201130000,    10000,  1,  1,  7.23366, 17
12001507  201190000, 0,  1,  1,  7.30986, 18
*
*    rightbndry    incre    B.C typ factor    no
*
12001601  202010000, 0,  1,  1,  7.30986,  1
12001602  202020000,    10000,  1,  1,  7.23366,  7
12001603  202080000, 0,  1,  1,  2.91468,  8
12001604  202090000, 0,  1,  1,  2.06466, 10
12001605  202080000, 0,  1,  1,  2.91468, 11
12001606  202070000,   -10000,  1,  1,  7.23366, 17
12001607  202010000. 0.  1,  1,  7.30986, 18
*
12001701  0.  0.0.    0.0,    0.0,    18
*12001801  0.    0.01974,  0.01974,  1.21831,  1
*12001802  0.    0.01974,  0.01974,  1.20561,  7
*12001803  0.    0.01974,  0.01974,  0.48578,  8
*12001804  0.    0.01974,  0.01974,  0.34411, 10
*12001805  0.    0.01974,  0.01974,  0.48578, 11
*12001806  0.    0.01974,  0.01974,  1.20561, 17
*12001807  0.    0.01974,  0.01974,  1.21831, 18
*12001901  0.    0.00635,  0.00635,  1.21831,  1
*12001902  0.    0.00635,  0.00635,  1.20561,  7
*12001903  0.    0.00635,  0.00635,  0.48578,  8
*12001904  0.    0.00635,  0.00635,  0.34411, 10
*12001905  0.    0.00635,  0.00635,  0.48578, 11
*12001906  0.    0.00635,  0.00635,  1.20561, 17
*12001907  0.    0.00635,  0.00635.1.21831.18
12001801  0.  10.  10.  0.  0.  0.  0.  1. 18
12001901  0.  10.  10.  0.  0.  0.  0.  1. 18
*
12012000  10  5  2  1  0.07479
12012100  0  2
12012101  0.00937.4
12012201  0006.4
12012301  0.0.4
12012400  2001
12012501  202010000. 0.  1.  1.  1.21831.  1
12012502  202020000. 10000.  1.  1.  1.20561.  7
12012503  202080000. 0.  1.  1.  0.48578.  8
12012504  202090000. 0.  1.  1.  0.58737.  9
12012505  202100000. 0.  1.  1.  0.41891. 10
12012601  202010000, 0.  1.  1.  1.21831.  1
12012602  202020000, 10000.  1.  1.  1.20561.  7
12012603  202080000, 0.  1.  1.  0.48578.  8
12012604  202090000, 0.  1.  1.  0.58737.  9
12012605  202100000, 0.  1.  1.  0.41891, 10
12012701  0,0.0.0.0,0.0.10
*12012801  0,0.0,0.0,1.21831,1
*12012802  0,0.0,0.0,1.20561,7
*12012803  0,0.0,0.0,0.48578,8
*12012804  0,0.0,0.0,0.58737,9
*12012805  0,0.0,0.0,0.41891,10
*12012901  0.0.0,0.0,1.21831,1
*12012902  0,0.0.0.0,1.20561,7
*12012903  0,0.0,0.0,0.48578,8
*12012904  0,0.0,0.0,0.58737,9
*12012905  0,0.0,0.0,0.41891,10
12012801  0.  10.  10.  0.  0.  0.  0.  1. 10
12012901  0.  10.  10.  0.  0.  0.  0.  1. 10
*-------------------------------------------------------
*    IL SG Shroud Wall
*-------------------------------------------------------
12022000  10  5  2  1  0.10578
12022100  0  2
12022101  0.00094.4
12022201  0001.4
12022301  0.0.4
12022400  2001
12022501  202010000,0.1.1.1.21831.1
12022502  202020000,10000.1.1.1.20561.7
12022503  202080000,0.1.1.0.48578.8
12022504  202090000,0.1.1.0.58737.9
12022505  202100000,0.1.1.0.41891.10
12022601  205100000,0.1.1.1.21831.1
12022602  205090000,-10000.1.1.1.20561.7
12022603  205030000,0.1.1.0.48578.8
12022604  205020000,0.1.1.0.58737.9
12022605  205010000,0.1.1.0.41891.10
12022701  0,0.0,0.0,0.0.10
*12022801  0,0.03108,0.04968.1.21831.1
*12022802  0,0.03108,0.04968.1.20561.7
*12022803  0.0.04063,0.07265,0.48578.8
*12022804  0.0.05956,0.11346,0.58737.9
*12022805  0.0.06729,0.18133,0.41891.10
*12022901  0.0.0.0.0,1.21831.1
*12022902  0.0.0.0.0,1.20561.7
*12022903  0,0.0.0.0.0.40578.8
*12022904  0.0.0.0.0.0.58737.9
*12022905  0.0.0.0.0.0.41891.10
12022801  0.  10.  10.  0.  0.  0.  0.  1. 10
12022901  0.  10.  10.  0.  0.  0.  0.  1. 10
*-------------------------------------------------------
*    IL SG Downcomer Internal Structure
```

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*-------------------------------------------------
12032000  10  5  2  1  0.11074
12032100  0  2
12032101  0.00238,4
12032201  0001,4
12032301  0.0,4
12032400  2001
12032501  205010000,0,1,1,0.35840,1
12032502  205020000,0,1,1,0.50253,2
12032503  205030000,0,1,1,0.41561,3
12032504  205040000,10000,1,1,1.03147,9
12032505  205100000,0,1,1,1.04234,10
12032601  205010000,0,1,1,0.35840,1
12032602  205020000,0,1,1,0.50253,2
12032603  205030000,0,1,1,0.41561,3
12032604  205040000,10000,1,1,1.03147,9
12032605  205100000,0,1,1,1.04234,10
12032701  0.0,0,0,0,0,0,10
*12032801  0,0,0,0,0,0,41891,1
*12032802  0,0,0,0,0,0,58737,2
*12032803  0,0,0,0,0,0,48578,3
*12032804  0,0,0,0,0,1,20561,9
*12032805  0,0,0,0,0,1,21831,10
*12032901  0,0,0,0,0,0,41891,1
*12032902  0,0,0,0,0,0,58737,2
*12032903  0,0,0,0,0,0,48578,3
*12032904  0,0,0,0,0,1,20561,9
*12032905  0,0,0,0,0,1,21831,10
12032801  0.  10.  10.  0.  0.  0.  0.  1.10
12032901  0.  10.  10.  0.  0.  0.  0.  1.10
*-------------------------------------------------
*    IL SG Shroud Wall Upper Part
*-------------------------------------------------
12042000  3  5  2  1  0.13233
12042100  0  2
12042101  0.00105,4
12042201  0001,4
12042301  0.0,4
12042400  2001
12042501  202110000,0,1,1,0.37827,1
12042502  202120000,0,1,1,0.50635,2
12042503  203010000,0,1,1,0.50635,3
12042601  209020000,0,1,1,0.37827,1
12042602  209010000,0,1,1,0.50635,2
12042603  203010000,0,1,1,0.50635,3
12042701  0.0,0,0,0,0,0,3
*12042801  0,0,0,0,0,0,37827,1
*12042802  0,0,0,0,0,0,50635,3
*12042901  0,0,0,0,0,0,37827,1
*12042902  0,0,0,0,0,0,50635,3
12042801  0.  10.  10.  0.  0.  0.  0.  1.3
12042901  0.  10.  10.  0.  0.  0.  0.  1.3
*-------------------------------------------------
*    IL SG Outer Wall to Environment
*-------------------------------------------------
12053000  10  5  2  1  0.12146
12053100  0  2
12053101  0.00377,4
12053201  0001,4
12053301  0.0,4
12053400  2001
12053501  205010000,0,1,1,0.41891,1
12053502  205020000,0,1,1,0.58737,2
12053503  205030000,0,1,1,0.48578,3
12053504  205040000,10000,1,1,1.20561,9
12053505  205100000,0,1,1,1.21831,10
12053601  -200,0,3205,1,0.41891,1
12053602  -200,0,3205,1,0.58737,2
12053603  -200,0,3205,1,0.48578,3
12053604  -200,0,3205,1,1.20561,9
12053605  -200,0,3205,1,1.21831,10
12053701  0,0,0,0,0,0,10
*12053801  0,0,0,0,0,0,41891,1
*12053802  0,0,0,0,0,0,58737,2
*12053803  0,0,0,0,0,0,48578,3
*12053804  0,0,0,0,0,1,20561,9
*12053805  0,0,0,0,0,1,21831,10
*12053901  0,0,0,0,0,0,41891,1
*12053902  0,0,0,0,0,0,58737,2
*12053903  0,0,0,0,0,0,48578,3
*12053904  0,0,0,0,0,1,20561,9
*12053905  0,0,0,0,0,1,21831,10
12053801  0.  10.  10.  0.  0.  0.  0.  1.10
12053901  0.  10.  10.  0.  0.  0.  0.  1.10
*-------------------------------------------------
*    IL SG Outer Wall at Steam Dome
*-------------------------------------------------
12054000  4  5  2  1  0.20477
12054100  0  2
12054101  0.00596,4
12054201  0001,4
12054301  0.0,4
12054400  2001
12054501  204010000,0,1,1,0.40005,1
12054502  203010000,0,1,1,0.50635,2
12054503  209010000,0,1,1,0.50635,3
12054504  209020000,0,1,1,0.37827,4
12054601  -200.  0.  3204.  1.0.40005,1
12054602  -200.  0.  3204.  1.0.50635,2
12054603  -200.  0.  3204.  1.0.50635,3
12054604  -200.  0.  3204.  1.0.37827,4
12054701  0.0,0,0,0,0,0,4
*12054801  0,0,0,0,0,0,40005,1
*12054802  0,0,0,0,0,0,50635,3
*12054803  0,0,0,0,0,0,37827,4
*12054901  0,0,0,0,0,0,40005,1
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*12054902  0.0.0,0.0,0.50635,3
*12054903  0,0.0,0.0,0.37827,4
12054801  0.  10.  10.  0.  0.  0.  0.  1.4
12054901  0.  10.  10.  0.  0.  0.  0.  1.4
*-------------------------------------------------
*   IL Steam Dome Outer Wall
*-------------------------------------------------
12055000  1  5  1  1  0.0
12055100  0  2
12055101  0.00596,4
12055201  0001,4
12055301  0.0,4
12055401  543.0,5
12055501  204010000,0.1,0.0.13174,1
12055601  0,0,0,0,0.13174,1
12055701  0,0.0,0.0,0.0,1
*12055801  0.0.0,0.0.0.40955,1
*12055901  0.0.0,0.0.0.40955,1
12055801  0.  10.  10.  0.  0.  0.  0.  1.1
12055901  0.  10.  10.  0.  0.  0.  0.  1.1
*-------------------------------------------------
*   Pressurizer  walls
*-------------------------------------------------
13011000  6 5 2 1  1.0795e-01
13011100  0  2
13011101  0.007144.4
13011201  0001,4
13011301  0.0,4
13011401  600.0,5
13011501  301010000,0.1,1,0.183565,1
13011502  301020000,10000,1,1,0.2549,5
13011503  301050000,0.1,1,0.00686,6
13011601  0.0,0.1,0.183565,1
13011602  0.0.0.1.0.2549,5
13011603  0.0.0.1.0.00686,6
13011701  0.0.0.0.0.0.0,6
*13011801  0.0.0.0.0.0.183564,2
*13011802  0.0.0.0.0.0.2549,5
*13011803  0.0.0.0.0.0.00686,6
*13011901  0.0.0.0.0.0.183564,2
*13011902  0.0.0.0.0.0.2549,5
*13011903  0.0.0.0.0.0.00686,6
13011801  0.  10.  10.  0.  0.  0.  0.  1.6
13011901  0.  10.  10.  0.  0.  0.  0.  1.6
*-------------------------------------------------
*   Pressurizer Heater
*-------------------------------------------------
13012000  2 5 2 1  0.0
13012100  0  2
13012101  0.00210.4
13012201  0001.4
13012301  1.0.1
13012302  0.0.4
13012401  615.0,5
13012501  0,0,0,1,5.91312,2
13012601  301050000,-10000,1,1,5.91312,2
13012701  300,0.5,0.0,0.0,2
*13012901  0,0.0,0.0168,0.24638,2
13012801  0.  10.  10.  0.  0.  0.  0.  1.2
13012901  0.  10.  10.  0.  0.  0.  0.  1.2
*-------------------------------------------------
*   Surgr Line Wall
*-------------------------------------------------
13022000  1 5 2 1  1.560000e-02
13022100  0  2
13022101  0.00178,4
13022201  0001,4
13022301  0.0,4
13022400  3011
13022501  302010000,0.1,1,0.36713,1
13022601  0,0,0,1,0.36713,1
13022701  0,0.0,0.0,0.0,1
*13022801  0,0.0,0.0,0.22860,1
*13022901  0,0.0,0.0,0.22860,1
13022801  0.  10.  10.  0.  0.  0.  0.  1.1
13022901  0.  10.  10.  0.  0.  0.  0.  1.1
*-------------------------------------------------
*   Surgeline Outer Wall
*-------------------------------------------------
13023000  6 5 2 1  4.70000e-03
13023100  0  2
13023101  0.00098.4
13023201  0001,4
13023301  0.0 4
13023400  3011
13023501  302020000,0,1,1,0.1778,1
13023502  302030000,0.1,1,0.48895,2
13023503  302040000,10000,1,1,0.6731,6
13023601  0,0,0,1,0.1778,1
13023602  0.0.0.1.0.48895,2
13023603  0.0.0.1.0.6731,6
13023701  0.0.0.0.0.0.0,6
*13023801  0.0.0.0.0.0.1778,1
*13023802  0.0.0.0.0.0.48895,2
*13023803  0.0.0.0.0.0.6731,6
*13023901  0.0.0.0.0.0.1778,1
*13023902  0.0.0.0.0.0.48895,2
*13023903  0.0.0.0.0.0.6731,6
13023801  0.  10.  10.  0.  0.  0.  0.  1.6
13023901  0.  10.  10.  0.  0.  0.  0.  1.6
*-------------------------------------------------
*   Broken Loop Piping
*-------------------------------------------------
*   BLHL Piping
*-------------------------------------------------
14011000  1  5  2  1  0.03332
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*14011100  1021
14011100  0  2
14011101  0.00278,4
14011201  0001,4
14011301  0.0 4
14011401  568.0,5
14011501  401010000,0,1,1,0.40818,1
14011601  0,0,0,1,0.40818,1
14011701  0,0.0,0.0,0.0,1
*14011801  0,0.0,0.0,0.40818,1
*14011901  0,0.0,0.0,0.40818,1
14011801  0.  10.  10.  0.  0.  0.  0.  1.1
14011901  0.  10.  10.  0.  0.  0.  0.  1.1
*-------------------------------------------------
*    BLHL Piping
*-------------------------------------------------
14021000  7  5  2  1  0.01699
14021100  0  2
14021101  0.00178,4
14021201  0001,4
14021301  0.0,4
14021401  568.0,5
14021501  402010000,0.1,1,0.60985,1
14021502  402020000,0.1,1,0.40860,2
14021503  402030000,0.1,1,0.98572,3
14021504  402040000,0.1,1,0.41783,4
14021505  402050000,0.1,1,0.35235,5
14021506  402060000,0.1,1,0.34925,6
14021507  402070000,0.1,1,0.60879,7
14021601  0,0,0 1,0.60985,1
14021602  0,0,0,1,0.40860,2
14021603  0,0,0,1,0.98572,3
14021604  0,0,0,1,0.41783,4
14021605  0,0,0,1,0.35235,5
14021606  0,0,0,1,0.34925,6
14021607  0,0,0,1,0.60879,7
14021701  0,0,0,0,0,0,0,7
*14021801  0,0,0,0,0,0,0,60985,1
*14021802  0,0,0,0,0,0,0,40860,2
*14021803  0,0,0,0,0,0,0,98572,3
*14021804  0,0,0,0,0,0,0,41783,4
*14021805  0,0,0,0,0,0,0,35235,5
*14021806  0,0,0,0,0,0,0,34925,6
*14021807  0,0,0,0,0,0,0,60879,7
*14021901  0,0,0,0,0,0,0,60985,1
*14021902  0,0,0,0,0,0,0,40860,2
*14021903  0,0,0,0,0,0,0,98572,3
*14021904  0,0,0,0,0,0,0,41783,4
*14021905  0,0,0,0,0,0,0,35235,5
*14021906  0,0,0,0,0,0,0,34925,6
*14021907  0,0,0,0,0,0,0,60879,7
14021801  0.  10.  10.  0.  0.  0.  0.  1.7
14021901  0.  10.  10.  0.  0.  0.  0.  1.7
*-------------------------------------------------
*    BL Crossover Leg Piping
*-------------------------------------------------
*14031000  1  5  2  1  0.01699
14031000  12 5  2  1  0.01699
*14031100  4021
14031100  0  2
14031101  0.00178,4
14031201  0001,4
14031301  0.0,4
14031401  557.0,5
14031501  403010000,0.1,1,0.49424,1
14031502  403020000,0.1,1,0.34925,2
14031503  403030000,0.1,1,0.35235,3
14031504  403040000,0.1,1,0.34925,4
14031505  403050000,0.1,1,1.08318,5
14031506  403060000,10000,1,1,0.78512,7
14031507  403080000,10000,1,1,0.48944,9
14031508  403100000,10000,1,1,0.78512,11
14031509  403120000,0,1,1,0.70002,12
14031601  0,0,0,1,0.49424,1
14031602  0,0,0,1,0.34925,2
14031603  0,0,0,1,0.35235,3
14031604  0,0,0,1,0.34925,4
14031605  0,0,0,1,1.08318,5
14031606  0,0,0,1,0.78512,7
14031607  0,0,0,1,0.48944,9
14031608  0,0,0,1,0.78512,11
14031609  0,0,0,1,0.70002,12
14031701  0,0,0,0,0,0,0,12
*14031801  0,0,0,0,0,0,0,49424,1
*14031802  0,0,0,0,0,0,0,34925,2
*14031803  0,0,0,0,0,0,0,35235,3
*14031804  0,0,0,0,0,0,0,34925,4
*14031805  0,0,0,0,0,1,08318,5
*14031806  0,0,0,0,0,0,0,78512,7
*14031807  0,0,0,0,0,0,0,48944,9
*14031808  0,0,0,0,0,0,0,78512,11
*14031809  0,0,0,0,0,0,0,70002,12
*14031901  0,0,0,0,0,0,0,49424,1
*14031902  0,0,0,0,0,0,0,34925,2
*14031903  0,0,0,0,0,0,0,35235,3
*14031904  0,0,0,0,0,0,0,34925,4
*14031905  0,0,0,0,0,0,1,08318,5
*14031906  0,0,0,0,0,0,0,78512,7
*14031907  0,0,0,0,0,0,0,48944,9
*14031908  0,0,0,0,0,0,0,78512,11
*14031909  0,0,0,0,0,0,0,70002,12
14031801  0.  10.  10.  0.  0.  0.  0.  1.12
14031901  0.  10.  10.  0.  0.  0.  0.  1.12
*-------------------------------------------------
*    BLCL Piping
*-------------------------------------------------
```

```
14041000 3 5 2 1  1.699000e-02
*14041100  4021
14041100  0  2
14041101  0.00178,4
14041201  0001,4
14041301  0.0,4
*14041400  4031
14041401  557.0  5
14041501  404010000,0,1,1,0.60046,1
14041502  405010000,0,1,1,0.50216,2
14041503  405020000,0,1,1,0.71145,3
14041601  0,0,0,1,0.60046,1
14041602  0,0,0,1,0.50216,2
14041603  0,0,0,1,0.71145,3
14041701  0,0.0,0.0,0.0,3
*14041801  0,0.0,0.0,0.0,0.60046,1
*14041802  0,0.0.0.0.0,0.50216,2
*14041803  0,0.0.0.0.0,0.71145,3
*14041901  0,0.0,0.0,0.0,0.60046,1
*14041902  0,0.0.0.0.0,0.50216,2
*14041903  0,0.0,0.0.0,0.71145,3
14041801  0.  10.  10.  0.  0.  0.  0.  1.3
14041901  0.  10.  10.  0.  0.  0.  0.  1.3
*-----------------------------------------------------
*   BLCL Piping
*-----------------------------------------------------
14051000  1  5  2  1  0.03332
*14051100  1021
14051100  0  2
14051101  0.00278,4
14051201  0001,4
14051301  0.0,4
14051401  557.  5
14051501  406010000  0  1  1  0.47168  1
14051601  0  0  0  1  0.47168  1
14051701  0  0.0  0.0  0.0  1
*14051801  0  0.0  0.0  0.47168  1
*14051901  0  0.0  0.0  0.47168  1
14051801  0.  10.  10.  0.  0.  0.  0.  1.1
14051901  0.  10.  10.  0.  0.  0.  0.  1.1
*
*-----------------------------------------------------
*   Reactor Vessel Structure
*-----------------------------------------------------
*   Lower Plenum Wall
*-----------------------------------------------------
15011000  1  5  1  1  0
15011100  0  2
15011101  0.0370  4
15011201  0001,4
15011301  0.0, 4
15011401  557.0  5
15011501  501010000,  0,  1,  0,  0.05200,  1
15011601  0,  0,  0,  0,  0.05200,  1
15011701  0,  0.0  0.0  0.0  1
*15011801  0,  0,  0.0,0.0,0.25730,  1
*15011901  0,  0,  0.0,0.0,0.25730,  1
15011801  0.  10.  10.  0.  0.  0.  0.  1.1
15011901  0.  10.  10.  0.  0.  0.  0.  1.1
*
15012000  4  5  2  1  0
15012100  0  2
15012101  0.00134,  4
15012201  0003, 4
15012301  0.0,  4
15012400  5011
15012501  0, 0, 0, 1, 3.556, 1
15012502  0, 0, 0, 1, 5.501, 2
15012503  0, 0, 0, 1, 7.93125, 3
15012504  0, 0, 0, 1, 4.534, 4
15012601  501010000, 0, 1, 1, 3.556, 1
15012602  502010000, 0, 1, 1, 5.501, 2
15012603  503010000, 0, 1, 1, 7.93125, 3
15012604  504010000, 0, 1, 1, 4.534, 4
15012701  0, 0.0, 0.0, 0.0, 4
*15012901  0, 0.0, 0.0, 0, 0.14224, 1
*15012902  0, 0.0, 0.0, 0, 0.22004, 2
*15012903  0, 0.0, 0.0, 0, 0.31725, 3
*15012904  0, 0.0, 0.0, 0, 0.18136, 4
15012801  0.  10.  10.  0.  0.  0.  0.  1.4
15012901  0.  10.  10.  0.  0.  0.  0.  1.4
*-----------------------------------------------------
*
*   Implementing two core channel model
*   power ratio avg:hot=60:40
*
*   average core
*-----------------------------------------------------
15013000  16  11  2  1  0
15013100  0  2
15013101  0.000529  3
15013102  0.000406  5
15013103  0.000656  8
15013104  0.000495 10
15013201  0004, 3
15013202  0005, 5
15013203  0004, 8
15013204  0001,  10
15013301  0.0,  3
15013302  1.0,  5
15013303  0.0, 10
15013401  557.0,  11
15013501  0, 0, 0, 0, 0.0, 16
*15013601  505010000, 10000, 1, 1, 13.4112, 2
*15013602  505030000, 10000, 1, 1, 6.7056,  6
*15013603  505070000, 10000, 1, 1, 13.4112, 8
```

```
*15013604    505010000, 10000, 1, 1, 1.8288, 10
*15013605    505030000, 10000, 1, 1, 0.9144, 14
*15013606    505070000, 10000, 1, 1, 1.8288, 16
*
*   implement 50:50 heat transfer area
*
15013601    505010000, 10000, 1, 1, 6.70560, 2
15013602    505030000, 10000, 1, 1, 3.35280   6
15013603    505070000, 10000, 1, 1, 6.70560, 8
15013604    505010000, 10000, 1, 1, 0.91440 10
15013605    505030000, 10000, 1, 1, 0.45720 14
15013606    505070000, 10000, 1, 1, 0.91440 16
15013701    500, 0.07500, 0.0, 0.0, 1
15013702    500, 0.17583, 0.0, 0.0, 2
15013703    500, 0.12000, 0.0, 0.0, 3
15013704    500, 0.12917, 0.0, 0.0, 4
15013705    500, 0.12917, 0.0, 0.0, 5
15013706    500, 0.12000, 0.0, 0.0, 6
15013707    500, 0.17583, 0.0, 0.0, 7
15013708    500, 0.07500, 0.0, 0.0, 8
15013709    0.    0.0, 0.0, 0.0, 16
*15013901    0, 0.0, 0.01357, 0.6096, 2
*15013902    0, 0.0, 0.01357, 0.3048, 6
*15013903    0, 0.0, 0.01357, 0.6096,10
*15013904    0, 0.0, 0.01357, 0.3048,14
*15013905    0, 0.0, 0.01357, 0.6096,16
15013801   0.   10.   10.   0.   0.   0.   0.   1. 16
15013901   0.   10.   10.   0.   0.   0.    0.   1. 16
*-------------------------------------------------------
*   hot channel core
*-------------------------------------------------------
15513000    16    11    2   1   0
15513100    0   2
15513101    0.000529   3
15513102    0.000406   5
15513103    0.000656   8
15513104    0.000495 10
15513201    0004, 3
15513202    0005, 5
15513203    0004, 8
15513204    0001,   10
15513301    0.0,   3
15513302    1.0,   5
15513303    0.0, 10
15513401    557.0,    11
15513501    0, 0, 0, 0, 0.0, 16
15513601    555010000, 10000, 1, 1, 6.70560, 2
15513602    555030000, 10000, 1, 1, 3.35280   6
15513603    555070000, 10000, 1, 1, 6.70560, 8
15513604    555010000, 10000, 1, 1, 0.91440 10
15513605    555030000, 10000, 1, 1, 0.45720 14
15513606    555070000, 10000, 1, 1, 0.91440 16
*
15513701    550, 0.07500, 0.0, 0.0, 1
15513702    550, 0.17583, 0.0, 0.0, 2
15513703    550, 0.12000, 0.0, 0.0, 3
15513704    550, 0.12917, 0.0, 0.0, 4
15513705    550, 0.12917, 0.0, 0.0, 5
15513706    550, 0.12000, 0.0, 0.0, 6
15513707    550, 0.17583, 0.0, 0.0, 7
15513708    550, 0.07500, 0.0, 0.0, 8
15513709    0,    0.0, 0.0, 0.0, 16
*15513901    0, 0.0, 0.01357, 0.6096, 2
*15513902    0, 0.0, 0.01357, 0.3048, 6
*15513903    0, 0.0, 0.01357, 0.6096,10
*15513904    0, 0.0, 0.01357, 0.3048,14
*15513905    0, 0.0, 0.01357, 0.6096,16
15513801   0.   10.   10.   0.   0.   0.   0.   1. 16
15513901   0.   10.   10.   0.   0.   0.    0.   1. 16
*-------------------------------------------------------
*   Lowe Plenum Wall
*-------------------------------------------------------
15021000   1   5    2   1   1.286500e-01
15021100    0   2
15021101    0.01568    4
15021201    0001, 4
15021301    0.0,   4
15021401    557.0    5
15021501    501010000, 0,    1,    1,    0.14224, 1
15021601    0,    0, 0, 1,    0.14224, 1
15021701    0,    0.0, 0.0, 0.0, 1
*15021801    0,    0.0, 0.0, 0.0, 1
*15021901    0,    0.0, 0.0, 0.0, 1
15021801   0.   10.   10.   0.   0.   0.   0.   1. 1
15021901   0.   10.   10   0.   0.   0.    0.   1. 1
*
15022000   1   5    2   1   9.771000e-02
15022100    0   2
15022101    0.01588    4
15022201    0001, 4
15022301    0.0,   4
15022401    557.0    5
15022501    502010000, 0,    1,    1,    0.22004, 1
15022601    0,   0,   0, 1,    0.22004, 1
15022701    0,    0.0, 0.0, 0.0, 1
*15022801    0,    0.0, 0.0, 0.22004, 1
*15022901    0,    0.0, 0.0, 0.22004, 1
15022801   0.   10.   10.   0.   0.   0.   0.   1. 1
15022901   0.   10.   10.   0.   0.   0.    0.   1. 1
*-------------------------------------------------------
*   External Downcomer Outer Wall
*-------------------------------------------------------
15023000   1   5    2   1   7.621000e-02
15023100    0   2
15023101    0.01588    4
15023201    0001, 4
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15023301    0.0,   4
15023401    557.0    5
15023501    519010000, 0,    1,    1,    0.29337, 1
15023601    0, 0,   0, 1,    0.29337, 1
15023701    0,    0.0. 0.0, 0.0, 1
*15023801    0,    0.0, 0.0, 0.29337, 1
*15023901    0,    0.0, 0.0, 0.29337, 1
15023801  0.  1.   10.  0.  0.  0.  0.  1. 1
15023901  0.  10.  10.  0.  0.  0.   0.  1. 1
*-------------------------------------------------
*    External Downcomer Outer Wall
*-------------------------------------------------
15031000    10  5    2  1   0.02775
15031100    0  2
15031101    0.00471    4
15031201    0001, 4
15031301    0.0,   4
15031401    557.0   5
15031501    518010000, 10000. 1, 1,    0.4890,   9
15031502    518100000, 0, 1, 1,    0.37661,10
15031601    0,    0,   0, 1,    0.4890,   9
15031602    0,    0,   0, 1,    0.37661,10
15031701    0,    0.0, 0.0, 0.0,   10
*15031801    0,    0.0, 0.0, 0.4890,   9
*15031802    0,    0.0. 0.0. 0.37661.10
*15031901    0,    0.0. 0.0. 0.4890.   9
*15031902    0,    0.0. 0.0. 0.37661.10
15031801  0.  10.  10.  0.  0.  0.  0.  1. 10
15031901  0.  10.  10.  0.  0.  0.   0.  1. 10
*-------------------------------------------------
*    Internal Wall between Downcomer and Lower Plenum
*-------------------------------------------------
15024000    1  5    2  1   0.05121
15024100    0  2
15024101    0.00160    4
15024201    0001. 4
15024301    0.0.   4
15024401    557.0    5
15024501    503010000. 0.    1.    1.   0.31725.   1
15024601    519010000. 0.    1.    1.   0.31725.   1
15024701    0.    0.0. 0.0. 0.0. 1
*15024801    0.    0.0. 0.0. 0.31725. 1
*15024901    0.    0.0. 0.0. 0.31725. 1
15024801  0.  10.  10.  0   0.  0.  0.  1. 1
15024901  0.  10.  10.  0.  0.  0.   0.  1. 1
*-------------------------------------------------
*    Outer Wall of Core Inlet Volume
*-------------------------------------------------
15025000  2  5    2  1   4.041000e-02
15025100    0  2
15025101    0.01765    4
15025201    0001. 4
15025301    0.0.   4
15025401    557.0   5
15025501    504010000, 0,    1,    1,   0.18136,   1
15025502    505010000, 0,    1,    1,   0.0762,    2
15025601    0, 0, 0, 1, 0.18136, 1
15025602    0, 0, 0, 1, 0.0762,  2
15025701    0,    0.0, 0.0, 0.0, 2
*15025801    0, 0.0, 0.0, 0.18136, 1
*15025802    0, 0.0, 0.0, 0.0762,  2
*15025901    0, 0.0, 0.0, 0.18136, 1
*15025902    0, 0.0, 0.0, 0.0762,  2
15025801  0.  10.  10.  0.  0.  0.  0.  1. 2
15025901  0.  10.  10.  0.  0.  0.   0.  1. 2
*-------------------------------------------------
*    Active Core Outer Wall
*-------------------------------------------------
15014000  8  5    2  1   4.041000e-02
15014100    0  2
15014101    0.01093    4
15014201    0001. 4
15014301    0.0,   4
15014401    575.5, 5
15014501    505010000. 0. 1,    1,   0.5334,    1
15014502    505020000. 0. 1,    1,   0.6096,    2
15014503    505030000, 10000.    1.   1.   0.3048.    6
15014504    505070000, 10000.    1.   1.   0.6096.    8
15014601    0.   0.   0. 1.   0.5334.    1
15014602    0.   0.   0. 1.   0.6096.    2
15014603    0.   0.   0. 1.   0.3048.    6
15014604    0.   0.   0. 1.   0.6096.    8
15014701    0.   0.0.0.0. 0.    8
*15014801    0.   0.0.0.0.   0.5334.    1
*15014802    0.   0.0.0.0.   0.6096.    2
*15014803    0.   0.0.0.0.   0.3048.    6
*15014804    0.   0.0.0.0.   0.6096.    8
*15014901    0.   0.0.0.0.   0.5334.    1
*15014902    0.   0.0.0.0.   0.6096.    2
*15014903    0.   0.0.0.0.   0.3048.    6
*15014904    0.   0.0.0.0.   0.6096.    8
15014801  0.  10.  10.  0.  0.  0.  0.  1. 8
15014901  0.  10.  10.  0.  0.  0.   0.  1. 8
*-------------------------------------------------
*    External Downcomer Upper Part Outer Wall
*-------------------------------------------------
*15015000  1  5    2  1   0.
*15015100    0  2
*15015101    0.02858    4
*15015201    0001. 4
*15015301    0.0.   4
*15015400    5011
*15015501    516010000. 0. 1,    1,   0.3765,    1
*15015601    0.   0.   0. 1.   0.3765.    1
*15015701    0.   0.0.0.0. 0.0.   1
**15015801    0.   0.0.0.0.   0.54381.   1
```

```
**15015901    0,  0.0,0.0,  0.54381,  1
*15015801  0.  10.  10.  0.  0.  0.  0.  1.1
*15015901  0.  10.  10.  0.  0.  0.  0.  1.1
*-----------------------------------------------
*   External Downcomer Middle Part Outer Wall
*-----------------------------------------------
15016000  2  5   2  1  3.810000e-02
15016100   0  2
15016101   0.00572   4
15016201   0001, 4
15016301   0.0,  4
15016400   5011
15016501   0,  0,  0, 1, 0.26670,  1
15016502   0,  0,  0, 1, 0.38418,  2
15016601   516010000, 0, 1,   1,  0.26670,  1
15016602   517010000, 0, 1,   1,  0.38418,  2
15016701   0,  0.0,0.0, 0.0,  2
*15016801   0,  0.0,0.0,  0.26670,  1
*15016802   0,  0.0,0.0,  0.38418,  2
*15016901   0,  0.0,0.0,  0.26670,  1
*15016902   0,  0.0,0.0,  0.38418,  2
15016801  0.  10.  10.  0.  0.  0.  0.  1.2
15016901  0.  10.  10.  0.  0.  0.   0.  1.2
*-----------------------------------------------
*   External Downcomer Outer Wall
*-----------------------------------------------
15017000  2  5   2  1  0.08272
15017100   0  2
15017101   0.00671   4
15017201   0001. 4
15017301   0.0.  4
15017400   5011
15017501   516010000. 0. 1.   1.  0.26670.  1
15017502   517010000. 0. 1.   1.  0.38418   2
15017601   0.  0.  0. 1.  0.26670.  1
15017602   0.  0.  0. 1.  0.38418.  2
15017701   0.  0.0.0. 0.0.  2
*15017801   0.  0.0.0.0.  0.26670.  1
*15017802   0.  0.0.0.0.  0.38418.  2
*15017901   0.  0.0.0.0.  0.26670.  1
*15017902   0.  0.0.0.0.  0.38418.  2
15017801  0.  10.  10.  0.  0.  0.  0.  1.2
15017901  0.  10.  10.  0.  0.  0.   0  1.2
*-----------------------------------------------
*   Core Outlet Wall
*-----------------------------------------------
15041000  1  5   2  1  0.
*15041100   5012
15041100   0  2
15041101   0.00134.  4
15041201   0003.4
15041301   0.0.4
15041401   594.0. 5
15041501   0,  0,  0,  1,  5.08.  1
15041601   506010000, 0, 1,   1,  5.08, 1
15041701   0,  0.0.0.0, 0.0,  1
*15041801   0,  0.0,0.0,  0.2032.  1
*15041901   0,  0.0,0.0,  0.2032.  1
15041801  0.  10.  10.  0.  0.  0.  0.  1.1
15041901  0.  10.  10.  0.  0.  0.   0.  1.1
*-----------------------------------------------
*   Core Outlet Wall
*-----------------------------------------------
15042000  1  5   2  1  0.04166
15042100   0  2
15042101   0.01816   4
15042201   0001. 4
15042301   0.0,  4
15042400   5041
15042501   506010000. 0. 1.   1.  0.30505.  1
15042601   0.  0.  0, 1.  0.30505.  1
15042701   0.  0.0.0.0, 0.0,  1
*15042801   0.  0.0,0.0,  0.30505.  1
*15042901   0.  0.0,0.0.  0.30505.  1
15042801  0.  10.  10.  ^  ?.  0.  0.  1.1
15042901  0.  10.  10.  '  J.  0.   0.  1.1
*-----------------------------------------------
*   Core Outlet Wall
*-----------------------------------------------
15043000  1  5   2  1  4.299000e-02
15043100   0  2
15043101   0.01153   4
15043201   0001. 4
15043301   0.0.  4
15043400   5041
15043501   507010000. 0. 1.   1.  0.68910.  1
15043601   0.  0.  0. 1.  0.68910.  1
15043701   0.  0.0.0.0. 0.0.  1
*15043801   0.  0.0.0.0.  0.68910.  1
*15043901   0.  0.0.0.0.  0.68910.  1
15043801  0.  10.  10.  0.  0.  0.  0.  1.1
15043901  0.  10.  10.  0.  0.  0.   0.  1.1
*-----------------------------------------------
*   Upper Plenum Wall
*-----------------------------------------------
15044000  1  5   2  1  3.826000e-02
15044100   0  2
15044101   0.01742   4
15044201   0001. 4
15044301   0.0.  4
15044400   5041
15044501   508010000. 0. 1.   1.  0.52070.  1
15044601   0.  0.  0. 1.  0.52070.  1
15044701   0.  0.0.0.0. 0.0.  1
*15044801   0.  0.0.0.0.  0.52070.  1
*15044901   0.  0.0.0.0.  0.52070.  1
```

```
15044801  0.  10.  10.  0.  0.  0.  0.  1.1
15044901  0.  10.  10.  0.  0.  0.  0.  1.1
*-------------------------------------------------------
*    Upper Plenum Wall
*-------------------------------------------------------
15045000  3  5  2  1  4.299000e-02
*15045100   5043
15045100  0  2
15045101  0.01153,4
15045201  0001,4
15045301  0.0,4
15045400   5041
15045501   509010000, 0, 1,   1,  0.2761,   1
15045502   509020000, 0, 1,   1,  0.7786,   2
15045503   510010000, 0, 1,   1,  0.0756,   3
15045601   0,  0,  0, 1,  0.2761,   1
15045602   0,  0,  0, 1,  0.7786,   2
15045603   0,  0,  0, 1,  0.0756,   3
15045701   0,  0.0,0.0, 0.0,  3
*15045801   0,  0.0,0.0,  0.2761,   1
*15045802   0,  0.0,0.0,  0.7786,   2
*15045803   0,  0.0,0.0,  0.0756,   3
*15045901   0,  0.0,0.0,  0.2761,   1
*15045902   0,  0.0,0.0,  0.7786,   2
*15045903   0,  0.0,0.0,  0.0756,   3
15045801  0.  10.  10.  0.  0.  0.  0.  1.3
15045901  0.  10.  10.  0.  0.  0.  0.  1.3
*-------------------------------------------------------
*    Upper Plenum Wall
*-------------------------------------------------------
15046000  1  5  1  1  0.
15046100   0  2
15046101   0.04976   4
15046201   0001. 4
15046301   0.0.  4
15046400   5043
15046501   510010000, 0, 1,   0,  0.00575,   1
15046601   0,  0,  0, 0,  0.00575,   1
15046701   0,  0.0,0.0, 0.0,  1
*15046801   0,  0.0,0.0,  0.26670,  1
*15046901   0,  0.0,0.0,  0.26670,  1
15046801  0.  10.  10.  0.  0.  0.  0.  1.1
15046901  0.  10.  10.  0.  0.  0.  0.  1.1
*-------------------------------------------------------
*    Internal Wall Between Upper Plenum and Downcomer
*-------------------------------------------------------
15062000  4  5  2  1  8.050000e-03
15062100   0  2
15062101   0.00037   4
15062201   0001. 4
15062301   0.0.  4
15062401   568.0, 5
15062501   513010000, 0, 1,   1,  0.0756,   1
15062502   513010000, 0, 1,   1,  0.7786,   2
15062503   513010000, 0, 1,   1,  0.2761,   3
15062504   513010000, 0, 1,   1,  0.5207,   4
15062601   510010000, 0, 1,   1,  0.0756,   1
15062602   509020000, 0, 1,   1,  0.7786,   2
15062603   509010000, 0, 1,   1,  0.2761,   3
15062604   508010000, 0, 1,   1,  0.5207,   4
15062701   0,  0.0,0.0, 0.0,  4
*15062801   0,  0.0,0.0,  0.0756,   1
*15062802   0,  0.0,0.0,  0.7786,   2
*15062803   0,  0.0,0.0,  0.2761,   3
*15062804   0,  0.0,0.0,  0.5207,   4
*15062901   0,  0.0,0.0,  0.0756,   1
*15062902   0,  0.0,0.0,  0.7786,   2
*15062903   0,  0.0,0.0,  0.2761,   3
*15062904   0,  0.0,0.0,  0.5207,   4
15062801  0.  10.  10.  0.  0.  0.  0.  1.4
15062901  0.  10.  10.  0.  0.  0.  0.  1.4
*-------------------------------------------------------
*    Internal Wall between Guide thime and Upper Plenum
*-------------------------------------------------------
15063000  5  5  2  1  4.880000e-03
15063100   0  2
15063101   0.00037   4
15063201   0001. 4
15063301   0.0.  4
15063401   568.0, 5
15063501   514010000, 0, 1,   1,  0.1512,   1
15063502   514010000, 0, 1,   1,  0.5572,   2
15063503   514010000, 0, 1,   1,  0.5522,   3
15063504   514010000, 0, 1,   1,  1.0414,   4
15063505   514010000, 0, 1,   1,  1.3782,   5
15063601   510010000, 0, 1,   1,  0.1512,   1
15063602   509020000, 0, 1,   1,  0.5572,   2
15063603   509010000, 0, 1,   1,  0.5522,   3
15063604   508010000, 0, 1,   1,  1.0414,   4
15063605   507010000, 0, 1,   1,  1.3782,   5
15063701   0.  0.0,0.0, 0.0,  5
*15063801   0.  0.0,0.0,  0.0756,   1
*15063802   0.  0.0,0.0,  0.7786,   2
*15063803   0.  0.0,0.0,  0.2761,   3
*15063804   0.  0.0,0.0,  0.5207,   4
*15063805   0.  0.0,0.0,  0.6891,   5
*15063901   0.  0.0,0.0,  0.0756,   1
*15063902   0.  0.0,0.0,  0.7786,   2
*15063903   0.  0.0,0.0,  0.2761,   3
*15063904   0.  0.0,0.0,  0.5207,   4
*15063905   0.  0.0,0.0,  0.6891,   5
15063801  0.  10.  10.  0.  0.  0.  0.  1.5
15063901  0.  10.  10.  0.  0.  0.  0.  1.5
*-------------------------------------------------------
*    Upper Annulus Outer Wall
*-------------------------------------------------------
```

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15064000  3  5    2  1  0.00470
15064100   0  2
15064101   0.00041    4
15064201   0001, 4
15064301   0.0,  4
15064401   557.0    5
15064501   531010000, 0, 1,    1,   0.38247,  3
15064601   0,    0, 0,    1,   0.38247,  3
15064701   0,   0.0,0.0, 0.0,  3
*15064801    0,   0.0,0.0,   0.38247,  3
*15064901    0,   0.0,0.0,   0.38247,  3
15064801  0.   10.   10.   0.   0.   0.   0.   1.3
15064901  0.   10.   10.   0.   0.   0.    0.   1.3
*
*---------------------------------------------------
*   broken-loop steam generator
*---------------------------------------------------
*    BL SG U-tubes
*---------------------------------------------------
17001000   16  5    2  1  0.00987
17001100   0  2
17001101   0.00031    4
17001201   0002, 4
17001301   0.0,  4
17001401   495.0, 5
17001501   701020000, 0, 1.    1.   2.39218.   1
17001502   701030000, 0, 1.    1.   2.46202.   2
17001503   701040000, 0, 1.    1.   2.30962.   3
17001504   701050000, 0, 1.    1.   2.46202.   4
17001505   701060000, 0, 1.    1.   2.51282.   5
17001506   701070000, 0, 1.    1.   2.30962.   6
17001507   701080000, 0, 1.    1.   2.13182.   7
17001508   701100000, 10000.    1.    1.   1.96412.   9
17001509   701110000, 0, 1.    1.   2.13182, 10
17001510   701120000, 0, 1.    1.   2.30962, 11
17001511   701130000, 0, 1.    1.   2.51282, 12
17001512   701140000, 0, 1.    1.   2.46202, 13
17001513   701150000, 0, 1.    1.   2.30962, 14
17001514   701160000, 0, 1.    1.   2.46202, 15
17001515   701170000, 0, 1.    1.   2.39218, 16
17001601   702010000, 0, 1.    1.   2.39218.   1
17001602   702020000, 0, 1.    1.   2.46202.   2
17001603   702030000, 0, 1.    1.   2.30962.   3
17001604   702040000, 0, 1.    1.   2.46202.   4
17001605   702050000, 0, 1.    1.   2.51282.   5
17001606   702060000, 0, 1.    1.   2.30962.   6
17001607   702070000, 0, 1.    1.   2.13182.   7
17001608   702080000, 10000.    1.    1.   1.96412.   9
17001609   702070000, 0, 1.    1.   2.13182, 10
17001610   702060000, 0, 1.    1.   2.30962, 11
17001611   702050000, 0, 1.    1.   2.51282, 12
17001612   702040000, 0, 1.    1.   2.46202, 13
17001613   702030000, 0, 1.    1.   2.30962, 14
17001614   702020000, 0, 1.    1.   2.46202, 15
17001615   702010000, 0, 1.    1.   2.39218, 16
17001701   0.    0.0.    0.0,    0.0,    16
*17001801    0.   0.01974, 0.01974, 1.19609.   1
*17001802    0.   0.01974, 0.01974, 1.23101.   2
*17001803    0.   0.01974, 0.01974, 1.15481.   3
*17001804    0.   0.01974, 0.01974, 1.23101.   4
*17001805    0.   0.01974, 0.01974, 1.25641.   5
*17001806    0.   0.01974, 0.01974, 1.15481.   6
*17001807    0.   0.01974, 0.01974, 1.06591.   7
*17001808    0.   0.01974, 0.01974, 0.98206.   9
*17001809    0.   0.01974, 0.01974, 1.06591, 10
*17001810    0.   0.01974, 0.01974, 1.15481, 11
*17001811    0.   0.01974, 0.01974, 1.25641, 12
*17001812    0.   0.01974, 0.01974, 1.23101, 13
*17001813    0.   0.01974, 0.01974, 1.15481, 14
*17001814    0.   0.01974, 0.01974, 1.23101, 15
*17001815    0.   0.01974, 0.01974, 1.19609, 16
*17001901    0.   0.00635, 0.00635, 1.19609.   1
*17001902    0.   0.00635, 0.00635, 1.23101.   2
*17001903    0.   0.00635, 0.00635, 1.15481.   3
*17001904    0.   0.00635, 0.00635, 1.23101.   4
*17001905    0.   0.00635, 0.00635, 1.25641.   5
*17001906    0.   0.00635, 0.00635, 1.15481.   6
*17001907    0.   0.00635, 0.00635, 1.06591.   7
*17001908    0.   0.00635, 0.00635, 0.98206.   9
*17001909    0.   0.00635, 0.00635, 1.06591, 10
*17001910    0.   0.00635, 0.00635, 1.15481, 11
*17001911    0.   0.00635, 0.00635, 1.25641, 12
*17001912    0.   0.00635, 0.00635, 1.23101, 13
*17001913    0.   0.00635, 0.00635, 1.15481, 14
*17001914    0.   0.00635, 0.00635, 1.23101, 15
*17001915    0.   0.00635, 0.00635, 1.19609, 16
17001801  0.   10.   10.   0.   0.   0.   0.   1.16
17001901  0.   10.   10.   0.   0.   0.    0.   1.16
*---------------------------------------------------
*    BL SG Internal Structure
*---------------------------------------------------
17012000  8  5    2  1  0.05255
17012100   0  2
17012101   0.01403    4
17012201   0006, 4
17012301   0.0,  4
17012400   7001
17012501   702010000, 0, 1.    1.   1.19609.   1
17012502   702020000, 0, 1.    1.   1.23101.   2
17012503   702030000, 0, 1.    1.   1.15481.   3
17012504   702040000, 0, 1.    1.   1.23101.   4
17012505   702050000, 0, 1.    1.   1.25641.   5
17012506   702060000, 0, 1.    1.   1.15481.   6
17012507   702070000, 0, 1.    1.   1.06591.   7
17012508   702080000, 0, 1.    1.   1.65398.   8
17012601   702010000, 0, 1.    1.   1.19609.   1
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17012602   702020000. 0. 1.    1.  1.23101.  2
17012603   702030000. 0. 1.    1.  1.15481.  3
17012604   702040000. 0. 1.    1.  1.23101.  4
17012605   702050000. 0. 1.    1.  1.25641.  5
17012606   702060000. 0. 1.    1.  1.15481.  6
17012607   702070000. 0. 1.    1.  1.06591.  7
17012608   702080000. 0. 1.    1.  1.65398.  8
17012701   0.   0.0. 0.0. 0.0.  8
*17012801   0.   0.0. 0.0.  1.19609.  1
*17012802   0.   0.0. 0.0.  1.23101.  2
*17012803   0.   0.0. 0.0.  1.15481.  3
*17012804   0.   0.0. 0.0.  1.23101.  4
*17012805   0.   0.0. 0.0.  1.25641.  5
*17012806   0.   0.0. 0.0.  1.15481.  6
*17012807   0.   0.0. 0.0.  1.06591.  7
*17012808   0.   0.0. 0.0.  1.65398.  8
*17012901   0.   0.0. 0.0.  1.19609.  1
*17012902   0.   0.0. 0.0.  1.23101.  2
*17012903   0.   0.0. 0.0.  1.15481.  3
*17012904   0.   0.0. 0.0.  1.23101.  4
*17012905   0.   0.0. 0.0.  1.25641.  5
*17012906   0.   0.0. 0.0.  1.15481.  6
*17012907   0.   0.0. 0.0.  1.06591.  7
*17012908   0.   0.0. 0.0.  1.65398.  8
17012801  0.  10.  10.  0.  0.  0.  0.  1 8
17012901  0.  10.  10.  0.  0.  0.  0.  1 8
*-----------------------------------------------------
*    BL SG Shroud Wall
*-----------------------------------------------------
17022000  8  5   2  1  0.10578
17022100  0  2
17022101  0.00094   4
17022201  0001, 4
17022301  0.0,  4
17022400  7001
17022501   702010000. 0. 1.    1.  1.19609.  1
17022502   702020000. 0. 1.    1.  1.23101.  2
17022503   702030000. 0. 1.    1.  1.15481.  3
17022504   702040000. 0. 1.    1.  1.23101.  4
17022505   702050000. 0. 1.    1.  1.25641.  5
17022506   702060000. 0. 1.    1.  1.15481.  6
17022507   702070000. 0. 1.    1.  1.06591.  7
17022508   702080000. 0. 1.    1.  1.65398.  8
*17022601   702010000. 0. 1.    1.  1.19609.  1
*17022602   702020000. 0. 1.    1.  1.23101.  2
*17022603   702030000. 0. 1.    1.  1.15481.  3
*17022604   702040000. 0. 1.    1.  1.23101.  4
*17022605   702050000. 0. 1.    1.  1.25641.  5
*17022606   702060000. 0. 1.    1.  1.15481.  6
*17022607   702070000. 0. 1.    1.  1.06591.  7
*17022608   702080000. 0. 1.    1.  1.65398.  8
17022601   705010000. 0. 1.    1.  1.19609.  1
17022602   705020000. 0. 1.    1.  1.23101.  2
17022603   705030000. 0. 1.    1.  1.15481.  3
17022604   705040000. 0. 1.    1.  1.23101.  4
17022605   705050000. 0. 1.    1.  1.25641.  5
17022606   705060000. 0. 1.    1.  1.15481.  6
17022607   705070000. 0. 1.    1.  1.06591.  7
17022608   705080000. 0. 1.    1.  1.65398.  8
17022701   0.   0.0. 0.0. 0.0.  8
*17022801   0.   0.01999.  0.05963.   1.19609.  1
*17022802   0.   0.01999.  0.05963.   1.23101.  2
*17022803   0.   0.01999.  0.05963.   1.15481.  3
*17022804   0.   0.01999.  0.05963.   1.23101.  4
*17022805   0.   0.01999.  0.05963.   1.25641.  5
*17022806   0.   0.01999.  0.05963.   1.15481.  6
*17022807   0.   0.01999.  0.05963.   1.06591.  7
*17022808   0.   0.01999.  0.05963.   1.65398.  8
*17022901   0.   0.0. 0.0.  1.19609.  1
*17022902   0.   0.0. 0.0.  1.23101.  2
*17022903   0.   0.0. 0.0.  1.15481.  3
*17022904   0.   0.0. 0.0.  1.23101.  4
*17022905   0.   0.0. 0.0.  1.25641.  5
*17022906   0.   0.0. 0.0.  1.15481.  6
*17022907   0.   0.0. 0.0.  1.06591.  7
*17022908   0.   0.0. 0.0.  1.65398.  8
17022801  0.  10.  10.  0.  0.  0.  0.  1 8
17022901  0.  10.  10.  0.  0.  0.  0.  1 8
*-----------------------------------------------------
*    BL SG Downcomer Internal Structure
*-----------------------------------------------------
17032000  8  5   2  1  0.11074
17032100  0  2
17032101  0.00238   4
17032201  0001, 4
17032301  0.0,  4
17032400  7001
17032501   705010000. 0. 1.    1.  1.33972.  1
17032502   705020000. 0. 1.    1.  0.86339.  2
17032503   705030000. 0. 1.    1.  0.93540.  3
17032504   705040000. 0. 1.    1.  1.01769.  4
17032505   705050000. 0. 1.    1.  0.99712.  5
17032506   705060000. 0. 1.    1.  0.93540.  6
17032507   705070000. 0. 1.    1.  0.99712.  7
17032508   705080000. 0. 1.    1.  0.96883.  8
17032601   705010000. 0. 1.    1.  1.33972.  1
17032602   705020000. 0. 1.    1.  0.86339.  2
17032603   705030000. 0. 1.    1.  0.93540.  3
17032604   705040000. 0. 1.    1.  1.01769.  4
17032605   705050000. 0. 1.    1.  0.99712.  5
17032606   705060000. 0. 1.    1.  0.93540.  6
17032607   705070000. 0. 1.    1.  0.99712.  7
17032608   705080000. 0. 1.    1.  0.96883.  8
17032701   0.   0.0. 0.0. 0.0.  8
*17032801   0.   0.0. 0.0.  1.65398.  1
*17032802   0.   0.0. 0.0.  1.06591.  2
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*17032803    0,   0.0, 0.0,   1.25481,   3
*17032804    0,   0.0, 0.0,   1.25641,   4
*17032805    0,   0.0, 0.0,   1.23101,   5
*17032806    0,   0.0, 0.0,   1.15481,   6
*17032807    0,   0.0, 0.0,   1.23101,   7
*17032808    0,   0.0, 0.0,   1.19609,   8
*17032901    0,   0.0, 0.0,   1.65398,   1
*17032902    0,   0.0, 0.0,   1.06591,   2
*17032903    0,   0.0, 0.0,   1.25481,   3
*17032904    0,   0.0, 0.0,   1.25641,   4
*17032905    0,   0.0, 0.0,   1.23101,   5
*17032906    0,   0.0, 0.0,   1.15481,   6
*17032907    0,   0.0, 0.0,   1.23101,   7
*17032908    0,   0.0, 0.0,   1.19609,   8
17032801  0.  10.  10.  0.  0.  0.  0.  1.8
17032901  0.  10.  10.  0.  0.  0.  0.  1.8
*-------------------------------------------------------
*    BL SG Internal Structure Upper Part
*-------------------------------------------------------
17042000  3  5   2  1  0.23233
17042100   0  2
17042101   0.00105   4
17042201   0001, 4
17042301   0.0,  4
17042400   7001
17042501   702090000, 0. 1.   1.  0.37827.  1
17042502   702100000. 0. 1.   1.  0.30635.  2
*17042503   702110000. 0. 1.   1.  0.30635.  3
17042503   703010000,  0.  1,   1.  0.30635.  3
17042601   709010000. 0. 1.   1.  0.37827.  1
17042602   709010000. 0. 1.   1.  0.30635.  2
17042603   703010000. 0. 1.   1.  0.30635.  3
17042701   0.  0.0. 0.0. 0.0.  3
*17042801   0.  0.0. 0.0.  0.37827.  1
*17042802   0.  0.0. 0.0.  0.50635.  2
*17042901   0.  0.0. 0.0.  0.37827.  1
*17042902   0.  0.0. 0.0.  0.50635.  2
17042801  0.  10.  10.  0.  0.  0.  0.  1.3
17042901  0.  10.  10.  0.  0.  0.   0.  1.3
*-------------------------------------------------------
*    BL SG Downcomer Outer Wall
*-------------------------------------------------------
17053000  8  5   2  1  0.12146
17053100   0  2
17053101   0.00377   4
17053201   0001. 4
17053301   0.0.  4
17053400   7001
17053501   705010000. 0. 1.   1.  1.65398.  1
17053502   705020000. 0. 1.   1.  1.10659.  2
17053503   705030000. 0. 1.   1.  1.15481.  3
17053504   705040000. 0. 1.   1.  1.25641.  4
17053505   705050000. 0. 1.   1.  1.23101.  5
17053506   705060000, 0. 1.   1.  1.15481.  6
17053507   705070000, 0. 1.   1.  1.23101.  7
17053508   705080000, 0. 1.   1.  1.19609.  8
*
*    Modify Right Boundary Condition identical to
*    Intact Loop S/G
*
*17053601   -200.  0, 1000.   1,  1.65398.  1
*17053602   -200.  0, 1000.   1,  1.10659.  2
*17053603   -200.  0, 1000.   1,  1.15481.  3
*17053604   -200.  0, 1000.   1,  1.25641.  4
*17053605   -200.  0, 1000.   1,  1.23101.  5
*17053606   -200.  0, 1000.   1,  1.15481.  6
*17057607   -200.  0, 1000.   1,  1.23101.  7
*17053608   -200.  0, 1000.   1,  1.19609.  8
*
17053601   -200.  0, 3205.   1,  1.65398.  1
17053602   -200.  0, 3205.   1,  1.10659.  2
17053603   -200.  0, 3205.   1,  1.15481.  3
17053604   -200.  0, 3205.   1,  1.25641.  4
17053605   -200.  0, 3205.   1,  1.23101.  5
17053606   -200.  0, 3205.   1,  1.15481.  6
17053607   -200.  0, 3205.   1,  1.23101.  7
17053608   -200.  0, 3205.   1,  1.19609.  8
*
*    End of modification by Y.S Bnag at Aug 31. 1994
*
17053701   0.  0.0. 0.0. 0.0.  8
*17053801   0.  0.0. 0.0.  1.65398.  1
*17053802   0.  0.0. 0.0.  1.06591.  2
*17053803   0.  0.0. 0.0.  1.15481.  3
*17053804   0.  0.0. 0.0.  1.25641.  4
*17053805   0.  0.0. 0.0.  1.23101.  5
*17053806   0.  0.0. 0.0.  1.15481.  6
*17053807   0.  0.0. 0.0.  1.23101.  7
*17053808   0.  0.0. 0.0.  1.19609.  8
*17053901   0.  0.0. 0.0.  1.65398.  1
*17053902   0.  0.0. 0.0.  1.06591.  2
*17053903   0.  0.0. 0.0.  1.15481.  3
*17053904   0.  0.0. 0.0.  1.25641.  4
*17053905   0.  0.0. 0.0.  1.23101.  5
*17053906   0.  0.0. 0.0.  1.15481.  6
*17053907   0.  0.0. 0.0.  1.23101.  7
*17053908   0.  0.0. 0.0.  1.19609.  8
17053801  0.  10.  10.  0.  0.  0.  0.  1.8
17053901  0.  10.  10.  0.  0.  0.   0.  1.8
*-------------------------------------------------------
*    BL SG Outer Wall Upper Part
*-------------------------------------------------------
17054000  4  5   2  1  0.20477
17054100   0  2
17054101   0.00596   4
17054201   0001. 4
```

```
17054301    0.0,  4
17054400    7001
17054501    704010000, 0, 1,    1,   0.40005,   1
17054502    703010000, 0, 1,    1,   0.50635,   2
17054503    709010000, 0, 1,    1,   0.50635,   3
17054504    709020000, 0, 1,    1,   0.37827,   4
*17054601   -200,   0, 1000,   1,   0.40005,   1
*17054602   -200,   0, 1000,   1,   0.50635,   2
*17054603   -200,   0, 1000,   1,   0.50635,   3
*17054604   -200,   0, 1000,   1,   0.37827,   4
*
*    modify right boundary condition
*    identical to intact loop sg
*    by ysbang at 94.9.6
*
17054601    -200,   0, 3204,    1,   0.40005,   1
17054602    -200,   0, 3204,    1,   0.50635,   2
17054603    -200,   0, 3204,    1,   0.50635,   3
17054604    -200,   0, 3204,    1,   0.37827,   4
*
17054701    0.   0.0, 0.0, 0.0,   4
*17054801   0.   0.0, 0.0,   0.40005,   1
*17054802   0.   0.0, 0.0,   0.50635,   3
*17054803   0.   0.0, 0.0,   0.37827,   4
*17054901   0.   0.0, 0.0.   0.40005.   1
*17054902   0.   0.0, 0.0,   0.50635,   3
*17054903   0.   0.0, 0.0,   0.37827,   4
17054801  0.   10.   10.   0.   0.   0.   0.   1.4
17054901  0.   10.   10.   0.   0.   0.    0.   1.4
*-------------------------------------------------
*    BL SG Steam Dome Upper Part Wall
*-------------------------------------------------
17055000  1   5    1   1   0.0
17055100    0   2
17055101    0.00596     4
17055201    0001. 4
17055301    0.0.   4
17055400    7001
17055501    704010000, 0, 1,    0,   0.13174,   1
17055601    0.   0.   0.   0.    0.13174,   1
17055701    0.   0.0, 0.0, 0.0,   1
*17055801   0.   0.0, 0.0.   0.40955,   1
*17055901   0.   0.0, 0.0.   0.49055,   1
17055801  0.   10.   10.   0.   0.   0.   0.   1.1
17055901  0.   10.   10.   0.   0.   0.    0.   1.1
*
*************************************************
*    heat structure thermal property data (si units)
*************************************************
*
20100100   tbl/fctn    1    1   * s-steel
20100200   tbl/fctn    1    1   * incoly 600
20100300   tbl/fctn    1    1   * copper
20100400   tbl/fctn    1    1   * boron nitride
20100500   tbl/fctn    1    1   * inconel 600
20100600   tbl/fctn    1    1   * filler pieces
*-------------------------------------------------
*    thermal conductivity S-Steel
*-------------------------------------------------
20100101    273.15   12.98
20100102   1199.82   25.1
*-------------------------------------------------
* thermal conductivity incoloy 600
*-------------------------------------------------
20100201    366.5    13.85
20100202    477.6    15.92
20100203    588.7    18.17
20100204    700.0    20.42
20100205    810.9    22.50
20100206    922.0    24.92
20100207   1033.2    26.83
20100208   1144.3    29.42
20100209   1477.6    36.06
*-------------------------------------------------
* thermal conductivity copper
*-------------------------------------------------
20100301   273.15    387.546
20100302   373.15    377.577
20100303   573.15    366.985
20100304   773.15    358.262
20100305    2477.60     358.262
*-------------------------------------------------
* thermal conductivity boron nitride
*-------------------------------------------------
20100401    273.15    15.888
20100402    366.48    15.016
20100403    533.15    13.458
20100404    810.93    10.841
20100405   1088.71    8.287
20100406   1366.48    5.664
20100407   1644.26    3.059
20100408   1922.04    0.461
20100409   2199.82    0.461
20100410   2477.602     0.461
*-------------------------------------------------
* thermal conductivity inconel 600
*-------------------------------------------------
20100501    273.15    14.7043
20100502    310.93    14.7043
20100503    422.04    16.6358
20100504    533.15    18.3181
20100505    644.26    20.0627
20100506    755.37    21.8073
20100507    866.48    23.5518
20100508   2477.60    23.5518
*-------------------------------------------------
```

```
* thermal conductivity fillers (air)
*-----------------------------------------------------
20100601    300.0 0.02622
20100602    400.0 0.03362
20100603    500.0 0.04035
20100604    600.0 0.04565
20100605    700.0 0.05227
*-----------------------------------------------------
* volumetric heat capacity s-steel
*-----------------------------------------------------
20100151    273.15   3.830e6
20100152    366.5 3.830e6
20100153   1466 5 5.376e6
*-----------------------------------------------------
* volumetric heat capacity incoloy 600
*-----------------------------------------------------
20100251    366.5 3.908e5
20100252    477.6 4.084e5
20100253    588.7 4.260e5
20100254    700.0 4.436e5
20100255    810.9 4.665e5
20100256    922.0 4.929e5
20100257   1033.2 5.105e5
20100258   1477.6 5.727e5
*-----------------------------------------------------
* volumetric heat capacity copper
*-----------------------------------------------------
20100351    273.15   3.6429e06
20100352   2477.60   3.4429e06
*-----------------------------------------------------
* volumetric hrat capacity boron nitride
*-----------------------------------------------------
20100451    273.15   2.5150e06
20100452    477.59   2.515e06
20100453    699.82   3.2393e06
20100454    922.04   3.661e06
20100455   1144.26   3.9100e06
20100456   1366.48   4.0240e06
20100457   1588.71   4.1172e06
20100458   2144.26   4.1916e06
20100459   2477.60   4.1916e06
*-----------------------------------------------------
* vloumetric heat capacity inconel 600
*-----------------------------------------------------
20100551    273.15   3.50253e06
20100552   2477.60   3.50253e06
*-----------------------------------------------------
* volumetric heat capacity filers
*-----------------------------------------------------
20100651    200.0 1.1595e06
20100652   1000.0 1.1595e06
*
**************************************************
```

```
* tabulat data
**************************************************
*
* power for pressurizer
*
20230000    power 502
20230001    -1.0   0.0
20230002   0.0   0.0
20230003   0.0   12000.
20230004 1.0e06   12000.
*
* reactor core power
*
*   power ratio of aver/hot = 70/30
*
*20250000    power
*20250001   0.0   66.5e03
*
*20255000    power
*20255001   0.0   28.5e03
*
*   modified by ysbang at Sep. 18, 1996
*   to adjusting rod temp increase
*
*   power ratio of aver/hot = 60/40
*
20250000    power
20250001   0.0   57.0e03
*
20255000    power
20255001   0.0   38.0e03
*
20220000   temp
20220001   0.0 300.
*
20270500    htc-t
20270501   0.0   6.086
*
20220500    htc-t
20220501   0.0   6.086
*
20220400    htc-t
20220401   0.0 5.98
*
20270400    htc-t
20270401   0.0 5.98
*
**************************************************
* homogeneous pump curves
**************************************************
*
* broken loop / gle-phase head curves
*
```

```
4501100   1 1
4501101   0.0 1.7821
4501102   0.2845   1.7059
4501103   0.569    1.627
4501104   0.8535   1.1878
4501105   1.0 1.0
*
4501200   1 2
4501201   0.0 -1.6359
4501202   0.713   0.0
4501203   0.8271    0.2959
4501204   1.0   1.0
*
4501300   1 3
4501301   -1.0   1.5
4501302   -0.8   1.275
4501303   -0.6   1.375
4501304   -0.4   1.375
4501305 0.0   1.2
*
4501400   1 4
4501401   -1.0   1.5
4501402   -0.8   1.15
4501403   -0.6   0.95
4501404   -0.4   0.83
4501405   -0.2   0.775
4501406 0.0   0.725
*
4501500   1 5
4501501 0.0   0.975
4501502 0.5   1.33
4501503 1.0   1.95
*
4501600    1   6
4501601   0.0 0.725
4501602   0.2 0.725
4501603   0.4 0.8
4501604   0.6 1.025
4501605   1.0 1.95
*
4501700    1   7
4501701    -1.0 0.175
4501702    -0.5 0.65
4501703   0.0 0.975
*
4501800    1   8
4501801    -1.0 0.175
4501802    -0.75    -0.15
4501803    -0.55    -0.3
4501804    -0.275   -0.4
4501805   0.0   -0.35
*
* broken loop single-phase torque curves
*
4501900   2 1
4501901   0.0 0.54
4501902   0.2 0.59
4501903   0.4 0.65
4501904   0.6 0.77
4501905   0.8 0.95
4501906   0.9 0.98
4501907   0.95   0.96
4501908   1.0 0.87
*
4502000   2 2
4502001   0.0 -0.15
4502002   0.2   0.02
4502003   0.4   0.22
4502004   0.6   0.46
4502005   0.8   0.71
4502006   0.9   0.81
4502007   0.95 0.85
4502008   1.0   0.87
*
4502100   2 3
4502101    -1.0 0.62
4502102    -0.8 0.68
4502103    -0.6 0.53
4502104    -0.4 0.46
4502105    -0.2 0.49
4502106   0.0 0.54
*
4502200   2 4
4502201   -1.0   0.62
4502202   -0.8   0.53
4502203   -0.6   0.46
4502204   -0.4   0.42
4502205   -0.2   0.39
4502206 0.0   0.36
*
4502300   2 5
4502301   0.0 -0.63
4502302   0.2 -0.51
4502303   0.4 -0.39
4502304   0.6 -0.29
4502305   0.8 -0.16
4502306   1.0 -0.13
*
4502400   2 6
4502401   0.0   0.36
4502402   0.2   0.32
4502403   0.4   0.27
4502404   0.6   0.18
4502405   0.8   0.05
4502406   1.0 -0.13
*
```

```
4502500   2 7
4502501   -1.0   -1.44
4502502   -0.8   -1.25
4502503   -0.6   -1.08
4502504   -0.4   -0.92
4502505   -0.2   -0.77
4502506 0.0   -0.63
*
4502600   2 8
4502601   -1.0   -1.44
4502602   -0.8   -1.12
4502603   -0.6   -0.79
4502604   -0.4   -0.52
4502605   -0.2   -0.31
4502606 0.0   -0.15
*
* two-phase head multiplier
*
4503000   0
4503001   0.0 0.0
4503002   0.1 0.0
4503003   0.15   0.05
4503004   0.24   0.8
4503005   0.3 0.96
4503006   0.4 0.98
4503007   0.6 0.97
4503008   0.8 0.90
4503009   0.9 0.8
4503010   0.96   0.5
4503011   1.0 0.0
*
* two-phase torque multiplier
*
4503100   0
4503101   0.0 -0.17
4503102   0.0001   -0.17
4503103   0.006   0.0
4503104   0.1   0.0
4503105   0.15 0.05
4503106   0.24 0.56
4503107   0.8   0.56
4503108   0.96 0.45
4503109   1.0   0.0
*
* two-phase head difference curves
*
4504100   1 1
4504101   0.0 0.0
4504102   0.1 0.85
4504103   0.2 1.09
4504104   0.5 1.02
4504105   0.7 1.01
4504106   0.9 0.94
4504107   1.0 1.0
*
4504200   1 2
4504201   0.0 0.0
4504202   0.1 -0.04
4504203   0.2 0.0
4504204   0.3 0.1
4504205   0.4 0.21
4504206   0.8 0.67
4504207   0.9 0.8
4504208   1.0 1.0
*
4504300   1   3
4504301   -1.0   -1.16
4504302   -0.9   -1.24
4504303   -0.8   -1.77
4504304   -0.7   -2.36
4504305   -0.6   -2.79
4504306   -0.5   -2.91
4504307   -0.4   -2.67
4504308   -0.25   -1.69
4504309   -0.1   -0.5
4504310 0.0   0.0
*
4504400   1   4
4504401   -1.0   -1.16
4504402   -0.9   -0.78
4504403   -0.8   -0.5
4504404   -0.7   -0.31
4504405   -0.6   -0 17
4504406   -0.5   -0.08
4504407   -0.35   0.0
4504408   -0.2   0.05
4504409   -0.1   0.08
4504410 0.0   0.11
*
4504500   1   5
4504501   0.0   0.0
4504502   0.2   -0.34
4504503   0.4   -0.65
4504504   0.6   -0.93
4504505   0.8   -1.19
4504506   1.0   -1.47
*
4504600   1   6
4504601   0.0   0.11
4504602   0.1   0.13
4504603   0.25   0.15
4504604   0.4   0.13
4504605   0.5   0.07
4504606   0.6   -0.04
4504607   0.7   -0.23
4504608   0.8   -0.51
```

```
4504609   0.9   -0.91
4504610   1.0   -1.47
*
4504700   1   7
4504701   -1.0     0.0
4504702 0.0     0.0
*
4504800   1   8
4504801   -1.0     0.0
4504802 0.0     0.0
*
* two-phase torque difference curves
*
4504900   2   1
4504901   0.0   0.54
4504902   0.2   0.59
4504903   0.4   0.65
4504904   0.6   0.77
4504905   0.8   0.95
4504906   0.9   0.98
4504907   0.95     0.96
4504908   1.0   0.87
*
4505000   2   2
4505001   0.0   -0.15
4505002   0.2 0.02
4505003   0.4 0.22
4505004   0.6 0.46
4505005   0.8 0.71
4505006   0.9 0.81
4505007   0.95   0.85
4505008   1.0 0.87
*
4505100   2   3
4505101   -1.0     0.62
4505102   -0.8     0.68
4505103   -0.6     0.53
4505104   -0.4     0.46
4505105   -0.2     0.49
4505106 0.0     0.54
*
4505200   2   4
4505201   -1.0     0.62
4505202   -0.8     0.53
4505203   -0.6     0.46
4505204   -0.4     0.42
4505205   -0.2     0.39
4505206 0.0     0.36
*
4505300   2   5
4505301   0.0   -0.63
4505302   0.2   -0.51
4505303   0.4   -0.39
4505304   0.6   -0.29
4505305   0.8   -0.20
4505306   0.9   -0.16
4505307   1.0   -0.13
*
4505400   2   6
4505401   0.0   0.36
4505402   0.2   0.32
4505403   0.4   0.27
4505404   0.6   0.18
4505405   0.8   0.05
4505406   1.0   -0.13
*
4505500   2   7
4505501   -1.0     -1.44
4505502   -0.8     -1.25
4505503   -0.6     -1.08
4505504   -0.4     -0.92
4505505   -0.2     -0.77
4505506 0.0     -0.63
*
4505600   2   8
4505601   -1.0     -1.44
4505602   -0.8     -1.12
4505603   -0.6     -0.79
4505604   -0.4     -0.52
4505605   -0.2     -0.31
4505606 0.0     -0.15
*
4506100   501
4506101   0.0   0.0
4506102   1.0e06 0.0
*
*****************************************************
* control components
*****************************************************
*
20500100   sgdc-lvl   sum   1.0   0.0   1
20500101   0.0   1.21831   voidf   205100000
20500102 1.20561   voidf   205090000
20500103 1.20561   voidf   205080000
20500104 1.20561   voidf   205070000
20500105 1.20561   voidf   205060000
20500106 1.20561   voidf   205050000
20500107 1.20561   voidf   205040000
20500108 0.48578   voidf   205030000
20500109 0.58737   voidf   205020000
20500110 0.41891   voidf   205010000
20500111 0.37827   voidf   209020000
20500112 0.50633   voidf   209010000
20500113 0.50635   voidf   203010000
20500114 0.40005   voidf   204010000
*
```

```
20500200  sgsd-lvl  sum  1.0  0.0  1
20500201  0.0  1.21831  voidf  202010000
20500202 1.20561  voidf  202020000
20500203 1.20561  voidf  202030000
20500204 1.20561  voidf  202040000
20500205 1.20561  voidf  202050000
20500206 1.20561  voidf  202060000
20500207 1.20561  voidf  202070000
20500208 0.48578  voidf  202080000
20500209 0.58737  voidf  202090000
20500210 0.41891  voidf  202100000
20500211 0.37827  voidf  202110000
20500212 0.50635  voidf  202120000
20500213 0.50635  voidf  203010000
20500214 0.40005  voidf  204010000
*
20500700  sg-delt  sum  1.0  20.0  1
20500701  0.  1.  tempf  201010000
20500702 -1.  tempf  201200000
*
*    calculate the core liquid collapsed height
*
20501000  cord-lvl  sum  1.  0.  1
20501001  0.  .6096  voidf  505010000
20501002  .6096  voidf  505020000
20501003  .3048  voidf  505030000
20501004  .3048  voidf  505040000
20501005  .3048  voidf  505050000
20501006  .3048  voidf  505060000
20501007  .6096  voidf  505070000
20501008  .6096  voidf  505080000
*
20501100  sgsr-lvl  sum.  1.0  0.0  1.
20501101  0.0 1.9609  voidf  702010000
20501102  1.23101  voidf  702020000
20501103  1.15481  voidf  702030000
20501104  1.23101  voidf  702040000
20501105  1.25641  voidf  702050000
20501106  1.15481  voidf  702060000
20501107  1.06591  voidf  702070000
20501108  1.65398  voidf  702080000
20501109  1.37827  voidf  702090000
20501110  0.50635  voidf  702100000
20501111  0.50635  voidf  703010000
20501112  0.40005  voidf  704010000
*
20501200  sgdc-lvl  sum  1.0  0.0  1
20501201  0.0 1.19009  voidf  705080000
20501202  1.25101  voidf  705070000
20501203  1.15481  voidf  705060000
20501204  1.23101  voidf  705050000
20501205  1.25641  voidf  705040000
20501206  1.13481  voidf  705030000
20501207  1.06591  voidf  705020000
20501208  1.65398  voidf  705010000
20501209  0.37827  voidf  709020000
20501210  0.50635  voidf  709010000
20501211  0.50635  voidf  703010000
20501212  0.40005  voidf  704010000
*
*
20501600  hotchlvl  sum  1.  0.  1
20501601  0.  .6096  voidf  555010000
20501602  .6096  voidf  555020000
20501603  .3048  voidf  555030000
20501604  .3048  voidf  555040000
20501605  .3048  voidf  555050000
20501606  .3048  voidf  555060000
20501607  .6096  voidf  555070000
20501608  .6096  voidf  555080000
*
20502300  przrlvl  sum  1.0  0.0  1
20502301  0.0  0.3671  voidf  301010000
20502302 0.2549  voidf  301020000
20502303 0.2549  voidf  301030000
20502304 0.2549  voidf  301040000
20502305 0.0663  voidf  301050000
*
*  heat losses to environment - pl sg
*
20502400  blsgpl sum 1. 0. 0
20502401 0.  1.41896 htmr 705300101
20502402 0.91445 htmr 705300201
20502403 0.99072 htmr 705300301
20502404 0.07788 htmr 705300401
20502405 0.05609 htmr 705300501
20502406 0.99072 htmr 705300601
20502407 0.05609 htmr 705300701
20502408 0.02613 htmr 705300801
20502409 0.57463 htmr 705400101
20502410 0.72732 htmr 705400201
20502411 0.72732 htmr 705400301
20502412 0.54335 htmr 705400401
*
* power losses to environment - il sg
*
20502500  ilsgpl  sum  1.  0.  0
20502501  0.  .35939  htmr  205300101
20502502  .50391  htmr  205300201
20502503  .41675  htmr  205300301
20502504  1.03430 htmr  205300401
20502505  1.03430 htmr  205300501
20502506  1.03430 htmr  205300601
20502507  1.03430 htmr  205300701
20502508  1.03430 htmr  205300801
20502509  1.03430 htmr  205300901
```

```
20502510   1.04520 htmr   205301001
20502511   .57463   htmr   205400101
20502512   .72732   htmr   205400201
20502513   .72732   htmr   205400301
2[illegible]314   .54335   htmr   205400401
*
*   energy loss to environment - il sg
*
20502600 blsgel integral 1. 0. 0
20502601   cntrlvar 24
*
*   energy loss to environment - il sg
20502700   ilsgel integral 1. 0. 0
20502701   cntrlvar 25
*
*   power loss to environment from sg
*
20502800 sgfl sum 1. 0. 0
20502801 0. 1. cntrlvar 24
20502802   1. cntrlvar 25
*
*   energy loss to environment from sg
*
20502900 sgel sum 1. 0. 0
20502901 0. 1. cntrlvar 26
20502902   1. cntrlvar 27
*
* integ of bl hot leg mass flow
*
20503000   blm integral 1. 0. 0
20503001 mflowj 402010000
*
* integ of il hot leg mass flow
*
20503100   ilm integral 1. 0. 0
20503101 mflowj 102020000
*
*
*
*
20510100   ilhlmass   sum   1.0   0.0   1
20510101   0.0   9.2278200-04 rho 101010000
20510102   1.9918830-03 rho 102010000
20510103   5.9836050-04 rho 102020000
20510104   5.9836050-04 rho 102030000
20510105   7.8538960-04 rho 102040000
20510106   8.8732920-04 rho 102050000
20510107   8.8732920-04 rho 102060000
20510108   1.2796520-03 rho 103010000
20510109   5.4559250-04 rho 104010000
20510110   9.7311260-04 rho 104020000
20510111   8.1432400-04 rho 104030000
20510112   8.1432400-04 rho 104040000
20510113   1.4841030-03 rho 104050000
*
20510200   crossms   sum   1.0   0.0   1
20510201   0.0   1.0187750-03 rho 105010000
20510202   9.3065600-04 rho 105020000
20510203   8.1432400-04 rho 105030000
20510204   8.1432400-04 rho 105040000
20510205   8.1432400-04 rho 105050000
20510206   1.1289930-03 rho 105060000
20510207   2.0441630-03 rho 105070000
20510208   2.7480260-03 rho 105080000
20510209   2.7480260-03 rho 105090000
20510210   9.1438000-04 rho 105100000
20510211   9.1438000-04 rho 105110000
20510212   2.7480260-03 rho 105120000
20510213   2.7480260-03 rho 105130000
20510214   2.0441630-03 rho 105140000
*
20510300   ilclmass   sum   1.0   0.0   1
20510301 0.0   4.0772550-04 rho 106010000
20510302   1.0447530-03 rho 106020000
20510303   5.4641860-04 rho 106030000
20510304   6.7631200-04 rho 106040000
20510305   2.6372190-03 rho 106050000
20510306   2.7614970-03 rho 107010000
20510307   7.6276200-04 rho 108010000
*
20510400   ilsgpr   sum   1.0   0.0   1
20510401 0.0   1.6407770-03 rho 201010000
20510402   2.2416900-03 rho 201020000
20510403   2.2183220-03 rho 201030000
20510404   2.2183220-03 rho 201040000
20510405   2.2183220-03 rho 201050000
20510406   2.2183220-03 rho 201060000
20510407   2.2183220-03 rho 201070000
20510408   2.2183220-03 rho 201080000
20510409   8.9383520-04 rho 201090000
20510410   6.3316240-04 rho 201100000
20510411   6.3316240-04 rho 201110000
20510412   8.9383520-04 rho 201120000
20510413   2.2183220-03 rho 201130000
20510414   2.2183220-03 rho 201140000
20510415   2.2183220-03 rho 201150000
20510416   2.2183220-03 rho 201160000
20510417   2.2183220-03 rho 201170000
20510418   2.2183220-03 rho 201180000
20510419   2.2416900-03 rho 201190000
20510420   1.6407770-03 rho 201200000
*
20520100   blsgpr   sum   1.0   0.0   1
20520101   0.0   1.4264000-02 rho 202010000
20520102   1.6574000-02 rho 202020000
20520103   1.3183000-02 rho 202030000
```

```
20520104  1.6789000-02 rho 202040000
20520105  1.3532000-02 rho 202050000
20520106  1.2870000-02 rho 202060000
20520107  1.2850000-02 rho 202070000
20520108  5.8490000-03 rho 202080000
20520109  9.2780000-03 rho 202090000
20520110  7.6310000-03 rho 202100000
20520111  1.5420000-02 rho 202110000
20520112  2.6025000-02 rho 202120000
20520113  5.9663000-02 rho 203010000
20520114  3.3900000-02 rho 204010000
*
20520300   ilsgsec   sum   1.0   0.0   1
20520301   0.0   6.3370000-03 rho 205010000
20520302  3.2520000-03 rho 205020000
20520303  1.3220000-03 rho 205030000
20520304  3.2790000-03 rho 205040000
20520305  3.2790000-03 rho 205050000
20520306  3.2790000-03 rho 205060000
20520307  3.2790000-03 rho 205070000
20520308  3.2790000-03 rho 205080000
20520309  3.2790000-03 rho 205090000
20520310  3.3140000-03 rho 205100000
20520311  1.1400000-03 rho 206010000
20520312  2.9856000-02 rho 209010000
20520313  2.0686000-02 rho 209020000
*
20530100   pressms   sum   1.0   0.0   1
20530101  0.0   6.4825000-03 rho 301010000
20530102  6.4825000-03 rho 301020000
20530103  5.9118000-03 rho 301030000
20530104  5.9118000-03 rho 301040000
20530105  5.9118000-03 rho 301050000
20530106  1.1360000-03 rho 301060000
20530107  7.1837000-04 rho 302010000
20530108  2.3214100-04 rho 302020000
20530109  1.6457700-04 rho 302030000
20530110  4.4046000-05 rho 302040000
20530111  4.4046000-05 rho 302050000
20530112  4.4046000-05 rho 302060000
20530113  4.4046000-05 rho 302070000
*
20510500   blhlmss   sum   1.0   0.0   1
20510501  0.0   1.4245480-03 rho 401010000
20510502  5.5496350-04 rho 402010000
20510503  3.7182600-04 rho 402020000
20510504  8.9706890-04 rho 402030000
20510505  3.8022530-04 rho 402040000
20510506  3.2063850-04 rho 402050000
20510507  3.1781750-04 rho 402060000
20510508  5.5399890-04 rho 402070000
*
20510700   blcross   sum   1.0   0.0   1
20510701  0.0   4.4975840-04 rho 403010000
20510702  3.1781750-04 rho 403020000
20510703  3.2063850-04 rho 403030000
20510704  3.1781750-04 rho 403040000
20510705  9.8569380-04 rho 403050000
20510706  7.1445920-04 rho 403060000
20510707  7.1445920-04 rho 403070000
20510708  4.4539040-04 rho 403080000
20510709  4.4539040-04 rho 403090000
20510710  7.1445920-04 rho 403100000
20510711  7.1445920-04 rho 403110000
20510712  6.3701820-04 rho 403120000
*
20510800   blclmass   sum   1.0   0.0   1
20510801  0.0   7.5605530-04 rho 404010000
20510802  2.4731980-04 rho 405010000
20510803  6.4741950-04 rho 405020000
20510804  1.3575400-03 rho 406010000
20510805  8.6000000-04 rho 450010000
*
20510900   rvcore   sum   1.0   0.0   1
20510901  0.0   6.7400000-03 rho 501010000
20510902  6.5900000-03 rho 502010000
20510903  2.9600000-03 rho 503010000
20510904  5.2000000-04 rho 504010000
20510905  1.7434560-03 rho 505010000
20510906  1.7434560-03 rho 505020000
20510907  8.7172800-04 rho 505030000
20510908  8.7172800-04 rho 505040000
20510909  8.7172800-04 rho 505050000
20510910  8.7172800-04 rho 505060000
20510911  1.7434560-03 rho 505070000
20510912  1.7434560-03 rho 505080000
20510913  1.6400000-03 rho 506010000
20510914  2.8100000-03 rho 507010000
20510915  2.1800000-03 rho 508010000
20510916  1.4300000-03 rho 509010000
20510917  4.0470000-03 rho 509020000
20510918  3.9300000-04 rho 510010000
20510919  3.4000000-04 rho 513010000
20510920  3.4525000-04 rho 514010000
*
20511000   rvdcnr   sum   1.0   0.0   1
20511001 0.0   2.6189940-03 rho 516010000
20511002  3.7726480-03 rho 517010000
20511003  1.1833800-03 rho 518010000
20511004  1.1833800-03 rho 518020000
20511005  1.1833800-03 rho 518030000
20511006  1.1833800-03 rho 518040000
20511007  1.1833800-03 rho 518050000
20511008  1.1833800-03 rho 518060000
20511009  1.1833800-03 rho 518070000
20511010  1.1833800-03 rho 518080000
```

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20511011  1.1833800-03 rho 518090000
20511012  9.1139620-04 rho 518100000
20511013  2.0770600-03 rho 519010000
20511014  2.6772900-05 rho 531010000
20511015  2.6772900-05 rho 531020000
20511016  2.6772900-05 rho 531030000
*
20510600   blsgpr  sum   1.0  0.0   1
20510601  0.0    1.3434060-03 rho 701010000
20510602  7.2961490-04 rho 701020000
20510603  7.5091610-04 rho 701030000
20510604  7.0443410-04 rho 701040000
20510605  7.5091610-04 rho 701050000
20510606  7.6641010-04 rho 701060000
20510607  7.0443410-04 rho 701070000
20510608  6.5020510-04 rho 701080000
20510609  5.9905660-04 rho 701090000
20510610  5.9905660-04 rho 701100000
20510611  6.5020510-04 rho 701110000
20510612  7.0443410-04 rho 701120000
20510613  7.6641010-04 rho 701130000
20510614  7.5091610-04 rho 701140000
20510615  7.0443410-04 rho 701150000
20510616  7.5091610-04 rho 701160000
20510617  7.2961490-04 rho 701170000
20510618  1.3434060-03 rho 701180000
*
20520200   blsgsec  sum   1.0  0.0   1
20520201  0.0    1.3509000-02 rho 702010000
20520202  9.0360000-03 rho 702020000
20520203  8.4700000-03 rho 702030000
20520204  1.0739000-02 rho 702040000
20520205  9.6150000-03 rho 702050000
20520206  8.4740000-03 rho 702060000
20520207  8.4250000-03 rho 702070000
20520208  1.5782000-02 rho 702080000
20520209  1.6807000-02 rho 702090000
20520210  2.5882000-02 rho 702100000
20520211  5.6736000-02 rho 703010000
20520212  3.3900000-02 rho 704010000
*
20520400  blsgsec   sum   1.0   0.0  1
20520401  0.0    1.4458000-02 rho 705010000
20520402  2.2410000-03 rho 705020000
20520403  2.4350000-03 rho 705030000
20520404  2.6390000-03 rho 705040000
20520405  2.5890000-03 rho 705050000
20520406  2.4310000-03 rho 705060000
20520407  2.5930000-03 rho 705070000
20520408  2.5140000-03 rho 705080000
20520409  2.9860000-02 rho 709010000
20520410  2.0686000-02 rho 709020000
*
*   total primary inventory
*
20511100   totalpr   sum   1.0   0.0  1
20511101   0.0 1.0   cntrlvar   101
20511102   1.0   cntrlvar   102
20511103   1.0   cntrlvar   103
20511104   1.0   cntrlvar   104
20511105   1.0   cntrlvar   105
20511106   1.0   cntrlvar   106
20511107   1.0   cntrlvar   107
20511108   1.0   cntrlvar   108
20511109   1.0   cntrlvar   109
20511110   1.0   cntrlvar   110
20511111   1.0   cntrlvar   301
*
*   total secondary inventory
*
20520500   totalsec  sum   1.0   0.0   1
20520501   0.0 1.0   cntrlvar   201
20520502   1.0   cntrlvar   202
20520503   1.0   cntrlvar   203
20520504   1.0   cntrlvar   204
*
*   core heat
*
20505000   thcore   sum   1.0   0.0   1
20505001   0.0 13.4112   htrnr   501300101
20505002 13.4112   htrnr   501300201
20505004   6.7056   htrnr   501300301
20505005   6.7056   htrnr   501300401
20505006   6.7056   htrnr   501300501
20505007   6.7056   htrnr   501300601
20505008 13.4112   htrnr   501300701
20505009 13.4112   htrnr   501300801
20505010   1.8288   htrnr   501300901
20505011   1.8288   htrnr   501301001
20505012   0.9144   htrnr   501301101
20505013   0.9144   htrnr   501301201
20505014   0.9144   htrnr   501301301
20505015   0.9144   htrnr   501301401
20505016   1.8288   htrnr   501301501
20505017   1.8288   htrnr   501301601
*
*   Intact Loop SG Heat Transfer
*
20505100   isgheat   sum   1.0   0.0   1
20505101   0.0 7.30986   htrnr   200100100
20505102 7.23366   htrnr   200100200
20505103 7.23366   htrnr   200100300
20505104 7.23366   htrnr   200100400
20505105 7.23366   htrnr   200100500
20505106 7.23366   htrnr   200100600
20505107 7.23366   htrnr   200100700
```

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20505108 2.91468   htmr   200106800
20505109 2.06466   htmr   200100900
20505110 2.06466   htmr   200101000
20505111 2.91468   htmr   200101100
20505112 7.23366   htmr   200101200
20505113 7.23366   htmr   200101300
20505114 7.23366   htmr   200101400
20505115 7.23366   htmr   200101500
20505116 7.23366   htmr   200101600
20505117 7.23366   htmr   200101700
20505118 7.30986   htmr   200101800
*
*   Broken Loop SG Heat Transfer
*
20505200   bsgheat   sum   1.0   0.0   1
20505201     0.0 2.39218   htmr   700100100
20505202 2.46202   htmr   700100200
20505203 2.30962   htmr   700100300
20505204 2.46202   htmr   700100400
20505205 2.51282   htmr   700100500
20505206 2.30962   htmr   700100600
20505207 2.13182   htmr   700100700
20505208 1.96412   htmr   700100800
20505209 1.96412   htmr   700100900
20505210 2.13182   htmr   700101000
20505211 2.30962   htmr   700101100
20505212 2.51282   htmr   700101200
20505213 2.46202   htmr   700101300
20505214 2.30962   htmr   700101400
20505215 2.46202   htmr   700101500
20505216 2.39218   htmr   700101600
*
*   * end of deck
```

Transient Input Deck for Case E01

```
*        the next input deck is for the transient calculation
*        of the semiscale natural circulation experiment 8.   *
= semiscale mod 2a -- nc8 configuration (2-loop)
*
*     two core channel modeling implemented
*
0000100  restart  transnt
0000101  run
0000103  8001
*0000104  none
0000105  10.0  12.0
0000201  1.0       1.0e-06  0.01  2  50   250    1000
0000201  5000.0 1.0e-06  0.05  2  200  20000 20000
*----------------------------------------------------
*     minor edit variables
*----------------------------------------------------
20800001  dt   0
20800002  dtcmt  0
20800003  cputime
20800004  tmass   0
20800005  emass   0
20800006  cntrlvar    211    * primary system pressure
20800007  cntrlvar    212    * ilsg pressure
20800008  cntrlvar    213    * blsg pressure
20800009  cntrlvar    214    * ilcrossoverleg sg side dp
20800010  cntrlvar    215    * ilcrossover leg pump sideJp
20800011  cntrlvar    216    * blcrossover leg sg side dp
20800012  cntrlvar    217    * blcrossover leg pump side dp
20800013  cntrlvar    218    * ector vessel core dp
*20800014  cntrlvar    228    * total acculator flow (intact)
*20800015  cntrlvar    229    * total accumulator flow (broken)
20800016  cntrlvar    101    * ilhl mass
20800017  cntrlvar    102    * ilcrl mass
20800018  cntrlvar    103    * ilcl mass
20800019  cntrlvar    104    * ilsg primary mass
20800020  cntrlvar    105    * blhl mass
20800021  cntrlvar    106    * blsg primary mass
20800022  cntrlvar    107    * blcrl mass
20800023  cntrlvar    108    * blcl mass
20800024  cntrlvar    109    * rv core mass
20800025  cntrlvar    110    * rv downcomer mass
20800026  cntrlvar    111    * total primary side inventory
20800027  cntrlvar    201    * ilsg secondary side mass
20800028  cntrlvar    202    * blsg secondary side mass
20800029  cntrlvar    203    * ilsg secondary mass
20800030  cntrlvar    204    * blsg secondary mass
20800031  cntrlvar    205    * total seconady mass
20800032  mflowj   101010000
20800033  mflowj   107010000
20800034  mflowj   401010000
20800035  mflowj   405010000
20800036  mflowj   518010000
20800037  mflowj   233000000
20800038  mflowj   733000000
20800039  mflowj   232000000
20800040  mflowj   732000000
20800041  mflowj   620000000
20800042  mflowj   820000000
*
20800043  tempf    101010000
20800044  tempf    107010000
20800045  tempf    401010000
20800046  tempf    405010000
20800047  httemp   501300711
20800048  httemp   501300811
*----------------------------------------------------------
*     trips
*----------------------------------------------------------
0000501  time  0  ge  null  0    -1.0  1  * always true
0000502  time  0  lt  null  0    -1.0  n  * always false
0000510  time  0  ge  null  0     0.0  1  * induce blowdown
*     after 0 s
0000511  time  0  ge  null  0   117.0  1  * close steam valve
*+     after 117 s
0000512  time  0  ge  null  0 2100.0  1  * open steam valve
*   after 2100 s
0000513  time  0  ge  null  0 7550.0  1  * open porv valve after
*     7550 s
0000514  time  0  ge  null  0 8098.0  1  * close porv valve after
*     8098 s
*
0000601  -511   or   512   n
0000602   513  and   514   n
0000610  -510  and  -510   n
*
*     modified by ysbang at 96/1/19
*     to implement sg steam leak both at iSG bSG
*
0000550   time  0  gt  null  0  117.0  n
0000551   time  0  le  null  0  2100.0  n
*
0000650   550  and  551  n
*
*-----------------------------------------------------------
*     intact loop steam leak junction
*-----------------------------------------------------------
2110000   isteaml  valve
2110101   204010000  240000000  0.3-5  0.0  0.0  0100 1.1
2110201   0   0.0   0.0
2110300   trpvlv
2110301   650
*-----------------------------------------------------------
```

```
*      broken loop steam leak junction
*-------------------------------------------------
7110000   isteaml   valve
7110101   704010000   740000000   0.3-5   0.0   0.0   0100 1. 1.
7110201   0   0.0   0.0
7110300   trpvlv
7110301   650
*-------------------------------------------------
*     intact loop sg steam leak junction downstream
*-------------------------------------------------
*
2400000   envir   tmdpvol
2400101   1.0   1.0   0.0   0.0   90.0   1.0   5.-6 0.0   00
2400200   2
*2400201  0.0       5.89e06     1.0
*2400202  2100.0    5.89e06     1.0
*2400203  2763.0    3.96e06     1.0
*2400204  3380.0    3.15e06     1.0
*2400205  4500.0    2.26e06     1.0
*2400206  6110.0    1.50e06     1.0
*2400207  8000.0    1.25e06     1.0
*
*     modified by ysbang at Sep 3, 1996 to
*     implement an exact boundary condition
*
2400201   0.0       5.85e06     1.0
2400202   2100.0    5.6e06      1.0
2400203   2763.0    2.78e06     1.0
2400204   3380.0    2.12e06     1.0
2400205   4500.0    1.80e06     1.0
2400206   6110.0    1.40e06     1.0
2400207   8000.0    1.20e06     1.0
*-------------------------------------------------
*     broken loop sg steam leak junction downstream
*-------------------------------------------------
7400000   envir   tmdpvol
7400101   1.0   1.0   0.0   0.0   90.0   1.0   5.-6 0.0   00
7400200   2
*7400201  0.0       5.89e06     1.0
*7400202  2100.0    5.89e06     1.0
*7400203  2763.0    3.96e06     1.0
*7400204  3380.0    3.15e06     1.0
*7400205  4500.0    2.26e06     1.0
*7400206  6110.0    1.50e06     1.0
*7400207  8000.0    1.25e06     1.0
*
*     modified by ysbang at Sep 3, 1996 to
*     implement an exact boundary condition
*
7400201   0.0       5.89e06     1.0
7400202   2100.0    5.60e06     1.0
7400203   2763.0    3.95e06     1.0
7400204   3380.0    3.15e06     1.0
7400205   4500.0    2.25e06     1.0
7400206   6110.0    1.50e06     1.0
7400207   8000.0    1.23e06     1.0
*
*     end of modification by ysbang
*-------------------------------------------------
*      upper head bypass junction modify
*-------------------------------------------------
*      modified by ysbang at Sep 16, 1996
*
5350000   byps-up      sngljun
5350101   531010000   510010000   1.62-5   300. 300. 0100
5350201   0   0.0   0.0   0.0
*-------------------------------------------------
*      intact loop sg steam discharge junction
*-------------------------------------------------
2320000   steamout      valve
2320101   204010000   207000000   0.0   0.0   0.0   0100
*2320201  0           -2.166700 .01040770 0.0
*
*     modified by ysbang at 94/9/14
*     to implement the steady state result
*
2320201   0       0.0379918   0.0139507   0.0
2320300   trpvlv
2320301   601
*-------------------------------------------------
*      intact loop sg feedwater
*-------------------------------------------------
2330000   feedint      tmdpjun
2330101   206000000   205000000   0.00043
2330200   1   512   cntrlvar   1
2330201   -1.0     0.0     0.0   0.0
2330202   0.0      0.0     0.0   0.0
2330203   0.0      0.216   0.0   0.0
2330204   9.5      0.216   0.0   0.0
2330205   9.58     0.054   0.0   0.0
2330206   9.7149   0.036   0.0   0.0
2330207   9.7800   0.027   0.0   0.0
2330208   9.8500   0.0     0.0   0.0
2330209   20.0     0.0     0.0   0.0
*-------------------------------------------------
*   pressurizer porv downstream tank
*-------------------------------------------------
3300000   presssup      tmdpvol
3300101   1.0   10.0   0.0   0.0   0.0   0.0   0.0   0.0   00
3300200   3
3300201     0.0     1.041e06    455.
3300202    49.0     1.041e06    455.
3300203    50.0     1.041e06    455.
3300204   150.0     0.280e06    406.
3300205  1500.0     0.270e06    403.
*-------------------------------------------------
```

```
*    pressurizer porv
*-----------------------------------------------------
3310000  porv              valve
3310101  301000000  330000000  0.0001267  0.0  0.0  0100
*    1.0  1.0
3310201  0     0.0    0.0    0.0
3310300  trpvlv
3310301  602
*-----------------------------------------------------
*    broken loop break junction
*-----------------------------------------------------
*4220000  brk-jun    valve
*4220101  404010000  499000000  9.0e-07  0.0  0.0  0100
*+    1.0  1.0
*4220101  404010000  499000000  9.0e-07  0.0  0.0  0100
1.5  1.5
*
*4220201  0     0.0    0.0    9.0
*4220300  trpvlv
*4220304  510
*
*     modified by ysbang to model smooth open
*     of break valve for 100 sec. Sep.30. 1996
*
4220000  brk-jun    valve
4220101  404010000  499000000  9.0e-07  0.0  0.0  0100  1.0
+    1.0
*4220101  404010000  499000000  9.0e-07  0.0  0.0  0100
*+    1.5  1.5
*
4220201  0     0.0    0.0    0.0
4220300  mtrvlv
4220304  510   610  0.01    .  0
*-----------------------------------------------
*    break downstream volume
*-----------------------------------------------
4990000  presssup    tmdpvol
4990101  1.0  10.0  0.0  0.0  0.0  0.0  0.0  0.0  00
4990200  3
*4990201       0.0    1.041e06    455.
*4990202      49.0    1.041e06    455.
*4990203      50.0    1.041e06    455.
*4990204     150.0    0.280e06    404.
*4990205    1500.0    0.270e06    403.
*
*   modified by y.s.bang for realistic modeling
*    of condensate tank pressure
*
4990201     0.0    0.098e06   455.
4990202  1000.0   0.094e06   455.
4990203  3400.0   0.123e06   455.
4990204  8000.0   0.123e06   455.
*
*-----------------------------------------------
*    broken loop steam generator steam outlet junction
*-----------------------------------------------
7320000  steamou      valve
7320101  704010000  707000000  0.0  0.0  0.0  0100
*
*7320201  0          -.0599056 .333999-3 0.0
*
*     modified by ysbang at 94/9/14
*     to implement the steady state resut
*
7320201   0      0.02012    0.001473   0.0
7320300  trpvlv
7320301  601
*-----------------------------------------------
* broken loop sg feedwater junction
*-----------------------------------------------
7330000  feedin       tmdpjun
7330101  706000000  705000000  0.00043
7330200  1  512  cntrlvar  12
7330201  -1.0     0.0      0.0  0.0
7330202   0.0     0.0      0.0  0.0
7330203   0.0     0.072    0.0  0.0
7330204  10.17    0.018    0.0  0.0
7330205  10.28    0.012    0.0  0.0
7330206  10.34    0.009    0.0  0.0
7330207  10.40    0.0      0.0  0.0
7330208  20.00    0.0      0.0  0.0
*
**********************************************
* general table  data
**********************************************
*
* power  for  pressurizer
*-----------------------------------
20230000  power       502
20230001  -1.0        0.0
20230002  0.0         0.0
20230003  0.0         12000.
20230004  1.0e06      12000.
*-----------------------------------
* reactor  core  power
*-----------------------------------
*20250000  power
*20250001  0.0         95.000e03
*20250002  131.0       95.000e03
*20250003  133.0       81.320e03
*20250004  163.0       68.305e03
*20250005  203.0       60.610e03
*20250006  1103.0      36.955e03
*20250007  10103.0     17.575e03
*
* reactor  core  power
```

```
*   power ratio hot/average = 60/40
*
*   hot channel : volume 500
*
20250000   power
20250001   0.0          57.000e03
20250002   131.0        57.000e03
20250003   133.0        48.792e03
20250004   163.0        40.983e03
20250005   203.0        36.366e03
*20250006   1103.0       36.955e03
20250006   1103.0       22.173e03
20250007   10103.0      10.545e03
*
*   average channel : volume 550
*
20255000   power
20255001   0.0          38.000e03
20255002   131.0        38.000e03
20255003   133.0        32.585e03
20255004   163.0        27.322e03
20255005   203.0        24.244e03
20255006   1103.0       14.782e03
20255007   10103.0      7.0100e03
*
20220000   temp
20220001   0.0          300.
*
20270500   htc-t
20270501   0.0          6.806
*
20220500   htc-t
20220501   0.0          6.806
*
20220400   htc-t
20220401   0.0          5.98
*
20270400   htc-t
20270401   0.0          5.98
*
*****************************************
* control   components
*****************************************
20500100   sgdclvl    sum    1.0    0.0   1
20500101   0.0   1.21831    voidf     205100000
20500102         1.20561    voidf     205090000
20500103         1.20561    voidf     205080000
20500104         1.20561    voidf     205070000
20500105         1.20561    voidf     205060000
20500106         1.20561    voidf     205050000
20500107         1.20561    voidf     205040000
20500108         0.48578    voidf     205030000
20500109         0.58737    voidf     205020000
20500110         0.41891    voidf     205010000
20500111         0.37827    voidf     209020000
20500112         0.50635    voidf     209010000
20500113         0.50635    voidf     203010000
20500114         0.40005    voidf     204010000
*
20500200   sgsrlvl    sum    1.0    0.0   1
20500201   0.0   1.21831    voidf     202010000
20500202         1.20561    voidf     202020000
20500203         1.20561    voidf     202030000
20500204         1.20561    voidf     202040000
20500205         1.20561    voidf     202050000
20500206         1.20561    voidf     202060000
20500207         1.20561    voidf     202070000
20500208         0.48578    voidf     202080000
20500209         0.58737    voidf     202090000
20500210         0.41891    voidf     202100000
20500211         0.37827    voidf     202110000
20500212         0.50635    voidf     202120000
*20500213         0.50635    voidf     202130000
20500214         0.40005    voidf     204010000
*
*20500300   fi-mass    sum    1.0    0.0   1
*20500301   0.0   1.0    cmpmass    101
*20500302         1.0    cmpmass    102
*20500303         1.0    cmpmass    103
*20500304         1.0    cmpmass    104
*20500305         1.0    cmpmass    105
*20500306         1.0    cmpmass    106
*20500307         1.0    cmpmass    107
*20500308         1.0    cmpmass    108
*20500309         1.0    cmpmass    201
*20500310         1.0    cmpmass    301
*20500311         1.0    cmpmass    301
**
*20500400   vssl-mass    sum    1.0    0.0   1
*20500401   0.0   1.0    cmpmass    501
*20500402         1.0    cmpmass    502
*20500403         1.0    cmpmass    503
*20500404         1.0    cmpmass    504
*20500405         1.0    cmpmass    505
*20500406         1.0    cmpmass    506
*20500407         1.0    cmpmass    507
*20500408         1.0    cmpmass    508
*20500409         1.0    cmpmass    509
*20500410         1.0    cmpmass    513
*20500411         1.0    cmpmass    514
*20500412         1.0    cmpmass    516
*20500413         1.0    cmpmass    517
*20500414         1.0    cmpmass    518
*20500415         1.0    cmpmass    519
*20500416         1.0    cmpmass    531
*20500417         1.0    cmpmass    510
```

```
**
*20500500  bi-mass    sum    1.0    0.0   1
*20500501  0.0  1.0    cmpmass    401
*20500502          1.0    cmpmass    402
*20500503          1.0    cmpmass    403
*20500504          1.0    cmpmass    404
*20500505          1.0    cmpmass    405
*20500506          1.0    cmpmass    406
*20500507          1.0    cmpmass    450
*20500508          1.0    cmpmass    701
**
*20500600  tot-p-mass    sum    1.0    0.0   1
*20500601  0.0  1.0    cntrvar    3
*20500602          1.0    cntlvar    4
*20500603          1.0    cntlvar    5
**
*205007600  sg-delt    sum    1.0   20.0   1
*205007601  0.   1.    temp    201010000
*205007602        -1.    temp    201200000
*
*       calculate   system   inventory
*      the first number on the following card is the full system mass
*20500800    invn   div   144.   1.   0
*20500801    cntrlvar 6
*20500900    invext   div   1.   1.   1
*20500901    cntrlvar 8
*
* calculate the core liquid collapsed   height
*
20501000  core-lvl    sum    1.      0.    1
20501001  0.   .6096    voidf      505010000
20501002          .6096    voidf      505020000
20501003          .3048    voidf      505030000
20501004          .3048    voidf      505040000
20501005          .3048    voidf      505050000
20501006          .3048    voidf      505060000
20501007          .6096    voidf      505070000
20501008          .6096    voidf      505080000
*
20501100  sgshlvl    sum    1.0    0.0   1
20501101  0.0          1.9609     voidf      702010000
20501102                1.23101    voidf      702020000
20501103                1.15481    voidf      702030000
20501104                1.23101    voidf      702040000
20501105                1.25641    voidf      702050000
20501106                1.15481    voidf      702060000
20501107                1.06591    voidf      702070000
20501108                0.65398    voidf      702080000
20501109                0.37827    voidf      702090000
20501110                0.50635    voidf      702100000
*20501111                 0.50635    voidf      702110000
20501112                0.40005    voidf      704010000
*
20501200  sgdclvl    sum    1.0    0.0   1
20501201  0.0          1.9609     voidf      705080000
20501202                1.23101    voidf      705070000
20501203                1.15481    voidf      705060000
20501204                1.23101    voidf      705050000
20501205                1.25641    voidf      705040000
20501206                1.15481    voidf      705030000
20501207                1.06591    voidf      705020000
20501208                0.65398    voidf      705010000
20501209                0.37827    voidf      709020000
20501210                0.50635    voidf      709010000
20501211                0.50635    voidf      703010000
20501212                0.40005    voidf      704010000
*
* calculate the broken leg generator upflow collapsed liquid level
*
20501300  blgu-cl sum   1.   9.532      0
20501301  0.   1.19609    voidf      701020000
20501302          1.23101    voidf      701030000
20501303          1.15481    voidf      701040000
20501304          1.23101    voidf      701050000
20501305          1.25641    voidf      701060000
20501306          1.15481    voidf      701070000
20501307          1.06591    voidf      701080000
20501308          0.98206    voidf      701090000
*
* calculate the broken leg generator downflow collapsed liquid level
*
20501400  slgd-cl   sum    1.      9.532    0
20501401  0.   0.98206    voidf      701100000
20501402          1.06591    voidf      701110000
20501403          1.15481    voidf      701120000
20501404          1.25641    voidf      701130000
20501405          1.23101    voidf      701140000
20501406          1.15481    voidf      701150000
20501407          1.23101    voidf      701160000
20501408          0.19609    voidf      701170000
*
* calculate the intact leg generator upflow collapsed liquid level
*
20501500  ileu-cl sum   1.0 9.525      1
20501501  0.   1.21831    voidf   201020000
20501502          1.20561    voidf   201030000
20501503          1.20561    voidf   201040000
20501504          1.20561    voidf   201050000
20501505          1.20561    voidf   201060000
20501506          1.20561    voidf   201070000
20501507          1.20561    voidf   201080000
20501508          0.48578    voidf   201090000
20501509          0.34411    voidf   201100000
*
* calculate the intact leg generator downflow collapsed liquid level
*
```

```
20501600  bigd-cl sum  1.0 9.525  1
20501601  0.  0.34411   voidf  201110000
20501602      0.48578   voidf  201120000
20501603      1.20561   voidf  201130000
20501604      1.20561   voidf  201140000
20501605      1.20561   voidf  201150000
20501606      1.20561   voidf  201160000
20501607      1.20561   voidf  201170000
20501608      1.20561   voidf  201180000
20501609      1.21381   voidf  201190000
*
20502300  pzrlevel   sum  1.0  0.0  1
20502301  0.0  0.3671   voidf   301010000
20502302       0.2549   voidf   301020000
20502303       0.2549   voidf   301030000
20502304       0.2549   voidf   301040000
20502305       0.0663   voidf   301050000
*
* heat losses to environment - bl sg
*
20502400   blsgpl sum 1. 0. 0
20502401  0.  1.41896 htmr 705300101
20502402      0.91455 htmr 705300201
20502403      0.99072 htmr 705300301
20502404      1.07788 htmr 705300401
20502405      1.05609 htmr 705300501
20502406      0.99072 htmr 705300601
20502407      1.05609 htmr 705300701
20502408      1.02613 htmr 705300801
20502409      0.57463 htmr 705400101
20502410      0.72732 htmr 705400201
20502411      0.72732 htmr 705400301
20502412      0.54335 htmr 705400401
*
* power losses to environment - il sg
*
20502500  ilsgpl   sum 1. 0. 0
20502501  0.  .35939  htmr  205300101
20502502      .50391  htmr  205300201
20502503      .41679  htmr  205300301
20502504     1.03430  htmr  205300401
20502505     1.03430  htmr  205300501
20502506     1.03430  htmr  205300601
20502507     1.03430  htmr  205300701
20502508     1.03430  htmr  205300801
20502509     1.03430  htmr  205300901
20502510     1.04520  htmr  205301001
20502511      .57463  htmr  205400101
20502512      .72732  htmr  205400201
20502513      .72732  htmr  205400301
20502514      .54335  htmr  205400401
*
* energy losses to environment - bl sg
*
20502600  blsgel integral 1. 0. 0
20502601   cntrlvar 24
*
* energy losses to environment - il sg
*
20502700  ilsgel integral 1. 0. 0
20502701   cntrlvar 25
*
* power losses to environment from sg
*
20502800  sgpl sum 1. 0. 0
20502801  0. 1. cntrlvar 24
20502802      1. cntrlvar 25
*
* energy losses to environment from sg
*
20502900  blsgel sum   1. 0. 0
20502901  0. 1. cntrlvar 26
20502902      1. cntrlvar 27
*
* integ of bl hot leg mass flow
*
20503000  blm integral 1.   0. 0
20503001  mflowj 402010000
*
* integ of il hot leg mass flow
*
20503000  ilm integral 1.   0. 0
20503001  mflowj 102020000
*
* integ of break mass flow
*
20503000  brm integral 1.   0. 0
20503001  mflowj 422000000
*
20510100   ilhimass   sum    1.0   0.0    1
20510101   0.0  9.2278200-04 rho 101010000
20510102        1.9918830-03 rho 102010000
20510103        5.9836050-04 rho 102020000
20510104        5.9836050-04 rho 102030000
20510105        7.8538960-04 rho 102040000
20510106        8.8732920-04 rho 102050000
20510107        8.8732920-04 rho 102060000
20510108        1.2796520-03 rho 103010000
20510109        5.4559250-04 rho 104010000
20510110        9.7311260-04 rho 104020000
20510111        8.1432400-04 rho 104030000
20510112        8.1432400-04 rho 104040000
20510113        1.4841030-03 rho 104050000
*
20510200   crossms   sum    1.0   0.0    1
20510201   0.0   1.0187750-03 rho 105010000
```

```
20510202          9.3065600-04 rho 105020000
20510203          8.1432400-04 rho 105030000
20510204          8.1432400-04 rho 105040000
20510205          8.1432400-04 rho 105050000
20510206          1.1289930-03 rho 105060000
20510207          2.0441630-03 rho 105070000
20510208          2.7480260-03 rho 105080000
20510209          2.7480260-03 rho 105090000
20510210          9.1438000-04 rho 105100000
20510211          9.1438000-04 rho 105110000
20510212          2.7480260-03 rho 105120000
20510213          2.7480260-03 rho 105130000
20510214          2.0441630-03 rho 105140000
*
20510300    ilclmass  sum    1.0  0.0    1
20510301 0.0      4.0772550-04 rho 106010000
20510302          1.0447530-03 rho 106020000
20510303          5.4641860-04 rho 106030000
20510304          6.7631200-04 rho 106040000
20510305          2.6372190-03 rho 106050000
20510306          2.7614970-03 rho 107010000
20510307          7.6276200-04 rho 108010000
*
20510400    ilsgpr   sum    1.0  0.0    1
20510401 0.0      1.6407770-03 rho 201010000
20510402          2.2416900-03 rho 201020000
20510403          2.2183220-03 rho 201030000
20510404          2.2183220-03 rho 201040000
20510405          2.2183220-03 rho 201050000
20510406          2.2183220-03 rho 201060000
20510407          2.2183220-03 rho 201070000
20510408          2.2183220-03 rho 201080000
20510409          8.9383520-04 rho 201090000
20510410          6.3316240-04 rho 201100000
20510411          6.3316240-04 rho 201110000
20510412          8.9383520-04 rho 201120000
20510413          2.2183220-03 rho 201130000
20510414          2.2183220-03 rho 201140000
20510415          2.2183220-03 rho 201150000
20510416          2.2183220-03 rho 201160000
20510417          2.2183220-03 rho 201170000
20510418          2.2183220-03 rho 201180000
20510419          2.2416900-03 rho 201190000
20510420          1.6407770-03 rho 201200000
*
20520100    blsgpr   sum    1.0  0.0    1
20520101  0.0     1.4264000-02 rho 202010000
20520102          1.6574000-02 rho 202020000
20520103          1.3183000-02 rho 202030000
20520104          1.6789000-02 rho 202040000
20520105          1.3532000-02 rho 202050000
20520106          1.2870000-02 rho 202060000
20520107          1.2850000-02 rho 202070000
20520108          5.8490000-03 rho 202080000
20520109          9.2780000-03 rho 202090000
20520110          7.6310000-03 rho 202100000
20520111          1.5420000-02 rho 202110000
20520112          2.6025000-02 rho 202120000
20520113          5.9663000-02 rho 203010000
20520114          3.3900000-02 rho 204010000
*
20520300    ilsgsec   sum    1.0  0.0    1
20520301  0.0     6.3370000-03 rho 205010000
20520302          3.2520000-03 rho 205020000
20520302          1.3220000-03 rho 205030000
20520304          3.2790000-03 rho 205040000
20520305          3.2790000-03 rho 205050000
20520306          3.2790000-03 rho 205060000
20520307          3.2790000-03 rho 205070000
20520308          3.2790000-03 rho 205080000
20520309          3.2790000-03 rho 205090000
20520310          3.3140000-03 rho 205100000
20520311          1.1400000-03 rho 206010000
20520312          2.9856000-02 rho 209010000
20520313          2.0686000-02 rho 209020000
*
20530100    pressms   sum    1.0  0.0    1
20530101  0.0     6.4825000-03 rho 301010000
20530102          6.4825000-03 rho 301020000
20530103          5.9118000-03 rho 301030000
20530104          5.9118000-03 rho 301040000
20530105          5.9118000-03 rho 301050000
20530106          1.1360000-03 rho 301060000
20530107          7.1837000-04 rho 302010000
20530108          2.3214100-04 rho 302020000
20530109          1.6457700-04 rho 302030000
20530110          4.4046000-05 rho 302040000
20530111          4.4046000-05 rho 302050000
20530112          4.4046000-05 rho 302060000
20530113          4.4046000-05 rho 302070000
*
20510500    blhlmss   sum    1.0  0.0    1
20510501  0.0     1.4245480-03 rho 401010000
20510502          5.5496350-04 rho 402010000
20510503          3.7182600-04 rho 402020000
20510504          8.9706890-04 rho 402030000
20510505          3.8022530-04 rho 402040000
20510506          3.2063850-04 rho 402050000
20510507          3.1781750-04 rho 402060000
20510508          5.5399890-04 rho 402070000
*
20510700    blcross   sum    1.0  0.0    1
20510701  0.0     4.4975840-04 rho 403010000
20510702          3.1781750-04 rho 403020000
20510703          3.2063850-04 rho 403030000
20510704          3.1781750-04 rho 403040000
```

```
20510705          9.8569380-04 rho 403050000
20510706          7.1445920-04 rho 403060000
20510707          7.1445920-04 rho 403070000
20510708          4.4539040-04 rho 403080000
20510709          4.4539040-04 rho 403090000
20510710          7.1445920-04 rho 403100000
20510711          7.1445920-04 rho 403110000
20510712          6.3701820-04 rho 403120000
*
20510800   biclmass  sum   1.0  0.0   1
20510801  0.0     7.5605530-04 rho 404010000
20510802          2.4731980-04 rho 405010000
20510803          6.4741950-04 rho 405020000
20510804          1.3575400-03 rho 406010000
20510805          8.6000000-04 rho 450010000
*
20510900   rvcore  sum   1.0  0.0   1
20510901  0.0     6.7400000-03 rho 501010000
20510902          6.5900000-03 rho 502010000
20510903          2.9600000-03 rho 503010000
20510904          5.2000000-04 rho 504010000
20510905          1.7434560-03 rho 505010000
20510906          1.7434560-03 rho 505020000
20510907          8.7172800-04 rho 505030000
20510908          8.7172800-04 rho 505040000
20510909          8.7172800-04 rho 505050000
20510910          8.7172800-04 rho 505060000
20511911          1.7434560-03 rho 505070000
20510912          1.7434560-03 rho 505080000
20510913          1.6400000-03 rho 506010000
20510914          2.8100000-03 rho 507010000
20510915          2.1800000-03 rho 508010000
20510916          1.4300000-03 rho 509010000
20510917          4.0470000-03 rho 509020000
20510918          3.9300000-04 rho 510010000
20510919          3.4000000-04 rho 513010000
20510920          3.4525000-04 rho 514010000
*
20511000   rvdcnr  sum   1.0  0.0   1
20511001 0.0     2.6189940-03 rho 516010000
20511002          3.7726480-03 rho 517010000
20511003          1.1833800-03 rho 518010000
20511004          1.1833800-03 rho 518020000
20511005          1.1833800-03 rho 518030000
20511006          1.1833800-03 rho 518040000
20511007          1.1833800-03 rho 518050000
20511008          1.1833800-03 rho 518060000
20511009          1.1833800-03 rho 518070000
20511010          1.1833800-03 rho 518080000
20511011          1.1833800-03 rho 518090000
20511012          9.1139620-04 rho 518100000
20511013          2.0770600-03 rho 519010000
20511014          2.6772900-05 rho 531010000
20511015          2.6772900-05 rho 531020000
20511016          2.6772900-05 rho 531030000
*
20510600   blsgpr  sum   1.0  0.0   1
20510601  0.0     1.3434060-03 rho 701010000
20510602          7.2961490-04 rho 701020000
20510603          7.5091610-04 rho 701030000
20510604          7.0443410-04 rho 701040000
20510605          7.5091610-04 rho 701050000
20510606          7.6641010-04 rho 701060000
20510607          7.0443410-04 rho 701070000
20510608          6.5020510-04 rho 701080000
20510609          5.9905660-04 rho 701090000
20510610          5.9905660-04 rho 701100000
20510611          6.5020510-04 rho 701110000
20510612          7.0443410-04 rho 701120000
20510613          7.6641010-04 rho 701130000
20510614          7.5091610-04 rho 701140000
20510615          7.0443410-04 rho 701150000
20510616          7.5091610-04 rho 701160000
20510617          7.2961490-04 rho 701170000
20510618          1.3434060-03 rho 701180000
*
20520200   blsgsec  sum   1.0  0.0   1
20520201  0.0     1.3509000-02 rho 702010000
20520202          9.0360000-03 rho 702020000
20520203          8.4700000-03 rho 702030000
20520204          1.0739000-02 rho 702040000
20520205          9.6150000-03 rho 702050000
20520206          8.4740000-03 rho 702060000
20520207          8.4250000-03 rho 702070000
20520208          1.5782000-02 rho 702080000
20520209          1.6807000-02 rho 702090000
20520210          2.5882000-02 rho 702100000
20520211          5.6736000-02 rho 703010000
20520212          3.3900000-02 rho 704010000
*
20520400  blsgsec   sum   1.0   0.0    1
20520401  0.0     1.4458000-02 rho 705010000
20520402          2.2410000-03 rho 705020000
20520403          2.4350000-03 rho 705030000
20520404          2.6390000-03 rho 705040000
20520405          2.5890000-03 rho 705050000
20520406          2.4310000-03 rho 705060000
20520407          2.5930000-03 rho 705070000
20520408          2.5140000-03 rho 705080000
20520409          2.9860000-02 rho 709010000
20520410          2.0686000-02 rho 709020000
*
*  total primary inventory
*
20511100   totalpr   sum   1.0   0.0    1
20511101  0.0          1.0  cntrlvar   101
```

```
20511102                1.0  cntrlvar   102
20511103                1.0  cntrlvar   103
20511104                1.0  cntrlvar   104
20511105                1.0  cntrlvar   105
20511106                1.0  cntrlvar   106
20511107                1.0  cntrlvar   107
20511108                1.0  cntrlvar   108
20511109                1.0  cntrlvar   109
20511110                1.0  cntrlvar   110
20511111                1.0  cntrlvar   301
*
*    total secondary inventory
*
20520500   totalsec  sum    1.0    0.0    1
20520501   0.0         1.0  cntrlvar   201
20520502                1.0  cntrlvar   202
20520503                1.0  cntrlvar   203
20520504                1.0  cntrlvar   204
*
2060000  feedinl     tmdpvol
2060101  0.00114  1.0  0.0  0.0  0.0  0.0  5.0e-06  0.0 00
2060200  1
*
*   modified by y.s.bang
*   maintaining 330 K
*
2060201    0.0    330.0    0.0
*2060201   0.0      460.0      0.0
*2060202   2100.0   460.0      0.0
*2060203   3000.0   400.0      0.0
*2060204   4500.0   300.0      0.0
*2060205   6000.0   220.0      0.0
*2060206   8000.0   130.0      0.0
*
2070000  steamout     tmdpvol
2070101  1.0  1.0  0.0  0.0  90.0  1.0  5.0e-06  0.0 00
2070200  2
*
2070201  0.0       5.85e06     1.0
2070202  2100.0    5.6e06      1.0
2070203  2763.0    2.78e06     1.0
2070204  3380.0    2.12e06     1.0
2070205  4500.0    1.80e06     1.0
2070206  6110.0    1.40e06     1.0
2070207  8000.0    1.20e06     1.0
*
*
7060000  feedinlc     tmdpvol
7060101  0.00114  1.0  0.0  0.0  0.0  0.0  5.0e-06  0.0 00
7060200  1
*
*   modified by y.s.bang
*   maintaining 330 K
*
7060201    0.0    330.0    0.0
*7060201   0.0      460.0      0.0
*7060202   2100.0   460.0      0.0
*7060203   3000.0   400.0      0.0
*7060204   4500.0   300.0      0.0
*7060205   6000.0   220.0      0.0
*7060206   8000.0   130.0      0.0
*
*
7070000  steamou     tmdpvol
7070101  1.0  1.0  0.0  0.0  90.0  1.0  5.0e-06  0.0 00
7070200  2
*
7070201  0.0       5.89e06     1.0
7070202  2100.0    5.60e06     1.0
7070203  2763.0    3.95e06     1.0
7070204  3380.0    3.15e06     1.0
7070205  4500.0    2.25e06     1.0
7070206  6110.0    1.50e06     1.0
7070207  8000.0    1.23e06     1.0
*
*
*   following items added to make easy postprocessing
*   at june 17, 1995 by ysbang.
*
*    control variables
*
* pressure in mpa
*
20521100  ppre   mult    0.000001   0.0   1
20521101    p     508010000
*
20521200  isgp   mult    0.000001   0.0   1
20521201    p     204010000
*
20521300  bsgp   mult    0.000001   0.0   1
20521301    p     704010000
*
20503000  ibrfw integral  1.   0.0   1
20503001  mflowj   422000000
*
*   differntial pressure in kpa
*
20521400  icrsg    sum    0.001    0.0    1
20521401  0.       1.     p      105100000
20521402           -1.     p      105030000
*
20521500  icrpm    sum    0.001    0.0    1
20521501  0.       1.     p      105110000
20521502           -1.     p      106020000
*
20521600  bcrsg    sum    0.001    0.0    1
```

```
20521601  0.     1.   p     403010000
20521602         -1.   p     403120000
*
20521700  bcrpm    sum   0.001   0.0    1
20521701  0.     1.   p     403080000
20521702         -1.   p     403120000
*
20521800  cordif   sum   0.001   0.0    1
20521801  0.     1.   p     505010000
20521802         -1.   p     505080000
*
*20523000  isglvl   sum   0.001   0.0    1
*20523001  0.     1.   p     202010000
*20523002         -1.   p     202120000
*
*20523100  bsglvl   sum   0.001   0.0    1
*20523101  0.     1.   p     702010000
*20523102         -1.   p     702100000
*
*    heat flus total
*
*20522800  tihf     sum     1.0    0.0     1
*20522801  0.   1.0    htmr    201010101
*20522802        1.0    htmr    201010201
*20522803        1.0    htmr    201010301
*20522804        1.0    htmr    201010401
*20522805        1.0    htmr    201010501
*20522806        1.0    htmr    201010601
*20522807        1.0    htmr    201010701
*20522808        1.0    htmr    201010801
*20522809        1.0    htmr    201010901
*20522810        1.0    htmr    201010001
*20522811        1.0    htmr    201010101
*20522812        1.0    htmr    201010201
*20522813        1.0    htmr    201010301
*20522814        1.0    htmr    201010401
*20522815        1.0    htmr    201010501
*20522816        1.0    htmr    201010601
*20522817        1.0    htmr    201010701
*20522818        1.0    htmr    201010801
*
*20522900  tbff   sum   1.0    0.0    1
*20522901  0.   1.0    htmr    701010101
*20522902        1.0    htmr    701010201
*20522903        1.0    htmr    701010301
*20522904        1.0    htmr    701010401
*20522905        1.0    htmr    701010501
*20522906        1.0    htmr    701010601
*20522907        1.0    htmr    701010701
*20522908        1.0    htmr    701010801
*20522909        1.0    htmr    701010901
*20522910        1.0    htmr    701010001
*20522911        1.0    htmr    701010101
*20522912        1.0    htmr    701010201
*20522913        1.0    htmr    701010301
*20522914        1.0    htmr    701010401
*20522915        1.0    htmr    701010501
*20522916        1.0    htmr    701010601
*
20523000  tilacc integral  1.   0.0   1
20523001  mflowj   611000000
*
20523100  tbacc integral  1.   0.0   1
20523101  mflowj   811000000
*
*
20510900   rvcore   sum    1.0   0.0    1
20510901  0.0    6.7400000-03 rho 501010000
20510902         6.5900000-03 rho 502010000
20510903         2.9600000-03 rho 503010000
20510904         5.2000000-04 rho 504010000
20510905         0.8717280-03 rho 505010000
20510906         0.8717280-03 rho 505020000
20510907         4.3586400-04 rho 505030000
20510908         4.3586400-04 rho 505040000
20510909         4.3586400-04 rho 505050000
20510910         4.3586400-04 rho 505060000
20510911         0.8717280-03 rho 505070000
20510912         0.8717280-03 rho 505080000
20510913         1.6400000-03 rho 506010000
20510914         2.8100000-03 rho 507010000
20510915         2.1800000-03 rho 508010000
20510916         1.4300000-03 rho 509010000
20510917         4.0470000-03 rho 509020000
20510918         3.9300000-04 rho 510010000
20510919         3.4000000-04 rho 513010000
20510920         3.4525000-04 rho 514010000
*
20540900   hcmass   sum    1.0   0.0    1
20540901  0.0    0.8717280-03 rho 555010000
20540902         0.8717280-03 rho 555020000
20540903         4.3586400-04 rho 555030000
20540904         4.3586400-04 rho 555040000
20540905         4.3586400-04 rho 555050000
20540906         4.3586400-04 rho 555060000
20540907         0.8717280-03 rho 555070000
20540908         0.8717280-03 rho 555080000
*
*   total primary inventory
*
20511100   totalpr   sum    1.0   0.0    1
20511101  0.0          1.0   cntrlvar   101
20511102               1.0   cntrlvar   102
20511103               1.0   cntrlvar   103
20511104               1.0   cntrlvar   104
20511105               1.0   cntrlvar   105
```

```
20511106              1.0   cntrlvar   106
20511107              1.0   cntrlvar   107
20511108              1.0   cntrlvar   108
20511109              1.0   cntrlvar   109
20511110              1.0   cntrlvar   110
20511111              1.0   cntrlvar   301
20511112              1.0   cntrlvar   409
*
*   implementation of reactor vessel dp
*
20548800   rvdp       sum   0.001 1.0    1
20548801   0.0        1.0   p     502010000
20548802             -1.0   p     508010000



20531000   hotpow     function   1.0   5.7+04   1
20531001   time   0      500
*
20531200   avepow     function   1.0   3.8+04   1
20531201   time   0      550
*
20531300   totpow     sum        1.0   9.5+04   1
20531301   0.0        1.0        cntrlvar   310
20531302              1.0        cntrlvar   312
*
*   steam generation from core
*
20547100   stem       sum   1.0    0.0    1
20547101   0.0   0.8717280-03 gammaw 505010000
20547102         0.8717280-03 gammaw 505020000
20547103         4.3586400-04 gammaw 505030000
20547105         4.3586400-04 gammaw 505040000
20547106         4.3586400-04 gammaw 505050000
20547107         4.3586400-04 gammaw 505060000
20547108         0.8717280-03 gammaw 505070000
20547109         0.8717280-03 gammaw 505080000
*
20547200   hsteam     sum   1.0   0.0    1
20547201   0.0   0.8717280-03 gammaw 555010000
20547202         0.8717280-03 gammaw 555020000
20547203         4.3586400-04 gammaw 555030000
20547204         4.3586400-04 gammaw 555040000
20547205         4.3586400-04 gammaw 555050000
20547206         4.3586400-04 gammaw 555060000
20547207         0.8717280-03 gammaw 555070000
20547208         0.8717280-03 gammaw 555080000
*
*
20547300   stem       sum   1.0    0.0    1
20547301   0.0   0.8717280-03 vapgen 505010000
20547302         0.8717280-03 vapgen 505020000
20547303         4.3586400-04 vapgen 505030000
20547305         4.3586400-04 vapgen 505040000
20547306         4.3586400-04 vapgen 505050000
20547307         4.3586400-04 vapgen 505060000
20547308         0.8717280-03 vapgen 505070000
20547309         0.8717280-03 vapgen 505080000
*
20547400   hsteam     sum   1.0   0.0    1
20547401   0.0   0.8717280-03 vapgen 555010000
20547402         0.8717280-03 vapgen 555020000
20547403         4.3586400-04 vapgen 555030000
20547404         4.3586400-04 vapgen 555040000
20547405         4.3586400-04 vapgen 555050000
20547406         4.3586400-04 vapgen 555060000
20547407         0.8717280-03 vapgen 555070000
20547408         0.8717280-03 vapgen 555080000
*
20548100   totsteam   sum   1.0   0.0   1
20548101   0.0   1.0   cntrlvar   471
20548102         1.0   cntrlvar   472
*
20548200   totsteam   sum   1.0   0.0   1
20548201   0.0   1.0   cntrlvar   473
20548202         1.0   cntrlvar   474
*
*   end of transient input deck
```

NRC FORM 335 (2-89) NRCM 1102, 3201, 3202

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG/IA-0144

2. TITLE AND SUBTITLE

Assessment of RELAP5/MOD3.2 With the Semiscale Natural Circulation Experiment, S-NC-8B

3. DATE REPORT PUBLISHED

MONTH	YEAR
August	1998

4. FIN OR GRANT NUMBER

W6238

5. AUTHOR(S)

Y. S. Bang, K. W. Seul, S. Lee, H. J. Kim

6. TYPE OF REPORT

7. PERIOD COVERED *(Inclusive Dates)*

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Korea Institute of Nuclear Safety
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9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

10. SUPPLEMENTARY NOTES

S. Smith, NRC Project Manager

11. ABSTRACT *(200 words or less)*

The predictability of RELAP5/MOD3.2 code is assessed for the natural circulation induced by small break loss of coolant accident in the pressurized water reactor by using Semiscale experiment S-NC-8B. The Semiscale Mod-2A facility is modeled, as a base case, by using single core channel model. The base case calculation is executed, the result is compared with the experiment data and code predictability on the important thermal-hydraulic phenomena is discussed.

Sensitivity calculations are attempted to figure out the problems in base case prediction, and to find out the effects of two core channel model and ECCMIX component model on the improvement code predictability. The important thermal-hydraulic phenomena include system depressurization, break flow in saturated and stratified conditions, natural circulation in two-phase mode and reflux mode, loop seal behavior at crossover legs, and accumulator injection behavior. The base calculation shows the RELAP5/MOD3.2 can predict the overall thermal-hydraulic behavior such as system depressurization, with the exception of underprediction of saturated break flow, deviation of loop seal behavior, and resultant discrepancy in core thermal response. Two core channel model can improve the predictability on loop seal behavior.

ECCMIX component can improve an early accumulator injection behavior and core thermal response. However, discontinuous accumulator injection is one of the problems in two core channel model calculation. To resolve the accmulator injection problem, the extensive modeling study and/or code model improvement are needed.

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

RELAP5, SBLOCA, Semiscale

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

(This Page)

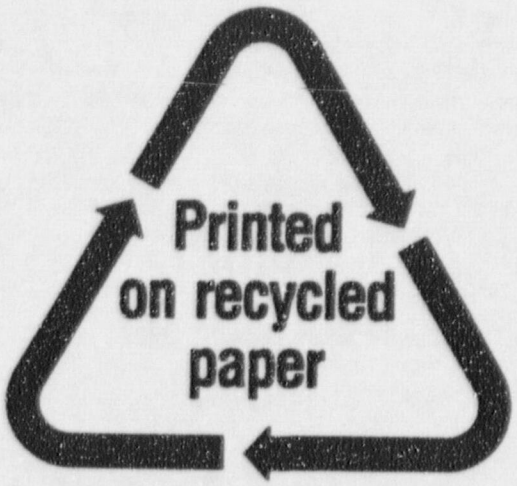
unclassified

(This Report)

unclassified

15. NUMBER OF PAGES

16. PRICE



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