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Assessment Study of RELAP5/MOD3.2 Based on the Kalinin NPP Unit-1 Stop of Feedwater Supply to the Steam Generator No. 4

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ABSTRACT

This report has been prepared as a part of the Agreement on Research Participation and Technical Exchange under the Code Assessment and Maintenance Program.

The data collected by Kalinin NPP Unit-1 Data Acquisition System and In-Vessel Monitoring System during stop of feedwater supply to the SG-4 transient have been analyzed by using the RELAP5/MOD3.2 and RELAP5/MOD3.2.2Beta codes. Kalinin NPP-1 is a Russian designed four loop pressurized water reactor (VVER-1000, project V-338) rated at 1000 MWe.

RELAP5 code calculated results were compared with plant data. Sensitivity studies were carried out to investigate the effects of modeling on major thermal-hydraulic parameters and to examine a new heat transfer model for horizontal tube bundles.

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EXECUTIVE SUMMARY

This report has been prepared as a part of the Agreement on Research Participation and Technical Exchange under the Code Assessment and Maintenance Program.

On July 1996 at the Unit-1 of Kalinin NPP (VVER-1000/V-338) the break of the check valve occurs in the steam generator No 4 feedwater supply pipeline, that initiated the transient with sharp decreasing of the feedwater to the steam generator.

In the present report the data collected by Kalinin NPP Data Acquisition System and In-Vessel Monitoring System were used to assess RELAP5/MOD3.2 code capabilities to simulate reactor unit with VVER-type reactor behavior during transient with stop of feedwater supply.

The model has been developed from Kalinin NPP plant drawing and documentation. Principal characteristics of the model include: reactor vessel, four circulation loops, pressurizer, four steam generators with steam lines, main steam header, control and trips also were modeled.

A point kinetic option was selected for core neutronic feedback, as considered adequate enough for this kind of transient. To get the reactivity coefficients BIPR-7 code was applied.

The comparison of calculated and measured data showed, that RELAP5/MOD3.2 code well describes main parameters in primary and secondary circuits, such as: pressure and pressure drops, coolant temperatures, collapsed water levels in a pressurizer and steam generators. Divergence between the calculated and measured data did not exceed limits of measurement accuracy for the most parameters of the transient.

The sensitivity study was carried out for estimating a heat transfer model in the RELAP5/MOD3.2 code. For the additional calculation boundary geometry for horizontal tube bundles (option 134) was applied. The sensitivity study showed that the heat transfer coefficients at the outer surface of the SG tubes for option 134 approximately is 1.54÷2.52 times larger than for the option 101. A choice between options 101 and 134 in simulation the tube bundles heat transfer practically does not influence the main parameters behaviour.

RELAP5/MOD3.2.2Beta calculations were performed to estimate differences in simulating considered transient by two code versions: MOD3.2 and MOD3.2.2Beta.

Analysis of the simulation results for two RELAP5 code versions showed that for the same input deck, the practically identical results with MOD3.2.2Beta and MOD3.2 were obtained.

NOMENCLATURE

AKNP – Neutron Flux Control Systems;

ARM – Automatic Reactor Power Regulator;

BRU-A – Fast Acting Relief Device Dump Steam to the Atmosphere;

BRU-K – Fast Acting Relief Device Dump Steam to the Condenser;

DAS – Data Acquisition System;

ECCS – Emergency Core Cooling System;

EGSR – Turbine Power Electric-Hydraulic Regulator;

KaNPP – Kalinin NPP;

HT – Heat Transfer Coefficient;

MCP – Main Circulation Pump;

MFR – Main Feedwater Regulator;

MSH – Main Steam Header;

MSIV – Main Steam Isolated Valve;

OR SUZ – Emergency Protection System;

PTU – Protection Tubes Unit;

RCS – Reactor Coolant System;

ROM – Reactor Power Limitation Regulator;

PRZ – Pressurizer;

RU – Reactor Unit;

RV – Reactor Vessel;

SG – Steam Generator;

SF – Safety Valve;

SPS - Submerged Perforated Sheet;

SSFR - Stop - Start-up Feedwater Regulator;

FIV – Fast Acting Isolated Valve;

TPN – Turbo-Feedwater Pump;

CL_i – Cold Leg of Loop No i;

HL_i – Hot Leg of Loop No i;

SG_i – Steam Generator of Loop No i.

1 INTRODUCTION

Experimental or transient data obtained at operating NPP are base for assessment of computer codes applied for substation of the power plant operation and reliability of equipment.

One of the most important parameters to be controlled at Russian designed NPP with VVER type reactors is a water level position in steam generators. When it exceeds the maximum permitted value, humidity of vapor entering turbine will be increased. If the water level will decrease heat exchange will be degraded.

In July 1996 at Unit-1 Kalinin NPP occurred the activation of the 1^{-st} kind emergency protection caused by decreasing of the steam generator No 4 water level during unit operation with 11^{-th} fuel cycle. The feedwater flowrate to the SG sharply decreased caused by the failure of the check valve in the SG feedwater supply pipeline.

The plant data collected at July 07 1996 by plant Data Acquisition and In-Vessel Monitoring Systems [1] were used at analyses performed as one of the stages of RELAP5/MOD3.2 code verification.

The main goals of this analysis are the RELAP5/MOD3.2 code assessment for the heat transfer removal accidents on the NPP with VVER-1000 reactors caused by stop of feedwater supply.

In the comparative analysis of the calculated and plant data the following parameters are considered:

Primary circuit parameters:

- Reactor power,
- Primary circuit pressure,
- Reactor vessel inlet/outlet coolant temperature,
- Main circulation pumps head,
- Reactor vessel pressure drop,
- Steam generators pressure drop,
- Pressurizer collapsed water level.

Secondary circuit parameters:

- Steam generators pressure,
- Steam generators collapsed water level,

- Feedwater mass flowrate,
- Feedwater temperature.

A brief description of the Kalinin NPP is provided in Chapter 2.

Description of transient is presented in Chapter 3.

An input deck developed to simulate this transient is described in Chapter 4.

Chapter 5 describes RELAP5/MOD3.2 code assessment against transient data on stop of feedwater supply to the SG-4 during Kalinin NPP Unit-1 operation at nominal conditions.

Sensitivity study for estimating a HT models for horizontal tube bundles is given in Chapter 6.

A brief description of the RELAP5/MOD3.2.2Beta calculation results is provided in Chapter 7.

Chapter 8 shows the run statistics.

Conclusions are presented in Chapter 9.

APPENDIX-A – Base case results.

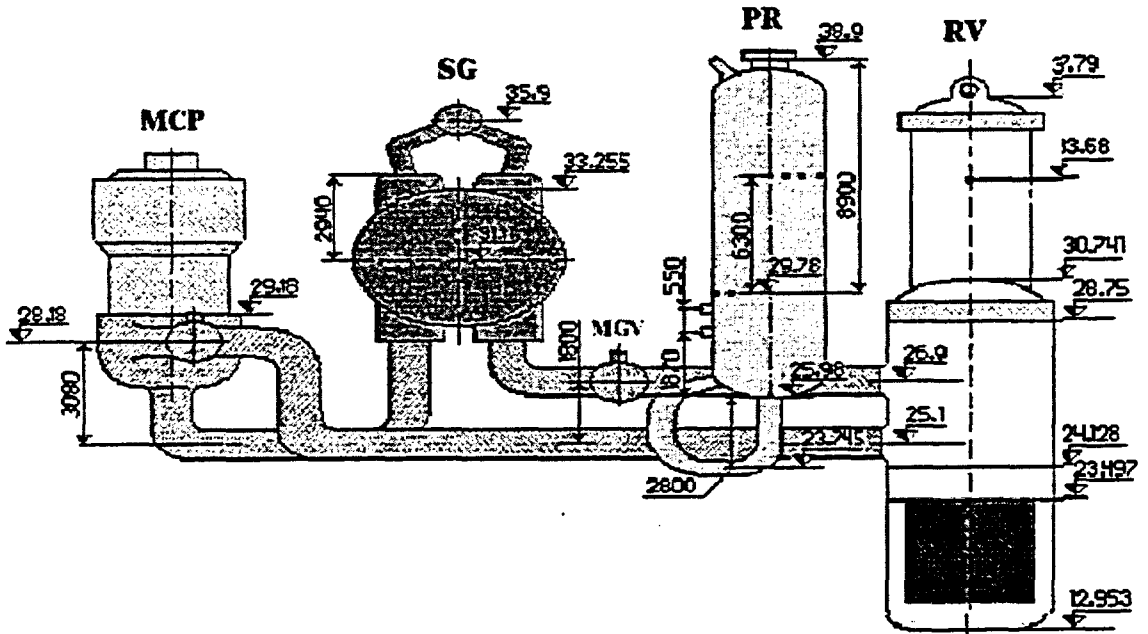
APPENDIX-B – Sensitivity study results.

APPENDIX-C – Results of RELAP5/MOD3.2.2Beta calculations.

APPENDIX-D – Input deck.

2 KALININ NPP DESCRIPTION

This section provides a brief description of the power plant and principal systems relevant to understand the examined transient NPP with VVER-1000 type reactor. The substantial systems associated with the event are the reactor coolant system, steam and feedwater lines, emergency protection systems (AZ-1), automatic reactor power regulator (ARM), reactor power limitation regulator (ROM) and electric-hydraulic regulator of the turbine power (EGSR).



Unit-1 of Kalinin NPP is the Russian design water pressurized reactor VVER-1000 (project V-338) rated at 1000 MWe. The general design features of VVER-1000/V-338 are similar to the standard VVER-1000/V-320, excepted of the main circulation loops configuration [2,3].

Each primary loop of project V-338 is equipped with main gate valves on the cold and hot legs. General view a reactor coolant system of Kalinin NPP is shown in Figure 2.1.

The main VVER-1000/V-338 reactor parameters are listed bellow:

Thermal power	**- 3000 MW,**
Coolant Pressure	**- 15.7 MPa,**
Circulation loops number	**- 4,**
Coolant flow through reactor	**- 84800 m^3/h,**
Coolant temperature inlet	**- 289.7 C,**
Coolant temperature outlet	**- 320.0 C.**

2.1 Primary side

Primary side consists of reactor vessel, four circulation loops, pressurizer and four hydroaccumulators.

Unlike, standard VVER-1000 (project V-320), hot legs and main circulation pumps are located approximately at the same elevation, the hot and cold legs have the main gate valves, loop seal is shorter. The main equipment of reactor unit (RV, MCP, SG, PR) are same type as project V-320.

2.1.1 Reactor Vessel

The reactor vessel is a cylindrical high pressure container where the fuel assemblies and vessel internal equipment are situated.

There are eight nozzles (DN=850 mm) in two levels (four nozzles at each level) in the reactor vessel. The nozzles are connected with the four primary circuit's loops.

Each level has two nozzles that are connected with hydroaccumulators of Emergency Core Cooling System (ECCS).

Main specifications of reactor vessel are shown in the Table 2.1.

Table 2.1 Reactor vessel main parameters

№	Parameter	Value
1.	Length, m	10.88
2.	Diameter, external on the flange, mm	4570
3.	Diameter, external on the cylindrical part, mm	4535
4.	Maximum dimension on the branch pipe section, mm	5280
5.	Thickness of the cladding layer, mm	7
6.	Reactor vessel weight, t	304
7.	Reactor vessel material	15ХНМФА

Volume and mass of the major reactor vessel components are presented in the Table 2.2.

Reactor consist of the following equipment: reactor pressure vessel, internal core barrel and baffle, protective tube unit, upper block, drives of control rods, trains of neutron measurement, core etc. Axial cross section of the reactor vessel with the in-vessel components are presented on Figure 2.2.

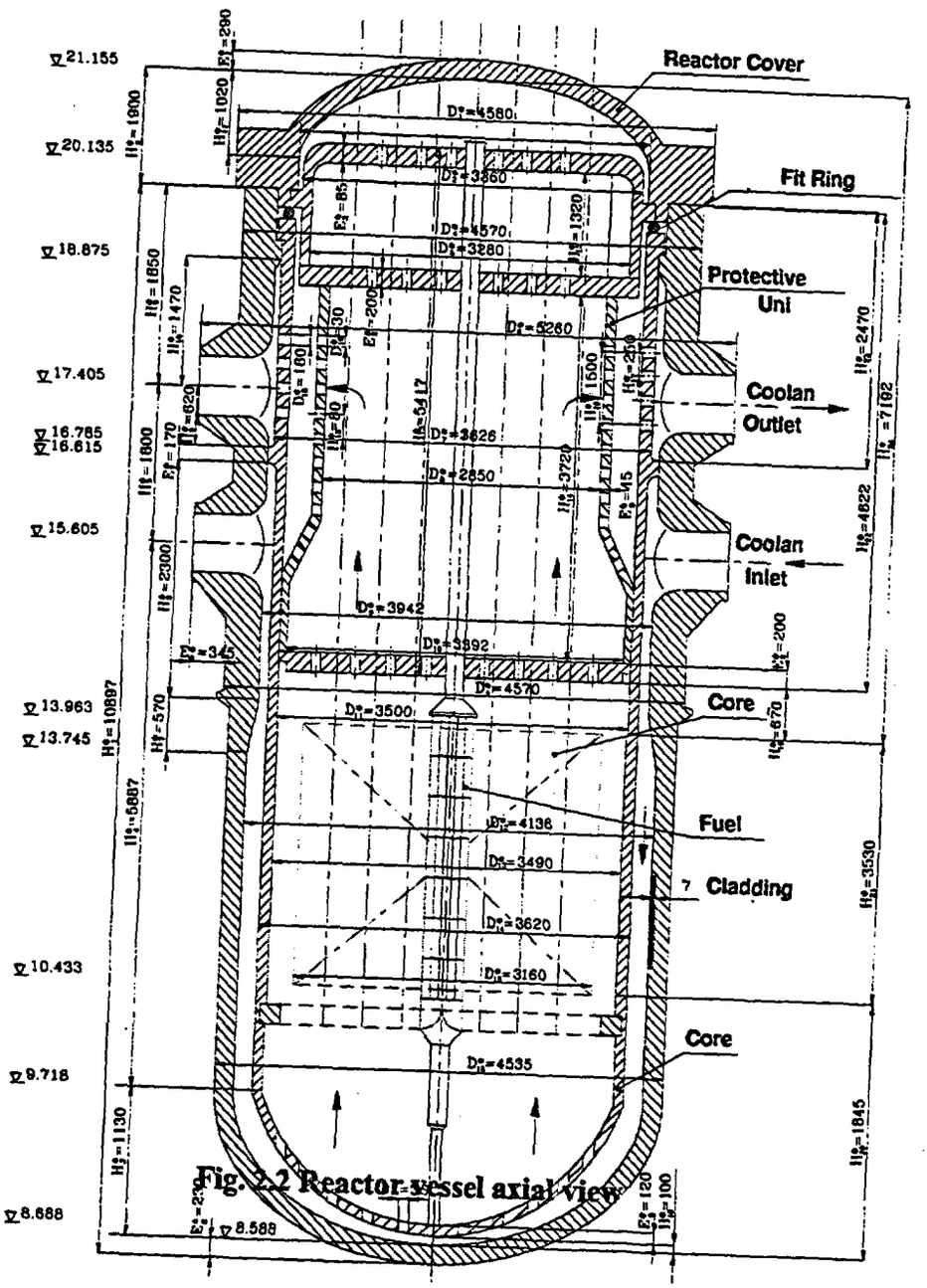


Fig. 2.2 Reactor vessel axial view

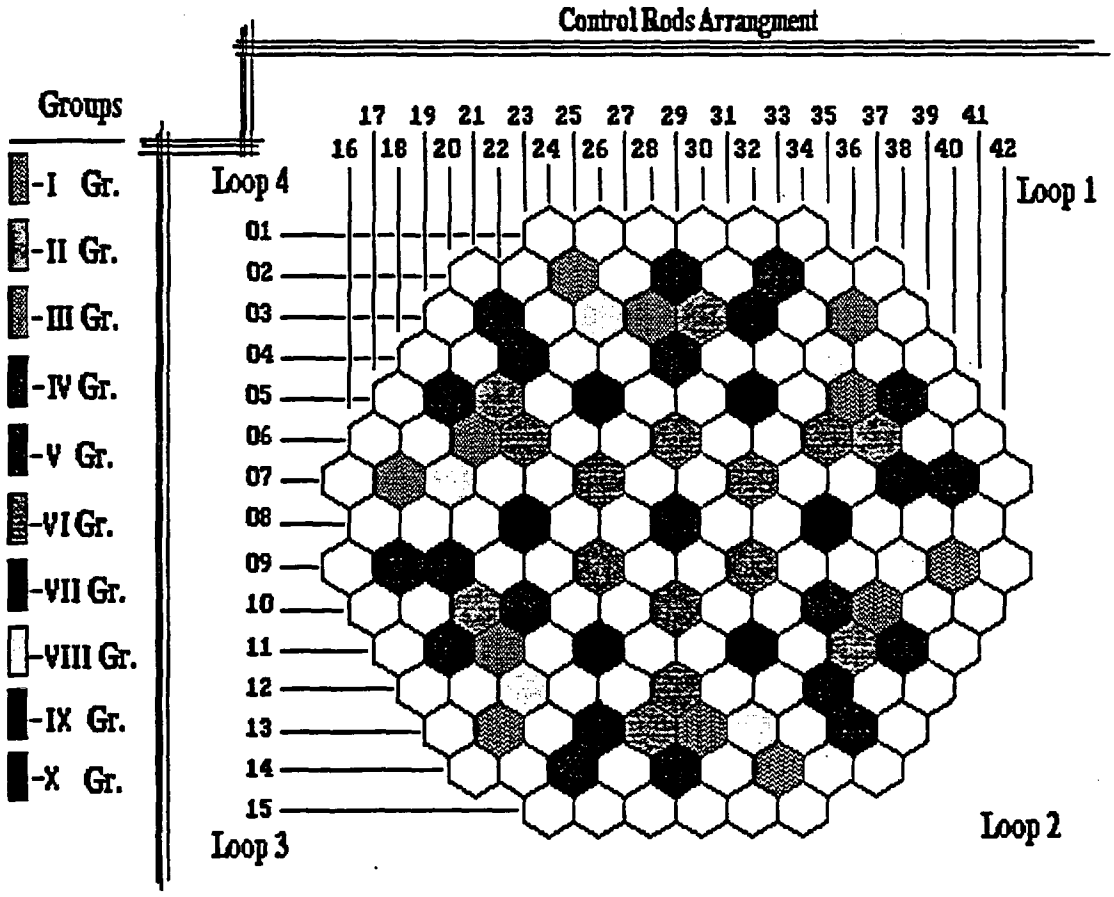
Table 2.2 Reactor vessel volumes and mass

№	Parameter	Value
1.	Reactor vessel total volume, m^3	110
2.	Upper plenum volume, m^3	38.0
3.	Downcomer and lower plenum volume, m^3	36.0
4.	Core volume, m^3	13.7
5.	Protective tubes volume, m^3	5.43
6.	Measurement units volume, m^3	2.3
7.	Upper head volume, m^3	20.0
8.	Core heat transfer surface, m^2	5130
9.	Mass of fuel in the core, kg	80100
10.	Mass of cladding in the core, kg	22630

2.1.2 Core

Core of the VVER-1000/V-338 consists of 163 hexagonal fuel assemblies (Figure 2.3). Each of fuel assembly consists of 312 fuel rods with fuel pellets of uranium dioxide, central tube and 18 guide tubes for absorber of control rods. Fuel pellets have central axial hole. Material of fuel rod cladding is Zr1%Nb alloy. Stainless steel grid spacers are located at every 255 mm along the core height.

Fuel assemblies of the VVER-1000/V-338 differ from that VVER-440. Opposite to VVER-440 fuel assemblies of VVER-1000 have no shroud. VVER-1000 fuel assembly has larger size, more fuel and control rods of different design. There are 61 assemblies of control rods in the core. Each assembly includes 18 absorber elements. Absorber material is B_4C. Control rod assemblies are combined into 10 groups one of which is the operational group (group No 10). This group of control rods is partially immersed into the core during operation.


Control Rods Arrangment
Groups
I Gr.
II Gr.
III Gr.
IV Gr.
V Gr.
VI Gr.
VII Gr.
VIII Gr.
IX Gr.
X Gr.
16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42
Loop 4
Loop 1
01
02
03
04
05
06
07
08
09
10
11
12
13
14
15
Loop 3
Loop 2

2.1.3 Primary loops

Each RCS loop (Figure 2.1) includes a horizontal steam generator, a main circulation pump, hot and cold legs, two main gate valves. Four primary loops have a common flow path through reactor vessel, but otherwise they are independent in operation.

Main circulation pump is a vertical one-stage pump with the following main parameters:

Type	-	195M;
Capacity	-	20000 m^3/h;
Head	-	$6.75^{\pm 0.25}$ kg/cm^2;
Suction side pressure	-	15.3 MPa;
Primary circuit coolant temperature	-	300 C.

Main circulation pump is capable to provide special law of flow decrease at accident with loss of off-site power. The MCP main characteristics are shown in the Table 2.3.

Table 2.3 Main circulation pump characteristics

№	Parameter	Value
1.	Power, kW	8000
2.	Nominal speed, rpm	1000
3.	Loss coefficient of stopped pump, relative to the loop velocity	
	Positive flow direction	27.0
	Reverse flow direction	32.7
4.	Nominal torque, Nm	
	Hot water flow	47500
	Cold water flow	64800
5.	Internal rotor torque, Nm	73600

The characteristics of main circulation legs are presented in the Table 2.4.

Table 2.4 Primary loops characteristics

№	Parameter	Value
	Hot leg	
1.	Length from reactor nozzle, m	16.94
2.	Inner diameter, mm	850
3.	Outer diameter, mm	990
4.	Length from reactor nozzle to the main gate valve, m	6.82
5.	Length from reactor nozzle to the pressurizer surge line, m	3.81
6.	Volume, m^3	9.61
	Cold leg	
1.	Length, m	28.72
2.	Inner diameter, mm	850
3.	Outer diameter, mm	990
4.	Length from MCP axis to the main gate valve, m	4.215
5.	Volume, m^3	16.3

2.1.4 Pressurizer

A pressurizer is connected to the hot leg of the loop No 4 by a surge line. The surge line length is 18 m. Pressurizer spray line is connected to the cold leg of the loop No 1. Spray can be also performed via make-up pipeline. A set of heaters is installed in pressurizer. The heaters are intended to keep pressure in case of its decrease. The steam dome of the pressurizer is connected to bubble condenser by steam dump pipelines. Steam and gas is released via three safety valves or emergency gas removal system.

The main characteristics of pressurizer are shown in the Tables 2.5÷2.7.

Table 2.5 Pressurizer main characteristics

№	Parameter	Value
1.	Total volume, m^3	79
2.	Nominal water volume, m^3	55
3.	Total height, m	12.92
4.	Inner diameter, mm	3000
5.	Outer diameter, mm	3330
6.	Dry weight, t	191.5
7.	Number of heater blocks	28
8.	Power per heater block, kW	90
9.	Operation temperature, C	346
10.	Design pressure, MPa	17.7
11.	Operation pressure, MPa	15.7
12.	Number of pressurizer relief valves	3
13.	PORV opening/closing pressure, kg/cm^2	
	Control valve 2YP21S01	185/180
	Operational valve 2YP22S01	190/180
	Operational valve 2YP23S01	190/180
14.	PORV opening/closing time, s	1
15.	Flow rate through one PORV, t/h	180

Table 2.6 Pressurizer surge line characteristics

№	Parameter	Displacement	Length, m	Elevation change, m
1.	Hot leg connection nozzle	-45°	0.62	-0.74
2.	Direct part	-45°	0.97	-0.69
3.	Bend part	45°	1.335	-1.21
4.	Vertical part	-90°	1.433	-1.433
5.	Bend part (bend radius R = 1.7 m)	90°	2.67	-1.7
6.	Horizontal part	0°	0.3	0.0
7.	Bend part (bend radius R = 1.7 m)	90°	2.67	0.0
8.	Horizontal part	0°	1.325	0.0
9.	Bend part (bend radius R = 1.7 m)	90°	2.67	0.0
10.	Horizontal part	0°	1.462	0.0
11.	Bend part (bend radius R = 1.7 m)	90°	2.67	1.7
12.	Vertical part to the PRZ nozzle	90°	0.15	0.15
Total			18.275	-3.923

Table 2.7 Pressurizer heaters characteristics

Group №	Nomenclature	Power, kW	Pressure, kg/cm^2	
			Switch On	Switch Off
1	1DV11VD1	90	158.5	161
	DD09	180		
2	1DV11V16	90	157	159.5
	DD10	180		
3	DD01	180	155	158
	DD02	180		
	DD05	180		
	DD06	180		
4	DD03	180	153	157
	DD04	180		
	DD07	180		
	DD08	180		

2.2 Secondary Side

Kalinin NPP secondary circuit includes feedwater system, steam generators, steam lines, turbine generator and condenser system.

2.2.1 Steam Generator PGV-1000

Kalinin NPP steam generators are of horizontal type of series PGV-1000.

Steam generator is designed for heat removal from primary coolant and for generation of dry saturated steam. Steam generator ensures primary circuit cooldown to prescribed temperatures in all design basis regimes. Construction of primary circuit together with steam generator provides primary circuit cooldown.

Steam Generator PGV-1000 is a vessel heat exchanger with the horizontal tube bundles submerged in a water volume and with the separating devices arranged in a steam volume. The vessel is a horizontal cylinder with elliptical faces having an inner diameter of 4 m and length of 11.8 m (Figures 2.4÷2.6). The thickness of the vessel wall is 120 mm at the ends, 145 mm at the central part and 105 mm at the other. The vessel is covered outside with thermal insulation. The heat exchange area is composed of 11000 U-shaped tubes of diameter 16x1.5 mm. The tubes are collected in staggered bundles (Figure 2.5). The tube ends are connected to vertical inlet ("hot") and outlet ("cold") primary collectors. The upper tube row is located at 2190 mm above SG bottom.

The collectors have an inner diameter D = 834 mm and wall thickness 168 mm in their perforated zone. The submerged perforated sheet is arranged 250 mm above the top row of tube bundles to decrease kinetic energy of steam-water mixture and equalize steam loads at evaporation surface. Feedwater is injected above "hot" side of tubes through distributing nozzles (Figure 2.4). Separating is of gravitational type with subsequent draining by a louver separator mounted in the steam dome. The separated liquid is moved down below the mixture level.

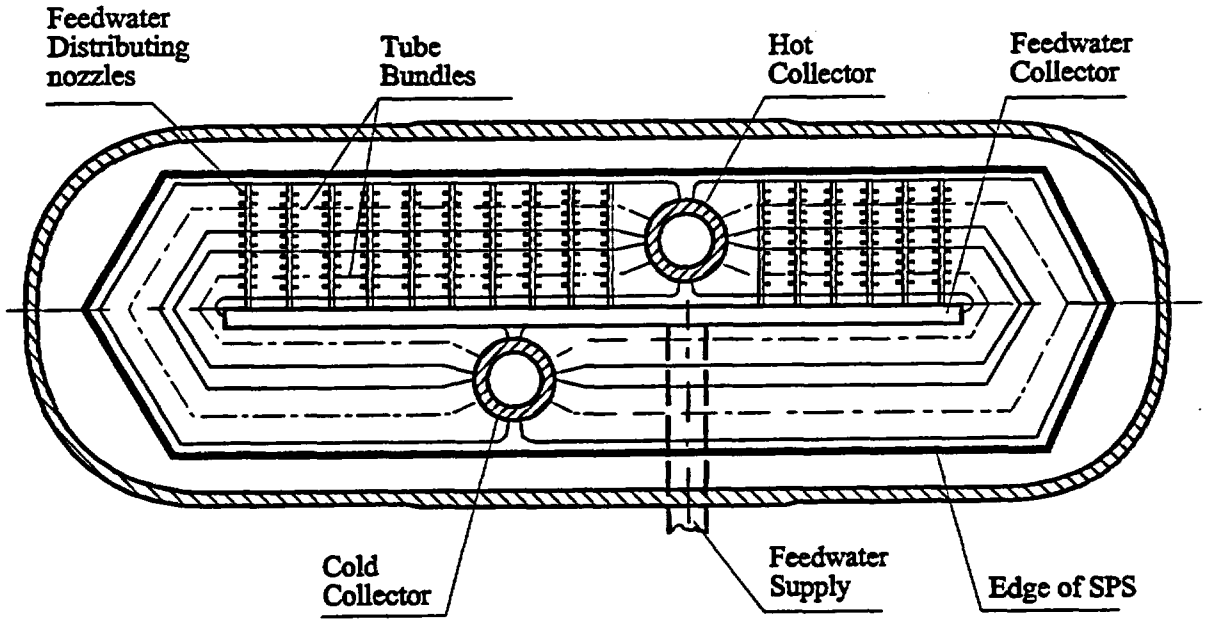


Fig. 2.4 PGV-1000: Top View

Cross section for tube bundle of the PGV-1000 is shown in Figure 2.5

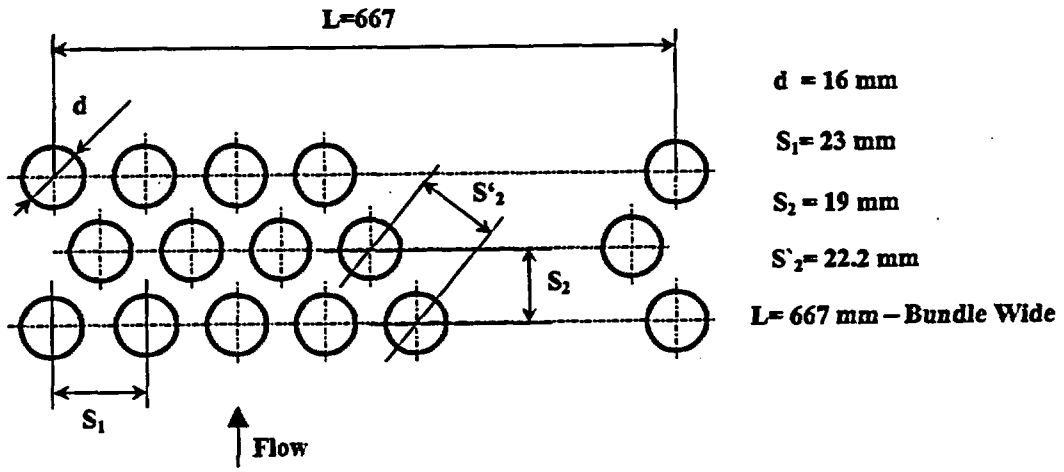


Fig. 2.5 Geometry of tube bundle

As follows from PGV-1000 design practice a flow area of the horizontal tube bundle is defined as:

$$F_b = F\frac{S_1 - d}{S_1}$$

Where:

F_b – effective flow area of a tube bundle;

F – total area of the tube bundle, derived from its width and length.

Form loss coefficient of a tube bundle is defined as:

$$\xi_b = \xi_r\,(Z+1),$$

where:

ξ_r – form loss coefficient of one tube row;

Z – number of tubes in the depth of a bundle.

For the central bundle Z = 110, for the side bundle Z = 88; in diverse estimates based on experimental data ξ_r varies in a range of 0.15 to 0.40.

Hydraulic diameter of the bundle is 17.4 mm.

Heat exchange tubes and most in-vessel structures of SG are made of stainless steel 08X18H10T. Collectors and SG vessel are made of steel 10ГН2МФА.

Cross section of PGV-1000 in vicinity of "hot" collector is presented in Figure 2.6.

Main design characteristics are presented in Tables 2.8÷2.9 and Figure 2.7.

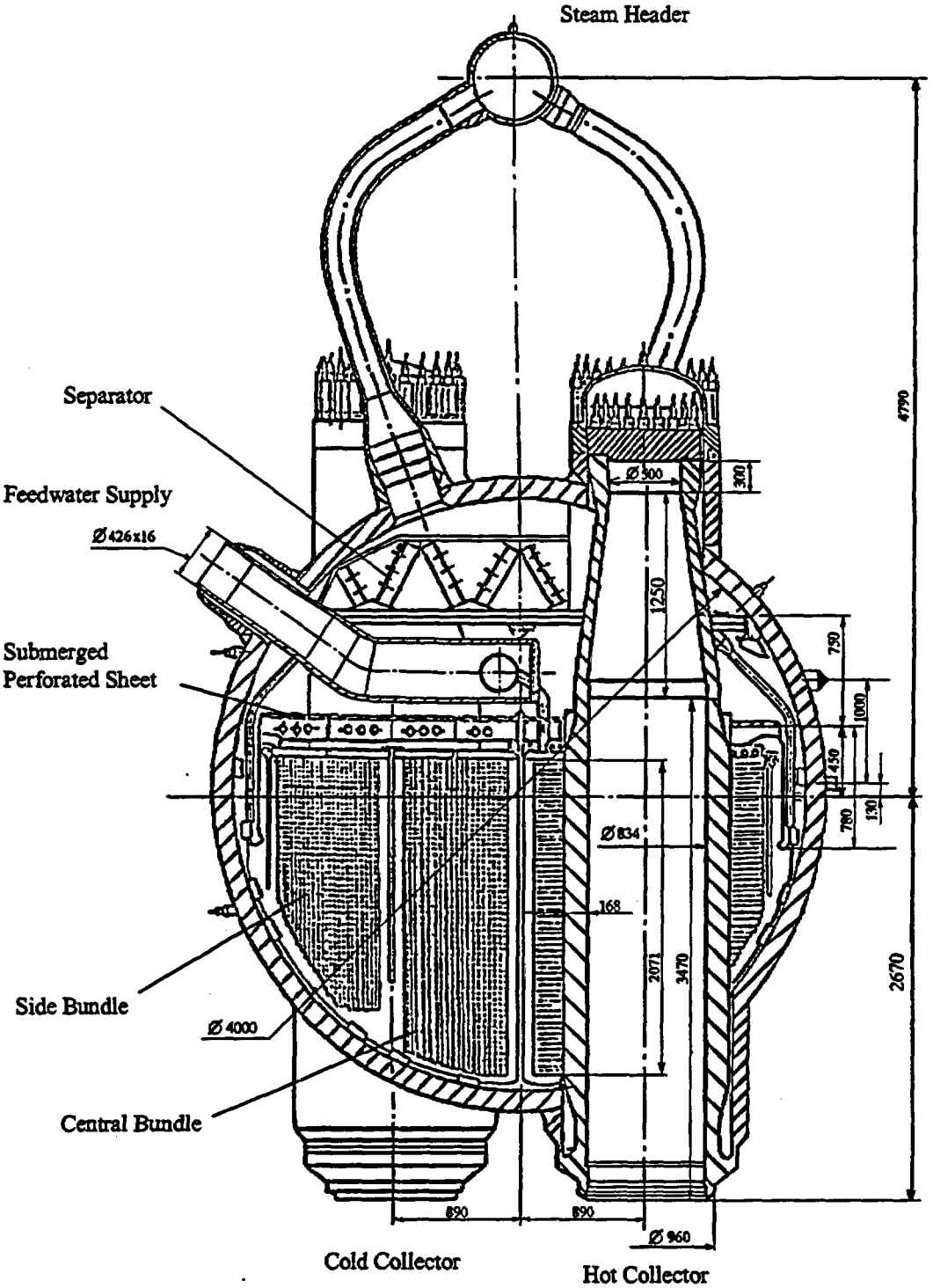


Fig. 2.6 PGV-1000: Cross view

Table 2.8 Main SG PGV-1000 parameters (design) at the nominal operation mode.

Parameter	Value
Thermal power, MW	750
Steam pressure, MPa	6.3
Steam capacity, kg/s	408
Averaged steam velocity at evaporation surface, m/s	0.38
Steam humidity at the SG outlet, %	≤0.2
Water collapsed level (at downcomer part, related to the SG bottom), m	2.25
Water mixture level (related to the SG bottom), m	2.55
Feedwater temperature, K	493
Primary coolant pressure at the SG inlet, MPa	15.69
Primary coolant temperature, K: - inlet to SG - outlet from SG	 593 563
Primary coolant flow rate, m^3/s	5.89
Primary coolant velocity in tubes, m/s	4.2
Pressure difference at SG primary side, MPa	0.15
Total heat exchange area, m^2	6115
Specific heat flux, kW/m^2: - average - maximal	 123 227
Average coefficient of heat transmission, $kW/(m^2 K)$: - with account of fouling - for clean surface	 5.4 6
Mean logarithmic temperature difference, K	24.7
Temperature of the SG vessel wall, K	548

Table 2.9 Secondary side volume and heat transfer surface of PGV-1000

Elevation, m	Heat transfer surface, m^2	Secondary Side volume, m^3
0.0	0.00	0.53
0.2	10.23	2.18
0.4	446	5.90
0.6	877	10.76
0.8	1385	15.80
1.0	1673	18.50
1.2	2627	28.00
1.4	3342.5	34.40
1.6	4057.5	42.00
1.8	4772.5	47.80
2.0	5487.5	55.16
2.19	6115	62.80
2.5	-	77.63
2.6	-	82.50
3.0	-	100.50
3.5	-	119.90
4.0	-	127.00

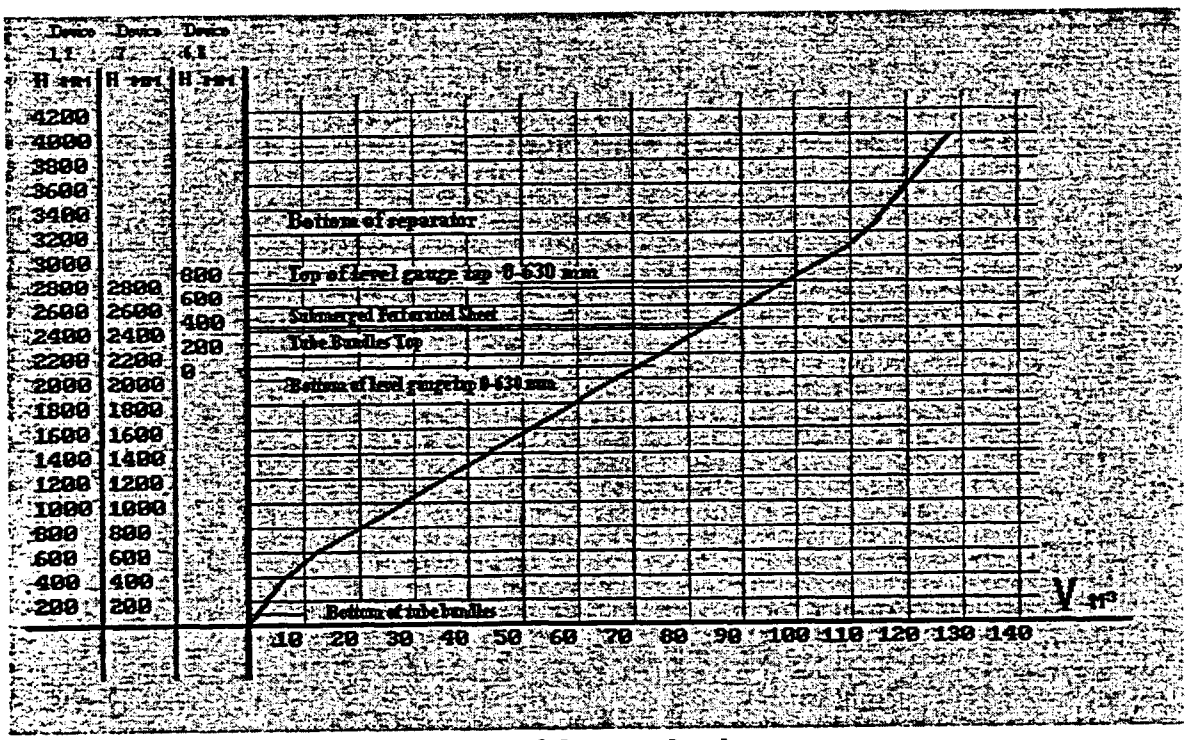


Fig. 2.7 KaNPP-1 SG water level nomogram

2.3 Monitoring, Control and Protection System

Kalinin NPP Control and Monitoring System include the following main controllers:

- ARM – Automatic Reactor Power Regulator;

- ROM - Reactor Power Limitation Regulator;

- Primary circuit pressure controller;

- PRZ water level controller;

- SG water level controllers.

ARM, ROM and SG water level controllers are briefly described herein.

Automatic reactor power regulator (ARM-5C) include two regulators:

- Regulator of thermal-hydraulic parameters;

- Fission reactor power regulator.

Influence to the 10^{-th} control rods group ARM provides steady state conditions of the following parameters:

- Reactor power, measured by AKNP (the mode "H");

- Pressure in the main steam header (the mode "T").

ARM operated together with turbine electric-hydraulic regulator (EGSR).

Influence to the turbine control valve EGSR provides a stable level of the following parameters:

- Turbine-generator capacity (the mode "RM");

- Pressure in the main steam header (the mode "RD1")

Reactor power limitation regulator (ROM-2M) decrease the reactor power to the given set point in the following cases:

- Stop one of four MCP – to 67% of power current value;
- Stop two opposite MCP – to 50% of power current value;
- Stop two neighboring MCP – to 40% of power current value;
- Stop one of two TPN – to 50% of power current value;
- Stop two of two TPN – to 8% of nominal power;

- Closing two of four FIV – to 40% of nominal power.

Power decreasing due to subsequent insertion (one by one) the 10^{-th}, 9^{-th}, 8^{-th} etc control rods groups with operational speed of 20 mm/s.

An algorithm of control rods groups insertion in the core provides the start of the next group moving, when the previous one gets the position 20% of the whole core height of core bottom.

2.3.1 Steam Generator Feedwater Control System

The SG feedwater control system is intended for maintaining a water level in SG within permitted range under steady state and transient conditions by means of changing a feedwater flow rate. Each steam generator has two types of water level control: main (RL71C02, RL72C02, RL73C02, RL74C02) and stop - start-up (RL71C04, RL72C04, RL73C04, RL74C04) feedwater regulators.

Stop - Start-up feedwater regulators (SSFR) should realize SG water level maintaining with accuracy ±50 mm in stop–start-up modes of the unit, and at the main feedwater regulator switching off.

In the operating mode SSFR should support the sum of the following signals:

$$E_{SFR} = a_1 * L_{sp} - a_2 * m - a_3 * L_i,$$

where:

m – valve RL7IC04 stem position,

L_i – SG_i water level,

L_{sp} – set point value of SG water level,

a_i – weight factors.

Main feedwater regulator (MFR) should realize SG water level maintaining with accuracy ±50 mm.

In the operating mode MFR should support the sum of the following signals:

$$E_{MFR} = a_1 * L_{sp} - [a_2 * L_i - a_3 * G_{sti} + a_4 * G_{Bi} + a_5 * (dP_{MSH}/dt) + a_6 * (dL_i/dt)],$$

where:

G_{sti} – SG_i steam flow rate,

P_{MSH} - main steam header pressure,

L_i – SG_i water level,

L_{sp} – set point value of SG water level,

$a_6 * (dL_i /dt)$ – is formed with dead zone - ±1%,

a_i – weight factors.

2.4 Plant Diagnostic Uncertainty Bands

Measurement of a collapsed water level in SG is measured by a hydrostatic method with use of static pressure taps, differential manometers and secondary registering instruments. Two types of level gauges are used: one with a base length, i.e. with a distance between taps is 4000 mm (level gauges 1, 2) and another with base length 630 mm (level gauges 4, 6, 7, 8). Two level gauges with a 4000 mm base take a collapsed level relative to the SG vessel bottom. Four level gauges with a 630 mm base length are staggered near the top row of tube bundles. The one-chamber transducers measure level on a base of 4000 mm. The measuring device is intended to fix a level in a plus pulse line and to create the sufficient water volume being able to compensate changes of water volume in a plus chamber of the differential manometer. Measurement accuracy depends on that as exactly known average water density in the plus pulse line which is installed separately from the minus pulse line.

The two-chamber vessels are used in level meters with a base 630 mm. The vessel consists of chambers of constant and variable level. The constant level chamber is designated to keep water at temperature that is maximum close to saturation temperature in SG secondary side. For this purpose it accumulates vapor condensate trapped from SG steam dome. The two-chamber vessels allow eliminating a temperature deviation; but resulting in delay of measurement due to design and long pulsing line.

Uncertainties of the major parameters are given in the Table 2.10 [4].

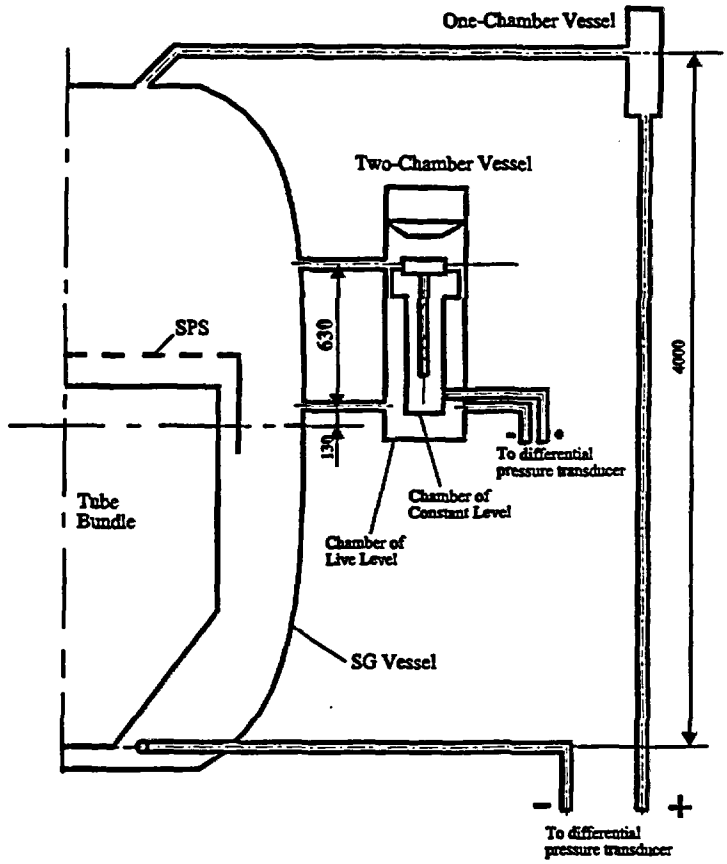


Fig. 2.8 Arrangement of SG level-meter vessels

Table 2.10 Uncertainties of measurement

Parameter	Value of uncertainty
Reactor power (thermal), %	2 +3
Primary circuit pressure, %	± 1.0
Pressurizer water level, %	± 1.5
Secondary side pressure, %	± 1.5
Steam generator water level, %	± 1.0
Coolant temperature, K	± 2.4

3 TRANSIENT DESCRIPTION

This description is prepared on the base of the archive data collected by DAS and In-Vessel Monitoring Systems Kalinin NPP on July 07, 1996 [1].

In this chapter there are given the initial data for plant status prior to the transient changes of the major thermal-hydraulic parameters during ten minutes after transient beginning.

3.1 Initial Plant State

Prior to the transient reactor unit was operated in the steady state at 97% of nominal power. A stationary mode of the RU has been supported by the operations of the two main power regulators: ARM had operated in the mode "T" (maintaining the reactor power), and EGSR had operated in the mode "RD1" (maintaining the pressure in the main steam header). The plant status prior to the transient is shown in Table 3.1.

Table 3.1 Plant status prior to transient

Parameter	Measured value			
Reactor power (thermal/electric), MW	2917/966			
Boron acid concentration, g/kg	0.93			
Position of the 10th control rods group, %	88			
Fuel cycle, effective days	194			
Primary circuit pressure (above the core), kg/cm^2	160			
Reactor vessel pressure drop, kg/cm^2	3.33			
Pressurizer level, m	8.77			
Loop parameters				
Primary Circuit	**Loop No**			
	1	2	3	4
Main circulation pump pressure drop, kg/cm^2	5.8	5.7	5.9	6.0
Coolant temperature at reactor vessel inlet, C	286.0	286.5	287.3	286.3
Coolant temperature at reactor vessel outlet, C	315.9	313.1	314.4	315.1
Reactor vessel coolant mass flowrate, m^3/h	20289	22925	23410	21599
SG pressure drop, kg/cm^2	1.49	1.54	1.50	1.59
Secondary Side	**Loop No**			
	1	2	3	4
Feedwater temperature, C	164.1	163.1	163.5	163.9
Feedwater flowrate, t/h	1244	1242	1296	1276
SG steam pressure, kg/cm^2	60.1	59.8	60.1	59.8
SG collapsed water level, mm	2224	2206	2273	2297

3.2 Sequence of Events

The sharp decreasing of the feedwater flowrate to the SG-4 was caused by the failure of the feedwater pipeline check valve. This moment is assumed to be the start of the transient.

A transient has been defined by the operation of the following regulators: ARM, EGSR, ROM. After check valve failure a sharp decreasing of the feedwater flowrate to the SG-4 occurred. Eight seconds later the water level in the SG-4 begins to decrease and at $\tau = 45$ sec, the set point for MCP-4 switch-off was reached.

ARM stops its management of the reactor power after switching-off MCP-4. ROM was moving the

10^{-th} control rods group with the working speed 20 mm/s during 8 s (of position 88% to position 83.5% counted from the core bottom). After that an activation of the 1^{-st} kind emergency protection has happened.

Due to the failure of the interlocking that was not activated after MCP-4 switching-off, the water level in the SG-4 decreased to 1600 mm and AZ-1 was activated.

Timing of events during the transient is presented in the Table 3.2 [1].

Table 3.2 Sequence of events

Event	Time, s
SG-4 feedwater pipelines check valve failure	0.0
Sharp decreasing SG-4 water level	8.00
Main SG-4 feed water regulator is transmitted to the remote control mode and is full (100%) opened	32.00
MCP-4 switching-off due to the signal "A decrease of the water level in the SG-4"	45.00
Activation of the ROM due to the signal "Switch-off MCP-4"	46.00
Activation of the AZ-1 due to the signal " The water level in the SG-4 reached 1600 mm"	54.00
Switching-on emergency feedwater pump	68.00
Trip turbine of the Unit-1. $W_{el} = 0.0$ MW	76.00
Switching-off turbo-feedwater pumps	132.00

Remark: Devices consisted in the protection had shown that SG-4 water level became lower than 1750 mm the 45 seconds beginning of transient. The 1^{-st} kind emergency protection had been activated the 54 seconds by the signal "A decrease of the SG-4 water level lower than 1600 mm". Signal for the AZ-1 activation is formed in conformity with principle "2 of 3". A signal about SG

water level changing is given by the detectors located in the different points of the steam generator. Steam generator water level measured data, using in this report are taken from DAS archive. DAS data are not used as initial signals for emergency protection system.

The KaNPP Data Acquisition System monitors parameters every 4 seconds. A registration of any parameters is performed by the DAS only if a parameter's deviation exceeds the established set point.

4 INPUT MODEL DESCRIPTION

The code used in analyses was RELAP5/MOD3.2.

The input deck developed for analyses is presented in Appendix D. The features of noding scheme are described herein.

The general philosophy is a compromise between precision and economy of the resources (CPU time). For the primary system, a minimum transport time (i.e. ratio of a component length to coolant velocity) of 0.0334 s was obtained for a steady state regime, when the SG hot collector is represented by six control volumes. Modeling SG is principally based on common (owner [5] and international) experience of modeling horizontal steam generators of NPP with VVER-type reactors. All external solid components were specified in the input model to account for heat release to the containment.

Kalinin NPP-1 nodalization scheme represents four loops scheme and includes the following basic components of the primary and secondary circuits:

- reactor vessel,
- four loops,
- PRZ,
- four SGs,
- steam lines,
- main steam header,
- SG safety and relief valves.

The final nodalization scheme (Figures 4.1÷4.2) comprises 562 volumes, 701 junctions and 494 heat structures (with 1944 mesh points).

The noding schemes of RU basic elements, rendering the greatest influence to the transient are presented below.

Reactor vessel nodalization scheme is shown in Figure 4.1.

Reactor vessel inlet chamber (inlet nozzles included) is simulated by four identical volumes – components 5÷8. Each of these components is connected to the cold leg of the related loop. All components are connected by crossflow junctions and will create a closed loop.

The upper points of each volume are connected to the components simulating reactor vessel inlet/outlet bypass (components - 1÷4).

The lower points of each volume are connected to the upper points of first sub-volumes of components simulating downcomer.

Downcomer (components 9÷12) are connected in cross direction; they are similar to the RV inlet volumes. Each element consists of six vertical sub-volumes. The lower point of 6^{-th} sub-volume is connected to the element simulating lower plenum.

Lower part of the reactor vessel (bellow bottom of the baffle) is simulated by the components 9÷12. Components 18÷25, simulated the part of the lower plenum from the baffle bottom to core the heated part inlet.

Heated part of the core is divided into four parallel channel (components 26÷40), each of which includes 10 sub-volumes. Components 26÷28 simulated 41 fuel assemblies, and components 29÷40 – 40 fuel assemblies each.

Core bypass between core barrel and baffle is represented by component No 34; the control rod guide tubes and core rim are simulated by the components No 35_{-01} ÷35_{-06}' 36.

Upper plenum is simulated by the elements 45÷64. The segment located above elements 41÷44 is divided on 12 parallel channels. The components 45÷48 simulate the volume inside PTU, the components 49÷52 - the volume between PTU and baffle; and elements 61÷64 – simulate the coolant outlet zone between the baffle and reactor vessel, including outlet nozzles.

Volume of PTU lower plate up to the bottom of the reactor cover is simulated by the component No 54. The reactor vessel upper head is simulated by an element No 56.

The nodalization schemes of two primary circulation loops (loop No 1 and No 4) are shown at the Figure 4.1. The loops No 2 and No 3 have a similar configuration, apart from pressurizer surge and spray lines.

The nodalization schemes of the steam generators secondary side and steam lines are shown in the Figure 4.2.

Heat exchange tubes with the primary coolant inside are distributed into five groups:

- first layer (lower) correspond to 1018 tubes with average length 10.61 m;
- second layer corresponds to 1798 tubes with average length 10.76 m;
- third layer corresponds to 2884 tubes with average length 11.04 m;
- fourth layer corresponds to 2932 tubes with average length 11.25 m;
- fifth layer corresponds to 2368 tubes with average length 11.25 m.

As heat flux significantly changes along the length of tubes due to the coolant temperature change, the tubes are divided into five nodes in longitudinal direction.

Steam generator secondary side is divided into the following main zones:

- area involving heat exchanges tube (between the elevations 0.0 and 2190 mm);
- layer between the upper tubes and SPS;
- layer of two-phase mixture above SPS;
- steam space above the mixture level;
- gap between vessel walls and SPS rim and between the tube bundles.

Secondary side of the tube bundles was simulated by the stack of five vertical volumes (for SG1 components No 161÷165. Feedwater is supplied in the element 165 on the part of the hot collector.

Area between tube bundles; gaps between SG vessel wall and tube bundles were simulated by the components No 171÷175 (SG No 1).

SPS is represented by reduced flow area in junctions, that connected the volumes 166 and 168 in exact accordance to the actual perforation rate. Loss coefficient of holes on SPS is derived from pressure drop 0.6÷1.1 kPa [5].

The steam layer between the upper tube rows and SPS is simulated by the component No 166. Layer of the two-phase mixture above SPS is simulated by component No 168; its height is

chosen so that a nominal position of mixture level corresponds to the elevation height of the volume center. SG steam dome and corresponding steam pipelines are simulated by the components No 169÷182.

Pressurizer is connected to the hot leg of the loop No 4 (Figure 4.1). Pressurizer is simulated by the component No 504 and divided in to 10 sub-volumes. In the top of pressurizer are located 3 safety valves. Pressurizer surge line is simulated by element No 504. Pressurizer spray line, which connected pressurizer steam dome to the cold leg of loop No 3, is simulated by the component No 349.

For obtaining KaNPP-1 initial steady-state condition some additional controllers were used. During steady-state calculation pressurizer and steam generator pressure and water levels are maintained.

Initial conditions were obtained by using RELAP5 steady state option and subsequent null-transient run of 1000 s duration. The measured and calculated values of the main parameters for steady state conditions are presented in the Table 4.1.

Table 4.1 Plant status prior to transient

№	Parameter	KaNPP-1	RELAP5
1.	Reactor power (thermal), MW	2917.0	2917.0
2.	Coolant flowrate, kg/s	18471	18471.1
	Loop No 1	4253.6	4253.6
	Loop No 2	4800.4	4800.1
	Loop No 3	4892.4	4892.4
	Loop No 4	4524.9	4525.0
3.	Primary side Pressure, MPa	15.68	15.674
4.	Reactor vessel inlet/outlet pressure drop, kPa	326	328.86
5.	Coolant temperature RV inlet/outlet, K		
	Loop No 1	559/589	559.3/589.6
	Loop No 2	559/586	559.2/586.4
	Loop No 3	560/587	560.3/588.0
	Loop No 4	559/588	559.4/588.7
6.	Pressurizer water level, mm	8770	8770
7.	MCP head, kPa		
	MCP No 1	568.4	568.48
	MCP No 2	558.6	560.45
	MCP No 3	578.2	578.58
	MCP No 4	588.0	588.09
8.	Feedwater temperature, K		
	SG No 1	437.3	437.3
	SG No 2	436.3	436.3
	SG No 3	436.7	436.7
	SG No 4	437.1	437.1
9.	Feedwater flowrate, kg/s		
	SG No 1	345.6	345.6
	SG No 2	345.0	345.0
	SG No 3	360.0	360.0
	SG No 4	354.4	354.4
10.	Steam generator pressure, MPa		
	SG No 1	5.89	5.883
	SG No 2	5.86	5.855
	SG No 3	5.89	5.881
	SG No 4	5.86	5.856
11.	Steam generator water level, mm		
	SG No 1	2224	2223
	SG No 2	2206	2199
	SG No 3	2273	2274
	SG No 4	2297	2297

Remark: In the RELAP calculation feedwater flow rate and feedwater temperature were applied as boundary conditions.

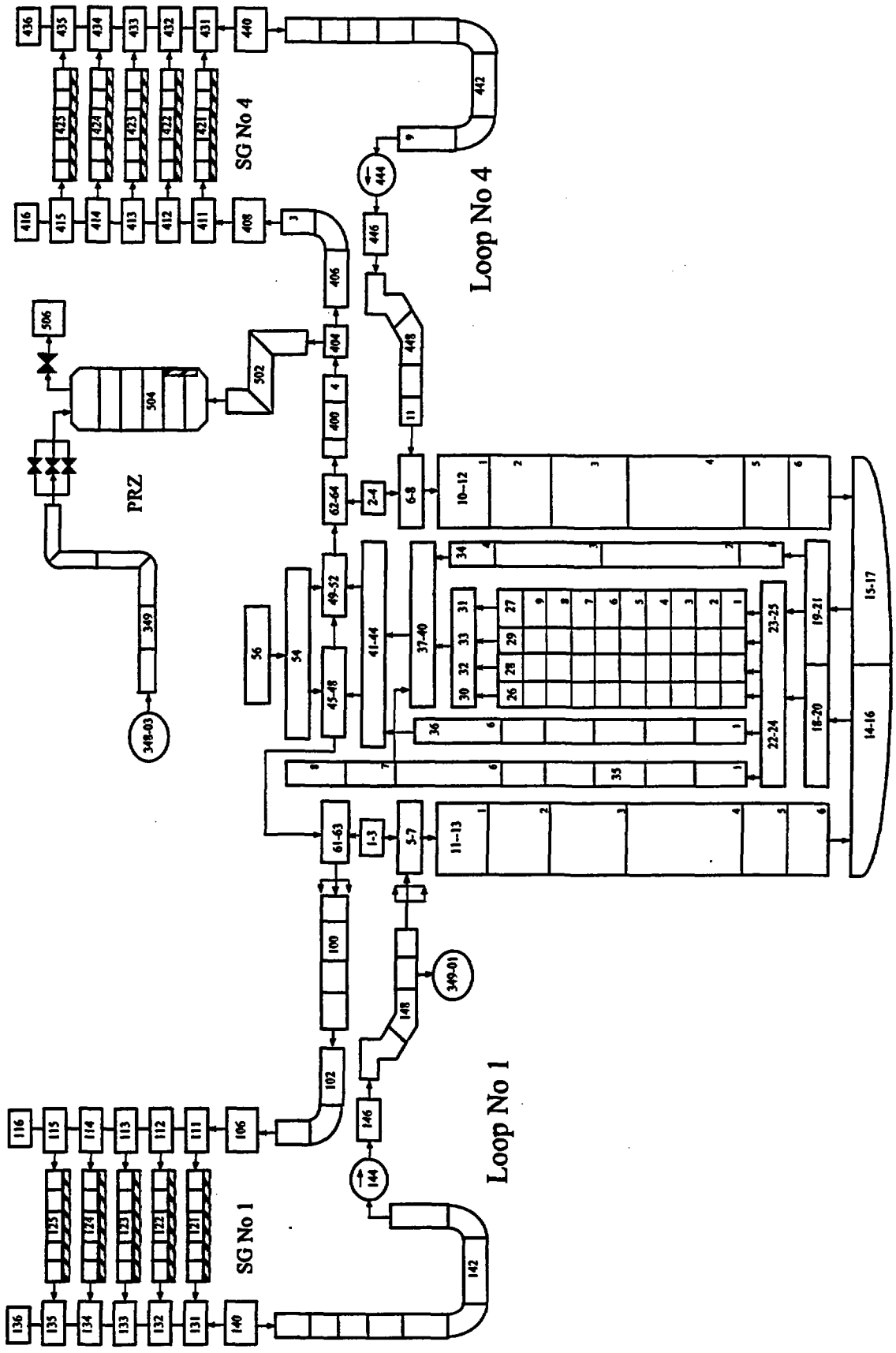


Fig. 4.1 VVER-1000/V338. Primary circuit nodalization scheme

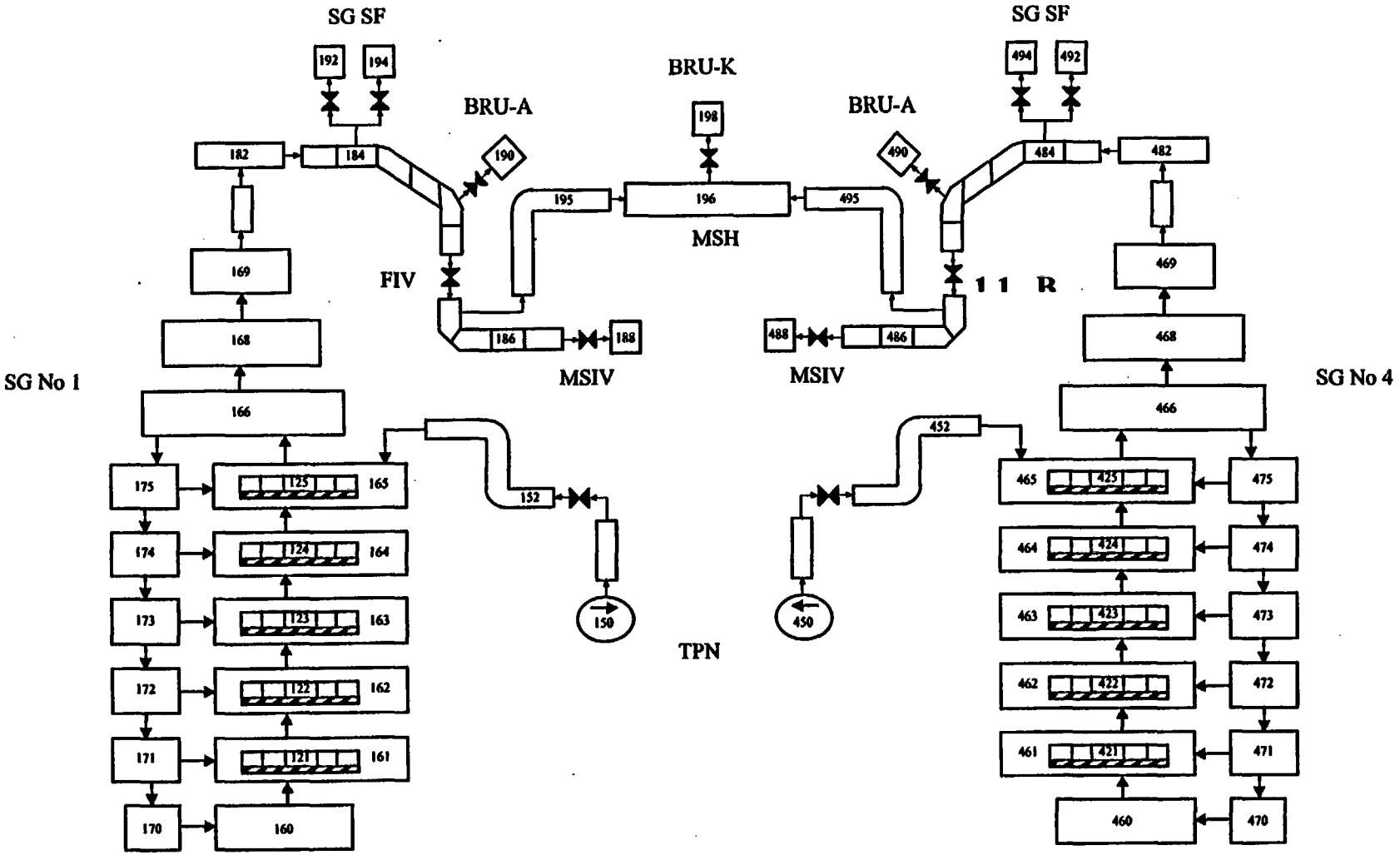


Fig. 4.2 VVER-1000/V338. Secondary side nodalization scheme

5 RESULTS OF SIMULATION

The transient considered in this report can be referred to a category of incidents caused by the plant equipment failure. Stop of feedwater supply to the steam generator No 4 of the KaNPP-1 occurred by the failure of the feedwater pipeline check valve. In the given analysis as beginning of transient (τ = 0.0 s) the time of sharp decrease of the feedwater flowrate to the SG-4 was assumed.

Calculated results and plant-recorded parameters are presented in Appendix-A. The sequence of events in simulation is presented in Table 5.1 compared to the chronology recorded at the plant.

Table 5.1 Sequence of events in the RELAP5 simulation

Event	Time, s	
	KaNPP	RELAP5
SG-4 feedwater pipelines check valve failure	0.0	0.0
MCP-4 switching-off due to the signal "A decrease of the water level in the SG-4". (SG collapsed level ≤ 1750 mm)	45.0	47.45
Activation of the ROM due to the signal "Switch-off MCP-4"	46.0	48.47
Activation of the AZ-1 (SG collapsed level ≤ 1600 mm)	54.0	56.85
Trip turbine of the Unit-1	76.0	72.03
Reversed loop-4 coolant flow	71.0	73.0
End of Simulation	-	600.0

The feedwater pipeline check valve failure leads to a sharp decrease of the feedwater flowrate to the SG-4 (Figure A-27) and as a consequence, to decrease of SG-4 collapsed water level and increase of SG-4 pressure (Figures A-23, A-19).

At τ = 32 s SG-4 main feedwater controller was transferred to the position "Distance", however it has not stopped the decrease of water level and at τ = 46 s, SG-4 water level became lower than 1750 mm (set point for MCP switching-off).

Due to MCP-4 switching-off (τ = 46 s, Figure A-11) ROM actuated insertion of the 10^{-th} control rods group with the speed of 20 mm/s (Figure A-1). At τ ~ 56 s SG-4 water level reached the set point of AZ-1 activation (level ≤ 1600 mm, Figure A-23). At the moment of the AZ-1 activation reactor power was ~ 94.5 % of nominal (W≈ 2836 MW, Figure A-1). After SCRAM (AZ-1 full insertion time ~ 3.5 s) reactor was shutdown, and at τ ~ 100 s, reactor power became less then 5% of nominal.

After emergency feedwater pump activation steam generators water level started to be restored and at τ ~ 10 min after transient start has reached values in the range of 2851÷3090 mm (SG1÷SG3) and of 1623 mm in the SG-4 (Figure A-20÷A-23).

Switch-off of turbine at τ ~ 76 s has caused some increase of secondary side pressure, however transition of EGSR to the mode "RD1" kept the secondary side pressure level at 5.77÷6.0 MPa (Figures A-16÷A-19).

Figures A-4÷A-7 show the coolant temperature at the inlet and outlet of the reactor vessel. After switch-off of MCP-4 the coolant temperature increased (~1÷2 K), however, after ROM and AZ-1 activation reactor vessel inlet/outlet coolant temperature was stabilized at the level T~ 548/555 K.

Increase of the coolant temperature in the inlet of the loop No 4 (hot leg) at τ ~ 65 ÷ 85 s (Figure A-7) may be explained as follows:

Decreasing primary side pressure after SCRAM (Figure A-2) lead to release of the water from pressurizer to the loop No 4 (hot leg, Figure A-3); as result, the coolant temperature rised (Figure A-7).

At τ ~ 73 s the reverse of the coolant flow rate in the loop No 4 occurred. Hot water of PRZ began to penetrate into the RV outlet nozzle.

Comparing the calculated results of the main parameters of the primary and secondary circuits with plant data, good agreement is found. The deviation of the calculated and measured data did not exceed the limits of the measurement channel accuracy at KaNPP (Table 2.16).

Finally, analysis of the transient proved that the RELAP5/MOD3.2 code describes satisfactorily the thermal hydraulic processes in both primary and secondary side of the NPP with VVER-1000 reactor.

6 SENSITIVITY STUDY

The objectives of additional runs were to estimate differences in simulating heat transfer by two code options: default option 101 for pipes and option 134 for horizontal tube bundles.

In base case, outer boundary of the SG tubes was specified with the option 101. In additional runs the RELAP5 option 134 was set. The results of two calculations are summarized in Tables 6.1 and 6.2 and also shown in Figures B-1÷B-14.

Table 6.1 shows heat transfer coefficients at steady state for heat structures related to the SG-4 heat exchange tubes. As seen, heat transfer coefficient at outer surfaces of SG tubes in the base case (option 101) in 1.54÷2.52 times less than in the additional run (with option 134). Difference is larger for lower layers of tubes.

Table 6.1 Heat transfer coefficient for option 101 and 134 on $\tau \sim 0.0$ s

SG-4 Heat Structures	Option 101		Option 134	
	H, W/m^{2}K	Q, MW	H, W/m^{2}K	Q, MW
Layer 1	17011	67.48	42898	69.86
Layer 2	18274	119.73	40654	121.78
Layer 3	19323	189.73	29758	186.09
Layer 4	19233	190.96	34362	194.95
Layer 5	17941	161.27	33727	162.05

Table 6.2 shows the key parameters of the reactor unit at steady state for two heat transfer models.

Table 6.2 Steady-state parameters for option 101 and 134

№	Parameter	Option 101	Option 134
1.	Coolant flowrate, kg/s	18471.1	18415.8
	Loop No 1	4253.6	4257.3
	Loop No 2	4800.1	4800.9
	Loop No 3	4892.4	4832.6
	Loop No 4	4525.0	4525.0
2.	Primary side pressure, MPa	15.674	15.678
3.	Reactor vessel inlet/outlet pressure drop, kPa	328.86	326.83
4.	Coolant temperature RV inlet/outlet, K		
	Loop No 1	559.29/589.57	558.68/587.3
	Loop No 2	559.24/586.44	556.63/584.21
	Loop No 3	560.25/587.96	557.52/585.57
	Loop No 4	559.41/588.69	556.72/588.28
5.	Pressurizer water level, mm	8770.3	8728.2
6.	MCP head, kPa		
	MCP No 1	568.48	564.58
	MCP No 2	560.45	556.54
	MCP No 3	578.58	574.50
	MCP No 4	588.09	584.03
7.	SG pressure drop, kPa		
	SG No 1	145.93	145.07
	SG No 2	152.83	151.32
	SG No 3	146.97	146.02
	SG No 4	155.80	154.80
8.	Steam generator pressure, MPa		
	SG No 1	5.89	5.89
	SG No 2	5.87	5.86
	SG No 3	5.90	5.89
	SG No 4	5.87	5.86
9.	Steam generator water level, mm		
	SG No 1	2225	2151
	SG No 2	2199	2154
	SG No 3	2274	2206
	SG No 4	2297	2206

The steady state of the examined regime, calculated with the RELAP5 option for horizontal tubes bundle showed rising heat flux to the SG secondary side, decrease of the coolant temperature in the primary circuit by ~2 K and increasing steam generation by 0.8 %. As result, the SG water collapsed levels decrease by ~ 4÷9 cm.

Figures B-1÷B-8 illustrate the behavior of the heat transfer coefficients at the outer surfaces of SG-1 and SG-4 tube bundles in the transient. As seen, the ratio of the heat transfer coefficients for the option 101 and 134 remains practically invariant for the lower part of the tubes bundle (layers 1÷4) during transient. The heat transfer coefficients for both models are practically the same for the part of the tubes bundle which is not covered by water (layer 5, $\tau > 50$ s).

Figures B-9÷B-10 show the behavior of the primary side pressure, PRZ water level and loops coolant temperatures. Some discrepancies of the primary side parameters at the beginning of the transient (τ <250÷300 s), may be explained by increase of the SG tube bundles heat transfer coefficients (Figures B-1÷B-8).

For the last stage of the transient ($\tau > 300$ s) coolant temperatures for the option 101 and 134 are practically identical, but primary side pressure and PRZ collapsed level for the option 134 are greater than for the option 101 (1%, 4% respectively, Figures B-11÷B-12).

The steam generators water level is shown in Figures B-13÷B-14. As seen, the choice of option 134 gives some overestimation of SG collapsed level at the last stage of transient.

The sensitivity studies show that in spite of using two different heat transfer models (option 101 and option 134) for the for horizontal tube bundles, the main parameters (primary and secondary pressure, coolant temperature, PRZ and SG collapsed levels etc.) remain within the uncertainty limits of the plant data.

7 RESULTS OF RELAP5/MOD3.2.2BETA CALCULATIONS

This section provides a brief description of the calculation results by two RELAP5 code versions: MOD3.2.2Beta and MOD3.2.

The input deck and run procedures for the MOD3.2.2Beta calculations are the same as for MOD3.2.

For obtained KaNPP-1 initial conditions, null-transient run of 1000 s duration and subsequent run with using RELAP5 steady state option were performed. The results of steady state calculations for both code versions are presented in the Table 7.1. As seen, the steady state parameters obtained by two code versions are practically identical. Maximum deviation of the parameters for the both codes does not exceed ~0.4 % for primary side parameters and ~0.9 % for secondary side parameters.

RELAP5/MOD3.2.2Beta calculation results of the transient are presented in Appendix-C. The sequence of events in simulation is presented in Table 7.2 compared to the MOD3.2 version and to the chronology recorded at the plant.

Comparing the RELAP5/MOD3.2.2Beta calculated results with MOD3.2 results and plant-recorded data, good agreement is found. Some oscillations of the SG-2 steam dome pressure and loop No 2 cold leg coolant temperature (Figure C-6, C-17) could be referred to a different numerical treatment of the pressure controller model (EGSR mode "RD1" simulation) by the version MOD3.2.2Beta.

Finally, analysis of the transient proved that the MOD3.2 and MOD3.2.2Beta versions of RELAP5 code describe satisfactorily the thermal hydraulic processes in both primary and secondary side of the NPP with VVER-1000 reactor.

Table 7.1 RELAP5/MOD3.2.2Beta Steady State Parameters

№	Parameter	KaNPP-1	MOD3.2	MOD3.2.2 Beta
	Primary Side			
1.	Coolant flowrate, kg/s	18471	18471.1	18471.1
	Core	-	17886.3	17890.5
	Loop No 1	4253.6	4253.6	4253.6
	Loop No 2	4800.4	4800.1	4800.1
	Loop No 3	4892.4	4892.4	4892.4
	Loop No 4	4524.9	4525.0	4525.0
2.	**Pressure, MPa**	15.68	15.674	15.676
3.	Coolant temperature RV inlet/outlet, K			
	Loop No 1	559/589	559.290/589.567	559.219/589.501
	Loop No 2	559/586	559.235/586.443	559.818/586.577
	Loop No 3	560587	560.250/587.955	560.178/587.902
	Loop No 4	559/588	559.412/588.636	559.306/588.504
4.	**Pressurizer water level, mm**	8770	8770.38	8761.98
5.	MCP head, kPa			
	MCP No 1	568.4	568.486	569.061
	MCP No 2	558.6	560.450	561.626
	MCP No 3	578.2	578.575	579.385
	MCP No 4	588.0	588.088	588.789
6.	**Reactor vessel pressure drop, kPa**	326	328.863	329.242
7.	Steam generator pressure drop, kPa			
	SG No 1	146.06	145.557	146.142
	SG No 2	152.52	152.830	153.324
	SG No 3	147.00	146.973	147.217
	SG No 4	155.82	155.802	155.953
	Secondary Side			
8.	Steam generator pressure, MPa			
	SG No 1	5.89	5.894	5.896
	SG No 2	5.86	5.871	5.926
	SG No 3	5.89	5.898	5.892
	SG No 4	5.86	5.866	5.867
9.	Steam generator water level, mm			
	SG No 1	2224	2224.61	2223.91
	SG No 2	2206	2199.80	2206.00
	SG No 3	2273	2273.89	2273.01
	SG No 4	2297	2297.09	2297.22

Table 7.2 Sequence of events in the RELAP5/MOD3.2.2Beta simulation

Event	Time, s		
	KaNPP	MOD3.2	MOD3.2.2Beta
SG-4 feedwater pipelines check valve failure	0.0	0.0	0.0
MCP-4 switching-off due to the signal "A decrease of the water level in the SG-4". (SG collapsed level ≤ 1750 mm)	45.0	47.45	46.13
Activation of the ROM due to the signal "Switch-off MCP-4"	46.0	48.47	47.157
Activation of the AZ-1 (SG collapsed level ≤ 1600 mm)	54.0	56.85	57.057
Reversed loop-4 coolant flow	71.0	73.03	74.0
PRZ Heaters On			
Group No 1 (W = 270 kW)	-	60.106	59.728
Group No 2 (W = 270 kW)	-	60.507	60.100
Group No 3 (W = 720 kW)	-	61.031	60.575
Group No 4 (W = 1260 kW)	-	61.580	61.250
Trip turbine of the Unit-1	76.0	72.03	75.057
End of Simulation	-	600.00	600.0

8 RUN STATISTICS

Calculations carried out on Workstation HP-9000 Model 715/100

The computation model used in a base case was done with 562 volumes, 701 junctions and 494 heat structures (with 1944 mesh points). Among there are 11 time-dependent volumes, 5 time-dependent junctions. 55 control variables are used.

Plots of computer statistics for a transient run are given in Figures A-28÷A-31; C-22÷25. The requested time step ($\Delta\tau = 0.025$ s) was chosen below material Courant limit ($\Delta\tau = 0.035$ s) and was not affected by the RELAP5/MOD3.2 code (Figure A-30). MOD3.2.2Beta version was made some first iterations with a small time step ($\Delta\tau \sim 10^{-9}$ s, Figure C-24). The CPU time versus problem time was approximately 1:19.3 for MOD3.2 and 1:19.7 for MOD3.2.2Beta as seen in Figures A-28; C-22.

Run statistics information for both code versions are summarized in the Table 8.1.

Table 8.1 Run Statistics

Parameter	Code Version	
	MOD3.2	MOD3.2.2Beta
Problem Time, s Steady-State Transient	 1018.68 600.0	 1022.4 600.0
Number of Hydrodynamic Volumes	562	562
Advancement Count Number Steady-State Transient	 40934 24000	 41218 24168
CPU Time, s Steady-State Transient	 19803.27 11606.6	 19939.8 11848.0
Grind Time[1], s Steady-State Transient	 $8.608\ 10^{-4}$ $8.605\ 10^{-4}$	 $8.608\ 10^{-4}$ $8.723\ 10^{-4}$

[1] The code efficiency factor ("Grind Time") as stated in [6] is obtained from: $\tau = CPU/(C*\Delta T)$,

where: C– total number of volumes; ΔT – advanced count number; CPU – CPU time.

9 CONCLUSION

The codes RELAP5/MOD3.2 and RELAP5/MOD3.2.2Beta were assessed using plant data " Stop of feedwater supply to the steam generator No 4 at KaNPP Unit-1". A base case was calculated with a RELAP5/MOD3.2 default heat transfer model for pipe (option 101). The additional run was done with a model of heat transfer for horizontal tube bundles (option 134). The calculations with the RELAP5/MOD3.2.2Beta were done to estimate the differences between two code versions. The calculation results for both code versions were compared against plant data to identify code capabilities. The following conclusion can be drawn:

1. The thermal-hydraulic parameters of the primary circuit (pressure, pressure drops, coolant temperature, pressurizer water level) and of secondary side (steam generators pressure and water level) are well predicted by the two RELAP5 code versions.
2. Divergence of the calculated and measured data does not exceed the range of KaNPP measurement channels accuracy.
3. The sensitivity study shows that a choice between option 101 and 134 of the heat transfer model in simulation of SG tubes practically does not influence the behavior of the considered parameters.

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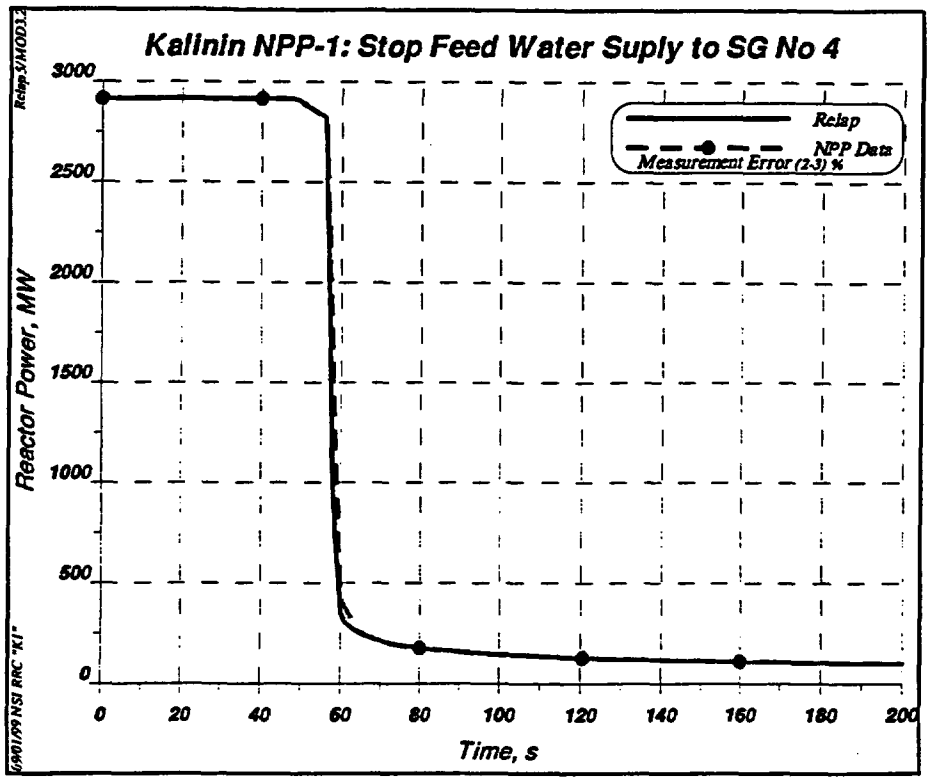
1. Description of the Transient "Activation of the 1^{-st} Kind Emergency Protection Caused by Decreasing of the Steam Generator No 4 Water Level During Unit Operation with 11^{-th} Fuel Load ". Technical Information about Kalinin NPP Unit 1&2 Transients. Nuclear Power Ministry of RF Concern "ROSENERGOATOM", Kalinin NPP, Udomly, 1997.
2. O. Prasolov, A. Achtjamov, Technologic Handbook, PTO, Kalinin NPP, Udomly,1992.
3. VVER-1000, Primary Circuit Scheme, CRDI NVV NPP, No 01.PU.YA.
4. L. Bogachek, "Accuracy of the main measurement channels Kalinin NPP", E-mail of 28.06.98.
5. S. Pylev, V. Roginskaja, "Assessment of RELAP5/MOD3.2 on Experimental Data of Void Fraction and Velocity Distributions in Secondary Side of Steam Generator PGV-1000". Report No 90-12/1-97, NSI RRC KI, Moscow, Russia, 1997.
6. Protocol for performing CAMP Development Assessment, Rev. 8/10/95, page 6.

APPENDIX-A

BASE CASE RESULTS



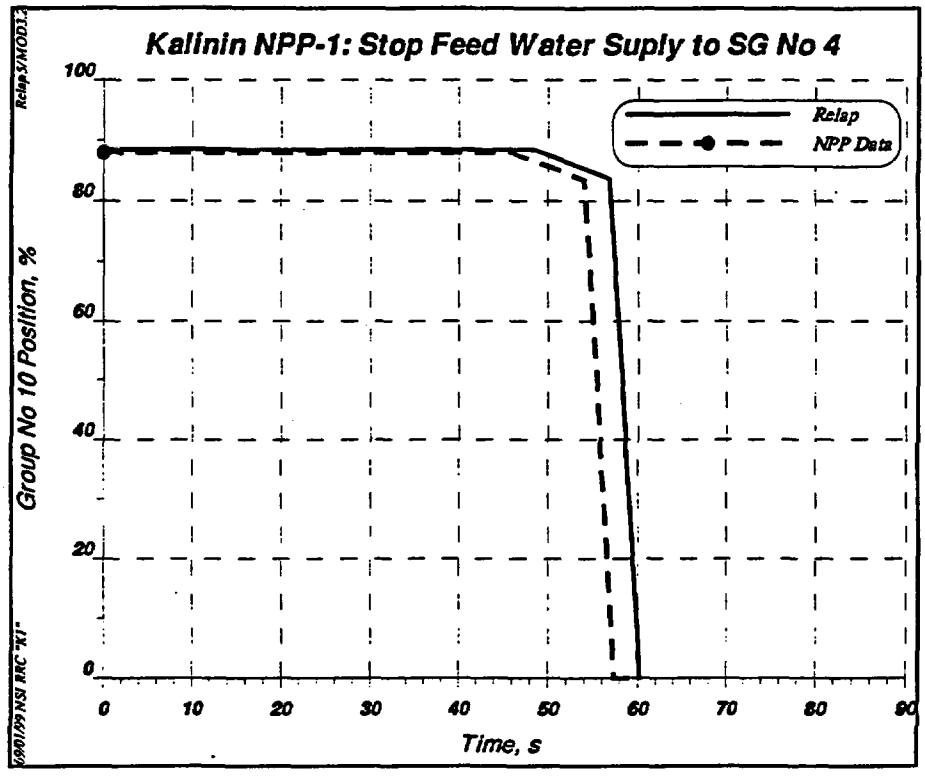


Fig. A- 1 Reactor Power and Control Rod Group 10 Position

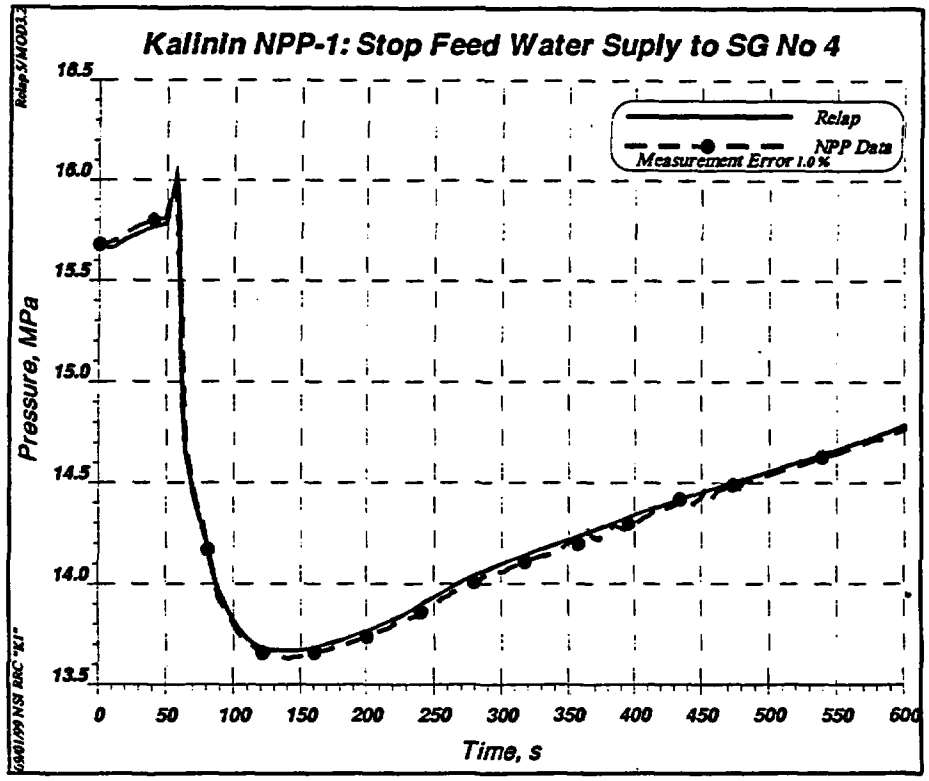


Fig. A- 2 Primary Side Pressure

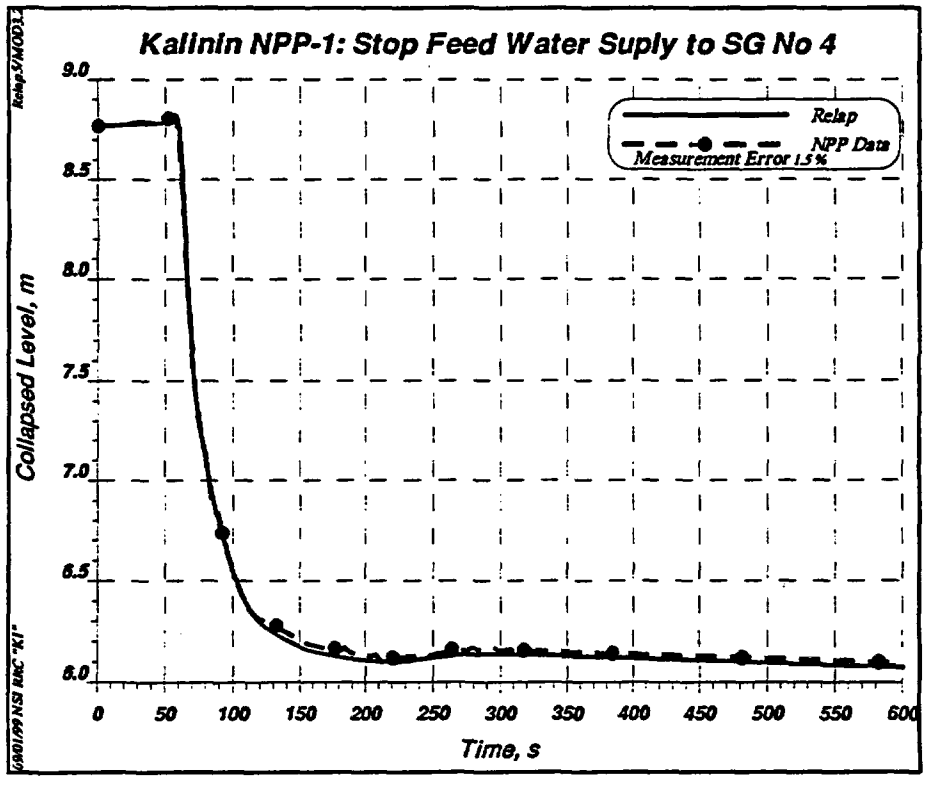


Fig. A- 3 Pressurizer Collapsed Level

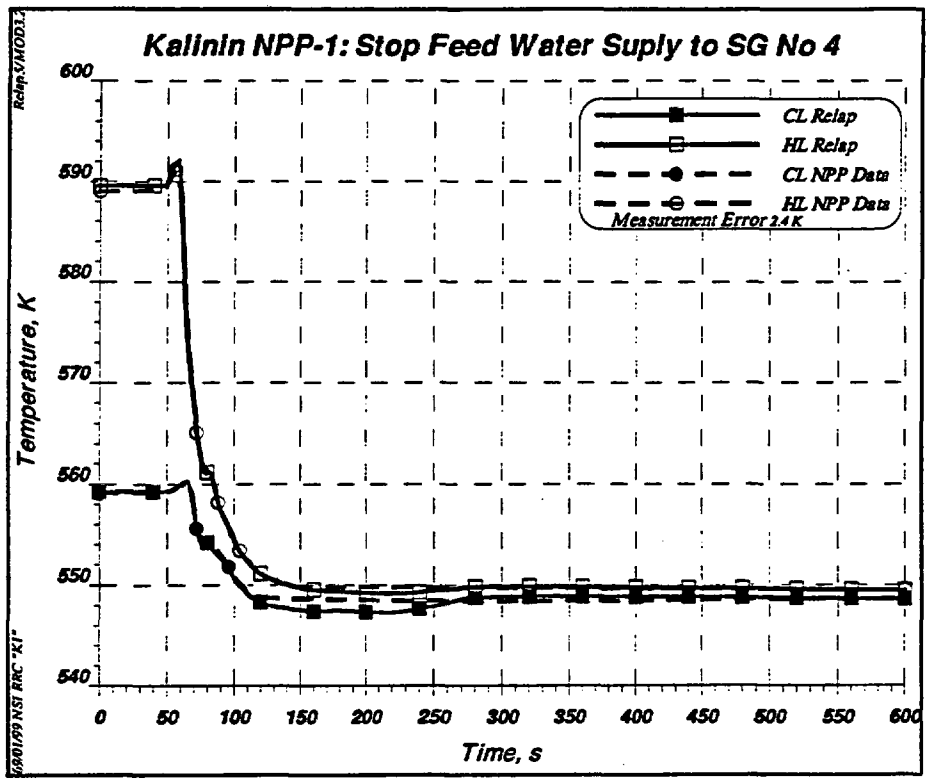


Fig. A- 4 Loop No 1: Coolant Temperature

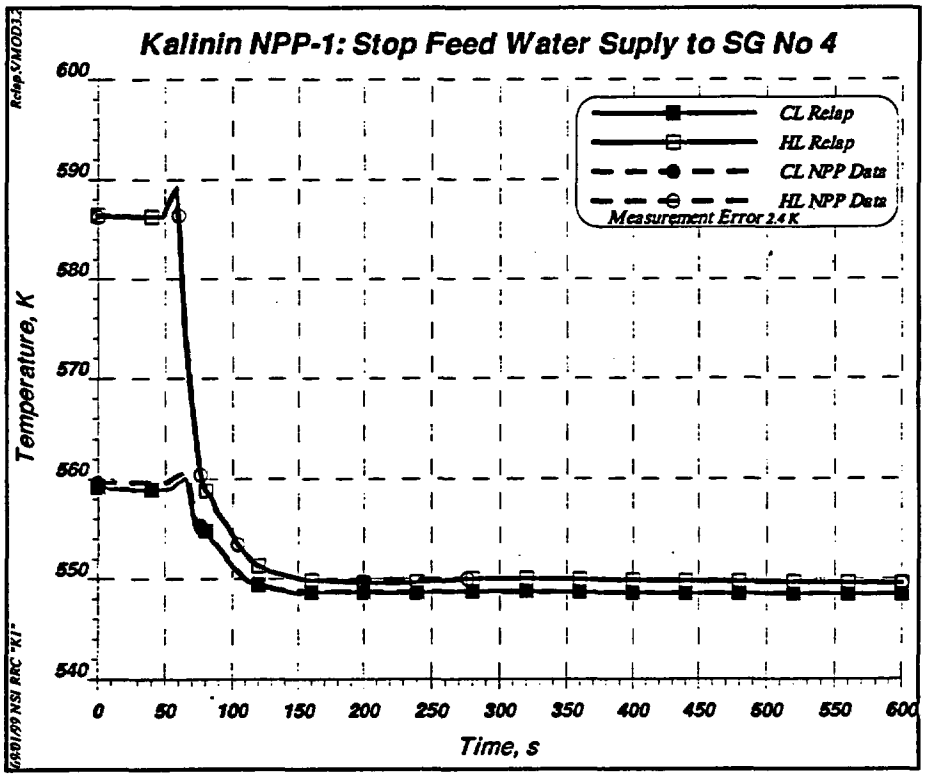


Fig. A- 5 Loop No 2: Coolant Temperature

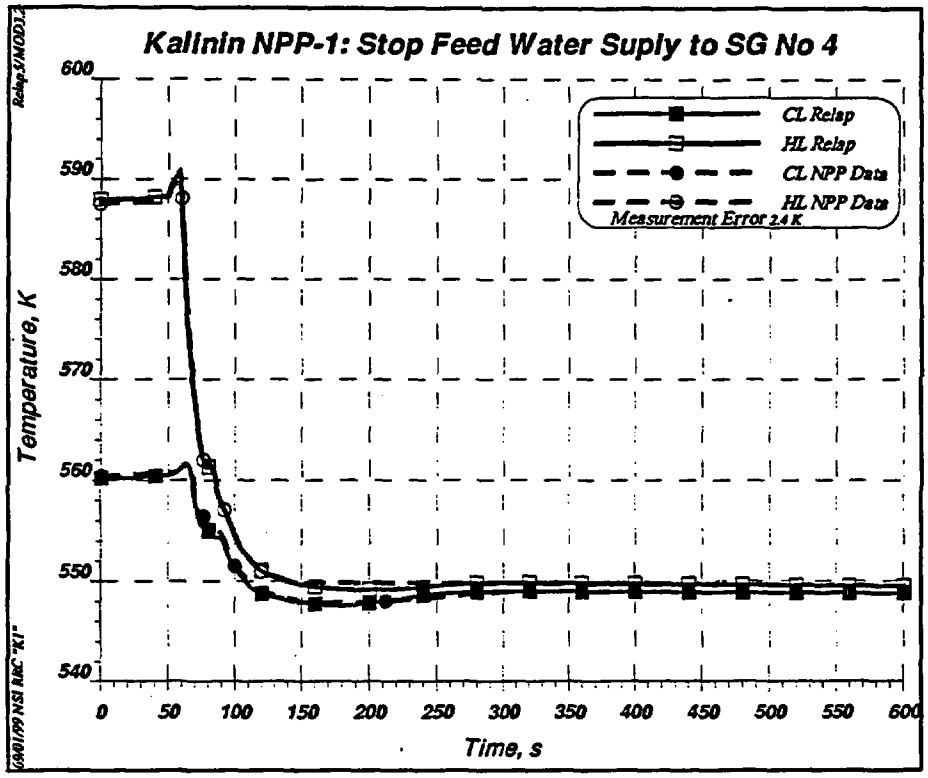


Fig. A- 6 Loop No 3: Coolant Temperature

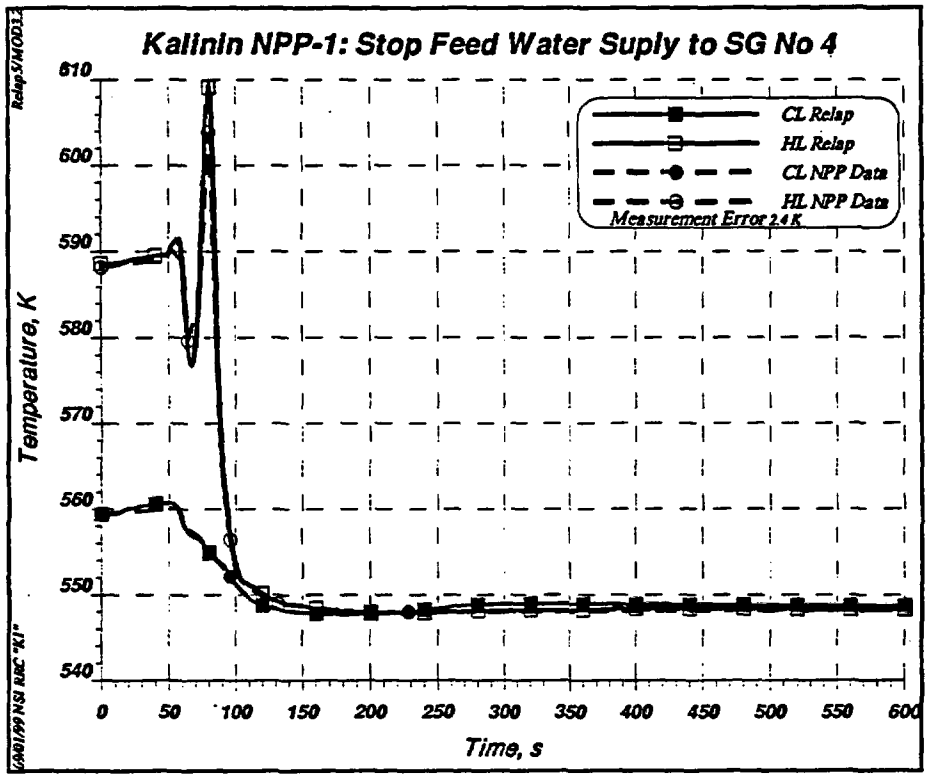


Fig. A- 7 Loop No 4: Coolant Temperature

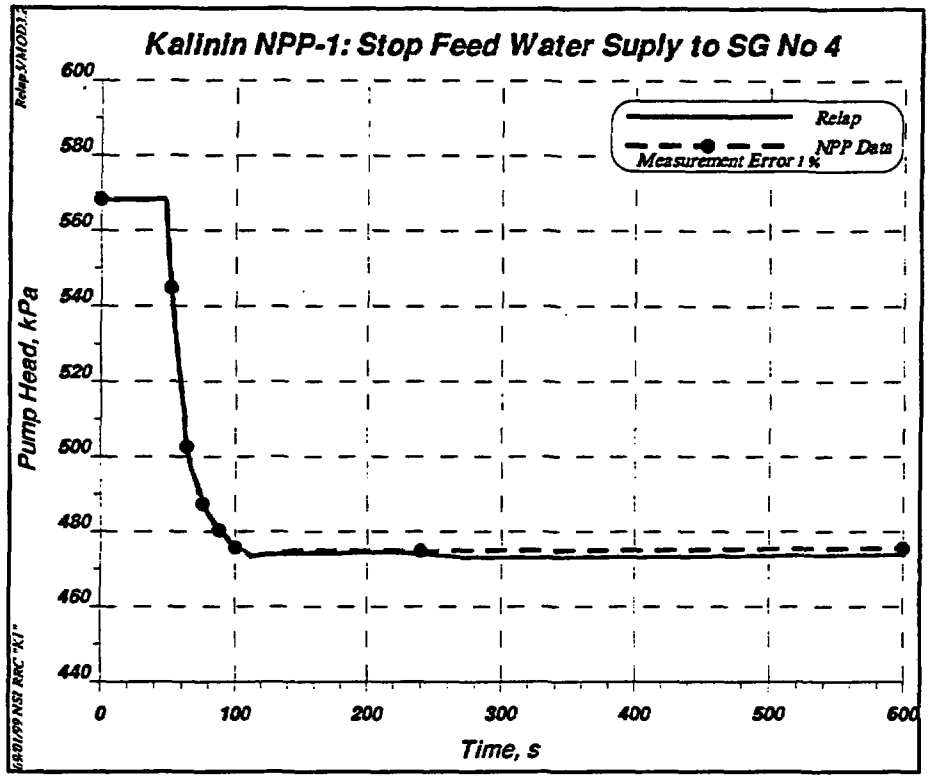


Fig. A- 8 MCP No 1 Head

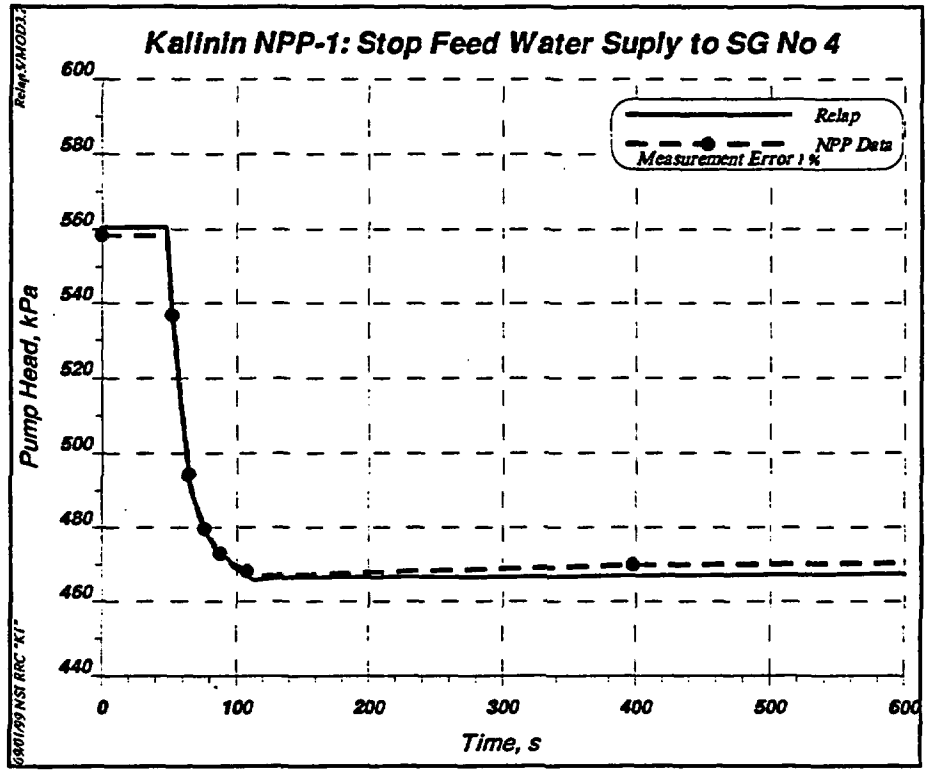


Fig. A- 9 MCP No 2 Head

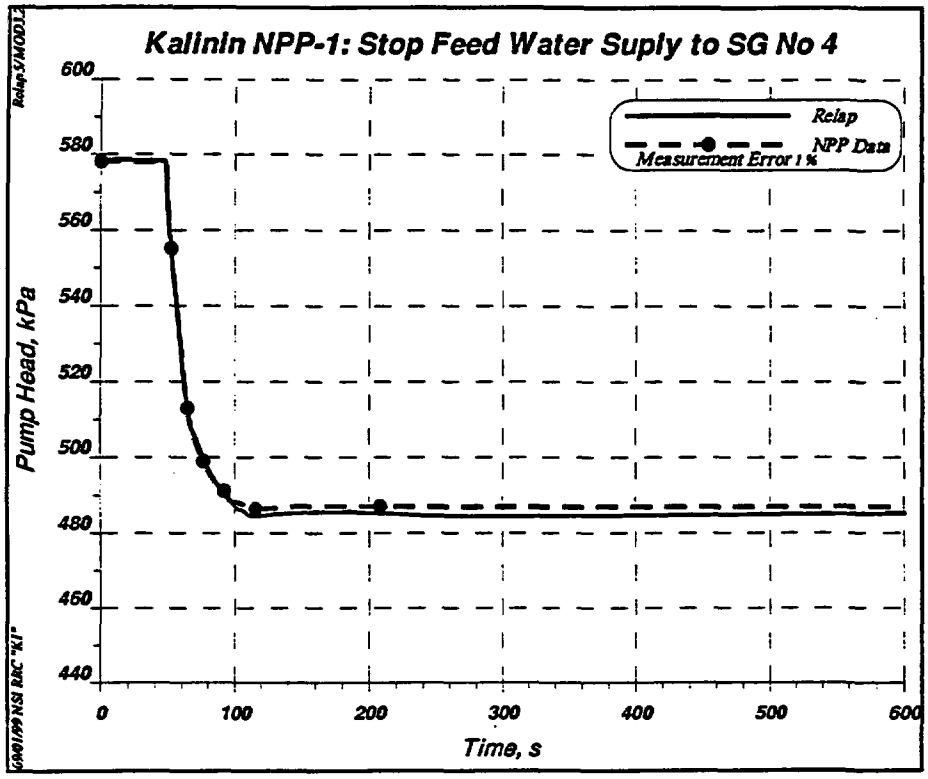


Fig. A- 10 MCP No 3 Head

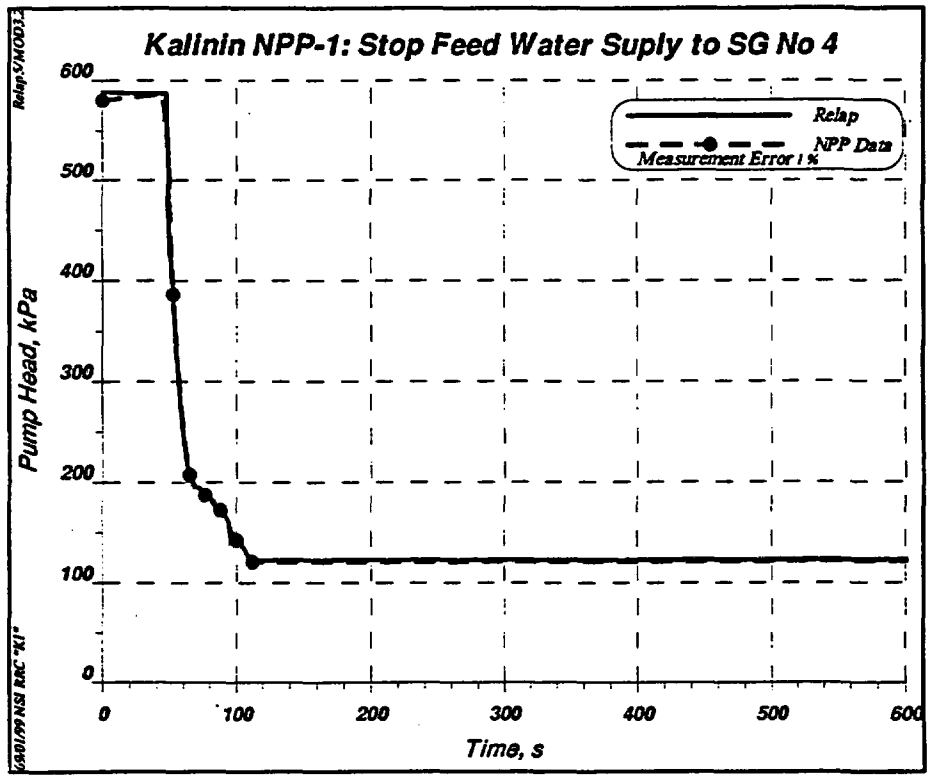


Fig. A- 11 MCP No 4 Head

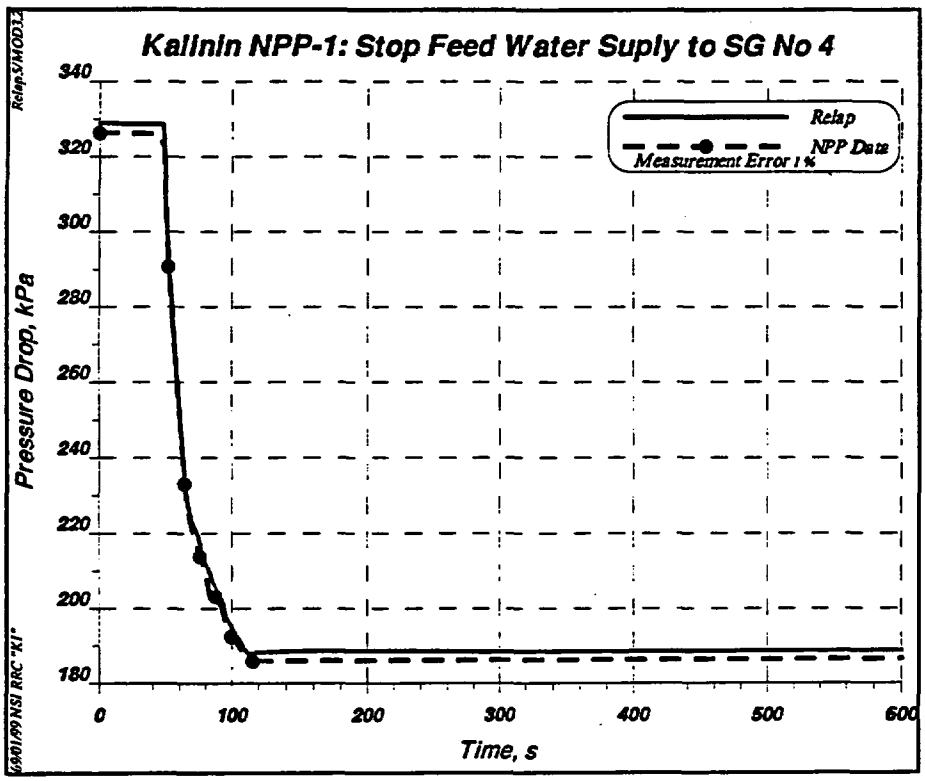


Fig. A- 12 Reactor Vessel Pressure Drop

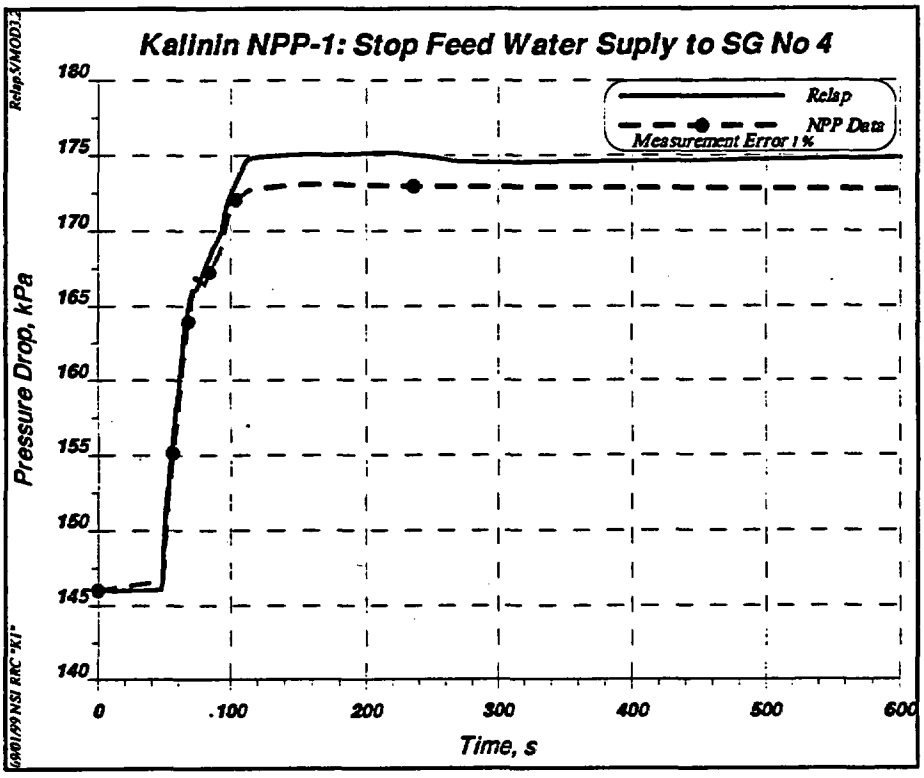


Fig. A- 13 SG No 1 (Primary Side) Pressure Drop

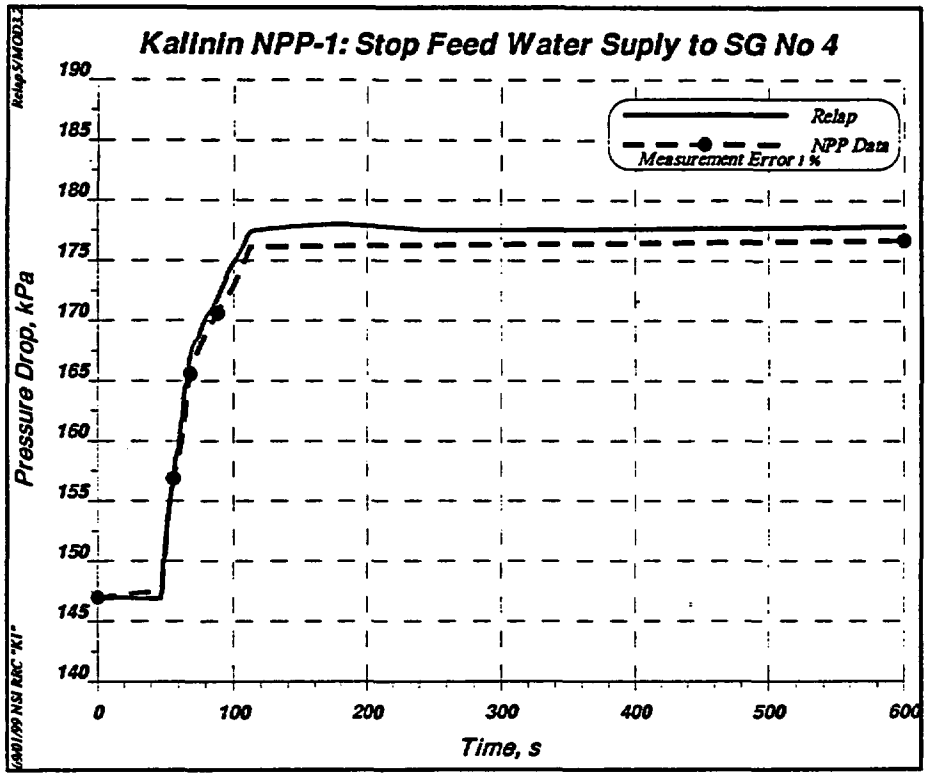


Fig. A- 14 SG No 3 (Primary Side) Pressure Drop

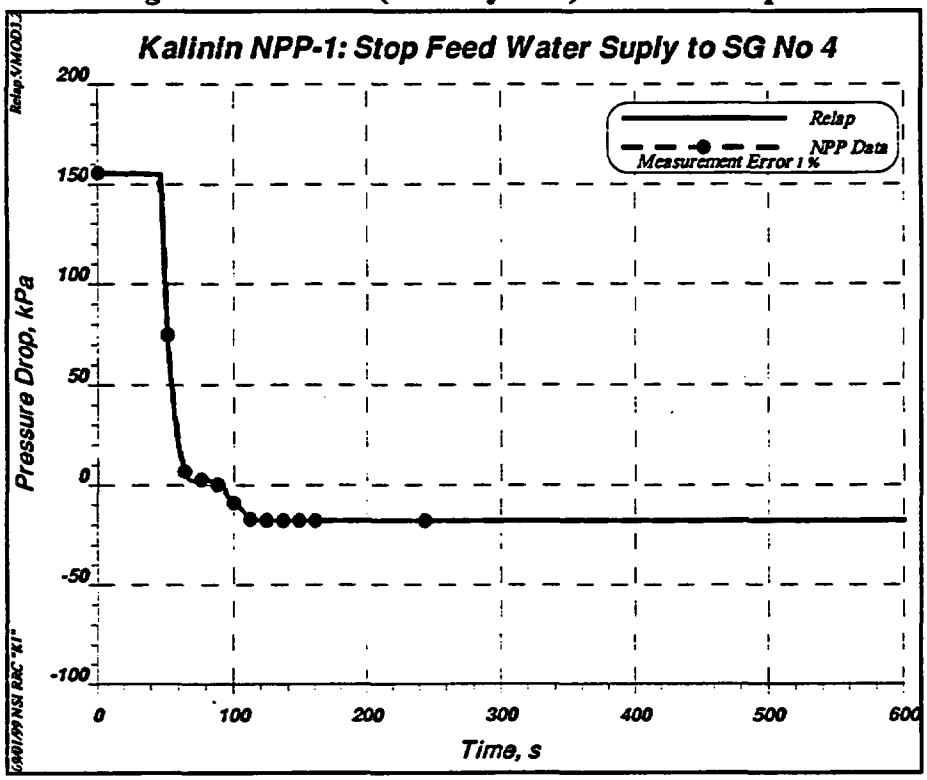


Fig. A- 15 SG No 4 (Primary Side) Pressure Drop

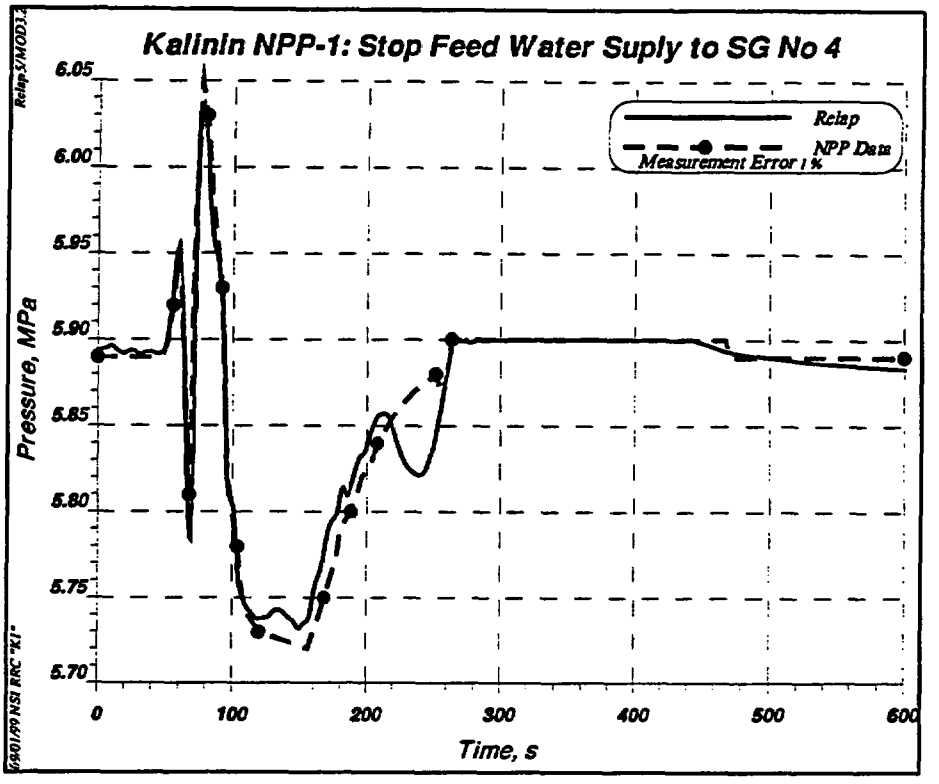


Fig. A- 16 SG No 1: Steam Dome Pressure

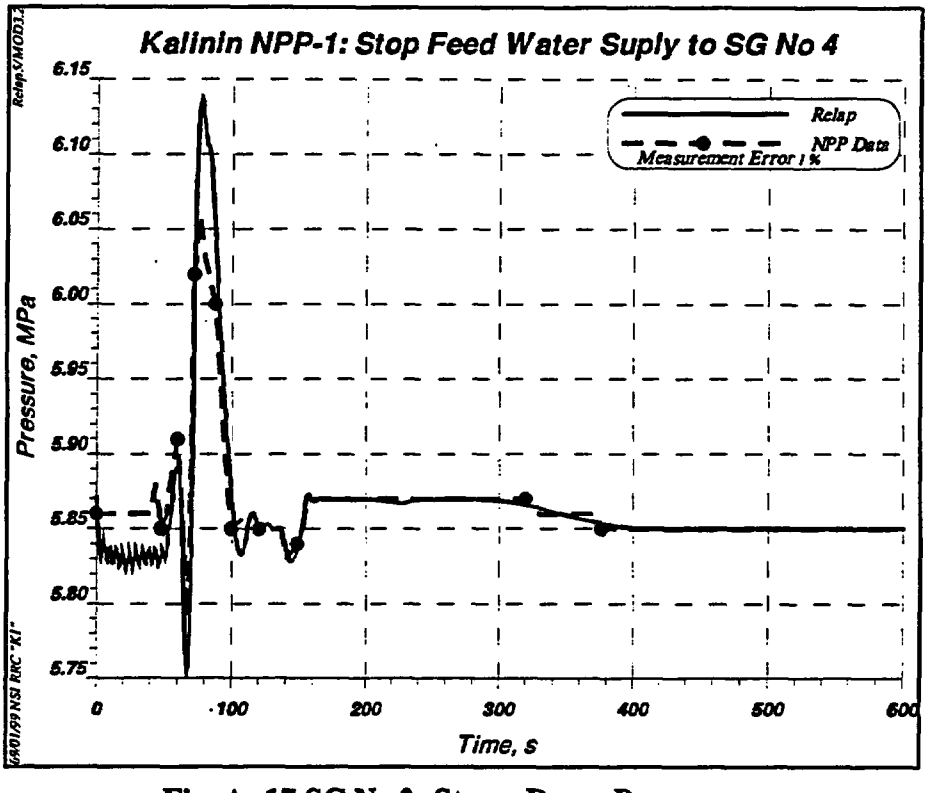


Fig. A- 17 SG No 2: Steam Dome Pressure

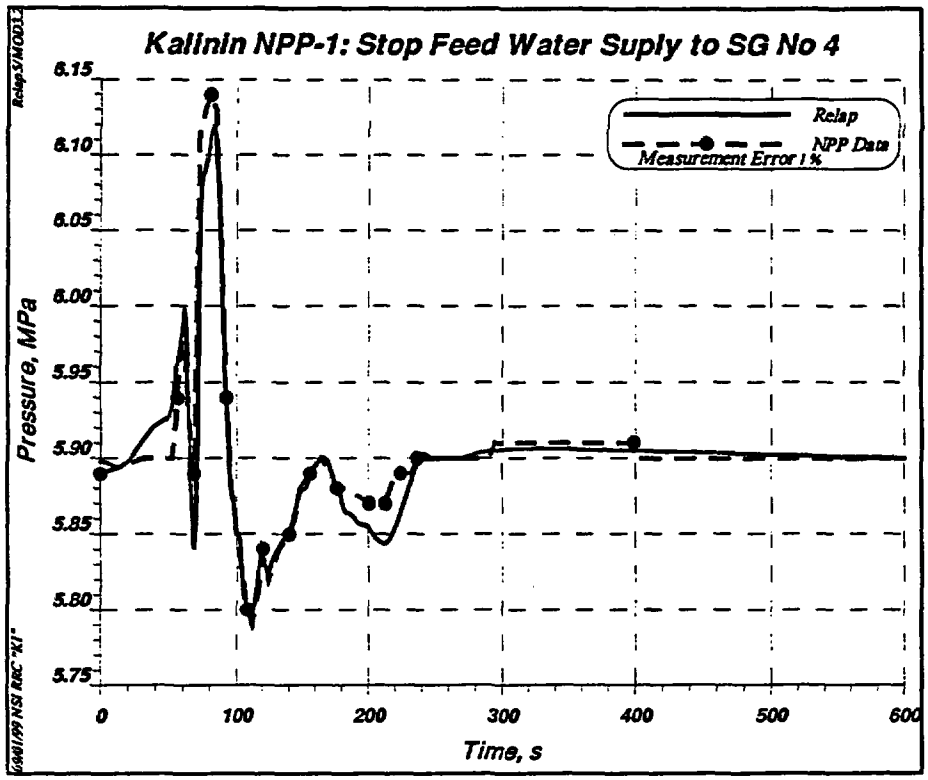


Fig. A- 18 SG No 3: Steam Dome Pressure

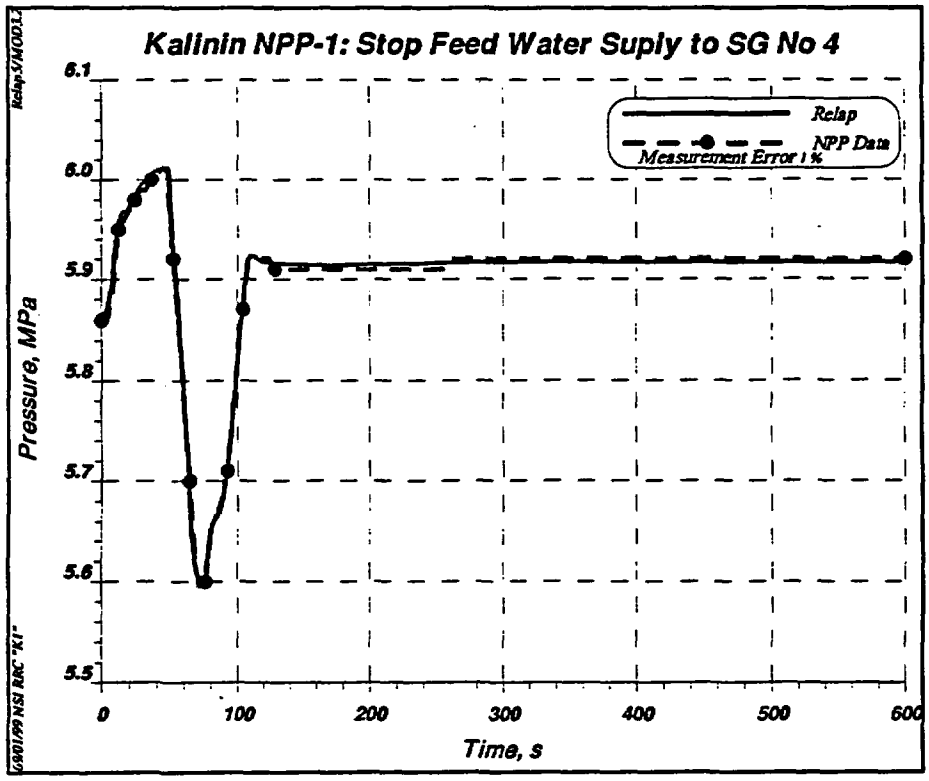


Fig. A- 19 SG No 4: Steam Dome Pressure

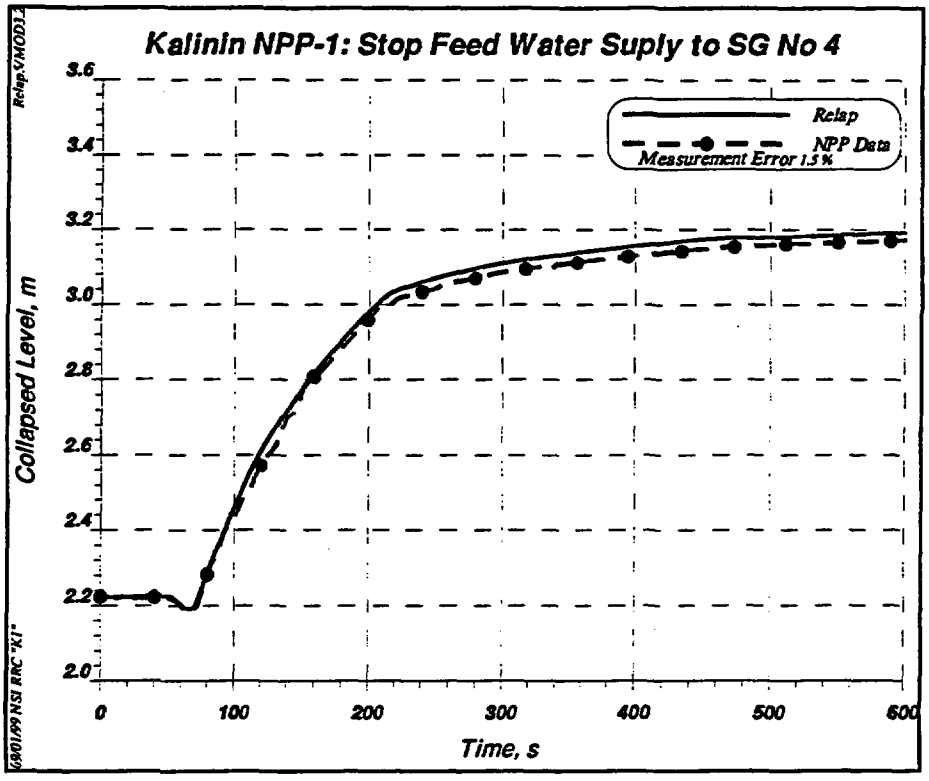


Fig. A- 20 SG No 1: Collapsed Level

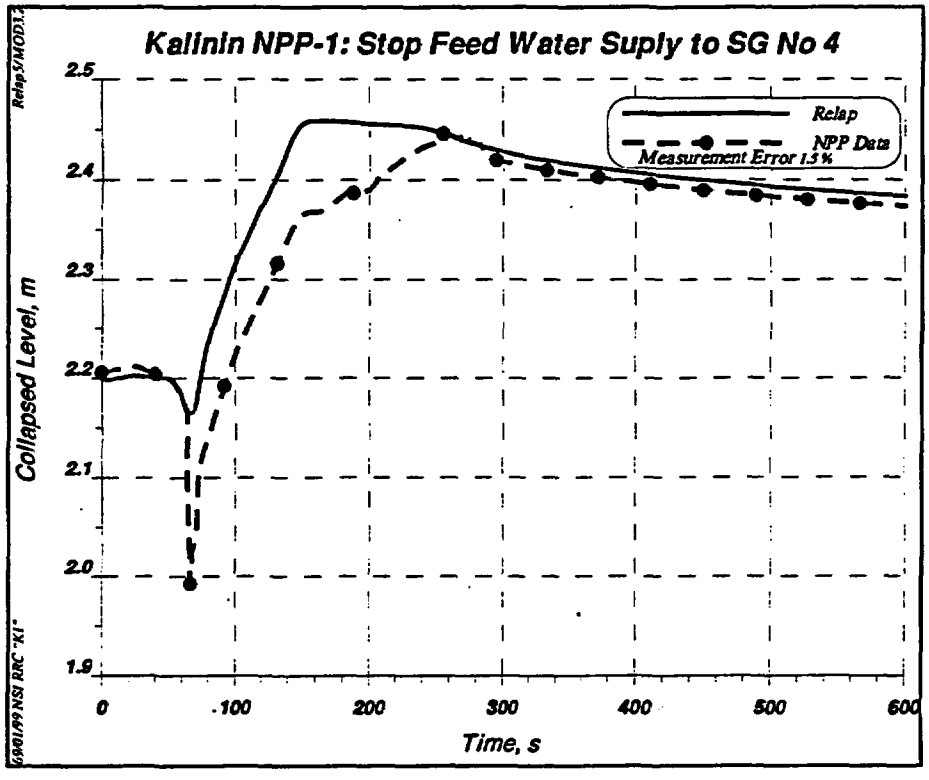


Fig. A- 21 SG No 2: Collapsed Level

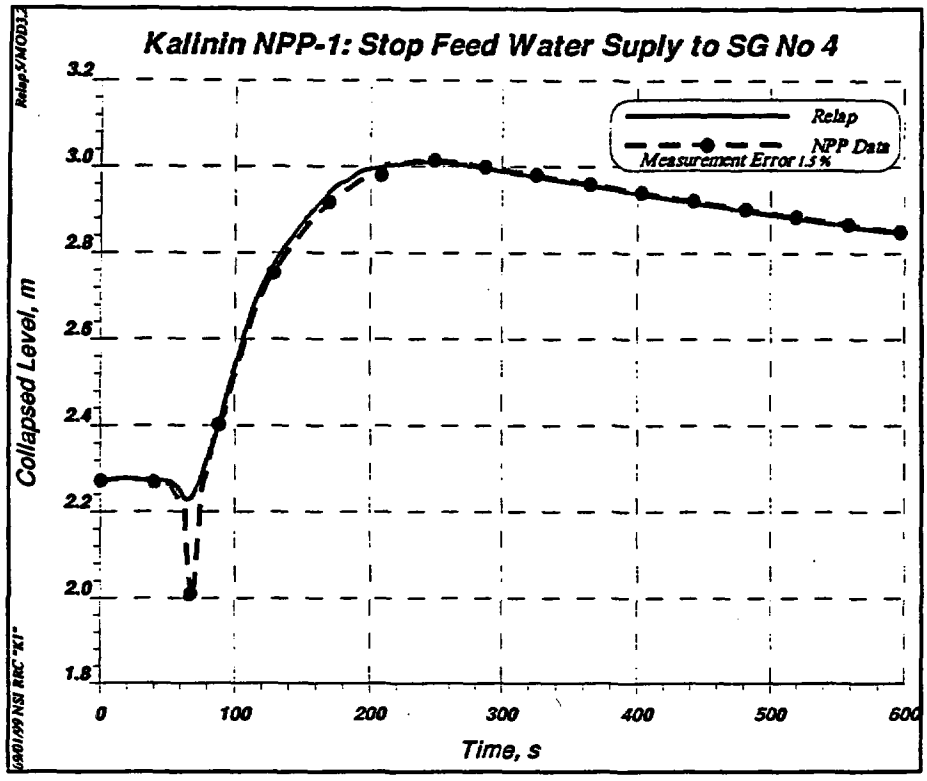


Fig. A- 22 SG No 3: Collapsed Level

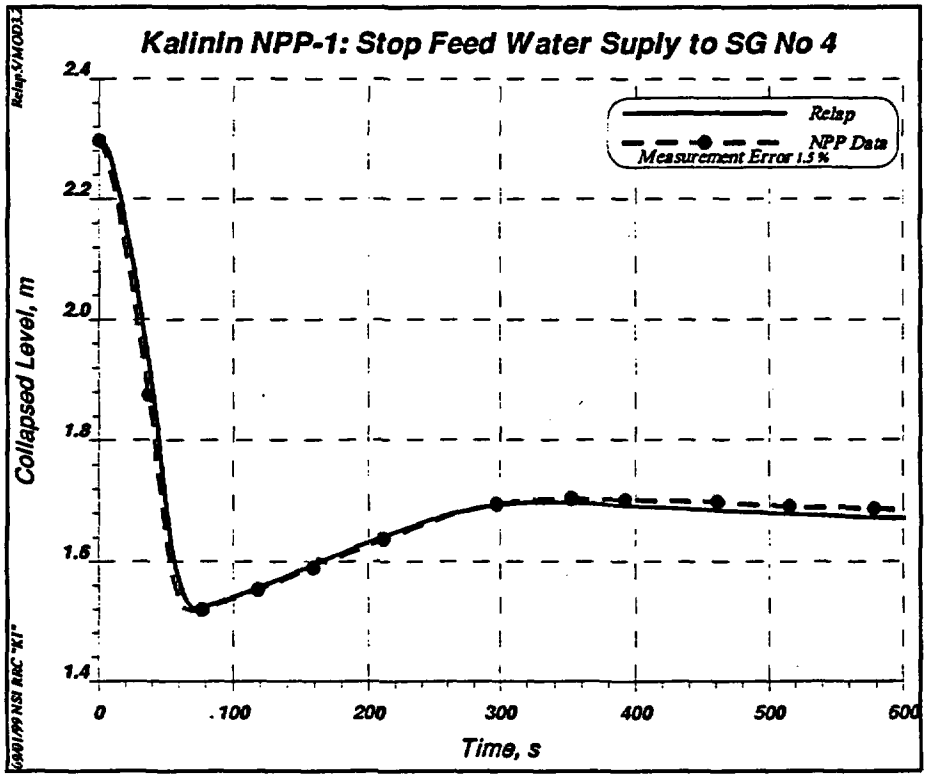


Fig. A- 23 SG No 4: Collapsed Level

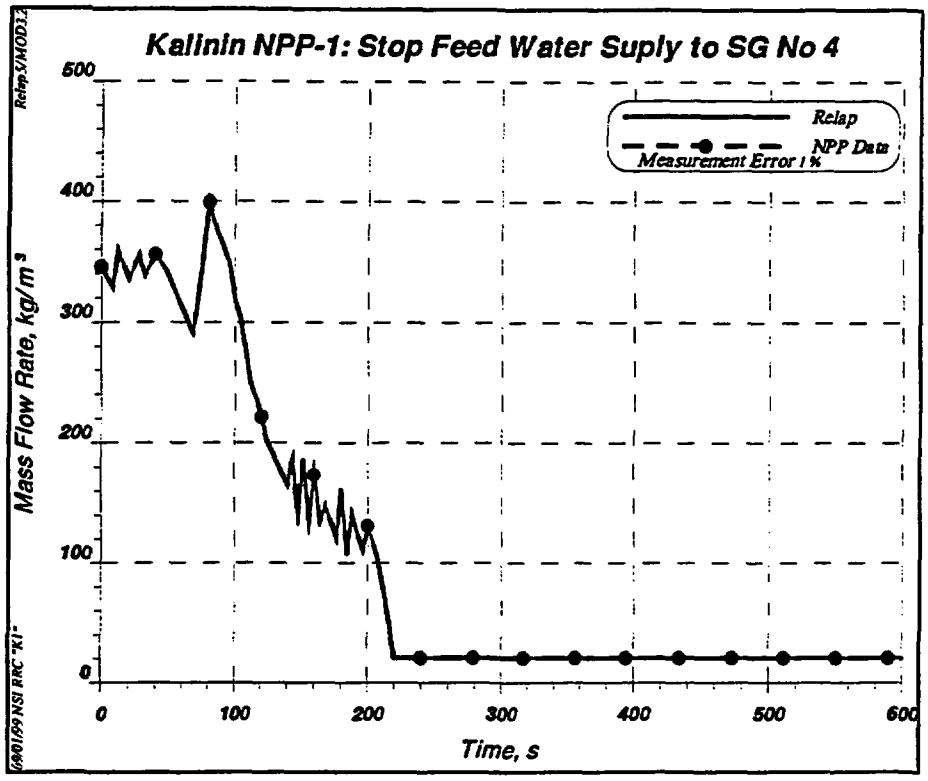


Fig. A- 24 SG No 1: Feed Water Flow Rate

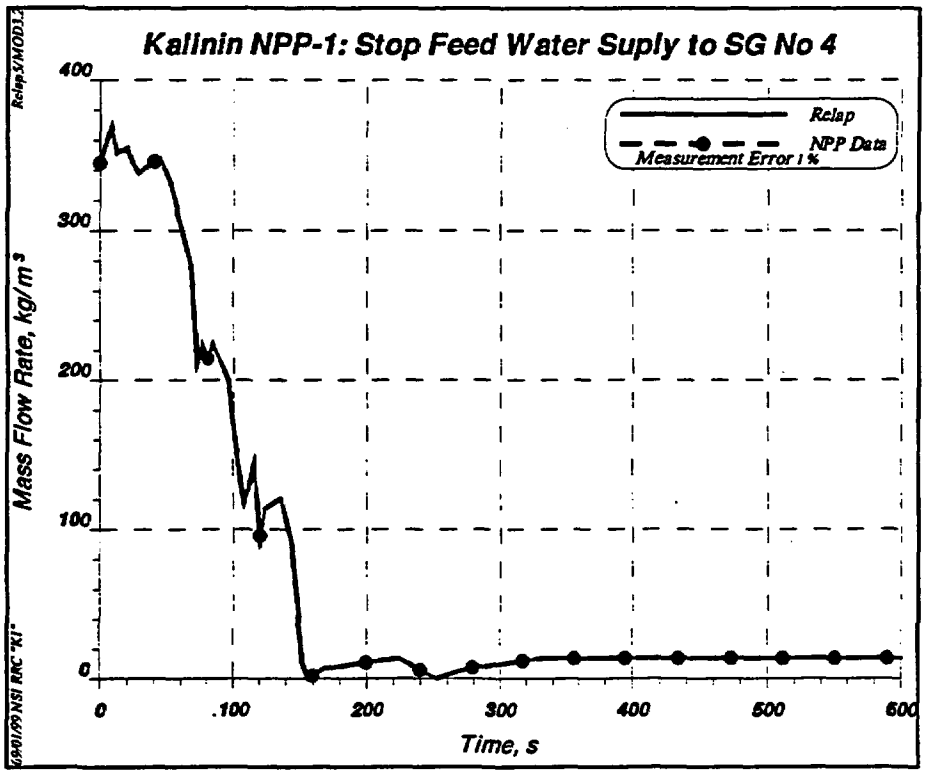


Fig. A- 25 SG No 2: Feed Water Flow Rate

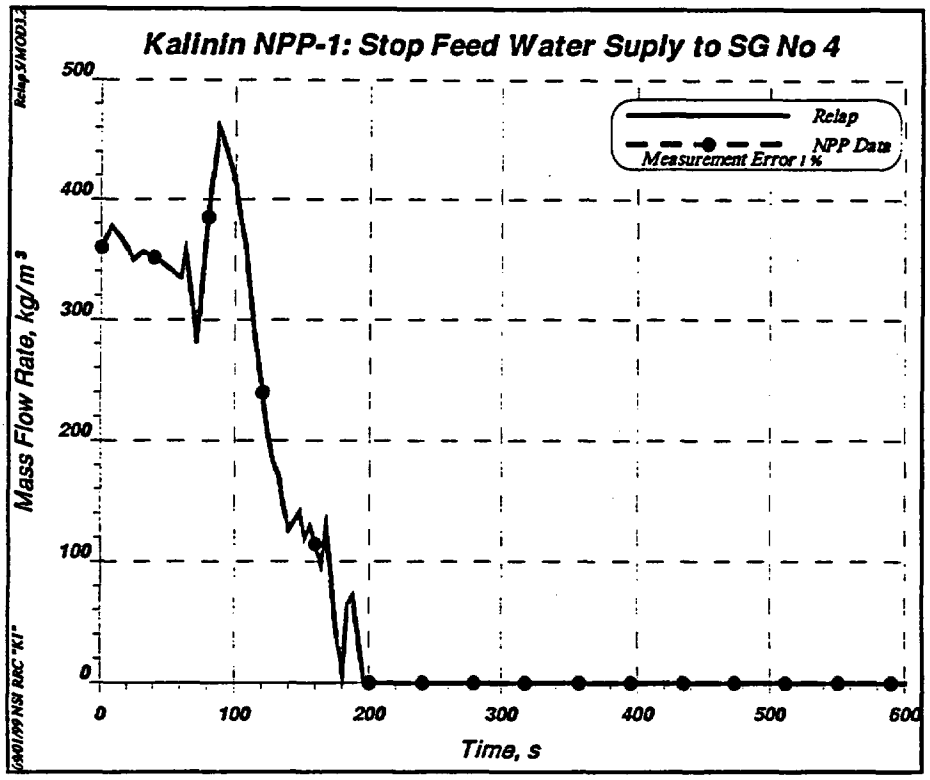


Fig. A- 26 SG No 3: Feed Water Flow Rate

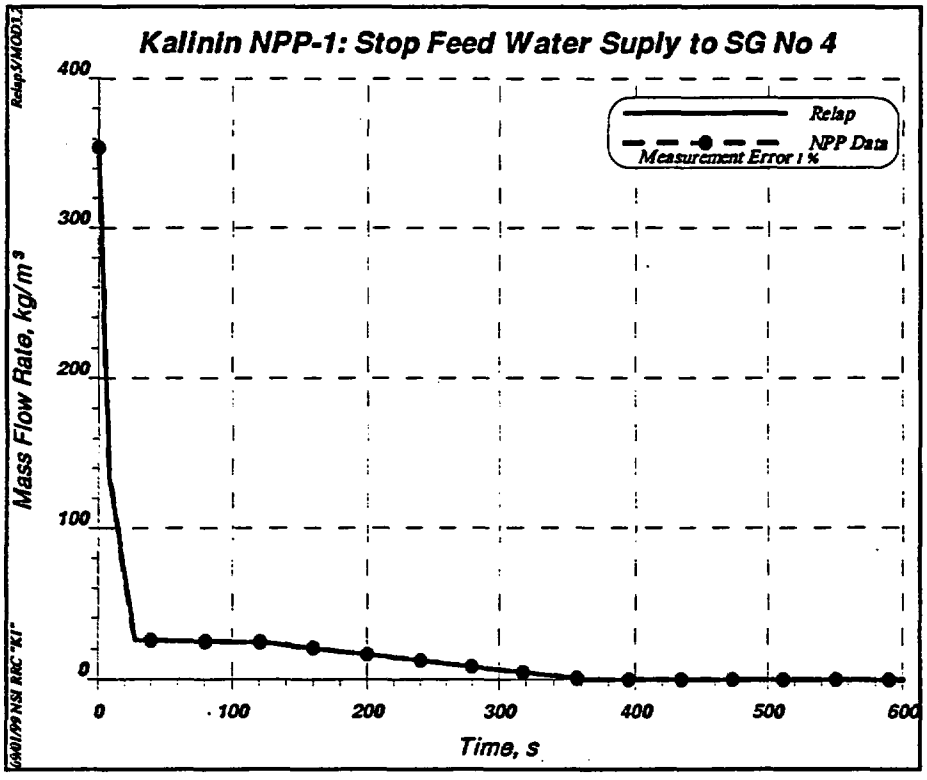


Fig. A- 27 SG No 4: Feed Water Flow Rate

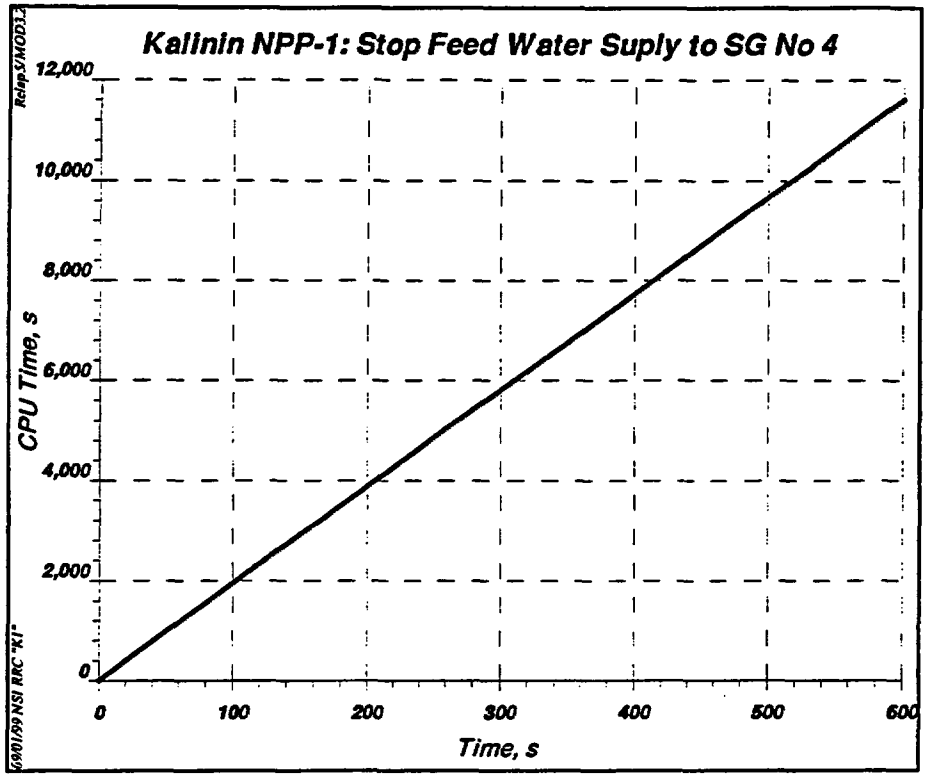


Fig. A- 28 Run Statistics: CPU Time

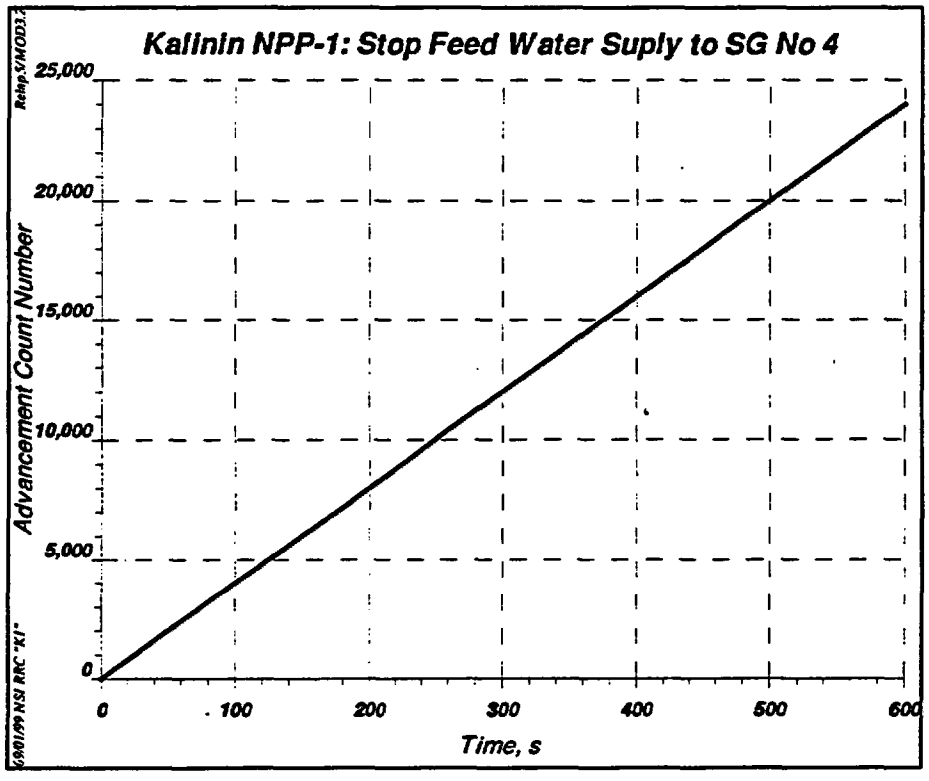


Fig. A- 29 Run Statistics: Advancement Count Number

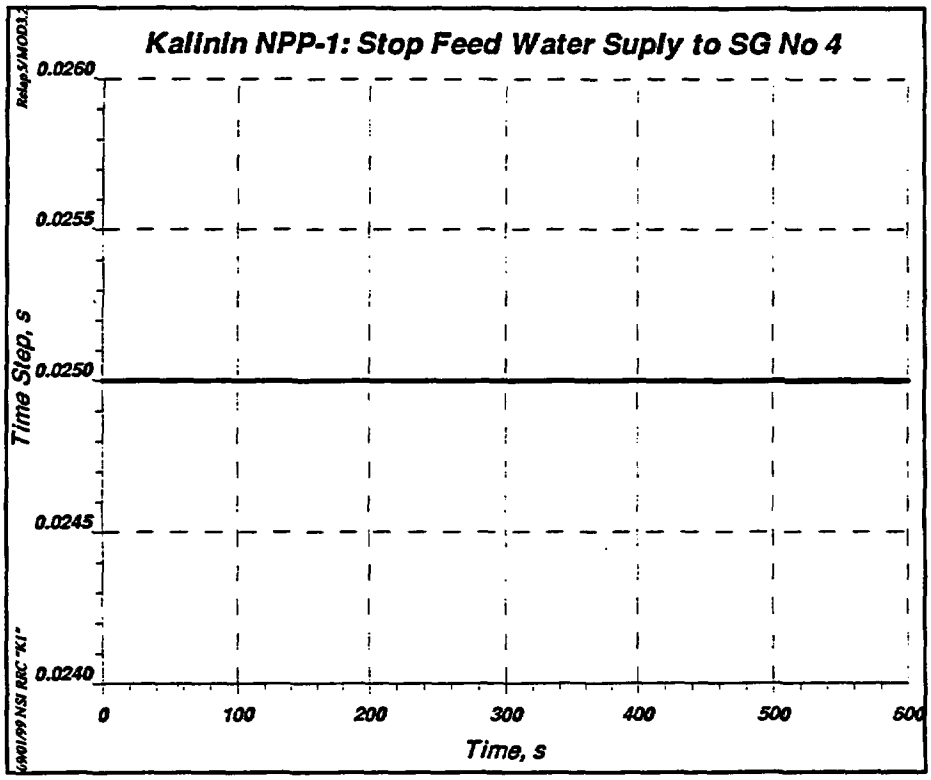


Fig. A- 30 Run Statistics: Time Step

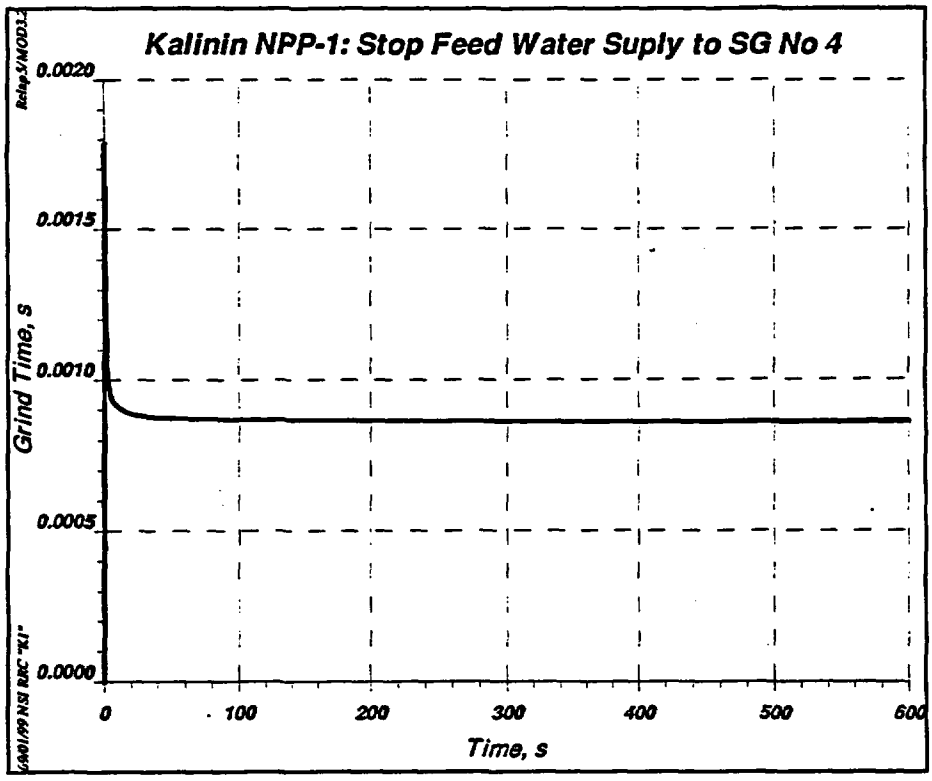


Fig. A- 31 Run Statistics: GRIND Time

APPENDIX-B

SENSITIVITY STUDY RESULTS

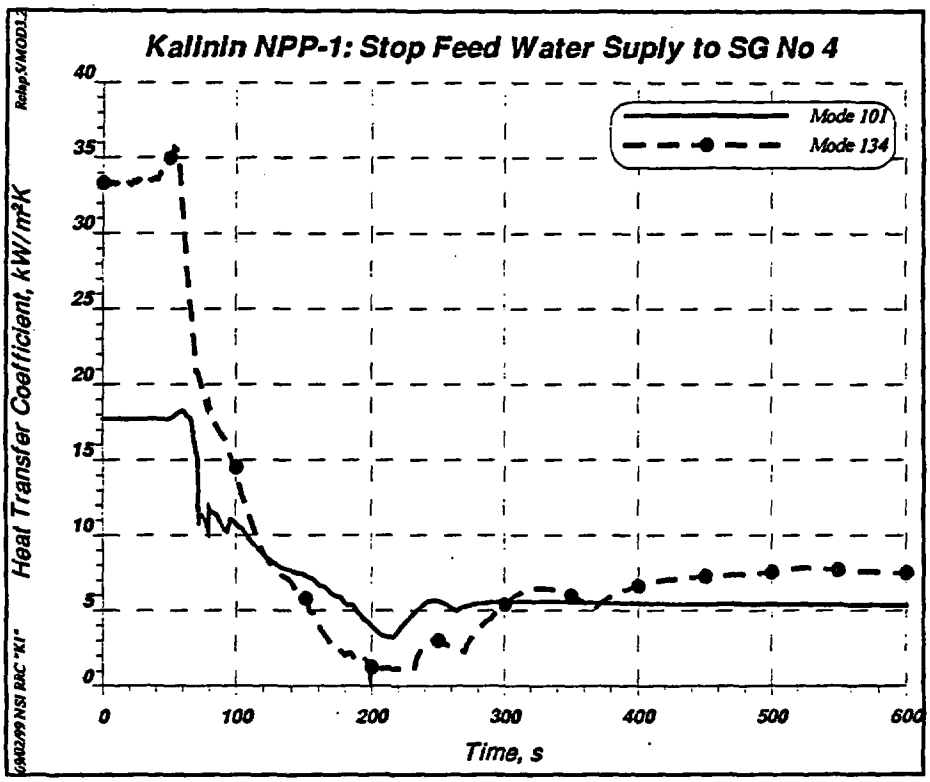


Fig. B- 1 SG No 1: Tube Bundles (Layer 5) Heat Transfer Coefficient

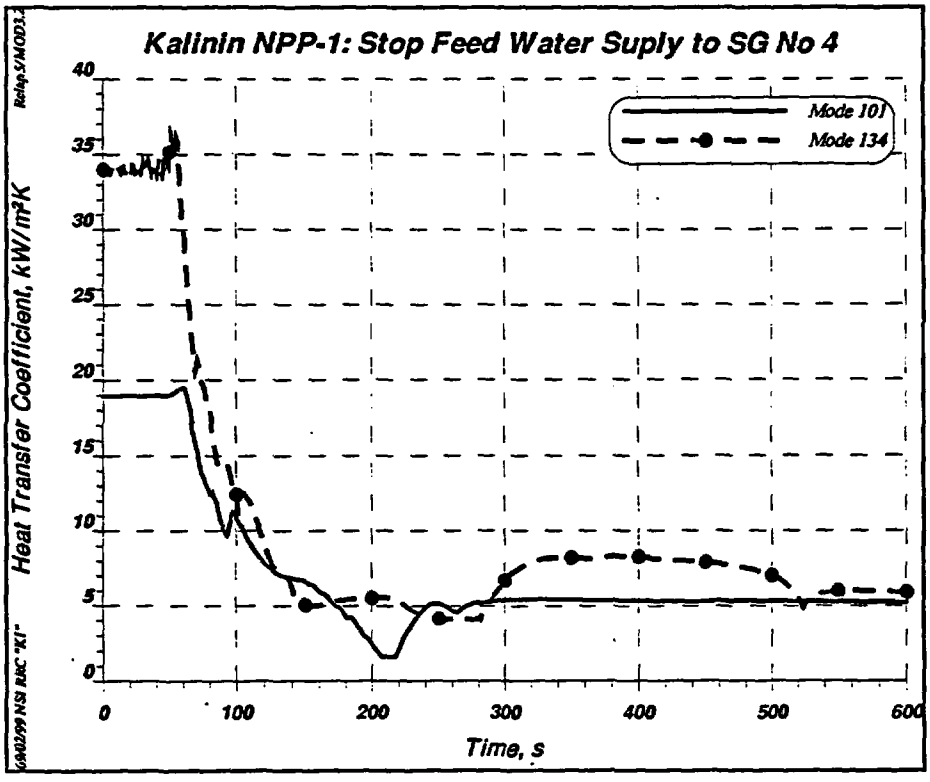


Fig. B- 2 SG No 1: Tube Bundles (Layer 4) Heat Transfer Coefficient

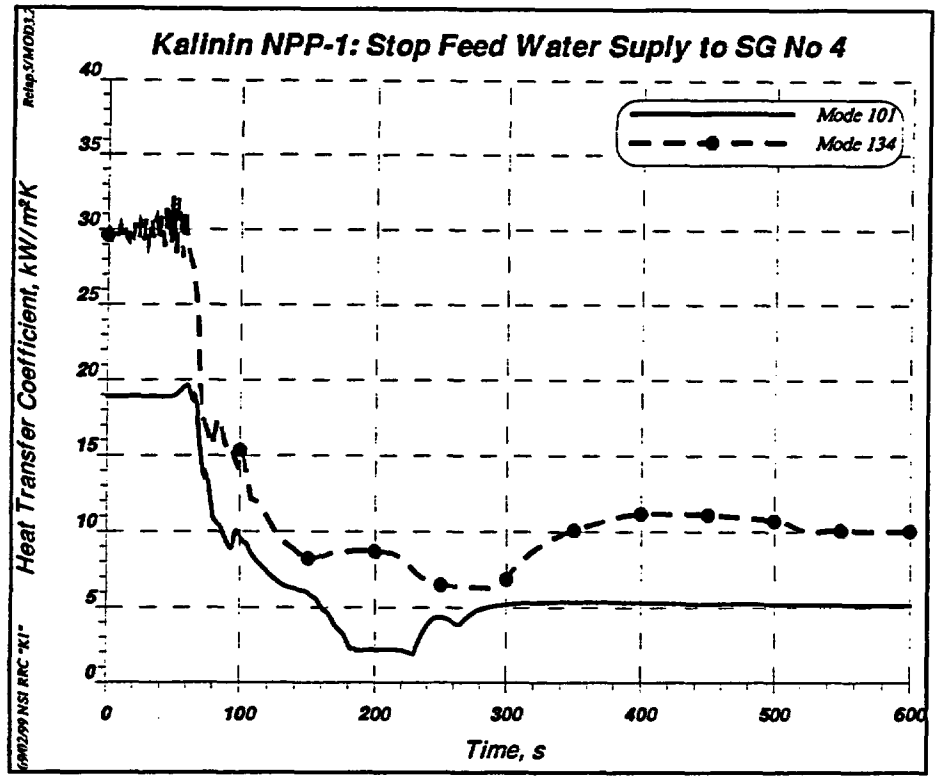


Fig. B- 3 SG No 1: Tube Bundles (Layer 3) Heat Transfer Coefficient

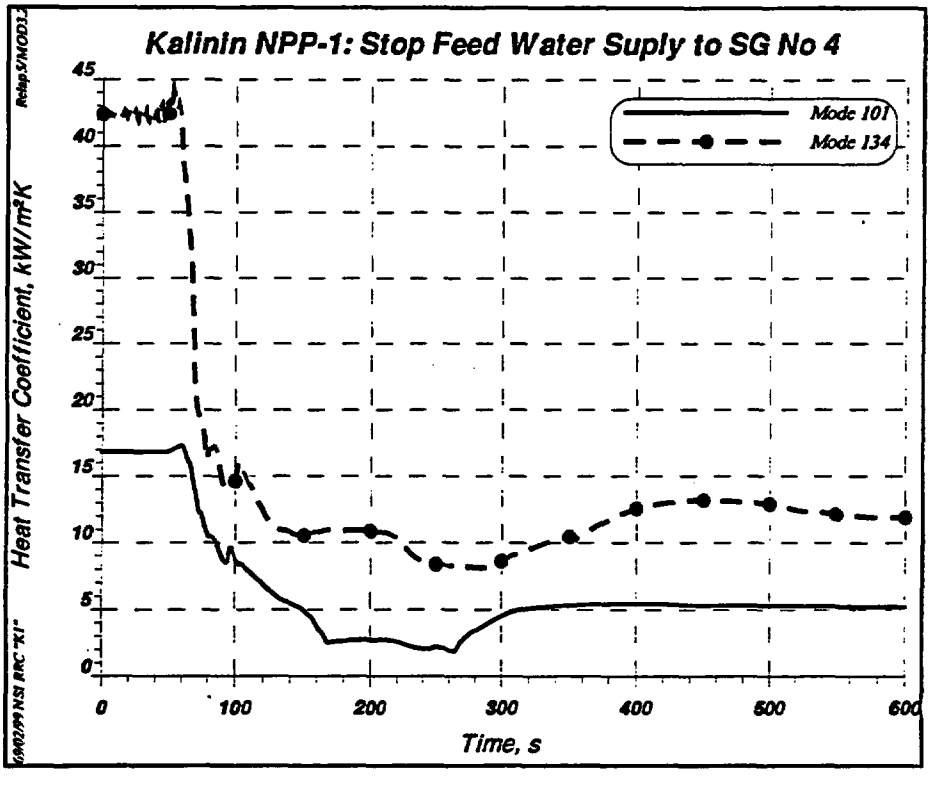


Fig. B- 4 SG No 1: Tube Bundles (Layer 1) Heat Transfer Coefficient

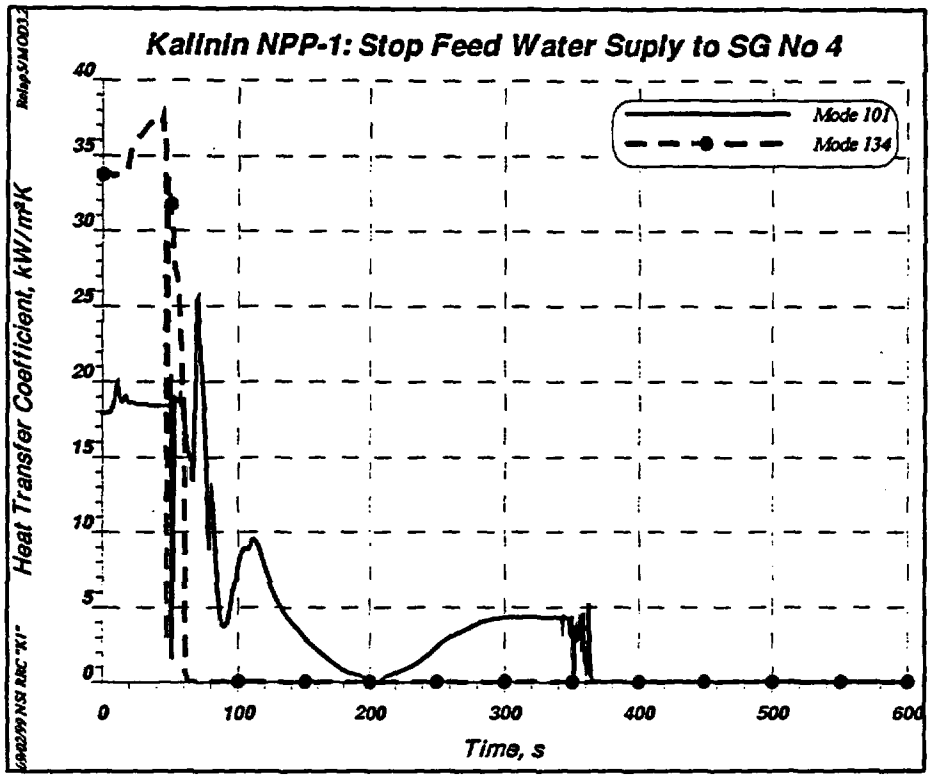


Fig. B- 5 SG No 4: Tube Bundles (Layer 5) Heat Transfer Coefficient

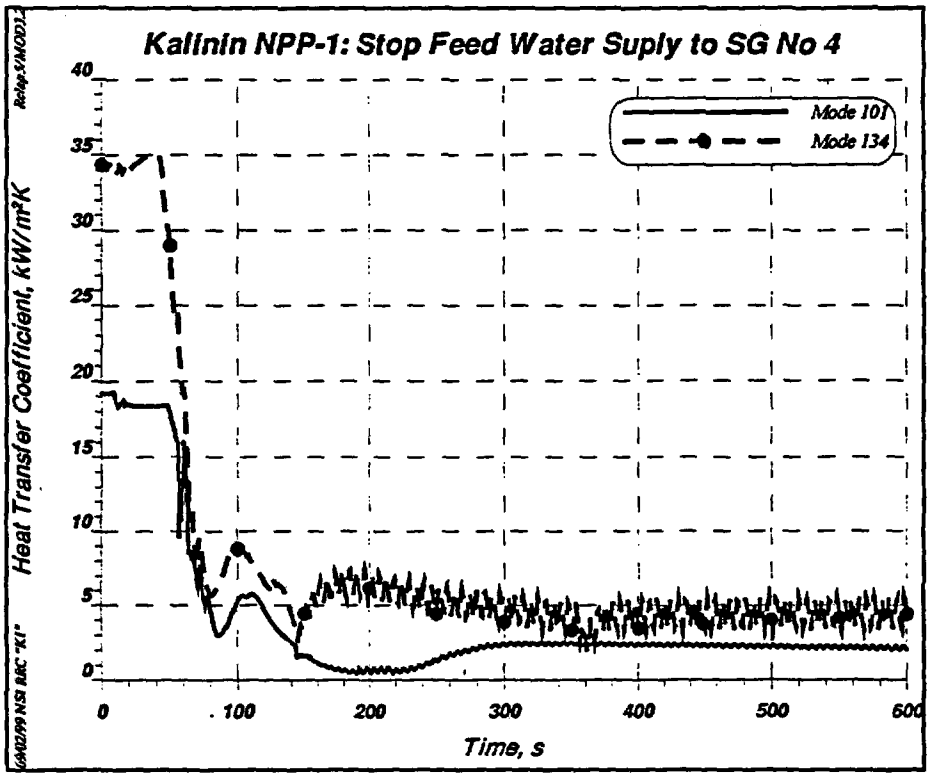


Fig. B- 6 SG No 4: Tube Bundles (Layer 4) Heat Transfer Coefficient

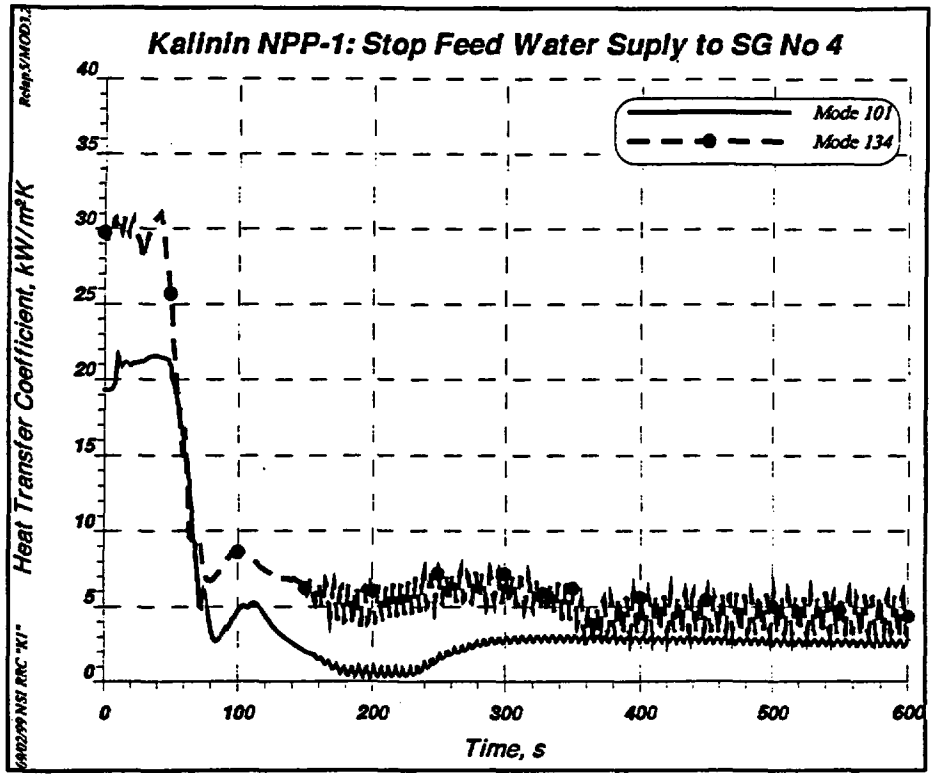


Fig. B- 7 SG No 4: Tube Bundles (layer 3) Heat Transfer Coefficient

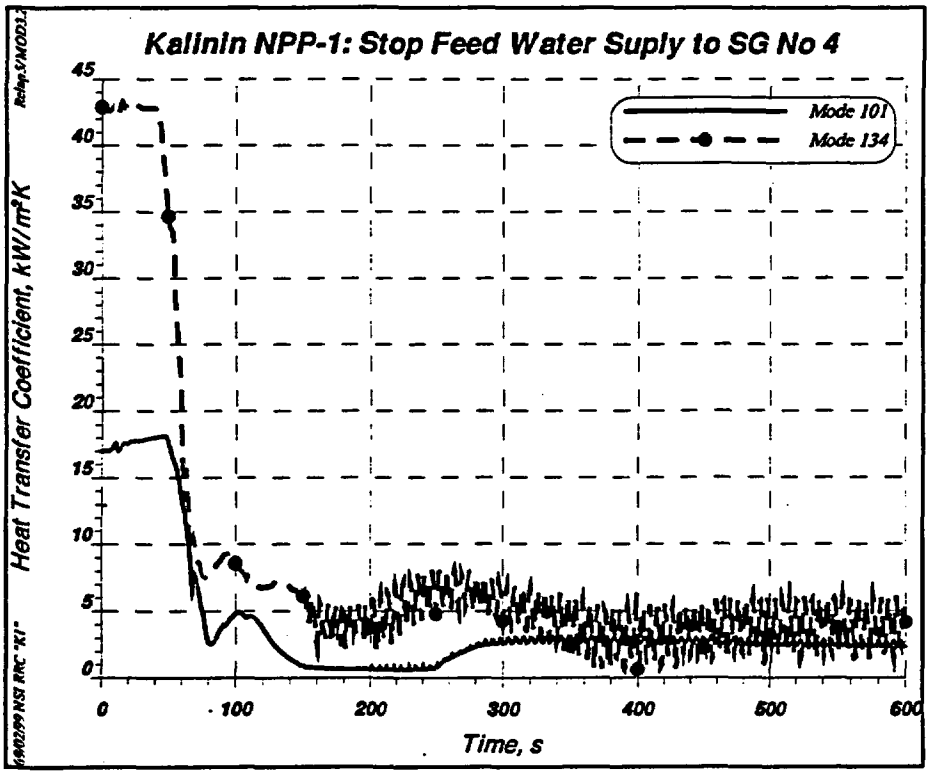


Fig. B- 8 SG No 4: Tube Bundles (Layer 1) Heat Transfer Coefficient

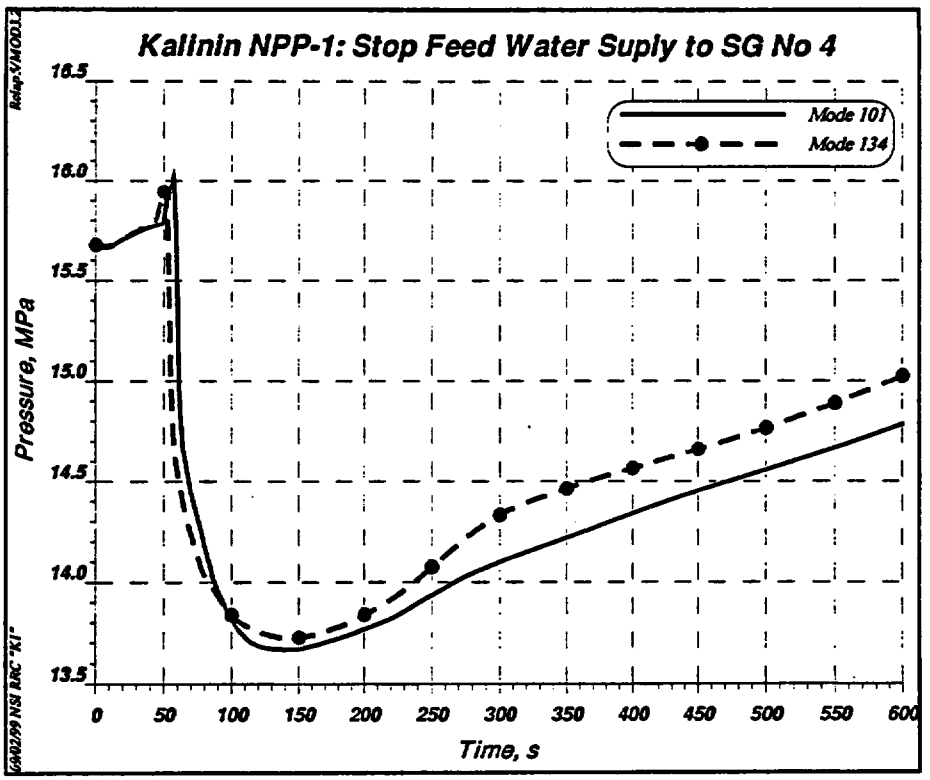


Fig. B- 9 Primary Side Pressure

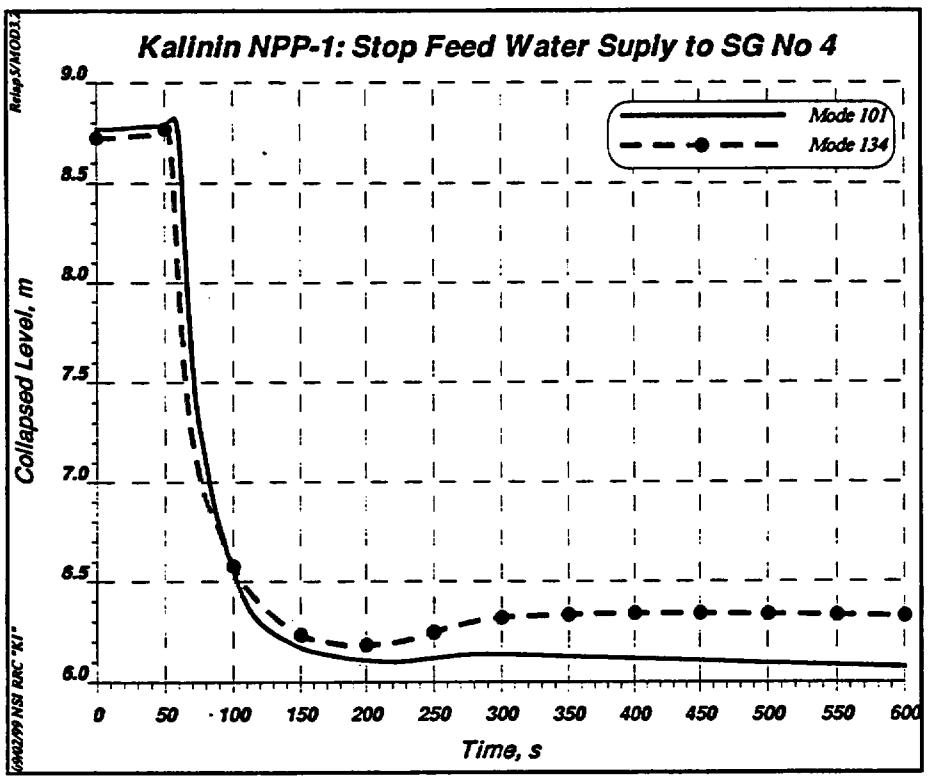


Fig. B- 10 Pressurizer Level

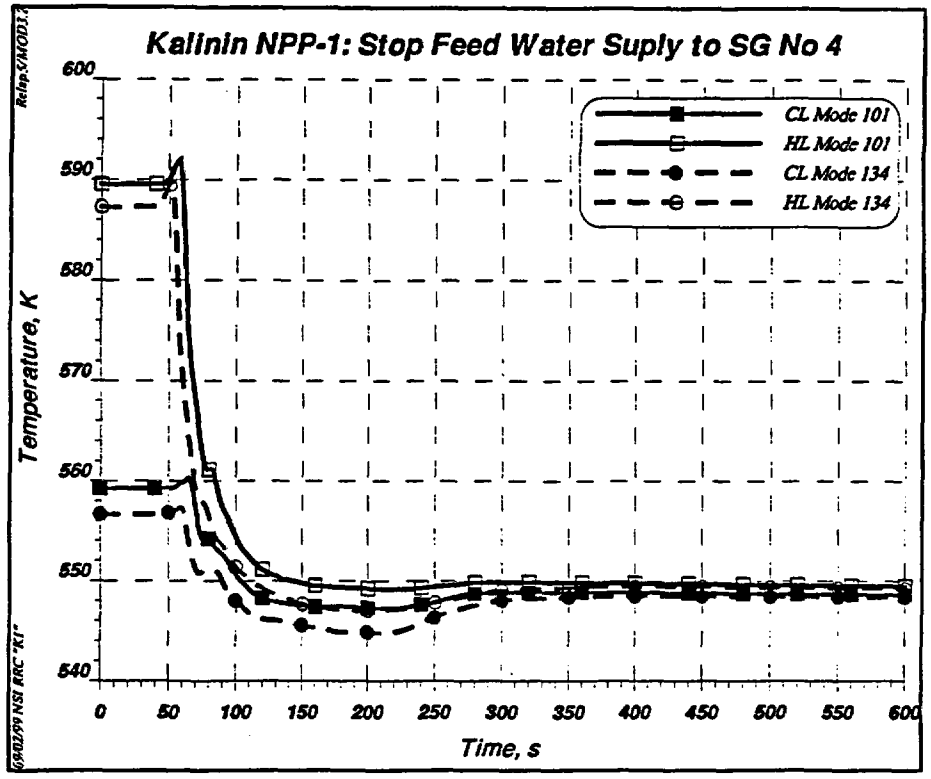


Fig. B- 11 Loop No 1: Coolant Temperature

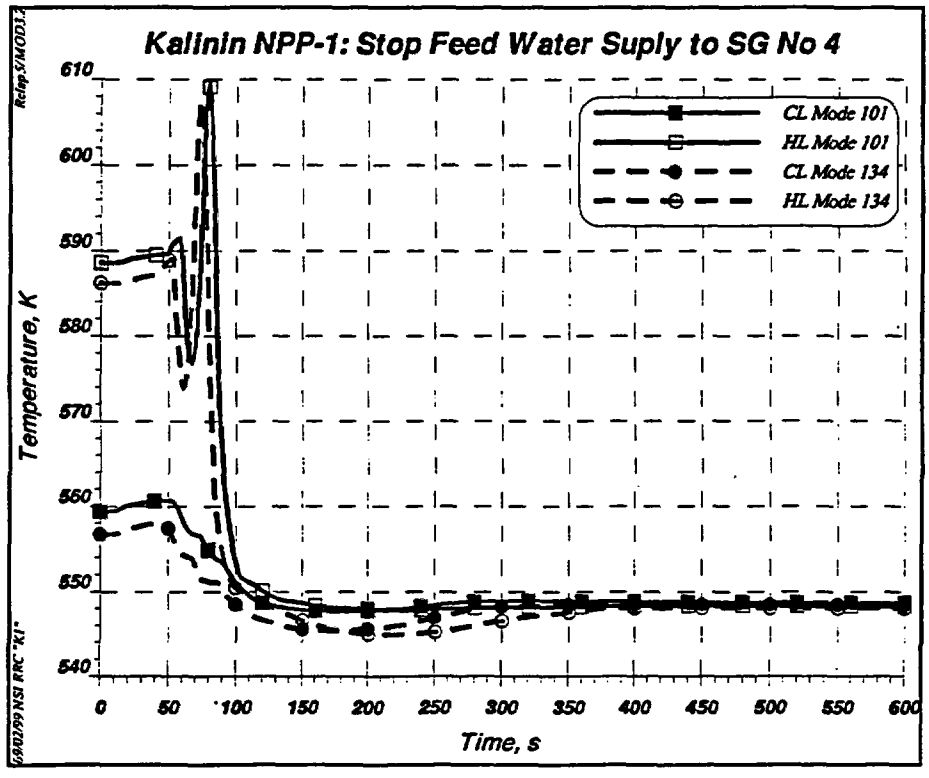


Fig. B- 12 Loop No 4: Coolant Temperature

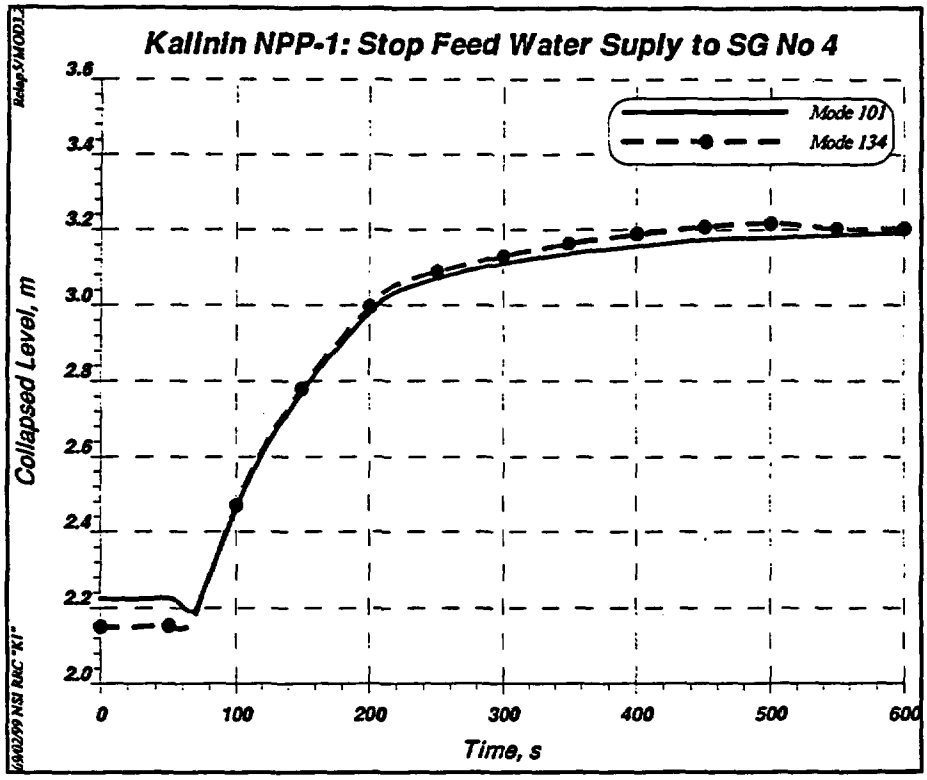


Fig. B- 13 SG No 1: Collapsed Level

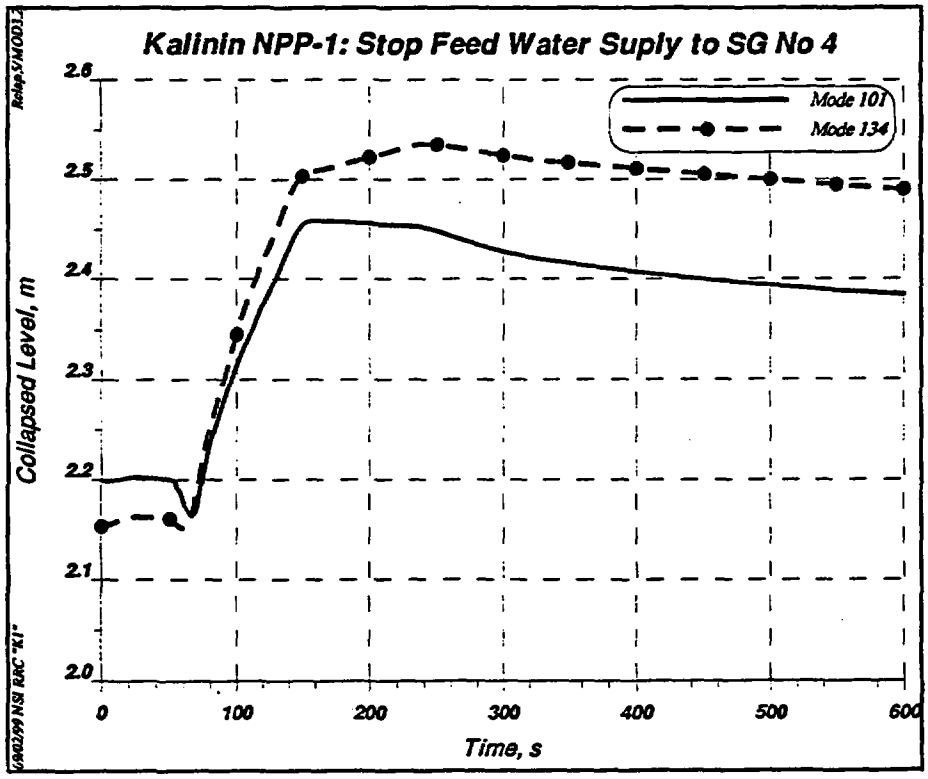


Fig. B- 14 SG No 2: Collapsed Level

APPENDIX-C

RELAP5/MOD3.2.2Beta RESULTS

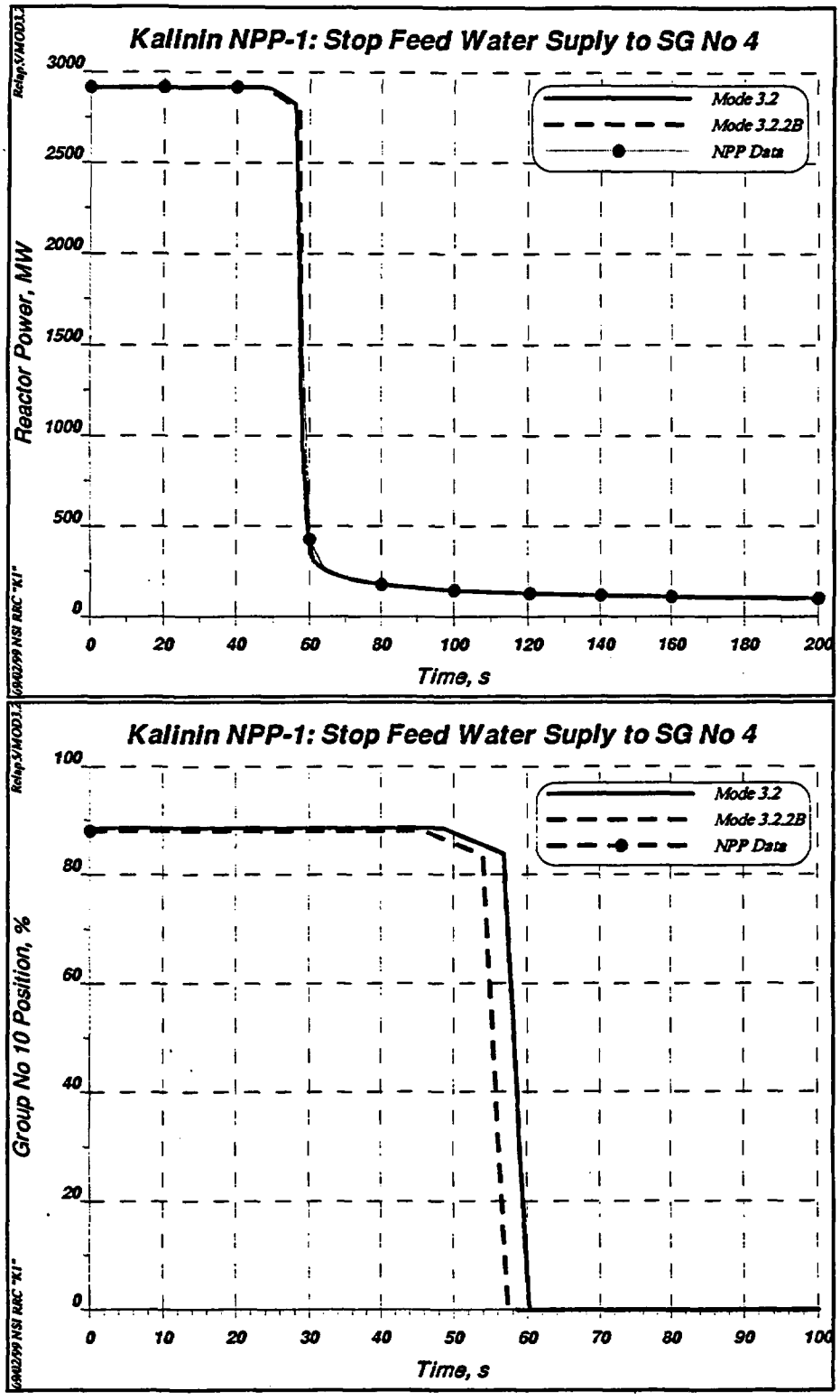


Fig. C- 1 Reactor Power and Control Rod Group 10 Position

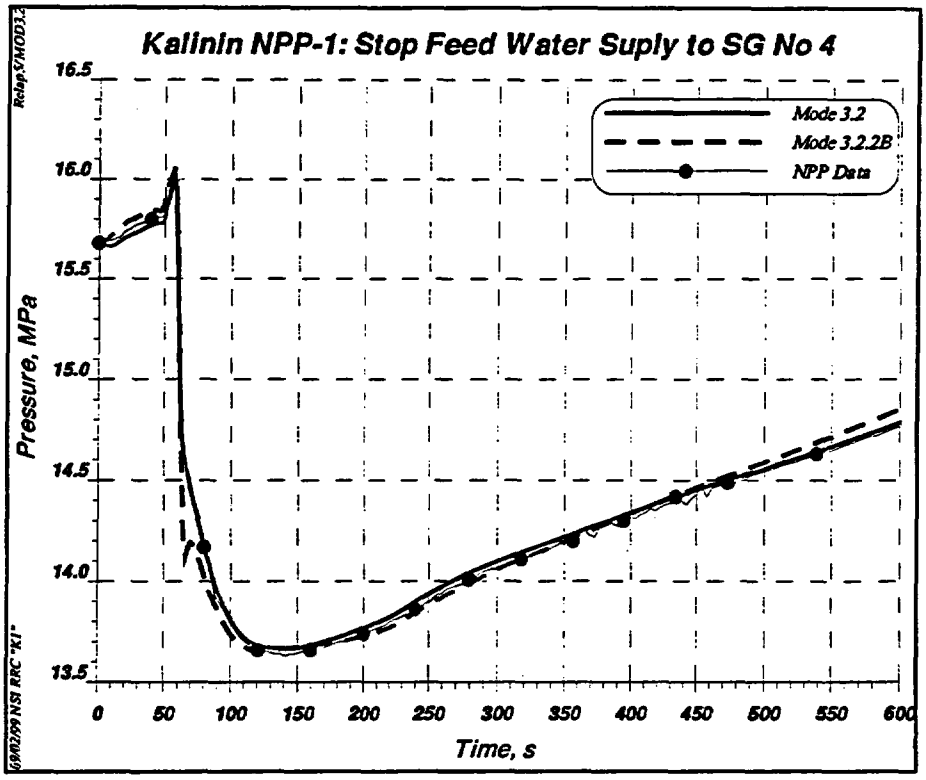


Fig. C- 2 Primary Side Pressure

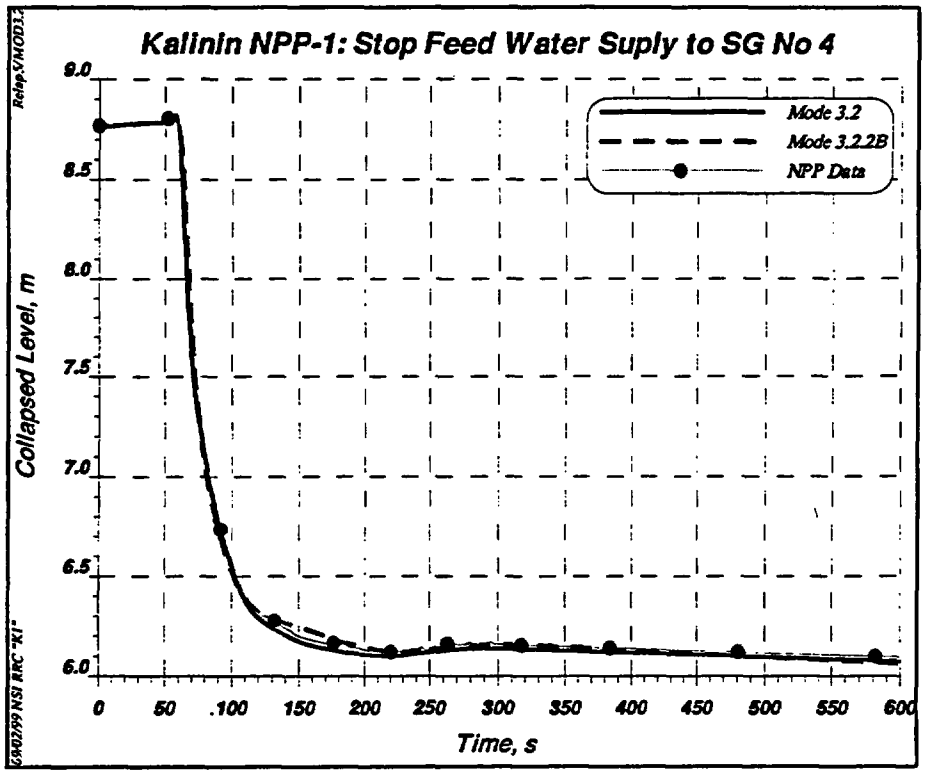


Fig. C- 3 Pressurizer Level

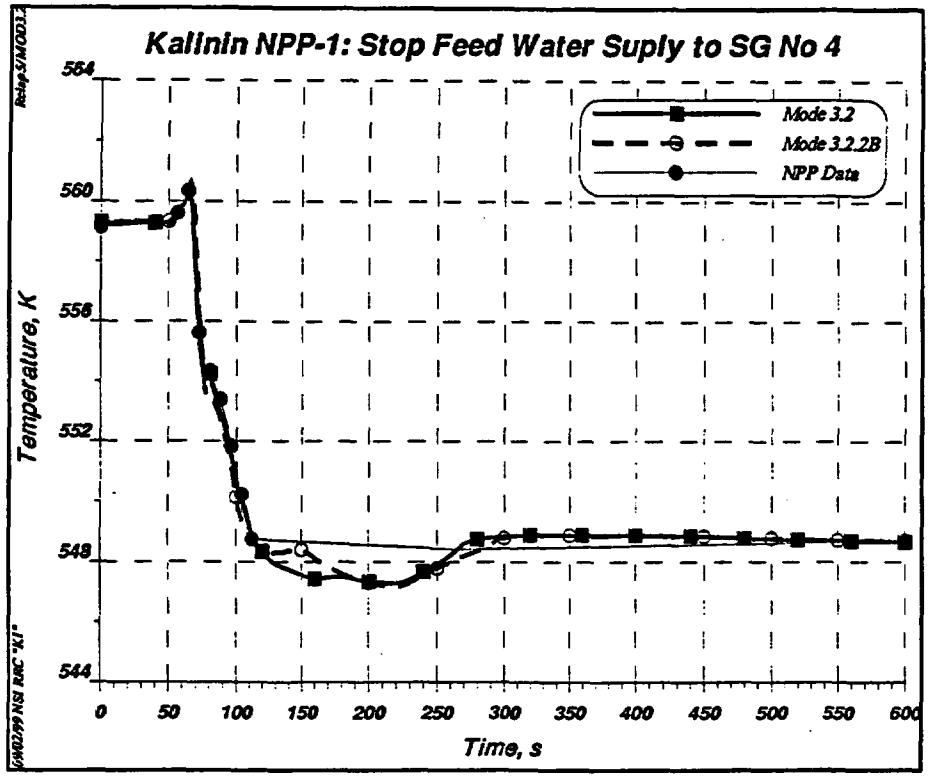


Fig. C- 4 Loop No 1: Cold Leg Coolant Temperature

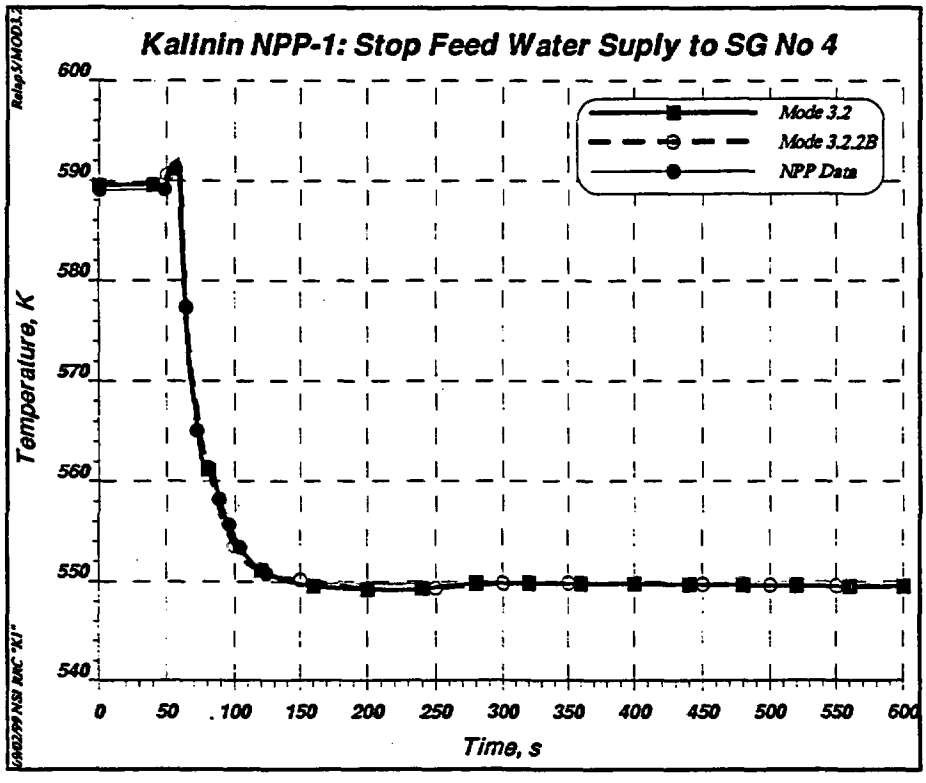


Fig. C- 5 Loop No 1: Hot Leg Coolant Temperature

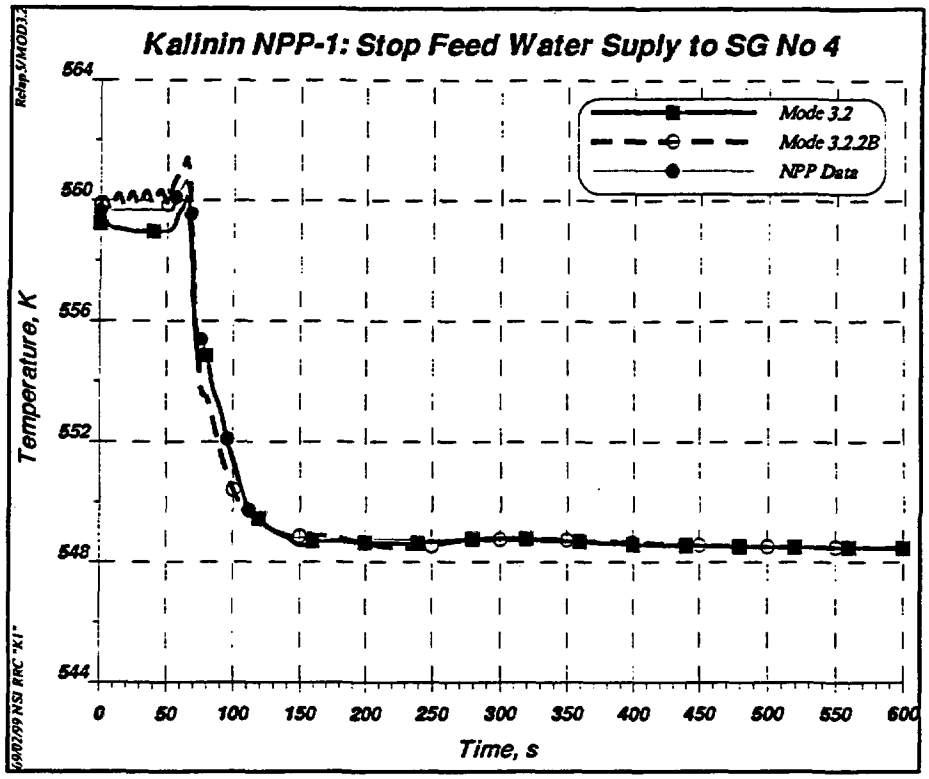


Fig. C- 6 Loop No 2: Cold Leg Coolant Temperature

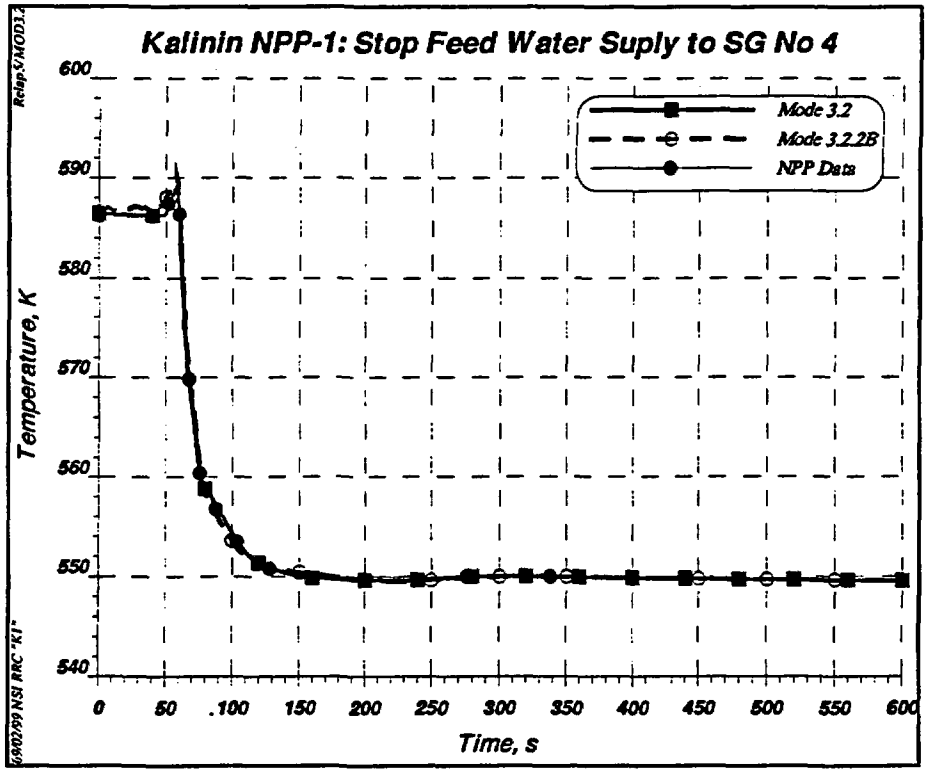


Fig. C- 7 Loop No 2: Hot Leg Coolant Temperature

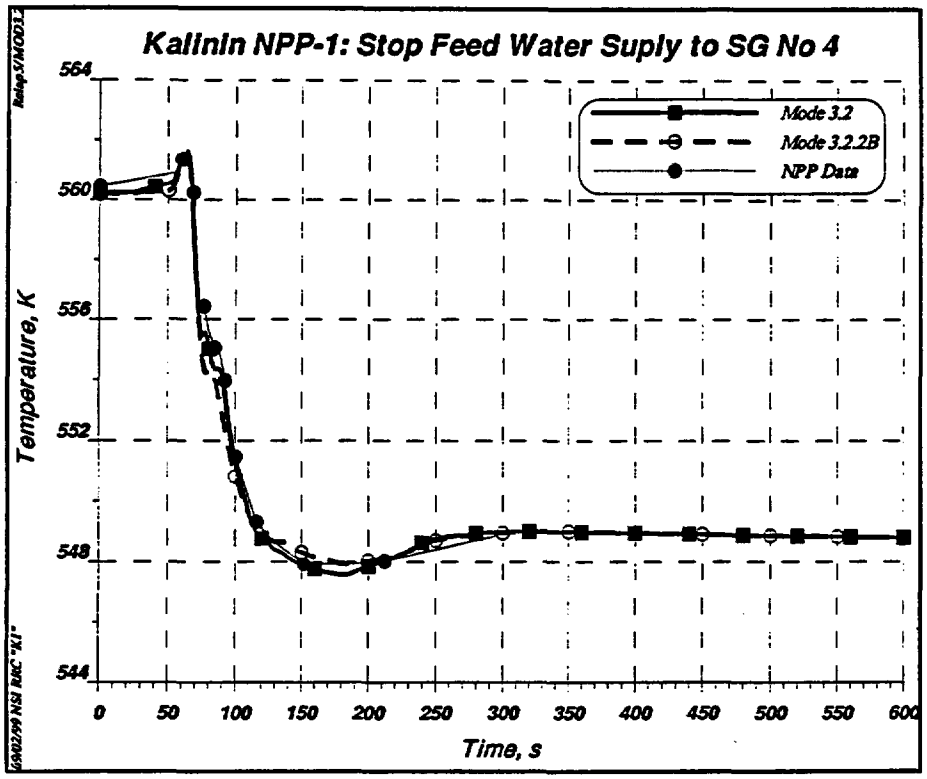


Fig. C- 8 Loop No 3: Cold Leg Coolant Temperature

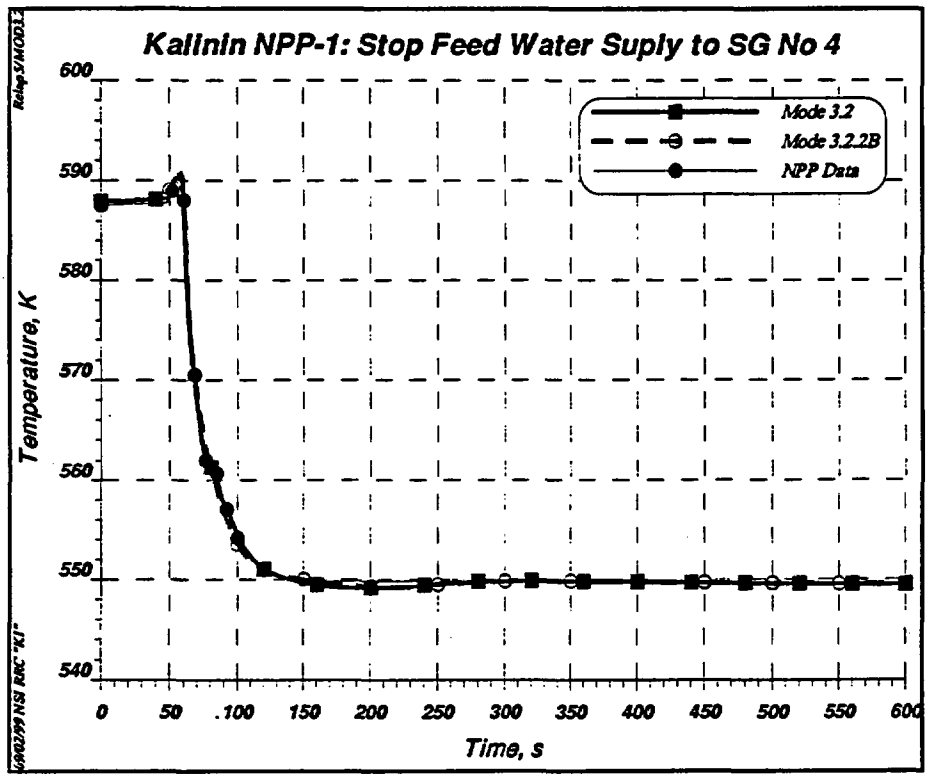


Fig. C- 9 Loop No 3: Hot Leg Coolant Temperature

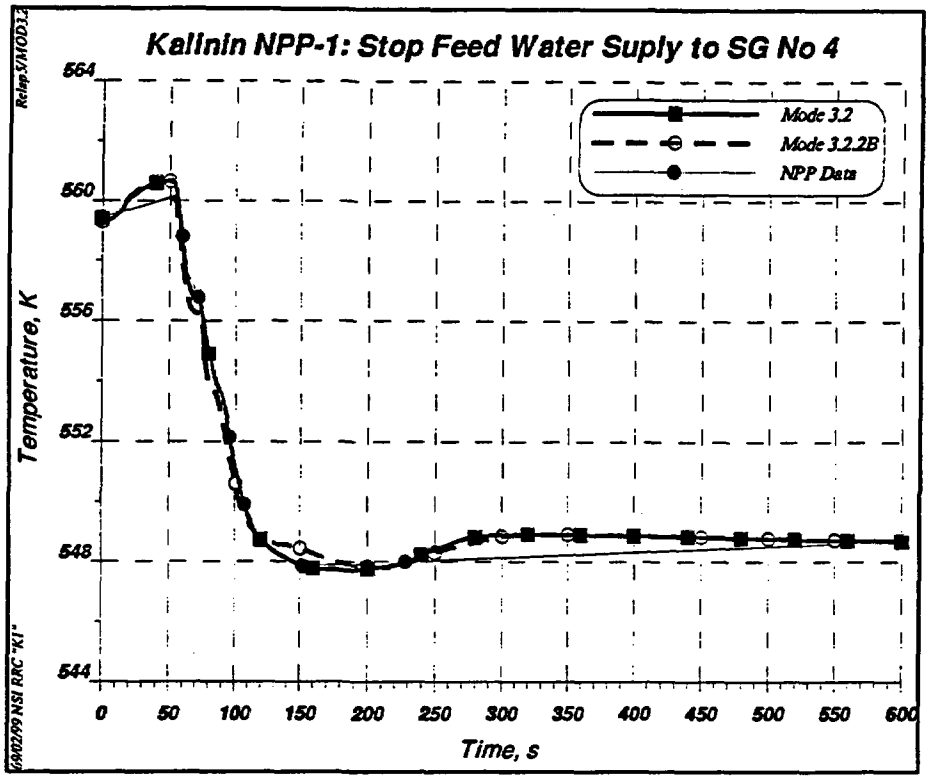


Fig. C- 10 Loop No 4: Cold Leg Coolant Temperature

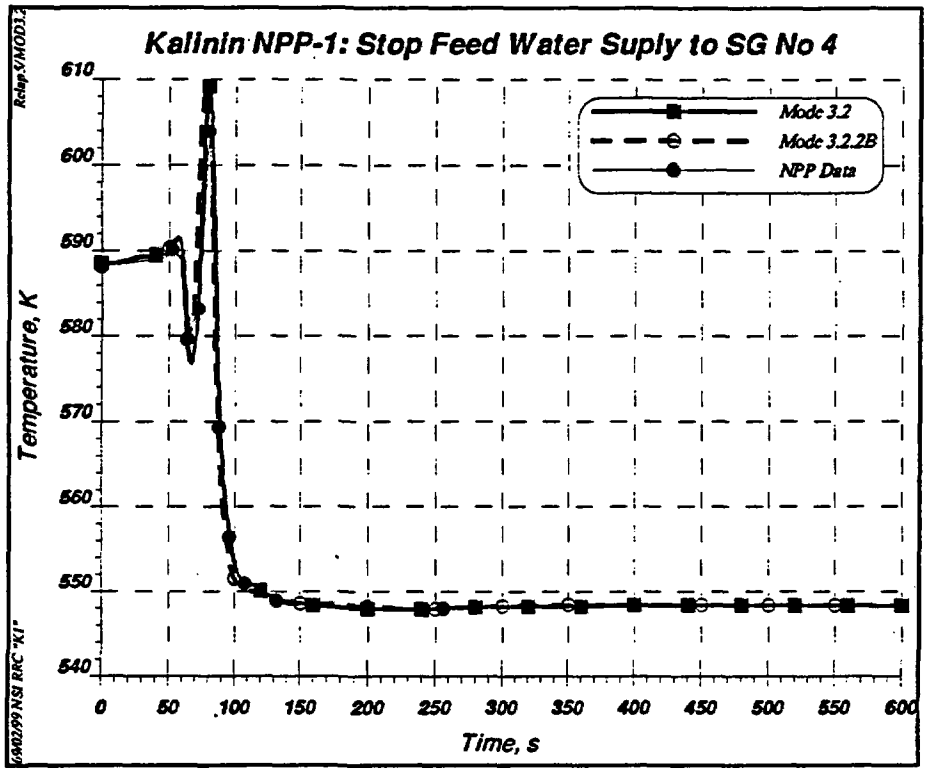


Fig. C- 11 Loop No 4: Hot Leg Coolant Temperature

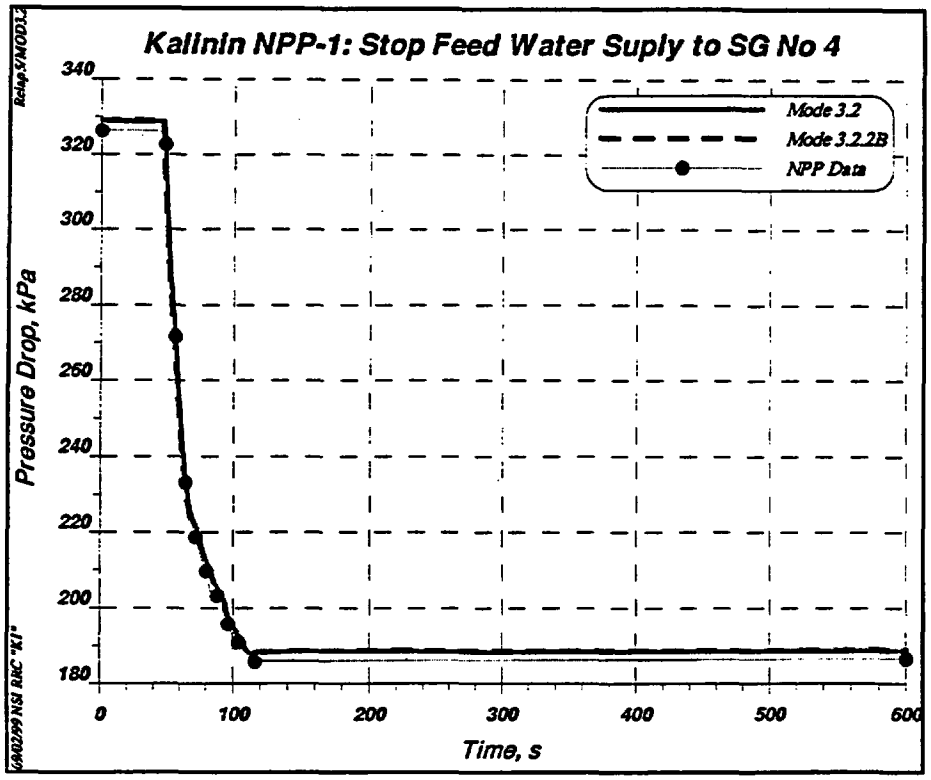


Fig. C- 12 Reactor Vessel Pressure Drop

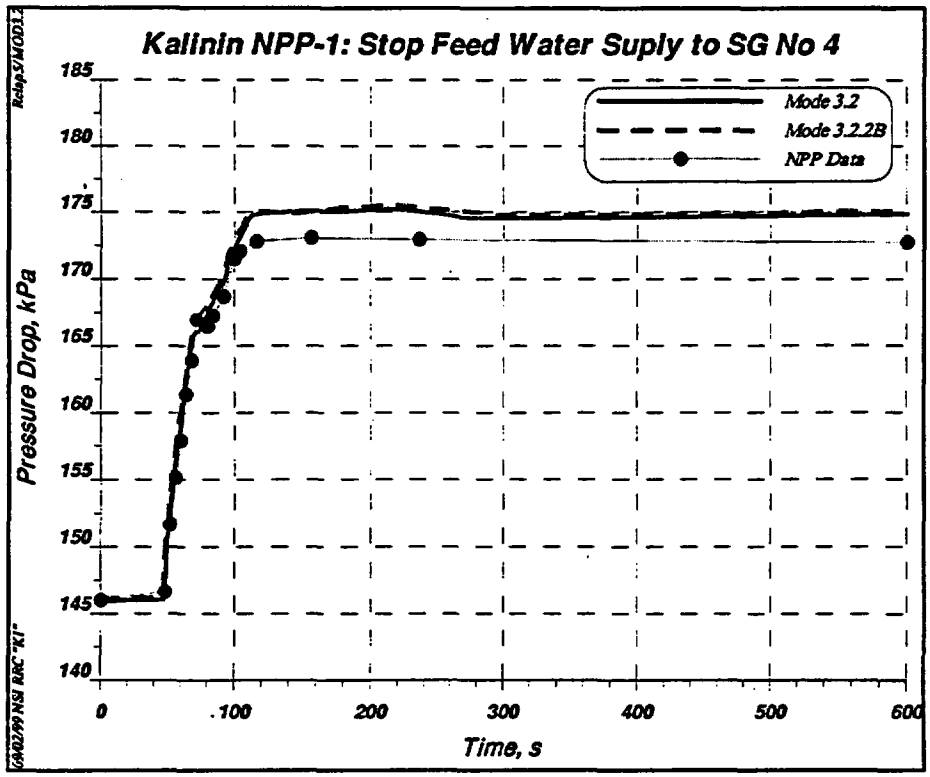


Fig. C- 13 SG No 1 (Primary Side) Pressure Drop

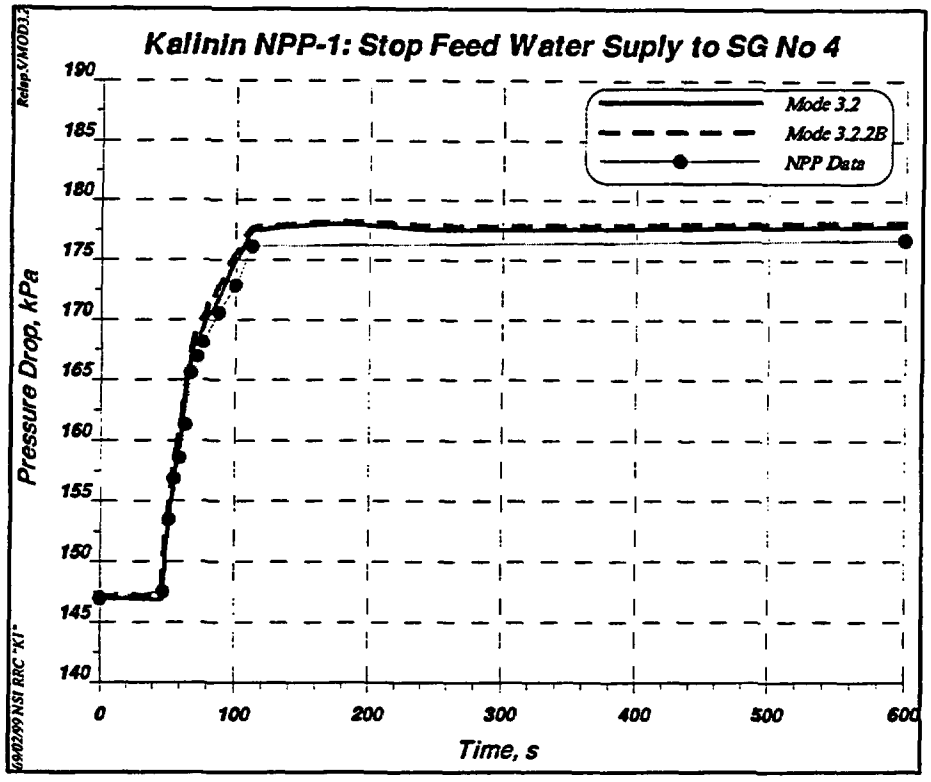


Fig. C- 14 SG No 3 (Primary Side) Pressure Drop

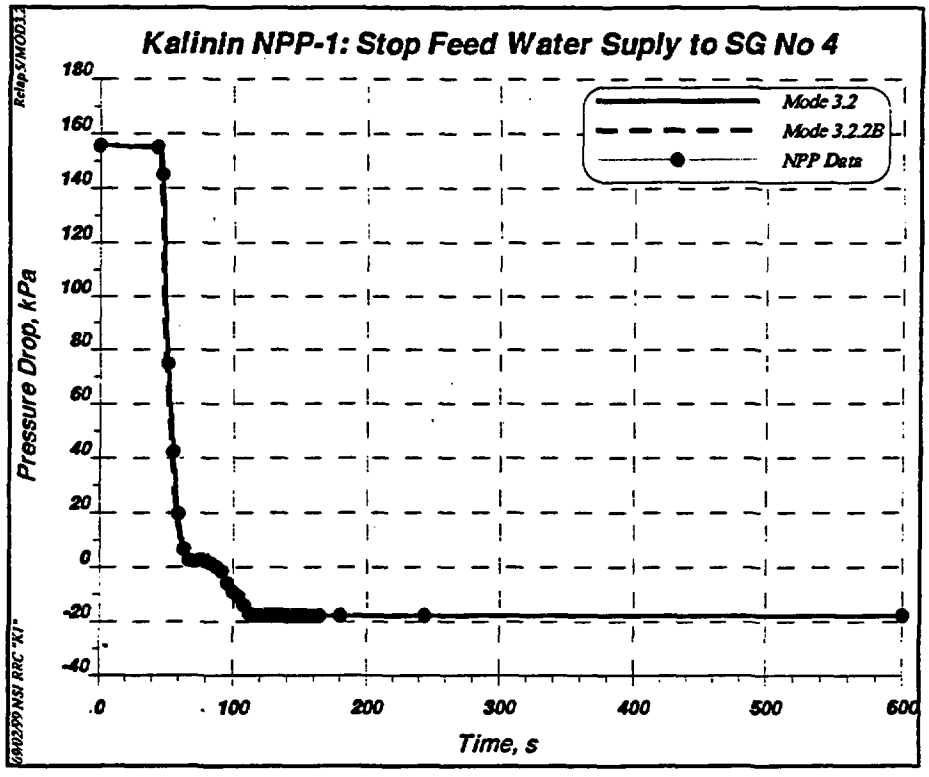


Fig. C- 15 SG No 4 (Primary Side) Pressure Drop

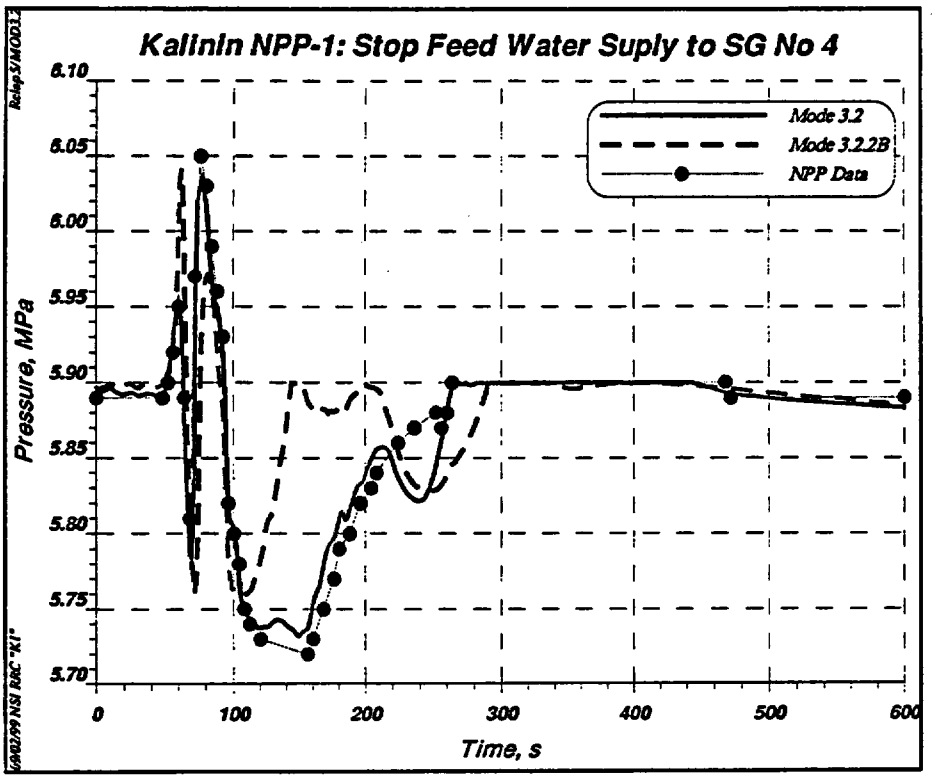


Fig. C- 16 SG No 1: Steam Dome Pressure

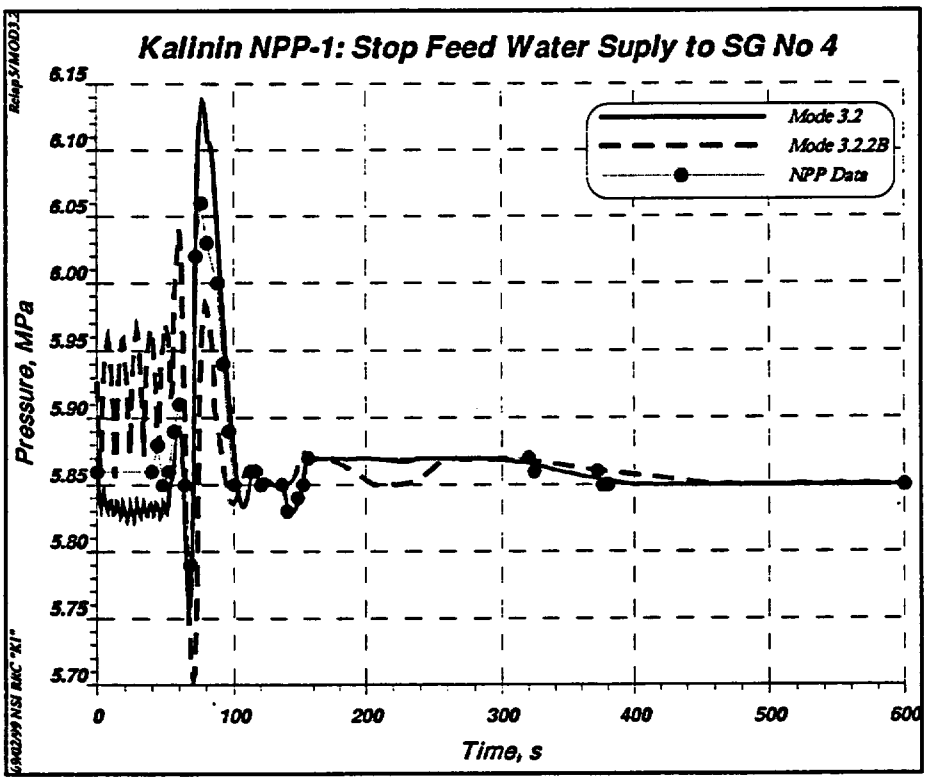


Fig. C- 17 SG No 2: Steam Dome Pressure

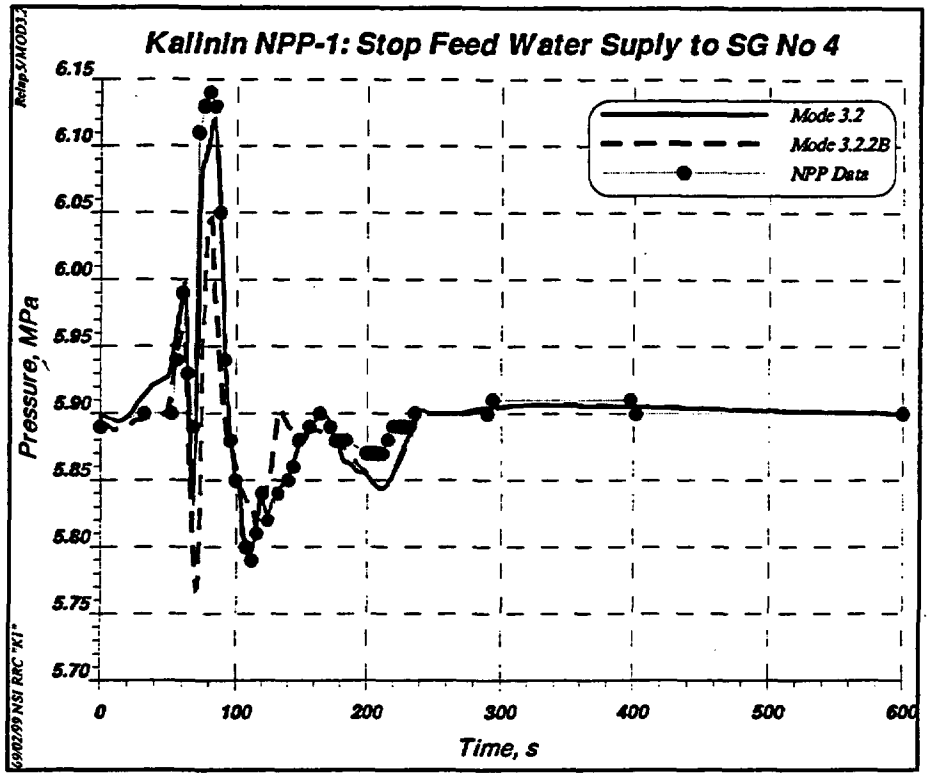


Fig. C- 18 SG No 3: Steam Dome Pressure

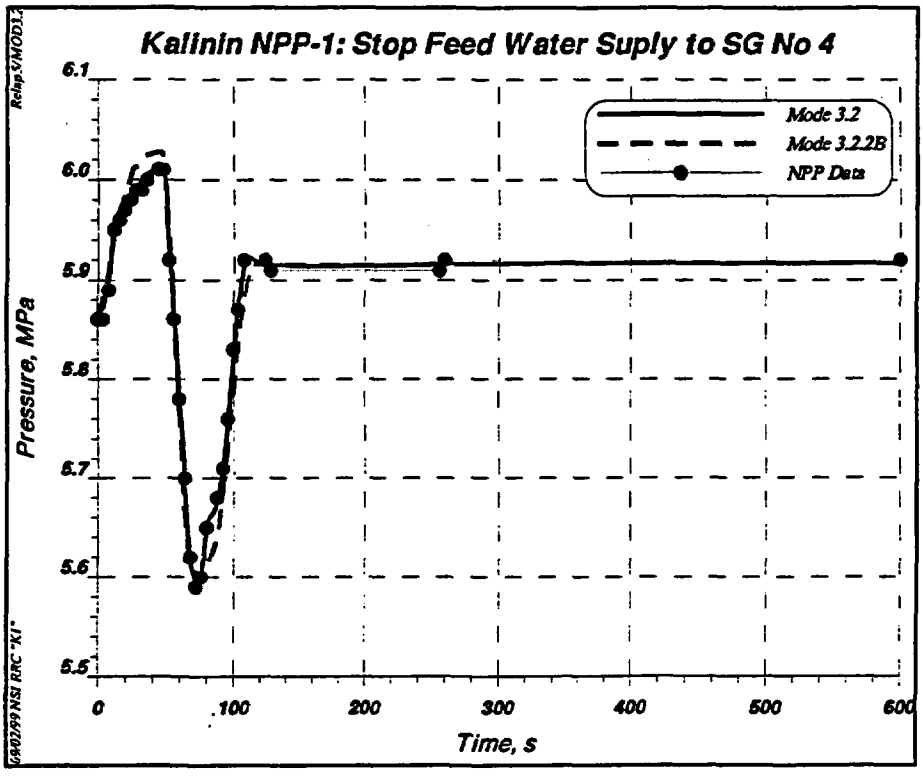


Fig. C- 19 SG No 4: Steam Dome Pressure

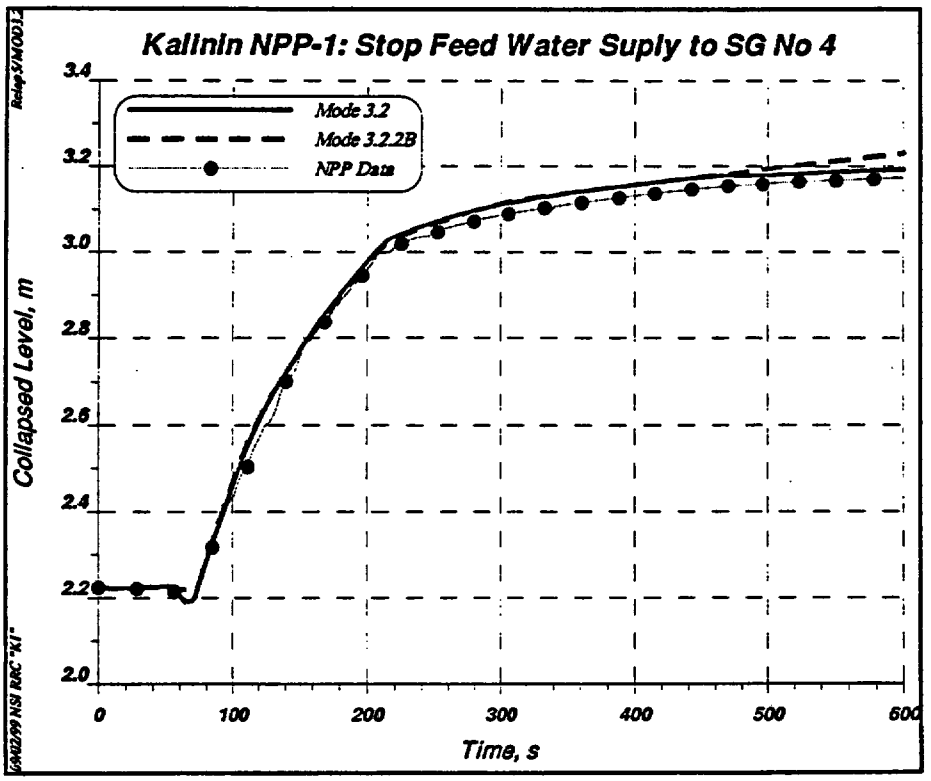


Fig. C- 20 SG No 1: Collapsed level

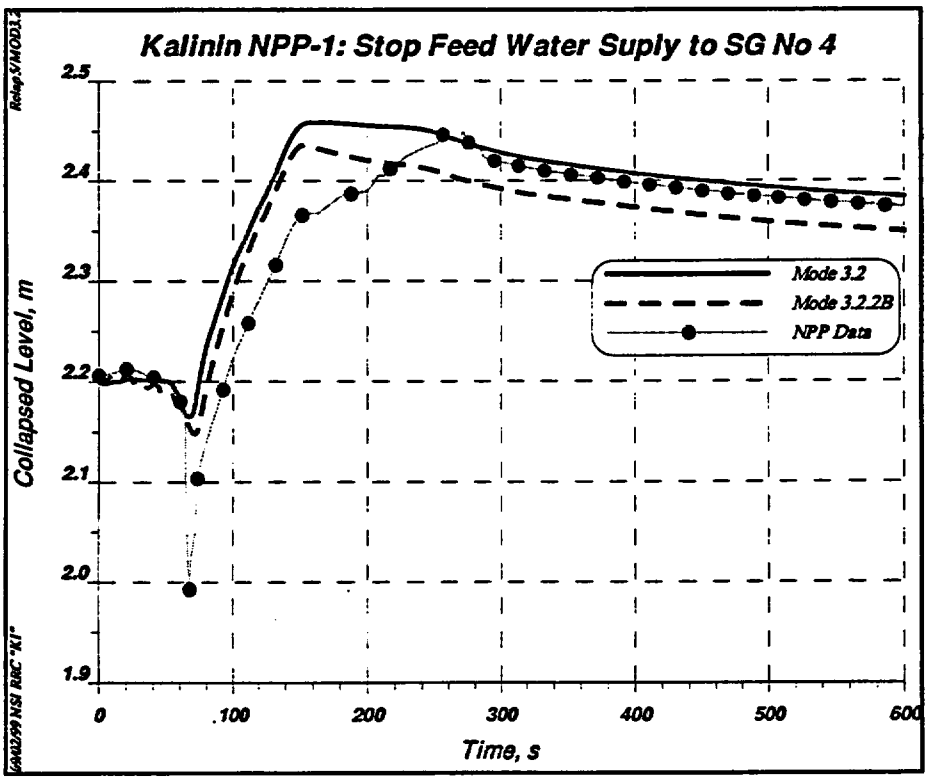


Fig. C- 21 SG No 2: Collapsed level

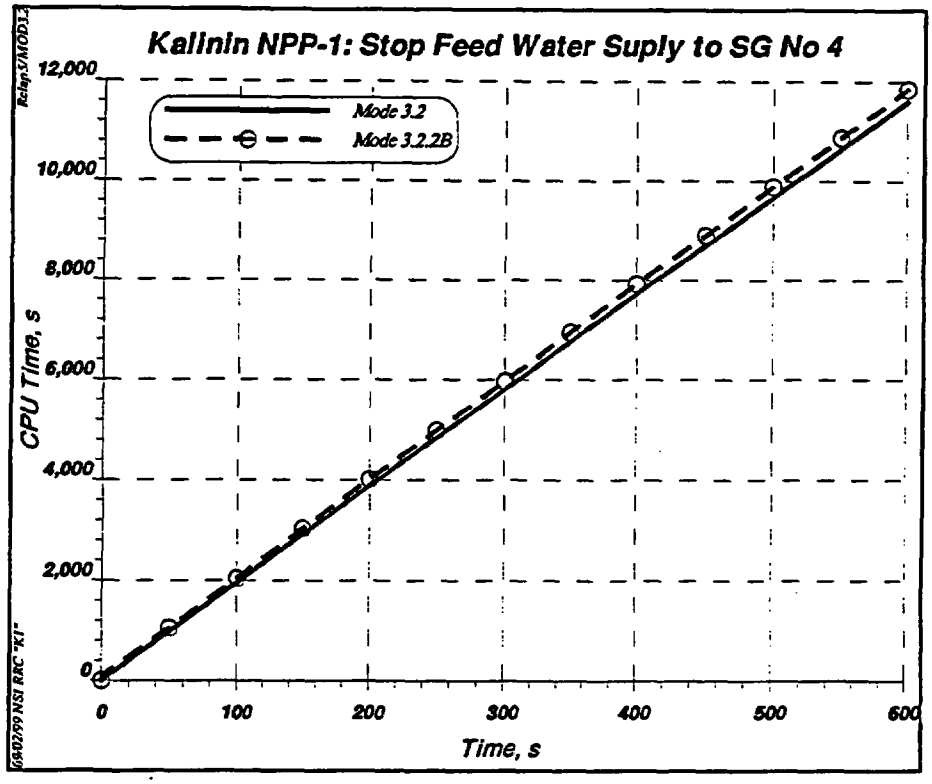


Fig. C- 22 Run Statistics: CPU Time

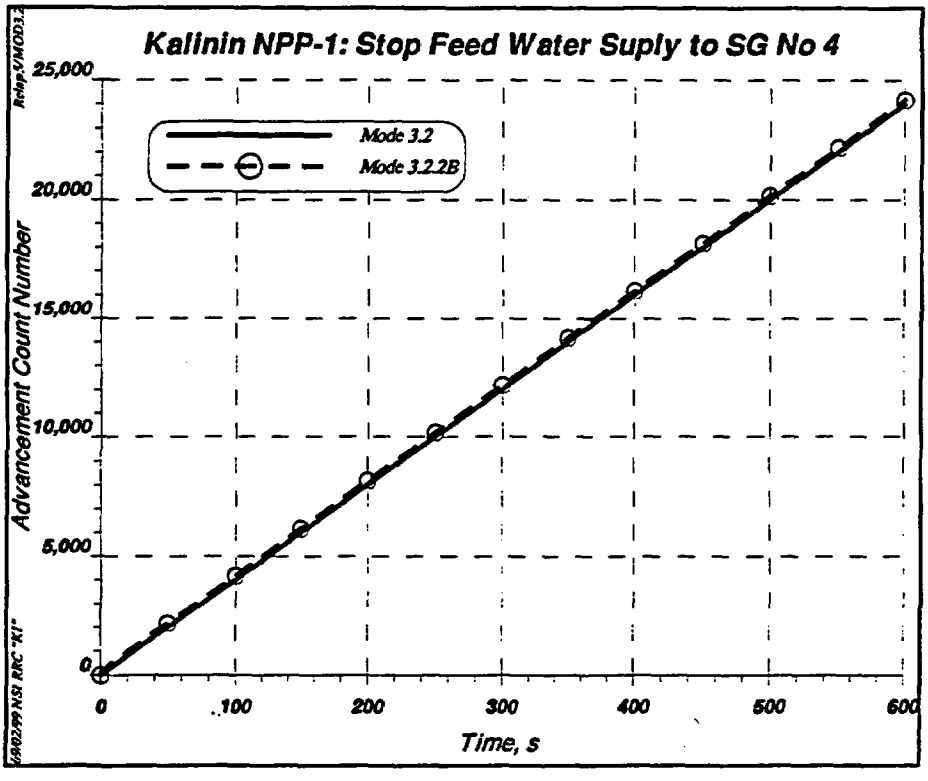


Fig. C- 23 Run Statistics: Advancement Count Number

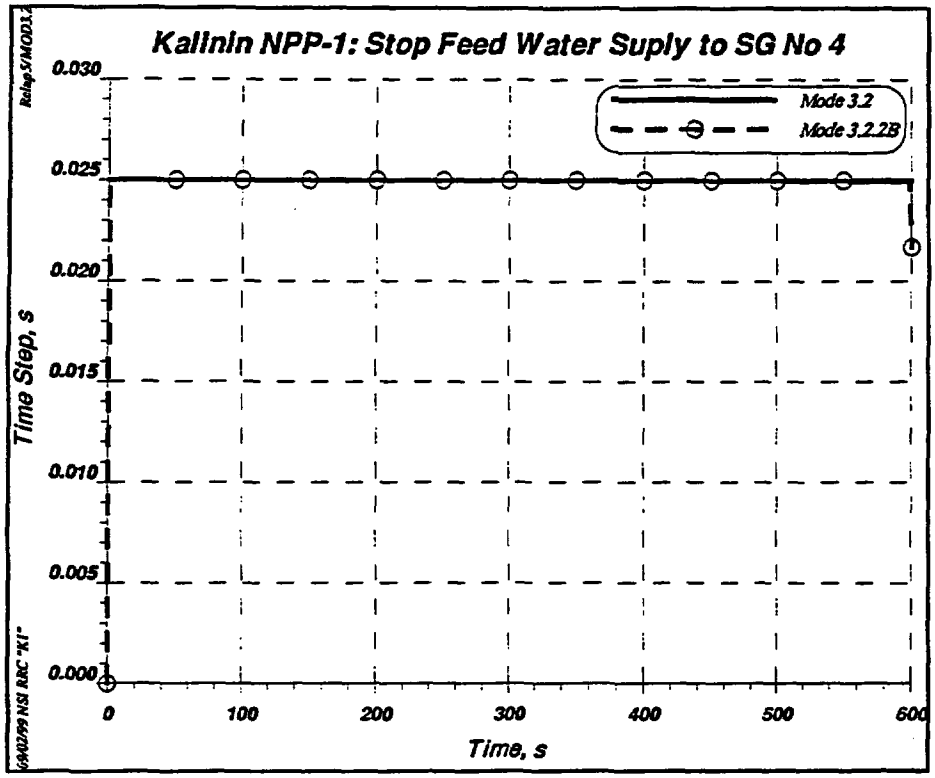


Fig. C- 24 Run Statistics: Time Step

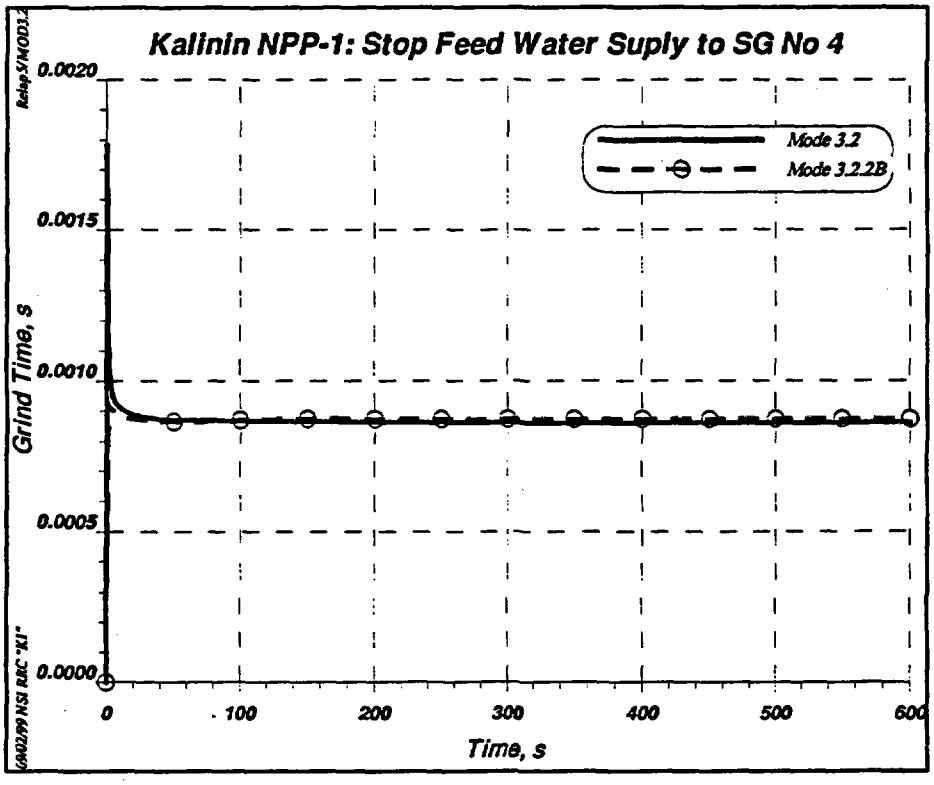


Fig. C- 25 Run Statistics: GRIND Time

APPENDIX-D

STEADY STATE INPUT DECK

```
=WWER1000/KaNPP Unit 1. Stop of Feedwater Supply to SG-4.
*-----------
* This Input deck prepared by S. Pylev
*   (NSI RRC KI, Moscow, Russia)
* on the base of the archived data collected by Kalinin NPP
* Data Aquisition and In-Vessel Monitoring Systems on 07.07.96
*-----------
* Input Model Include:
* 4 - primary loops;
* 4 - Steam Generators;
* 4 - Steam Lines;
* Reactor Vessel:
* Inlet/Outlet Nozzles, DC, LP and UP are splitted on 4 segments
*-----------
* Description of the Transient:
* "Activation of the 1-st kind Emergency Protection
* caused by Decrease of the SG No 4 Water Level
* during Kalinin NPP-1 Operation with 11-th Feal Load"
* Inititial data for a Reactor Steady state mode:
* ---------------------------------
* Thermal Reactor Power  - 2917 MW
* Loop1: - 0.245632
* Loop2: - 0.246615
* Loop3: - 0.256065
* Loop4: - 0.251688
*  -----
*   1.000000
* Company Duration  - 194 ef. days
* Boron Concentration  - 0.939 g/kg
* Position (of core bottom)
* of 10-th OR SUZ group - 83 %
* Primary Side:
* -----------
* Pressure above Core  - 15.68 MPa
* Loop Coolant Flow Rate:
*  Loop No 1 - 4253.59 kg/s
*  Loop No 2 - 4800.43 kg/s
*  Loop No 3 - 4892.43 kg/s
*  Loop No 4 - 4524.95 kg/s
* Reactor inlet/outlet Pressure Drop - 326.34 kPa
* SG (Primary side) Pressure Drop:
*  SG No 1 - 146.02 kPa
*  SG No 2 - 152.92 kPa
*  SG No 3 - 147.0 kPa
*  SG No 4 - 155.82 kPa
* MCP Pressure Drop:
*  Loop No 1 - 568.4 kPa
*  Loop No 2 - 558.6 kPa
*  Loop No 3 - 578.2 kPa
*  Loop No 4 - 588.0 kPa
* Reactor Inlet Coolant Temperarure:
*  Loop No 1 - 559.15 K
*  Loop No 2 - 559.65 K
*  Loop No 3 - 560.45 K
*  Loop No 4 - 559.45 K
* Reactor Outlet Coolant Temperarure:
*  Loop No 1 - 589.05 K
*  Loop No 2 - 586.25 K
*  Loop No 3 - 587.55 K
*  Loop No 4 - 588.25 K
* Pressurizer Level - 8.77 m
* Secondary Side:
* -----------
* Feedwater Temperature:
*  SG No 1 - 437.25 K
*  SG No 2 - 436.25 K
*  SG No 3 - 436.65 K
*  SG No 4 - 437.05 K
* Feedwater flowrate:
*  SG No 1 - 345.6 kg/s
*  SG No 2 - 345.0 kg/s
*  SG No 3 - 360.0 kg/s
*  SG No 4 - 354.4 kg/s
* Feedwater Pressure at the SG Inlet:
*  SG No 1 - 7.056 MPa
*  SG No 2 - 7.056 MPa
*  SG No 3 - 7.056 MPa
*  SG No 4 - 7.056 MPa
* Steam Generator Pressure:
*  SG No 1 - 5.89 MPa
*  SG No 2 - 5.86 MPa
*  SG No 3 - 5.89 MPa
*  SG No 4 - 5.86 MPa
* Steam Generator Water Level:
*  SG No 1 - 2.224 m
*  SG No 2 - 2.206 m
*  SG No 3 - 2.273 m
*  SG No 4 - 2.297 m
* Transient Descriptions:
* -----------
* t = 0 sec - Start of Transient
* t = 8 sec - Beginning of the decrease of the SG-4 water level
* t = 45 sec - MCP-4 Switchi-off by the signal
* t = 46 sec - Activation of the ROM3 due to switch- off MCP-4
* t = 54 sec - Activation of the AZ-1
* t = 68 sec - Switch-on of the EFWP pump
* t = 76 sec - A trip of the Unit 1 Turbine-generator
* t = 241 sec - Switch-off the TPN No 1&2
*crdno pr.type pr.optiom
100  new  transnt
*-----------
* I. Elevation cards
*-----------
*crdno vol.no elev fluid name
121  100010002  26.9  h2o Primary
122  182010002  35.9  h2o Second
*-----------
* II. Time Step cards
*-----------
*crdno time min_dt max_dt ssdn minor major restart
201  500.0  1.-9  2.5-2  00003  20000  20000  20000
202  1000.0  1.-9  2.5-2  00003  20000  20000  20000
*-----------
* III. Trips
*-----------
* 3.1 Auxilliary Trips
*crdno var code rel var  code const  Li timeof
401  time  0  gt  null  0  -1.  1  0.0
402  time  0  lt  null  0  -1.  1  -1.0
* 3.2 Accident Trips
* -----
* 3.2.1 Stop Feedwater supply
*crdno var code rel var  code const  Li timeof
403  time  0  lt  null  0  -1.  1  -1.0
* 3.2.1 True Before Accident
*crdno trip rel trip  Li timeof
601  -403  and  -403  n  0.0
* 3.2.2 Accident
*crdno trip rel trip  Li timeof
602  403  and  403  n  -1.0
* 3.3 Steam Line Trips
* -----
* 3.3.1 BRU-A
* -----
*crdno var  code  rel var  code const  Li timeof
404  p  169010000  ge  null  0  7.15+6  n  -1.0  * SG1 BRU-A Open
405  p  169010000  le  null  0  6.27+6  n  -1.0  * SG1 BRU-A Close
406  p  269010000  ge  null  0  7.15+6  n  -1.0  * SG2 BRU-A Open
407  p  269010000  le  null  0  6.27+6  n  -1.0  * SG2 BRU-A Close
408  p  369010000  ge  null  0  7.15+6  n  -1.0  * SG3 BRU-A Open
409  p  369010000  le  null  0  6.27+6  n  -1.0  * SG3 BRU-A Close
410  p  469010000  ge  null  0  7.15+6  n  -1.0  * SG4 BRU-A Open
411  p  469010000  le  null  0  6.27+6  n  -1.0  * SG4 BRU-A Close
*crdno trip  rel  trip  Li timeof
603  602  and  404  n  -1.0  * SG1 BRU-A Open
604  602  and  405  n  -1.0  * SG1 BRU-A Close
605  602  and  406  n  -1.0  * SG2 BRU-A Open
606  602  and  407  n  -1.0  * SG2 BRU-A Close
607  602  and  408  n  -1.0  * SG3 BRU-A Open
608  602  and  409  n  -1.0  * SG3 BRU-A Close
609  602  and  410  n  -1.0  * SG4 BRU-A Open
610  602  and  411  n  -1.0  * SG4 BRU-A Close
* 3.3.2 MSIV
* -----
* MSIV Closed with 10-12 sec delay after SCRAM
*crdno var code rel. var  code const  Li timeof
501  time  0  gt  timeof  617  10.0  1  -1.0  * Loop No 1: vlv#187
502  time  0  gt  timeof  617  10.0  1  -1.0  * Loop No 2: vlv#287
503  time  0  gt  timeof  617  10.0  1  -1.0  * Loop No 3: vlv#387
504  time  0  gt  timeof  617  18.0  1  -1.0  * Loop No 4: vlv#487
* 3.3.3 Pressure Regulators
* -----
* a. Pressure Set Point
* -----
*crdno var code  rel var  code const  Li
413  p  169010000  le  null  0  5.88+6  n  * SG1 RV#185 Close
414  p  169010000  ge  null  0  5.90+6  n  * SG1 RV#185 Open
415  p  269010000  le  null  0  5.85+6  n  * SG2 RV#285 Close
416  p  269010000  ge  null  0  5.87+6  n  * SG2 RV#285 Open
417  p  369010000  le  null  0  5.88+6  n  * SG3 RV#385 Close
418  p  369010000  ge  null  0  5.90+6  n  * SG3 RV#385 Open
419  p  469010000  le  null  0  5.85+6  n  * SG4 RV#485 Close
420  p  469010000  ge  null  0  5.87+6  n  * SG4 RV#485 Open
* b. Steady State Pressure Controllers
* -----
*crdno trip rel trip  Li timeof
701  601  and  413  n  -1.0  * SG1 RV#185 Close
702  601  and  414  n  -1.0  * SG1 RV#185 Open
703  601  and  415  n  -1.0  * SG2 RV#285 Close
704  601  and  416  n  -1.0  * SG2 RV#285 Open
705  601  and  417  n  -1.0  * SG3 RV#385 Close
706  601  and  418  n  -1.0  * SG3 RV#385 Open
707  601  and  419  n  -1.0  * SG4 RV#485 Close
708  601  and  420  n  -1.0  * SG4 RV#485 Open
* c. EGSR Mode "RD1"
* -----
*crdno trip rel trip  Li timeof
711  403  and  413  n  -1.0  * SG1 RV#189 Close
712  403  and  414  n  -1.0  * SG1 RV#189 Open
713  403  and  415  n  -1.0  * SG2 RV#289 Close
714  403  and  416  n  -1.0  * SG2 RV#289 Open
715  403  and  417  n  -1.0  * SG3 RV#389 Close
716  403  and  418  n  -1.0  * SG3 RV#389 Open
717  403  and  419  n  -1.0  * SG4 RV#489 Close
718  403  and  420  n  -1.0  * SG4 RV#489 Open
*
* 3.4 MCP Trips
* -----
*crdno var code rel var  code const  Li timeof
421  time  0  lt  null  0  -1.  1  -1.0  * MCP#1 set point
422  time  0  lt  null  0  -1.  1  -1.0  * MCP#2 set point
423  time  0  lt  null  0  -1.  1  -1.0  * MCP#3 set point
424  cntrivar  476  le  null  0  1.75  n  -1.0  * MCP#4 set point
*crdno trip rel trip  Li timeof
612  602  and  421  1  -1.0  * MCP#1(141) switch off
613  602  and  422  1  -1.0  * MCP#2(241) switch off
614  602  and  423  1  -1.0  * MCP#3(341) switch off
615  602  and  424  1  -1.0  * MCP#4(441) switch off
* 3.5 SCRAM
* -----
*crdno var  code rel var code const Li timeof
425  time  0  ge  timeof  615  1.0  1  -1.0  * ROM set point
426  cntrivar  476  le  null  0  1.6  n  -1.0  * AZ-1 set point
*crdno trip rel trip Li timeof
616  602  and  425  1  -1.0  * ROM switch on
617  615  and  426  1  -1.0  * AZ-1  switch on
* 3.6 Pressurizer Heaters
* -----
*crdno var  code rel var  code const Li timeof
427  cntrivar  504  lt  null  0  4.2  1  -1.0  * Heaters switch off
* All heaters switch off - Level too low
*crdno trip rel trip Li timeof
618  403  and  427  1  -1.0
* PRZ Heaters Group No 1 (W = 270 kW)
*crdno var code  rel var  code const  Li timeof
428  p  054010000  le  null  0  15.54+6  n  -1.0  * On
429  p  054010000  ge  null  0  15.79+6  n  -1.0  * Off
*crdno trip rel  trip Li timeof
619  618  or  429  n  -1.0
620  428  or  621  n  -1.0
621  620  and  -618  n  -1.0  * Group 1 Switch On
* PRZ Heaters Group No 2 (W = 270 kW)
*crdno var code  rel var  code const  Li timeof
430  p  054010000  le  null  0  15.39+6  n  -1.0  * On
431  p  054010000  ge  null  0  15.64+6  n  -1.0  * Off
*crdno trip rel  trip Li timeof
622  618  or  431  n  -1.0
623  430  or  624  n  -1.0
624  623  and  -618  n  -1.0  * Group 2 Switch On
* PRZ Heaters Group No 3 (W = 720 kW)
*crdno var code  rel var  code const  Li timeof
432  p  054010000  le  null  0  15.20+6  n  -1.0  * On
433  p  054010000  ge  null  0  15.49+6  n  -1.0  * Off
*crdno trip rel  trip Li timeof
625  618  or  433  n  -1.0
626  432  or  627  n  -1.0
627  626  and  -618  n  -1.0  * Group 3 Switch On
* PRZ Heaters Group No 4 (W = 1260 kW)
*crdno var code  rel var  code const  Li timeof
434  p  054010000  le  null  0  15.01+6  n  -1.0  * On
435  p  054010000  ge  null  0  15.39+6  n  -1.0  * Off
*crdno trip rel  trip Li timeof
628  618  or  435  n  -1.0
629  434  or  630  n  -1.0
630  629  and  -618  n  -1.0  * Group 4 Switch On
*-----------
* IV. Steady State Adjustment components
*-----------
* 4.1 MCP Controllers
* -----
* a) Loop#1: MCP#141
* -----
* Control variable 140
*  Loop#1 Mass flow set point
20514000  G1sp  constant  4253.59
*-----------
* Control variable 141
*  MCP#1 controller
20514100  rpm-141  pumpctl  1.0  101.743  0  3  100.0  500.0
20514101  cntrivar  140  mflowj  143000000  10.0  10.  2.
*-----------
* b) Loop#2: MCP#241
* -----
* Control variable 240
*  Loop#2 Mass flow set point
20524000  G2sp  constant  4800.43
*-----------
* Control variable 241
*  MCP#2 controller
20524100  rpm-241  pumpctl  1.0  101.377  0  3  100.0  500.0
20524101  cntrivar  240  mflowj  243000000  10.0  10.  2.
*-----------
*
* c) Loop#3: MCP#341
* -----
* Control variable 340
*  Loop#3 Mass flow set point
20534000  G3sp  constant  4892.43
*-----------
* Control variable 341
*  MCP#3 controller
```

```
20534100 rpm-341 pumpctl 1.0  102.392  0  3 100.0 500.0
20534101 cntrlvar 340  mflowj 343000000 10.0  10.  2.
*_____
* d) Loop#4: MCP#441
* _____
* Control variable 440
*  Loop#4 Mass flow set point
20544000 G4sp  constant  4524.95
*_____
* Control variable 441
*  MCP#4 controller
20544100 rpm-441 pumpctl 1.0  102.702 0 3 100.0 500.0
20544101 cntrlvar 440  mflowj 443000000 10.0  10.  2.
*_____
*  4.2 Pressurizer Controllers
*_____
*  4.2.1 PRZ Pressure Controllers
*  _____
* Control variable 500
*  PRZ Pressure Set Point
20550000 PRZ-P constant  15.63+6
*_____
*  4.2.2  PRZ Level Controllers
*  _____
* Control variable 501
*  PRZ Level Set Point
20550100 PRZ-L constant 8.77
*_____
* cntrlvar N 509
*  PRZ - level Deviation
20550900  prz-ler sum  1.0 -1.991723-4  0  3 -10.0 10.0
20550901 0.0
20550902 1.0 cntrlvar 501
20550903  -1.0 cntrlvar 504
*_____
*  4.3  Feedwater controler
*_____
*  4.3.1 Level Set Point
*  _____
* Control variable 160
* SG1 Water Level set point
20516000  SG1-Lsp  constant  2.224
*_____
* Control variable 260
* SG2 Water Level set point
20526000  SG2-Lsp  constant  2.206
*_____
* Control variable 360
* SG3 Water Level set point
20536000  SG3-Lsp  constant  2.273
*_____
* Control variable 460
* SG3 Water Level set point
20546000  SG4-Lsp  constant  2.297
*_____
*  4.3.2 Function SG Level vs. Water Volume
*  _____
20216100 reac-t
*  Level Range H = 0.0 - 0.96 m
20216101 0.530 0.00
20216102 0.547 0.01
20216103 0.571 0.02
20216104 0.603 0.03
20216105 0.642 0.04
20216106 0.689 0.05
20216107 0.742 0.06
20216108 0.803 0.07
20216109 0.871 0.08
20216110 0.945 0.09
20216111 1.026 0.10
20216112 1.114 0.11
20216113 1.208 0.12
20216114 1.309 0.13
20216115 1.415 0.14
20216116 1.528 0.15
20216117 1.647 0.16
20216118 1.772 0.17
20216119 1.902 0.18
20216120 2.038 0.19
20216121 2.180 0.20
20216122 2.327 0.21
20216123 2.479 0.22
20216124 2.637 0.23
20216125 2.799 0.24
20216126 2.966 0.25
20216127 3.137 0.26
20216128 3.313 0.27
20216129 3.492 0.28
20216130 3.676 0.29
20216131 3.863 0.30
20216132 4.054 0.31
20216133 4.248 0.32
20216134 4.446 0.33
20216135 4.646 0.34
20216136 4.849 0.35
20216137 5.055 0.36
20216138 5.263 0.37
20216139 5.473 0.38
20216140 5.686 0.39
20216141 5.900 0.40
20216142 6.116 0.41
20216143 6.334 0.42
20216144 6.554 0.43
20216145 6.776 0.44
20216146 7.000 0.45
20216147 7.227 0.46
20216148 7.456 0.47
20216149 7.689 0.48
20216150 7.924 0.49
20216151 8.163 0.50
20216152 8.404 0.51
20216153 8.650 0.52
20216154 8.899 0.53
20216155 9.152 0.54
20216156 9.409 0.55
20216157 9.670 0.56
20216158 9.936 0.57
20216159  10.206 0.58
20216160  10.480 0.59
20216161  10.760 0.60
20216162  11.044 0.61
20216163  11.333 0.62
20216164  11.624 0.63
20216165  11.916 0.64
20216166  12.208 0.65
20216167  12.500 0.66
20216168  12.789 0.67
20216169  13.075 0.68
20216170  13.356 0.69
20216171  13.632 0.70
20216172  13.900 0.71
20216173  14.160 0.72
20216174  14.411 0.73
20216175  14.651 0.74
20216176  14.879 0.75
20216177  15.094 0.76
20216178  15.295 0.77
20216179  15.481 0.78
20216180  15.649 0.79
20216181  15.800 0.80
20216182  15.932 0.81
20216183  16.048 0.82
20216184  16.151 0.83
20216185  16.242 0.84
20216186  16.326 0.85
20216187  16.404 0.86
20216188  16.480 0.87
20216189  16.556 0.88
20216190  16.635 0.89
20216191  16.720 0.90
20216192  16.814 0.91
20216193  16.919 0.92
20216194  17.038 0.93
20216195  17.174 0.94
20216196  17.329 0.95
20216197  17.508 0.96
20216198  17.5080001 0.0
20216199 127.000 0.0
20216200 reac-t
*  Level Range H = 0.96 - 1.9 m
20216201 0.000 0.0
20216202  17.508 0.0
20216203  17.5080001 0.96
20216204  17.711 0.97
20216205  17.942 0.98
20216206  18.204 0.99
20216207  18.500 1.00
20216208  18.831 1.01
20216209  19.195 1.02
20216210  19.590 1.03
20216211  20.012 1.04
20216212  20.458 1.05
20216213  20.925 1.06
20216214  21.410 1.07
20216215  21.911 1.08
20216216  22.423 1.09
20216217  22.945 1.10
20216218  23.473 1.11
20216219  24.004 1.12
20216220  24.535 1.13
20216221  25.063 1.14
20216222  25.585 1.15
20216223  26.098 1.16
20216224  26.599 1.17
20216225  27.085 1.18
20216226  27.553 1.19
20216227  28.000 1.20
20216228  28.424 1.21
20216229  28.825 1.22
20216230  29.206 1.23
20216231  29.568 1.24
20216232  29.914 1.25
20216233  30.246 1.26
20216234  30.564 1.27
20216235  30.872 1.28
20216236  31.170 1.29
20216237  31.462 1.30
20216238  31.748 1.31
20216239  32.031 1.32
20216240  32.312 1.33
20216241  32.594 1.34
20216242  32.878 1.35
20216243  33.167 1.36
20216244  33.461 1.37
20216245  33.764 1.38
20216246  34.076 1.39
20216247  34.400 1.40
20216248  34.737 1.41
20216249  35.087 1.42
20216250  35.447 1.43
20216251  35.818 1.44
20216252  36.196 1.45
20216253  36.582 1.46
20216254  36.974 1.47
20216255  37.370 1.48
20216256  37.769 1.49
20216257  38.170 1.50
20216258  38.572 1.51
20216259  38.973 1.52
20216260  39.373 1.53
20216261  39.768 1.54
20216262  40.159 1.55
20216263  40.545 1.56
20216264  40.923 1.57
20216265  41.292 1.58
20216266  41.652 1.59
20216267  42.000 1.60
20216268  42.336 1.61
20216269  42.661 1.62
20216270  42.976 1.63
20216271  43.281 1.64
20216272  43.579 1.65
20216273  43.869 1.66
20216274  44.153 1.67
20216275  44.433 1.68
20216276  44.708 1.69
20216277  44.981 1.70
20216278  45.253 1.71
20216279  45.523 1.72
20216280  45.795 1.73
20216281  46.068 1.74
20216282  46.343 1.75
20216283  46.623 1.76
20216284  46.907 1.77
20216285  47.197 1.78
20216286  47.495 1.79
20216287  47.800 1.80
20216288  48.114 1.81
20216289  48.437 1.82
20216290  48.769 1.83
20216291  49.108 1.84
20216292  49.454 1.85
20216293  49.807 1.86
20216294  50.166 1.87
20216295  50.530 1.88
20216296  50.900 1.89
20216297  51.274 1.90
20216298  51.2740001 0.00
20216299 127.000 0.00
20216300 reac-t
*  Level Range H = 1.9 - 2.84 m
20216301 0.000 0.0
20216302  51.274 0.0
20216303  51.2740001 1.90
20216304  51.653 1.91
20216305  52.035 1.92
20216306  52.420 1.93
20216307  52.808 1.94
20216308  53.197 1.95
20216309  53.589 1.96
20216310  53.981 1.97
20216311  54.374 1.98
20216312  54.767 1.99
20216313  55.160 2.00
20216314  55.552 2.01
20216315  55.943 2.02
20216316  56.334 2.03
20216317  56.724 2.04
20216318  57.115 2.05
20216319  57.507 2.06
20216320  57.900 2.07
20216321  58.293 2.08
20216322  58.689 2.09
20216323  59.086 2.10
20216324  59.486 2.11
20216325  59.888 2.12
20216326  60.293 2.13
20216327  60.701 2.14
20216328  61.112 2.15
20216329  61.528 2.16
20216330  61.947 2.17
20216331  62.371 2.18
20216332  62.800 2.19
20216333  63.234 2.20
20216334  63.672 2.21
20216335  64.116 2.22
20216336  64.563 2.23
20216337  65.016 2.24
20216338  65.472 2.25
20216339  65.932 2.26
20216340  66.396 2.27
20216341  66.863 2.28
20216342  67.334 2.29
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20216343 67.807 2.30
20216344 68.284 2.31
20216345 68.763 2.32
20216346 69.245 2.33
20216347 69.729 2.34
20216348 70.216 2.35
20216349 70.704 2.36
20216350 71.194 2.37
20216351 71.685 2.38
20216352 72.178 2.39
20216353 72.672 2.40
20216354 73.167 2.41
20216355 73.662 2.42
20216356 74.159 2.43
20216357 74.655 2.44
20216358 75.152 2.45
20216359 75.648 2.46
20216360 76.145 2.47
20216361 76.640 2.48
20216362 77.136 2.49
20216363 77.630 2.50
20216364 78.123 2.51
20216365 78.616 2.52
20216366 79.106 2.53
20216367 79.596 2.54
20216368 80.084 2.55
20216369 80.571 2.56
20216370 81.056 2.57
20216371 81.539 2.58
20216372 82.021 2.59
20216373 82.500 2.60
20216374 82.977 2.61
20216375 83.453 2.62
20216376 83.926 2.63
20216377 84.398 2.64
20216378 84.868 2.65
20216379 85.336 2.66
20216380 85.802 2.67
20216381 86.266 2.68
20216382 86.729 2.69
20216383 87.190 2.70
20216384 87.650 2.71
20216385 88.108 2.72
20216386 88.565 2.73
20216387 89.020 2.74
20216388 89.474 2.75
20216389 89.926 2.76
20216390 90.377 2.77
20216391 90.827 2.78
20216392 91.276 2.79
20216393 91.723 2.80
20216394 92.170 2.81
20216395 92.615 2.82
20216396 93.059 2.83
20216397 93.503 2.84
20216398 93.5030001 0.00
20216399 127.000 0.00
20216400 reac-t
* Level Range H = 2.84 - 4.0 m
20216401 0.000 0.0
20216402 93.503 0.0
20216403 93.5030001 2.84
20216404 93.945 2.85
20216405 94.386 2.86
20216406 94.827 2.87
20216407 95.267 2.88
20216408 95.706 2.89
20216409 96.144 2.90
20216410 96.582 2.91
20216411 97.019 2.92
20216412 97.456 2.93
20216413 97.892 2.94
20216414 98.328 2.95
20216415 98.763 2.96
20216416 99.197 2.97
20216417 99.632 2.98
20216418 100.066 2.99
20216419 100.500 3.00
20216420 100.934 3.01
20216421 101.367 3.02
20216422 101.800 3.03
20216423 102.233 3.04
20216424 102.665 3.05
20216425 103.096 3.06
20216426 103.526 3.07
20216427 103.956 3.08
20216428 104.384 3.09
20216429 104.812 3.10
20216430 105.238 3.11
20216431 105.663 3.12
20216432 106.087 3.13
20216433 106.509 3.14
20216434 106.930 3.15
20216435 107.349 3.16
20216436 107.766 3.17
20216437 108.181 3.18
20216438 108.595 3.19
20216439 109.006 3.20
20216440 109.415 3.21
20216441 109.822 3.22
20216442 110.227 3.23
20216443 110.629 3.24
20216444 111.028 3.25
20216445 111.425 3.26
20216446 111.819 3.27
20216447 112.211 3.28
20216448 112.599 3.29
20216449 112.984 3.30
20216450 113.366 3.31
20216451 113.745 3.32
20216452 114.121 3.33
20216453 114.493 3.34
20216454 114.862 3.35
20216455 115.227 3.36
20216456 115.588 3.37
20216457 115.945 3.38
20216458 116.299 3.39
20216459 116.648 3.40
20216460 116.994 3.41
20216461 117.335 3.42
20216462 117.672 3.43
20216463 118.004 3.44
20216464 118.332 3.45
20216465 118.655 3.46
20216466 118.974 3.47
20216467 119.287 3.48
20216468 119.596 3.49
20216469 119.900 3.50
20216470 127.000 4.00
*_____
* V. Control Variables
*_____
* 5.1 Pressurizer Level
*_____
* cntrlvar N 504
* PRZ - level
20550400 prz-lev sum 1.0 8.77 1 3 0.0 11.562
20550401 0.0
20550402 0.900 voidf 504010000
20550403 1.200 voidf 504020000
20550404 1.227 voidf 504030000
20550405 1.227 voidf 504040000
20550406 1.227 voidf 504050000
20550407 1.227 voidf 504060000
20550408 1.227 voidf 504070000
20550409 1.227 voidf 504080000
20550410 1.200 voidf 504090000
20550411 0.900 voidf 504100000
*_____
* 5.2 Steam Generator Level
*_____
* 5.2.1 SG1 Level
*_____
* Control variable 170
* SG1 Water Volume
20517000 SG1-W sum 1.0 66.7276 1
20517001 0.0 3.0 voidf 161010000
20517002 3.99 voidf 171010000
20517003 5.94 voidf 162010000
20517004 4.1 voidf 172010000
20517005 8.97 voidf 163010000
20517006 6.38 voidf 173010000
20517007 9.4 voidf 164010000
20517008 2.3 voidf 174010000
20517009 3.75 voidf 178010000
20517010 9.93 voidf 165010000
20517011 3.88 voidf 175010000
20517012 4.72 voidf 179010000
20517013 10.71 voidf 166010000
20517014 1.0 voidf 176010000
20517015 28.558 voidf 167010000
20517016 10.09 voidf 168010000
20517017 10.21 voidf 169010000
20517018 0.072 voidf 177010000
*_____
* Control variable 171
* SG1 Water Level (Range of 0.0 - 0.96)
20517100 SG1-L1 function 1.0 0.0 1
20517101 cntrlvar 170 161
*_____
* Control variable 172
* SG1 Water Level (Range of 0.96 - 1.9)
20517200 SG1-L2 function 1.0 0.0 1
20517201 cntrlvar 170 162
*_____
* Control variable 173
* SG1 Water Level (Range of 1.9 - 2.84)
20517300 SG1-L3 function 1.0 2.2771 1
20517301 cntrlvar 170 163
*_____
* Control variable 174
* SG1 Water Level (Range of 2.84 - 4.0)
20517400 SG1-L4 function 1.0 0.0 1
20517401 cntrlvar 170 164
*_____
* Control variable 175
* SG1 Collapsed Level (Range 0.0 - 4.0)
20517500 SG1-L sum 1.0 2.2771 1
20517501 0.0 1.0 cntrlvar 171
20517502 1.0 cntrlvar 172
20517503 1.0 cntrlvar 173
20517504 1.0 cntrlvar 174
*_____
* Control variable 176
* SG1 Corrected Level
20517600 SG1-Lc sum 1.0 2.224 1
20517601 -0.0531
20517602 1.0 cntrlvar 175
*_____
* 5.2.2 SG2 Level
*_____
* Control variable 270
* SG2 Water Volume
20527000 SG2-W sum 1.0 65.6616 1
20527001 0.0 3.0 voidf 261010000
20527002 3.99 voidf 271010000
20527003 5.94 voidf 262010000
20527004 4.1 voidf 272010000
20527005 8.97 voidf 263010000
20527006 6.38 voidf 273010000
20527007 9.4 voidf 264010000
20527008 2.3 voidf 274010000
20527009 3.75 voidf 278010000
20527010 9.93 voidf 265010000
20527011 3.88 voidf 275010000
20527012 4.72 voidf 279010000
20527013 10.71 voidf 266010000
20527014 1.0 voidf 276010000
20527015 28.558 voidf 267010000
20527016 10.09 voidf 268010000
20527017 10.21 voidf 269010000
20527018 0.072 voidf 277010000
*_____
* Control variable 271
* SG2 Water Level (Range of 0.0 - 0.96)
20527100 SG2-L1 function 1.0 0.0 1
20527101 cntrlvar 270 161
*_____
* Control variable 272
* SG2 Water Level (Range of 0.96 - 1.9)
20527200 SG2-L2 function 1.0 0.0 1
20527201 cntrlvar 270 162
*_____
* Control variable 273
* SG2 Water Level (Range of 1.9 - 2.84)
20527300 SG2-L3 function 1.0 2.25412 1
20527301 cntrlvar 270 163
*_____
* Control variable 274
* SG2 Water Level (Range of 2.84 - 4.0)
20527400 SG2-L4 function 1.0 0.0 1
20527401 cntrlvar 270 164
*_____
* Control variable 275
* SG2 Collapsed Level (Range 0.0 - 4.0)
20527500 SG2-L sum 1.0 2.25412 1
20527501 0.0 1.0 cntrlvar 271
20527502 1.0 cntrlvar 272
20527503 1.0 cntrlvar 273
20527504 1.0 cntrlvar 274
*_____
* Control variable 276
* SG2 Corrected Level
20527600 SG2-Lc sum 1.0 2.206 1
20527601 -0.04812
20527602 1.0 cntrlvar 275
*_____
* 5.2.3 SG3 Level
*_____
* Control variable 370
* SG3 Water Volume
20537000 SG3-W sum 1.0 65.6344 1
20537001 0.0 3.0 voidf 361010000
20537002 3.99 voidf 371010000
20537003 5.94 voidf 362010000
20537004 4.1 voidf 372010000
20537005 8.97 voidf 363010000
20537006 6.38 voidf 373010000
20537007 9.4 voidf 364010000
20537008 2.3 voidf 374010000
20537009 3.75 voidf 378010000
20537010 9.93 voidf 365010000
20537011 3.88 voidf 375010000
20537012 4.72 voidf 379010000
20537013 10.71 voidf 366010000
20537014 1.0 voidf 376010000
20537015 28.558 voidf 367010000
20537016 10.09 voidf 368010000
20537017 10.21 voidf 369010000
20537018 0.072 voidf 377010000
*_____
* Control variable 371
* SG3 Water Level (Range of 0.0 - 0.96)
20537100 SG3-L1 function 1.0 0.0 1
20537101 cntrlvar 370 161
*_____
* Control variable 372
* SG3 Water Level (Range of 0.96 - 1.9)
20537200 SG3-L2 function 1.0 0.0 1
20537201 cntrlvar 370 162
*
* Control variable 373
* SG3 Water Level (Range of 1.9 - 2.84)
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20537300 SG3-L3 function 1.0 2.25353 1
20537301 cntrivar 370 163
*----------
* Control variable 374
* SG3 Water Level (Range of 2.84 - 4.0)
20537400 SG3-L4 function 1.0 0.0 1
20537401 cntrivar 370 164
*----------
* Control variable 375
* SG3 Collapsed Level (Range 0.0 - 4.0)
20537500 SG3-L sum 1.0 2.25353 1
20537501 0.0 1.0 cntrivar 371
20537502 1.0 cntrivar 372
20537503 1.0 cntrivar 373
20537504 1.0 cntrivar 374
*----------
* Control variable 376
* SG3 Corrected Level
20537600 SG3-Lc sum 1.0 2.273 1
20537601 0.01947
20537602 1.0 cntrivar 375
*
*----------
* 5.2.4 SG4 Level
*----------
* Control variable 470
* SG4 Water Volume
20547000 SG4-W sum 1.0 66.1983 1
20547001 0.0 3.0 voidf 461010000
20547002 3.99 voidf 471010000
20547003 5.94 voidf 462010000
20547004 4.1 voidf 472010000
20547005 8.97 voidf 463010000
20547006 6.38 voidf 473010000
20547007 9.4 voidf 464010000
20547008 2.3 voidf 474010000
20547009 3.75 voidf 478010000
20547010 9.93 voidf 465010000
20547011 3.88 voidf 475010000
20547012 4.72 voidf 479010000
20547013 10.71 voidf 466010000
20547014 1.0 voidf 476010000
20547015 28.558 voidf 467010000
20547016 10.09 voidf 468010000
20547017 10.21 voidf 469010000
20547018 0.072 voidf 477010000
*----------
* Control variable 471
* SG4 Water Level (Range of 0.0 - 0.96)
20547100 SG4-L1 function 1.0 0.0 1
20547101 cntrivar 470 161
*----------
* Control variable 472
* SG4 Water Level (Range of 0.96 - 1.9)
20547200 SG4-L2 function 1.0 0.0 1
20547201 cntrivar 470 162
*----------
* Control variable 473
* SG4 Water Level (Range of 1.9 - 2.84)
20547300 SG4-L3 function 1.0 2.26574 1
20547301 cntrivar 470 163
*----------
* Control variable 474
* SG4 Water Level (Range of 2.84 - 4.0)
20547400 SG4-L4 function 1.0 0.0 1
20547401 cntrivar 470 164
*----------
* Control variable 475
* SG4 Collapsed Level (Range 0.0 - 4.0)
20547500 SG4-L sum 1.0 2.26574 1
20547501 0.0 1.0 cntrivar 471
20547502 1.0 cntrivar 472
20547503 1.0 cntrivar 473
20547504 1.0 cntrivar 474
*----------
* Control variable 476
* SG4 Corrected Level
20547600 SG4-Lc sum 1.0 2.297 1
20547601 0.03126
20547602 1.0 cntrivar 475
*
*----------
* 5.3 Pressure Drop
*----------
* cntrivar N 800
* Reactor Vessel Pressure drop, kPa
20580000 RV-DP sum 1.-3 326.34 1
20580001 0.0
20580002 0.25 p 005010000
20580003 -0.25 p 061010000
20580004 0.25 p 006010000
20580005 -0.25 p 062010000
20580006 0.25 p 007010000
20580007 -0.25 p 063010000
20580008 0.25 p 008010000
20580009 -0.25 p 064010000
*----------
* cntrivar N 801
* SG1 Pressure drop, kPa
20580100 SG1-DP sum 1.-3 146.02 1
20580101 0.0
20580102 1.0 p 102030000
20580103 -1.0 p 130010000
*----------
* cntrivar N 802
* SG2 Pressure drop, kPa
20580200 SG2-DP sum 1.-3 152.92 1
20580201 0.0
20580202 1.0 p 202030000
20580203 -1.0 p 230010000
*----------
* cntrivar N 803
* SG3 Pressure drop, kPa
20580300 SG3-DP sum 1.-3 147.0 1
20580301 0.0
20580302 1.0 p 302030000
20580303 -1.0 p 330010000
*----------
* cntrivar N 804
* SG4 Pressure drop, kPa
20580400 SG4-DP sum 1.-3 155.82 1
20580401 0.0
20580402 1.0 p 402030000
20580403 -1.0 p 430010000
*----------
* cntrivar N 811
* MCP1 Pressure drop, kPa
20581100 MCP1-DP sum 1.-3 568.4 1
20581101 0.0
20581102 1.0 pmphead 141
*----------
* cntrivar N 812
* MCP2 Pressure drop, kPa
20581200 MCP2-DP sum 1.-3 558.6 1
20581201 0.0
20581202 1.0 pmphead 241
*----------
* cntrivar N 813
* MCP3 Pressure drop, kPa
20581300 MCP3-DP sum 1.-3 578.2 1
20581301 0.0
20581302 1.0 pmphead 341
*----------
* cntrivar N 814
* MCP4 Pressure drop, kPa
20581400 MCP4-DP sum 1.-3 588.0 1
20581401 0.0
20581402 1.0 pmphead 441
*
*----------
* VL Reactor Vessel
*----------
* 6.1 Downcomer:
* Volumes above Inlet Nozzle
*----------
* Component No 1
* Downcommer Volume above inlet Nozzle of Loop No 1
0010000 dc-top1 branch
0010001 3 1
0010101 0.0 0.458 0.150023 0.0 90.0 0.458 1.0-5 0.358
0000000
0010200 013 16.0073+6 559.264 0.939-3
0011101 001010003 002010004 0.099524 1.0 1.0 0001100
0012101 001010002 061010001 0.003375 1.0 1.0 0001000
0013101 005010001 001010001 0.5340872 0.0 0.0 0001000
0011110 0.358 0.0 1.0 1.0
0012110 0.006 0.0 1.0 1.0
0013110 0.358 0.0 1.0 1.0
0011201 67.067 0.0 0.0
0012201 74.959 0.0 0.0
0013201 94.986 0.0 0.0
*----------
* Component No 2
* Downcommer:
* Volume above inlet Nozzle of Loop No 2
0020000 dc-top2 branch
0020001 3 1
0020101 0.0 0.458 0.150023 0.0 90.0 0.458 1.0-5 0.358
0000000
0020200 013 16.0069+6 559.552 0.939-3
0021101 002010003 003010004 0.099524 1.0 1.0 0001100
0022101 002010002 062010001 0.003375 1.0 1.0 0001000
0023101 006010001 002010001 0.5340872 0.0 0.0 0001000
0021110 0.358 0.0 1.0 1.0
0022110 0.006 0.0 1.0 1.0
0023110 0.358 0.0 1.0 1.0
0021201 -63.640 0.0 0.0
0022201 73.098 0.0 0.0
0023201 -57.609 0.0 0.0
*----------
* Component No 3
* Downcommer:
* Volume above inlet Nozzle of Loop No 3
0030000 dc-top3 branch
0030001 3 1
0030101 0.0 0.458 0.150023 0.0 90.0 0.458 1.0-5 0.358
0000000
0030200 013 16.0072+6 559.833 0.939-3
0031101 003010003 004010004 0.099524 1.0 1.0 0001100
0032101 003010002 063010001 0.003375 1.0 1.0 0001000
0033101 007010001 003010001 0.5340872 0.0 0.0 0001000
0031110 0.358 0.0 1.0 1.0
0032110 0.006 0.0 1.0 1.0
0033110 0.358 0.0 1.0 1.0
0031201 -51.517 0.0 0.0
0032201 73.129 0.0 0.0
0033201 85.252 0.0 0.0
*----------
* Component No 4
* Downcommer:
* Volume above inlet Nozzle of Loop No 4
0040000 dc-top4 branch
0040001 3 1
0040101 0.0 0.458 0.150023 0.0 90.0 0.458 1.0-5 0.358
0000000
0040200 013 16.0075+6 559.354 0.939-3
0041101 004010003 001010004 0.099524 1.0 1.0 0001100
0042101 004010002 064010001 0.003375 1.0 1.0 0001000
0043101 008010001 004010001 0.5340872 0.0 0.0 0001000
0041110 0.358 0.0 1.0 1.0
0042110 0.006 0.0 1.0 1.0
0043110 0.358 0.0 1.0 1.0
0041201 47.040 0.0 0.0
0042201 73.218 0.0 0.0
0043201 171.78 0.0 0.0
*
*----------
* 6.2 Downcomer:
* Cold Leg Inlet Volumes
*----------
* Component No 5
* Downcommer Inlet Volume for Loop 1
0050000 dc-in11 branch
0050001 3 1
0050101 0.5340872 1.444 0.0 0.0 -90.0 -1.444 1.0-5 0.358
000000
0050200 013 16.0149+6 559.198 0.939-3
0051101 144110002 005010003 0.567450 0.73 0.73 0001000
0052101 005010003 006010004 0.516952 1.0 1.0 0001000
0053101 005010002 009010001 0.5340872 1.09 1.09 0001000
0051110 0.358 0.0 1.0 1.0
0052110 0.358 0.0 1.0 1.0
0053110 0.358 0.0 1.0 1.0
0051201 4253.6 0.0 0.0
0052201 -302.15 0.0 0.0
0053201 4546.8 0.0 0.0
*----------
* Component No 6
* Downcommer Inlet Volume for Loop 2
0060000 dc-in12 branch
0060001 3 1
0060101 0.5340872 1.444 0.0 0.0 -90.0 -1.444 1.0-5 0.358
0000000
0060200 013 16.0136+6 559.259 0.939-3
0061101 244110002 006010003 0.567450 0.73 0.73 0001000
0062101 006010003 007010004 0.516952 1.0 1.0 0001000
0063101 006010002 010010001 0.5340872 1.09 1.09 0001000
0061110 0.358 0.0 1.0 1.0
0062110 0.358 0.0 1.0 1.0
0063110 0.358 0.0 1.0 1.0
0061201 4800.3 0.0 0.0
0062201 19.270 0.0 0.0
0063201 4536.5 0.0 0.0
*----------
* Component No 7
* Downcommer Inlet Volume for Loop 3
0070000 dc-in13 branch
0070001 3 1
0070101 0.5340872 1.444 0.0 0.0 -90.0 -1.444 1.0-5 0.358
0000000
0070200 013 16.0147+6 560.098 0.939-3
0071101 344110002 007010003 0.567450 0.73 0.73 0001000
0072101 007010003 008010004 0.516952 1.0 1.0 0001000
0073101 007010002 011010001 0.5340872 1.09 1.09 0001000
0071110 0.358 0.0 1.0 1.0
0072110 0.358 0.0 1.0 1.0
0073110 0.358 0.0 1.0 1.0
0071201 4892.4 0.0 0.0
0072201 286.20 0.0 0.0
0073201 4540.2 0.0 0.0
*----------
* Component No 8
* Downcommer Inlet Volume for Loop 4
0080000 dc-in14 branch
0080001 3 1
0080101 0.5340872 1.444 0.0 0.0 -90.0 -1.444 1.0-5 0.358
0000000
0080200 013 16.0156+6 559.344 0.939-3
0081101 444110002 008010003 0.567450 0.73 0.73 0001000
0082101 008010003 005010004 0.516952 1.0 1.0 0001000
0083101 008010002 012010001 0.5340872 1.09 1.09 0001000
0081110 0.358 0.0 1.0 1.0
0082110 0.358 0.0 1.0 1.0
0083110 0.358 0.0 1.0 1.0
0081201 4525.0 0.0 0.0
0082201 86.056 0.0 0.0
0083201 4553.3 0.0 0.0
*----------
* 6.3 Downcomer:
* Middle Part Volumes
*----------
* Component No 9
* Downcomer: Middle Part for Loop 1
```

```
0090000 dcm-l1 annulus
0090001 6
0090101 0.000000 2
0090102 0.782562 5
0090103 0.000000 6
0090201 0.650762 1
0090202 0.782562 5
0090301 0.9010 1
0090302 0.7445 2
0090303 1.0550 4
0090304 1.0050 5
0090305 0.8255 6
0090401 0.4970897 1
0090402 0.5629797 2
0090403 0.000000 5
0090404 0.7012277 6
0090601 -90.0 6
0090801 1.0-5 0.0 6
0090901 0.0 0.0 5
0091001 0000000 6
0091101 0001000 5
0091201 013 15.9250+6 559.167 0.0 0.0 0.0 1
0091202 013 15.9518+6 559.177 0.0 0.0 0.0 2
0091203 013 15.9599+6 559.179 0.0 0.0 0.0 3
0091204 013 15.9675+6 559.181 0.0 0.0 0.0 4
0091205 013 15.9749+6 559.185 0.0 0.0 0.0 5
0091206 013 15.9848+6 559.192 0.0 0.0 0.0 6
0091300 1
0091301 4548.4 0.0 0.0 1
0091302 4550.4 0.0 0.0 2
0091303 4547.1 0.0 0.0 3
0091304 4559.3 0.0 0.0 4
0091305 4522.5 0.0 0.0 5
0091401 0.432 0.0 1.0 1.0 1
0091402 0.514 0.0 1.0 1.0 5
0092001 0.939-3 6
*-----------
* Component No 10
* Downcomer:
* Middle Part for Loop 2
0100000 dcm-l2 annulus
0100001 6
0100101 0.000000 2
0100102 0.782562 5
0100103 0.000000 6
0100201 0.650762 1
0100202 0.782562 5
0100301 0.9010 1
0100302 0.7445 2
0100303 1.0550 4
0100304 1.0050 5
0100305 0.8255 6
0100401 0.4970897 1
0100402 0.5629797 2
0100403 0.000000 5
0100404 0.7012277 6
0100601 -90.0 6
0100801 1.0-5 0.0 6
0100901 0.0 0.0 5
0101001 0000000 6
0101101 0001000 5
0101201 013 15.9250+6 559.228 0.0 0.0 0.0 1
0101202 013 15.9518+6 559.237 0.0 0.0 0.0 2
0101203 013 15.9599+6 559.240 0.0 0.0 0.0 3
0101204 013 15.9675+6 559.240 0.0 0.0 0.0 4
0101205 013 15.9749+6 559.252 0.0 0.0 0.0 5
0101206 013 15.9851+6 559.255 0.0 0.0 0.0 6
0101300 1
0101301 4525.5 0.0 0.0 1
0101302 4518.3 0.0 0.0 2
0101303 4535.1 0.0 0.0 3
0101304 4486.5 0.0 0.0 4
0101305 4641.2 0.0 0.0 5
0101401 0.432 0.0 1.0 1.0 1
0101402 0.514 0.0 1.0 1.0 5
0102001 0.939-3 6
*-----------
* Component No 11
* Downcomer:
* Middle Part for Loop 3
0110000 dcm-l3 annulus
0110001 6
0110101 0.000000 2
0110102 0.782562 5
0110103 0.000000 6
0110201 0.650762 1
0110202 0.782562 5
0110301 0.9010 1
0110302 0.7445 2
0110303 1.0550 4
0110304 1.0050 5
0110305 0.8255 6
0110401 0.4970897 1
0110402 0.5629797 2
0110403 0.000000 5
0110404 0.7012277 6
0110601 -90.0 6
0110801 1.0-5 0.0 6
0110901 0.0 0.0 5
0111001 0000000 6
0111101 0001000 5
0111201 013 15.9250+6 560.067 0.0 0.0 0.0 1
0111202 013 15.9518+6 560.076 0.0 0.0 0.0 2
0111203 013 15.9599+6 560.077 0.0 0.0 0.0 3
0111204 013 15.9675+6 560.075 0.0 0.0 0.0 4
0111205 013 15.9749+6 560.066 0.0 0.0 0.0 5
0111206 013 15.9849+6 560.032 0.0 0.0 0.0 6
0111300 1
0111301 4538.2 0.0 0.0 1
0111302 4537.0 0.0 0.0 2
0111303 4535.9 0.0 0.0 3
0111304 4534.6 0.0 0.0 4
0111305 4535.9 0.0 0.0 5
0111401 0.432 0.0 1.0 1.0 1
0111402 0.514 0.0 1.0 1.0 5
0112001 0.939-3 6
*-----------
* Component No 12
* Downcomer:
* Middle Part for Loop 4
0120000 dcm-l4 annulus
0120001 6
0120101 0.000000 2
0120102 0.782562 5
0120103 0.000000 6
0120201 0.650762 1
0120202 0.782562 5
0120301 0.9010 1
0120302 0.7445 2
0120303 1.0550 4
0120304 1.0050 5
0120305 0.8255 6
0120401 0.4970897 1
0120402 0.5629797 2
0120403 0.000000 5
0120404 0.7012277 6
0120601 -90.0 6
0120801 1.0-5 0.0 6
0120901 0.0 0.0 5
0121001 0000000 6
0121101 0001000 5
0121201 013 15.9250+6 559.314 0.0 0.0 0.0 1
0121202 013 15.9518+6 559.324 0.0 0.0 0.0 2
0121203 013 15.9599+6 559.326 0.0 0.0 0.0 3
0121204 013 15.9675+6 559.331 0.0 0.0 0.0 4
0121205 013 15.9749+6 559.333 0.0 0.0 0.0 5
0121206 013 15.9848+6 559.366 0.0 0.0 0.0 6
0121300 1
0121301 4564.8 0.0 0.0 1
0121302 4571.2 0.0 0.0 2
0121303 4558.8 0.0 0.0 3
0121304 4596.5 0.0 0.0 4
0121305 4477.3 0.0 0.0 5
0121401 0.432 0.0 1.0 1.0 1
0121402 0.514 0.0 1.0 1.0 5
0122001 0.939-3 6
*-----------
* Component No 13
* Downcomer Transverse Junctions
0130000 DwC-mj mtpljun
0130001 24 1
0130011 009010003 010010004 0.430394 1.0 1.0 0001000
0130021 009020003 010020004 0.370496 1.0 1.0 0001000
0130031 009030003 010030004 0.542270 1.0 1.0 0001000
0130041 009040003 010040004 0.542270 1.0 1.0 0001000
0130051 009050003 010050004 0.516570 1.0 1.0 0001000
0130061 009060003 010060004 0.481040 1.0 1.0 0001000
0130071 012010003 009010004 0.430394 1.0 1.0 0001000
0130081 012020003 009020004 0.370496 1.0 1.0 0001000
0130091 012030003 009030004 0.542270 1.0 1.0 0001000
0130101 012040003 009040004 0.542270 1.0 1.0 0001000
0130111 012050003 009050004 0.516570 1.0 1.0 0001000
0130121 012060003 009060004 0.481040 1.0 1.0 0001000
0130012 1.0 1.0 1.0 1000000 1000000 0 3
0130022 1.0 1.0 1.0 1000000 1000000 0 6
0130032 1.0 1.0 1.0 1000000 1000000 0 9
0130042 1.0 1.0 1.0 1000000 1000000 0 12
0130052 1.0 1.0 1.0 1000000 1000000 0 15
0130062 1.0 1.0 1.0 1000000 1000000 0 18
0130072 1.0 1.0 1.0 0 0 0 19
0130082 1.0 1.0 1.0 0 0 0 20
0130092 1.0 1.0 1.0 0 0 0 21
0130102 1.0 1.0 1.0 0 0 0 22
0130112 1.0 1.0 1.0 0 0 0 23
0130122 1.0 1.0 1.0 0 0 0 24
0131011 0.0 0.0 3
0131021 0.0 0.0 6
0131031 0.0 0.0 9
0131041 0.0 0.0 12
0131051 0.0 0.0 15
0131061 0.0 0.0 18
0131071 0.0 0.0 19
0131081 0.0 0.0 20
0131091 0.0 0.0 21
0131101 0.0 0.0 22
0131111 0.0 0.0 23
0131121 0.0 0.0 24
0132011 0.478 0.0 1.0 1.0 3
0132021 0.498 0.0 1.0 1.0 6
0132031 0.514 0.0 1.0 1.0 9
0132041 0.514 0.0 1.0 1.0 12
0132051 0.514 0.0 1.0 1.0 15
0132061 0.583 0.0 1.0 1.0 18
0132071 0.478 0.0 1.0 1.0 19
0132081 0.498 0.0 1.0 1.0 20
0132091 0.514 0.0 1.0 1.0 21
0132101 0.514 0.0 1.0 1.0 22
0132111 0.514 0.0 1.0 1.0 23
0132121 0.583 0.0 1.0 1.0 24
*-----------
* 6.4 Downcomer: Bottom Volumes
*-----------
* Component No 14
* Downcommer:
* Bottom Volume for Loop 1
0140000 dc-btl1 branch
0140001 3 1
0140101 0.0 0.712 0.701544 0.0 -90.0 -0.712 1.0-5 0.125
0000000
0140200 013 16.0086+6 559.204 0.939-3
0141101 009060002 014010001 1.063560 0.0 0.0 0001000
0142101 014010003 015010004 0.000000 1.0 1.0 0001000
0143101 014010001 018010001 0.430241 1.5 1.5 0001000
0141110 0.758 0.0 1.0 1.0
0142110 0.758 0.0 1.0 1.0
0143110 0.040 0.0 1.0 1.0
0141201 4672.2 0.0 0.0
0142201 237.35 0.0 0.0
0143201 4545.7 0.0 0.0
*-----------
* Component No 15
* Downcommer:
* Bottom Volume for Loop 2
0150000 dc-btl2 branch
0150001 3 1
0150101 0.0 0.712 0.701544 0.0 -90.0 -0.712 1.0-5 0.125
0000000
0150200 013 16.0085+6 559.287 0.939-3
0151101 010060002 015010001 1.063560 0.0 0.0 0001000
0152101 015010003 016010004 0.000000 1.0 1.0 0001000
0153101 015010001 019010001 0.430241 1.5 1.5 0001000
0151110 0.758 0.0 1.0 1.0
0152110 0.758 0.0 1.0 1.0
0153110 0.040 0.0 1.0 1.0
0151201 4131.8 0.0 0.0
0152201 -175.30 0.0 0.0
0153201 4544.5 0.0 0.0
*-----------
* Component No 16
* Downcommer:
* Bottom Volume for Loop 3
0160000 dc-btl3 branch
0160001 3 1
0160101 0.0 0.712 0.701544 0.0 -90.0 -0.712 1.0-5 0.125
0000000
0160200 013 16.0085+6 560.013 0.939-3
0161101 011060002 016010001 1.063560 0.0 0.0 0001000
0162101 016010003 017010004 0.000000 1.0 1.0 0001000
0163101 016010001 020010001 0.430241 1.5 1.5 0001000
0161110 0.758 0.0 1.0 1.0
0162110 0.758 0.0 1.0 1.0
0163110 0.040 0.0 1.0 1.0
0161201 4521.1 0.0 0.0
0162201 -194.21 0.0 0.0
0163201 4540.0 0.0 0.0
*-----------
* Component No 17
* Downcommer:
* Bottom Volume for Loop 4
0170000 dc-btl4 branch
0170001 3 1
0170101 0.0 0.712 0.701544 0.0 -90.0 -0.712 1.0-5 0.125
0000000
0170200 013 16.0086+6 559.374 0.939-3
0171101 012060002 017010001 1.063560 0.0 0.0 0001000
0172101 017010003 014010004 0.000000 1.0 1.0 0001000
0173101 017010001 021010001 0.430241 1.5 1.5 0001000
0171110 0.758 0.0 1.0 1.0
0172110 0.758 0.0 1.0 1.0
0173110 0.040 0.0 1.0 1.0
0171201 4851.7 0.0 0.0
0172201 110.80 0.0 0.0
0173201 4546.7 0.0 0.0
*-----------
* 6.5 Lower Plenum: Bottom Volumes
*-----------
* Component No 18
* Lower Plenum:
* Bottom Volume for Loop 1
0180000 dc-lpb1 branch
0180001 3 1
0180101 0.0 0.8255 1.96239975 0.0 90.0 0.8255 1.0-5 0.236
0000000
0180200 013 15.8884+6 559.161 0.939-3
0181101 018010003 019010004 3.677077 1.0 1.0 0001000
0182101 018010002 022010001 0.91926925 0.0 0.0 0001100
0183101 018010002 034010001 0.00157875 3.5 3.5 0001100
0181110 0.236 0.0 1.0 1.0
0182110 0.170 0.0 1.0 1.0
0183110 0.008 0.0 1.0 1.0
0181201 9.8717 0.0 0.0
0182201 4525.5 0.0 0.0
0183201 13.388 0.0 0.0
```

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*-----------
* Component No 19
* Lower Plenum:
* Bottom Volume for Loop 2
0190000 dc-lpb2 branch
0190001 3 1
0190101 0.0 0.8255 1.96239975 0.0 90.0 0.8255 1.0-5 0.236
0000000
0190200 013 15.8884+6 559.242 0.939-3
0191101 019010003 020010004 3.677077 1.0 1.0 0001000
0192101 019010002 023010001 0.91926925 0.0 0.0 0001100
0193101 019010002 034010001 0.00157875 3.5 3.5 0001100
0191110 0.236 0.0 1.0 1.0
0192110 0.170 0.0 1.0 1.0
0193110 0.008 0.0 1.0 1.0
0191201 2.1099 0.0 0.0
0192201 4538.9 0.0 0.0
0193201 13.387 0.0 0.0
*-----------
* Component No 20
* Lower Plenum:
* Bottom Volume for Loop 3
0200000 dc-lpb3 branch
0200001 3 1
0200101 0.0 0.8255 1.96239975 0.0 90.0 0.8255 1.0-5 0.236
0000000
0200200 013 15.8884+6 559.970 0.939-3
0201101 020010003 021010004 3.677077 1.0 1.0 0001000
0202101 020010002 024010001 0.91926925 0.0 0.0 0001100
0203101 020010002 034010001 0.00157875 3.5 3.5 0001100
0201110 0.236 0.0 1.0 1.0
0202110 0.170 0.0 1.0 1.0
0203110 0.008 0.0 1.0 1.0
0201201 -0.73714 0.0 0.0
0202201 4529.5 0.0 0.0
0203201 13.376 0.0 0.0
*-----------
* Component No 21
* Lower Plenum:
* Bottom Volume for Loop 4
0210000 dc-lpb4 branch
0210001 3 1
0210101 0.0 0.8255 1.96239975 0.0 90.0 0.8255 1.0-5 0.236
0000000
0210200 013 15.8884+6 559.331 0.939-3
0211101 021010003 018010004 3.677077 1.0 1.0 0001000
0212101 021010002 025010001 0.91926925 0.0 0.0 0001100
0213101 021010002 034010001 0.00157875 3.5 3.5 0001100
0211110 0.236 0.0 1.0 1.0
0212110 0.170 0.0 1.0 1.0
0213110 0.008 0.0 1.0 1.0
0211201 3.0234 0.0 0.0
0212201 4529.6 0.0 0.0
0213201 13.386 0.0 0.0
*-----------
* 6.6 Lower Plenum: Top Volumes
*-----------
* Component No 22
* Lower Plenum:
* Top Volume for Loop 1
0220000 dc-lpt1 branch
0220001 3 1
0220101 0.0 0.3295 0.4455035 0.0 90.0 0.3295 1.0-5 0.170
0000000
0220200 013 15.8667+6 559.154 0.939-3
0221101 022010002 026010001 1.04933625 0.2 0.2 0001000
0222101 022010002 035010001 0.00684255 1.0 1.0 0001100
0223101 022010002 036010001 0.002375 1.0 1.0 0001100
0221110 0.170 0.0 1.0 1.0
0222110 0.002 0.0 1.0 1.0
0223110 0.002 0.0 1.0 1.0
0221201 4466.4 0.0 0.0
0222201 50.311 0.0 0.0
0223201 8.7707 0.0 0.0
*-----------
* Component No 23
* Lower Penum:
* Top Volume for Loop 2
0230000 dc-lpt2 branch
0230001 3 1
0230101 0.0 0.3295 0.4455035 0.0 90.0 0.3295 1.0-5 0.170
0000000
0230200 013 15.8665+6 559.234 0.939-3
0231101 023010002 027010001 1.04933625 0.2 0.2 0001000
0232101 023010002 035010001 0.00684255 1.0 1.0 0001100
0233101 023010002 036010001 0.002375 1.0 1.0 0001100
0231110 0.170 0.0 1.0 1.0
0232110 0.002 0.0 1.0 1.0
0233110 0.002 0.0 1.0 1.0
0231201 4479.8 0.0 0.0
0232201 50.286 0.0 0.0
0233201 8.7556 0.0 0.0
*-----------
* Component No 24
* Lower Plenum:
* Top Volume for Loop 3
0240000 dc-lpt3 branch
0240001 3 1
0240101 0.0 0.3295 0.4455035 0.0 90.0 0.3295 1.0-5 0.170
0000000
0240200 013 15.8666+6 559.963 0.939-3
0241101 024010002 028010001 1.04933625 0.2 0.2 0001000
0242101 024010002 035010001 0.00684255 1.0 1.0 0001100
0243101 024010002 036010001 0.002375 1.0 1.0 0001100
0241110 0.170 0.0 1.0 1.0
0242110 0.002 0.0 1.0 1.0
0243110 0.002 0.0 1.0 1.0
0241201 4470.5 0.0 0.0
0242201 50.252 0.0 0.0
0243201 8.7554 0.0 0.0
*-----------
* Component No 25
* Lower Plenum:
* Top Volume for Loop 4
0250000 dc-lpt4 branch
0250001 3 1
0250101 0.0 0.3295 0.4455035 0.0 90.0 0.3295 1.0-5 0.170
0000000
0250200 013 15.8666+6 559.324 0.939-3
0251101 025010002 029010001 1.04933625 0.2 0.2 0001000
0252101 025010002 035010001 0.00684255 1.0 1.0 0001100
0253101 025010002 036010001 0.002375 1.0 1.0 0001100
0251110 0.170 0.0 1.0 1.0
0252110 0.002 0.0 1.0 1.0
0253110 0.002 0.0 1.0 1.0
0251201 4470.5 0.0 0.0
0252201 50.294 0.0 0.0
0253201 8.7645 0.0 0.0
*-----------
* 6.7 Core
*-----------
* Component No 26
* Core:
* 1/4 part ( 40.75 FA) of Loop 1
0260000 core-l1 pipe
0260001 10
0260101 1.0500465 10
0260201 1.0500465 9
0260301 0.353 10
0260401 0.0 10
0260601 90.0 10
0260801 1.0-5 0.0106 10
0260901 0.02 0.02 9
0261001 0000100 10
0261101 0001000 9
0261201 013 15.8531+6 562.025 0.0 0.0 0.0 1
0261202 013 15.8421+6 566.949 0.0 0.0 0.0 2
0261203 013 15.8309+6 571.962 0.0 0.0 0.0 3
0261204 013 15.8196+6 576.681 0.0 0.0 0.0 4
0261205 013 15.8082+6 580.946 0.0 0.0 0.0 5
0261206 013 15.7968+6 584.347 0.0 0.0 0.0 6
0261207 013 15.7853+6 586.988 0.0 0.0 0.0 7
0261208 013 15.7739+6 588.935 0.0 0.0 0.0 8
0261209 013 15.7624+6 590.120 0.0 0.0 0.0 9
0261210 013 15.7509+6 590.595 0.0 0.0 0.0 10
0261300 1
0261301 4466.4 0.0 0.0 9
0261401 0.0106 0.0 1.0 1.0 9
0262001 0.939-3 10
*-----------
* Component No 27
* Core:
* 1/4 part ( 40.75 FA) of Loop 2
0270000 core-l2 pipe
0270001 10
0270101 1.0500465 10
0270201 1.0500465 9
0270301 0.353 10
0270401 0.0 10
0270601 90.0 10
0270801 1.0-5 0.0106 10
0270901 0.02 0.02 9
0271001 0000100 10
0271101 0001000 9
0271201 013 15.8529+6 561.778 0.0 0.0 0.0 1
0271202 013 15.8419+6 566.140 0.0 0.0 0.0 2
0271203 013 15.8307+6 570.628 0.0 0.0 0.0 3
0271204 013 15.8194+6 574.810 0.0 0.0 0.0 4
0271205 013 15.8080+6 578.635 0.0 0.0 0.0 5
0271206 013 15.7966+6 581.718 0.0 0.0 0.0 6
0271207 013 15.7852+6 584.060 0.0 0.0 0.0 7
0271208 013 15.7737+6 585.786 0.0 0.0 0.0 8
0271209 013 15.7623+6 586.841 0.0 0.0 0.0 9
0271210 013 15.7508+6 587.284 0.0 0.0 0.0 10
0271300 1
0271301 4479.9 0.0 0.0 9
0271401 0.0106 0.0 1.0 1.0 9
0272001 0.939-3 10
*-----------
* Component No 28
* Core:
* 1/4 part ( 40.75 FA) of Loop 3
0280000 core-l3 pipe
0280001 10
0280101 1.0500465 10
0280201 1.0500465 9
0280301 0.353 10
0280401 0.0 10
0280601 90.0 10
0280801 1.0-5 0.0106 10
0280901 0.02 0.02 9
0281001 0000100 10
0281101 0001000 9
0281201 013 15.8530+6 562.528 0.0 0.0 0.0 1
0281202 013 15.8420+6 566.968 0.0 0.0 0.0 2
0281203 013 15.8308+6 571.500 0.0 0.0 0.0 3
0281204 013 15.8195+6 575.755 0.0 0.0 0.0 4
0281205 013 15.8082+6 579.648 0.0 0.0 0.0 5
0281206 013 15.7968+6 582.733 0.0 0.0 0.0 6
0281207 013 15.7853+6 585.116 0.0 0.0 0.0 7
0281208 013 15.7739+6 586.872 0.0 0.0 0.0 8
0281209 013 15.7625+6 587.946 0.0 0.0 0.0 9
0281210 013 15.7511+6 588.396 0.0 0.0 0.0 10
0281300 1
0281301 4470.5 0.0 0.0 9
0281401 0.0106 0.0 1.0 1.0 9
0282001 0.939-3 10
*-----------
* Component No 29
* Core:
* 1/4 part ( 40.75 FA) of Loop 4
0290000 core-l4 pipe
0290001 10
0290101 1.0500465 10
0290201 1.0500465 9
0290301 0.353 10
0290401 0.0 10
0290601 90.0 10
0290801 1.0-5 0.0106 10
0290901 0.02 0.02 9
0291001 0000100 10
0291101 0001000 9
0291201 013 15.8530+6 562.079 0.0 0.0 0.0 1
0291202 013 15.8420+6 566.811 0.0 0.0 0.0 2
0291203 013 15.8308+6 571.640 0.0 0.0 0.0 3
0291204 013 15.8195+6 576.175 0.0 0.0 0.0 4
0291205 013 15.8082+6 580.307 0.0 0.0 0.0 5
0291206 013 15.7967+6 583.576 0.0 0.0 0.0 6
0291207 013 15.7853+6 586.115 0.0 0.0 0.0 7
0291208 013 15.7738+6 587.987 0.0 0.0 0.0 8
0291209 013 15.7623+6 589.132 0.0 0.0 0.0 9
0291210 013 15.7509+6 589.611 0.0 0.0 0.0 10
0291300 1
0291301 4470.5 0.0 0.0 9
0291401 0.0106 0.0 1.0 1.0 9
0292001 0.939-3 10
*-----------
* 6.8 Core Unheated Top Volumes
*-----------
* Component No 30
* Core Top:
* Volume for Loop 1
0300000 core-tl1 branch
0300001 2 1
0300101 0.0 0.469 0.6868085 0.0 90.0 0.469 1.0-5 0.0106
0000100
0300200 013 15.7405+6 590.591 0.939-3
0301101 026100002 030010001 1.0500465 0.5 0.5 0001000
0302101 030010002 037010001 0.0 0.9 0.9 0001000
0301110 0.0106 0.0 1.0 1.0
0302110 0.0106 0.0 1.0 1.0
0301201 4466.4 0.0 0.0
0302201 4466.4 0.0 0.0
*-----------
* Component No 31
* Core Top:
* Volume for Loop 2
0310000 core-tl2 branch
0310001 2 1
0310101 0.0 0.469 0.6868085 0.0 90.0 0.469 1.0-5 0.0106
0000100
0310200 013 15.7405+6 587.280 0.939-3
0311101 027100002 031010001 1.0500465 0.5 0.5 0001000
0312101 031010002 038010001 0.0 0.9 0.9 0001000
0311110 0.0106 0.0 1.0 1.0
0312110 0.0106 0.0 1.0 1.0
0311201 4479.9 0.0 0.0
0312201 4479.9 0.0 0.0
*-----------
* Component No 32
* Core Top Volume for Loop 3
0320000 core-tl3 branch
0320001 2 1
0320101 0.0 0.469 0.6868085 0.0 90.0 0.469 1.0-5 0.0106
0000100
0320200 013 15.7407+6 588.392 0.939-3
0321101 028100002 032010001 1.0500465 0.5 0.5 0001000
0322101 032010002 039010001 0.0 0.9 0.9 0001000
0321110 0.0106 0.0 1.0 1.0
0322110 0.0106 0.0 1.0 1.0
0321201 4470.5 0.0 0.0
0322201 4470.5 0.0 0.0
*-----------
* Component No 33
* Core Top:
* Volume for Loop 4
0330000 core-tl4 branch
0330001 2 1
0330101 0.0 0.469 0.6868085 0.0 90.0 0.469 1.0-5 0.0106
0000100
0330200 013 15.7405+6 589.607 0.939-3
0331101 029100002 033010001 1.0500465 0.5 0.5 0001000
0332101 033010002 040010001 0.0 0.9 0.9 0001000
```

```
0331110 0.0106 0.0 1.0 1.0
0332110 0.0106 0.0 1.0 1.0
0331201 4470.5 0.0 0.0
0332201 4470.5 0.0 0.0
*----------
* 6.9 Core Bypass:
* Inside Baffle and Between Baffle and Barrel
*----------
* Component No 34
* Barrel bypass
0340000 co-bybaf pipe
0340001 4
0340101 0.0 4
0340201 0.248642 3
0340301 1.005 1
0340302 1.055 3
0340304 1.2135 4
0340401 0.406876 1
0340402 0.484764 3
0340403 0.484054 4
0340601 90.0 4
0340801 1.0-5 0.070 4
0340901 1.0 1.0 3
0341001 0000000 4
0341101 0001100 3
0341201 013 15.7606+6 559.383 0.0 0.0 0.0 1
0341202 013 15.7529+6 559.382 0.0 0.0 0.0 2
0341203 013 15.7451+6 559.380 0.0 0.0 0.0 3
0341204 013 15.7368+6 568.577 0.0 0.0 0.0 4
0341300 1
0341301 53.537 0.0 0.0 3
0341401 0.070 0.0 1.0 1.0 3
0342001 0.939-3 4
*----------
* 6.10 Core Bypass:
* Inside 121 FA (Guide Tubes)
*----------
* Component No 35
* Core Bypass inside 121 FA
0350000 co-by121 pipe
0350001 8
0350101 0.206982 5
0350102 0.0 8
0350201 0.091962 4
0350202 0.0 7
0350301 0.706 5
0350302 0.901 6
0350304 3.575 7
0350305 1.592 8
0350401 0.0 5
0350402 0.558709 6
0350403 6.997912 7
0350404 0.219073 8
0350601 90.0 8
0350801 1.0-5 0.011 5
0350802 1.0-5 0.0028 6
0350803 1.0-5 0.120 7
0350804 1.0-5 0.013 8
0350901 0.25 0.25 4
0350902 1.0 1.0 5
0350903 0.0 0.0 7
0351001 0000000 8
0351101 0001100 7
0351201 013 15.7800+6 559.387 0.0 0.0 0.0 1
0351202 013 15.7700+6 559.384 0.0 0.0 0.0 2
0351203 013 15.7600+6 559.381 0.0 0.0 0.0 3
0351204 013 15.7500+6 559.378 0.0 0.0 0.0 4
0351205 013 15.7400+6 559.376 0.0 0.0 0.0 5
0351206 013 15.7328+6 560.844 0.0 0.0 0.0 6
0351207 013 15.7165+6 563.283 0.0 0.0 0.0 7
0351208 013 15.6975+6 563.285 0.0 0.0 0.0 8
0351300 1
0351301 201.14 0.0 0.0 5
0351302 0.0 0.0 0.0 7
0351401 0.0028 0.0 1.0 1.0 4
0351402 0.070 0.0 1.0 1.0 7
0352001 0.939-3 8
*----------
* 6.11 Core Bypass: Inside 42 FA
*----------
* Component No 36
* Core Bypass inside 42 FA
0360000 co-by42 pipe
0360001 6
0360101 0.0 6
0360201 0.022351 5
0360301 0.706 5
0360302 0.901 6
0360401 0.0160966 5
0360402 0.099545 6
0360601 90.0 6
0360801 1.0-5 0.00187 6
0360901 0.2 0.2 5
0361001 0000000 6
0361101 0001000 5
0361201 013 15.8455+6 559.413 0.0 0.0 0.0 1
0361202 013 15.8200+6 559.409 0.0 0.0 0.0 2
0361203 013 15.7945+6 559.405 0.0 0.0 0.0 3
0361204 013 15.7689+6 559.402 0.0 0.0 0.0 4
0361205 013 15.7434+6 559.398 0.0 0.0 0.0 5
0361206 013 15.7280+6 559.394 0.0 0.0 0.0 6
0361300 1
0361301 35.046 0.0 0.0 5
0361401 0.00187 0.0 1.0 1.0 5
0362001 0.939-3 6
*----------
* 6.12 Upper Plenum inlet Volumes
*----------
* Component No 37
* Upper plenum:
* Inlet Volume for Loop 1
0370000 UP-Inl1 branch
0370001 4 1
0370101 0.0 0.432 0.492998 0.0 90.0 0.432 1.0-5 0.091
0000000
0370200 013 15.7199+6 590.131 0.939-3
0371101 034040002 037010001 0.06763875 1.0 1.0 0001000
0372101 037010003 038010004 0.0 1.0 1.0 0001000
0373101 035060002 037010002 0.0 1.0 1.0 0001000
0374101 037010002 041010001 0.77943425 0.2 0.2 0001000
0371110 0.0700 0.0 1.0 1.0
0372110 0.091 0.0 1.0 1.0
0373110 0.0106 0.0 1.0 1.0
0374110 0.091 0.0 1.0 1.0
0371201 23.689 0.0 0.0
0372201 3.7547 0.0 0.0
0373201 57.703 0.0 0.0
0374201 4523.4 0.0 0.0
*----------
* Component No 38
* Upper plenum:
* Inlet Volume for Loop 2
0380000 UP-Inl2 branch
0380001 4 1
0380101 0.0 0.432 0.492998 0.0 90.0 0.432 1.0-5 0.091
0000000
0380200 013 15.7199+6 586.701 0.939-3
0381101 034040002 038010001 0.06763875 1.0 1.0 0001000
0382101 038010003 039010004 0.0 1.0 1.0 0001000
0383101 035060002 038010002 0.0 1.0 1.0 0001000
0384101 038010002 042010001 0.77943425 0.2 0.2 0001000
0381110 0.0700 0.0 1.0 1.0
0382110 0.091 0.0 1.0 1.0
0383110 0.0106 0.0 1.0 1.0
0384110 0.091 0.0 1.0 1.0
0381201 27.708 0.0 0.0
0382201 66.605 0.0 0.0
0383201 84.535 0.0 0.0
0384201 4529.3 0.0 0.0
*----------
* Component No 39
* Upper plenum:
* Inlet Volume for Loop 3
0390000 UP-Inl3 branch
0390001 4 1
0390101 0.0 0.432 0.492998 0.0 90.0 0.432 1.0-5 0.091
0000000
0390200 013 15.7199+6 588.366 0.939-3
0391101 034040002 039010001 0.06763875 1.0 1.0 0001000
0392101 039010003 040010004 0.0 1.0 1.0 0001000
0393101 035060002 039010002 0.0 1.0 1.0 0001000
0394101 039010002 043010001 0.77943425 0.2 0.2 0001000
0391110 0.0700 0.0 1.0 1.0
0392110 0.091 0.0 1.0 1.0
0393110 0.0106 0.0 1.0 1.0
0394110 0.091 0.0 1.0 1.0
0391201 -23.781 0.0 0.0
0392201 -62.784 0.0 0.0
0393201 -10.110 0.0 0.0
0394201 4566.0 0.0 0.0
*----------
* Component No 40
* Upper plenum:
* Inlet Volume for Loop 4
0400000 UP-Inl4 branch
0400001 4 1
0400101 0.0 0.432 0.492998 0.0 90.0 0.432 1.0-5 0.091
0000000
0400200 013 15.7199+6 589.071 0.939-3
0401101 034040002 040010001 0.06763875 1.0 1.0 0001000
0402101 040010003 037010004 0.0 1.0 1.0 0001000
0403101 035060002 040010002 0.0 1.0 1.0 0001000
0404101 040010002 044010001 0.77943425 0.2 0.2 0001000
0401110 0.0700 0.0 1.0 1.0
0402110 0.091 0.0 1.0 1.0
0403110 0.0106 0.0 1.0 1.0
0404110 0.091 0.0 1.0 1.0
0401201 25.921 0.0 0.0
0402201 -20.616 0.0 0.0
0403201 69.011 0.0 0.0
0404201 4523.3 0.0 0.0
*----------
* 6.13 Upper Plenum:
* Lower Volumes
*----------
* Component No 41
* Upper plenum:
* Lower Volume for Loop 1
0410000 UP-Lol1 branch
0410001 4 1
0410101 0.0 1.469 2.2191995 0.0 90.0 1.469 1.0-5 0.343
0000000
0410200 013 15.7125+6 590.062 0.939-3
0411101 036060002 041010001 0.014754 1.0 1.0 0001100
0412101 041010003 042010004 0.0 1.0 1.0 0001000
0413101 041010002 045010001 0.825 0.2 0.2 0001000
0414101 041010002 049010001 0.2605 0.2 0.2 0001000
0411110 0.032 0.0 1.0 1.0
0412110 0.343 0.0 1.0 1.0
0413110 0.193 0.0 1.0 1.0
0414110 0.040 0.0 1.0 1.0
0411201 8.8825 0.0 0.0
0412201 -11.107 0.0 0.0
0413201 2395.6 0.0 0.0
0414201 2149.2 0.0 0.0
*----------
* Component No 42
* Upper plenum:
* Lower Volume for Loop 2
0420000 UP-Lol2 branch
0420001 4 1
0420101 0.0 1.469 2.2191995 0.0 90.0 1.469 1.0-5 0.343
0000000
0420200 013 15.7125+6 586.645 0.939-3
0421101 036060002 042010001 0.014754 1.0 1.0 0001100
0422101 042010003 043010004 0.0 1.0 1.0 0001000
0423101 042010002 046010001 0.825 0.2 0.2 0001000
0424101 042010002 050010001 0.2605 0.2 0.2 0001000
0421110 0.032 0.0 1.0 1.0
0422110 0.343 0.0 1.0 1.0
0423110 0.193 0.0 1.0 1.0
0424110 0.040 0.0 1.0 1.0
0421201 9.0203 0.0 0.0
0422201 -0.15013 0.0 0.0
0423201 2379.0 0.0 0.0
0424201 2148.3 0.0 0.0
*----------
* Component No 43
* Upper plenum:
* Lower Volume for Loop 3
0430000 UP-Lol3 branch
0430001 4 1
0430101 0.0 1.469 2.2191995 0.0 90.0 1.469 1.0-5 0.343
0000000
0430200 013 15.7125+6 588.311 0.939-3
0431101 036060002 043010001 0.014754 1.0 1.0 0001100
0432101 043010003 044010004 0.0 1.0 1.0 0001000
0433101 043010002 047010001 0.825 0.2 0.2 0001000
0434101 043010002 051010001 0.2605 0.2 0.2 0001000
0431110 0.032 0.0 1.0 1.0
0432110 0.343 0.0 1.0 1.0
0433110 0.193 0.0 1.0 1.0
0434110 0.040 0.0 1.0 1.0
0431201 8.1993 0.0 0.0
0432201 10.596 0.0 0.0
0433201 2406.5 0.0 0.0
0434201 2156.9 0.0 0.0
*----------
* Component No 44
* Upper plenum:
* Lower Volume for Loop 4
0440000 UP-Lol4 branch
0440001 4 1
0440101 0.0 1.469 2.2191995 0.0 90.0 1.469 1.0-5 0.343
0000000
0440200 013 15.7125+6 589.008 0.939-3
0441101 036060002 044010001 0.014754 1.0 1.0 0001100
0442101 044010003 041010004 0.0 1.0 1.0 0001000
0443101 044010002 048010001 0.825 0.2 0.2 0001000
0444101 044010002 052010001 0.2605 0.2 0.2 0001000
0441110 0.032 0.0 1.0 1.0
0442110 0.343 0.0 1.0 1.0
0443110 0.193 0.0 1.0 1.0
0444110 0.040 0.0 1.0 1.0
0441201 8.9440 0.0 0.0
0442201 1.3771 0.0 0.0
0443201 2391.8 0.0 0.0
0444201 2149.6 0.0 0.0
*----------
* 6.14 Upper Plenum:
* Middle Volumes
*----------
* Component No 45
* Upper plenum:
* Middle Volume for Loop 1
0450000 UP-Mdl1 branch
0450001 3 1
0450101 0.0 2.106 1.81735125 0.0 90.0 2.106 1.0-5 0.193
00000
0450200 013 15.7010+6 589.98 0.939-3
0451101 045010003 046010004 0.0 1.0 1.0 0001000
0452101 045010003 049010004 0.6268105 1.0 1.0 0001000
0453101 045010002 054010001 0.23707475 1.0 1.0 0001000
0451110 0.193 0.0 1.0 1.0
0452110 0.055 0.0 1.0 1.0
0453110 0.040 0.0 1.0 1.0
0451201 -58.465 0.0 0.0
0452201 2359.6 0.0 0.0
0453201 93.726 0.0 0.0
*----------
* Component No 46
* Upper plenum:
* Middle Volume for Loop 2
```

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0460000 UP-Mdl2 branch
0460001 3 1
0460101 0.0 2.106 1.81735125 0.0 90.0 2.106 1.0-5 0.193
0000000
0460200 013 15.7011+6 586.745 0.939-3
0461101 046010003 047010004 0.0 1.0 1.0 0001000
0462101 046010003 050010004 0.6268105 1.0 1.0 0001000
0463101 046010002 054010001 0.23707475 1.0 1.0 0001000
0461110 0.193 0.0 1.0 1.0
0462110 0.055 0.0 1.0 1.0
0463110 0.040 0.0 1.0 1.0
0461201 47.278 0.0 0.0
0462201 2373.4 0.0 0.0
0463201 -100.15 0.0 0.0
*----------
* Component No 47
* Upper plenum:
* Middle Volume for Loop 3
0470000 UP-Mdl3 branch
0470001 3 1
0470101 0.0 2.106 1.81735125 0.0 90.0 2.106 1.0-5 0.193
0000000
0470200 013 15.7010+6 588.275 0.939-3
0471101 047010003 048010004 0.0 1.0 1.0 0001000
0472101 047010003 051010004 0.6268105 1.0 1.0 0001000
0473101 047010002 054010001 0.23707475 1.0 1.0 0001000
0471110 0.193 0.0 1.0 1.0
0472110 0.055 0.0 1.0 1.0
0473110 0.040 0.0 1.0 1.0
0471201 21.774 0.0 0.0
0472201 2367.0 0.0 0.0
0473201 65.076 0.0 0.0
*----------
* Component No 48
* Upper plenum:
* Middle Volume for Loop 4
0480000 UP-Mdl3 branch
0480001 3 1
0480101 0.0 2.106 1.81735125 0.0 90.0 2.106 1.0-5 0.193
0000000
0480200 013 15.7010+6 588.996 0.939-3
0481101 048010003 045010004 0.0 1.0 1.0 0001000
0482101 048010003 052010004 0.6268105 1.0 1.0 0001000
0483101 048010002 054010001 0.23707475 1.0 1.0 0001000
0481110 0.193 0.0 1.0 1.0
0482110 0.055 0.0 1.0 1.0
0483110 0.040 0.0 1.0 1.0
0481201 -0.67939 0.0 0.0
0482201 2363.8 0.0 0.0
0483201 50.463 0.0 0.0
*----------
* 6.15 Upper Plenum:
* Outer Volumes
*----------
* Component No 49
* Upper plenum:
* Outer Volume for Loop 1
0490000 UP-Oul1 branch
0490001 3 1
0490101 0.0 2.106 1.526362 0.0 90.0 2.106 1.0-5 0.55
0000000
0490200 013 15.6907+6 590.007 0.939-3
0491101 049010003 050010004 0.0 1.0 1.0 0001000
0492101 049010002 054010001 0.0079922 1.0 1.0 0001000
0493101 049010004 061010004 1.7685595 0.2 0.2 0001000
0491110 0.550 0.0 1.0 1.0
0492110 0.006 0.0 1.0 1.0
0493110 0.180 0.0 1.0 1.0
0491201 31.391 0.0 0.0
0492201 -27.149 0.0 0.0
0493201 4497.8 0.0 0.0
*----------
* Component No 50
* Upper plenum:
* Outer Volume for Loop 2
0500000 UP-Oul2 branch
0500001 3 1
0500101 0.0 2.106 1.526362 0.0 90.0 2.106 1.0-5 0.55
0000000
0500200 013 15.6907+6 586.729 0.939-3
0501101 050010003 051010004 0.0 1.0 1.0 0001000
0502101 050010002 054010001 0.0079922 1.0 1.0 0001000
0503101 050010004 062010004 1.7685595 0.2 0.2 0001000
0501110 0.550 0.0 1.0 1.0
0502110 0.006 0.0 1.0 1.0
0503110 0.180 0.0 1.0 1.0
0501201 -3.7644 0.0 0.0
0502201 -27.440 0.0 0.0
0503201 4584.3 0.0 0.0
*----------
* Component No 51
* Upper plenum:
* Outer Volume for Loop 3
0510000 UP-Oul3 branch
0510001 3 1
0510101 0.0 2.106 1.526362 0.0 90.0 2.106 1.0-5 0.55
0000000
0510200 013 15.6907+6 588.294 0.939-3
0511101 051010003 052010004 0.0 1.0 1.0 0001000
0512101 051010002 054010001 0.0079922 1.0 1.0 0001000
0513101 051010004 063010004 1.7685595 0.2 0.2 0001000
0511110 0.550 0.0 1.0 1.0
0512110 0.006 0.0 1.0 1.0
0513110 0.180 0.0 1.0 1.0
0511201 -33.904 0.0 0.0
0512201 -27.260 0.0 0.0
0513201 4581.3 0.0 0.0
*----------
* Component No 52
* Upper plenum:
* Outer Volume for Loop 4
0520000 UP-Oul4 branch
0520001 3 1
0520101 0.0 2.106 1.526362 0.0 90.0 2.106 1.0-5 0.55
0000000
0520200 013 15.6907+6 588.995 0.939-3
0521101 052010003 049010004 0.0 1.0 1.0 0001000
0522101 052010002 054010001 0.0079922 1.0 1.0 0001000
0523101 052010004 064010004 1.7685595 0.2 0.2 0001000
0521110 0.550 0.0 1.0 1.0
0522110 0.006 0.0 1.0 1.0
0523110 0.180 0.0 1.0 1.0
0521201 -6.7832 0.0 0.0
0522201 -27.254 0.0 0.0
0523201 4513.5 0.0 0.0
*----------
* 6.16 Upper Head:
* Lower Volume
*----------
* Component No 54
* Upper Head Lower Volume
0540000 UH-low branch
0540001 1 1
0540101 0.0 1.592 11.225261 0.0 90.0 1.592 1.0-5 1.30
0000000
0540200 013 15.6928+6 589.205 0.939-3
0541101 054010002 056010001 2.1571224 1.0 1.0 0001000
0541110 0.140 0.0 1.0 1.0
0541201 0.0 0.0 0.0
*----------
* 6.17 Upper Head:
* Top Volume
*----------
* Component No 56
* Upper Head Top Volume
0560000 UH-top snglvol
0560101 0.0 1.075 6.338612 0.0 90.0 1.075 1.0-5 3.3 0000000
0560200 013 15.6838+6 588.249 0.939-3
*----------
* 6.18 Reactor Vessel Outlet
*----------
* Component No 61
* RV Outlet to Loop 1
0610000 RV-Oul1 branch
0610001 2 1
0610101 0.0 1.240 0.93954175 0.0 90.0 1.24 1.0-5 0.348
0000000
0610200 013 15.6744+6 589.518 0.939-3
0611101 061010003 062010004 0.0 1.0 1.0 0001000
0612101 061010003 100010001 0.567450 0.61 0.61 0001000
0611110 0.348 0.0 1.0 1.0
0612110 0.850 0.0 1.0 1.0
0611201 203.86 0.0 0.0
0612201 4253.6 0.0 0.0
*----------
* Component No 62
* RV Outlet to Loop 2
0620000 RV-Oul2 branch
0620001 2 1
0620101 0.0 1.240 0.93954175 0.0 90.0 1.24 1.0-5 0.348
0000000
0620200 013 15.6897+6 586.458 0.939-3
0621101 062010003 063010004 0.0 1.0 1.0 0001000
0622101 062010004 200010001 0.567450 0.61 0.61 0001000
0621110 0.348 0.0 1.0 1.0
0622110 0.850 0.0 1.0 1.0
0621201 60.874 0.0 0.0
0622201 4800.4 0.0 0.0
*----------
* Component No 63
* RV Outlet to Loop 3
0630000 RV-Oul3 branch
0630001 2 1
0630101 0.0 1.240 0.93954175 0.0 90.0 1.24 1.0-5 0.348
0000000
0630200 013 15.6897+6 587.876 0.939-3
0631101 063010003 064010004 0.0 1.0 1.0 0001000
0632101 063010004 300010001 0.567450 0.61 0.61 0001000
0631110 0.348 0.0 1.0 1.0
0632110 0.850 0.0 1.0 1.0
0631201 -177.18 0.0 0.0
0632201 4892.5 0.0 0.0
*----------
* Component No 64
* RV Outlet to Loop 4
0640000 RV-Oul4 branch
0640001 2 1
0640101 0.0 1.240 0.93954175 0.0 90.0 1.24 1.0-5 0.348
0000000
0640200 013 15.6897+6 588.568 0.939-3
0641101 064010003 061010004 0.0 1.0 1.0 0001000
0642101 064010004 400010001 0.567450 0.61 0.61 0001000
0641110 0.348 0.0 1.0 1.0
0642110 0.850 0.0 1.0 1.0
0641201 -115.25 0.0 0.0
0642201 4524.8 0.0 0.0
*----------
* VII. Loops (Primary Side)
*----------
* 7.1.1 Loop 1: Hot leg
*----------
* Component No 100
* Hot Leg of loop1 of RV outlet to gate valve
1000000 hl1-lp1 pipe
1000001 4
1000101 0.56745 4
1000201 0.56745 3
1000301 1.49 1
1000302 1.8 4
1000401 0.0 4
1000601 0.0 4
1000801 1.0-5 0.850 4
1000901 0.0 0.0 3
1001001 0000000 4
1001101 0001000 3
1001201 013 15.6239+6 589.490 0.0 0.0 0.0 1
1001202 013 15.6232+6 589.487 0.0 0.0 0.0 2
1001203 013 15.6225+6 589.487 0.0 0.0 0.0 3
1001204 013 15.6217+6 589.486 0.0 0.0 0.0 4
1001300 1
1001301 4253.6 0.0 0.0 3
1001401 0.850 0.0 1.0 1.0 3
1002001 0.939-3 4
*----------
* Component No 101
* Loop 1: Hot leg Gate Valve
1010000 hl1-mgv sngljun
1010101 100040002 102010001 0.3117 0.1 0.1 0001000
1010201 1 4253.6 0.0 0.
*----------
* Component No 102
* Hot Leg of loop1 of MGV to SG1 Inlet
1020000 hl2-lp1 pipe
1020001 3
1020101 0.56745 3
1020201 0.56745 2
1020301 1.28 1
1020302 1.052 2
1020303 1.252 3
1020401 0.0 3
1020601 0.0 1
1020602 45.0 2
1020603 45.0 3
1020701 0.0 1
1020702 0.67 2
1020703 0.87 3
1020801 1.0-6 0.850 3
1020901 0.0 0.0 1
1020902 0.07 0.07 2
1021001 0000000 3
1021101 0001000 2
1021201 013 15.6077+6 589.478 0.0 0.0 0.0 1
1021202 013 15.6050+6 589.476 0.0 0.0 0.0 2
1021203 013 15.5966+6 589.471 0.0 0.0 0.0 3
1021300 1
1021301 4253.6 0.0 0.0 2
1021401 0.850 0.0 1.0 1.0 2
1022001 0.939-3 3
*----------
* 7.1.2 SG1: Hot Collector
*----------
* Component No 110
* SG1 Hot Collector Inlet Volume
1100000 SG1-Hcin branch
1100001 2 1
1100101 0.546 0.670 0.0 0.0 90.0 0.670 1.0-5 0.834 0000000
1100200 013 15.5426+6 589.442 0.939-3
1101101 102030002 110010001 0.0 1.0252 1.0252 0001000
1102101 110010002 111010001 0.0 0.000 0.0000 0001000
1101110 0.850 0.0 1.0 1.0
1102110 0.834 0.0 1.0 1.0
1101201 4253.6 0.0 0.0
1102201 4253.6 0.0 0.0
*----------
* Component No 111
* SG1 Hot Collector Tube conection level 1
1110000 SG1-Hcl1 branch
1110001 2 1
1110101 0.546 0.445 0.0 0.0 90.0 0.445 1.0-5 0.834 0000000
1110200 013 15.5407+6 589.441 0.939-3
1111101 111010002 112010001 0.0 0.0 0.0 0001000
1112101 111010003 121010001 0.0 0.0 0.0 0001100
1111110 0.834 0.0 1.0 1.0
1112110 0.013 0.0 1.0 1.0
1111201 3848.7 0.0 0.0
1112201 404.94 0.0 0.0
*----------
* Component No 112
* SG1 Hot Collector Tube conection level 2
1120000 SG1-Hcl2 branch
1120001 2 1
1120101 0.546 0.446 0.0 0.0 90.0 0.446 1.0-5 0.834 0000000
1120200 013 15.5467+6 589.444 0.939-3
```

```
1121101 112010002 113010001 0.0 0.0 0.0 0001000
1122101 112010003 122010001 0.0 0.0 0.0 0001100
1121110 0.834 0.0 1.0 1.0
1122110 0.013 0.0 1.0 1.0
1121201 3141.5 0.0 0.0
1122201 707.19 0.0 0.0
*----------
* Component No 113
* SG1 Hot Collector Tube conection level 3
1130000 SG1-Hcl3 branch
1130001 2 1
1130101 0.546 0.446 0.0 0.0 90.0 0.446 1.0-5 0.834 0000000
1130200 013 15.5564+6 589.449 0.939-3
1131101 113010002 114010001 0.0 0.0 0.0 0001000
1132101 113010003 123010001 0.0 0.0 0.0 0001100
1131110 0.834 0.0 1.0 1.0
1132110 0.013 0.0 1.0 1.0
1131201 2060.4 0.0 0.0
1132201 1081.1 0.0 0.0
*----------
* Component No 114
* SG1 Hot Collector Tube conection level 4
1140000 SG1-Hcl4 branch
1140001 2 1
1140101 0.546 0.464 0.0 0.0 90.0 0.464 1.0-5 0.834 0000000
1140200 013 15.5657+6 589.453 0.939-3
1141101 114010002 115010001 0.0 0.0 0.0 0001000
1142101 114010003 124010001 0.0 0.0 0.0 0001100
1141110 0.834 0.0 1.0 1.0
1142110 0.013 0.0 1.0 1.0
1141201 942.55 0.0 0.0
1142201 1117.9 0.0 0.0
*----------
* Component No 115
* SG1 Hot Collector Tube conection level 5
1150000 SG1-Hcl5 branch
1150001 2 1
1150101 0.546 0.464 0.0 0.0 90.0 0.464 1.0-5 0.834 0000000
1150200 013 15.5690+6 589.454 0.939-3
1151101 115010002 116010001 0.0 0.0 0.0 0001000
1152101 115010003 125010001 0.0 0.0 0.0 0001100
1151110 0.834 0.0 1.0 1.0
1152110 0.013 0.0 1.0 1.0
1151201 0.0 0.0 0.0
1152201 942.54 0.0 0.0
*----------
* Component No 116
* SG1 Hot Collector Top
1160000 SG1-Hct pipe
1160001 2
1160101 0.546 1
1160102 0.0 2
1160201 0.546 1
1160301 0.485 1
1160302 1.55 2
1160401 0.0 1
1160402 0.505 2
1160601 90.0 2
1160801 1.0-5 0.834 1
1160802 1.0-5 0.0 2
1160901 0.0 0.0 1
1161001 0000000 2
1161101 0001000 1
1161201 013 15.5668+6 583.583 0.0 0.0 0.0 1
1161202 013 15.5598+6 582.959 0.0 0.0 0.0 2
1161300 1
1161301 0.0 0.0 0.0 1
1161401 0.834 0.0 1.0 1.0 1
1162001 0.939-3 2
*----------
* 7.1.3 SG1: Tube Bundles
*----------
* Component No 121
* SG1 Tube Bundle Level 1
* 1018 Tubes; L = 10.61 m
1210000 SG1-Tbl1 pipe
1210001 5
1210101 0.13512 5
1210301 2.122 5
1210401 0.0 5
1210601 0.0 5
1210801 4.0-6 0.013 5
1210901 0.0 0.0 4
1211001 0000000 5
1211101 0001000 4
1211201 013 15.5234+6 580.406 0.0 0.0 0.0 1
1211202 013 15.5066+6 573.230 0.0 0.0 0.0 2
1211203 013 15.4900+6 567.675 0.0 0.0 0.0 3
1211204 013 15.4736+6 563.345 0.0 0.0 0.0 4
1211205 013 15.4574+6 560.022 0.0 0.0 0.0 5
1211300 1
1211301 404.94 0.0 0.0 4
1211401 0.013 0.0 1.0 1.0 4
1212001 0.939-3 5
*----------
* Component No 122
* SG1 Tube Bundle Level 2
* 1798 Tubes; L = 10.76
1220000 SG1-Tbl2 pipe
1220001 5
1220101 0.23865 5
1220301 2.152 5
1220401 0.0 5
1220601 0.0 5
1220801 4.0-6 0.013 5
1220901 0.0 0.0 4
1221001 0000000 5
1221101 0001000 4
1221201 013 15.5311+6 580.087 0.0 0.0 0.0 1
1221202 013 15.5144+6 572.736 0.0 0.0 0.0 2
1221203 013 15.4980+6 567.117 0.0 0.0 0.0 3
1221204 013 15.4818+6 562.813 0.0 0.0 0.0 4
1221205 013 15.4657+6 559.543 0.0 0.0 0.0 5
1221300 1
1221301 707.19 0.0 0.0 4
1221401 0.013 0.0 1.0 1.0 4
1222001 0.939-3 5
*----------
* Component No 123
* SG1 Tube Bundle Level 3
* 2884 Tubes; L = 11.04 m
1230000 SG1-Tbl3 pipe
1230001 5
1230101 0.3828 5
1230301 2.208 5
1230401 0.0 5
1230601 0.0 5
1230801 4.0-6 0.013 5
1230901 0.0 0.0 4
1231001 0000000 5
1231101 0001000 4
1231201 013 15.5417+6 579.461 0.0 0.0 0.0 1
1231202 013 15.5261+6 571.795 0.0 0.0 0.0 2
1231203 013 15.5108+6 566.030 0.0 0.0 0.0 3
1231204 013 15.4956+6 561.736 0.0 0.0 0.0 4
1231205 013 15.4806+6 558.514 0.0 0.0 0.0 5
1231300 1
1231301 1081.1 0.0 0.0 4
1231401 0.013 0.0 1.0 1.0 4
1232001 0.939-3 5
*----------
* Component No 124
* SG1 Tube Bundle Level 4
* 2932 Tubes; L = 11.25 m
1240000 SG1-Tbl4 pipe
1240001 5
1240101 0.38917 5
1240301 2.25 5
1240401 0.0 5
1240601 0.0 5
1240801 4.0-6 0.013 5
1240901 0.0 0.0 4
1241001 0000000 5
1241101 0001000 4
1241201 013 15.5504+6 579.409 0.0 0.0 0.0 1
1241202 013 15.5340+6 571.716 0.0 0.0 0.0 2
1241203 013 15.5178+6 565.938 0.0 0.0 0.0 3
1241204 013 15.5019+6 561.644 0.0 0.0 0.0 4
1241205 013 15.4861+6 558.426 0.0 0.0 0.0 5
1241300 1
1241301 1117.9 0.0 0.0 4
1241401 0.013 0.0 1.0 1.0 4
1242001 0.939-3 5
*----------
* Component No 125
* SG1 Tube Bundle Level 5
* 2368 Tubes; L = 11.25 m
1250000 SG1-Tbl5 pipe
1250001 5
1250101 0.31431 5
1250301 2.25 5
1250401 0.0 5
1250601 0.0 5
1250801 4.0-6 0.013 5
1250901 0.0 0.0 4
1251001 0000000 5
1251101 0001000 4
1251201 013 15.5529+6 579.881 0.0 0.0 0.0 1
1251202 013 15.5350+6 572.418 0.0 0.0 0.0 2
1251203 013 15.5174+6 566.747 0.0 0.0 0.0 3
1251204 013 15.5000+6 562.443 0.0 0.0 0.0 4
1251205 013 15.4828+6 559.186 0.0 0.0 0.0 5
1251300 1
1251301 942.54 0.0 0.0 4
1251401 0.013 0.0 1.0 1.0 4
1252001 0.939-3 5
*----------
* 7.1.4 SG1: Cold Collector
*----------
* Component No 130
* SG1 Cold Collector Outlet Volume
1300000 SG1-Ccou branch
1300001 2 1
1300101 0.546 0.670 0.0 0.0 -90.0 -0.670 1.0-5 0.834 0000000
1300200 013 15.4506+6 558.945 0.939-3
1301101 131010002 130010001 0.0 0.0 0.0 0001000
1302101 130010002 140010001 0.0 0.0 0.0 0001100
1301110 0.834 0.0 1.0 1.0
1302110 0.850 0.0 1.0 1.0
1301201 4253.6 0.0 0.0
1302201 4253.6 0.0 0.0
*----------
* Component No 131
* SG1 Cold Collector Tube conection level 1
1310000 SG1-Ccl1 branch
1310001 2 1
1310101 0.546 0.445 0.0 0.0 -90.0 -0.445 1.0-5 0.834 0000000
1310200 013 15.4523+6 558.945 0.939-3
1311101 132010002 131010001 0.0 0.0 0.0 0001000
1312101 121050002 131010003 0.0 0.0 0.0 0001100
1311110 0.834 0.0 1.0 1.0
1312110 0.013 0.0 1.0 1.0
1311201 3848.7 0.0 0.0
1312201 404.94 0.0 0.0
*----------
* Component No 132
* SG1 Cold Collector Tube conection level 2
1320000 SG1-Ccl2 branch
1320001 2 1
1320101 0.546 0.446 0.0 0.0 -90.0 -0.446 1.0-5 0.834 0000000
1320200 013 15.4594+6 558.835 0.939-3
1321101 133010002 132010001 0.0 0.0 0.0 0001000
1322101 122050002 132010003 0.0 0.0 0.0 0001100
1321110 0.834 0.0 1.0 1.0
1322110 0.013 0.0 1.0 1.0
1321201 3141.5 0.0 0.0
1322201 707.18 0.0 0.0
*----------
* Component No 133
* SG1 Cold Collector Tube conection level 3
1330000 SG1-Ccl3 branch
1330001 2 1
1330101 0.546 0.446 0.0 0.0 -90.0 -0.446 1.0-5 0.834 0000000
1330200 013 15.4687+6 558.679 0.939-3
1331101 134010002 133010001 0.0 0.0 0.0 0001000
1332101 123050002 133010003 0.0 0.0 0.0 0001100
1331110 0.834 0.0 1.0 1.0
1332110 0.013 0.0 1.0 1.0
1331201 2060.4 0.0 0.0
1332201 1081.1 0.0 0.0
*----------
* Component No 134
* SG1 Cold Collector Tube conection level 4
1340000 SG1-Ccl4 branch
1340001 2 1
1340101 0.546 0.464 0.0 0.0 -90.0 -0.464 1.0-5 0.834 0000000
1340200 013 15.4741+6 558.770 0.939-3
1341101 135010002 134010001 0.0 0.0 0.0 0001000
1342101 124050002 134010003 0.0 0.0 0.0 0001100
1341110 0.834 0.0 1.0 1.0
1342110 0.013 0.0 1.0 1.0
1341201 942.54 0.0 0.0
1342201 1117.9 0.0 0.0
*----------
* Component No 135
* SG1 Cold Collector Tube conection level 5
1350000 SG1-Ccl5 branch
1350001 2 1
1350101 0.546 0.464 0.0 0.0 -90.0 -0.464 1.0-5 0.834 0000000
1350200 013 15.4739+6 559.182 0.939-3
1351101 136010001 135010001 0.0 0.0 0.0 0001000
1352101 125050002 135010003 0.0 0.0 0.0 0001100
1351110 0.834 0.0 1.0 1.0
1352110 0.013 0.0 1.0 1.0
1351201 0.0 0.0 0.0
1352201 942.54 0.0 0.0
*----------
* Component No 136
* SG1 Cold Collector Top
1360000 SG1-Cct pipe
1360001 2
1360101 0.546 1
1360102 0.0 2
1360201 0.546 1
1360301 0.485 1
1360302 1.55 2
1360401 0.0 1
1360402 0.505 2
1360601 90.0 2
1360801 1.0-5 0.834 1
1360802 1.0-5 0.0 2
1360901 0.0 0.0 1
1361001 0000000 2
1361101 0001000 1
1361201 013 15.4704+6 557.475 0.0 0.0 0.0 1
1361202 013 15.4628+6 557.243 0.0 0.0 0.0 2
1361300 1
1361301 0.0 0.0 0.0 1
1361401 0.834 0.0 1.0 1.0 1
1362001 0.939-3 2
*----------
* 7.1.5 Loop 1 Cold Leg
*----------
* Component No 140
* Seal Loop of SG1 Outlet to MCP1 Inlet
1400000 sl-lp1 pipe
1400001 9
1400101 0.56745 9
1400301 0.8 1
1400302 1.2 2
1400303 1.052 4
1400304 1.51 6
1400305 1.052 8
```

```
1400306 1.74 9
1400401 0.0 9
1400601 -90.0 2
1400602 -45.0 4
1400603 0.0 6
1400604 45.0 8
1400605 90.0 9
1400701 -0.8 1
1400702 -1.2 2
1400703 -0.67 4
1400704 0.0 6
1400705 0.67 8
1400706 1.74 9
1400801 1.0-6 0.850 9
1400901 0.0 0.0 2
1400902 0.07 0.07 3 * R/d = 1.58, 90 deg -> k = 0.26
1400903 0.0 0.0 6
1400904 0.07 0.07 7 * R/d = 1.58, 90 deg -> k = 0.26
1400905 0.0 0.0 8
1401001 0000000 9
1401101 0001000 8
1401201 013 15.4587+6 558.947 0.0 0.0 0.0 1
1401202 013 15.4658+6 558.949 0.0 0.0 0.0 2
1401203 013 15.4724+6 558.950 0.0 0.0 0.0 3
1401204 013 15.4745+6 558.951 0.0 0.0 0.0 4
1401205 013 15.4766+6 558.950 0.0 0.0 0.0 5
1401206 013 15.4761+6 558.950 0.0 0.0 0.0 6
1401207 013 15.4733+6 558.948 0.0 0.0 0.0 7
1401208 013 15.4654+6 558.946 0.0 0.0 0.0 8
1401209 013 15.4561+6 558.942 0.0 0.0 0.0 9
1401300 1
1401301 4253.6 0.0 0.0 8
1401401 0.850 0.0 1.0 1.0 8
1402001 0.939-3 9
*-----------
* 7.1.6 Main Circulation Pump 1
*-----------
* PUMP WWER 1000 (95M):
* Volume = 3.0 cub.m
* Ratings: Speed = 104.720 p/sec
* Actual speed = 104.196 p/sec
* Flow = 5.888 m3/sec
* Head = 84.00 m
* Torque = 47500.0 n*m
* Mom.In. = 7500.0 kg*m*m
* Density = 747 kg/m3
*-----------
* Component No 141
* MCP#1
1410000 MCP#1 pump
1410101 0.0 5.287 3.0 0.0 0.0 0.0 0.0 0000000
1410108 140090002 0.0 0.0 0.0 0000100
1410109 142010001 0.0 0.0 0.0 0000100
1410200 013 15.7336+6 559.104 0.939-3
1410201 1 4253.6 0.0 0.0
1410202 1 4253.6 0.0 0.0
1410301 0 -1 -3 -1 0 612 0
1410302 104.72 1.0 5.694 84.0 47511. 7500. 747.0 0.0 0.0 0.0 0.0 0.0
*-----------
* 7.1.6.1 Table pump velocity
*-----------
1416100 0 entrivar 141
1416101 0.0 0.0
1416102 500.0 500.0
*-----------
* 7.1.6.2 Pump Homologous Curves
* Single Phase Head Curves
*-----------
* Head Curve no 1 HAN (Normal)
1411100 1 1
1411101 0.0 1.826
1411102 0.04 1.739
1411103 0.11 1.562
1411104 0.205 1.413
1411105 0.3 1.315
1411106 0.41 1.239
1411107 0.5 1.228
1411108 0.6 1.206
1411109 0.72 1.184
1411110 0.82 1.141
1411111 0.91 1.076
1411112 1.0 1.00
*
* Torque Curve no 1 BAN (Normal)
1411200 2 1
1411201 0.0 1.045
1411202 0.271 0.796
1411203 0.3 0.82
1411204 0.4 0.816
1411205 0.5 0.82
1411206 0.82 0.95
1411207 1.00 1.00
* Head Curve no 2 HVN (Pump)
1411300 1 2
1411301 0.0 -1.227
1411302 0.221 -0.909
1411303 0.42 -0.5
1411304 0.62 0.0
1411305 0.84 0.5
1411306 0.904 0.658
1411307 1.0 1.00
* Torque Curve no 2 BVN (Pump)
1411400 2 2
1411401 0.0 -1.148
1411402 0.5 0.0
1411403 1.0 1.0
* Head Curve no 3 HAD (Energy)
1411500 1 3
1411501 -1.0 4.89
1411502 -0.5 2.95
1411503 -0.39 2.695
1411504 -0.29 2.434
1411505 -0.181 2.173
1411506 -0.1 2.0
1411507 0.000 1.826
* Torque Curve no 3 BAD (Energy)
1411600 2 3
1411601 -1.0 3.43
1411602 -0.89 2.978
1411603 -0.79 2.609
1411604 -0.58 2.0
1411605 -0.5 1.826
1411606 -0.19 1.239
1411607 -0.1 1.13
1411608 0.00 1.045
* Head Curve no 4 HVD (Dissipation)
1411700 1 4
1411701 -1.0 4.272
1411702 -0.769 3.272
1411703 -0.576 2.545
1411704 -0.384 2.0
1411705 -0.192 1.458
1411706 0.000 1.272
* Torque Curve no 4 BVD (Dissipation)
1411800 2 4
1411801 -1.0 3.272
1411802 -0.769 2.453
1411803 -0.576 2.0
1411804 -0.384 1.636
1411805 -0.192 1.272
1411806 0.000 1.09
* Head Curve no 5 HAT (Normal)
1411900 1 5
1411901 0.0 0.42
1411902 0.0452 0.426
1411903 0.0905 0.420
1411904 0.181 0.444
1411905 0.271 0.480
1411906 0.362 0.504
1411907 0.452 0.552
1411908 0.543 0.600
1411909 0.633 0.696
1411910 0.724 0.828
1411911 0.814 0.984
1411912 0.905 1.188
1411913 1.000 1.360
* Torque Curve no 5 BAT (Normal)
1412000 2 5
1412001 0.0 -0.704
1412002 0.0452 -0.684
1412003 0.136 -0.684
1412004 0.181 -0.612
1412005 0.271 -0.449
1412006 0.362 -0.255
1412007 0.452 -0.122
1412008 0.543 -0.0306
1412009 0.633 0.0816
1412010 0.724 0.224
1412011 0.814 0.388
1412012 0.905 0.592
1412013 0.995 0.776
1412014 1.000 0.790
* Head Curve no 6 HVT (Turbine)
1412100 1 6
1412101 0.0 2.024
1412102 0.221 1.731
1412103 0.442 1.525
1412104 0.663 1.408
1412105 0.884 1.379
1412106 1.0 1.36
* Torque Curve no 6 BVT (Turbine)
1412200 2 6
1412201 0.0 1.547
1412202 0.221 1.397
1412203 0.442 1.197
1412204 0.663 1.048
1412205 0.884 0.848
1412206 1.000 0.790
* Head Curve no 7 HAR (Reverse)
1412300 1 7
1412301 -1.0 -3.12
1412302 -0.814 -2.016
1412303 -0.724 -1.608
1412304 -0.633 -1.296
1412305 -0.543 -0.996
1412306 -0.452 -0.672
1412307 -0.362 -0.360
1412308 -0.271 -0.072
1412309 -0.181 0.216
1412310 -0.0905 0.360
1412311 -0.0452 0.408
1412312 0.000 0.420
* Torque Curve no 7 BAR (Reverse)
1412400 2 7
1412401 -1.0 -4.34
1412402 -0.814 -3.142
1412403 -0.724 -2.724
1412404 -0.543 -2.286
1412405 -0.452 -1.939
1412406 -0.362 -1.592
1412407 -0.271 -1.286
1412408 -0.181 -1.000
1412409 -0.0905 -0.796
1412410 0.000 -0.704
* Head Curve no 8 HVR (Pump)
1412500 1 8
1412501 -1.0 -3.12
1412502 -0.884 -2.992
1412503 -0.663 -2.757
1412504 -0.442 -2.435
1412505 -0.221 -2.053
1412506 0.000 -1.584
* Torque Curve no 8 BVR (Pump)
1412600 2 8
1412601 -1.0 -4.34
1412602 -0.884 -3.941
1412603 -0.663 -3.218
1412604 -0.442 -2.495
1412605 -0.221 -1.821
1412606 0.000 -1.148
*-----------
* 7.1.7 Loop 1 Cold Leg of MCP to RV
*-----------
* Component No 142
* Cold leg of MCP#1 to Cold leg MGV
1420000 cl1-lp1 pipe
1420001 2
1420101 0.56745 2
1420301 2.1075 2
1420401 0.0 2
1420601 0.0 2
1420701 0.0 2
1420801 1.0-5 0.850 2
1420901 0.0 0.0 1
1421001 0000000 2
1421101 0001000 1
1421201 013 16.0174+6 559.201 0.0 0.0 0.0 1
1421202 013 16.0166+6 559.201 0.0 0.0 0.0 2
1421300 1
1421301 4253.6 0.0 0.0 1
1421401 0.850 0.0 1.0 1.0 1
1422001 0.939-3 2
*-----------
* Component No 143
* Loop 1: Cold leg Gate Valve
1430000 cl1-mgv mgljun
1430101 142020002 144010001 0.3117 0.1 0.1 0001000
1430201 1 4253.6 0.0 0.
*-----------
* Component No 144
* Cold leg of Cold leg MGV to RV
1440000 cl2-lp1 pipe
1440001 11
1440101 0.56745 11
1440301 1.5 1
1440302 1.052 2
1440303 1.252 4
1440304 1.052 5
1440305 1.528 6
1440306 2.5 7
1440307 4.5 8
1440308 3.5 9
1440309 1.25 11
1440401 0.0 11
1440601 0.0 1
1440602 -45.0 5
1440603 0.0 11
1440701 0.0 1
1440702 -0.67 2
1440703 -0.87 4
1440704 -0.67 5
1440705 0.0 11
1440801 1.0-6 0.850 11
1440901 0.0 0.0 1
1440902 0.07 0.07 2
1440903 0.0 0.0 3
1440904 0.07 0.07 4
1440905 0.0 0.0 10
1441001 0000000 11
1441101 0001000 10
1441201 013 16.0037+6 559.196 0.0 0.0 0.0 1
1441202 013 16.0058+6 559.196 0.0 0.0 0.0 2
1441203 013 16.0085+6 559.195 0.0 0.0 0.0 3
1441204 013 16.0146+6 559.198 0.0 0.0 0.0 4
1441205 013 16.0173+6 559.198 0.0 0.0 0.0 5
1441206 013 16.0194+6 559.198 0.0 0.0 0.0 6
1441207 013 16.0188+6 559.196 0.0 0.0 0.0 7
1441208 013 16.0178+6 559.193 0.0 0.0 0.0 8
1441209 013 16.0166+6 559.191 0.0 0.0 0.0 9
1441210 013 16.0159+6 559.189 0.0 0.0 0.0 10
1441211 013 16.0156+6 559.189 0.0 0.0 0.0 11
1441300 1
```

```
1441301 4253.6 0.0 0.0 10
1441401 0.850 0.0 1.0 1.0 10
1442001 0.939-3 11
*-----------
* 7.2 Loop 2: Hot leg
*-----------
* Component No 200
* Hot Leg of loop2 of RV outlet to gate valve
2000000 hl1-lp2 pipe
2000001 4
2000101 0.56745 4
2000201 0.56745 3
2000301 1.49 1
2000302 1.8 4
2000401 0.0 4
2000601 0.0 4
2000801 1.0-5 0.850 4
2000901 0.0 0.0 3
2001001 0000000 4
2001101 0001000 3
2001201 013 15.6067+6 586.416 0.0 0.0 0.0 1
2001202 013 15.6059+6 586.413 0.0 0.0 0.0 2
2001203 013 15.6049+6 586.414 0.0 0.0 0.0 3
2001204 013 15.6040+6 586.414 0.0 0.0 0.0 4
2001300 1
2001301 4800.4 0.0 0.0 3
2001401 0.850 0.0 1.0 1.0 3
2002001 0.939-3 4
*-----------
* Component No 201
* Loop 2: Hot leg Gate Valve
2010000 hl2-mgv sngljun
2010101 200040002 202010001 0.3117 0.02 0.02 0001000
2010201 1 4800.3 0.0 0.
*
*-----------
* Component No 202
* Hot Leg of loop2 of MGV to SG2 Inlet
2020000 hl1-lp2 pipe
2020001 3
2020101 0.56745 3
2020201 0.56745 2
2020301 1.28 1
2020302 1.052 2
2020303 1.252 3
2020401 0.0 3
2020601 0.0 1
2020602 45.0 2
2020603 45.0 3
2020701 0.0 1
2020702 0.67 2
2020703 0.87 3
2020801 1.0-6 0.850 3
2020901 0.0 0.0 1
2020902 0.0 0.0 2 * R/d = 1.58, 90 deg -> k = 0.26
2021001 0000000 3
2021101 0001000 2
2021201 013 15.5999+6 586.412 0.0 0.0 0.0 1
2021202 013 15.5972+6 586.411 0.0 0.0 0.0 2
2021203 013 15.5914+6 586.408 0.0 0.0 0.0 3
2021300 1
2021301 4800.3 0.0 0.0 2
2021401 0.850 0.0 1.0 1.0 2
2022001 0.939-3 3
*-----------
* 7.2.2 SG2: Hot Collector
*-----------
* Component No 210
* SG2 Hot Collector Inlet Volume
2100000 SG2-Hcio branch
2100001 2 1
2100101 0.546 0.670 0.0 0.0 90.0 0.670 1.0-5 0.834 0000000
2100200 013 15.5552+6 586.389 0.939-3
2101101 202030002 210010001 0.0 0.4764 0.4764 0001000
2102101 210010002 211010001 0.0 0.0000 0.0000 0001000
2101110 0.850 0.0 1.0 1.0
2102110 0.834 0.0 1.0 1.0
2101201 4800.3 0.0 0.0
2102201 4800.3 0.0 0.0
*-----------
* Component No 211
* SG2 Hot Collector Tube conection level 1
2110000 SG2-Hcl1 branch
2110001 2 1
2110101 0.546 0.445 0.0 0.0 90.0 0.445 1.0-5 0.834 0000000
2110200 013 15.5537+6 586.389 0.939-3
2111101 211010002 212010001 0.0 0.0 0.0 0001000
2112101 211010003 221010001 0.0 0.0 0.0 0001100
2111110 0.834 0.0 1.0 1.0
2112110 0.013 0.0 1.0 1.0
2111201 4342.1 0.0 0.0
2112201 458.25 0.0 0.0
*-----------
* Component No 212
* SG2 Hot Collector Tube conection level 2
2120000 SG2-Hcl2 branch
2120001 2 1
2120101 0.546 0.446 0.0 0.0 90.0 0.446 1.0-5 0.834 0000000
2120200 013 15.5621+6 586.393 0.939-3
2121101 212010002 213010001 0.0 0.0 0.0 0001000
2122101 212010003 222010001 0.0 0.0 0.0 0001100
2121110 0.834 0.0 1.0 1.0
2122110 0.013 0.0 1.0 1.0
2121201 3542.7 0.0 0.0
2122201 799.37 0.0 0.0
*-----------
* Component No 213
* SG2 Hot Collector Tube conection level 3
2130000 SG2-Hcl3 branch
2130001 2 1
2130101 0.546 0.446 0.0 0.0 90.0 0.446 1.0-5 0.834 0000000
2130200 013 15.5751+6 586.399 0.939-3
2131101 213010002 214010001 0.0 0.0 0.0 0001000
2132101 213010003 223010001 0.0 0.0 0.0 0001100
2131110 0.834 0.0 1.0 1.0
2132110 0.013 0.0 1.0 1.0
2131201 2322.4 0.0 0.0
2132201 1220.3 0.0 0.0
*-----------
* Component No 214
* SG2 Hot Collector Tube conection level 4
2140000 SG2-Hcl4 branch
2140001 2 1
2140101 0.546 0.464 0.0 0.0 90.0 0.464 1.0-5 0.834 0000000
2140200 013 15.5875+6 586.405 0.939-3
2141101 214010002 215010001 0.0 0.0 0.0 0001000
2142101 214010003 224010001 0.0 0.0 0.0 0001100
2141110 0.834 0.0 1.0 1.0
2142110 0.013 0.0 1.0 1.0
2141201 1062.3 0.0 0.0
2142201 1260.2 0.0 0.0
*-----------
* Component No 215
* SG2 Hot Collector Tube conection level 5
2150000 SG2-Hcl5 branch
2150001 2 1
2150101 0.546 0.464 0.0 0.0 90.0 0.464 1.0-5 0.834 0000000
2150200 013 15.5924+6 586.407 0.939-3
2151101 215010002 216010001 0.0 0.0 0.0 0001000
2152101 215010003 225010001 0.0 0.0 0.0 0001100
2151110 0.834 0.0 1.0 1.0
2152110 0.013 0.0 1.0 1.0
2151201 0.0 0.0 0.0
2152201 1062.2 0.0 0.0
*-----------
* Component No 216
* SG2 Hot Collector Top
2160000 SG2-Hct pipe
2160001 2
2160101 0.546 1
2160102 0.0 2
2160201 0.546 1
2160301 0.485 1
2160302 1.55 2
2160401 0.0 1
2160402 0.505 2
2160601 90.0 2
2160801 1.0-5 0.834 1
2160802 1.0-5 0.0 2
2160901 0.0 0.0 1
2161001 0000000 2
2161101 0001000 1
2161201 013 15.5904+6 580.905 0.0 0.0 0.0 1
2161202 013 15.5834+6 580.953 0.0 0.0 0.0 2
2161300 1
2161301 0.0 0.0 0.0 1
2161401 0.834 0.0 1.0 1.0 1
2162001 0.939-3 2
*-----------
* 7.2.3 SG2: Tube Bundles
*-----------
* Component No 221
* SG2 Tube Bundle Level 1
* 1018 Tubes; L = 10.61 m
2210000 SG2-Tbl1 pipe
2210001 5
2210101 0.13512 5
2210301 2.122 5
2210401 0.0 5
2210601 0.0 5
2210801 4.0-6 0.013 5
2210901 0.0 0.0 4
2211001 0000000 5
2211101 0001000 4
2211201 013 15.5320+6 578.603 0.0 0.0 0.0 1
2211202 013 15.5107+6 572.313 0.0 0.0 0.0 2
2211203 013 15.4897+6 567.324 0.0 0.0 0.0 3
2211204 013 15.4689+6 563.364 0.0 0.0 0.0 4
2211205 013 15.4483+6 560.260 0.0 0.0 0.0 5
2211300 1
2211301 458.24 0.0 0.0 4
2211401 0.013 0.0 1.0 1.0 4
2212001 0.939-3 5
*-----------
* Component No 222
* SG2 Tube Bundle Level 2
* 1798 Tubes; L = 10.76
2220000 SG2-Tbl2 pipe
2220001 5
2220101 0.23865 5
2220301 2.152 5
2220401 0.0 5
2220601 0.0 5
2220801 4.0-6 0.013 5
2220901 0.0 0.0 4
2221001 0000000 5
2221101 0001000 4
2221201 013 15.5425+6 578.281 0.0 0.0 0.0 1
2221202 013 15.5214+6 571.819 0.0 0.0 0.0 2
2221203 013 15.5007+6 566.741 0.0 0.0 0.0 3
2221204 013 15.4801+6 562.778 0.0 0.0 0.0 4
2221205 013 15.4598+6 559.703 0.0 0.0 0.0 5
2221300 1
2221301 799.34 0.0 0.0 4
2221401 0.013 0.0 1.0 1.0 4
2222001 0.939-3 5
*-----------
* Component No 223
* SG2 Tube Bundle Level 3
* 2884 Tubes; L = 11.04 m
2230000 SG2-Tbl3 pipe
2230001 5
2230101 0.3828 5
2230301 2.208 5
2230401 0.0 5
2230601 0.0 5
2230801 4.0-6 0.013 5
2230901 0.0 0.0 4
2231001 0000000 5
2231101 0001000 4
2231201 013 15.5567+6 577.580 0.0 0.0 0.0 1
2231202 013 15.5371+6 570.738 0.0 0.0 0.0 2
2231203 013 15.5177+6 565.450 0.0 0.0 0.0 3
2231204 013 15.4986+6 561.459 0.0 0.0 0.0 4
2231205 013 15.4797+6 558.401 0.0 0.0 0.0 5
2231300 1
2231301 1220.3 0.0 0.0 4
2231401 0.013 0.0 1.0 1.0 4
2232001 0.939-3 5
*-----------
* Component No 224
* SG2 Tube Bundle Level 4
* 2932 Tubes; L = 11.25 m
2240000 SG2-Tbl4 pipe
2240001 5
2240101 0.38917 5
2240301 2.25 5
2240401 0.0 5
2240601 0.0 5
2240801 4.0-6 0.013 5
2240901 0.0 0.0 4
2241001 0000000 5
2241101 0001000 4
2241201 013 15.5684+6 577.724 0.0 0.0 0.0 1
2241202 013 15.5478+6 570.964 0.0 0.0 0.0 2
2241203 013 15.5275+6 565.730 0.0 0.0 0.0 3
2241204 013 15.5074+6 561.755 0.0 0.0 0.0 4
2241205 013 15.4875+6 558.702 0.0 0.0 0.0 5
2241300 1
2241301 1260.1 0.0 0.0 4
2241401 0.013 0.0 1.0 1.0 4
2242001 0.939-3 5
*-----------
* Component No 225
* SG2 Tube Bundle Level 5
* 2368 Tubes; L = 11.25 m
2250000 SG2-Tbl5 pipe
2250001 5
2250101 0.31431 5
2250301 2.25 5
2250401 0.0 5
2250601 0.0 5
2250801 4.0-6 0.013 5
2250901 0.0 0.0 4
2251001 0000000 5
2251101 0001000 4
2251201 013 15.5723+6 577.970 0.0 0.0 0.0 1
2251202 013 15.5499+6 571.327 0.0 0.0 0.0 2
2251203 013 15.5278+6 566.146 0.0 0.0 0.0 3
2251204 013 15.5060+6 562.166 0.0 0.0 0.0 4
2251205 013 15.4843+6 559.096 0.0 0.0 0.0 5
2251300 1
2251301 1062.3 0.0 0.0 4
2251401 0.013 0.0 1.0 1.0 4
2252001 0.939-3 5
*-----------
* 7.2.4 SG2: Cold Collector
*-----------
* Component No 230
* SG2 Cold Collector Outlet Volume
2300000 SG2-Ccou branch
2300001 2 1
2300101 0.546 0.670 0.0 0.0 -90.0 -0.670 1.0-5 0.834 0000000
2300200 013 15.4386+6 559.012 0.939-3
2301101 231010002 230010001 0.0 0.0 0.0 0001000
2302101 230010002 240010001 0.0 0.0 0.0 0001100
2301110 0.834 0.0 1.0 1.0
2302110 0.850 0.0 1.0 1.0
2301201 4800.5 0.0 0.0
2302201 4800.5 0.0 0.0
*-----------
* Component No 231
* SG2 Cold Collector Tube conection level 1
```

```
2310000 SG2-Cel1 branch
2310001 2 1
2310101 0.546 0.445 0.0 0.0 -90.0 -0.445 1.0-5 0.834 0000000
2310200 013 15.4419+6 559.014 0.939-3
2311101 232010002 231010001 0.0 0.0 0.0 0001000
2312101 221050002 231010003 0.0 0.0 0.0 0001100
2311110 0.834 0.0 1.0 1.0
2312110 0.013 0.0 1.0 1.0
2311201 4342.2 0.0 0.0
2312201 458.25 0.0 0.0
*----------
* Component No 232
* SG2 Cold Collector Tube conection level 2
2320000 SG2-Cel2 branch
2320001 2 1
2320101 0.546 0.446 0.0 0.0 -90.0 -0.446 1.0-5 0.834 0000000
2320200 013 15.4519+6 558.886 0.939-3
2321101 233010002 232010001 0.0 0.0 0.0 0001000
2322101 222050002 232010003 0.0 0.0 0.0 0001100
2321110 0.834 0.0 1.0 1.0
2322110 0.013 0.0 1.0 1.0
2321201 3542.8 0.0 0.0
2322201 799.37 0.0 0.0
*----------
* Component No 233
SG2 Cold Collector Tube conection level 3
2330000 SG2-Cel3 branch
2330001 2 1
2330101 0.546 0.446 0.0 0.0 -90.0 -0.446 1.0-5 0.834 0000000
2330200 013 15.4646+6 558.707 0.939-3
2331101 234010002 233010001 0.0 0.0 0.0 0001000
2332101 223050002 233010003 0.0 0.0 0.0 0001100
2331110 0.834 0.0 1.0 1.0
2332110 0.013 0.0 1.0 1.0
2331201 2322.5 0.0 0.0
2332201 1220.3 0.0 0.0
*----------
* Component No 234
* SG2 Cold Collector Tube conection level 4
2340000 SG2-Cel4 branch
2340001 2 1
2340101 0.546 0.464 0.0 0.0 -90.0 -0.464 1.0-5 0.834 0000000
2340200 013 15.4724+6 558.875 0.939-3
2341101 235010002 234010001 0.0 0.0 0.0 0001000
2342101 224050002 234010003 0.0 0.0 0.0 0001100
2341110 0.834 0.0 1.0 1.0
2342110 0.013 0.0 1.0 1.0
2341201 1062.4 0.0 0.0
2342201 1260.1 0.0 0.0
*----------
* Component No 235
* SG2 Cold Collector Tube conection level 5
2350000 SG2-Cel5 branch
2350001 2 1
2350101 0.546 0.464 0.0 0.0 -90.0 -0.464 1.0-5 0.834 0000000
2350200 013 15.4730+6 559.088 0.939-3
2351101 236010001 235010001 0.0 0.0 0.0 0001000
2352101 225050002 235010003 0.0 0.0 0.0 0001100
2351110 0.834 0.0 1.0 1.0
2352110 0.013 0.0 1.0 1.0
2351201 0.0 0.0 0.0
2352201 1062.4 0.0 0.0
*----------
* Component No 236
* SG2 Cold Collector Top
2360000 SG2-Cet pipe
2360001 2
2360101 0.546 1
2360102 0.0 2
2360201 0.546 1
2360301 0.485 1
2360302 1.55 2
2360401 0.0 1
2360402 0.505 2
2360601 90.0 2
2360801 1.0-5 0.834 1
2360802 1.0-5 0.0 2
2360901 0.0 0.0 1
2361001 0000000 2
2361101 0001000 1
2361201 013 15.4695+6 557.230 0.0 0.0 0.0 1
2361202 013 15.4619+6 557.625 0.0 0.0 0.0 2
2361300 1
2361301 0.0 0.0 0.0 1
2361401 0.834 0.0 1.0 1.0 1
2362001 0.939-3 2
*----------
* 7.2.5 Loop 2 Cold Leg
*----------
* Component No 240
* Seal Loop of SG2 Outlet to MCP2 Inlet
2400000 sl-lp2 pipe
2400001 9
2400101 0.56745 9
2400301 0.8 1
2400302 1.2 2
2400303 1.052 4
2400304 1.51 6
2400305 1.052 8
2400306 1.74 9
2400401 0.0 9
2400601 -90.0 2
2400602 -45.0 4
2400603 0.0 6
2400604 45.0 8
2400605 90.0 9
2400701 -0.8 1
2400702 -1.2 2
2400703 -0.67 4
2400704 0.0 6
2400705 0.67 8
2400706 1.74 9
2400801 1.0-6 0.850 9
2400901 0.0 0.0 2
2400902 0.0 0.0 3 * R/d = 1.58, 90 deg -> k = 0.26
2400903 0.0 0.0 6
2400904 0.0 0.0 7 * R/d = 1.58, 90 deg -> k = 0.26
2400905 0.0 0.0 8
2401001 0000000 9
2401101 0001000 8
2401201 013 15.4474+6 559.014 0.0 0.0 0.0 1
2401202 013 15.4545+6 559.015 0.0 0.0 0.0 2
2401203 013 15.4610+6 559.015 0.0 0.0 0.0 3
2401204 013 15.4655+6 559.016 0.0 0.0 0.0 4
2401205 013 15.4675+6 559.014 0.0 0.0 0.0 5
2401206 013 15.4670+6 559.013 0.0 0.0 0.0 6
2401207 013 15.4640+6 559.011 0.0 0.0 0.0 7
2401208 013 15.4587+6 559.008 0.0 0.0 0.0 8
2401209 013 15.4492+6 559.004 0.0 0.0 0.0 9
2401300 1
2401301 4800.6 0.0 0.0 8
2401401 0.850 0.0 1.0 1.0 8
2402001 0.939-3 9
*----------
* 7.2.6 Main Circulation Pump 2
*----------
* Component No 241
MCP#2
2410000 MCP#2 pump
2410101 0.0 5.287 3.0 0.0 0.0 0.0 0000000
2410108 240090002 0.0 0.0 0.0 0000100
2410109 242010001 0.0 0.0 0.0 0000100
2410200 013 15.7226+6 559.144 0.939-3
2410201 1 4800.6 0.0 0.0
2410202 1 4800.6 0.0 0.0
2410301 141 -1 -3 -1 0 613 0
2410302 104.72 1.0 6.425 84.0 47511. 7500. 747.0 0.0 0.0 0.0
0.0 0.0
*----------
* 7.2.6.1 Table pump velocity
*----------
2416100 0 cntrlvar 241
2416101 0.0 0.0
2416102 500.0 500.0
*----------
* 7.2.7 Loop 2 Cold Leg of MCP to RV
*----------
* Component No 242
* Cold leg of MCP#2 to Cold leg MGV
2420000 cl1-lp2 pipe
2420001 2
2420101 0.56745 2
2420301 2.1075 2
2420401 0.0 2
2420601 0.0 2
2420701 0.0 2
2420801 1.0-5 0.850 2
2420901 0.0 0.0 1
2421001 0000000 2
2421101 0001000 1
2421201 013 16.0023+6 559.242 0.0 0.0 0.0 1
2421202 013 16.0014+6 559.244 0.0 0.0 0.0 2
2421300 1
2421301 4800.5 0.0 0.0 1
2421401 0.850 0.0 1.0 1.0 1
2422001 0.939-3 2
*----------
* Component No 243
* Loop 2: Cold leg Gate Valve
2430000 cl2-mgv snglljun
2430101 242020002 244010001 0.3117 0.02 0.02 0001000
2430201 1 4800.5 0.0 0.
*----------
* Component No 244
* Cold leg of MGV to RV
2440000 cl2-lp2 pipe
2440001 11
2440101 0.56745 11
2440301 1.5 1
2440302 1.052 2
2440303 1.252 4
2440304 1.052 5
2440305 1.528 6
2440306 2.5 7
2440307 4.5 8
2440308 3.5 9
2440309 1.25 11
2440401 0.0 11
2440601 0.0 1
2440602 -45.0 5
2440603 0.0 11
2440701 0.0 1
2440702 -0.67 2
2440703 -0.87 4
2440704 -0.67 5
2440705 0.0 11
2440801 1.0-6 0.850 11
2440901 0.0 0.0 1
2440902 0.0 0.0 2
2440903 0.0 0.0 3
2440904 0.0 0.0 4
2440905 0.0 0.0 10
2441001 0000000 11
2441101 0001000 10
2441201 013 16.9974+6 559.244 0.0 0.0 0.0 1
2441202 013 16.9995+6 559.245 0.0 0.0 0.0 2
2441203 013 16.0047+6 559.247 0.0 0.0 0.0 3
2441204 013 16.0107+6 559.251 0.0 0.0 0.0 4
2441205 013 16.0160+6 559.254 0.0 0.0 0.0 5
2441206 013 16.0180+6 559.255 0.0 0.0 0.0 6
2441207 013 16.0172+6 559.257 0.0 0.0 0.0 7
2441208 013 16.0159+6 559.257 0.0 0.0 0.0 8
2441209 013 16.0145+6 559.256 0.0 0.0 0.0 9
2441210 013 16.0136+6 559.254 0.0 0.0 0.0 10
2441211 013 16.0131+6 559.254 0.0 0.0 0.0 11
2441300 1
2441301 4800.5 0.0 0.0 10
2441401 0.850 0.0 1.0 1.0 10
2442001 0.939-3 11
*----------
* 7.3 Loop 3: Hot leg
*----------
* Component No 300
* Hot Leg of loop3 of RV outlet to gate valve
3000000 hl1-lp3 pipe
3000001 4
3000101 0.56745 4
3000201 0.56745 3
3000301 1.49 1
3000302 1.8 4
3000401 0.0 4
3000601 0.0 4
3000801 1.0-5 0.850 4
3000901 0.0 0.0 3
3001001 0000000 4
3001101 0001000 3
3001201 013 15.6030+6 587.830 0.0 0.0 0.0 1
3001202 013 15.6022+6 587.827 0.0 0.0 0.0 2
3001203 013 15.6012+6 587.827 0.0 0.0 0.0 3
3001204 013 15.6003+6 587.826 0.0 0.0 0.0 4
3001300 1
3001301 4892.5 0.0 0.0 3
3001401 0.850 0.0 1.0 1.0 3
3002001 0.939-3 4
*----------
* Component No 301
* Loop 3: Hot leg Gate Valve
3010000 hl3-mgv snglljun
3010101 300040002 302010001 0.3117 0.05 0.05 0001000
3010201 1 4892.5 0.0 0.
*----------
* Component No 302
* Hot Leg of loop3 of MGV to SG3 Inlet
3020000 hl2-lp3 pipe
3020001 3
3020101 0.56745 3
3020201 0.56745 2
3020301 1.28 1
3020302 1.052 2
3020303 1.252 3
3020401 0.0 3
3020601 0.0 1
3020602 45.0 2
3020603 45.0 3
3020701 0.0 1
3020702 0.67 2
3020703 0.87 3
3020801 1.0-6 0.850 3
3020901 0.0 0.0 1
3020902 0.039 0.039 2 * R/d = 1.58, 90 deg -> k = 0.26
3021001 0000000 3
3021101 0001000 2
3021201 013 15.5906+6 587.821 0.0 0.0 0.0 1
3021202 013 15.5879+6 587.819 0.0 0.0 0.0 2
3021203 013 15.5801+6 587.815 0.0 0.0 0.0 3
3021300 1
3021301 4892.5 0.0 0.0 2
3021401 0.850 0.0 1.0 1.0 2
3022001 0.939-3 3
*----------
* 7.3.2 SG3: Hot Collector
*----------
* Component No 310
* SG3 Hot Collector Inlet Volume
3100000 SG3-Hcin branch
3100001 2 1
3100101 0.546 0.670 0.0 0.0 90.0 0.670 1.0-5 0.834 0000000
3100200 013 15.5544+6 587.801 0.939-3
3101101 302030002 310010001 0.0 0.271 0.271 0001000
3102101 310010002 311010001 0.0 0.000 0.000 0001000
3101110 0.850 0.0 1.0 1.0
3102110 0.834 0.0 1.0 1.0
3101201 4892.5 0.0 0.0
```

```
3102201 4892.4 0.0 0.0
*-----------
* Component No 311
 SG3 Hot Collector Tube conection level 1
3110000 SG3-Hcl1 branch
3110001 2 1
3110101 0.546 0.445 0.0 0.0 90.0 0.445 1.0-5 0.834 0000000
3110200 013 15.5530+6 587.800 0.939-3
3111101 311010002 312010001 0.0 0.0 0.0 0001000
3112101 311010003 321010001 0.0 0.0 0.0 0001100
3111110 0.834 0.0 1.0 1.0
3112110 0.013 0.0 1.0 1.0
3111201 4425.6 0.0 0.0
3112201 466.87 0.0 0.0
*-----------
* Component No 312
* SG3 Hot Collector Tube conection level 2
3120000 SG3-Hcl2 branch
3120001 2 1
3120101 0.546 0.446 0.0 0.0 90.0 0.446 1.0-5 0.834 0000000
3120200 013 15.5619+6 587.805 0.939-3
3121101 312010002 313010001 0.0 0.0 0.0 0001000
3122101 312010003 322010001 0.0 0.0 0.0 0001100
3121110 0.834 0.0 1.0 1.0
3122110 0.013 0.0 1.0 1.0
3121201 3611.0 0.0 0.0
3122201 814.53 0.0 0.0
*-----------
* Component No 313
* SG3 Hot Collector Tube conection level 3
3130000 SG3-Hcl3 branch
3130001 2 1
3130101 0.546 0.446 0.0 0.0 90.0 0.446 1.0-5 0.834 0000000
3130200 013 15.5756+6 587.812 0.939-3
3131101 313010002 314010001 0.0 0.0 0.0 0001000
3132101 313010003 323010001 0.0 0.0 0.0 0001100
3131110 0.834 0.0 1.0 1.0
3132110 0.013 0.0 1.0 1.0
3131201 2367.5 0.0 0.0
3132201 1243.5 0.0 0.0
*-----------
* Component No 314
* SG3 Hot Collector Tube conection level 4
3140000 SG3-Hcl4 branch
3140001 2 1
3140101 0.546 0.464 0.0 0.0 90.0 0.464 1.0-5 0.834 0000000
3140200 013 15.5887+6 587.818 0.939-3
3141101 314010002 315010001 0.0 0.0 0.0 0001000
3142101 314010003 324010001 0.0 0.0 0.0 0001100
3141110 0.834 0.0 1.0 1.0
3142110 0.013 0.0 1.0 1.0
3141201 1082.8 0.0 0.0
3142201 1284.7 0.0 0.0
*-----------
* Component No 315
* SG3 Hot Collector Tube conection level 5
3150000 SG3-Hcl5 branch
3150001 2 1
3150101 0.546 0.464 0.0 0.0 90.0 0.464 1.0-5 0.834 0000000
3150200 013 15.5940+6 587.820 0.939-3
3151101 315010002 316010001 0.0 0.0 0.0 0001000
3152101 315010003 325010001 0.0 0.0 0.0 0001100
3151110 0.834 0.0 1.0 1.0
3152110 0.013 0.0 1.0 1.0
3151201 0.0 0.0 0.0
3152201 1082.8 0.0 0.0
*-----------
* Component No 316
* SG3 Hot Collector Top
3160000 SG3-Hct pipe
3160001 2
3160101 0.546 1
3160102 0.0 2
3160201 0.546 1
3160301 0.485 1
3160302 1.55 2
3160401 0.0 1
3160402 0.505 2
3160601 90.0 2
3160801 1.0-5 0.834 1
3160802 1.0-5 0.0 2
3160901 0.0 0.0 1
3161001 0000000 2
3161101 0001000 1
3161201 013 15.5921+6 582.283 0.0 0.0 0.0 1
3161202 013 15.5851+6 582.236 0.0 0.0 0.0 2
3161300 1
3161301 0.0 0.0 0.0 1
3161401 0.834 0.0 1.0 1.0 1
3162001 0.939-3 2
*-----------
* 7.3.3 SG3: Tube Bundles
*-----------
* Component No 321
* SG3 Tube Bundle Level 1
* 1018 Tubes; L = 10.61 m
3210000 SG3-Tbl1 pipe
3210001 5
3210101 0.13512 5
3210301 2.122 5
3210401 0.0 5
3210601 0.0 5
3210801 4.0-6 0.013 5
3210901 0.0 0.0 4
3211001 0000000 5
3211101 0001000 4
3211201 013 15.5304+6 579.887 0.0 0.0 0.0 1
3211202 013 15.5082+6 573.420 0.0 0.0 0.0 2
3211203 013 15.4864+6 568.312 0.0 0.0 0.0 3
3211204 013 15.4648+6 564.215 0.0 0.0 0.0 4
3211205 013 15.4434+6 560.995 0.0 0.0 0.0 5
3211300 1
3211301 466.87 0.0 0.0 4
3211401 0.013 0.0 1.0 1.0 4
3212001 0.939-3 5
*-----------
* Component No 322
* SG3 Tube Bundle Level 2
* 1798 Tubes; L = 10.76
3220000 SG3-Tbl2 pipe
3220001 5
3220101 0.23865 5
3220301 2.152 5
3220401 0.0 5
3220601 0.0 5
3220801 4.0-6 0.013 5
3220901 0.0 0.0 4
3221001 0000000 5
3221101 0001000 4
3221201 013 15.5415+6 579.572 0.0 0.0 0.0 1
3221202 013 15.5196+6 572.940 0.0 0.0 0.0 2
3221203 013 15.4980+6 567.751 0.0 0.0 0.0 3
3221204 013 15.4766+6 563.661 0.0 0.0 0.0 4
3221205 013 15.4555+6 560.488 0.0 0.0 0.0 5
3221300 1
3221301 814.53 0.0 0.0 4
3221401 0.013 0.0 1.0 1.0 4
3222001 0.939-3 5
*-----------
* Component No 323
* SG3 Tube Bundle Level 3
* 2884 Tubes; L = 11.04 m
3230000 SG3-Tbl3 pipe
3230001 5
3230101 0.3828 5
3230301 2.208 5
3230401 0.0 5
3230601 0.0 5
3230801 4.0-6 0.013 5
3230901 0.0 0.0 4
3231001 0000000 5
3231101 0001000 4
3231201 013 15.5564+6 578.959 0.0 0.0 0.0 1
3231202 013 15.5360+6 571.998 0.0 0.0 0.0 2
3231203 013 15.5159+6 566.632 0.0 0.0 0.0 3
3231204 013 15.4960+6 562.522 0.0 0.0 0.0 4
3231205 013 15.4763+6 559.384 0.0 0.0 0.0 5
3231300 1
3231301 1243.5 0.0 0.0 4
3231401 0.013 0.0 1.0 1.0 4
3232001 0.939-3 5
*-----------
* Component No 324
* SG3 Tube Bundle Level 4
* 2932 Tubes; L = 11.25 m
3240000 SG3-Tbl4 pipe
3240001 5
3240101 0.38917 5
3240301 2.25 5
3240401 0.0 5
3240601 0.0 5
3240801 4.0-6 0.013 5
3240901 0.0 0.0 4
3241001 0000000 5
3241101 0001000 4
3241201 013 15.5688+6 578.951 0.0 0.0 0.0 1
3241202 013 15.5473+6 571.983 0.0 0.0 0.0 2
3241203 013 15.5262+6 566.614 0.0 0.0 0.0 3
3241204 013 15.5053+6 562.504 0.0 0.0 0.0 4
3241205 013 15.4846+6 559.365 0.0 0.0 0.0 5
3241300 1
3241301 1284.7 0.0 0.0 4
3241401 0.013 0.0 1.0 1.0 4
3242001 0.939-3 5
*-----------
* Component No 325
* SG3 Tube Bundle Level 5
* 2368 Tubes; L = 11.25 m
3250000 SG3-Tbl5 pipe
3250001 5
3250101 0.31431 5
3250301 2.25 5
3250401 0.0 5
3250601 0.0 5
3250801 4.0-6 0.013 5
3250901 0.0 0.0 4
3251001 0000000 5
3251101 0001000 4
3251201 013 15.5730+6 579.380 0.0 0.0 0.0 1
3251202 013 15.5497+6 572.638 0.0 0.0 0.0 2
3251203 013 15.5267+6 567.389 0.0 0.0 0.0 3
3251204 013 15.5040+6 563.289 0.0 0.0 0.0 4
3251205 013 15.4815+6 560.131 0.0 0.0 0.0 5
3251300 1
3251301 1082.8 0.0 0.0 4
3251401 0.013 0.0 1.0 1.0 4
3252001 0.939-3 5
*-----------
* 7.3.4 SG3: Cold Collector
*-----------
* Component No 330
* SG3 Cold Collector Outlet Volume
3300000 SG3-Ccou branch
3300001 2 1
3300101 0.546 0.670 0.0 0.0 -90.0 -0.670 1.0-5 0.834 0000000
3300200 013 15.4331+6 559.874 0.939-3
3301101 331010002 330010001 0.0 0.0 0.0 0001000
3302101 330010002 340010001 0.0 0.0 0.0 0001100
3301110 0.834 0.0 1.0 1.0
3302110 0.850 0.0 1.0 1.0
3301201 4892.4 0.0 0.0
3302201 4892.4 0.0 0.0
*-----------
* Component No 331
* SG3 Cold Collector Tube conection level 1
3310000 SG3-Ccl1 branch
3310001 2 1
3310101 0.546 0.445 0.0 0.0 -90.0 -0.445 1.0-5 0.834 0000000
3310200 013 15.4367+6 559.876 0.939-3
3311101 332010002 331010001 0.0 0.0 0.0 0001000
3312101 321050002 331010003 0.0 0.0 0.0 0001100
3311110 0.834 0.0 1.0 1.0
3312110 0.013 0.0 1.0 1.0
3311201 4425.6 0.0 0.0
3312201 466.87 0.0 0.0
*-----------
* Component No 332
* SG3 Cold Collector Tube conection level 2
3320000 SG3-Ccl2 branch
3320001 2 1
3320101 0.546 0.446 0.0 0.0 -90.0 -0.446 1.0-5 0.834 0000000
3320200 013 15.4473+6 559.758 0.939-3
3321101 333010002 332010001 0.0 0.0 0.0 0001000
3322101 322050002 332010003 0.0 0.0 0.0 0001100
3321110 0.834 0.0 1.0 1.0
3322110 0.013 0.0 1.0 1.0
3321201 3611.0 0.0 0.0
3322201 814.53 0.0 0.0
*-----------
* Component No 333
* SG3 Cold Collector Tube conection level 3
3330000 SG3-Ccl3 branch
3330001 2 1
3330101 0.546 0.446 0.0 0.0 -90.0 -0.446 1.0-5 0.834 0000000
3330200 013 15.4607+6 559.595 0.939-3
3331101 334010002 333010001 0.0 0.0 0.0 0001000
3332101 323050002 333010003 0.0 0.0 0.0 0001100
3331110 0.834 0.0 1.0 1.0
3332110 0.013 0.0 1.0 1.0
3331201 2367.5 0.0 0.0
3332201 1243.5 0.0 0.0
*-----------
* Component No 334
* SG3 Cold Collector Tube conection level 4
3340000 SG3-Ccl4 branch
3340001 2 1
3340101 0.546 0.464 0.0 0.0 -90.0 -0.464 1.0-5 0.834 0000000
3340200 013 15.4690+6 559.712 0.939-3
3341101 335010002 334010001 0.0 0.0 0.0 0001000
3342101 324050002 334010003 0.0 0.0 0.0 0001100
3341110 0.834 0.0 1.0 1.0
3342110 0.013 0.0 1.0 1.0
3341201 1082.8 0.0 0.0
3342201 1284.7 0.0 0.0
*-----------
* Component No 335
* SG3 Cold Collector Tube conection level 5
3350000 SG3-Ccl5 branch
3350001 2 1
3350101 0.546 0.464 0.0 0.0 -90.0 -0.464 1.0-5 0.834 0000000
3350200 013 15.4697+6 560.126 0.939-3
3351101 336010001 335010001 0.0 0.0 0.0 0001000
3352101 325050002 335010003 0.0 0.0 0.0 0001100
3351110 0.834 0.0 1.0 1.0
3352110 0.013 0.0 1.0 1.0
3351201 0.0 0.0 0.0
3352201 1082.8 0.0 0.0
*-----------
* Component No 336
* SG3 Cold Collector Top
3360000 SG3-Cct pipe
3360001 2
3360101 0.546 1
3360102 0.0 2
3360201 0.546 1
3360301 0.485 1
3360302 1.55 2
3360401 0.0 1
3360402 0.505 2
3360601 90.0 2
3360801 1.0-5 0.834 1
3360802 1.0-5 0.0 2
3360901 0.0 0.0 1
```

```
3361001 0000000 2
3361101 0001000 1
3361201 013 15.4662+6 558.626 0.0 0.0 0.0 1
3361202 013 15.4587+6 558.528 0.0 0.0 0.0 2
3361300 1
3361301 0.0 0.0 0.0 1
3361401 0.834 0.0 1.0 1.0 1
3362001 0.939-3 2
*---------
* 7.3.5 Loop 3 Cold Leg
*---------
* Component No 340
* Seal Loop of SG3 Outlet to MCP3 Inlet
3400000 sl-lp3 pipe
3400001 9
3400101 0.56745 9
3400301 0.8 1
3400302 1.2 2
3400303 1.052 4
3400304 1.51 6
3400305 1.052 8
3400306 1.74 9
3400401 0.0 9
3400601 -90.0 2
3400602 -45.0 4
3400603 0.0 6
3400604 45.0 8
3400605 90.0 9
3400701 -0.8 1
3400702 -1.2 2
3400703 -0.67 4
3400704 0.0 6
3400705 0.67 8
3400706 1.74 9
3400801 1.0-6 0.850 9
3400901 0.0 0.0 2
3400902 0.039 0.039 3 * R/d = 1.58, 90 deg -> k = 0.26
3400903 0.0 0.0 6
3400904 0.039 0.039 7 * R/d = 1.58, 90 deg -> k = 0.26
3400905 0.0 0.0 8
3401001 0000000 9
3401101 0001000 8
3401201 013 15.4421+6 559.877 0.0 0.0 0.0 1
3401202 013 15.4491+6 559.879 0.0 0.0 0.0 2
3401203 013 15.4556+6 559.880 0.0 0.0 0.0 3
3401204 013 15.4582+6 559.881 0.0 0.0 0.0 4
3401205 013 15.4602+6 559.881 0.0 0.0 0.0 5
3401206 013 15.4596+6 559.881 0.0 0.0 0.0 6
3401207 013 15.4566+6 559.879 0.0 0.0 0.0 7
3401208 013 15.4493+6 559.876 0.0 0.0 0.0 8
3401209 013 15.4399+6 559.872 0.0 0.0 0.0 9
3401300 1
3401301 4892.4 0.0 0.0 8
3401401 0.850 0.0 1.0 1.0 8
3402001 0.939-3 9
*---------
* 7.3.6 Main Circulation Pump 3
*---------
* Component No 341
* MCP#3
3410000 MCP#3 pump
3410101 0.0 5.287 3.0 0.0 0.0 0.0 0000000
3410108 340090002 0.0 0.0 0.0 0000100
3410109 342010001 0.0 0.0 0.0 0000100
3410200 013 15.7224+6 560.010 0.939-3
3410201 1 4892.4 0.0 0.0
3410202 1 4892.4 0.0 0.0
3410301 141 -1 -3 -1 0 614 0
3410302 104.72 1.0 6.549 84.0 47511. 7500. 747.0 0. 0. 0. 0.
0.
*---------
* 7.3.6.1 Table pump velocity
*---------
3416100 0 cntrlvar 341
3416101 0.0 0.0
3416102 500.0 500.0
*---------
* 7.3.7 Loop 3 Cold Leg of MCP to RV
*---------
* Component No 342
* Cold leg of MCP#3 to Cold leg MGV
3420000 cl1-lp3 pipe
3420001 2
3420101 0.56745 2
3420301 2.1075 2
3420401 0.0 2
3420601 0.0 2
3420701 0.0 2
3420801 1.0-5 0.850 2
3420901 0.0 0.0 1
3421001 0000000 2
3421101 0001000 1
3421201 013 16.0111+6 560.107 0.0 0.0 0.0 1
3421202 013 16.0101+6 560.107 0.0 0.0 0.0 2
3421300 1
3421301 4892.4 0.0 0.0 1
3421401 0.850 0.0 1.0 1.0 1
3422001 0.939-3 2
*---------
* Component No 343
* Loop 3: Cold leg Gate Valve
3430000 cl3-mgv sngljun
3430101 342020002 344010001 0.3117 0.05 0.05 0001000
3430201 1 4892.4 0.0 0.
*---------
* Component No 344
* Cold leg of MGV to RV
3440000 cl2-lp3 pipe
3440001 11
3440101 0.56745 11
3440301 1.5 1
3440302 1.052 2
3440303 1.252 4
3440304 1.052 5
3440305 1.528 6
3440306 2.5 7
3440307 4.5 8
3440308 3.5 9
3440309 1.25 11
3440401 0.0 11
3440601 0.0 1
3440602 -45.0 5
3440603 0.0 11
3440701 0.0 1
3440702 -0.67 2
3440703 -0.87 4
3440704 -0.67 5
3440705 0.0 11
3440801 1.0-6 0.850 11
3440901 0.0 0.0 1
3440902 0.039 0.039 2
3440903 0.0 0.0 3
3440904 0.039 0.039 4
3440905 0.0 0.0 10
3441001 0000000 11
3441101 0001000 10
3441201 013 16.0011+6 560.103 0.0 0.0 0.0 1
3441202 013 16.0031+6 560.103 0.0 0.0 0.0 2
3441203 013 16.0064+6 560.103 0.0 0.0 0.0 3
3441204 013 16.0123+6 560.106 0.0 0.0 0.0 4
3441205 013 16.0157+6 560.106 0.0 0.0 0.0 5
3441206 013 16.0176+6 560.106 0.0 0.0 0.0 6
3441207 013 16.0169+6 560.105 0.0 0.0 0.0 7
3441208 013 16.0155+6 560.103 0.0 0.0 0.0 8
3441209 013 16.0140+6 560.100 0.0 0.0 0.0 9
3441210 013 16.0131+6 560.099 0.0 0.0 0.0 10
3441211 013 16.0126+6 560.099 0.0 0.0 0.0 11
3441300 1
3441301 4892.4 0.0 0.0 10
3441401 0.850 0.0 1.0 1.0 10
3442001 0.939-3 11
*---------
* 7.4.1 Loop 4: Hot leg
*---------
* Component No 400
* Hot Leg of loop1 of RV outlet to gate valve
4000000 hl1-lp4 pipe
4000001 4
4000101 0.56745 4
4000201 0.56745 3
4000301 1.49 1
4000302 1.8 4
4000401 0.0 4
4000601 0.0 4
4000801 1.0-5 0.850 4
4000901 0.0 0.0 3
4001001 0000000 4
4001101 0001000 3
4001201 013 15.6154+6 588.529 0.0 0.0 0.0 1
4001202 013 15.6147+6 588.525 0.0 0.0 0.0 2
4001203 013 15.6139+6 588.525 0.0 0.0 0.0 3
4001204 013 15.6130+6 588.525 0.0 0.0 0.0 4
4001300 1
4001301 4524.8 0.0 0.0 3
4001401 0.850 0.0 1.0 1.0 3
4002001 0.939-3 4
*---------
* Component No 401
* Loop 4: Hot leg Gate Valve
4010000 hl4-mgv sngljun
4010101 400040002 402010001 0.3117 0.1 0.1 0001000
4010201 1 4525.0 0.0 0.
*---------
* Component No 402
* Hot Leg of loop4 of MGV to SG4 Inlet
4020000 hl2-lp4 pipe
4020001 3
4020101 0.56745 3
4020201 0.56745 2
4020301 1.28 1
4020302 1.052 2
4020303 1.252 3
4020401 0.0 3
4020601 0.0 1
4020602 45.0 2
4020603 45.0 3
4020701 0.0 1
4020702 0.67 2
4020703 0.87 3
4020801 1.0-6 0.850 3
4020901 0.0 0.0 1
4020902 0.052 0.052 2 * R/d = 1.58, 90 deg -> k = 0.26
4021001 0000000 3
4021101 0001000 2
4021201 013 15.5972+6 588.516 0.0 0.0 0.0 1
4021202 013 15.5945+6 588.514 0.0 0.0 0.0 2
4021203 013 15.5865+6 588.509 0.0 0.0 0.0 3
4021300 1
4021301 4525.0 0.0 0.0 2
4021401 0.850 0.0 1.0 1.0 2
4022001 0.939-3 3
*---------
* 7.4.2 SG4: Hot Collector
*---------
* Component No 410
* SG4 Hot Collector Inlet Volume
4100000 SG4-Hcin branch
4100001 2 1
4100101 0.546 0.670 0.0 0.0 90.0 0.670 1.0-5 0.834 0000000
4100200 013 15.5346+6 588.482 0.939-3
4101101 402030002 410010001 0.0 0.8575 0.8575 0001000
4102101 410010002 411010001 0.0 0.0000 0.0000 0001000
4101110 0.850 0.0 1.0 1.0
4102110 0.834 0.0 1.0 1.0
4101201 4525.0 0.0 0.0
4102201 4525.0 0.0 0.0
*---------
* Component No 411
* SG4 Hot Collector Tube conection level 1
4110000 SG4-Hcl1 branch
4110001 2 1
4110101 0.546 0.445 0.0 0.0 90.0 0.445 1.0-5 0.834 0000000
4110200 013 15.5329+6 588.481 0.939-3
4111101 411010002 412010001 0.0 0.0 0.0 0001000
4112101 411010003 421010001 0.0 0.0 0.0 0001100
4111110 0.834 0.0 1.0 1.0
4112110 0.013 0.0 1.0 1.0
4111201 4093.7 0.0 0.0
4112201 431.26 0.0 0.0
*---------
* Component No 412
* SG4 Hot Collector Tube conection level 2
4120000 SG4-Hcl2 branch
4120001 2 1
4120101 0.546 0.446 0.0 0.0 90.0 0.446 1.0-5 0.834 0000000
4120200 013 15.5400+6 588.484 0.939-3
4121101 412010002 413010001 0.0 0.0 0.0 0001000
4122101 412010003 422010001 0.0 0.0 0.0 0001100
4121110 0.834 0.0 1.0 1.0
4122110 0.013 0.0 1.0 1.0
4121201 3340.9 0.0 0.0
4122201 752.79 0.0 0.0
*---------
* Component No 413
* SG4 Hot Collector Tube conection level 3
4130000 SG4-Hcl3 branch
4130001 2 1
4130101 0.546 0.446 0.0 0.0 90.0 0.446 1.0-5 0.834 0000000
4130200 013 15.5514+6 588.490 0.939-3
4131101 413010002 414010001 0.0 0.0 0.0 0001000
4132101 413010003 423010001 0.0 0.0 0.0 0001100
4131110 0.834 0.0 1.0 1.0
4132110 0.013 0.0 1.0 1.0
4131201 2190.9 0.0 0.0
4132201 1150.1 0.0 0.0
*---------
* Component No 414
* SG4 Hot Collector Tube conection level 4
4140000 SG4-Hcl4 branch
4140001 2 1
4140101 0.546 0.464 0.0 0.0 90.0 0.464 1.0-5 0.834 0000000
4140200 013 15.5622+6 588.495 0.939-3
4141101 414010002 415010001 0.0 0.0 0.0 0001000
4142101 414010003 424010001 0.0 0.0 0.0 0001100
4141110 0.834 0.0 1.0 1.0
4142110 0.013 0.0 1.0 1.0
4141201 1002.1 0.0 0.0
4142201 1188.7 0.0 0.0
*---------
* Component No 415
* SG4 Hot Collector Tube conection level 5
4150000 SG4-Hcl5 branch
4150001 2 1
4150101 0.546 0.464 0.0 0.0 90.0 0.464 1.0-5 0.834 0000000
4150200 013 15.5663+6 588.496 0.939-3
4151101 415010002 416010001 0.0 0.0 0.0 0001000
4152101 415010003 425010001 0.0 0.0 0.0 0001100
4151110 0.834 0.0 1.0 1.0
4152110 0.013 0.0 1.0 1.0
4151201 0.0 0.0 0.0
4152201 1002.1 0.0 0.0
*---------
* Component No 416
* SG4 Hot Collector Top
4160000 SG4-Hct pipe
4160001 2
4160101 0.546 1
4160102 0.0 2
4160201 0.546 1
4160301 0.485 1
4160302 1.55 2
4160401 0.0 1
4160402 0.505 2
```

```
4160601 90.0 2
4160801 1.0-5 0.834 1
4160802 1.0-5 0.0 2
4160901 0.0 0.0 1
4161001 0000000 2
4161101 0001000 1
4161201 013 15.5642+6 582.841 0.0 0.0 0.0 1
4161202 013 15.5572+6 582.359 0.0 0.0 0.0 2
4161300 1
4161301 0.0 0.0 0.0 1
4161401 0.834 0.0 1.0 1.0 1
4162001 0.939-3 2
*---------
* 7.4.3 SG4: Tube Bundles
*---------
* Component No 421
* SG4 Tube Bundle Level 1
* 1018 Tubes; L = 10.61 m
4210000 SG4-Tbl1 pipe
4210001 5
4210101 0.13512 5
4210301 2.122 5
4210401 0.0 5
4210601 0.0 5
4210801 4.0-6 0.013 5
4210901 0.0 0.0 4
4211001 0000000 5
4211101 0001000 4
4211201 013 15.5134+6 579.939 0.0 0.0 0.0 1
4211202 013 15.4944+6 573.058 0.0 0.0 0.0 2
4211203 013 15.4757+6 567.682 0.0 0.0 0.0 3
4211204 013 15.4572+6 563.446 0.0 0.0 0.0 4
4211205 013 15.4389+6 560.160 0.0 0.0 0.0 5
4211300 1
4211301 431.26 0.0 0.0 4
4211401 0.013 0.0 1.0 1.0 4
4212001 0.939-3 5
*---------
* Component No 422
* SG4 Tube Bundle Level 2
* 1798 Tubes; L = 10.76
4220000 SG4-Tbl2 pipe
4220001 5
4220101 0.23865 5
4220301 2.152 5
4220401 0.0 5
4220601 0.0 5
4220801 4.0-6 0.013 5
4220901 0.0 0.0 4
4221001 0000000 5
4221101 0001000 4
4221201 013 15.5225+6 579.613 0.0 0.0 0.0 1
4221202 013 15.5037+6 572.570 0.0 0.0 0.0 2
4221203 013 15.4851+6 567.122 0.0 0.0 0.0 3
4221204 013 15.4668+6 562.903 0.0 0.0 0.0 4
4221205 013 15.4487+6 559.665 0.0 0.0 0.0 5
4221300 1
4221301 752.79 0.0 0.0 4
4221401 0.013 0.0 1.0 1.0 4
4222001 0.939-3 5
*---------
* Component No 423
* SG4 Tube Bundle Level 3
* 2884 Tubes; L = 11.04 m
4230000 SG4-Tbl3 pipe
4230001 5
4230101 0.3828 5
4230301 2.208 5
4230401 0.0 5
4230601 0.0 5
4230801 4.0-6 0.013 5
4230901 0.0 0.0 4
4231001 0000000 5
4231101 0001000 4
4231201 013 15.5349+6 578.989 0.0 0.0 0.0 1
4231202 013 15.5173+6 571.626 0.0 0.0 0.0 2
4231203 013 15.5000+6 566.017 0.0 0.0 0.0 3
4231204 013 15.4830+6 561.796 0.0 0.0 0.0 4
4231205 013 15.4660+6 558.595 0.0 0.0 0.0 5
4231300 1
4231301 1150.1 0.0 0.0 4
4231401 0.013 0.0 1.0 1.0 4
4232001 0.939-3 5
*---------
* Component No 424
* SG4 Tube Bundle Level 4
* 2932 Tubes; L = 11.25 m
4240000 SG4-Tbl4 pipe
4240001 5
4240101 0.38917 5
4240301 2.25 5
4240401 0.0 5
4240601 0.0 5
4240801 4.0-6 0.013 5
4240901 0.0 0.0 4
4241001 0000000 5
4241101 0001000 4
4241201 013 15.5450+6 578.958 0.0 0.0 0.0 1
4241202 013 15.5265+6 571.577 0.0 0.0 0.0 2
4241203 013 15.5084+6 565.960 0.0 0.0 0.0 3
4241204 013 15.4904+6 561.738 0.0 0.0 0.0 4
4241205 013 15.4726+6 558.538 0.0 0.0 0.0 5
4241300 1
4241301 1188.7 0.0 0.0 4
4241401 0.013 0.0 1.0 1.0 4
4242001 0.939-3 5
*---------
* Component No 425
* SG4 Tube Bundle Level 5
* 2368 Tubes; L = 11.25 m
4250000 SG4-Tbl5 pipe
4250001 5
4250101 0.31431 5
4250301 2.25 5
4250401 0.0 5
4250601 0.0 5
4250801 4.0-6 0.013 5
4250901 0.0 0.0 4
4251001 0000000 5
4251101 0001000 4
4251201 013 15.5482+6 579.411 0.0 0.0 0.0 1
4251202 013 15.5281+6 572.259 0.0 0.0 0.0 2
4251203 013 15.5083+6 566.755 0.0 0.0 0.0 3
4251204 013 15.4888+6 562.532 0.0 0.0 0.0 4
4251205 013 15.4694+6 559.304 0.0 0.0 0.0 5
4251300 1
4251301 1002.1 0.0 0.0 4
4251401 0.013 0.0 1.0 1.0 4
4252001 0.939-3 5
*---------
* 7.4.4 SG4: Cold Collector
*---------
* Component No 430
* SG4 Cold Collector Outlet Volume
4300000 SG4-Ccou branch
4300001 2 1
4300101 0.546 0.670 0.0 0.0 -90.0 -0.670 1.0-5 0.834 0000000
4300200 013 15.4307+6 559.053 0.939-3
4301101 431010002 430010001 0.0 0.0 0.0 0001000
4302101 430010002 440010001 0.0 0.0 0.0 0001100
4301110 0.834 0.0 1.0 1.0
4302110 0.850 0.0 1.0 1.0
4301201 4525.0 0.0 0.0
4302201 4525.0 0.0 0.0
*---------
* Component No 431
* SG4 Cold Collector Tube conection level 1
4310000 SG4-Ccl1 branch
4310001 2 1
4310101 0.546 0.445 0.0 0.0 -90.0 -0.445 1.0-5 0.834 0000000
4310200 013 15.4331+6 559.054 0.939-3
4311101 432010002 431010001 0.0 0.0 0.0 0001000
4312101 421050002 431010003 0.0 0.0 0.0 0001100
4311110 0.834 0.0 1.0 1.0
4312110 0.013 0.0 1.0 1.0
4311201 4093.7 0.0 0.0
4312201 431.26 0.0 0.0
*---------
* Component No 432
* SG4 Cold Collector Tube conection level 2
4320000 SG4-Ccl2 branch
4320001 2 1
4320101 0.546 0.446 0.0 0.0 -90.0 -0.446 1.0-5 0.834 0000000
4320200 013 15.4416+6 558.940 0.939-3
4321101 433010002 432010001 0.0 0.0 0.0 0001000
4322101 422050002 432010003 0.0 0.0 0.0 0001100
4321110 0.834 0.0 1.0 1.0
4322110 0.013 0.0 1.0 1.0
4321201 3340.9 0.0 0.0
4322201 752.79 0.0 0.0
*---------
* Component No 433
* SG4 Cold Collector Tube conection level 3
4330000 SG4-Ccl3 branch
4330001 2 1
4330101 0.546 0.446 0.0 0.0 -90.0 -0.446 1.0-5 0.834 0000000
4330200 013 15.4526+6 558.781 0.939-3
4331101 434010002 433010001 0.0 0.0 0.0 0001000
4332101 423050002 433010003 0.0 0.0 0.0 0001100
4331110 0.834 0.0 1.0 1.0
4332110 0.013 0.0 1.0 1.0
4331201 2190.8 0.0 0.0
4332201 1150.1 0.0 0.0
*---------
* Component No 434
* SG4 Cold Collector Tube conection level 4
4340000 SG4-Ccl4 branch
4340001 2 1
4340101 0.546 0.464 0.0 0.0 -90.0 -0.464 1.0-5 0.834 0000000
4340200 013 15.4592+6 558.884 0.939-3
4341101 435010002 434010001 0.0 0.0 0.0 0001000
4342101 424050002 434010003 0.0 0.0 0.0 0001100
4341110 0.834 0.0 1.0 1.0
4342110 0.013 0.0 1.0 1.0
4341201 1002.1 0.0 0.0
4342201 1188.7 0.0 0.0
*---------
* Component No 435
* SG4 Cold Collector Tube conection level 5
4350000 SG4-Ccl5 branch
4350001 2 1
4350101 0.546 0.464 0.0 0.0 -90.0 -0.464 1.0-5 0.834 0000000
4350200 013 15.4593+6 559.300 0.939-3
4351101 436010001 435010001 0.0 0.0 0.0 0001000
4352101 425050002 435010003 0.0 0.0 0.0 0001100
4351110 0.834 0.0 1.0 1.0
4352110 0.013 0.0 1.0 1.0
4351201 0.0 0.0 0.0
4352201 1002.1 0.0 0.0
*---------
* Component No 436
* SG4 Cold Collector Top
4360000 SG4-Cct pipe
4360001 2
4360101 0.546 1
4360102 0.0 2
4360201 0.546 1
4360301 0.485 1
4360302 1.55 2
4360401 0.0 1
4360402 0.505 2
4360601 90.0 2
4360801 1.0-5 0.834 1
4360802 1.0-5 0.0 2
4360901 0.0 0.0 1
4361001 0000000 2
4361101 0001000 1
4361201 013 15.4558+6 557.595 0.0 0.0 0.0 1
4361202 013 15.4483+6 557.433 0.0 0.0 0.0 2
4361300 1
4361301 0.0 0.0 0.0 1
4361401 0.834 0.0 1.0 1.0 1
4362001 0.939-3 2
*---------
* 7.4.5 Loop 4 Cold Leg
*---------
* Component No 440
* Seal Loop of SG4 Outlet to MCP4 Inlet
4400000 sl-lp4 pipe
4400001 9
4400101 0.56745 9
4400301 0.8 1
4400302 1.2 2
4400303 1.052 4
4400304 1.51 6
4400305 1.052 8
4400306 1.74 9
4400401 0.0 9
4400601 -90.0 2
4400602 -45.0 4
4400603 0.0 6
4400604 45.0 8
4400605 90.0 9
4400701 -0.8 1
4400702 -1.2 2
4400703 -0.67 4
4400704 0.0 6
4400705 0.67 8
4400706 1.74 9
4400801 1.0-6 0.850 9
4400901 0.0 0.0 2
4400902 0.052 0.052 3 * R/d = 1.58, 90 deg -> k = 0.26
4400903 0.0 0.0 6
4400904 0.052 0.052 7 * R/d = 1.58, 90 deg -> k = 0.26
4400905 0.0 0.0 8
4401001 0000000 9
4401101 0001000 8
4401201 013 15.4392+6 559.056 0.0 0.0 0.0 1
4401202 013 15.4462+6 559.058 0.0 0.0 0.0 2
4401203 013 15.4528+6 559.059 0.0 0.0 0.0 3
4401204 013 15.4552+6 559.060 0.0 0.0 0.0 4
4401205 013 15.4572+6 559.059 0.0 0.0 0.0 5
4401206 013 15.4567+6 559.059 0.0 0.0 0.0 6
4401207 013 15.4538+6 559.057 0.0 0.0 0.0 7
4401208 013 15.4463+6 559.054 0.0 0.0 0.0 8
4401209 013 15.4370+6 559.050 0.0 0.0 0.0 9
4401300 1
4401301 4525.0 0.0 0.0 8
4401401 0.850 0.0 1.0 1.0 8
4402001 0.939-3 9
*---------
* 7.4.6 Main Circulation Pump 4
*---------
* Component No 441
* MCP#4
4410000 MCP#4 pump
4410101 0.0 5.287 3.0 0.0 0.0 0.0 0000000
4410108 440090002 0.0 0.0 0.0 0000100
4410109 442010001 0.0 0.0 0.0 0000100
4410200 013 15.7242+6 559.204 0.939-3
4410201 1 4525.0 0.0 0.0
4410202 1 4525.0 0.0 0.0
4410301 141 -1 -3 -1 0 615 0
4410302 104.72 1.0 6.057 84.0 47511. 7500. 747.0 0.0 0.0 0.0
0.0 0.0
*---------
* 7.4.6.1 Table pump velocity
*---------
4416100 0 curvar 441
4416101 0.0 0.0
4416102 500.0 500.0
*---------
* 7.4.7 Loop 4 Cold Leg of MCP to RV
```

```
*------------------
* Component No 442
* Cold leg of MCP#1 to Cold leg MGV
4420000 cll-lp4 pipe
4420001 2
4420101 0.56745 2
4420301 2.1075 2
4420401 0.0 2
4420601 0.0 2
4420701 0.0 2
4420801 1.0-5 0.850 2
4420901 0.0 0.0 1
4421001 0000000 2
4421101 0001000 1
4421201 013 16.0178+6 559.305 0.0 0.0 0.0 1
4421202 013 16.0169+6 559.305 0.0 0.0 0.0 2
4421300 1
4421301 4525.0 0.0 0.0 1
4421401 0.850 0.0 1.0 1.0 1
4422001 0.939-3 2
*------------------
* Component No 443
* Loop 4: Cold leg Gate Valve
4430000 cl4-mgv sngljun
4430101 442020002 444010001 0.3117 0.1 0.1 0001000
4430201 1 4525.0 0.0 0.
*------------------
* Component No 444
* Cold leg of Cold leg MGV to RV
4440000 cl2-lp4 pipe
4440001 11
4440101 0.56745 11
4440301 1.5 1
4440302 1.052 2
4440303 1.252 4
4440304 1.052 5
4440305 1.528 6
4440306 2.5 7
4440307 4.5 8
4440308 3.5 9
4440309 1.25 11
4440401 0.0 11
4440601 0.0 1
4440602 -45.0 5
4440603 0.0 11
4440701 0.0 1
4440702 -0.67 2
4440703 -0.87 4
4440704 -0.67 5
4440705 0.0 11
4440801 1.0-6 0.850 11
4440901 0.0 0.0 1
4440902 0.052 0.052 2
4440903 0.0 0.0 3
4440904 0.052 0.052 4
4440905 0.0 0.0 10
4441001 0000000 11
4441101 0001000 10
4441201 013 16.0023+6 559.299 0.0 0.0 0.0 1
4441202 013 16.0043+6 559.299 0.0 0.0 0.0 2
4441203 013 16.0074+6 559.299 0.0 0.0 0.0 3
4441204 013 16.0135+6 559.301 0.0 0.0 0.0 4
4441205 013 16.0166+6 559.302 0.0 0.0 0.0 5
4441206 013 16.0186+6 559.302 0.0 0.0 0.0 6
4441207 013 16.0180+6 559.300 0.0 0.0 0.0 7
4441208 013 16.0168+6 559.297 0.0 0.0 0.0 8
4441209 013 16.0155+6 559.295 0.0 0.0 0.0 9
4441210 013 16.0147+6 559.293 0.0 0.0 0.0 10
4441211 013 16.0143+6 559.293 0.0 0.0 0.0 11
4441300 1
4441301 4525.0 0.0 0.0 10
4441401 0.850 0.0 1.0 1.0 10
4442001 0.939-3 11
*------------------
* 8. Pressurizer, Surge and Spray Lines
*------------------
* 8.1 Pressurizer Surge
*------------------
* Component No 501
* PRZ surge line connction with Loop 4
5010000 prz-hl4 sngljun
5010101 400040002 502010001 0.094 2.64 1.85 0001100
5010201 1 0.0 0.0 0.0
*------------------
* Component No 502
* Pressurizer Surge line
5020000 prz-sl pipe
5020001 8
5020101 0.094 8
5020301 2.015 1
5020302 1.335 2
5020303 1.433 3
5020304 2.670 4
5020305 2.452 5
5020306 3.0 7
5020307 3.14 8
5020401 0.0 8
5020601 -45.0 1
5020602 -45.0 2
5020603 -90.0 3
5020604 -90.0 4
5020605 0.0 7
5020606 90.0 8
5020701 -1.42 1
5020702 -1.207 2
5020703 -1.433 3
5020704 -1.7 4
5020705 0.0 7
5020706 2.17 8
5020801 1.0-5 0.346 8
5020901 0.18 0.18 1 * R/d = 4.9, 90 -> k = 0.18
5020902 0.0 0.0 2
5020903 0.18 0.18 3 * R/d = 4.9, 90 -> k = 0.18
5020904 0.0 0.0 6
5020905 0.18 0.18 7 * R/d = 4.9, 90 -> k = 0.18
5021001 0000000 8
5021101 0001000 7
5021201 013 15.6638+6 588.634 0.0 0.0 0.0 1
5021202 013 15.6728+6 588.869 0.0 0.0 0.0 2
5021203 013 15.6817+6 589.283 0.0 0.0 0.0 3
5021204 013 15.6923+6 590.037 0.0 0.0 0.0 4
5021205 013 15.6981+6 591.779 0.0 0.0 0.0 5
5021206 013 15.6982+6 595.008 0.0 0.0 0.0 6
5021207 013 15.6982+6 600.572 0.0 0.0 0.0 7
5021208 013 15.6915+6 608.154 0.0 0.0 0.0 8
5021300 1
5021301 0.0 0.0 0.0 7
5021401 0.346 0.0 1.0 1.0 7
5022001 0.939-3 8
*------------------
* Component No 503
* PRZ surge line connction with Loop 4
5030000 prz-hl4 sngljun
5030101 502080002 504010001 0.094 0.0 0.0 0001100
5030201 1 0.0 0.0 0.0
*------------------
* 8.2 Pressurizer Tank
*------------------
* Component No 504
* Pressurizer Tank
5040000 PRZ pipe
5040001 10
5040101 0.0000 10
5040301 0.970 1 * below heaters
5040302 0.550 2 * PRZ heaters
5040303 1.000 3 * above heaters
5040304 1.400 9 *
5040305 0.880 10 * top part
* ----
* 11.8 m
5040401 4.652 1
5040402 3.887 2
5040403 7.069 3
5040404 9.896 9
5040405 4.016 10
* ----
* 79 cub. m
5040601 90.0 10
5040801 1.0-5 0.0 1
5040802 1.0-5 3.0 9
5040803 1.0-5 0.0 10
5040901 0.0 0.0 9
5041001 0000000 10
5041101 0001000 9
5041201 013 15.6819+6 616.164 0.0 0.0 0.0 1
5041202 013 15.6774+6 617.881 0.0 0.0 0.0 2
5041203 013 15.6729+6 617.994 0.0 0.0 0.0 3
5041204 013 15.6659+6 617.997 0.0 0.0 0.0 4
5041205 013 15.6577+6 617.987 0.0 0.0 0.0 5
5041206 013 15.6495+6 617.783 0.0 0.0 0.0 6
5041207 013 15.6413+6 615.043 0.0 0.0 0.0 7
* Level 8.77 m
5041208 000 15.6347+6 1.4607+6 2.4446+6 0.56381 0.0 8
5041209 002 15.6316+6 1.000 0.0 0.0 0.0 9
5041210 002 15.6304+6 1.000 0.0 0.0 0.0 10
5041300 1
5041301 0.0 0.0 0.0 9
5041401 3.0 0.0 1.0 1.0 9
5042001 0.939-3 7
5042002 0.939-3 10
*------------------
* 8.3 Pressurizer Stady State Controllers
*------------------
* Component No 505
* PRZ Pressure Controller Valve
5050000 prz-p valve
5050101 504100002 506000000 0.0 0.0 0.0 0001000
5050201 1 0.0 0.0 0.0
5050300 trpvlv
5050301 601
*------------------
* Component No 506
* PRZ Pressure Boundary Volume
5060000 prz-p tmdpvol
5060101 0.0 1.0 1.0 0.0 0.0 0.0 1.-5 0.0 0000000
5060200 002 0 cntrlvar 500
5060201 15.0+6 15.0+6 1.0
5060202 16.0+6 16.0+6 1.0
*------------------
* Component No 508
* PRZ Level Boundary Volume
5080000 prz-l tmdpvol
5080101 0.0 10.0 70.0 0.0 0.0 0.0 1.-5 0.0 0000000
5080200 001
5080201 0.0 593.0 0.0
*------------------
* Component No 509
* PRZ Level Controller
5090000 prz-l tmdpjun
5090101 508000000 504010001 0.0
5090200 1 0 cntrlvar 509
5090201 -1.00 -1000.0 0.0 0.0
5090202 -0.05 -5.0 0.0 0.0
5090203 0.00 0.0 0.0 0.0
5090204 0.05 5.0 0.0 0.0
5090205 1.0 1000.0 0.0 0.0
*------------------
* 9. Secondary Side
*------------------
* 9.1 Feedwater Line for Loop 1
*------------------
* Component No 150
* Feedwater Boundary Volume for Loop 1
1500000 FWT-11 tmdpvol
1500101 0.196 1.0 0.0 0.0 0.0 0.0 1.-5 0.0 0000000
1500200 003 602
1500201 -1.0 7.056+6 437.25
1500202 0.0 7.056+6 437.25
*------------------
* Component No 151
* Loop 1 Feedwater pump
1510000 SG1-FW tmdpjun
1510101 150000000 152010001 0.0
1510200 1
1510201 0.0 345.6 0.0 0.0
*------------------
* Component No 152
*crdno name type
1520000 FW-SG1 pipe
1520001 1
1520101 0.06469 1
1520301 2.0 1
1520601 0.0 1
1520801 1.0-5 0.0 1
1521001 0010000 1
1521201 003 5.95496+6 437.117 0.0 0.0 0.0 1
*------------------
* Component No 153
* Feedwater line connetcion to SG1
1530000 j200-202 sngljun
1530101 152010002 166010001 0.0 5.0 20.0 0001000
1530201 1 345.60 0.0 0.0
*------------------
* 9.2 SG#1 Secondary Side
*------------------
* Component No 161
* SG#1 Tube bundles Level 1
1610000 sg1-Tl1 branch
1610001 1 0
1610101 0.0 0.445 3.0 0.0 90.0 0.445 1.0-5 0.015 0000100
1610200 000 5.90065+6 1.1960+6 2.5909+6 0.21384
1611101 161010002 162010001 0.0 0.0 0.0 0001000
1611110 0.015 0.0 1.0 1.0
1611201 0.29589 0.77050 0.0
*------------------
* Component No 162
* SG#1 Tube bundles Level 2
1620000 sg1-Tl2 branch
1620001 1 0
1620101 0.0 0.446 5.94 0.0 90.0 0.446 1.0-5 0.015 0000100
1620200 000 5.89811+6 1.1982+6 2.5910+6 0.30530
1621101 162010002 163010001 0.0 0.0 0.0 0001000
1621110 0.015 0.0 1.0 1.0
1621201 0.32523 0.82842 0.0
*------------------
* Component No 163
* SG#1 Tube bundles Level 3
1630000 sg1-Tl3 branch
1630001 1 0
1630101 0.0 0.446 8.97 0.0 90.0 0.446 1.0-5 0.015 0000100
1630200 000 5.89588+6 1.1997+6 2.5910+6 0.41187
1631101 163010002 164010001 0.0 0.0 0.0 0001000
1631110 0.015 0.0 1.0 1.0
1631201 0.32240 0.86114 0.0
*------------------
* Component No 164
* SG#1 Tube bundles Level 4
1640000 sg1-Tl4 branch
1640001 1 0
1640101 0.0 0.464 9.4 0.0 90.0 0.464 1.0-5 0.015 0000100
1640200 000 5.89392+6 1.2000+6 2.5911+6 0.51323
1641101 164010002 165010001 0.0 0.0 0.0 0001000
1641110 0.015 0.0 1.0 1.0
1641201 0.35684 1.0339 0.0
*------------------
* Component No 165
* SG#1 Tube bundles Level 5
1650000 sg1-Tl5 branch
1650001 1 0
1650101 0.0 0.464 9.93 0.0 90.0 0.464 1.0-5 0.015 0000100
1650200 000 5.89213+6 1.1999+6 2.5911+6 0.53938
1651101 165010002 166010001 0.0 0.0 0.0 0001000
1651110 0.015 0.0 1.0 1.0
```

```
1651201 0.27069 1.0558 0.0
*-----------
* Component No 166
* SG#1 Volume between tube bundle and perforated sheete
1660000 sg1-l6 branch
1660001 1 0
1660101 0.0 0.245 10.71 0.0 90.0 0.245 1.0-5 0.0 0001000
1660200 000 5.89119+6 1.1352+6 2.5911+6 0.93583
1661101 166010002 167010001 2.5 0.0 0.0 1001100
1661110 0.013 0.0 1.0 1.0
1661201 0.28431 0.29528 0.0
*-----------
* Component No 167
* SG#1 Volume above perforated sheete
1670000 sg1-l7 snglvol
1670101 0.0 0.650 28.558 0.0 90.0 0.650 1.0-5 0.0 0001000
1670200 000 5.88704+6 1.1862+6 2.5911+6 0.34728
*-----------
* Component No 168
* SG#1 Separator
1680000 sg1-sep separatr
1680001 3 0
1680101 0.0 0.260 10.09 0.0 90.0 0.260 1.0-5 0.0 0000000
1680200 000 5.88491+6 1.1978+6 2.5911+6 0.49884
1681101 168010002 169010001 0.0 0.0 0.0 0001100 * 0.35
1682101 168010001 177010002 0.0 0.0 0.0 0001100 * 0.05
1683101 167010002 168010001 0.0 0.0 0.0 0001100
1681110 0.0 0.0 1.0 1.0
1682110 0.0 0.0 1.0 1.0
1683110 0.0 0.0 1.0 1.0
1681201 0.18819 0.64312 0.0
1682201 2.4662 2.5885 0.0
1683201 5.25354-3 0.84002 0.0
*-----------
* Component No 169
* SG#1 Steam dom
1690000 sg1-sd branch
1690001 1 1
1690101 0.0 0.580 10.21 0.0 90.0 0.580 1.0-5 0.0 0001000
1690200 002 5.88432+6 1.0
1691101 169010002 180010001 0.0 0.1 0.1 0001100
1691110 0.187 0.0 1.0 1.0
1691201 0.0 346.85 0.0
*-----------
* Component No 171
* SG#1 Side channels in the of tube bundles Level 1
1710000 sg1-sl1 branch
1710001 2 0
1710101 0.0 0.445 3.99 0.0 90.0 0.445 1.0-5 0.2 0001000
1710200 000 5.90192+6 1.1824+6 2.5910+6 4.73308-2
1711101 171010002 172010001 0.0 0.0 0.0 0001100
1712101 171010004 161010003 0.0 0.4 0.4 0001100
1711110 0.2 0.0 1.0 1.0
1712110 0.0334 0.0 1.0 1.0
1711201 -0.20947 -0.10215 0.0
1712201 1.6391 1.7705 0.0
*-----------
* Component No 172
* SG#1 Side channels in the of tube bundles Level 2
1720000 sg1-sl2 branch
1720001 2 0
1720101 0.0 0.446 4.1 0.0 90.0 0.446 1.0-5 0.2 0001000
1720200 000 5.89886+6 1.1804+6 2.5910+6 0.15053
1721101 172010002 173010001 0.0 0.0 0.0 0001100
1722101 172010004 162010003 0.0 0.4 0.4 0001100
1721110 0.2 0.0 1.0 1.0
1722110 0.0334 0.0 1.0 1.0
1721201 -0.42569 -0.32527 0.0
1722201 1.4781 1.6771 0.0
*-----------
* Component No 173
* SG#1 Side channels in the of tube bundles Level 3
1730000 sg1-sl3 branch
1730001 3 0
1730101 0.0 0.446 6.38 0.0 90.0 0.446 1.0-5 0.2 0001000
1730200 000 5.89608+6 1.1765+6 2.5911+6 0.21108
1731101 173010002 174010001 0.0 0.0 0.0 0001100
1732101 173010004 163010003 0.0 0.4 0.4 0001100
1733101 173010002 178010001 0.0 0.0 0.0 0001100
1731110 0.2 0.0 1.0 1.0
1732110 0.0334 0.0 1.0 1.0
1733110 0.1 0.0 1.0 1.0
1731201 -0.18703 -3.14247-2 0.0
1732201 0.78793 1.0303 0.0
1733201 -0.89402 -0.31244 0.0
*-----------
* Component No 174
* SG#1 Channels between SG side wall and sheet vertical wall
1740000 sg1-sl4 branch
1740001 1 0
1740101 0.0 0.464 2.3 0.0 90.0 0.464 1.0-5 0.2 0001000
1740200 000 5.89318+6 1.1945+6 2.5911+6 8.55498-2
1741101 174010002 175010001 0.0 0.0 0.0 0001100
1741110 0.2 0.0 1.0 1.0
1741201 -0.22528 -1.94714-2 0.0
*-----------
* Component No 175
* SG#1 Channels between SG side wall and sheet vertical wall
level 2
1750000 sg1-sl5 branch
1750001 1 0
1750101 0.0 0.464 3.88 0.0 90.0 0.464 1.0-5 0.2 0001000
1750200 000 5.89046+6 1.1921+6 2.5911+6 0.36046
1751101 175010002 176010001 0.0 0.0 0.0 0001100
1751110 0.2 0.0 1.0 1.0
1751201 -0.51623 -3.57991-2 0.0
*-----------
* Component No 176
* SG#1 Channels between SG side wall and sheet vertical wall
level 3
1760000 sg1-sl6 branch
1760001 1 0
1760101 0.0 0.245 1.0 0.0 90.0 0.245 1.0-5 0.2 0001000
1760200 000 5.88899+6 1.1867+6 2.5911+6 0.66340
1761101 176010002 167010001 0.0 0.0 0.0 0001100
1761110 0.2 0.0 1.0 1.0
1761201 -0.26629 -7.17213-2 0.0
*-----------
* Component No 177
* SG#1 Channels between SG side wall and sheet vertical wall
level 4
1770000 sg1-sl7 branch
1770001 1 0
1770101 0.0 1.359 0.072 0.0 90.0 1.359 1.0-5 0.05 0001000
1770200 000 5.88681+6 1.1984+6 2.5911+6 1.29266-2
1771101 174010002 177010001 0.0 0.0 0.0 0001100
1771110 0.05 0.0 1.0 1.0
1771201 -2.5004 0.27893 0.0
*-----------
* Component No 178
* SG#1 Channels between Tube bundle and sheet vertical wall
* and channel in the middle level 1
1780000 sg1-sl8 branch
1780001 2 0
1780101 0.0 0.464 3.75 0.0 90.0 0.464 1.0-5 0.2 0001000
1780200 000 5.89389+6 1.1621+6 2.5911+6 0.56590
1781101 178010002 179010001 0.0 0.0 0.0 0001100
1782101 178010004 164010003 0.0 0.4 0.4 0001100
1781110 0.2 0.0 1.0 1.0
1782110 0.0334 0.0 1.0 1.0
1781201 -0.70259 -0.30212 0.0
1782201 -0.23940 -0.62467 0.0
*-----------
* Component No 179
* SG#1 Channels between Tube bundle and sheet vertical wall
* and channel in the middle level 2
1790000 sg1-sl9 branch
1790001 2 0
1790101 0.0 0.464 4.72 0.0 90.0 0.464 1.0-5 0.2 0001000
1790200 000 5.89157+6 1.1583+6 2.5911+6 0.47277
1791101 179010002 166010001 0.0 0.0 0.0 0001100
1792101 179010004 165010003 0.0 0.4 0.4 0001100
1791110 0.2 0.0 1.0 1.0
1792110 0.0334 0.0 1.0 1.0
1791201 -3.4523 7.27886-2 0.0
1792201 -1.1901 -2.6437 0.0
*-----------
* 9.3 SG#1 Steam Line
*-----------
* Component No 180
* SG#1 Steam Outlet Pipe
1800000 SG1/Stp pipe
1800001 1
1800101 0.274646 1
1800301 2.79 1
1800401 0.0 1
1800601 90.0 1
1800801 1.0-5 0.187 1
1801001 0010000 1
1801201 002 5.84345+6 1.0 0.0 0.0 0.0 1
*-----------
* Component No 181
* SG1 Steam Out
1810000 jl80-182 sngljun
1810101 180010002 182010003 0.0 0.0 0.0 0001100
1810201 1 0.0 346.84 0.0
*-----------
* Component No 182
* SG1 Steam Header
1820000 SG1/StH pipe
1820001 2
1820101 0.2206 2
1820301 5.67 2
1820401 0.0 2
1820601 0.0 2
1820801 1.0-5 0.530 2
1820901 0.0 0.0 1
1821001 0010000 2
1821101 0001000 1
1821201 002 5.84599+6 1.0 0.0 0.0 0.0 1
1821202 002 5.80197+6 1.0 0.0 0.0 0.0 2
1821300 1
1821301 0.0 346.77 0.0 1
*-----------
* Component No 183
* SG1 Header Steam Line connection
1830000 SL1-out sngljun
1830101 182020002 184010001 0.2206 0.0 0.0 0001000
1830201 1 0.0 346.66 0.0
*-----------
* Component No 184
* Steam line of SG1 header to FIV
* Length = 68.8 m, Flow area = 0.2642 sq.m
1840000 SG1/Stl1 pipe
1840001 6
1840101 0.2642 6
1840301 5.0 1
1840302 9.0 2
1840303 16.3 4
1840304 8.2 5
1840305 14.0 6
1840401 0.0 6
1840601 0.0 4
1840602 -36.0 5
1840603 0.0 6
1840701 0.0 4
1840702 -4.8 5
1840703 0.0 6
1840801 1.0-5 0.58 6
1840901 0.0 0.0 5
1841001 0010000 6
1841101 0001000 5
1841201 002 5.81069+6 1.0 0.0 0.0 0.0 1
1841202 002 5.80770+6 1.0 0.0 0.0 0.0 2
1841203 002 5.80205+6 1.0 0.0 0.0 0.0 3
1841204 002 5.79478+6 1.0 0.0 0.0 0.0 4
1841205 002 5.79007+6 1.0 0.0 0.0 0.0 5
1841206 002 5.78564+6 1.0 0.0 0.0 0.0 6
1841300 1
1841301 0.0 345.02 0.0 5
*-----------
* Component No 185
* SG1 Pressure Regulated Valve
1850000 SG1/PRV valve
1850101 184060002 186010001 0.2642 1.0 1.0 0000100
1850201 1 0.0 344.95 0.
1850300 mrvlv
1850301 702 701 0.05 0.48750
*-----------
* Component No 186
* SG#1 Steam Line to the MSIV
* Length = 6.0 m, Flow area = 0.2642 sq.m
1860000 St-ln1 pipe
1860001 1
1860101 0.2642 1
1860301 6.0 1
1860401 0.0 1
1860601 90.0 1
1860701 6.0 1
1860801 1.0-5 0.58 1
1861001 0010000 1
1861201 002 5.62668+6 1.0 0.0 0.0 0.0 1
*-----------
* Component No 187
* MSIV for SG1
1870000 MSIV1 valve
1870101 186010002 194010001 0.2642 1.0 1.0 0000100
1870201 1 0.0 344.95 0.
1870300 mrvlv
1870301 402 501 0.125 1.0
*-----------
* 9.4 SG1 BRU-A
*-----------
* Component No 189
* BRU-A1
1890000 BRU-A1 valve
1890101 184050002 190000000 0.02236 1.0 1.0 0000120
1890201 1 0.0 0.0 0.
1890300 mrvlv
1890301 603 604 0.0666666667 0.0
*-----------
* Component No 190
* Atmospher
1900000 atm tmdpvol
1900101 8.0 0.0 70.0 0.0 0.0 0.0 5.-6 0.0 0000000
1900200 002
1900201 0.0 1.05+5 1.0
*-----------
* 9.4.1 SG1 In-house
*-----------
* Component No 191
* SG#1 In-house
1910000 BRU-In1 valve
1910101 184050002 192000000 0.02236 1.0 1.0 0000120
1910201 1 0.0 0.0 0.
1910300 mrvlv
1910301 712 711 0.0666666667 0.0
*-----------
* Component No 192
* In-House
1920000 In-h#1 tmdpvol
1920101 8.0 0.0 70.0 0.0 0.0 0.0 5.-6 0.0 0000000
1920200 002
1920201 0.0 5.76158+6 1.0
*-----------
* 9.4.2 Common Steam Line
*-----------
* Component No 194
* Common Steam Line of MSIV to Turbine
* Length = 6.0 m, Flow area = 4 * 0.2642 sq.m
1940000 St-ln pipe
1940001 1
1940101 1.0568 1
```

```
1940301 6.0 1
1940401 0.0 1
1940601 90.0 1
1940701 6.0 1
1940801 1.0-5 0.58 1
1941001 0010000 1
1941201 002 5.62668+6 1.0 0.0 0.0 0.0 1
*----------
* Component No 195
* Common Steam Line Outlet
1950000 Stl-j sngljun
1950101 194010002 196000000 0.0 0.0 0.0 0001000
1950201 1 0.0 1404.93 0.0
*----------
* Component No 196
* Turbine
1960000 Turbin tmdpvol
1960101 8.0 0.0 70.0 0.0 0.0 0.0 0.5-5 0.0 0000000
1960200 002
1960201 0.0 5.6+6 1.0
*----------
* 9.5 Feedwater Line for Loop 2
*----------
* Component No 250
* Feedwater Boundary Volume for Loop 2
2500000 FWT-l2 tmdpvol
2500101 0.196 1.0 0.0 0.0 0.0 0.0 1.-5 0.0 0000000
2500200 003 602
2500201 -1.0 7.056+6 436.25
2500202 0.0 7.056+6 436.25
*----------
* Component No 251
* Loop 2 Feedwater pump
2510000 SG2-FW tmdpjun
2510101 250000000 252010001 0.0
2510200 1
2510201 0.0 345.0 0.0 0.0
*----------
* Component No 252
* Feedwater line of Servo Valve to the SG#2
2520000 FW-SG2 pipe
2520001 1
2520101 0.06469 1
2520301 2.0 1
2520601 0.0 1
2520801 1.0-5 0.0 1
2521001 0010000 1
2521201 003 5.93360+6 436.115 0.0 0.0 0.0 1
*----------
* Component No 253
* Feedwater line connetcion to SG2
2530000 j252-266 sngljun
2530101 252010002 266010001 0.0 5.0 20.0 0001000
2530201 1 345.0 0.0 0.0
*
*
*
*
*----------
* 9.6 SG#2 Secondary Side
*----------
* Component No 261
* SG#2 Tube bundles Level 1
2610000 sg2-Tl1 branch
2610001 1 0
2610101 0.0 0.445 3.0 0.0 90.0 0.445 1.0-5 0.015 0000100
2610200 000 5.87924+6 1.1970+6 2.5911+6 0.23102
2611101 261010002 262010001 0.0 0.0 0.0 0001000
2611110 0.015 0.0 1.0 1.0
2611201 0.29146 0.77492 0.0
*----------
* Component No 262
* SG#2 Tube bundles Level 2
2620000 sg2-Tl2 branch
2620001 1 0
2620101 0.0 0.446 5.94 0.0 90.0 0.446 1.0-5 0.015 0000100
2620200 000 5.87676+6 1.1984+6 2.5912+6 0.32243
2621101 262010002 263010001 0.0 0.0 0.0 0001000
2621110 0.015 0.0 1.0 1.0
2621201 0.31746 0.83240 0.0
*----------
* Component No 263
* SG#2 Tube bundles Level 3
2630000 sg2-Tl3 branch
2630001 1 0
2630101 0.0 0.446 8.97 0.0 90.0 0.446 1.0-5 0.015 0000100
2630200 000 5.87460+6 1.1988+6 2.5912+6 0.43894
2631101 263010002 264010001 0.0 0.0 0.0 0001000
2631110 0.015 0.0 1.0 1.0
2631201 0.27082 0.83983 0.0
*----------
* Component No 264
* SG#2 Tube bundles Level 4
2640000 sg2-Tl4 branch
2640001 1 0
2640101 0.0 0.464 9.4 0.0 90.0 0.464 1.0-5 0.015 0000100
2640200 000 5.87273+6 1.1988+6 2.5912+6 0.52829
2641101 264010002 265010001 0.0 0.0 0.0 0001000
2641110 0.015 0.0 1.0 1.0
2641201 0.25579 0.95584 0.0
*----------
* Component No 265
* SG#2 Tube bundles Level 5
2650000 sg2-Tl5 branch
2650001 1 0
2650101 0.0 0.464 9.93 0.0 90.0 0.464 1.0-5 0.015 0000100
2650200 000 5.87102+6 1.1987+6 2.5912+6 0.56136
2651101 265010002 266010001 0.0 0.0 0.0 0001000
2651110 0.015 0.0 1.0 1.0
2651201 0.19973 1.0223 0.0
*----------
* Component No 266
* SG#2 Volume between tube bundle and perforated sheete
2660000 sg2-l6 branch
2660001 1 0
2660101 0.0 0.245 10.71 0.0 90.0 0.245 1.0-5 0.0 0001000
2660200 000 5.87007+6 1.1161+6 2.5914+6 0.88965
2661101 266010002 267010001 2.5 0.0 0.0 1001100
2661110 0.013 0.0 1.0 1.0
2661201 0.30820 0.32135 0.0
*----------
* Component No 267
* SG#2 Volume above perforated sheete
2670000 sg2-l7 snglvol
2670101 0.0 0.650 28.558 0.0 90.0 0.650 1.0-5 0.0 0001000
2670200 000 5.86430+6 1.1730+6 2.5913+6 0.34157
*----------
* Component No 268
* SG#2 Separator
2680000 sg2-sep separatr
2680001 3 0
2680101 0.0 0.260 10.09 0.0 90.0 0.260 1.0-5 0.0 0000000
2680200 000 5.86217+6 1.1943+6 2.5914+6 0.56668
2681101 268010002 269010001 0.0 0.0 0.0 0001100 * 0.4
2682101 268010001 277010002 0.0 0.0 0.0 0001100 * 0.1
2683101 267010002 268010001 0.0 0.0 0.0 0001100
2681110 0.0 0.0 1.0 1.0
2682110 0.0 0.0 1.0 1.0
2683110 0.0 0.0 1.0 1.0
2681201 0.14833 0.65077 0.0
2682201 2.0077 2.1470 0.0
2683201 9.16702-3 0.85815 0.0
*----------
* Component No 269
* SG#2 Steam dom
2690000 sg2-sd branch
2690001 1 1
2690101 0.0 0.580 10.21 0.0 90.0 0.580 1.0-5 0.0 0001000
2690200 002 5.86164+6 1.0
2691101 269010002 280010001 0.0 0.1 0.1 0001100
2691110 0.187 0.0 1.0 1.0
2691201 0.0 343.95 0.0
*----------
* Component No 271
* SG#2 Side channels in the of tube bundles Level 1
2710000 sg2-sl1 branch
2710001 2 0
2710101 0.0 0.445 3.99 0.0 90.0 0.445 1.0-5 0.2 0001000
2710200 000 5.88008+6 1.1873+6 2.5912+6 5.36907-2
2711101 271010002 272010001 0.0 0.0 0.0 0001100
2712101 271010004 261010003 0.0 0.4 0.4 0001100
2711110 0.2 0.0 1.0 1.0
2712110 0.0334 0.0 1.0 1.0
2711201 -0.20479 -9.22926-2 0.0
2712201 1.5919 1.7005 0.0
*----------
* Component No 272
* SG#2 Side channels in the of tube bundles Level 2
2720000 sg2-sl2 branch
2720001 2 0
2720101 0.0 0.446 4.1 0.0 90.0 0.446 1.0-5 0.2 0001000
2720200 000 5.87705+6 1.1853+6 2.5912+6 0.15728
2721101 272010002 273010001 0.0 0.0 0.0 0001100
2722101 272010004 262010003 0.0 0.4 0.4 0001100
2721110 0.2 0.0 1.0 1.0
2722110 0.0334 0.0 1.0 1.0
2721201 -0.40379 -0.30190 0.0
2722201 1.3931 1.5853 0.0
*----------
* Component No 273
* SG#2 Side channels in the of tube bundles Level 3
2730000 sg2-sl3 branch
2730001 3 0
2730101 0.0 0.446 6.38 0.0 90.0 0.446 1.0-5 0.2 0001000
2730200 000 5.87429+6 1.1819+6 2.5912+6 0.21403
2731101 273010002 274010001 0.0 0.0 0.0 0001100
2732101 273010004 263010003 0.0 0.4 0.4 0001100
2733101 273010002 278010001 0.0 0.0 0.0 0001100
2731110 0.2 0.0 1.0 1.0
2732110 0.0334 0.0 1.0 1.0
2733110 0.1 0.0 1.0 1.0
2731201 -0.21958 -7.71092-2 0.0
2732201 0.25127 0.36754 0.0
2733201 -0.64526 -0.23813 0.0
*----------
* Component No 274
* SG#2 Channels between SG side wall and sheet vertical wall
2740000 sg2-sl4 branch
2740001 1 0
2740101 0.0 0.464 2.3 0.0 90.0 0.464 1.0-5 0.2 0001000
2740200 000 5.87144+6 1.1870+6 2.5912+6 0.12115
2741101 274010002 275010001 0.0 0.0 0.0 0001100
2741110 0.2 0.0 1.0 1.0
2741201 -0.22583 -5.05943-2 0.0
*----------
* Component No 275
* SG#2 Channels between SG side wall and sheet vertical wall level 2
2750000 sg2-sl5 branch
2750001 1 0
2750101 0.0 0.464 3.88 0.0 90.0 0.464 1.0-5 0.2 0001000
2750200 000 5.86850+6 1.1839+6 2.5913+6 0.19773
2751101 275010002 276010001 0.0 0.0 0.0 0001100
2751110 0.2 0.0 1.0 1.0
2751201 -0.36765 -0.12214 0.0
*----------
* Component No 276
* SG#2 Channels between SG side wall and sheet vertical wall level 3
2760000 sg2-sl6 branch
2760001 1 0
2760101 0.0 0.245 1.0 0.0 90.0 0.245 1.0-5 0.2 0001000
2760200 000 5.86650+6 1.1761+6 2.5913+6 0.38923
2761101 276010002 267010001 0.0 0.0 0.0 0001100
2761110 0.2 0.0 1.0 1.0
2761201 -0.33377 -0.19000 0.0
*----------
* Component No 277
* SG#2 Channels between SG side wall and sheet vertical wall level 4
2770000 sg2-sl7 branch
2770001 1 0
2770101 0.00 1.359 0.072 0.0 90.0 1.359 1.0-5 0.05 0001000
2770200 000 5.86479+6 1.1943+6 2.5913+6 5.70662-2
2771101 274010002 277010001 0.0 0.0 0.0 0001100
2771110 0.05 0.0 1.0 1.0
2771201 -2.1061 -0.28215 0.0
*----------
* Component No 278
* SG#2 Channels between Tube bundle and sheet vertical wall
* and channel in the middle level 1
2780000 sg2-sl8 branch
2780001 2 0
2780101 0.0 0.464 3.75 0.0 90.0 0.464 1.0-5 0.2 0001000
2780200 000 5.87223+6 1.1679+6 2.5914+6 0.59726
2781101 278010002 279010001 0.0 0.0 0.0 0001100
2782101 278010004 264010003 0.0 0.4 0.4 0001100
2781110 0.2 0.0 1.0 1.0
2782110 0.0334 0.0 1.0 1.0
2781201 -0.45278 -9.11490-2 0.0
2782201 -0.95366 -1.7357 0.0
*----------
* Component No 279
* SG#2 Channels between Tube bundle and sheet vertical wall
* and channel in the middle level 2
2790000 sg2-sl9 branch
2790001 2 0
2790101 0.0 0.464 4.72 0.0 90.0 0.464 1.0-5 0.2 0001000
2790200 000 5.87083+6 1.1513+6 2.5914+6 0.66511
2791101 279010002 266010001 0.0 0.0 0.0 0001100
2792101 279010004 265010003 0.0 0.4 0.4 0001100
2791110 0.2 0.0 1.0 1.0
2792110 0.0334 0.0 1.0 1.0
2791201 -0.62828 8.29284-2 0.0
2792201 -0.82892 -1.6266 0.0
*----------
* 9.7 SG#2 Steam Line
*----------
* Component No 280
* SG#2 Steam Outlet Pipe
2800000 SG2/Stp pipe
2800001 1
2800101 0.274646 1
2800301 2.79 1
2800401 0.0 1
2800601 90.0 1
2800801 1.0-5 0.187 1
2801001 0010000 1
2801201 002 5.82064+6 1.0 0.0 0.0 0.0 1
*----------
* Component No 281
* SG2 Steam Out
2810000 j280-282 sngljun
2810101 280010002 282010003 0.0 0.0 0.0 0001100
2810201 1 0.0 343.96 0.0
*----------
* Component No 282
* SG2 Steam Header
2820000 SG2/StH pipe
2820001 2
2820101 0.2206 2
2820301 5.67 2
2820401 0.0 2
2820601 0.0 2
2820801 1.0-5 0.530 2
2820901 0.0 0.0 1
2821001 0010000 2
2821101 0001000 1
2821201 002 5.82319+6 1.0 0.0 0.0 0.0 1
2821202 002 5.77874+6 1.0 0.0 0.0 0.0 2
2821300 1
2821301 0.0 344.06 0.0 1
*----------
```

```
* Component No 283
* SG2 Header Steam Line connection
2830000 SL2-out  sngljun
2830101  282020002 284010001  0.2206 0.0  0.0 0001000
2830201  1 0.0 344.23 0.0
*-------------------
* Component No 284
* Steam line  of SG2 header to FIV
* Length = 68.8 m, Flow area = 0.2642 sq.m
2840000 SG2/Stl1 pipe
2840001  6
2840101  0.2642 6
2840301  5.0 1
2840302  9.0 2
2840303 16.3 4
2840304  8.2 5
2840305 14.0 6
2840401  0.0 6
2840601  0.0 4
2840602 -36.0 5
2840603  0.0 6
2840701  0.0  4
2840702  -4.8  5
2840703  0.0  6
2840801  1.0-5 0.58 6
2840901  0.0  0.0  5
2841001  0010000 6
2841101  0001000  5
2841201 002  5.78738+6  1.0 0.0 0.0  0.0  1
2841202 002  5.78417+6  1.0 0.0 0.0  0.0  2
2841203 002  5.77814+6  1.0 0.0 0.0  0.0  3
2841204 002  5.77023+6  1.0 0.0 0.0  0.0  4
2841205 002  5.76502+6  1.0 0.0 0.0  0.0  5
2841206 002  5.76014+6  1.0 0.0 0.0  0.0  6
2841300  1
2841301  0.0 346.52  0.0 5
*-------------------
* Component No 285
* SG2 Pressure Regulated Valve
2850000 SG2/PRV valve
2850101 284060002 286010001  0.2642  1.0  1.0 0000100
2850201  1  0.0 345.84  0.
2850300  mrvlv
2850301  704 703  0.05 0.5209375
*-------------------
* Component No 286
* SG2 Steam Line to the MSIV
* Length = 6.0 m, Flow area = 0.2642
2860000  St-ln2 pipe
2860001  1
2860101  0.2642  1
2860301  6.0 1
2860401  0.0 1
2860601  90.0 1
2860701 6.0 1
2860801 1.0-5 0.58 1
2861001 0010000 1
2861201 002  5.62668+6 1.0 0.0 0.0  0.0  1
*-------------------
* Component No 287
* MSIV for SG2
2870000 MSIV2  valve
2870101 286010002 194010001  0.2642  1.0  1.0 0000100
2870201  1  0.0 345.84 0.
2870300  mrvlv
2870301 402 502  0.1428 1.0
*-------------------
* 9.8 SG2 BRU-A
*-------------------
* Component No 289
* BRU-A2
2890000  BRU-A2  valve
2890101 284050002 290000000  0.02236 1.0  1.0 0000120
2890201  1  0.0  0.0  0.
2890300  mrvlv
2890301 605 606 0.0666666667  0.0
*-------------------
* Component No 290
* Atmospher
2900000  atm  tmdpvol
2900101  8.0 0.0 70.0 0.0  0.0  0.0  5.-6 0.0  0000000
2900200  002
2900201 0.0 1.05+5  1.0
*-------------------
* 9.8.1 SG2 In-house
*-------------------
* Component No 291
* SG#2 In-house
2910000 BRU-In2  valve
2910101 284050002 292000000  0.02236 1.0  1.0 0000120
2910201  1  0.0  0.0  0.
2910300  mrvlv
2910301 714 713 0.0666666667  0.0
*-------------------
* Component No 292
* In-House
2920000  In-h#2 tmdpvol
2920101  8.0 0.0 70.0 0.0  0.0  0.0  5.-6 0.0  0000000
2920200  002
2920201 0.0 5.68252+6 1.0
*-------------------
* 9.9 Feedwater Line for Loop 3
*-------------------
* Component No 350
* Feedwater Boundary Volume for Loop 3
3500000 FWT-I3 tmdpvol
3500101 0.196  1.0  0.0 0.0 0.0  0.0  1.-5 0.0  0000000
3500200 003  602
3500201 -1.0  7.056+6  436.65
3500202  0.0  7.056+6  436.65
*-------------------
* Component No 351
* Loop 3 Feedwater pump
3510000 SG3-FW tmdpjun
3510101 350000000  352010001  0.0
3510200  1
3510201 0.0  360.0  0.0 0.0
*-------------------
* Component No 352
* Feedwater line of Servo Valve to the SG#3
3520000  FW-SG3  pipe
3520001  1
3520101 0.06469 1
3520301 2.0 1
3520601 0.0 1
3520801  1.0-5  0.0  1
3521001 0010000 1
3521201 003 5.95948+6 436.518 0.0  0.0  0.0 1
*-------------------
* Component No 353
* Feedwater line connetcion to SG3
3530000 j352-366 sngljun
3530101  352010002 366010001  0.0  5.0 20.0 0001000
3530201  1  360.0  0.0 0.0
*-------------------
* 9.10 SG#3 Secondary Side
*-------------------
* Component No 361
* SG#3 Tube bundles Level 1
3610000  sg3-Tl1  branch
3610001  1  0
3610101 0.0 0.445  3.0  0.0 90.0 0.445 1.0-5 0.015 0000100
3610200 000  5.89963+6  1.1956+6 2.5909+6  0.21866
3611101 361010002 362010001  0.0 0.0 0.0  0001000
3611110  0.015  0.0 1.0  1.0
3611201 0.29937 0.77701  0.0
*-------------------
* Component No 362
* SG#3 Tube bundles Level 2
3620000  sg3-Tl2  branch
3620001  1  0
3620101 0.0 0.446  5.94 0.0 90.0 0.446 1.0-5 0.015 0000100
3620200 000  5.89711+6  1.1977+6 2.5910+6  0.31333
3621101 362010002 363010001  0.0 0.0 0.0  0001000
3621110  0.015  0.0 1.0  1.0
3621201 0.32815 0.83822  0.0
*-------------------
* Component No 363
* SG#3 Tube bundles Level 3
3630000  sg3-Tl3  branch
3630001  1  0
3630101 0.0 0.446  8.97 0.0 90.0 0.446 1.0-5 0.015 0000100
3630200 000  5.89491+6  1.1997+6 2.5911+6  0.42606
3631101 363010002 364010001  0.0 0.0 0.0  0001000
3631110  0.015  0.0 1.0  1.0
3631201 0.31392 0.86927  0.0
*-------------------
* Component No 364
* SG#3 Tube bundles Level 4
3640000  sg3-Tl4  branch
3640001  1  0
3640101 0.0 0.464  9.4  0.0 90.0 0.464 1.0-5 0.015 0000100
3640200 000  5.89300+6  1.1999+6 2.5911+6  0.52845
3641101 364010002 365010001  0.0 0.0 0.0  0001000
3641110  0.015  0.0 1.0  1.0
3641201 0.34713 1.0501  0.0
*-------------------
* Component No 365
* SG#3 Tube bundles Level 5
3650000  sg3-Tl5  branch
3650001  1  0
3650101 0.0 0.464  9.93 0.0 90.0 0.464 1.0-5 0.015 0000100
3650200 000  5.89126+6  1.1999+6 2.5911+6  0.55531
3651101 365010002 366010001  0.0 0.0 0.0  0001000
3651110  0.015  0.0 1.0  1.0
3651201 0.26630 1.0744  0.0
*-------------------
* Component No 366
* SG#3 Volume between tube bundle and perforated sheete
3660000  sg3-l6  branch
3660001  1  0
3660101 0.0 0.245  10.71  0.0 90.0 0.245 1.0-5 0.0 0001000
3660200 000  5.89035+6  1.1298+6 2.5911+6  0.93951
3661101 366010002 367010001  2.5 0.0 0.0  1001100
3661110  0.013  0.0 1.0  1.0
3661201 0.29910 0.31039  0.0
*-------------------
* Component No 367
* SG#3 Volume above perforated sheete
3670000  sg3-l7  snglvol
3670101 0.0 0.650 28.558  0.0 90.0 0.650 1.0-5 0.0 0001000
3670200 000  5.88607+6  1.1855+6 2.5911+6  0.35868
*-------------------
* Component No 368
* SG#3 Separator
3680000  sg3-sep  separatr
3680001  3  0
3680101 0.0 0.260  10.09  0.0 90.0 0.260 1.0-5 0.0 0000000
3680200 000  5.88397+6  1.1976+6 2.5911+6  0.49991
3681101 368010002 369010001  0.0 0.0 0.0  0001100 * 0.5
3682101 368010001 377010002  0.0 0.0 0.0  0001100 * 0.1
3683101 367010002 368010001  0.0 0.0 0.0  0001100
3681110  0.0  0.0 1.0  1.0
3682110  0.0  0.0 1.0  1.0
3683110  0.0  0.0 1.0  1.0
3681201 0.21828 0.67652  0.0
3682201 2.5417  2.6703 0.0
3683201 5.34399-3 0.85712  0.0
*-------------------
* Component No 369
* SG#3 Steam dom
3690000  sg3-sd branch
3690001  1  1
3690101 0.0 0.580  10.21  0.0 90.0 0.580 1.0-5 0.0 0001000
3690200 002  5.88338+6  1.0
3691101 369010002 380010001  0.0 0.1 0.1  0001100
3691110 0.187 0.0 1.0  1.0
3691201  0.0  360.03 0.0
*-------------------
* Component No 371
* SG#3 Side channels in the of tube bundles Level 1
3710000  sg3-sl1  branch
3710001  2  0
3710101 0.0 0.445  3.99 0.0 90.0 0.445 1.0-5 0.2 0001000
3710200 000  5.90090+6  1.1810+6 2.5910+6  4.58883-2
3711101 371010002 372010001  0.0 0.0 0.0  0001100
3712101 371010004 361010003  0.0 0.4 0.4  0001100
3711110  0.2  0.0 1.0  1.0
3712110  0.0334 0.0 1.0  1.0
3711201 -0.20984 -0.10346  0.0
3712201  1.6461 1.7798 0.0
*-------------------
* Component No 372
* SG#3 Side channels in the of tube bundles Level 2
3720000  sg3-sl2  branch
3720001  2  0
3720101 0.0 0.446  4.1  0.0 90.0 0.446 1.0-5 0.2 0001000
3720200 000  5.89783+6  1.1789+6 2.5911+6  0.14715
3721101 372010002 373010001  0.0 0.0 0.0  0001100
3722101 372010004 362010003  0.0 0.4 0.4  0001100
3721110  0.2  0.0 1.0  1.0
3722110  0.0334 0.0 1.0  1.0
3721201 -0.42455 -0.32538  0.0
3722201  1.4591 1.6540 0.0
*-------------------
* Component No 373
* SG#3 Side channels in the of tube bundles Level 3
3730000  sg3-sl3  branch
3730001  3  0
3730101 0.0 0.446  6.38 0.0 90.0 0.446 1.0-5 0.2 0001000
3730200 000  5.89504+6  1.1748+6 2.5911+6  0.21023
3731101 373010002 374010001  0.0 0.0 0.0  0001100
3732101 373010004 363010003  0.0 0.4 0.4  0001100
3733101 373010002 378010001  0.0 0.0 0.0  0001100
3731110  0.2  0.0 1.0  1.0
3732110  0.0334 0.0 1.0  1.0
3733110  0.1  0.0 1.0  1.0
3731201 -0.18705 -3.18432-2 0.0
3732201  0.64132  0.87552 0.0
3733201 -0.97943 -0.27823 0.0
*-------------------
* Component No 374
* SG#3 Channels between SG side wall and sheet vertical wall
3740000  sg3-sl4  branch
3740001  1  0
3740101 0.0 0.464  2.3  0.0 90.0 0.464 1.0-5 0.2 0001000
3740200 000  5.89215+6  1.1942+6 2.5911+6  8.66335-2
3741101 374010002 375010001  0.0 0.0 0.0  0001100
3741110  0.2  0.0 1.0  1.0
3741201 -0.22605 -1.85380-2 0.0
*-------------------
* Component No 375
* SG#3 Channels between SG side wall and sheet vertical wall
level 2
3750000  sg3-sl5  branch
3750001  1  0
3750101 0.0 0.464  3.88 0.0 90.0 0.464 1.0-5 0.2 0001000
3750200 000  5.88943+6  1.1918+6 2.5911+6  0.36570
3751101 375010002 376010001  0.0 0.0 0.0  0001100
3751110  0.2  0.0 1.0  1.0
3751201 -0.53048 -3.61154-2 0.0
*-------------------
* Component No 376
* SG#3 Channels between SG side wall and sheet vertical wall
level 3
3760000  sg3-sl6  branch
3760001  1  0
3760101 0.0 0.245  1.0 0.0 90.0 0.245 1.0-5 0.2 0001000
3760200 000  5.88799+6  1.1860+6 2.5911+6  0.67386
3761101 376010002 367010001  0.0 0.0 0.0  0001100
3761110  0.2  0.0 1.0  1.0
3761201 -0.26965 -7.15029-2 0.0
*-------------------
```

```
* Component No 377
* SG#3 Channels between SG side wall and sheet vertical wall
level 4
3770000 sg3-sl7 branch
3770001 1 0
3770101 0.00 1.359 0.072 0.0 90.0 1.359 1.0-5 0.05 0001000
3770200 000 5.88567+6 1.1977+6 2.5911+6 0.0
3771101 374010002 377010001 0.0 0.0 0.0 0001100
3771110 0.05 0.0 1.0 1.0
3771201 -2.5417 -0.58399 0.0
*-----------
* Component No 378
* SG#3 Channels between Tube bundle and sheet vertical wall
* and channel in the middle level 1
3780000 sg3-sl8 branch
3780001 2 0
3780101 0.0 0.464 3.75 0.0 90.0 0.464 1.0-5 0.2 0001000
3780200 000 5.89297+6 1.1585+6 2.5911+6 0.62629
3781101 378010002 379010001 0.0 0.0 0.0 0001100
3782101 378010004 364010003 0.0 0.4 0.4 0001100
3781110 0.2 0.0 1.0 1.0
3782110 0.0334 0.0 1.0 1.0
3781201 -0.65653 -0.28274 0.0
3782201 -0.25535 -0.66716 0.0
*-----------
* Component No 379
* SG#3 Channels between Tube bundle and sheet vertical wall
* and channel in the middle level 2
3790000 sg3-sl9 branch
3790001 2 0
3790101 0.0 0.464 4.72 0.0 90.0 0.464 1.0-5 0.2 0001000
3790200 000 5.89076+6 1.1547+6 2.5911+6 0.46998
3791101 379010002 366010001 0.0 0.0 0.0 0001100
3792101 379010004 365010003 0.0 0.4 0.4 0001100
3791110 0.2 0.0 1.0 1.0
3792110 0.0334 0.0 1.0 1.0
3791201 -3.4825 9.79002-2 0.0
3792201 -1.1037 -2.6714 0.0
*-----------
* 9.11 SG#3 Steam Line
*-----------
* Component No 380
* SG#3 Steam Outlet Pipe
3800000 SG3/Stp pipe
3800001 1
3800101 0.274646 1
3800301 2.79 1
3800401 0.0 1
3800601 90.0 1
3800801 1.0-5 0.187 1
3801001 0010000 1
3801201 002 5.83874+6 1.0 0.0 0.0 0.0 1
*-----------
* Component No 381
* SG3 Steam Out
3810000 j380-382 sngljun
3810101 380010002 382010003 0.0 0.0 0.0 0001100
3810201 1 0.0 360.03 0.0
*-----------
* Component No 382
* SG3 Steam Header
3820000 SG3/StH pipe
3820001 2
3820101 0.2206 2
3820301 5.67 2
3820401 0.0 2
3820601 0.0 2
3820801 1.0-5 0.530 2
3820901 0.0 0.0 1
3821001 0010000 2
3821101 0001000 1
3821201 002 5.84160+6 1.0 0.0 0.0 0.0 1
3821202 002 5.79325+6 1.0 0.0 0.0 0.0 2
3821300 1
3821301 0.0 360.04 0.0 1
*-----------
* Component No 383
* SG3 Header Steam Line connection
3830000 SL3-out sngljun
3830101 382020002 384010001 0.2206 0.0 0.0 0001000
3830201 1 0.0 360.05 0.0
*-----------
* Component No 384
* Steam line of SG3 header to FIV
* Length = 68.8 m, Flow area = 0.2642 sq.m
3840000 SG3/St1 pipe
3840001 6
3840101 0.2642 6
3840301 5.0 1
3840302 9.0 2
3840303 16.3 4
3840304 8.2 5
3840305 14.0 6
3840401 0.0 6
3840601 0.0 4
3840602 -36.0 5
3840603 0.0 6
3840701 0.0 4
3840702 -4.8 5
3840703 0.0 6
3840801 1.0-5 0.58 6
3840901 0.0 0.0 5
3841001 0010000 6
3841101 0001000 5
3841201 002 5.80284+6 1.0 0.0 0.0 0.0 1
3841202 002 5.79955+6 1.0 0.0 0.0 0.0 2
3841203 002 5.79340+6 1.0 0.0 0.0 0.0 3
3841204 002 5.78543+6 1.0 0.0 0.0 0.0 4
3841205 002 5.78019+6 1.0 0.0 0.0 0.0 5
3841206 002 5.77535+6 1.0 0.0 0.0 0.0 6
3841300 1
3841301 0.0 360.01 0.0 5
*-----------
* Component No 385
* SG3 Pressure Regulated Valve
3850000 SG3/PRV valve
3850101 384060002 386010001 0.2642 1.0 1.0 0000100
3850201 1 0.0 359.96 0.
3850300 mrvlv
3850301 706 705 0.05 0.51750
*-----------
* Component No 386
* SG3 Steam Line to the MSIV
* Length = 6.0 m, Flow area = 0.2642
3860000 St-ln3 pipe
3860001 1
3860101 0.2642 1
3860301 6.0 1
3860401 0.0 1
3860601 90.0 1
3860701 6.0 1
3860801 1.0-5 0.58 1
3861001 0010000 1
3861201 002 5.62668+6 1.0 0.0 0.0 0.0 1
*-----------
* Component No 387
* MSIV for SG3
3870000 MSIV3 valve
3870101 386010002 194010001 0.2642 1.0 1.0 0000100
3870201 1 0.0 359.96 0.
3870300 mrvlv
3870301 402 503 0.1428 1.0
*-----------
* 9.12 SG3 BRU-A
*-----------
* Component No 389
* BRU-A3
3890000 BRU-A3 valve
3890101 384050002 390000000 0.02236 1.0 1.0 0000120
3890201 1 0.0 0.0 0.
3890300 mrvlv
3890301 607 608 0.0666666667 0.0
*-----------
* Component No 390
* Atmospher
3900000 atm tmdpvol
3900101 8.0 0.0 70.0 0.0 0.0 0.0 5.-6 0.0 0000000
3900200 002
3900201 0.0 1.05+5 1.0
*-----------
* 9.12.1 SG3 In-house
*-----------
* Component No 391
* SG#3 In-house
3910000 BRU-In3 valve
3910101 384050002 392000000 0.02236 1.0 1.0 0000120
3910201 1 0.0 0.0 0.
3910300 mrvlv
3910301 716 715 0.0666666667 0.0
*-----------
* Component No 392
* In-House
3920000 In-h#3 tmdpvol
3920101 8.0 0.0 70.0 0.0 0.0 0.0 5.-6 0.0 0000000
3920200 002
3920201 0.0 5.88347+6 1.0
*-----------
* 9.13 Feedwater Line for Loop 4
*-----------
* Component No 450
* Feedwater Boundary Volume for Loop 4
4500000 FWT-l4 tmdpvol
4500101 0.196 1.0 0.0 0.0 0.0 0.0 1.-5 0.0 0000000
4500200 003 602
4500201 -1.0 7.056+6 437.05
4500202 0.0 7.056+6 437.05
*-----------
* Component No 451
* Loop 4 Feedwater pump
4510000 SG4-FW tmdpjun
4510101 450000000 452010001 0.0
4510200 1
4510201 0.0 354.4 0.0 0.0
*-----------
* Component No 452
* Feedwater line of Servo Valve to the SG#4
4520000 FW-SG4 pipe
4520001 1
4520101 0.06469 1
4520301 2.0 1
4520601 0.0 1
4520801 1.0-5 0.0 1
4521001 0010000 1
4521201 003 5.92903+6 436.914 0.0 0.0 0.0 1
*-----------
* Component No 453
* Feedwater line connetcion to SG4
4530000 j452-466 sngljun
4530101 452010002 466010001 0.0 5.0 20.0 0001000
4530201 1 354.4 0.0 0.0
*-----------
* 9.14 SG#4 Secondary Side
*-----------
* Component No 461
* SG#4 Tube bundles Level 1
4610000 sg4-Tl1 branch
4610001 1 0
4610101 0.0 0.445 3.0 0.0 90.0 0.445 1.0-5 0.015 0000100
4610200 000 5.87138+6 1.1942+6 2.5911+6 0.21642
4611101 461010002 462010001 0.0 0.0 0.0 0001000
4611110 0.015 0.0 1.0 1.0
4611201 0.29793 0.77482 0.0
*-----------
* Component No 462
* SG#4 Tube bundles Level 2
4620000 sg4-Tl2 branch
4620001 1 0
4620101 0.0 0.446 5.94 0.0 90.0 0.446 1.0-5 0.015 0000100
4620200 000 5.86884+6 1.1964+6 2.5912+6 0.30960
4621101 462010002 463010001 0.0 0.0 0.0 0001000
4621110 0.015 0.0 1.0 1.0
4621201 0.32709 0.83455 0.0
*-----------
* Component No 463
* SG#4 Tube bundles Level 3
4630000 sg4-Tl3 branch
4630001 1 0
4630101 0.0 0.446 8.97 0.0 90.0 0.446 1.0-5 0.015 0000100
4630200 000 5.86662+6 1.1981+6 2.5912+6 0.41902
4631101 463010002 464010001 0.0 0.0 0.0 0001000
4631110 0.015 0.0 1.0 1.0
4631201 0.31921 0.86694 0.0
*-----------
* Component No 464
* SG#4 Tube bundles Level 4
4640000 sg4-Tl4 branch
4640001 1 0
4640101 0.0 0.464 9.4 0.0 90.0 0.464 1.0-5 0.015 0000100
4640200 000 5.86469+6 1.1984+6 2.5913+6 0.52092
4641101 464010002 465010001 0.0 0.0 0.0 0001000
4641110 0.015 0.0 1.0 1.0
4641201 0.35333 1.0443 0.0
*-----------
* Component No 465
* SG#4 Tube bundles Level 5
4650000 sg4-Tl5 branch
4650001 1 0
4650101 0.0 0.464 9.93 0.0 90.0 0.464 1.0-5 0.015 0000100
4650200 000 5.86292+6 1.1983+6 2.5913+6 0.54717
4651101 465010002 466010001 0.0 0.0 0.0 0001000
4651110 0.015 0.0 1.0 1.0
4651201 0.26937 1.0684 0.0
*-----------
* Component No 466
* SG#4 Volume between tube bundle and perforated sheete
4660000 sg4-l6 branch
4660001 1 0
4660101 0.0 0.245 10.71 0.0 90.0 0.245 1.0-5 0.0 0001000
4660200 000 5.86200+6 1.1312+6 2.5912+6 0.93754
4661101 466010002 467010001 2.5 0.0 0.0 1001100
4661110 0.013 0.0 1.0 1.0
4661201 0.29241 0.30361 0.0
*-----------
* Component No 467
* SG#4 Volume above perforated sheete
4670000 sg4-l7 snglvol
4670101 0.0 0.650 28.558 0.0 90.0 0.650 1.0-5 0.0 0001000
4670200 000 5.85778+6 1.1842+6 2.5913+6 0.35299
*-----------
* Component No 468
* SG#4 Separator
4680000 sg4-sep separatr
4680001 3 0
4680101 0.0 0.260 10.09 0.0 90.0 0.260 1.0-5 0.0 0000000
4680200 000 5.85566+6 1.1961+6 2.5913+6 0.49904
4681101 468010002 469010001 0.0 0.0 0.0 0001100
4682101 468010001 477010002 0.0 0.0 0.0 0001100
4683101 467010002 468010001 0.0 0.0 0.0 0001100
4681110 0.0 0.0 1.0 1.0
4682110 0.0 0.0 1.0 1.0
4683110 0.0 0.0 1.0 1.0
4681201 0.20401 0.66192 0.0
4682201 2.5260 2.6525 0.0
4683201 5.49352-3 0.85078 0.0
*-----------
* Component No 469
* SG#4 Steam dom
4690000 sg4-sd branch
4690001 1 1
4690101 0.0 0.580 10.21 0.0 90.0 0.580 1.0-5 0.0 0001000
4690200 002 5.85506+6 1.0
4691101 469010002 480010001 0.0 0.1 0.1 0001100
4691110 0.187 0.0 1.0 1.0
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4691201 0.0 354.58 0.0
*-----------
* Component No 471
* SG#4 Side channels in the of tube bundles Level 1
4710000 sg4-sl1 branch
4710001 2 0
4710101 0.0 0.445 3.99 0.0 90.0 0.445 1.0-5 0.2 0001000
4710200 000 5.87264+6 1.1801+6 2.5912+6 4.65918-2
4711101 471010002 472010001 0.0 0.0 0.0 0001100
4712101 471010004 461010003 0.0 0.4 0.4 0001100
4711110 0.2 0.0 1.0 1.0
4712110 0.0334 0.0 1.0 1.0
4711201 -0.20984 -0.10292 0.0
4712201 1.6437 1.7764 0.0
*-----------
* Component No 472
* SG#4 Side channels in the of tube bundles Level 2
4720000 sg4-sl2 branch
4720001 2 0
4720101 0.0 0.446 4.1 0.0 90.0 0.446 1.0-5 0.2 0001000
4720200 000 5.86958+6 1.1780+6 2.5912+6 0.14903
4721101 472010002 473010001 0.0 0.0 0.0 0001100
4722101 472010004 462010003 0.0 0.4 0.4 0001100
4721110 0.2 0.0 1.0 1.0
4722110 0.0334 0.0 1.0 1.0
4721201 -0.42562 -0.32552 0.0
4722201 1.4698 1.6676 0.0
*-----------
* Component No 473
* SG#4 Side channels in the of tube bundles Level 3
4730000 sg4-sl3 branch
4730001 3 0
4730101 0.0 0.446 6.38 0.0 90.0 0.446 1.0-5 0.2 0001000
4730200 000 5.86679+6 1.1741+6 2.5913+6 0.21106
4731101 473010002 474010001 0.0 0.0 0.0 0001100
4732101 473010004 463010003 0.0 0.4 0.4 0001100
4733101 473010002 478010001 0.0 0.0 0.0 0001100
4731110 0.2 0.0 1.0 1.0
4732110 0.0334 0.0 1.0 1.0
4733110 0.1 0.0 1.0 1.0
4731201 -0.18667 -3.07223-2 0.0
4732201 0.72159 0.96151 0.0
4733201 -0.93409 -0.29643 0.0
*-----------
* Component No 474
* SG#4 Channels between SG side wall and sheet vertical wall
4740000 sg4-sl4 branch
4740001 1 0
4740101 0.0 0.464 2.3 0.0 90.0 0.464 1.0-5 0.2 0001000
4740200 000 5.86389+6 1.1926+6 2.5913+6 8.48016-2
4741101 474010002 475010001 0.0 0.0 0.0 0001100
4741110 0.2 0.0 1.0 1.0
4741201 -0.22460 -1.82063-2 0.0
*-----------
* Component No 475
* SG#4 Channels between SG side wall and sheet vertical wall level 2
4750000 sg4-sl5 branch
4750001 1 0
4750101 0.0 0.464 3.88 0.0 90.0 0.464 1.0-5 0.2 0001000
4750200 000 5.86117+6 1.1903+6 2.5913+6 0.36106
4751101 475010002 476010001 0.0 0.0 0.0 0001100
4751110 0.2 0.0 1.0 1.0
4751201 -0.52166 -3.53692-2 0.0
*-----------
* Component No 476
* SG#4 Channels between SG side wall and sheet vertical wall level 3
4760000 sg4-sl6 branch
4760001 1 0
4760101 0.0 0.245 1.0 0.0 90.0 0.245 1.0-5 0.2 0001000
4760200 000 5.85971+6 1.1847+6 2.5913+6 0.66803
4761101 476010002 467010001 0.0 0.0 0.0 0001100
4761110 0.2 0.0 1.0 1.0
4761201 -0.26756 -7.06050-2 0.0
*-----------
* Component No 477
* SG#4 Channels between SG side wall and sheet vertical wall level 4
4770000 sg4-sl7 branch
4770001 1 1
4770101 0.00 1.359 0.072 0.0 90.0 1.359 1.0-5 0.05 0001000
4770200 000 5.85741+6 1.1961+6 2.5913+6 0.00000
4771101 474010002 477010001 0.0 0.0 0.0 0001100
4771110 0.05 0.0 1.0 1.0
4771201 -101.94 0.0 0.0
*-----------
* Component No 478
* SG#4 Channels between Tube bundle and sheet vertical wall
* and channel in the middle level 1
4780000 sg4-sl8 branch
4780001 2 0
4780101 0.0 0.464 3.75 0.0 90.0 0.464 1.0-5 0.2 0001000
4780200 000 5.86466+6 1.1588+6 2.5913+6 0.59496
4781101 478010002 479010001 0.0 0.0 0.0 0001100
4782101 478010004 464010003 0.0 0.4 0.4 0001100
4781110 0.2 0.0 1.0 1.0
4782110 0.0334 0.0 1.0 1.0
4781201 -0.68210 -0.29310 0.0
4782201 -0.24753 -0.64885 0.0
*-----------
* Component No 479
* SG#4 Channels between Tube bundle and sheet vertical wall
* and channel in the middle level 2
4790000 sg4-sl9 branch
4790001 2 0
4790101 0.0 0.464 4.72 0.0 90.0 0.464 1.0-5 0.2 0001000
4790200 000 5.86239+6 1.1551+6 2.5913+6 0.47149
4791101 479010002 466010001 0.0 0.0 0.0 0001100
4792101 479010004 465010003 0.0 0.4 0.4 0001100
4791110 0.2 0.0 1.0 1.0
4792110 0.0334 0.0 1.0 1.0
4791201 -3.4701 8.47321-2 0.0
4792201 -1.1522 -2.6616 0.0
*
*-----------
* 9.15 SG#4 Steam Line
*-----------
* Component No 480
* SG#4 Steam Outlet Pipe
4800000 SG4/Stp pipe
4800001 1
4800101 0.274646 1
4800301 2.79 1
4800401 0.0 1
4800601 90.0 1
4800801 1.0-5 0.187 1
4801001 0010000 1
4801201 002 5.81208+6 1.0 0.0 0.0 0.0 1
*-----------
* Component No 481
* SG4 Steam Out
4810000 j480-482 snglJun
4810101 480010002 482010003 0.0 0.0 0.0 0001100
4810201 1 0.0 354.58 0.0
*-----------
* Component No 482
* SG4 Steam Header
4820000 SG4/StH pipe
4820001 2
4820101 0.2206 2
4820301 5.67 2
4820401 0.0 2
4820601 0.0 2
4820801 1.0-5 0.530 2
4820901 0.0 0.0 1
4821001 0010000 2
4821101 0001000 1
4821201 002 5.81477+6 1.0 0.0 0.0 0.0 1
4821202 002 5.76839+6 1.0 0.0 0.0 0.0 2
4821300 1
4821301 0.0 354.59 0.0 1
*-----------
* Component No 483
* SG4 Header Steam Line connection
4830000 SL4-out snglJun
4830101 482020002 484010001 0.2206 0.0 0.0 0001000
4830201 1 0.0 354.59 0.0
*-----------
* Component No 484
* Steam line of SG4 header to FIV
* Length = 68.8 m, Flow area = 0.2642 sq.m
4840000 SG4/Stl1 pipe
4840001 6
4840101 0.2642 6
4840301 5.0 1
4840302 9.0 2
4840303 16.3 4
4840304 8.2 5
4840305 14.0 6
4840401 0.0 6
4840601 0.0 4
4840602 -36.0 5
4840603 0.0 6
4840701 0.0 4
4840702 -4.8 5
4840703 0.0 6
4840801 1.0-5 0.58 6
4840901 0.0 0.0 5
4841001 0010000 6
4841101 0001000 5
4841201 002 5.77756+6 1.0 0.0 0.0 0.0 1
4841202 002 5.77440+6 1.0 0.0 0.0 0.0 2
4841203 002 5.76843+6 1.0 0.0 0.0 0.0 3
4841204 002 5.76071+6 1.0 0.0 0.0 0.0 4
4841205 002 5.75564+6 1.0 0.0 0.0 0.0 5
4841206 002 5.75084+6 1.0 0.0 0.0 0.0 6
4841300 1
4841301 0.0 354.35 0.0 5
*-----------
* Component No 485
* SG4 Pressure Regulated Valve
4850000 SG4/PRV valve
4850101 484060002 486010001 0.2642 1.0 1.0 0000100
4850201 1 0.0 354.18 0.
4850300 mtrvlv
4850301 708 707 0.05 0.54150
*-----------
* Component No 486
* SG4 Steam Line to the MSIV
* Length = 6.0 m, Flow area = 0.2642
4860000 St-ln pipe
4860001 1
4860101 0.2642 1
4860301 6.0 1
4860401 0.0 1
4860601 90.0 1
4860701 6.0 1
4860801 1.0-5 0.58 1
4861001 0010000 1
4861201 002 5.62668+6 1.0 0.0 0.0 0.0 1
*-----------
* Component No 487
* MSIV for SG#4
4870000 MSIV4 valve
4870101 486010002 194010001 0.2642 1.0 1.0 0000100
4870201 1 0.0 354.18 0.
4870300 mtrvlv
4870301 402 504 0.2 1.0
*
*-----------
* 9.16 SG4 BRU-A
*-----------
* Component No 489
* BRU-A4
4890000 BRU-A4 valve
4890101 484050002 490000000 0.02236 1.0 1.0 0000120
4890201 1 0.0 0.0 0.
4890300 mtrvlv
4890301 609 610 0.0666666667 0.0
*-----------
* Component No 490
* Atmospher
4900000 atm tmdpvol
4900101 8.0 0.0 70.0 0.0 0.0 0.0 5.-6 0.0 0000000
4900200 002
4900201 0.0 1.05+5 1.0
*
*-----------
* 9.16.1 SG4 In-house
*-----------
* Component No 491
* SG#4 In-house
4910000 BRU-In4 valve
4910101 484050002 492000000 0.02236 1.0 1.0 0000120
4910201 1 0.0 0.0 0.
4910300 mtrvlv
4910301 718 717 0.0666666667 0.0
*-----------
* Component No 492
* In-House
4920000 In-h#4 tmdpvol
4920101 8.0 0.0 70.0 0.0 0.0 0.0 5.-6 0.0 0000000
4920200 002
4920201 0.0 5.91685+6 1.0
*-----------
* 10. Heat Structures
*-----------
* 10.1 Steam Generators
*-----------
* 10.1.1 SG1
* —
* heat structure 110-0
* SG#1 Hot and Cold Collector
11100000 20 3 2 1 0.417
11100100 0 1
11100101 2 0.588
11100201 4 2
11100301 0.0 2
11100400 -1
11100401 589.23 566.61 547.26
11100402 558.88 552.40 546.90
11100403 589.22 566.90 547.83
11100404 558.77 552.60 547.38
11100405 589.17 567.03 548.10
11100406 558.60 552.71 547.72
11100407 589.07 567.00 548.13
11100408 558.66 552.77 547.78
11100409 588.82 566.85 548.07
11100410 559.00 552.91 547.74
11100411 580.36 563.65 549.07
11100412 556.16 551.47 547.51
11100413 580.24 562.76 547.62
11100414 556.01 550.70 546.12
11100415 579.82 562.64 547.62
11100416 555.85 550.63 546.11
11100417 579.97 563.68 549.16
11100418 556.08 551.84 548.10
11100419 579.89 563.11 548.41
11100420 556.05 551.68 547.96
11100501 111010000 20000000 1 1 0.445 2
11100502 112010000 20000000 1 1 0.446 4
11100503 113010000 20000000 1 1 0.446 6
11100504 114010000 20000000 1 1 0.464 8
11100505 115010000 20000000 1 1 0.464 10
11100506 116010000 20000000 1 1 0.245 12
11100507 116010000 20000000 1 1 0.24 14
11100508 116020000 20000000 1 1 0.45 16
11100509 116020000 20000000 1 1 0.26 18
11100510 116020000 20000000 1 1 0.58 20
11100601 161010000 0 1 1 0.445 2
11100602 162010000 0 1 1 0.446 4
11100603 163010000 0 1 1 0.446 6
```

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11100604 164010000 0 1 1 0.464 8
11100605 165010000 0 1 1 0.464 10
11100606 166010000 0 1 1 0.245 12
11100607 167010000 0 1 1 0.24 14
11100608 167010000 0 1 1 0.45 16
11100609 168010000 0 1 1 0.26 18
11100610 169010000 0 1 1 0.58 20
11100701 0 0.0 0.0 0.0 20
11100801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
11100901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
*-----------
* heat structure 110-1
* SG#1 Vessel Level 1
11101000 1 3 2 1 15.98
11101100 0 1
11101101 2 16.13
11101201 6 2
11101301 0.0 2
11101400 -1
11101401 546.44 539.76 533.14
11101501 161010000 0 1 1 0.445 1
11101601 -20 0 3021 1 0.445 1
11101701 0 0.0 0.0 0.0 1
11101801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11101901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 110-2
* SG#1 Vessel Level 2
11102000 1 3 2 1 6.26
11102100 0 1
11102101 2 6.41
11102201 6 2
11102301 0.0 2
11102400 -1
11102401 546.74 539.99 533.33
11102501 162010000 0 1 1 0.446 1
11102601 -20 0 3021 1 0.446 1
11102701 0 0.0 0.0 0.0 1
11102801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11102901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 110-3
* SG#1 Vessel Level 3
11103000 1 3 2 1 5.27
11103100 0 1
11103101 2 5.42
11103201 6 2
11103301 0.0 2
11103400 -1
11103401 546.68 539.91 533.25
11103501 163010000 0 1 1 0.446 1
11103601 -20 0 3021 1 0.446 1
11103701 0 0.0 0.0 0.0 1
11103801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11103901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 110-4
* SG#1 Vessel Level 4
11104000 1 3 2 1 4.86
11104100 0 1
11104101 2 5.01
11104201 6 2
11104301 0.0 2
11104400 -1
11104401 546.50 539.73 533.07
11104501 164010000 0 1 1 0.464 1
11104601 -20 0 3021 1 0.464 1
11104701 0 0.0 0.0 0.0 1
11104801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11104901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 110-5
* SG#1 Vessel Level 5
11105000 1 3 2 1 4.75
11105100 0 1
11105101 2 4.90
11105201 6 2
11105301 0.0 2
11105400 -1
11105401 546.64 539.85 533.19
11105501 165010000 0 1 1 0.464 1
11105601 -20 0 3021 1 0.464 1
11105701 0 0.0 0.0 0.0 1
11105801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11105901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 110-6
* SG#1 Vessel Level 6
11106000 1 3 2 1 4.83
11106100 0 1
11106101 2 4.98
11106201 6 2
11106301 0.0 2
11106400 -1
11106401 534.21 526.70 520.20
11106501 166010000 0 1 1 0.245 1
11106601 -20 0 3021 1 0.245 1
11106701 0 0.0 0.0 0.0 1
11106801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11106901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 110-7
* SG#1 Vessel Level 7
11107000 1 3 2 1 5.22
11107100 0 1
11107101 2 5.37
11107201 6 2
11107301 0.0 2
11107400 -1
11107401 543.35 536.71 530.16
11107501 167010000 0 1 1 0.650 1
11107601 -20 0 3021 1 0.650 1
11107701 0 0.0 0.0 0.0 1
11107801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11107901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 110-8
* SG#1 Vessel Level 8
11108000 1 3 2 1 6.07
11108100 0 1
11108101 2 6.22
11108201 6 2
11108301 0.0 2
11108400 -1
11108401 545.91 538.79 532.10
11108501 168010000 0 1 1 0.26 1
11108601 -20 0 3021 1 0.26 1
11108701 0 0.0 0.0 0.0 1
11108801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11108901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 110-9
* SG#1 Vessel Level 9
11109000 1 3 2 1 9.52
11109100 0 1
11109101 2 9.67
11109201 6 2
11109301 0.0 2
11109400 -1
11109401 545.67 538.95 532.33
11109501 169010000 0 1 1 0.58 1
11109601 -20 0 3021 1 0.58 1
11109701 0 0.0 0.0 0.0 1
11109801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
11109901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 120-1
* SG#1 Tube Bundles
11201000 25 4 2 1 6.5-3
11201100 0 1
11201101 3 8.0-3
11201201 4 3
11201301 0.0 3
11201400 -1
11201401 573.39 567.42 561.83 556.59
11201402 567.86 563.34 559.12 555.16
11201403 563.58 560.14 556.93 553.93
11201404 560.21 557.59 555.15 552.86
11201405 557.61 555.60 553.72 551.96
11201406 572.93 566.90 561.27 555.97
11201407 567.34 562.84 558.63 554.68
11201408 563.05 559.68 556.53 553.58
11201409 559.75 557.21 554.85 552.63
11201410 557.22 555.30 553.51 551.83
11201411 572.10 566.14 560.56 555.32
11201412 566.36 562.00 557.92 554.10
11201413 562.03 558.83 555.85 553.06
11201414 558.78 556.43 554.24 552.18
11201415 556.32 554.58 552.96 551.44
11201416 572.12 566.14 560.54 555.29
11201417 566.34 561.97 557.89 554.06
11201418 561.99 558.80 555.82 553.02
11201419 558.74 556.39 554.20 552.15
11201420 556.27 554.54 552.93 551.41
11201421 572.86 566.89 561.31 556.07
11201422 567.16 562.74 558.60 554.72
11201423 562.82 559.53 556.46 553.58
11201424 559.50 557.05 554.76 552.61
11201425 556.97 555.13 553.40 551.79
11201501 121010000 10000 1 1 2160.4289 5
11201502 122010000 10000 1 1 3871.6827 10
11201503 123010000 10000 1 1 6370.4949 15
11201504 124010000 10000 1 1 6600.7921 20
11201505 125010000 10000 1 1 5327.4133 25
11201601 161010000 0 1 1 2160.4289 5
11201602 162010000 0 1 1 3871.6827 10
11201603 163010000 0 1 1 6370.4949 15
11201604 164010000 0 1 1 6600.7921 20
11201605 165010000 0 1 1 5327.4133 25
11201701 0 0.0 0.0 0.0 25
11201801 6.5-3 20.0 20.0 0.0 0.0 0.0 0.0 1.0 25
11201900 1 * 1 - twelve word format
11201901 0.0327 20.0 20.0 0.0 0.0 0.0 0.0 1.0 10.-3 1.43 1.0
25
*-----------
* 10.1.2 SG2
* ---
* heat structure 210-0
* SG#2 Hot and Cold Collector
12100000 20 3 2 1 0.417
12100100 0 1
12100101 2 0.588
12100201 4 2
12100301 0.0 2
12100400 -1
12100401 586.21 565.35 547.44
12100402 558.96 552.59 547.11
12100403 586.20 565.51 547.74
12100404 558.83 552.70 547.40
12100405 586.16 565.56 547.88
12100406 558.65 552.69 547.55
12100407 586.07 565.48 547.82
12100408 558.80 552.73 547.51
12100409 585.86 565.38 547.81
12100410 558.94 552.80 547.51
12100411 577.73 561.50 547.37
12100412 555.12 546.50 539.47
12100413 577.56 560.30 545.28
12100414 555.59 549.17 543.61
12100415 577.60 560.31 545.28
12100416 555.89 549.29 543.63
12100417 578.99 569.13 553.44
12100418 556.93 554.45 549.97
12100419 579.40 572.02 565.36
12100420 556.95 554.55 549.46
12100501 211010000 20000000 1 1 0.445 2
12100502 212010000 20000000 1 1 0.446 4
12100503 213010000 20000000 1 1 0.446 6
12100504 214010000 20000000 1 1 0.464 8
12100505 215010000 20000000 1 1 0.464 10
12100506 216010000 20000000 1 1 0.245 12
12100507 216010000 20000000 1 1 0.24 14
12100508 216020000 20000000 1 1 0.45 16
12100509 216020000 20000000 1 1 0.26 18
12100510 216020000 20000000 1 1 0.58 20
12100601 261010000 0 1 1 0.445 2
12100602 262010000 0 1 1 0.446 4
12100603 263010000 0 1 1 0.446 6
12100604 264010000 0 1 1 0.464 8
12100605 265010000 0 1 1 0.464 10
12100606 266010000 0 1 1 0.245 12
12100607 267010000 0 1 1 0.24 14
12100608 267010000 0 1 1 0.45 16
12100609 268010000 0 1 1 0.26 18
12100610 269010000 0 1 1 0.58 20
12100701 0 0.0 0.0 0.0 20
12100801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
12100901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
*-----------
* heat structure 210-1
* SG#2 Vessel Level 1
12101000 1 3 2 1 15.98
12101100 0 1
12101101 2 16.13
12101201 6 2
12101301 0.0 2
12101400 -1
12101401 546.58 539.93 533.30
12101501 261010000 0 1 1 0.445 1
12101601 -20 0 3021 1 0.445 1
12101701 0 0.0 0.0 0.0 1
12101801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12101901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 210-2
* SG#2 Vessel Level 2
12102000 1 3 2 1 6.26
12102100 0 1
12102101 2 6.41
12102201 6 2
12102301 0.0 2
12102400 -1
12102401 546.60 539.88 533.23
12102501 262010000 0 1 1 0.446 1
12102601 -20 0 3021 1 0.446 1
12102701 0 0.0 0.0 0.0 1
12102801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12102901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 210-3
* SG#2 Vessel Level 3
12103000 1 3 2 1 5.27
12103100 0 1
12103101 2 5.42
12103201 6 2
12103301 0.0 2
12103400 -1
12103401 546.01 539.22 532.58
12103501 263010000 0 1 1 0.446 1
12103601 -20 0 3021 1 0.446 1
12103701 0 0.0 0.0 0.0 1
12103801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12103901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 210-4
* SG#2 Vessel Level 4
12104000 1 3 2 1 4.86
12104100 0 1
12104101 2 5.01
12104201 6 2
12104301 0.0 2
12104400 -1
12104401 546.29 539.59 532.96
```

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12104501 264010000 0 1 1 0.464 1
12104601 -20 0 3021 1 0.464 1
12104701 0 0.0 0.0 0.0 1
12104801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12104901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 210-5
* SG#2 Vessel Level 5
12105000 1 3 2 1 4.75
12105100 0 1
12105101 2 4.90
12105201 6 2
12105301 0.0 2
12105400 -1
12105401 546.17 539.44 532.80
12105501 265010000 0 1 1 0.464 1
12105601 -20 0 3021 1 0.464 1
12105701 0 0.0 0.0 0.0 1
12105801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12105901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 210-6
* SG#2 Vessel Level 6
12106000 1 3 2 1 4.83
12106100 0 1
12106101 2 4.98
12106201 6 2
12106301 0.0 2
12106400 -1
12106401 530.02 524.62 518.45
12106501 266010000 0 1 1 0.245 1
12106601 -20 0 3021 1 0.245 1
12106701 0 0.0 0.0 0.0 1
12106801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12106901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 210-7
* SG#2 Vessel Level 7
12107000 1 3 2 1 5.22
12107100 0 1
12107101 2 5.37
12107201 6 2
12107301 0.0 2
12107400 -1
12107401 541.24 534.33 527.78
12107501 267010000 0 1 1 0.650 1
12107601 -20 0 3021 1 0.650 1
12107701 0 0.0 0.0 0.0 1
12107801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12107901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 210-8
* SG#2 Vessel Level 8
12108000 1 3 2 1 6.07
12108100 0 1
12108101 2 6.22
12108201 6 2
12108301 0.0 2
12108400 -1
12108401 542.76 535.62 529.02
12108501 268010000 0 1 1 0.26 1
12108601 -20 0 3021 1 0.26 1
12108701 0 0.0 0.0 0.0 1
12108801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12108901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 210-9
* SG#2 Vessel Level 9
12109000 1 3 2 1 9.52
12109100 0 1
12109101 2 9.67
12109201 6 2
12109301 0.0 2
12109400 -1
12109401 546.09 538.63 531.88
12109501 269010000 0 1 1 0.58 1
12109601 -20 0 3021 1 0.58 1
12109701 0 0.0 0.0 0.0 1
12109801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
12109901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 220-1
* SG#2 Tube Bundles
12201000 25 4 2 1 6.5-3
12201100 0 1
12201101 3 8.0-3
12201201 4 3
12201301 0.0 3
12201400 -1
12201401 572.44 566.67 561.27 556.20
12201402 567.50 563.02 558.85 554.92
12201403 563.57 560.09 556.85 553.81
12201404 560.43 557.73 555.21 552.85
12201405 557.96 555.84 553.86 552.02
12201406 571.97 566.12 560.65 555.51
12201407 566.95 562.47 558.29 554.37
12201408 563.00 559.57 556.37 553.37
12201409 559.89 557.26 554.80 552.50
12201410 557.47 555.43 553.53 551.76
12201411 570.98 565.10 559.59 554.43
12201412 565.76 561.36 557.26 553.40
12201413 561.72 558.44 555.38 552.51
12201414 558.65 556.19 553.90 551.76
12201415 556.29 554.44 552.72 551.11
12201416 571.33 565.56 560.17 555.11
12201417 566.12 561.79 557.75 553.96
12201418 562.08 558.83 555.80 552.97
12201419 559.00 556.54 554.26 552.12
12201420 556.61 554.75 553.02 551.40
12201421 571.69 565.84 560.36 555.22
12201422 566.54 562.10 557.96 554.08
12201423 562.51 559.15 556.02 553.09
12201424 559.39 556.84 554.47 552.24
12201425 556.97 555.03 553.21 551.52
12201501 221010000 10000 1 1 2160.4289 5
12201502 222010000 10000 1 1 3871.6827 10
12201503 223010000 10000 1 1 6370.4949 15
12201504 224010000 10000 1 1 6600.7921 20
12201505 225010000 10000 1 1 5327.4133 25
12201601 261010000 0 1 1 2160.4289 5
12201602 262010000 0 1 1 3871.6827 10
12201603 263010000 0 1 1 6370.4949 15
12201604 264010000 0 1 1 6600.7921 20
12201605 265010000 0 1 1 5327.4133 25
12201701 0 0.0 0.0 0.0 25
12201801 6.5-3 20.0 20.0 0.0 0.0 0.0 0.0 0.0 1.0 25
12201900 1 * 1 - twelve word format
12201901 0.0327 20.0 20.0 0.0 0.0 0.0 0.0 1.0 10.-3 1.43 1.0
25
*-----------
* 10.1.3 SG3
*---
* heat structure 310-0
* SG#3 Hot and Cold Collector
13100000 20 3 2 1 0.417
13100100 0 1
13100101 2 0.588
13100201 4 2
13100301 0.0 2
13100400 -1
13100401 587.62 565.81 547.16
13100402 559.82 552.79 546.83
13100403 587.61 566.11 547.73
13100404 559.69 552.98 547.29
13100405 587.58 566.29 548.09
13100406 559.52 553.15 547.74
13100407 587.48 566.25 548.11
13100408 559.61 553.21 547.79
13100409 587.27 566.12 548.05
13100410 559.95 553.35 547.75
13100411 579.14 563.01 548.94
13100412 557.16 551.72 546.88
13100413 579.01 562.14 547.54
13100414 557.05 551.16 546.08
13100415 578.98 562.13 547.54
13100416 556.96 551.11 546.07
13100417 579.87 568.04 555.00
13100418 557.61 554.40 550.83
13100419 580.64 572.94 566.11
13100420 557.81 555.38 553.01
13100501 311010000 20000000 1 1 0.445 2
13100502 312010000 20000000 1 1 0.446 4
13100503 313010000 20000000 1 1 0.446 6
13100504 314010000 20000000 1 1 0.464 8
13100505 315010000 20000000 1 1 0.464 10
13100506 316010000 20000000 1 1 0.245 12
13100507 316010000 20000000 1 1 0.24 14
13100508 316020000 20000000 1 1 0.45 16
13100509 316020000 20000000 1 1 0.26 18
13100510 316020000 20000000 1 1 0.58 20
13100601 361010000 0 1 1 0.445 2
13100602 362010000 0 1 1 0.446 4
13100603 363010000 0 1 1 0.446 6
13100604 364010000 0 1 1 0.464 8
13100605 365010000 0 1 1 0.464 10
13100606 366010000 0 1 1 0.245 12
13100607 367010000 0 1 1 0.24 14
13100608 367010000 0 1 1 0.45 16
13100609 368010000 0 1 1 0.26 18
13100610 369010000 0 1 1 0.58 20
13100701 0 0.0 0.0 0.0 20
13100801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
13100901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
*-----------
* heat structure 310-1
* SG#3 Vessel Level 1
13101000 1 3 2 1 15.98
13101100 0 1
13101101 2 16.13
13101201 6 2
13101301 0.0 2
13101400 -1
13101401 546.37 539.70 533.07
13101501 361010000 0 1 1 0.445 1
13101601 -20 0 3021 1 0.445 1
13101701 0 0.0 0.0 0.0 1
13101801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
13101901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 310-2
* SG#3 Vessel Level 2
13102000 1 3 2 1 6.26
13102100 0 1
13102101 2 6.41
13102201 6 2
13102301 0.0 2
13102400 -1
13102401 546.68 539.93 533.27
13102501 362010000 0 1 1 0.446 1
13102601 -20 0 3021 1 0.446 1
13102701 0 0.0 0.0 0.0 1
13102801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
13102901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 310-3
* SG#3 Vessel Level 3
13103000 1 3 2 1 5.27
13103100 0 1
13103101 2 5.42
13103201 6 2
13103301 0.0 2
13103400 -1
13103401 546.61 539.84 533.18
13103501 363010000 0 1 1 0.446 1
13103601 -20 0 3021 1 0.446 1
13103701 0 0.0 0.0 0.0 1
13103801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
13103901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 310-4
* SG#3 Vessel Level 4
13104000 1 3 2 1 4.86
13104100 0 1
13104101 2 5.01
13104201 6 2
13104301 0.0 2
13104400 -1
13104401 546.47 539.69 533.04
13104501 364010000 0 1 1 0.464 1
13104601 -20 0 3021 1 0.464 1
13104701 0 0.0 0.0 0.0 1
13104801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
13104901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 310-5
* SG#3 Vessel Level 5
13105000 1 3 2 1 4.75
13105100 0 1
13105101 2 4.90
13105201 6 2
13105301 0.0 2
13105400 -1
13105401 546.60 539.82 533.15
13105501 365010000 0 1 1 0.464 1
13105601 -20 0 3021 1 0.464 1
13105701 0 0.0 0.0 0.0 1
13105801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
13105901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 310-6
* SG#3 Vessel Level 6
13106000 1 3 2 1 4.83
13106100 0 1
13106101 2 4.98
13106201 6 2
13106301 0.0 2
13106400 -1
13106401 533.20 526.44 520.21
13106501 366010000 0 1 1 0.245 1
13106601 -20 0 3021 1 0.245 1
13106701 0 0.0 0.0 0.0 1
13106801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
13106901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 310-7
* SG#3 Vessel Level 7
13107000 1 3 2 1 5.22
13107100 0 1
13107101 2 5.37
13107201 6 2
13107301 0.0 2
13107400 -1
13107401 543.35 536.69 530.14
13107501 367010000 0 1 1 0.650 1
13107601 -20 0 3021 1 0.650 1
13107701 0 0.0 0.0 0.0 1
13107801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
13107901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 310-8
* SG#3 Vessel Level 8
13108000 1 3 2 1 6.07
13108100 0 1
13108101 2 6.22
13108201 6 2
13108301 0.0 2
13108400 -1
13108401 546.08 538.85 532.14
13108501 368010000 0 1 1 0.26 1
13108601 -20 0 3021 1 0.26 1
13108701 0 0.0 0.0 0.0 1
13108801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
13108901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
```

```
*_____
* heat structure 310-9
* SG#3 Vessel Level 9
13109000 1 3 2 1 9.52
13109100 0 1
13109101 2 9.67
13109201 6 2
13109301 0.0 2
13109400 -1
13109401 546.38 538.81 532.04
13109501 369010000 0 1 1 0.58 1
13109601 -20 0 3021 1 0.58 1
13109701 0 0.0 0.0 0.0 1
13109801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 0.0 1.0 1
13109901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 320-1
* SG#3 Tube Bundles
13201000 25 4 2 1 6.5-3
13201100 0 1
13201101 3 8.0-3
13201201 4 3
13201301 0.0 3
13201400 -1
13201401 573.56 567.54 561.91 556.62
13201402 568.46 563.78 559.41 555.30
13201403 564.42 560.77 557.36 554.16
13201404 561.17 558.31 555.65 553.16
13201405 558.59 556.35 554.25 552.29
13201406 573.11 567.02 561.33 555.98
13201407 567.94 563.26 558.90 554.80
13201408 563.88 560.28 556.92 553.77
13201409 560.67 557.89 555.31 552.88
13201410 558.16 556.01 554.00 552.11
13201411 572.27 566.21 560.55 555.23
13201412 566.92 562.37 558.11 554.12
13201413 562.80 559.37 556.17 553.17
13201414 559.62 557.03 554.62 552.35
13201415 557.17 555.21 553.38 551.66
13201416 572.36 566.31 560.65 555.34
13201417 566.98 562.44 558.19 554.21
13201418 562.84 559.42 556.23 553.24
13201419 559.64 557.06 554.66 552.40
13201420 557.19 555.23 553.40 551.69
13201421 573.04 567.01 561.38 556.09
13201422 567.76 563.17 558.88 554.86
13201423 563.64 560.14 556.86 553.79
13201424 560.41 557.73 555.22 552.87
13201425 557.91 555.84 553.90 552.09
13201501 321010000 10000 1 1 2160.4289 5
13201502 322010000 10000 1 1 3871.6827 10
13201503 323010000 10000 1 1 6370.4949 15
13201504 324010000 10000 1 1 6600.7921 20
13201505 325010000 10000 1 1 5327.4133 25
13201601 361010000 0 1 1 2160.4289 5
13201602 362010000 0 1 1 3871.6827 10
13201603 363010000 0 1 1 6370.4949 15
13201604 364010000 0 1 1 6600.7921 20
13201605 365010000 0 1 1 5327.4133 25
13201701 0 0.0 0.0 0.0 25
13201801 6.5-3 20.0 20.0 0.0 0.0 0.0 0.0 1.0 25
13201900 1 * 1 - twelve word format
13201901 0.0327 20.0 20.0 0.0 0.0 0.0 0.0 1.0 10.-3 1.43 1.0
25
*_____
* 10.1.4 SG4
*__
* heat structure 410-0
* SG#4 Hot and Cold Collector
14100000 20 3 2 1 0.417
14100100 0 1
14100101 2 0.588
14100201 4 2
14100301 0.0 2
14100400 -1
14100401 588.29 565.97 546.89
14100402 558.99 552.26 546.54
14100403 588.27 566.27 547.46
14100404 558.88 552.46 547.01
14100405 588.23 566.42 547.78
14100406 558.71 552.59 547.41
14100407 588.13 566.39 547.80
14100408 558.78 552.65 547.46
14100409 587.90 566.25 547.74
14100410 559.12 552.79 547.43
14100411 579.64 563.12 548.70
14100412 556.23 551.35 547.19
14100413 579.51 562.23 547.26
14100414 556.09 550.54 545.76
14100415 579.23 562.17 547.26
14100416 555.99 550.51 545.75
14100417 579.36 563.04 548.70
14100418 556.21 551.68 547.75
14100419 579.30 562.64 547.96
14100420 556.21 551.64 547.59
14100501 411010000 20000000 1 1 0.445 2
14100502 412010000 20000000 1 1 0.446 4
14100503 413010000 20000000 1 1 0.446 6
14100504 414010000 20000000 1 1 0.464 8
14100505 415010000 20000000 1 1 0.464 10
14100506 416010000 20000000 1 1 0.245 12
14100507 416010000 20000000 1 1 0.24 14
14100508 416020000 20000000 1 1 0.45 16
14100509 416020000 20000000 1 1 0.26 18
14100510 416020000 20000000 1 1 0.58 20
14100601 461010000 0 1 1 0.445 2
14100602 462010000 0 1 1 0.446 4
14100603 463010000 0 1 1 0.446 6
14100604 464010000 0 1 1 0.464 8
14100605 465010000 0 1 1 0.464 10
14100606 466010000 0 1 1 0.245 12
14100607 467010000 0 1 1 0.24 14
14100608 467010000 0 1 1 0.45 16
14100609 468010000 0 1 1 0.26 18
14100610 469010000 0 1 1 0.58 20
14100701 0 0.0 0.0 0.0 20
14100801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
14100901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
*_____
* heat structure 410-1
* SG#4 Vessel Level 1
14101000 1 3 2 1 15.98
14101100 0 1
14101101 2 16.13
14101201 6 2
14101301 0.0 2
14101400 -1
14101401 546.08 539.42 532.81
14101501 461010000 0 1 1 0.445 1
14101601 -20 0 3021 1 0.445 1
14101701 0 0.0 0.0 0.0 1
14101801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14101901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 410-2
* SG#4 Vessel Level 2
14102000 1 3 2 1 6.26
14102100 0 1
14102101 2 6.41
14102201 6 2
14102301 0.0 2
14102400 -1
14102401 546.39 539.65 533.01
14102501 462010000 0 1 1 0.446 1
14102601 -20 0 3021 1 0.446 1
14102701 0 0.0 0.0 0.0 1
14102801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14102901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 410-3
* SG#4 Vessel Level 3
14103000 1 3 2 1 5.27
14103100 0 1
14103101 2 5.42
14103201 6 2
14103301 0.0 2
14103400 -1
14103401 546.33 539.57 532.92
14103501 463010000 0 1 1 0.446 1
14103601 -20 0 3021 1 0.446 1
14103701 0 0.0 0.0 0.0 1
14103801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14103901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 410-4
* SG#4 Vessel Level 4
14104000 1 3 2 1 4.86
14104100 0 1
14104101 2 5.01
14104201 6 2
14104301 0.0 2
14104400 -1
14104401 546.17 539.41 532.76
14104501 464010000 0 1 1 0.464 1
14104601 -20 0 3021 1 0.464 1
14104701 0 0.0 0.0 0.0 1
14104801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14104901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 410-5
* SG#4 Vessel Level 5
14105000 1 3 2 1 4.75
14105100 0 1
14105101 2 4.90
14105201 6 2
14105301 0.0 2
14105400 -1
14105401 546.30 539.53 532.87
14105501 465010000 0 1 1 0.464 1
14105601 -20 0 3021 1 0.464 1
14105701 0 0.0 0.0 0.0 1
14105801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14105901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 410-6
* SG#4 Vessel Level 6
14106000 1 3 2 1 4.83
14106100 0 1
14106101 2 4.98
14106201 6 2
14106301 0.0 2
14106400 -1
14106401 533.42 526.16 519.85
14106501 466010000 0 1 1 0.245 1
14106601 -20 0 3021 1 0.245 1
14106701 0 0.0 0.0 0.0 1
14106801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14106901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 410-7
* SG#4 Vessel Level 7
14107000 1 3 2 1 5.22
14107100 0 1
14107101 2 5.37
14107201 6 2
14107301 0.0 2
14107400 -1
14107401 542.97 536.33 529.79
14107501 467010000 0 1 1 0.650 1
14107601 -20 0 3021 1 0.650 1
14107701 0 0.0 0.0 0.0 1
14107801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14107901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 410-8
* SG#4 Vessel Level 8
14108000 1 3 2 1 6.07
14108100 0 1
14108101 2 6.22
14108201 6 2
14108301 0.0 2
14108400 -1
14108401 545.54 538.81 532.19
14108501 468010000 0 1 1 0.26 1
14108601 -20 0 3021 1 0.26 1
14108701 0 0.0 0.0 0.0 1
14108801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14108901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 410-9
* SG#4 Vessel Level 9
14109000 1 3 2 1 9.52
14109100 0 1
14109101 2 9.67
14109201 6 2
14109301 0.0 2
14109400 -1
14109401 545.26 538.56 531.96
14109501 469010000 0 1 1 0.58 1
14109601 -20 0 3021 1 0.58 1
14109701 0 0.0 0.0 0.0 1
14109801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
14109901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*_____
* heat structure 420-1
* SG#4 Tube Bundles
14201000 25 4 2 1 6.5-3
14201100 0 1
14201101 3 8.0-3
14201201 4 3
14201301 0.0 3
14201400 -1
14201401 573.22 567.21 561.59 556.31
14201402 567.86 563.26 558.96 554.92
14201403 563.67 560.13 556.82 553.73
14201404 560.34 557.62 555.07 552.69
14201405 557.74 555.63 553.65 551.80
14201406 572.76 566.69 561.01 555.68
14201407 567.34 562.75 558.46 554.43
14201408 563.14 559.65 556.41 553.36
14201409 559.86 557.22 554.75 552.43
14201410 557.33 555.31 553.42 551.65
14201411 571.92 565.90 560.27 554.98
14201412 566.34 561.88 557.71 553.81
14201413 562.08 558.78 555.69 552.80
14201414 558.86 556.40 554.10 551.95
14201415 556.39 554.55 552.84 551.23
14201416 571.97 565.94 560.31 555.02
14201417 566.36 561.90 557.74 553.83
14201418 562.08 558.78 555.70 552.81
14201419 558.84 556.39 554.10 551.95
14201420 556.37 554.54 552.83 551.23
14201421 572.68 566.68 561.06 555.78
14201422 567.16 562.65 558.44 554.49
14201423 562.90 559.51 556.34 553.37
14201424 559.61 557.05 554.66 552.42
14201425 557.08 555.13 553.32 551.62
14201501 421010000 10000 1 1 2160.4289 5
14201502 422010000 10000 1 1 3871.6827 10
14201503 423010000 10000 1 1 6370.4949 15
14201504 424010000 10000 1 1 6600.7921 20
14201505 425010000 10000 1 1 5327.4133 25
14201601 461010000 0 1 1 2160.4289 5
14201602 462010000 0 1 1 3871.6827 10
14201603 463010000 0 1 1 6370.4949 15
14201604 464010000 0 1 1 6600.7921 20
14201605 465010000 0 1 1 5327.4133 25
14201701 0 0.0 0.0 0.0 25
14201801 6.5-3 20.0 20.0 0.0 0.0 0.0 0.0 1.0 25
14201900 1 * 1 - twelve word format
14201901 0.0327 20.0 20.0 0.0 0.0 0.0 0.0 1.0 10.-3 1.43 1.0
25
*_____
```

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* 10.2 Loops
*-----------
* heat structure 100-1
* Loop 1
11001000 29 3 2 1 0.425
11001100 0 1
11001101 2 0.495
11001201 7 2
11001301 0.0 2
11001400 -1
11001401 589.28 584.42 579.91
11001402 589.28 584.42 579.91
11001403 589.28 584.42 579.91
11001404 589.28 584.42 579.91
11001405 589.27 584.41 579.90
11001406 589.27 584.41 579.90
11001407 589.26 584.40 579.89
11001408 558.75 554.42 550.40
11001409 558.75 554.42 550.40
11001410 558.76 554.42 550.40
11001411 558.76 554.42 550.40
11001412 558.75 554.42 550.40
11001413 558.75 554.42 550.40
11001414 558.75 554.42 550.40
11001415 558.75 554.42 550.40
11001416 558.75 554.41 550.39
11001417 559.01 554.68 550.65
11001418 559.01 554.68 550.65
11001419 559.00 554.67 550.65
11001420 559.00 554.67 550.65
11001421 559.00 554.67 550.65
11001422 559.00 554.67 550.65
11001423 559.00 554.67 550.65
11001424 559.00 554.67 550.65
11001425 559.00 554.67 550.65
11001426 559.00 554.66 550.64
11001427 558.99 554.66 550.64
11001428 558.99 554.66 550.64
11001429 558.99 554.66 550.64
11001501 100010000 0 1 1 1.49 1
11001502 100020000 0 1 1 1.8 4
11001503 102010000 0 1 1 1.28 5
11001504 102020000 0 1 1 1.052 6
11001505 102030000 0 1 1 1.252 7
11001506 140010000 0 1 1 0.8 8
11001507 140020000 0 1 1 1.2 9
11001508 140030000 0 1 1 1.052 11
11001509 140050000 0 1 1 1.51 13
11001510 140070000 0 1 1 1.052 15
11001511 140090000 0 1 1 1.74 16
11001512 142010000 0 1 1 2.1075 18
11001513 144010000 0 1 1 1.5 19
11001514 144020000 0 1 1 1.052 20
11001515 144030000 0 1 1 1.252 22
11001516 144050000 0 1 1 1.052 23
11001517 144060000 0 1 1 1.528 24
11001518 144070000 0 1 1 2.5 25
11001519 144080000 0 1 1 4.5 26
11001520 144090000 0 1 1 3.5 27
11001521 144100000 0 1 1 1.25 29
11001601 -20 0 3021 1 1.49 1
11001602 -20 0 3021 1 1.8 4
11001603 -20 0 3021 1 1.28 5
11001604 -20 0 3021 1 1.052 6
11001605 -20 0 3021 1 1.252 7
11001606 -20 0 3021 1 0.8 8
11001607 -20 0 3021 1 1.2 9
11001608 -20 0 3021 1 1.052 11
11001609 -20 0 3021 1 1.51 13
11001610 -20 0 3021 1 1.052 15
11001611 -20 0 3021 1 1.74 16
11001612 -20 0 3021 1 2.1075 18
11001613 -20 0 3021 1 1.5 19
11001614 -20 0 3021 1 1.052 20
11001615 -20 0 3021 1 1.252 22
11001616 -20 0 3021 1 1.052 23
11001617 -20 0 3021 1 1.528 24
11001618 -20 0 3021 1 2.5 25
11001619 -20 0 3021 1 4.5 26
11001620 -20 0 3021 1 3.5 27
11001621 -20 0 3021 1 1.25 29
11001701 0 0.0 0.0 0.0 29
11001801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 0.0 1.0 29
*-----------
* heat structure 200-1
* Loop 2
12001000 29 3 2 1 0.425
12001100 0 1
12001101 2 0.495
12001201 7 2
12001301 0.0 2
12001400 -1
12001401 586.23 581.42 576.96
12001402 586.23 581.42 576.96
12001403 586.23 581.42 576.96
12001404 586.23 581.42 576.96
12001405 586.22 581.42 576.95
12001406 586.22 581.41 576.95
12001407 586.22 581.41 576.94
12001408 558.84 554.52 550.50
12001409 558.84 554.52 550.50
12001410 558.84 554.52 550.50
12001411 558.84 554.52 550.50
12001412 558.84 554.51 550.49
12001413 558.84 554.51 550.49
12001414 558.84 554.51 550.49
12001415 558.84 554.51 550.49
12001416 558.84 554.50 550.48
12001417 559.07 554.74 550.72
12001418 559.07 554.74 550.72
12001419 559.07 554.74 550.72
12001420 559.07 554.74 550.72
12001421 559.07 554.74 550.72
12001422 559.07 554.74 550.72
12001423 559.08 554.74 550.72
12001424 559.08 554.74 550.72
12001425 559.08 554.74 550.72
12001426 559.07 554.74 550.72
12001427 559.07 554.74 550.72
12001428 559.07 554.74 550.72
12001429 559.07 554.74 550.72
12001501 200010000 0 1 1 1.49 1
12001502 200020000 0 1 1 1.8 4
12001503 202010000 0 1 1 1.28 5
12001504 202020000 0 1 1 1.052 6
12001505 202030000 0 1 1 1.252 7
12001506 240010000 0 1 1 0.8 8
12001507 240020000 0 1 1 1.2 9
12001508 240030000 0 1 1 1.052 11
12001509 240050000 0 1 1 1.51 13
12001510 240070000 0 1 1 1.052 15
12001511 240090000 0 1 1 1.74 16
12001512 242010000 0 1 1 2.1075 18
12001513 244010000 0 1 1 1.5 19
12001514 244020000 0 1 1 1.052 20
12001515 244030000 0 1 1 1.252 22
12001516 244050000 0 1 1 1.052 23
12001517 244060000 0 1 1 1.528 24
12001518 244070000 0 1 1 2.5 25
12001519 244080000 0 1 1 4.5 26
12001520 244090000 0 1 1 3.5 27
12001521 244100000 0 1 1 1.25 29
12001601 -20 0 3021 1 1.49 1
12001602 -20 0 3021 1 1.8 4
12001603 -20 0 3021 1 1.28 5
12001604 -20 0 3021 1 1.052 6
12001605 -20 0 3021 1 1.252 7
12001606 -20 0 3021 1 0.8 8
12001607 -20 0 3021 1 1.2 9
12001608 -20 0 3021 1 1.052 11
12001609 -20 0 3021 1 1.51 13
12001610 -20 0 3021 1 1.052 15
12001611 -20 0 3021 1 1.74 16
12001612 -20 0 3021 1 2.1075 18
12001613 -20 0 3021 1 1.5 19
12001614 -20 0 3021 1 1.052 20
12001615 -20 0 3021 1 1.252 22
12001616 -20 0 3021 1 1.052 23
12001617 -20 0 3021 1 1.528 24
12001618 -20 0 3021 1 2.5 25
12001619 -20 0 3021 1 4.5 26
12001620 -20 0 3021 1 3.5 27
12001621 -20 0 3021 1 1.25 29
12001701 0 0.0 0.0 0.0 29
12001801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 0.0 1.0 29
*-----------
* heat structure 300-1
* Loop 3
13001000 29 3 2 1 0.425
13001100 0 1
13001101 2 0.495
13001201 7 2
13001301 0.0 2
13001400 -1
13001401 587.64 582.81 578.33
13001402 587.64 582.81 578.33
13001403 587.64 582.81 578.33
13001404 587.64 582.81 578.33
13001405 587.63 582.81 578.32
13001406 587.63 582.80 578.32
13001407 587.63 582.80 578.31
13001408 559.70 555.36 551.32
13001409 559.70 555.36 551.32
13001410 559.71 555.36 551.32
13001411 559.71 555.36 551.32
13001412 559.71 555.36 551.32
13001413 559.71 555.36 551.32
13001414 559.70 555.35 551.32
13001415 559.70 555.35 551.32
13001416 559.70 555.35 551.31
13001417 559.93 555.59 551.55
13001418 559.93 555.59 551.55
13001419 559.93 555.59 551.55
13001420 559.93 555.59 551.55
13001421 559.93 555.58 551.55
13001422 559.93 555.58 551.55
13001423 559.93 555.58 551.55
13001424 559.93 555.58 551.55
13001425 559.93 555.58 551.55
13001426 559.93 555.58 551.54
13001427 559.92 555.58 551.54
13001428 559.92 555.58 551.54
13001429 559.92 555.58 551.54
13001501 300010000 0 1 1 1.49 1
13001502 300020000 0 1 1 1.8 4
13001503 302010000 0 1 1 1.28 5
13001504 302020000 0 1 1 1.052 6
13001505 302030000 0 1 1 1.252 7
13001506 340010000 0 1 1 0.8 8
13001507 340020000 0 1 1 1.2 9
13001508 340030000 0 1 1 1.052 11
13001509 340050000 0 1 1 1.51 13
13001510 340070000 0 1 1 1.052 15
13001511 340090000 0 1 1 1.74 16
13001512 342010000 0 1 1 2.1075 18
13001513 344010000 0 1 1 1.5 19
13001514 344020000 0 1 1 1.052 20
13001515 344030000 0 1 1 1.252 22
13001516 344050000 0 1 1 1.052 23
13001517 344060000 0 1 1 1.528 24
13001518 344070000 0 1 1 2.5 25
13001519 344080000 0 1 1 4.5 26
13001520 344090000 0 1 1 3.5 27
13001521 344100000 0 1 1 1.25 29
13001601 -20 0 3021 1 1.49 1
13001602 -20 0 3021 1 1.8 4
13001603 -20 0 3021 1 1.28 5
13001604 -20 0 3021 1 1.052 6
13001605 -20 0 3021 1 1.252 7
13001606 -20 0 3021 1 0.8 8
13001607 -20 0 3021 1 1.2 9
13001608 -20 0 3021 1 1.052 11
13001609 -20 0 3021 1 1.51 13
13001610 -20 0 3021 1 1.052 15
13001611 -20 0 3021 1 1.74 16
13001612 -20 0 3021 1 2.1075 18
13001613 -20 0 3021 1 1.5 19
13001614 -20 0 3021 1 1.052 20
13001615 -20 0 3021 1 1.252 22
13001616 -20 0 3021 1 1.052 23
13001617 -20 0 3021 1 1.528 24
13001618 -20 0 3021 1 2.5 25
13001619 -20 0 3021 1 4.5 26
13001620 -20 0 3021 1 3.5 27
13001621 -20 0 3021 1 1.25 29
13001701 0 0.0 0.0 0.0 29
13001801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 0.0 1.0 29
*-----------
* heat structure 400-1
* Loop 4
14001000 29 3 2 1 0.425
14001100 0 1
14001101 2 0.495
14001201 7 2
14001301 0.0 2
14001400 -1
14001401 588.33 583.49 578.99
14001402 588.33 583.48 578.99
14001403 588.33 583.48 578.99
14001404 588.33 583.48 578.99
14001405 588.32 583.47 578.98
14001406 588.31 583.47 578.98
14001407 588.31 583.46 578.97
14001408 558.87 554.54 550.52
14001409 558.87 554.54 550.52
14001410 558.87 554.54 550.52
14001411 558.87 554.54 550.52
14001412 558.87 554.54 550.52
14001413 558.87 554.54 550.52
14001414 558.87 554.54 550.51
14001415 558.87 554.54 550.51
14001416 558.86 554.53 550.51
14001417 559.12 554.79 550.77
14001418 559.12 554.79 550.77
14001419 559.11 554.78 550.76
14001420 559.11 554.78 550.76
14001421 559.11 554.78 550.76
14001422 559.11 554.78 550.76
14001423 559.12 554.78 550.76
14001424 559.11 554.78 550.76
14001425 559.11 554.78 550.76
14001426 559.11 554.78 550.75
14001427 559.11 554.78 550.75
14001428 559.11 554.77 550.75
14001429 559.11 554.77 550.75
14001501 400010000 0 1 1 1.49 1
14001502 400020000 0 1 1 1.8 4
14001503 402010000 0 1 1 1.28 5
14001504 402020000 0 1 1 1.052 6
14001505 402030000 0 1 1 1.252 7
14001506 440010000 0 1 1 0.8 8
14001507 440020000 0 1 1 1.2 9
14001508 440030000 0 1 1 1.052 11
14001509 440050000 0 1 1 1.51 13
14001510 440070000 0 1 1 1.052 15
14001511 440090000 0 1 1 1.74 16
14001512 442010000 0 1 1 2.1075 18
14001513 444010000 0 1 1 1.5 19
14001514 444020000 0 1 1 1.052 20
14001515 444030000 0 1 1 1.252 22
14001516 444050000 0 1 1 1.052 23
14001517 444060000 0 1 1 1.528 24
14001518 444070000 0 1 1 2.5 25
```

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14001519 444080000 0 1 1 4.5 26
14001520 444090000 0 1 1 3.5 27
14001521 444100000 0 1 1 1.25 29
14001601 -20 0 3021 1 1.49 1
14001602 -20 0 3021 1 1.8 4
14001603 -20 0 3021 1 1.28 5
14001604 -20 0 3021 1 1.052 6
14001605 -20 0 3021 1 1.252 7
14001606 -20 0 3021 1 0.8 8
14001607 -20 0 3021 1 1.2 9
14001608 -20 0 3021 1 1.052 11
14001609 -20 0 3021 1 1.51 13
14001610 -20 0 3021 1 1.052 15
14001611 -20 0 3021 1 1.74 16
14001612 -20 0 3021 1 2.1075 18
14001613 -20 0 3021 1 1.5 19
14001614 -20 0 3021 1 1.052 20
14001615 -20 0 3021 1 1.252 22
14001616 -20 0 3021 1 1.052 23
14001617 -20 0 3021 1 1.528 24
14001618 -20 0 3021 1 2.5 25
14001619 -20 0 3021 1 4.5 26
14001620 -20 0 3021 1 3.5 27
14001621 -20 0 3021 1 1.25 29
14001701 0 0.0 0.0 0.0 29
14001801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 29
*_____
* 10.3 Reactor Vessel
*_____
* heat structure 10-1
* Reactor Vessel Think Cylindrical
10101000 20 4 2 1 2.068
10101100 0 1
10101101 1 2.075
10101102 2 2.2675
10101201 4 1
10101202 5 3
10101301 0.0 3
10101400 -1
10101401 558.97 557.34 546.22 535.61
10101402 558.96 557.33 546.21 535.61
10101403 558.96 557.33 546.22 535.61
10101404 558.97 557.34 546.22 535.61
10101405 558.96 557.33 546.21 535.61
10101406 559.02 557.39 546.28 535.67
10101407 559.02 557.39 546.27 535.66
10101408 559.02 557.39 546.28 535.67
10101409 559.03 557.41 546.29 535.68
10101410 559.01 557.38 546.27 535.66
10101411 559.86 558.23 547.07 536.42
10101412 559.86 558.22 547.06 536.41
10101413 559.86 558.22 547.06 536.41
10101414 559.85 558.21 547.05 536.40
10101415 559.80 558.16 547.01 536.36
10101416 559.11 557.48 546.36 535.74
10101417 559.11 557.48 546.35 535.74
10101418 559.11 557.48 546.36 535.75
10101419 559.12 557.48 546.36 535.75
10101420 559.14 557.51 546.38 535.76
10101501 009020000 0 1 1 0.186125 1
10101502 009030000 0 1 1 0.26375 2
10101503 009040000 0 1 1 0.26375 3
10101504 009050000 0 1 1 0.25125 4
10101505 009060000 0 1 1 0.206375 5
10101506 010020000 0 1 1 0.186125 6
10101507 010030000 0 1 1 0.26375 7
10101508 010040000 0 1 1 0.26375 8
10101509 010050000 0 1 1 0.25125 9
10101510 010060000 0 1 1 0.206375 10
10101511 011020000 0 1 1 0.186125 11
10101512 011030000 0 1 1 0.26375 12
10101513 011040000 0 1 1 0.26375 13
10101514 011050000 0 1 1 0.25125 14
10101515 011060000 0 1 1 0.206375 15
10101516 012020000 0 1 1 0.186125 16
10101517 012030000 0 1 1 0.26375 17
10101518 012040000 0 1 1 0.26375 18
10101519 012050000 0 1 1 0.25125 19
10101520 012060000 0 1 1 0.206375 20
10101601 -20 0 3021 1 0.186125 1
10101602 -20 0 3021 1 0.26375 2
10101603 -20 0 3021 1 0.26375 3
10101604 -20 0 3021 1 0.25125 4
10101605 -20 0 3021 1 0.206375 5
10101606 -20 0 3021 1 0.186125 6
10101607 -20 0 3021 1 0.26375 7
10101608 -20 0 3021 1 0.26375 8
10101609 -20 0 3021 1 0.25125 9
10101610 -20 0 3021 1 0.206375 10
10101611 -20 0 3021 1 0.186125 11
10101612 -20 0 3021 1 0.26375 12
10101613 -20 0 3021 1 0.26375 13
10101614 -20 0 3021 1 0.25125 14
10101615 -20 0 3021 1 0.206375 15
10101616 -20 0 3021 1 0.186125 16
10101617 -20 0 3021 1 0.26375 17
10101618 -20 0 3021 1 0.26375 18
10101619 -20 0 3021 1 0.25125 19
10101620 -20 0 3021 1 0.206375 20
10101701 0 0.0 0.0 0.0 20
10101801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 20
* heat structure 10-2
* Reactor Vessel Thick Cylindrical
10102000 16 4 2 1 1.971
10102100 0 1
10102101 1 1.978
10102102 2 2.285
10102201 4 1
10102202 5 3
10102301 0.0 3
10102400 -1
10102401 589.29 587.48 567.66 549.30
10102402 582.48 580.71 561.44 543.59
10102403 585.39 583.61 564.10 546.03
10102404 585.37 583.58 564.07 546.01
10102405 557.63 556.01 538.72 522.71
10102406 555.60 554.00 536.87 521.01
10102407 558.15 556.53 539.21 523.15
10102408 557.78 556.16 538.86 522.83
10102409 558.99 557.37 539.97 523.86
10102410 559.06 557.43 540.04 523.92
10102411 559.89 558.27 540.80 524.62
10102412 559.13 557.51 540.10 523.98
10102413 559.01 557.38 539.99 523.87
10102414 559.07 557.44 540.05 523.92
10102415 559.91 558.28 540.82 524.63
10102416 559.16 557.53 540.12 524.00
10102501 061010000 0 1 1 0.31 1
10102502 062010000 0 1 1 0.31 2
10102503 063010000 0 1 1 0.31 3
10102504 064010000 0 1 1 0.31 4
10102505 001010000 0 1 1 0.1145 5
10102506 002010000 0 1 1 0.1145 6
10102507 003010000 0 1 1 0.1145 7
10102508 004010000 0 1 1 0.1145 8
10102509 005010000 0 1 1 0.36 9
10102510 006010000 0 1 1 0.36 10
10102511 007010000 0 1 1 0.36 11
10102512 008010000 0 1 1 0.36 12
10102513 009010000 0 1 1 0.22525 13
10102514 010010000 0 1 1 0.22525 14
10102515 011010000 0 1 1 0.22525 15
10102516 012010000 0 1 1 0.22525 16
10102601 -20 0 3021 1 0.31 1
10102602 -20 0 3021 1 0.31 2
10102603 -20 0 3021 1 0.31 3
10102604 -20 0 3021 1 0.31 4
10102605 -20 0 3021 1 0.1145 5
10102606 -20 0 3021 1 0.1145 6
10102607 -20 0 3021 1 0.1145 7
10102608 -20 0 3021 1 0.1145 8
10102609 -20 0 3021 1 0.36 9
10102610 -20 0 3021 1 0.36 10
10102611 -20 0 3021 1 0.36 11
10102612 -20 0 3021 1 0.36 12
10102613 -20 0 3021 1 0.22525 13
10102614 -20 0 3021 1 0.22525 14
10102615 -20 0 3021 1 0.22525 15
10102616 -20 0 3021 1 0.22525 16
10102701 0 0.0 0.0 0.0 16
10102801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 16
*_____
* heat structure 10-3
* Reactor Vessel Bottom Part
10103000 4 4 2 1 3.428
10103100 0 1
10103101 1 3.435
10103102 2 3.658
10103201 4 1
10103202 5 3
10103301 0.0 3
10103400 -1
10103401 557.68 556.12 543.72 531.75
10103402 557.38 555.82 543.45 531.49
10103403 558.52 556.96 544.52 532.50
10103404 557.05 555.49 543.14 531.20
10103501 014010000 0 1 1 0.178 1
10103502 015010000 0 1 1 0.178 2
10103503 016010000 0 1 1 0.178 3
10103504 017010000 0 1 1 0.178 4
10103601 -20 0 3021 1 0.178 1
10103602 -20 0 3021 1 0.178 2
10103603 -20 0 3021 1 0.178 3
10103604 -20 0 3021 1 0.178 4
10103701 0 0.0 0.0 0.0 4
10103801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
*_____
* heat structure 10-4
* Core Barrel
10104000 36 4 2 1 1.745
10104100 0 1
10104101 3 1.810
10104201 5 3
10104301 0.0 3
10104400 -1
10104401 588.38 580.24 572.22 564.30
10104402 585.49 579.29 573.17 567.13
10104403 586.81 579.30 571.90 564.60
10104404 587.43 579.53 571.74 564.07
10104405 588.98 579.16 569.49 559.96
10104406 585.68 576.96 568.37 559.90
10104407 587.33 578.35 569.51 560.79
10104408 587.97 578.54 569.25 560.09
10104409 589.45 579.40 569.51 559.77
10104410 586.09 577.19 568.41 559.75
10104411 587.74 578.57 569.53 560.61
10104412 588.41 578.76 569.26 559.89
10104413 566.23 563.89 561.59 559.31
10104414 566.24 563.92 561.63 559.36
10104415 566.45 564.34 562.25 560.19
10104416 566.26 563.96 561.69 559.45
10104417 566.24 563.92 561.63 559.36
10104418 566.25 563.95 561.67 559.41
10104419 566.46 564.37 562.29 560.24
10104420 566.28 563.99 561.73 559.51
10104421 559.33 559.28 559.23 559.18
10104422 559.34 559.31 559.28 559.24
10104423 559.57 559.74 559.90 560.06
10104424 559.37 559.36 559.34 559.33
10104425 559.33 559.28 559.24 559.19
10104426 559.35 559.31 559.28 559.24
10104427 559.57 559.74 559.90 560.06
10104428 559.37 559.36 559.35 559.33
10104429 559.34 559.29 559.24 559.19
10104430 559.35 559.32 559.29 559.25
10104431 559.56 559.73 559.89 560.05
10104432 559.37 559.36 559.35 559.33
10104433 559.16 559.17 559.18 559.19
10104434 559.24 559.25 559.25 559.25
10104435 559.97 560.00 560.01 560.03
10104436 559.33 559.35 559.36 559.37
10104501 049010000 0 1 1 0.1145 1
10104502 050010000 0 1 1 0.1145 2
10104503 051010000 0 1 1 0.1145 3
10104504 052010000 0 1 1 0.1145 4
10104505 041010000 0 1 1 0.3600 5
10104506 042010000 0 1 1 0.3600 6
10104507 043010000 0 1 1 0.3600 7
10104508 044010000 0 1 1 0.3600 8
10104509 037010000 0 1 1 0.1080 9
10104510 038010000 0 1 1 0.1080 10
10104511 039010000 0 1 1 0.1080 11
10104512 040010000 0 1 1 0.1080 12
10104513 034040000 0 1 1 0.11725 13
10104514 034040000 0 1 1 0.11725 14
10104515 034040000 0 1 1 0.11725 15
10104516 034040000 0 1 1 0.11725 16
10104517 034040000 0 1 1 0.186125 17
10104518 034040000 0 1 1 0.186125 18
10104519 034040000 0 1 1 0.186125 19
10104520 034040000 0 1 1 0.186125 20
10104521 034030000 0 1 1 0.26375 21
10104522 034030000 0 1 1 0.26375 22
10104523 034030000 0 1 1 0.26375 23
10104524 034030000 0 1 1 0.26375 24
10104525 034020000 0 1 1 0.26375 25
10104526 034020000 0 1 1 0.26375 26
10104527 034020000 0 1 1 0.26375 27
10104528 034020000 0 1 1 0.26375 28
10104529 034010000 0 1 1 0.25125 29
10104530 034010000 0 1 1 0.25125 30
10104531 034010000 0 1 1 0.25125 31
10104532 034010000 0 1 1 0.25125 32
10104533 018010000 0 1 1 0.206375 33
10104534 019010000 0 1 1 0.206375 34
10104535 020010000 0 1 1 0.206375 35
10104536 021010000 0 1 1 0.206375 36
10104601 001010000 0 1 1 0.1145 1
10104602 002010000 0 1 1 0.1145 2
10104603 003010000 0 1 1 0.1145 3
10104604 004010000 0 1 1 0.1145 4
10104605 005010000 0 1 1 0.3600 5
10104606 006010000 0 1 1 0.3600 6
10104607 007010000 0 1 1 0.3600 7
10104608 008010000 0 1 1 0.3600 8
10104609 009010000 0 1 1 0.1080 9
10104610 010010000 0 1 1 0.1080 10
10104611 011010000 0 1 1 0.1080 11
10104612 012010000 0 1 1 0.1080 12
10104613 009010000 0 1 1 0.11725 13
10104614 010010000 0 1 1 0.11725 14
10104615 011010000 0 1 1 0.11725 15
10104616 012010000 0 1 1 0.11725 16
10104617 009020000 0 1 1 0.186125 17
10104618 010020000 0 1 1 0.186125 18
10104619 011020000 0 1 1 0.186125 19
10104620 012020000 0 1 1 0.186125 20
10104621 009030000 0 1 1 0.26375 21
10104622 010030000 0 1 1 0.26375 22
10104623 011030000 0 1 1 0.26375 23
10104624 012030000 0 1 1 0.26375 24
10104625 009040000 0 1 1 0.26375 25
10104626 010040000 0 1 1 0.26375 26
10104627 011040000 0 1 1 0.26375 27
10104628 012040000 0 1 1 0.26375 28
10104629 009050000 0 1 1 0.25125 29
10104630 010050000 0 1 1 0.25125 30
10104631 011050000 0 1 1 0.25125 31
10104632 012050000 0 1 1 0.25125 32
10104633 009060000 0 1 1 0.206375 33
10104634 010060000 0 1 1 0.206375 34
10104635 011060000 0 1 1 0.206375 35
10104636 012060000 0 1 1 0.206375 36
```

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10104701 0 0.0 0.0 0.0 36
10104801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 36
10104901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 36
*---------------
* heat structure 10-5
* Core supporting plate
10105000 4 4 1 1 0.0
10105100 0 1
10105101 3 0.2
10105201 5 3
10105301 0.0 3
10105400 -1
10105401 559.16 559.17 559.16 559.15
10105402 559.24 559.26 559.25 559.24
10105403 559.97 559.98 559.98 559.96
10105404 559.33 559.34 559.33 559.32
10105501 018010000 0 1 1 1.875 1
10105502 019010000 0 1 1 1.875 2
10105503 020010000 0 1 1 1.875 3
10105504 021010000 0 1 1 1.875 4
10105601 022010000 0 1 1 1.875 1
10105602 023010000 0 1 1 1.875 2
10105603 024010000 0 1 1 1.875 3
10105604 025010000 0 1 1 1.875 4
10105701 0 0.0 0.0 0.0 4
10105801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
10105901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
*---------------
* heat structure 10-6
* Core upper perforated plate
10106000 4 4 1 1 0.0
10106100 0 1
10106101 3 0.2
10106201 5 3
10106301 0.0 3
10106400 -1
10106401 590.59 590.44 590.29 590.14
10106402 587.28 587.10 586.91 586.71
10106403 588.39 588.39 588.38 588.37
10106404 589.60 589.43 589.26 589.08
10106501 030010000 0 1 1 2.259 1
10106502 031010000 0 1 1 2.259 2
10106503 032010000 0 1 1 2.259 3
10106504 033010000 0 1 1 2.259 4
10106601 037010000 0 1 1 2.259 1
10106602 038010000 0 1 1 2.259 2
10106603 039010000 0 1 1 2.259 3
10106604 040010000 0 1 1 2.259 4
10106701 0 0.0 0.0 0.0 4
10106801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
10106901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
*---------------
* heat structure 10-7
* Lower protecive tube supporeted plate
10107000 4 4 1 1 0.0
10107100 0 1
10107101 3 0.2
10107201 5 3
10107301 0.0 3
10107400 -1
10107401 590.13 590.11 590.09 590.06
10107402 586.71 586.70 586.68 586.65
10107403 588.37 588.36 588.34 588.31
10107404 589.07 589.06 589.04 589.01
10107501 037010000 0 1 1 10.425 1
10107502 038010000 0 1 1 10.425 2
10107503 039010000 0 1 1 10.425 3
10107504 040010000 0 1 1 10.425 4
10107601 041010000 0 1 1 10.425 1
10107602 042010000 0 1 1 10.425 2
10107603 043010000 0 1 1 10.425 3
10107604 044010000 0 1 1 10.425 4
10107701 0 0.0 0.0 0.0 4
10107801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
10107901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
*---------------
* heat structure 10-8
*crdno no.h.s no.m.p geo s.s.flg left
10108000 4 4 1 1 0.0
10108100 0 1
10108101 3 0.2
10108201 5 3
10108301 0.0 3
10108400 -1
10108401 590.06 590.04 590.01 589.98
10108402 586.65 586.69 586.72 586.75
10108403 588.31 588.31 588.30 588.28
10108404 589.01 589.01 589.01 589.00
10108501 041010000 0 1 1 3.6 1
10108502 042010000 0 1 1 3.6 2
10108503 043010000 0 1 1 3.6 3
10108504 044010000 0 1 1 3.6 4
10108601 045010000 0 1 1 3.6 1
10108602 046010000 0 1 1 3.6 2
10108603 047010000 0 1 1 3.6 3
10108604 048010000 0 1 1 3.6 4
10108701 0 0.0 0.0 0.0 4
10108801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
10108901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 4
*---------------
* heat structure 11-1
* Protective Tubes
* 60 tubes Din = 0.108, Dou = 0.116
10111000 13 4 2 1 0.054
10111100 0 1
10111101 3 0.058
10111201 5 3
10111301 0.0 3
10111400 -1
10111401 590.13 590.13 590.13 590.13
10111402 586.70 586.70 586.70 586.70
10111403 588.37 588.37 588.37 588.37
10111404 589.07 589.07 589.07 589.07
10111405 590.06 590.06 590.06 590.06
10111406 586.65 586.65 586.65 586.65
10111407 588.31 588.31 588.31 588.31
10111408 589.01 589.01 589.01 589.01
10111409 589.98 589.98 589.98 589.98
10111410 586.75 586.75 586.75 586.75
10111411 588.28 588.28 588.28 588.28
10111412 589.00 589.00 589.00 589.00
10111413 589.20 589.20 589.20 589.20
10111501 037010000 0 1 1 6.48 1
10111502 038010000 0 1 1 6.48 2
10111503 039010000 0 1 1 6.48 3
10111504 040010000 0 1 1 6.48 4
10111505 041010000 0 1 1 22.035 5
10111506 042010000 0 1 1 22.035 6
10111507 043010000 0 1 1 22.035 7
10111508 044010000 0 1 1 22.035 8
10111509 045010000 0 1 1 31.59 9
10111510 046010000 0 1 1 31.59 10
10111511 047010000 0 1 1 31.59 11
10111512 048010000 0 1 1 31.59 12
10111513 054010000 0 1 1 95.52 13
10111601 037010000 0 1 1 6.48 1
10111602 038010000 0 1 1 6.48 2
10111603 039010000 0 1 1 6.48 3
10111604 040010000 0 1 1 6.48 4
10111605 041010000 0 1 1 22.035 5
10111606 042010000 0 1 1 22.035 6
10111607 043010000 0 1 1 22.035 7
10111608 044010000 0 1 1 22.035 8
10111609 045010000 0 1 1 31.59 9
10111610 046010000 0 1 1 31.59 10
10111611 047010000 0 1 1 31.59 11
10111612 048010000 0 1 1 31.59 12
10111613 054010000 0 1 1 95.52 13
10111701 0 0.0 0.0 0.0 13
10111801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 13
10111901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 13
*---------------
* heat structure 11-2
* Protective Tubes
* 61 tubes Din = 0.180, Dou = 0.116
10112000 13 4 2 1 0.090
10112100 0 1
10112101 3 0.095
10112201 5 3
10112301 0.0 3
10112400 -1
10112401 590.13 590.13 590.13 590.13
10112402 586.70 586.70 586.70 586.70
10112403 588.37 588.37 588.37 588.37
10112404 589.07 589.07 589.07 589.07
10112405 590.06 590.06 590.06 590.06
10112406 586.65 586.65 586.65 586.65
10112407 588.31 588.31 588.31 588.31
10112408 589.01 589.01 589.01 589.01
10112409 589.98 589.98 589.98 589.98
10112410 586.75 586.75 586.75 586.75
10112411 588.28 588.28 588.28 588.28
10112412 589.00 589.00 589.00 589.00
10112413 589.20 589.20 589.20 589.20
10112501 037010000 0 1 1 6.588 1
10112502 038010000 0 1 1 6.588 2
10112503 039010000 0 1 1 6.588 3
10112504 040010000 0 1 1 6.588 4
10112505 041010000 0 1 1 22.402 5
10112506 042010000 0 1 1 22.402 6
10112507 043010000 0 1 1 22.402 7
10112508 044010000 0 1 1 22.402 8
10112509 045010000 0 1 1 32.117 9
10112510 046010000 0 1 1 32.117 10
10112511 047010000 0 1 1 32.117 11
10112512 048010000 0 1 1 32.117 12
10112513 054010000 0 1 1 97.112 13
10112601 037010000 0 1 1 6.588 1
10112602 038010000 0 1 1 6.588 2
10112603 039010000 0 1 1 6.588 3
10112604 040010000 0 1 1 6.588 4
10112605 041010000 0 1 1 22.402 5
10112606 042010000 0 1 1 22.402 6
10112607 043010000 0 1 1 22.402 7
10112608 044010000 0 1 1 22.402 8
10112609 045010000 0 1 1 32.117 9
10112610 046010000 0 1 1 32.117 10
10112611 047010000 0 1 1 32.117 11
10112612 048010000 0 1 1 32.117 12
10112613 054010000 0 1 1 97.112 13
10112701 0 0.0 0.0 0.0 13
10112801 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 13
10112901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 13
*---------------
* 10.4 Core
*---------------
* heat structure 26-1
* 40.75 FA corresponding to Loop 1: Q = 0.245632
10261000 10 9 2 1 1.2-3
10261100 0 1
10261101 4 3.785-3
10261102 1 3.860-3
10261103 3 4.565-3
10261201 1 4
10261202 -3 5
10261203 -2 8
10261301 1.0 4
10261302 0.0 8
10261400 -1
10261401 1173. 1154. 1105. 1034. 945. 595. 588. 581.46 575.21
10261402 1674. 1628. 1513. 1352. 1164. 624. 611.8 600.4
589.65
10261403 1725. 1675. 1553. 1382. 1184. 630.6 618.2 606.5
595.3
10261404 1683. 1636. 1520. 1358. 1170. 633. 621.1 609.8 599.1
10261405 1580. 1540. 1439. 1299. 1132. 632. 621.5 611.1
601.26
10261406 1397. 1368. 1293. 1187. 1058. 627.0 617.9 609.3
601.1
10261407 1209. 1189. 1138. 1063. 970.2 620.1 613. 606.3
599.93
10261408 1044. 1031. 997. 947. 884.0 613.3 608.1 603.14
598.44
10261409 867.1 860.1 842.2 815.5 781.2 605.1 601.9 598.8
595.9
10261410 707.8 705.3 698.8 688.9 676.1 596.9 595.5 594.3
593.0
10261501 0 0 0 1 4488.042 10
10261601 026010000 10000 1 1 4488.042 10
10261701 10026 0.08623 0.0 0.0 1
10261702 10026 0.14930 0.0 0.0 2
10261703 10026 0.15460 0.0 0.0 3
10261704 10026 0.14930 0.0 0.0 4
10261705 10026 0.13670 0.0 0.0 5
10261706 10026 0.11360 0.0 0.0 6
10261707 10026 0.08833 0.0 0.0 7
10261708 10026 0.06519 0.0 0.0 8
10261709 10026 0.03996 0.0 0.0 9
10261710 10026 0.01682 0.0 0.0 10
10261901 0.01149 20.0 20.0 0.0 0.0 0.0 0.0 1.0 10
*---------------
* heat structure 27-1
* 40.75 FA corresponding to Loop 2: Q = 0.246615
10271000 10 9 2 1 1.2-3
10271100 0 1
10271101 4 3.785-3
10271102 1 3.860-3
10271103 3 4.565-3
10271201 1 4
10271202 -3 5
10271203 -2 8
10271301 1.0 4
10271302 0.0 8
10271400 -1
10271401 1103. 1087. 1045. 984.8 908.8 591.1 584.9 579.0
573.5
10271402 1535. 1496. 1402. 1268. 1110. 616.6 606. 595.9
586.29
10271403 1577. 1537. 1436. 1295. 1128. 622.8 611.7 601.3
591.4
10271404 1542. 1504. 1408. 1275. 1116. 625. 614.4 604.3
594.71
10271405 1455. 1422. 1339. 1222. 1081. 624.5 614.7 605.5
596.7
10271406 1298. 1274. 1212. 1122. 1012. 619.7 611.6 603.9
596.7
10271407 1135. 1118. 1074. 1011. 931.7 613.6 607.2 601.3
595.6
10271408 989.8 978.6 949.8 907. 852.8 607.5 602.9 598.5
594.27
10271409 833.2 827.3 811.9 788.8 759.1 600.2 597.3 594.6
592.0
10271410 691.7 689.5 683.8 675.2 664. 592. 591.68 590.6
589.47
10271501 0 0 0 1 4488.042 10
10271601 027010000 10000 1 1 4488.042 10
10271701 10027 0.08623 0.0 0.0 1
10271702 10027 0.14930 0.0 0.0 2
10271703 10027 0.15460 0.0 0.0 3
10271704 10027 0.14930 0.0 0.0 4
10271705 10027 0.13670 0.0 0.0 5
10271706 10027 0.11360 0.0 0.0 6
10271707 10027 0.08833 0.0 0.0 7
10271708 10027 0.06519 0.0 0.0 8
10271709 10027 0.03996 0.0 0.0 9
10271710 10027 0.01682 0.0 0.0 10
10271901 0.01149 20.0 20.0 0.0 0.0 0.0 0.0 1.0 10
*---------------
* heat structure 28-1
* 40.75 FA corresponding to Loop 3: Q = 0.256065
10281000 10 9 2 1 1.2-3
10281100 0 1
10281101 4 3.785-3
```

```
10281102 1 3.860-3
10281103 3 4.565-3
10281201 1 4
10281202 -3 5
10281203 -2 8
10281301 1.0 4
10281302 0.0 8
10281400 -1
10281401 1112. 1096. 1053. 991.5 914.0 592.3 586.0 580.1
574.4
10281402 1552. 1513. 1416. 1279. 1117. 618.3 607.4 597.2
587.5
10281403 1596. 1555. 1451. 1306. 1136. 624.5 613.2 602.6
592.6
10281404 1560. 1520. 1423. 1285. 1123. 626.7 615.9 605.7
595.9
10281405 1471. 1437. 1352. 1232. 1088. 626.2 616.3 606.9
598.0
10281406 1311. 1286. 1223. 1131. 1018. 621.3 613.1 605.3
597.9
10281407 1145. 1127. 1083. 1018. 937.0 615.0 608.6 602.6
596.8
10281408 997.1 985.7 956.3 912.6 857.3 608.9 604.2 599.7
595.5
10281409 838.1 832.0 816.3 792.7 762.4 601.5 598.6 595.8
593.2
10281410 694.3 692.1 686.3 677.6 666.1 594.1 592.9 591.7
590.6
10281501 0 0 0 1 4488.042 10
10281601 028010000 10000 1 1 4488.042 10
10281701 10028 0.08623 0.0 0.0 1
10281702 10028 0.14930 0.0 0.0 2
10281703 10028 0.15460 0.0 0.0 3
10281704 10028 0.14930 0.0 0.0 4
10281705 10028 0.13670 0.0 0.0 5
10281706 10028 0.11360 0.0 0.0 6
10281707 10028 0.08833 0.0 0.0 7
10281708 10028 0.06519 0.0 0.0 8
10281709 10028 0.03996 0.0 0.0 9
10281710 10028 0.01682 0.0 0.0 10
10281901 0.01149 20.0 20.0 0.0 0.0 0.0 0.0 1.0 10
*-----------
* heat structure 29-1
* 40.75 FA corresponding to Loop 4: Q = 0.251688
10291000 10 9 2 1 1.2-3
10291100 0 1
10291101 4 3.785-3
10291102 1 3.860-3
10291103 3 4.565-3
10291201 1 4
10291202 -3 5
10291203 -2 8
10291301 1.0 4
10291302 0.0 8
10291400 -1
10291401 1149. 1131. 1085. 1017. 933.1 593.8 587.1 580.8
574.8
10291402 1626. 1583. 1474. 1323. 1146. 621.5 609.9 599.0
588.6
10291403 1673. 1627. 1512. 1352. 1165. 628.1 616.1 604.8
594.1
10291404 1634. 1590. 1482. 1330. 1152. 630.5 618.9 608.1
597.7
10291405 1537. 1499. 1405. 1273. 1115. 629.9 619.3 609.3
599.9
10291406 1364. 1336. 1266. 1165. 1042. 624.6 615.9 607.6
599.7
10291407 1183. 1165. 1116. 1045. 957.3 618.0 611.2 604.7
598.6
10291408 1026. 1013. 981.1 933.7 873.5 611.5 606.4 601.7
597.1
10291409 855.6 849. 832. 806.5 773.8 603.5 600.4 597.5 594.7
10291410 702.4 700.0 693.8 684.4 672.1 595.7 594.4 593.1 592.
10291501 0 0 0 1 4488.042 10
10291601 029010000 10000 1 1 4488.042 10
10291701 10029 0.08623 0.0 0.0 1
10291702 10029 0.14930 0.0 0.0 2
10291703 10029 0.15460 0.0 0.0 3
10291704 10029 0.14930 0.0 0.0 4
10291705 10029 0.13670 0.0 0.0 5
10291706 10029 0.11360 0.0 0.0 6
10291707 10029 0.08833 0.0 0.0 7
10291708 10029 0.06519 0.0 0.0 8
10291709 10029 0.03996 0.0 0.0 9
10291710 10029 0.01682 0.0 0.0 10
10291901 0.01149 20.0 20.0 0.0 0.0 0.0 0.0 1.0 10
*-----------
* 10.5 Pressurizer Heaters
*-----------
* heat structure 504-1
* PRZ heaters Group No 1
* Number of Blocks - 3; Power - 270 kW, D = 13 mm,
* Length of 1 Heater = 1.905 m
* F = 3 * 9 * 0.0777 = 2.0979 sq.m; Heq = 51.3678 m
15041000 1 4 2 1 0.0
15041100 0 1
15041101 3 13.0-3
15041201 4 3
15041301 1.0 3
15041400 -1
15041401 617.89 617.89 617.89 617.89
15041501 0 0 0 1 51.3678 1
15041601 504020000 0 1 1 51.3678 1
15041701 501 1.0 0.0 0.0 1
15041901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 504-2
* PRZ heaters Group No 2
* Number of Blocks - 3; Power - 270 kW, D = 13 mm,
* Length of 1 Heater = 1.905 m
* F = 3 * 9 * 0.0777 = 2.0979 sq.m; Heq = 51.3678 m
15042000 1 4 2 1 0.0
15042100 0 1
15042101 3 13.0-3
15042201 4 3
15042301 1.0 3
15042400 -1
15042401 617.89 617.89 617.89 617.89
15042501 0 0 0 1 51.3678 1
15042601 504020000 0 1 1 51.3678 1
15042701 502 1.0 0.0 0.0 1
15042901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 504-3
* PRZ heaters Group No 3
* Number of Blocks - 8; Power - 720 kW, D = 13 mm,
* Length of 1 Heater = 1.905 m
* F = 8 * 9 * 0.0777 = 5.5944 sq.m; Heq = 136.981 m
15043000 1 4 2 1 0.0
15043100 0 1
15043101 3 13.0-3
15043201 4 3
15043301 1.0 3
15043400 -1
15043401 617.89 617.89 617.89 617.89
15043501 0 0 0 1 136.981 1
15043601 504020000 0 1 1 136.981 1
15043701 503 1.0 0.0 0.0 1
15043901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* heat structure 504-4
* PRZ heaters Group No 4
* Number of Blocks - 14; Power - 1260 kW, D = 13 mm,
* Length of 1 Heater = 1.905 m
* F = 14 * 9 * 0.0777 = 9.7902 sq.m; Heq = 239.7167 m
15044000 1 4 2 1 0.0
15044100 0 1
15044101 3 13.0-3
15044201 4 3
15044301 1.0 3
15044400 -1
15044401 617.89 617.89 617.89 617.89
15044501 0 0 0 1 239.7167 1
15044601 504020000 0 1 1 239.7167 1
15044701 504 1.0 0.0 0.0 1
15044901 0.0 20.0 20.0 0.0 0.0 0.0 0.0 1.0 1
*-----------
* 11. Thermal Properties
*-----------
20100100 tbl/fctn 1 1 * UO2
20100200 tbl/fctn 1 1 * Zr1%Ni
20100300 tbl/fctn 3 1 * Gas in average rod / bottom /
20100400 tbl/fctn 1 1 * Stainless Steel, 08X18H10T
20100500 tbl/fctn 1 1 * Steel, 15X2HMFA (p.vessel)
20100600 tbl/fctn 1 1 * Steel, 22k (sg vessel and prz)
20100700 tbl/fctn 1 1 * MCP, SG-v, PRZ-v, PRZ surge and
20100800 tbl/fctn 1 1 * absorber
*-----------
* UO2 Thermal Conductivity
20100101 300.0 8.15
20100102 500.0 6.70
20100103 700.0 5.40
20100104 900.0 4.40
20100105 1100.0 3.75
20100106 1300.0 3.25
20100107 1500.0 2.80
20100108 1700.0 2.50
20100109 1900.0 2.40
20100110 2100.0 2.42
20100111 2300.0 2.44
20100112 2500.0 2.50
20100113 2700.0 2.65
20100114 2900.0 3.00
20100115 3100.0 3.50
20100116 3120.0 3.44
20100117 3120.1 11.00
*-----------
* Zr1%Ni Thermal Conductivity
20100201 293.0 17.2
20100202 373.0 18.0
20100203 473.0 19.3
20100204 573.0 20.1
20100205 673.0 20.5
20100206 773.0 20.9
20100207 873.0 21.8
20100208 973.0 22.0
20100209 1273.0 27.8
20100210 1373.0 29.0
20100211 1473.0 30.1
20100212 1573.0 31.2
20100213 1573.01 34.3222
20100214 1673.0 37.7650
20100215 1773.0 41.6875
20100216 1873.0 46.1357
20100217 1973.0 51.1556
20100218 2073.0 56.7933
20100219 2173.0 36.0000
20100220 3500.0 36.0000
*-----------
* GAP thermal conductivity
20100301 helium 0.68
20100302 xenon 0.27
20100303 krypton 0.05
*-----------
* Stainless Steel thermal conductivity
20100401 273.0 16.9 * 13.52 16.9
20100402 373.0 16.9 * 13.52 16.9
20100403 473.0 18.1 * 14.48 18.1
20100404 573.0 19.5 * 15.60 19.5
20100405 673.0 20.3 * 16.64 20.3
20100406 3073.0 20.3 * 16.64 20.3
*-----------
* Steel thermal conductivity
20100501 273.0 39.8
20100502 373.0 39.8
20100503 673.0 36.8
20100504 3073.0 36.8
*-----------
* SG Vessel & PRZ Steel thermal conductivity
20100601 273.0 49.3
20100602 373.0 49.3
20100603 673.0 43.4
20100604 3073.0 43.4
*-----------
* MCP, SG-v, PRZ-v, PRZ surge and ing. line,
* steel 10GH2MFA thermal conductivity
*-----------
20100701 273.0 34.0
20100702 373.0 34.0
20100703 473.0 39.0
20100704 573.0 40.0
20100705 673.0 42.0
20100706 3073.0 42.0
*-----------
* Absorber thermal conductivity
*
20100801 273.0 0.2
20100802 3000.0 0.2
*-----------
* UO2 volumetric heat capacity
20100151 298.15 2.45447+6
20100152 300.00 2.46547+6
20100153 400.00 2.83383+6
20100154 500.00 2.98299+6
20100155 600.00 3.05385+6
20100156 700.00 3.09464+6
20100157 800.00 3.12552+6
20100158 900.00 3.15616+6
20100159 1000.0 3.19162+6
20100160 1100.0 3.23473+6
20100161 1200.0 3.28729+6
20100162 1300.0 3.35039+6
20100163 1400.0 3.42468+6
20100164 1500.0 3.51071+6
20100165 1600.0 3.60877+6
20100166 1700.0 3.71914+6
20100167 1800.0 3.84198+6
20100168 1900.0 3.97744+6
20100169 2000.0 4.12563+6
20100170 2100.0 4.28657+6
20100171 2200.0 4.46035+6
20100172 2300.0 4.64706+6
20100173 2400.0 4.84666+6
20100174 2500.0 5.05922+6
20100175 2600.0 5.28476+6
20100176 2700.0 5.52329+6
20100177 2800.0 5.77488+6
20100178 2900.0 6.03947+6
20100179 3000.0 6.31710+6
20100180 3100.0 6.60778+6
20100181 3123.0 6.67647+6
20100182 3123.01 5.05559+6
*-----------
* Zr1%Ni volumetric heat capacity
20100251 273.0 1863680.0
20100252 373.0 1863680.0
20100253 473.0 1963880.0
20100254 573.0 2096140.0
20100255 673.0 2227790.0
20100256 773.0 2384750.0
20100257 873.0 2573290.0
20100258 973.0 2889970.0
20100259 1073.0 3115060.0
20100260 1173.0 3940700.0
20100261 1300.0 2059640.0
20100262 1400.0 2094790.0
20100263 1500.0 2137440.0
20100264 1600.0 2185700.0
20100265 1700.0 2238050.0
20100266 1800.0 2293690.0
20100267 1900.0 2351660.0
20100268 2000.0 2411540.0
20100269 2100.0 2564930.0
```

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20100270 2133.0 2588760.0
20100271 2133.1 3058870.0
20100272 3500.0 3058870.0
*-----------
* GAP volumetric heat capacity
20100351 225.0 549.0
20100352 10000.0 549.0
*-----------
* Stainless Steel volumetric heat capacity
20100451 273.0 3.9+6
20100452 373.0 3.9+6
20100453 573.0 4.23+6
20100454 673.0 4.33+6
20100455 3073.0 4.33+6
*-----------
* Steel volumetric heat capacity
20100551 273.0 3.89+6
20100552 373.0 3.89+6
20100553 473.0 3.95+6
20100554 573.0 4.28+6
20100555 673.0 4.52+6
20100556 3073.0 4.52+6
*-----------
* SG Vessel & PRZ Steel volumetric heat capacity
20100651 273.0 3.87+6
20100652 373.0 3.87+6
20100653 673.0 4.83+6
20100654 3073.0 4.83+6
*-----------
* MCP, SG-v, PRZ-v, PRZ surge and ing. line,
* steel 10GH2MFA heat capacity
20100751 273.0 3.7807+6
20100752 373.0 3.7807+6
20100753 473.0 4.1186+6
20100754 573.0 4.4723+6
20100755 673.0 4.8575+6
20100756 3073.0 4.8575+6
*-----------
* Absorber heat capacity
20100851 273. 500.0
20100852 2000.0 500.0
*-----------
* 12. Reactor Kinetics
*-----------
30000000 point separabl
30000001 gamma-ac 2917.0+6 0.0 286.0 1.1 0.65
30000002 ans79-1
30000101 0.029 0.0124
30000102 0.211 0.0305
30000103 0.191 0.111
30000104 0.388 0.301
30000105 0.135 1.14
30000106 0.046 3.01
30000401 2917.0+6 650.0 day
30000011 11 10
30000701 026010000 0 0.2118-1 0.0
30000702 026020000 0 0.3668-1 0.0
30000703 026030000 0 0.3797-1 0.0
30000704 026040000 0 0.3668-1 0.0
30000705 026050000 0 0.3358-1 0.0
30000706 026060000 0 0.2790-1 0.0
30000707 026070000 0 0.2170-1 0.0
30000708 026080000 0 0.1601-1 0.0
30000709 026090000 0 0.9815-2 0.0
30000710 026100000 0 0.4133-2 0.0
30000711 027010000 0 0.2126-1 0.0
30000712 027020000 0 0.3682-1 0.0
30000713 027030000 0 0.3812-1 0.0
30000714 027040000 0 0.3682-1 0.0
30000715 027050000 0 0.3371-1 0.0
30000716 027060000 0 0.2801-1 0.0
30000717 027070000 0 0.2178-1 0.0
30000718 027080000 0 0.1608-1 0.0
30000719 027090000 0 0.9854-2 0.0
30000720 027100000 0 0.4149-2 0.0
30000721 028010000 0 0.2208-1 0.0
30000722 028020000 0 0.3823-1 0.0
30000723 028030000 0 0.3958-1 0.0
30000724 028040000 0 0.3823-1 0.0
30000725 028050000 0 0.3500-1 0.0
30000726 028060000 0 0.2908-1 0.0
30000727 028070000 0 0.2262-1 0.0
30000728 028080000 0 0.1669-1 0.0
30000729 028090000 0 0.1023-1 0.0
30000730 028100000 0 0.4308-2 0.0
30000731 029010000 0 0.2170-1 0.0
30000732 029020000 0 0.3758-1 0.0
30000733 029030000 0 0.3890-1 0.0
30000734 029040000 0 0.3758-1 0.0
30000735 029050000 0 0.3441-1 0.0
30000736 029060000 0 0.2858-1 0.0
30000737 029070000 0 0.2223-1 0.0
30000738 029080000 0 0.1641-1 0.0
30000739 029090000 0 0.1006-1 0.0
30000740 029100000 0 0.4234-2 0.0
30000801 0261001 0 0.2118-1 0.0
30000802 0261002 0 0.3668-1 0.0
30000803 0261003 0 0.3797-1 0.0
30000804 0261004 0 0.3668-1 0.0
30000805 0261005 0 0.3358-1 0.0
30000806 0261006 0 0.2790-1 0.0
30000807 0261007 0 0.2170-1 0.0
30000808 0261008 0 0.1601-1 0.0
30000809 0261009 0 0.9815-2 0.0
30000810 0261010 0 0.4133-2 0.0
30000811 0271001 0 0.2126-1 0.0
30000812 0271002 0 0.3682-1 0.0
30000813 0271003 0 0.3812-1 0.0
30000814 0271004 0 0.3682-1 0.0
30000815 0271005 0 0.3371-1 0.0
30000816 0271006 0 0.2801-1 0.0
30000817 0271007 0 0.2178-1 0.0
30000818 0271008 0 0.1608-1 0.0
30000819 0271009 0 0.9854-2 0.0
30000820 0271010 0 0.4149-2 0.0
30000821 0281001 0 0.2208-1 0.0
30000822 0281002 0 0.3823-1 0.0
30000823 0281003 0 0.3958-1 0.0
30000824 0281004 0 0.3823-1 0.0
30000825 0281005 0 0.3500-1 0.0
30000826 0281006 0 0.2908-1 0.0
30000827 0281007 0 0.2262-1 0.0
30000828 0281008 0 0.1669-1 0.0
30000829 0281009 0 0.1023-1 0.0
30000830 0281010 0 0.4308-2 0.0
30000831 0291001 0 0.2170-1 0.0
30000832 0291002 0 0.3758-1 0.0
30000833 0291003 0 0.3890-1 0.0
30000834 0291004 0 0.3758-1 0.0
30000835 0291005 0 0.3441-1 0.0
30000836 0291006 0 0.2858-1 0.0
30000837 0291007 0 0.2223-1 0.0
30000838 0291008 0 0.1641-1 0.0
30000839 0291009 0 0.1006-1 0.0
30000840 0291010 0 0.4234-2 0.0
* Density reactivity table
*cdmo moderator reactivity
30000501 100.0 0.0
30000502 150.0 0.0
30000503 200.0 0.0
30000504 250.0 0.0
30000505 300.0 0.0
30000506 350.0 0.0
30000507 400.0 0.0
30000508 450.0 0.0
30000509 500.0 0.0
30000510 550.0 0.0
30000511 600.0 0.0
30000512 650.0 0.0
30000513 700.0 0.0
30000514 750.0 0.0
30000515 800.0 0.0
30000516 850.0 0.0
30000601 400.0 0.0
30000602 600.0 0.0
30000603 800.0 0.0
30000604 1000.0 0.0
30000605 1200.0 0.0
30000606 1400.0 0.0
30000607 1600.0 0.0
30000608 1800.0 0.0
*-----------
* 13. Reactor Power
* cntrlvar N 26
* Power of 40.75 FA corresponding to the Loop 1
* Q = 0.2664314
20502600 Pow-Lp1 sum 0.2664314 777.1803938+6 0
20502601 0.0 1.0 rktpow 0
* cntrlvar N 27
* Power of 40.75 FA corresponding to the Loop 2
* Q = 0.2367771
20502700 Pow-Lp2 sum 0.2367771 690.6788007+6 0
20502701 0.0 1.0 rktpow 0
* cntrlvar N 28
* Power of 40.75 FA corresponding to the Loop 3
* Q = 0.2404831
20502800 Pow-Lp3 sum 0.2404831 701.4892027+6 0
20502801 0.0 1.0 rktpow 0
* cntrlvar N 29
* Power of 40.75 FA corresponding to the Loop 4
* Q = 0.2563084
20502900 Pow-Lp4 sum 0.2563084 747.6516028+6 0
20502901 0.0 1.0 rktpow 0
*-----------
* 13.1 PRZ Heaters Power
*-----------
* Table No 501
* Group No 1
20250100 power 621
20250101 -1.0 0.0
20250102 0.0 270.0+3
* Table No 502
* Group No 2
20250200 power 624
20250201 -1.0 0.0
20250202 0.0 270.0+3
* Table No 503
* Group No 3
20250300 power 627
20250301 -1.0 0.0
20250302 0.0 720.0+3
* Table No 504
* Group No 4
20250400 power 630
20250401 -1.0 0.0
20250402 0.0 1260.0+3
*-----------
* 13.2 SCRAM
*-----------
* Table No 10
* Reactivity after SCRAM
20201000 reac-t 617
20201001 -1.0 0.0
20201002 0.0 0.0
20201003 0.4 0.0
20201004 0.8 -0.65
20201005 1.2 -1.03
20201006 1.6 -1.40
20201007 2.0 -1.64
20201008 2.4 -1.87
20201009 2.8 -2.46
20201010 3.2 -3.39
20201011 3.6 -5.73
20201012 4.0 -9.01
20201013 4.4 -11.70
*-----------
* Table No 11
* Reactivity of Group 10
* Initial position H = 88 % = 312.4 cm of bottom
* Velocity = 20 mm/s
20201100 reac-t 616
20201101 -1.0 0.0 * t Ro
20201102 0.0 0.0000 * 0.0 0.0
20201103 1.0 -0.0122 * 0.5 -0.0009951
20201104 2.0 -0.0236 * 1.0 -0.0011041
20201105 3.0 -0.0343 * 1.5 -0.0017350
20201106 4.0 -0.0444 * 2.0 -0.0023659
20201107 5.0 -0.0540 * 2.5 -0.0028391
20201108 6.0 -0.0631 * 3.0 -0.0034700
20201109 7.0 -0.0718 * 3.5 -0.0041009
20201110 8.0 -0.0801 * 4.0 -0.0047319
20201111 9.0 -0.0882 * 4.5 -0.0053628
20201112 10.0 -0.0958 * 5.0 -0.0058360
20201113 11.0 -0.1033 * 5.5 -0.0064669
20201114 12.0 -0.1104 * 6.0 -0.0070978
20201115 13.0 -0.1174 * 6.5 -0.0077287
20201116 14.0 -0.1244 * 7.0 -0.0082019
20201117 15.0 -0.1316 * 7.5 -0.0088328
*-----------
* 14. Containment parameters
*-----------
* Table No 20
* Containment temperature
20202000 temp
20202001 0.0 330.0
*-----------
* Table No 21
* Heat Transfer Coefficient with Containment
20202100 htc-t
20202101 0.0 20.0
*--- end input deck ---
```

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11. ABSTRACT *(200 words or less)*

This report has been prepared as a part of the Agreement on Research Participation and Technical Exchange under the Code Assessment and Maintenance Program. The data collected by Kalinin NPP Unit-1 Data Acquisition System and In-Vessel Monitoring System during stop of feedwater supply on the SG-4 transient have been analyzed by using the RELAP5/MOD3.2 and RELAP5/MOD3.2.2 Beta codes. Kalinin NPP-1 is a Russian designed four loop pressurized water reactor (VVER-1000, project V-338) rated at 1000MWe. RELAP5 code calculation results were compared with plant data. Sensitivity studies were carried out to investigate the effects of modeling on major thermal-hydraulic parameters and to examine a new heat transfer model for horizontal tube bundles.

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