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International Agreement Report

RELAP5/MOD3.3 Assessment against New PMK Experiments

Prepared by:
P. Kral

Nuclear Research Institute Rez
Husinec-Rez 130
250 68 Rez, Czech Republic

A. Calvo, NRC Project Manager

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Abstract

The results of RELAP5 post-test analysis of 3 tests performed on the PMK integral test facility are presented and discussed. The Hungarian facility PMK is a scaled-down model of NPP with VVER-440/213 reactor. The code version RELAP5/MOD3.3 Path02 has been assessed against the experimental data from the tests T2.1, T2.2, and T2.3. The tests were focused on medium-break LOCA without HPSI. Generally, RELAP5 predictions are in very good agreement with the measured data.

FOREWORD

The RELAP5 is a very important computational tool for increasing nuclear safety also of the VVER reactors, especially in the Czech Republic. The Nuclear Research Institute (NRI) Rez has assessed the code against numerous experiments and consequently applied it to safety analyses of Czech NPP. The presented report documents one of the assessment works.

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EXECUTIVE SUMMARY

The PMK-2 facility [3] is a scaled down model of the VVER-440/213 and it had been primarily designed for investigation of small-break loss of coolant accidents (SBLOCA) and transient processes of this type of NPP. Nowadays the facility is also widely used for assessment of advanced computer code, that are used for safety analysis in VVER-operating countries.

One of the most important and world-widespread computer codes is the RELAP5 code. In the Czech Republic, the RELAP5 is installed under agreement between US NRC and Czech regulatory body (SONS). The main user of the code is the Nuclear Research Institute (NRI, UJV) Rez, where the code is widely assessed and applied to NPP safety analyses.

The tests used in this report for assessment of RELAP5/MOD3.3 computer code are medium-break LOCA accidents without HPSI and with operator interventions (secondary bleed, primary bleed). Also the effect of lower hydroaccumulator pressure is studied.

Comparison of the measured test data and the RELAP5/MOD3.3 results showed very good overall agreement of all major system parameters as primary pressure, reactor level, reactor coolant and clad temperature etc.

The work is focused not only on the computer code assessment – it also gives important conclusions for the Emergency Operating Procedures (EOP) that have been lastly improved at the VVER power plants.

ACKNOWLEDGMENTS

The authors acknowledge the support of the Czech regulatory body - the State Office of Nuclear Safety (SONS) - in acquiring the advanced thermal hydraulic codes. We also acknowledge the support of the Ministry of Industry and Trade of the Czech Republic within the national programs and grants focused on increase of the nuclear safety and the level of knowledge in branch of thermal hydraulics.

ABBREVIATIONS, GREEK LETTERS

BE	best-estimate
CL	cold leg
D	diameter
DC	downcomer
ECCS	Emergency Core Cooling System
EOP	Emergency Operating Procedures
HA	hydroaccumulator
HL	hot leg
HPIS	High Pressure Injection System
HPSI	high pressure safety injection
ID	inner diameter
LOCA	loss-of-coolant accident
LOOP	loss-of-offsite power
LPIS	Low Pressure Injection System
LPSI	low pressure safety injection
MBLOCA	medium-break LOCA
N/A	not applicable
EOP	emergency operating procedures
PCT	peak clad temperature
PRZ	pressurizer
RCP	reactor coolant pump
SBLOCA	small-break LOCA
SCRAM	reactor trip ("safety control rod ax man")
SG	steam generator
SIT	safety injection tank
UP	upper plenum
VVER	Russian type of PWR (with horizontal SGs)

1. INTRODUCTION

The tests used in this report for assessment of RELAP5/MOD3.3 computer code were carried out in frame of the IMPAM-VVER project. The project was focused on different problems encountered during the development of EOPs for VVER reactors. The participants of the project performed both pre- and post-test analyses of the test with computer codes CATHARE, ATHLET and RELAP. UJV Rez participated in the assessment part of the project mainly with the ATHLET code [4].

Objective the work presented in this report is additional assessment of RELAP5/MOD3.3 against selected tests performed at the PMK facility in frame of IMPAM project. The tests are medium-break LOCA accidents without HPSI and with operator interventions (secondary bleed, primary bleed). Also the effect of lower hydroaccumulator pressure is studied.

The following PMK tests will be post-analyzed in this report:

- Test 2.1 reproducing the EOP steps for larger SB-LOCA. A reduced number of hydro-accumulators is assumed to be available. Since no HPIS is working, core overheating will occur after emptying of the hydro-accumulators. Secondary bleed and primary bleed and feed will be started following the procedures. The aim is to investigate whether LPIS injection can be started before renewed core overheating occurs.
- Test 2.2 reproducing Test 2.1, but bleed and feed start earlier.
- Test 2.3 starting from lower parameters (attempt to make a counter-part test with PACTEL facility) and investigating the effect of reduced initial pressure and higher level in hydroaccumulators.

The work is focused not only on the computer code assessment – it gives important conclusions also for the Emergency Operating Procedures (EOP), that have been lastly improved at the VVER power plants.

2. DESCRIPTION OF THE PMK FACILITY

The PMK-2 facility [3] is a scaled down model of the VVER-440/213 and it was primarily designed for investigating small-break loss of coolant accidents (SBLOCA) and transient processes of this type of NPP. The specific features of VVER-440/213 are as follows: 6-loop primary circuit, horizontal steam generators, loop seal in hot and cold legs, safety injection tank (SIT) set-point pressure higher than secondary pressure (nowadays modified at majority of VVER-440/213), the coolant from SITs directly injected to the upper plenum and downcomer. As a consequence of the differences the transient behavior of such a reactor system should be different from the usual PWR system behavior.

The volume and power scaling of PMK facility are 1:2070. Transients can be started from nominal operating conditions. The ratio of elevations is 1:1 except for the lower plenum and pressurizer. The six loops of the plant are modeled by a single active loop. In the secondary side of the steam generator the steam/water volume ratio is maintained. The coolant is water under the same operating conditions as in the nuclear power plant.

The core model consists of 19 electrically heated rods, with uniform power distribution. Core length, elevation and flow area are the same as in the Paks NPP.

In the modeling of the steam generator primary side, the tube diameter, length and number were determined by the requirement of keeping the 1:2070 ratio of the product of the overall heat transfer coefficient and the equivalent heat transfer area. The elevations of tube rows and the axial surface distribution of tubes are the same as in the reference system. On the secondary side the water level and the steam to water volume ratios are kept. The temperature and pressure are the same as in the NPP. The horizontal design of the VVER steam generator affects the primary circuit behavior during a small break LOCA in quite a different way to the usual vertical steam generators.

Cold and hot legs are volume scaled and care was taken to reproduce the correct elevations of the loop seals in both the cold and the hot legs. Cold and hot leg cross section areas if modeled according to volume scaling principles would have produced much too high pressure drops. Since, for practical reasons, length could not be maintained 1:1, relatively large cross sections were chosen for the PMK loop. On the one hand this results in smaller cold and hot leg frictional pressure drops than in the NPP, on the other hand, however, it improves the relatively high surface to volume ratio of the PMK pipework. As to the former effect, the small frictional pressure drop of the PMK cold and hot legs will have a negligible effect on small-break processes. However, the pressure drop is increased using orifices around the loop.

For the pressurizer the volume scaling, the water to steam volume ratio and the elevation of the water level is kept. For practical reasons the diameter and length ratios cannot be realized. The pressurizer is connected to the same point of the hot leg as in the reference system. Electrical heaters are installed in the model and the provision of the spray cooling is similar to that of Paks NPP.

For the hydroaccumulators, the volume scaling and elevation is kept. They are connected to the downcomer and upper plenum similar to those of the reference system. The four hydroaccumulators of the VVER-440/213 are modeled by 2 SIT vessels.

The HPIS and LPIS systems are modeled by controlling the coolant flow rate in the lines by control valves. The flow rates measured during the start-up period of the Paks NPP are used to control the valves.

The main circulating pump of the PMK serves to produce the nominal operating conditions corresponding to that of the NPP prior to break initiation as well as to simulate the flow coast-down following pump trip early in the transient. For this reason the pump is accommodated in a by-pass line. Flow coast-down is modeled by closing a control valve in an appropriate manner and if flow rate is reduced to that of natural circulation, the valve in the by-passed cold leg part is opened while the pump line is simultaneously closed.

PMK Test Facility Characteristics:

Reference NPP:
Paks Nuclear Power Plant with VVER-440/213 (6 loops)
1375 MWt - hexagonal fuel arrangement

General Scaling factor:
Power, volumes: 1/2070, loops 1/345
Elevations: 1/1

Primary coolant system (1 loop representation):
- Pressure: 12.3 MPa (nominal), 16 MPa (max.)
- Nominal core inlet temperature: 540K
- Nominal core power: 664 kW
- Nominal flow rate: 4.5 kg/s

Special features:
- 19 heater rods, uniform axial and radial power distribution
- 2.5 m heated length
- External downcomer
- Pump is accommodated in by-pass line
    -- flow rate 0 to nominal value
    -- NPP pump coast down simulation
- Loop piping: 46 mm ID

Secondary system:
- Pressure: 4.6 MPa, feed water temperature: 496 K
- Nominal steam and feed water mass flow: 0.36 kg/s

Special features:
- Horizontal steam generator
- Controlled heat removal system

Safety injection systems:
- High Pressure Injection System (HPIS) and Low Pressure Injection System (LPIS)
- Safety Injection Tanks (SITs)
- Emergency feed water

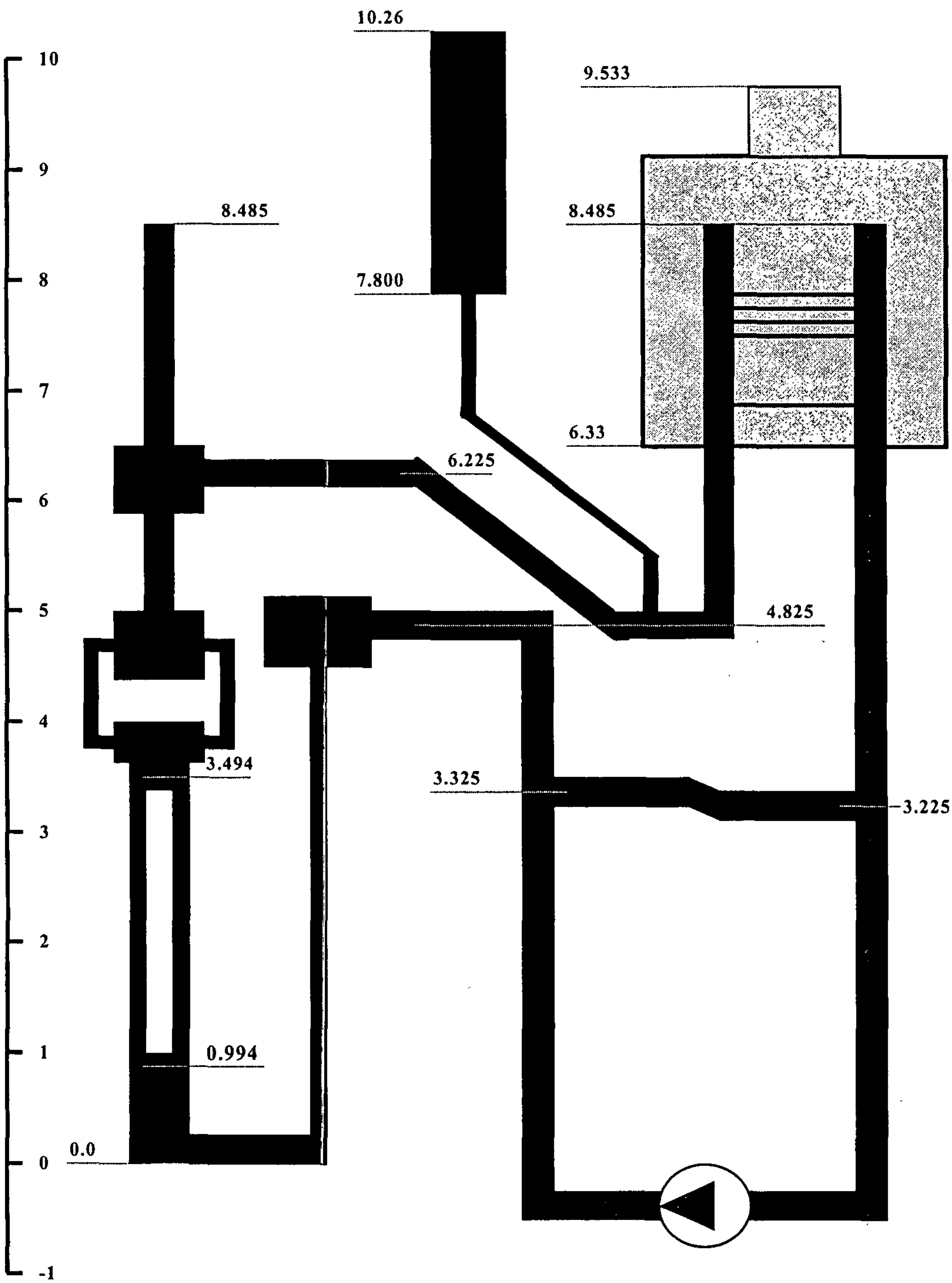

Figure 1 Elevation diagram

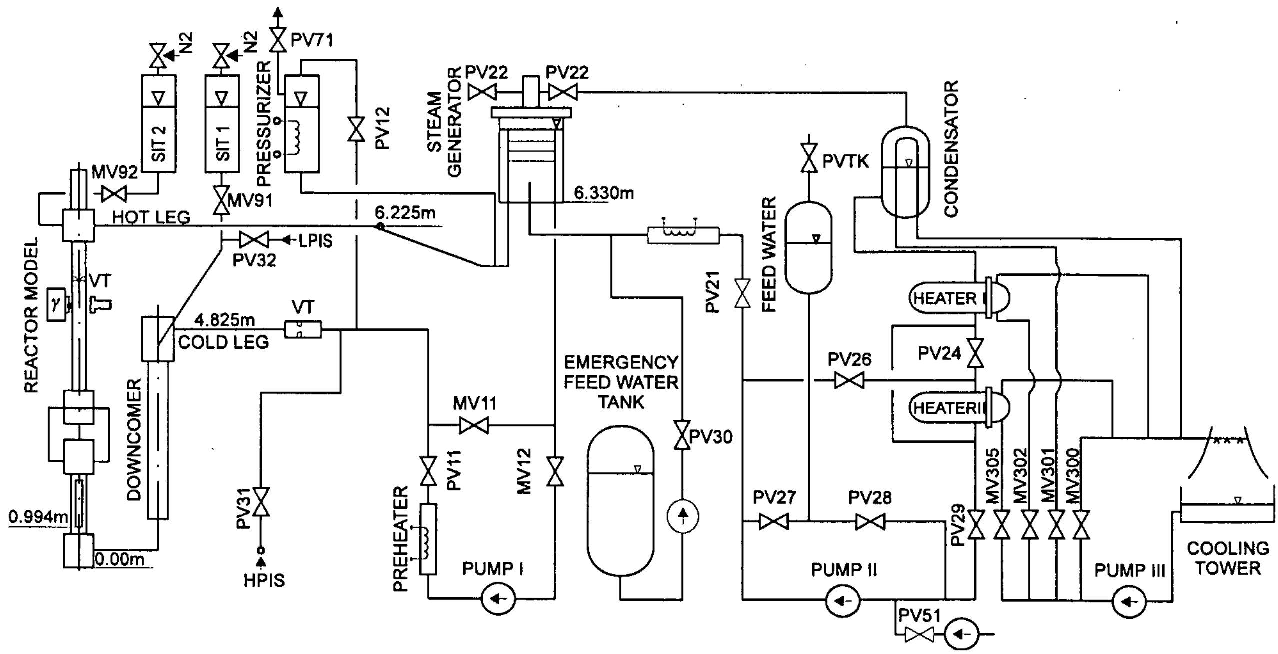

Figure 2 Flow diagram of the PMK facility

3. UJV INPUT MODEL OF PMK FACILITY

The RELAP5 input deck of PMK used for the post-test analyses is a modified version of our older deck [1, 2] used for modeling of PMK-NVH in early 90-ties, when we analyzed the IAEA organized SPE tests.

The modeling approach used in development of PMK model is similar to the approach applied in development of input models of Czech NPPs with VVER reactors. Generally, geometry and nodalization of primary circuit except of SG is very similar to those of standard PWR. There are only 3 major specific features of VVER-440/213, that should be reflected in nodalization – horizontal SG (reflected in multi-layer nodalization of SG tubing), loop seal in hot leg (reflected in detailed nodalization of HL), and direct HA/LPIS injection to reactor (we don't expect any multi-dimensional effects in small-scale facility like PMK, so simple 1-D modeling of reactor vessel was used).

Our RELAP5 input model of PMK experimental facility consists of:

- 134 volumes
- 144 junctions
- 126 heat structures (with 553 mesh points)
- 62 control variables
- 68 trips

Nodalization scheme can be seen in **Figure 3**. Comparing to our „old" model of PMK-NVH [1, 2], the major modifications of PMK nodalization implemented during work on this report, are as follows: more exact modeling of lower plenum, remodeled core outlet and upper plenum, and modified nodalization of PRZ and PRZ surge line (incl. location of PRZ surge line connection to the hot leg).

Listing of the current version of the PMK input deck used for the presented analyses (specifically T2.3) can be found in the Appendix I.

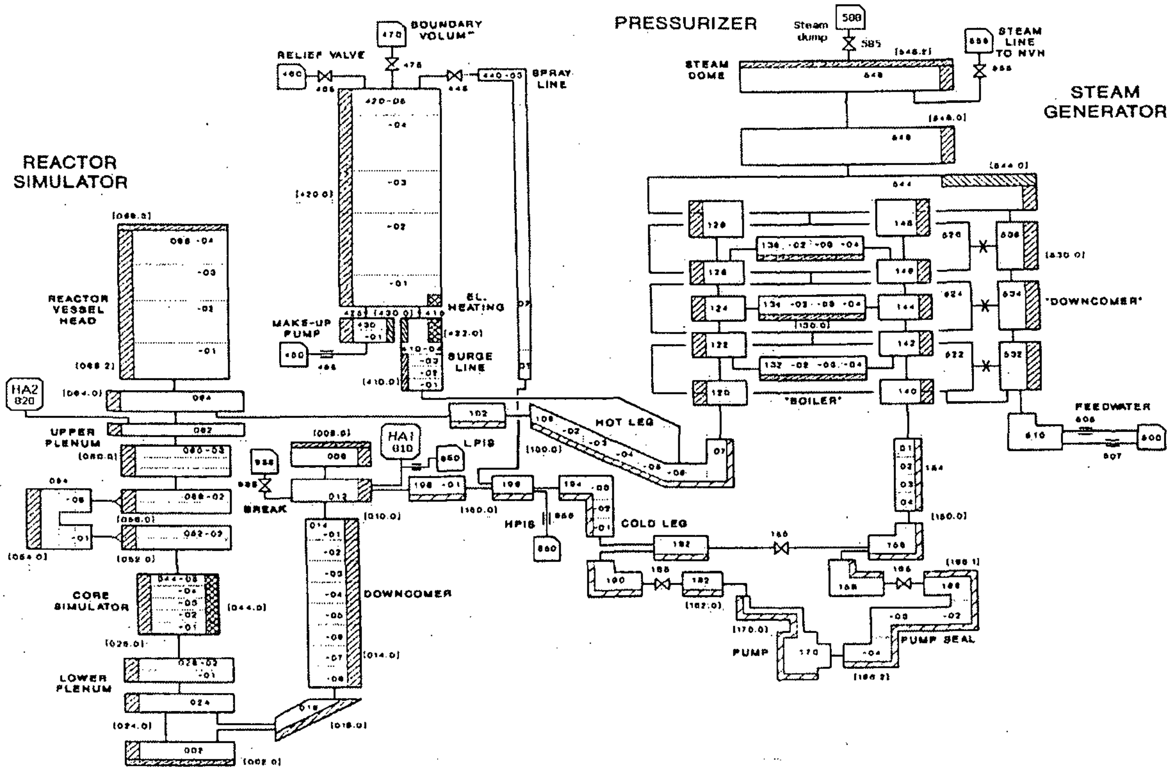

Figure 3 Nodalization scheme of PMK for RELAP5

4. POST-TEST ANALYSIS OF T2.1 EXPERIMENT

4.1 Experiment description

The Test 2.1 (T2.1-BF) [5, 6] experiment simulates a primary loss-of-coolant accident without high pressure injection and the basic question is whether the primary pressure can be reduced to the shut-off head of the pumps of the LPI systems. Earlier PMK tests indicate that in these situations it is too late to start bleed and feed at superheated core outlet temperature if the SITs are no longer available. The significant loss of primary coolant may lead to core overheating before the system pressure decreases to the activation pressure of LPI systems.

The test is defined by the following steps:

- Experiment started from nominal operating parameters of the loop by opening the 7.4% break in the cold leg (break orifice D3 mm corresponding with D135 mm break size in VVER-440);
  actually break line is connected not directly to the cold leg, but to the reactor downcomer top, close to reactor inlet from cold leg;
- SCRAM actuation simultaneously;
- Secondary side isolation simultaneously;
- Pressurizer heaters off simultaneously;
- Pump coast down simultaneously,
- 1 SIT to the upper plenum and 2 SITs to the downcomer,
- Secondary bleed starts at Tclad > 350 °C
  (plus we applied here additional condition of „time > 900 s (15 min)“ to avoid too early initiation of sec. bleed by temperature peaks in first hundreds of seconds and to be realistic as for timing of first operator interventions),
- Primary bleed starts at Tclad > 500 °C,
- LPIS starts at p < 0,7 MPa,
- Power to core simulator off if Tclad > 600 °C,
- Test terminated if Tclad > 650 °C.

The main objective of the test is to get experimental evidence on the effectiveness of the secondary bleed and the primary bleed and feed to reduce the primary pressure to the setpoint pressure of LPIS without core damage. Further on it will help to assess the predictive capabilities of codes in the calculation of the complex transient scenario and identification of key events.

The initial conditions of the test are nearly the same as the nominal operating parameters of the plant considering the scaling ratio. In **Table 1** below these conditions are given. Specified data are compared with measured data and the steady-state calculation results.

Table 1 Initial conditions of test T2.1

	Unit	Specified	Measured	Calculation NRI
Primary system pressure (PR21)	MPa	12.3	12.377	12.425
Primary loop flow (FL53)	kg/s	4.5	4.34	4.34
Core inlet temperature (TE63)	K	541	541.8	542.1
Core power (PW01)	kW	664	665.1	665.5
Coolant level in PRZ (LE71)	m	9.2	9.22	9.20
SIT-1 initial pressure (PR91)	MPa	5.8	5.82	5.82
SIT-2 initial pressure (PR92)	MPa	5.8	5.90	5.90
SIT-1 initial level (LE91)	m	9.62	9.64	9.644
SIT-2 initial level (LE92)	m	10.03	10.05	10.052
Secondary pressure (PR81)	MPa	4.6	4.84	4.84
Feedwater flow (FL81)	kg/s	0.35	0.43	0.43
Feedwater temperature (TE81)	K	496	491.4	491.4
Coolant level in SG (LE81)	m	8.2	8.62	8.630

As boundary conditions it was decided to have the SCRAM, the RCP trip and the secondary side isolation together with the opening of the break valve. The secondary bleed starts when the heater rod surface temperature is more than 350°C (plus we used additional condition "not before 900 s" in our calculation), the primary bleed starts when the fuel surface temperature is more than 500°C and LPIS starts when the primary pressure is less than 0,7 MPa. The boundary conditions are listed in **Table 2** below.

Table 2 Boundary conditions of test T2.1

	Unit	Specified	Measured	Calculation NRI
Break orifice diameter	mm	3.0	3.0	3.0
Secondary bleed valve diameter	mm	4.0	4.0	4.0
Primary bleed valve diameter	mm	1.0	1.0	1.0
Break opens at	s	0.0	1.0	0.0
SCRAM is initiated at	s	0.0	2.0	2.0
Isolation of feedwater and steam lines	s	0.0	0.0	0.0
RCP coast-down initiated at	s	0.0	4.0	4.0
Steam dump valve opens at	MPa	5.3	5.37	5.3
Steam dump valve closes at	MPa	4.9	4.89	4.9
Secondary bleed initiated at Tclad >	°C	350	347	350 *
Primary bleed initiated at Tclad >	°C	500	504	500
LPIS injection starts if primary pressure	MPa	0.7	0.7	0.7
LPIS flow rate (1 system assumed)	kg/s	0.042	0.07	0.07
SIT-1 injection ended at	m	8.22	8.22	8.22
SIT-2 injection ended at	m	9.33	9.25	9.25

* Note: For start of operator initiated secondary bleed we applied additional condition of „time > 900 s (15 min)" to avoid its too early initiation by clad temperature peaks in first hundreds of seconds (and to be realistic as for timing of first operator interventions).

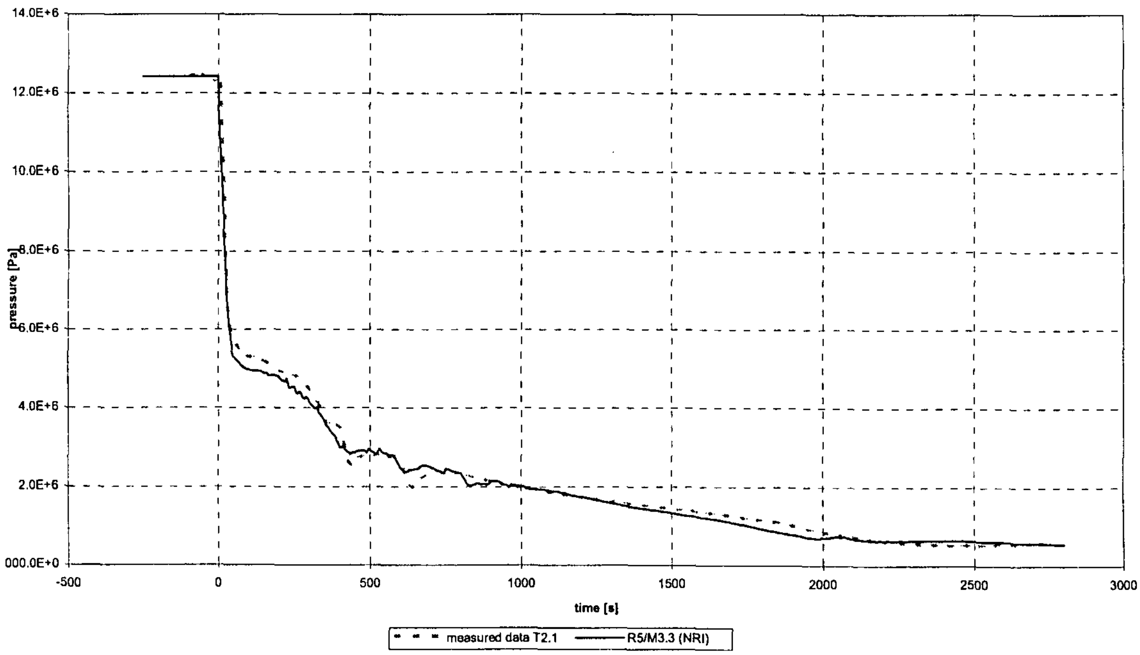

Figure 4 Primary pressure (T2.1)

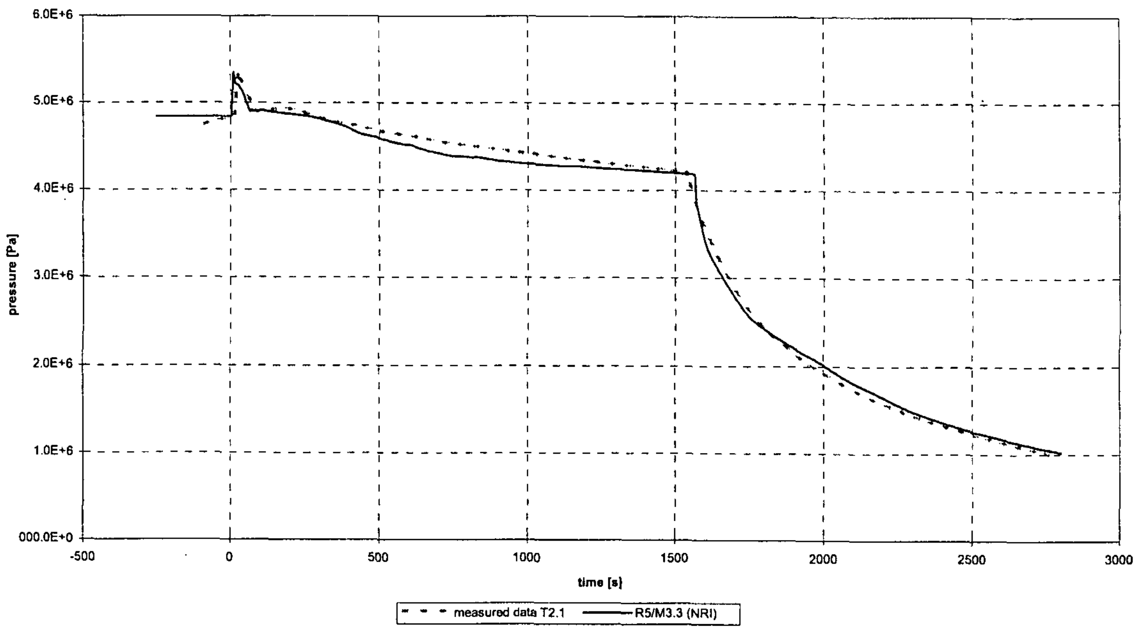

Figure 5 Secondary pressure (T2.1)

4.2 Results of calculation

The main events of the Test 2.1 and the RELAP5 calculations are listed in **Table 3** below:

Table 3 Timing of main events of test T2.1

Event	Timing [s]		Comment
	Measured	Calculation NRI	
Break valve opening	1.0	0.0	Break diameter is 3 mm (i.e. 7.4% of CL flow area)
Isolation of feedwater and steam lines initiated	0.0	0.0	Closing of valves: 4 s
SCRAM actuated	3.0	3.0	timing of effective power decrease
RCP trip	4.0	4.0	
Steam dump valve opening	24	11	At sec. press. 5.3 MPa
SIT-1, SIT-2 injection start	48	38	
Steam dump valve closing	79	66	At sec. press 4.9 MPa
First reversal of heat transfer at SG	not measured	99	
First clad overheating	245-325 (320 °C)	200-230 (339 °C)	
SIT-1 injection to downcomer end	629	830	
SIT-2 injection to upper plenum end	637	1020	
Final fuel rod overheating (TW01) start	1414	1495	
Secondary bleed initiation	1534	1565	After clad temp 350 °C (+ in calculation additional condition t > 900 s)
Primary bleed initiation	1706	1680	After clad temp 500 °C
Core power switching off	1861	1756	Protection from 600 °C
Time of fuel rod temperature maximum	1863 (601 °C)	1756 (600 °C)	
LPIS injection starts at	2114	1965	
Core fully flooded	2250	2055	
Transient end	2763	2800	

The defined LOCA scenario starts with opening of the break valve at reactor downcomer top and with coincident loss of offsite power (LOOP) simulation. Major consequences of LOOP are the immediate trip of RCP, reactor SCRAM, and isolation of SG secondary side.

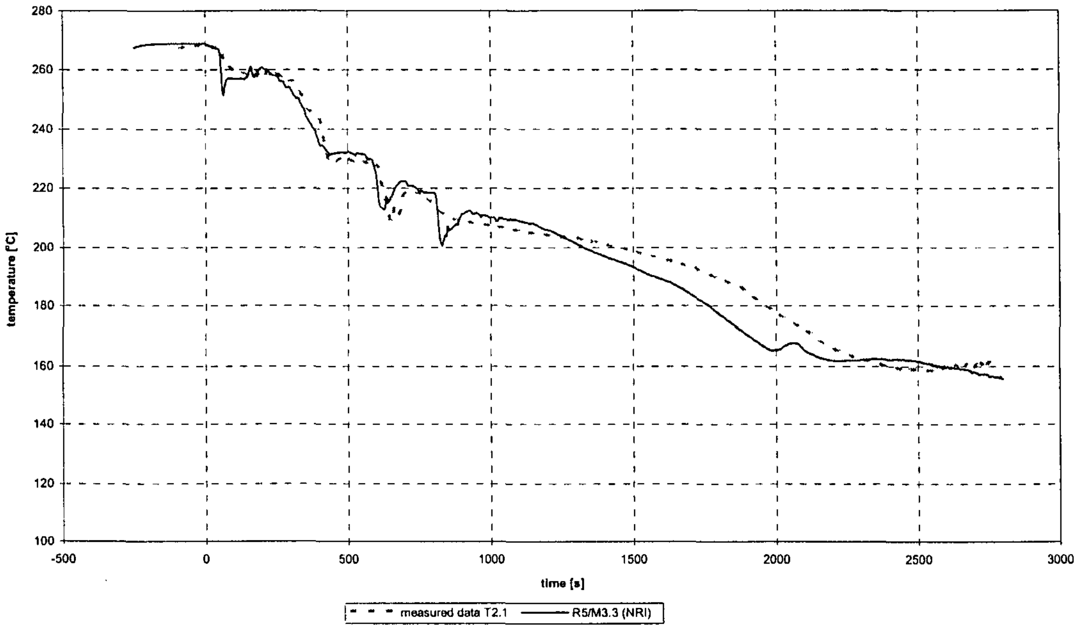

Figure 6 Core inlet temperature (T2.1)

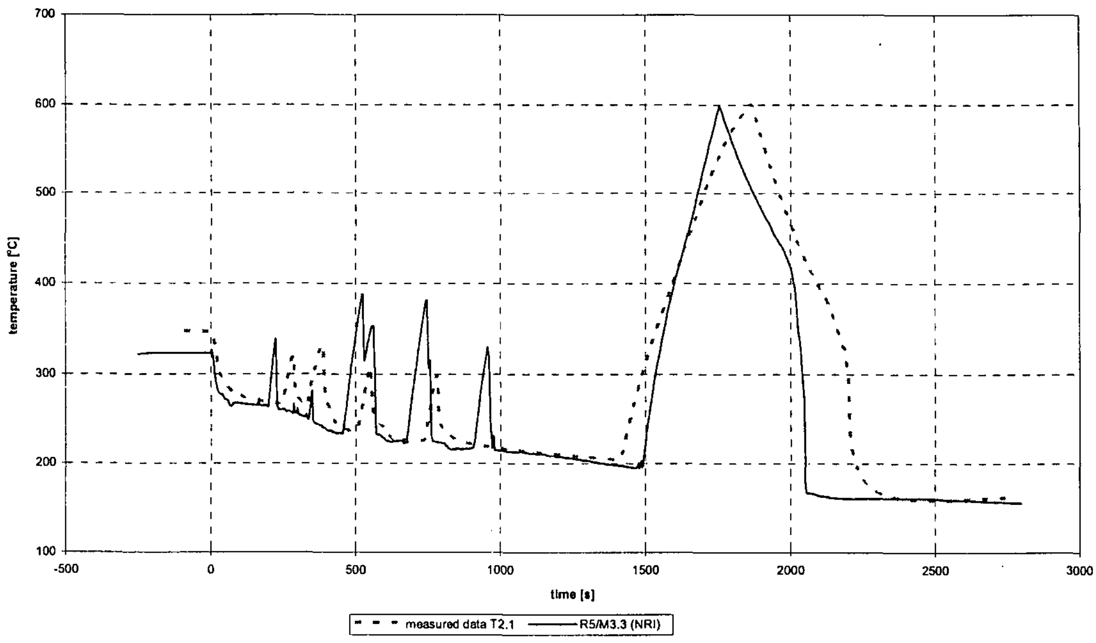

Figure 7 Cladding temperature (T2.1)

Due to the isolation of the secondary side, the steam generator pressure increases fast, reaching the steam dump opening setpoint 5.3 MPa. In the calculation, the steam dump occurs in time interval 11-66 s. After closing of the valve (at 4.9 MPa), the secondary pressure is stabilized and slowly decreases due to heat losses and drop of parameters in primary circuit (reversed heat transfer at SG after 99 s).

Outflow of primary coolant through break with equivalent diameter 3 mm (7.4% of cold leg flow area) leads to fast decrease of primary pressure. After dropping under 6.0 MPa, the hydroaccumulators start to inject cold water into UP and DC.

As there is no HPIS available in the test T2.1, end of HA injection (at time 1020 s, with primary pressure about 2 MPa, i.e. high above LPIS shut-off head of 0.7 MPa) means further decrease of primary inventory and finally core uncovery and heat-up.

After reaching of cladding temperature level 350 °C secondary bleed is initiated (note: in the calculation we applied additional condition for secondary bleed initiation: „time > 900 s (15 min)“ to avoid its too early initiation by clad temperature peaks in first hundreds of seconds and to be realistic as for timing of first operator interventions). Unfortunately, both the experiment and the calculation show that the secondary bleed had almost no effect on the heater rod temperature.

So the core heat-up continues and when clad temperature reaches 500 °C, primary bleed is initiated. Again it had minimal effect on behavior of the system and core cooling (both in experiment and in calculation).

So ultimately, the PMK facility core protection stops the core power after clad temperature reaches set-point 600 °C and the same (a measure not "available" at real NPP with nuclear fuel and decay heat production after SCRAM) is modeled in the RELAP5 calculation. After that, clad temperatures and other primary parameters starts to decrease. The clad temperature decrease is strongly accelerated by start of LPIS injection into DC (after primary pressure drop under 0.7 MPa).

4.3 Comparison of results

The most important comparison plots of the measured data and the post-test UJV calculations are shown in **Figure 4 - Figure 10**. Complete set of comparison plots can be found in Appendix III.

Most calculated parameters is in very good agreement with measured data, especially the most important system parameters like primary and sec. pressure, coolant and clad temperature etc. The integrated break flow is slightly overpredicted in the first 300 s of the transient and on the contrary, substantially underpredicted after 400 s. The difference between measured and calculated leak is after 800 s more or less constant and amounts approximately 20 kg (15% of steady state inventory).

Initial increase of secondary pressure is faster in calculation than in experiment (see the timing of the steam dump), which could be caused by not modeling of steam pipes between SG and valves. Overall agreement between measured and computed course of secondary pressure is however very good.

As the prediction of primary pressure course is very good, also the step-wise injection from the HAs is predicted well by the code, but there is some difference in the timing and the amount injected in the different steps. In the facility the HA valves are opened by the primary pressure signal and they remain then open, after a discharge phase significant backflow from the primary can be seen in the measured HA level curves. In the RELAP hydroaccumulator model, that valve is a check valve, which does not enable any reverse flow in the hydroaccumulator line. In PMK these reverse flows bring warmer water into subcooled HA (subcooled by gas expansion) and warms it up, which consequently accelerates HA injection. Thus the HA injection in experiment is naturally little bit faster than injection predicted in calculation.

Both the experiment and calculations show that in this LOCA scenario the Accident Management can't reduce the primary pressure fast enough to prevent substantial overheating of the core.

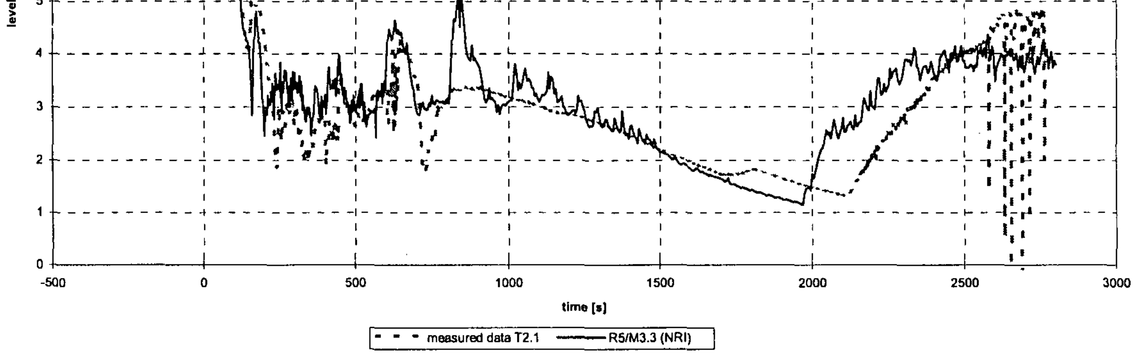

Figure 8 Collapsed level in reactor (T2.1)

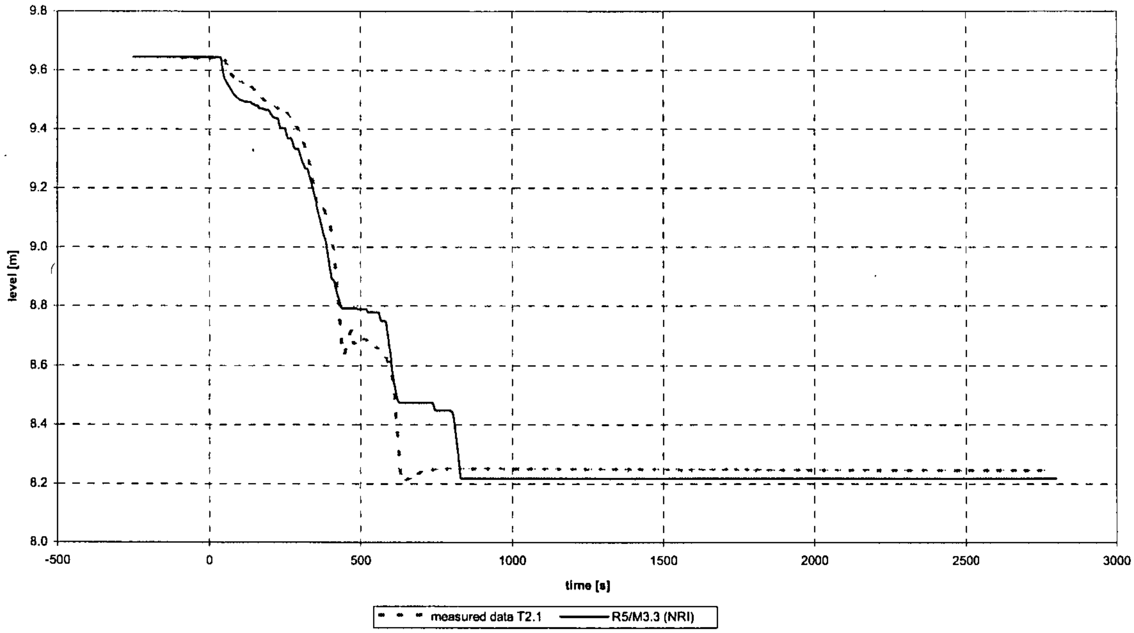

Figure 9 Collapsed level in hydroaccumulator SIT-1 (T2.1)

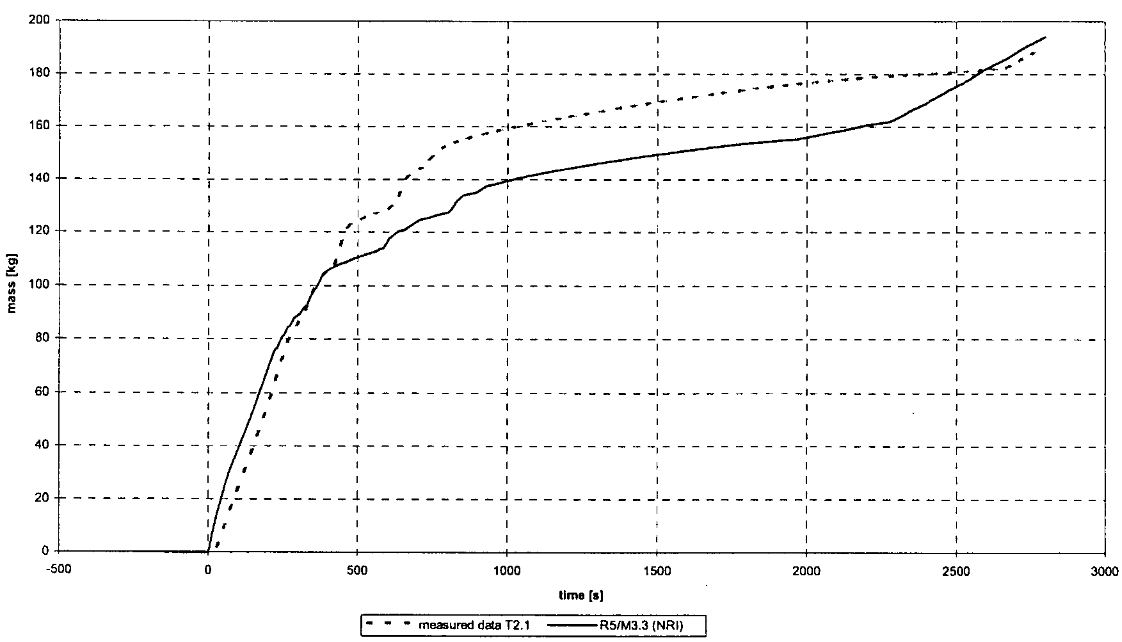

Figure 10 Integrated break mass flow rate (T2.1)

5. POST-TEST ANALYSIS OF T2.2 EXPERIMENT

5.1 Experiment description

The Test 2.2 (T2.2-BF) [5, 6] experiment simulated a primary loss-of-coolant accident without high pressure injection and the basic question is whether in case of very early operator initiated depressurization of the system, the primary pressure can be reduced to the shut-off head of the pumps of the LPI systems. Earlier PMK tests had indicated that in these situations it is too late to start bleed and feed at superheated core outlet temperature if the SITs are no longer available. The significant loss of primary coolant may lead to core overheating before the system pressure decreases to the activation pressure of LPI system.

This test followed Test 2.1. The only difference was that the bleed and feed interventions were started earlier to get the setpoint pressure of LPI systems. Secondary system depressurization in here in T2.2 started at 900 s before start of ultimate core heat up (in T2.1 it was started by 350 °C cladding temp., i.e. at about 1500 s) and primary system depressurization is here started when core heat up lead to clad temperature 300 °C (while in T2.1 is was started at 500 C).

The test scenario was defined by the following steps:

- Experiment started from nominal operating parameters of the loop by opening the 7.4% break in the cold leg (actually break line is connected not directly to the cold leg, but to the reactor downcomer top, close to cold leg inlet);
- SCRAM actuation simultaneously;
- Secondary side isolation simultaneously;
- Pressurizer heaters off simultaneously;
- Pump (RCP) coast down simultaneously,
- 1 SIT to the upper plenum and 2 SITs to the downcomer,
- Secondary bleed starts at 900 s,
- Primary bleed starts at Tclad > 300 °C, (plus we applied here again additional condition of „time > time of sec. bleed + 5 min = 1200 s " to be realistic as for timing of the operator interventions sequence),
- LPIS starts at p < 0,7 MPa,
- Power to core simulator off if Tclad > 600 °C,
- Test terminated if Tclad > 650 °C.

The main objective of the test is to get experimental evidence on the effectiveness of the secondary bleed and the primary bleed and feed to reduce the primary pressure to the setpoint pressure of LPIS without core damage. Further on it will help to assess the predictive capabilities of codes in the prediction of the complex transient scenario and identification of key events.

The initial conditions of the test are nearly the same as the nominal operating parameters of the plant considering the scaling ratio. In the **Table 4** below these conditions are given. Specified values are compared with measured data and the steady-state calculation results.

Table 4 Initial conditions of test T2.2

	Unit	Specified	Measured	Calculation NRI
Primary system pressure (PR21)	MPa	12.3	12.37	12.370
Primary loop flow (FL53)	kg/s	4.5	4.40	4.34
Core inlet temperature (TE63)	K	541	541.4	541.62
Core power (PW01)	kW	664	667	665
Coolant level in PRZ (LE71)	m	9.2	9.19	9.20
SIT-1 initial pressure (PR91)	MPa	5.8	5.83	5.83
SIT-2 initial pressure (PR92)	MPa	5.8	5.87	5.87
SIT-1 initial level (LE91)	m	9.62	9.64	9.64
SIT-2 initial level (LE92)	m	10.03	10.04	10.05
Secondary pressure (PR81)	MPa	4.6	4.80	4.80
Feedwater flow (FL81)	kg/s	0.35	0.423	0.34
Feedwater temperature (TE81)	K	496	478.8	478.8
Coolant level in SG (LE81)	m	8.2	8.65	8.63

As boundary conditions it was decided to have the SCRAM, the RCP trip and the secondary side isolation together with the opening of the break valve. The secondary bleed starts when the heater rod surface temperature is more than 350°C (plus we used additional condition "not before 900 s" in our calculation), the primary bleed starts when the fuel surface temperature is more than 500 °C and LPIS starts when the primary pressure is less than 0,7 MPa.

Table 5 Boundary conditions of test T2.2

	Unit	Specified	Measured	Calculation NRI
Break orifice diameter	mm	3.0	3.0	3.0
Secondary bleed valve diameter	mm	4.0	4.0	4.0
Primary bleed valve diameter	mm	1.0	1.0	1.0
Break opens at	s	0.0	0.0	0.0
SCRAM is initiated at	s	0.0	2.0	2.0
Isolation of feedwater and steam lines	s	0.0	2.0	0.0
RCP coast-down initiated at	s	0.0	0.0	0.0
RCP coast-down time	s	150	117	147.5
Steam dump valve opens at	MPa	5.3	5.37	5.3
Steam dump valve closes at	MPa	4.9	4.89	4.9
Secondary bleed initiated at time	s	900	889	889
Primary bleed initiated at Tclad >	°C	300	295	295
LPIS injection starts if primary pressure	MPa	0.7	0.73	0.73
LPIS flow rate (1 system assumed)	kg/s	0.042	0.042	0.042
SIT-1 injection ended at	m	8.275	8.221	8.23
SIT-2 injection ended at	m	9.360	9.278	9.28

* Note: For start of operator initiated primary bleed we applied additional condition of „time > time of sec. bleed + 5 min (1200 s)" to avoid its too early initiation by clad temperature peaks in first hundreds of seconds and to be realistic as for timing of the operator interventions sequence.

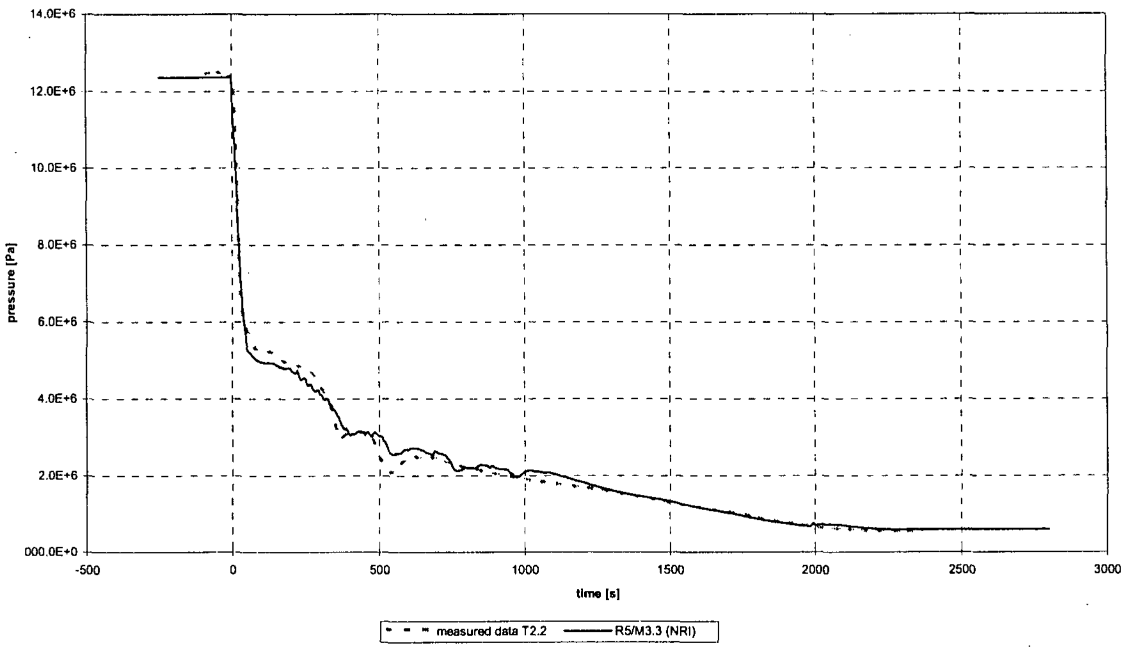

Figure 11 Primary pressure (T2.2)

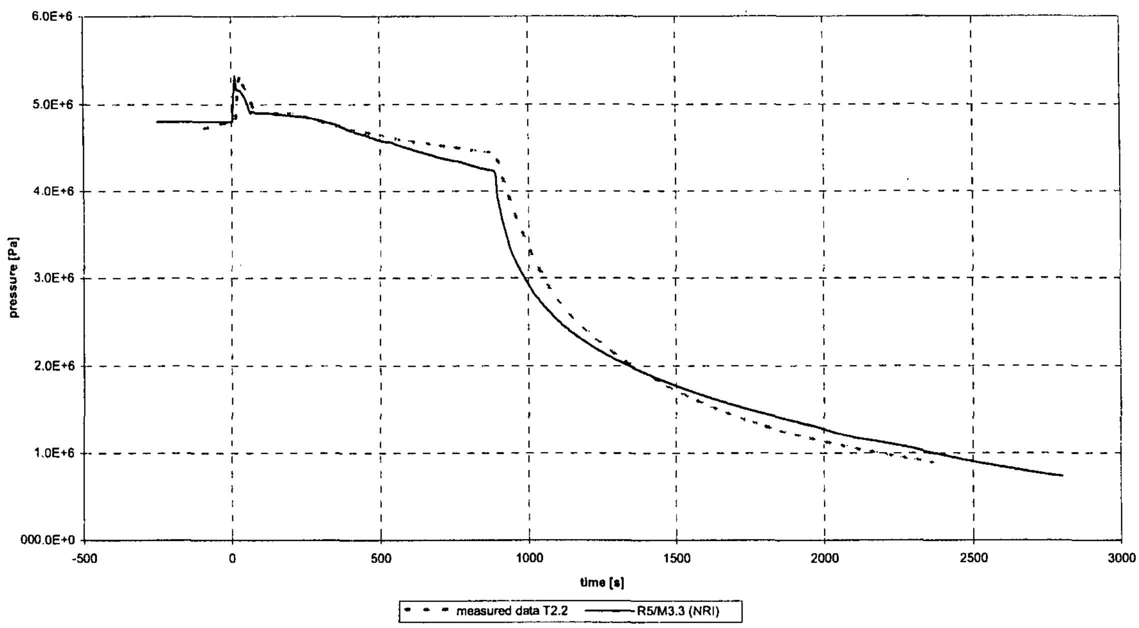

Figure 12 Secondary pressure (T2.2)

5.2 Results of calculation

The main events of the test T2.2 and the RELAP5 calculations are listed in **Table 6** below:

Table 6 Timing of main events of test T2.2

Event	Timing [s]		Comment
	Measured	Calculation NRI	
Break valve opening	0.0	0.0	Break diameter is 3 mm (i.e. 7.4% of CL flow area)
RCP trip	0.0	0.0	
SCRAM actuated	2.0	2.0	
Isolation of feedwater and steam lines initiated	2.0	0.0	Closing time of MSIV/FW equals to 4 s
Steam dump valve opening	29	11	At sec. press. 5.3 MPa
SIT-1, SIT-2 injection start	46	42	
Steam dump valve closing	79	65	At sec. press 4.9 MPa
First reversal of heat transfer at SG	not measured	97	
First clad overheating	235-275	200-225	
SIT-1 injection to upper plenum end	536	950	
SIT-2 injection to downcomer end	538	965	
Secondary bleed initiation	889	889	Predefined
Final fuel rod overheating (TW01) start	1212	1460	
Primary bleed initiation	1277	1503	After final clad heat up to clad temp 300 (295) °C
Core power switching off	1756	1726	Protection from 600 °C
Time of fuel rod temperature maximum	1759 (605 °C)	1725 (600 °C)	
LPIS injection starts at	1920	1909	
Reactor level minimum	1938 (1.02 m)	1910 (1.13 m)	
Core fully flooded	2150	2035	
Transient end	2370	2800	

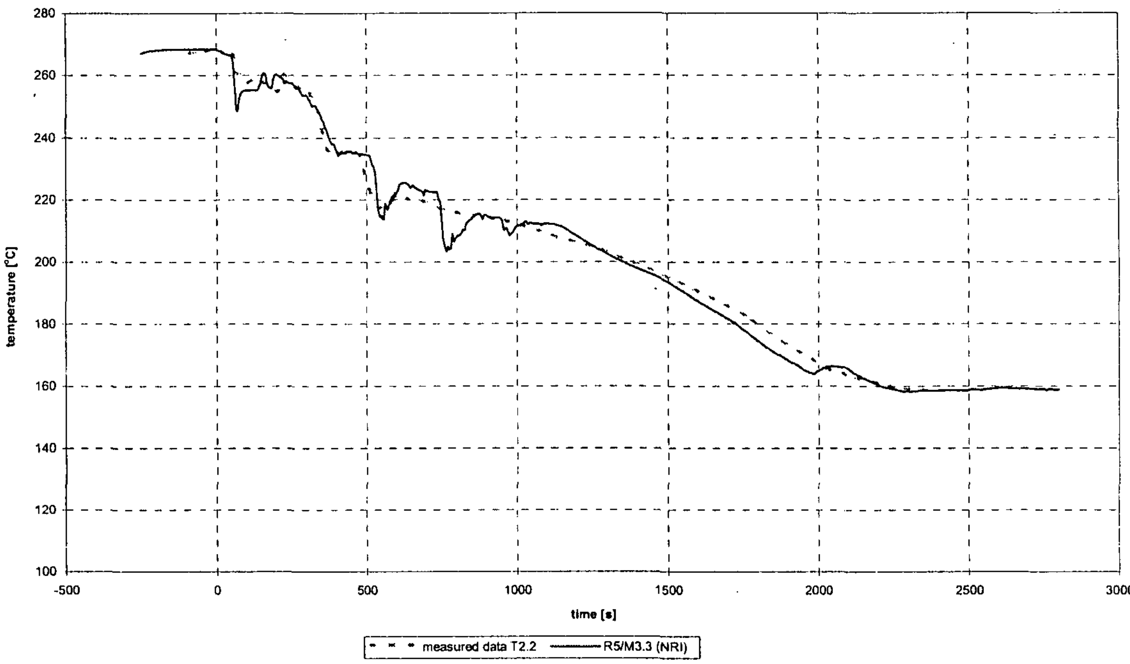

Figure 13 Core inlet temperature (T2.2)

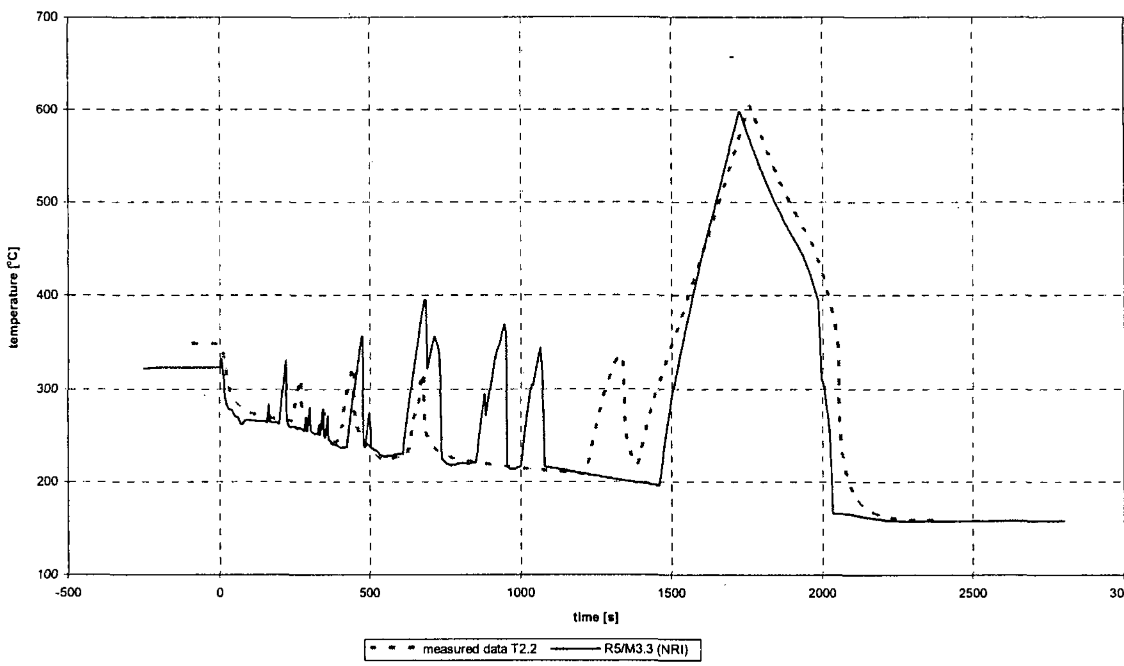

Figure 14 Cladding temperature (T2.2)

The defined medium-break LOCA scenario starts with opening of the break valve at reactor downcomer top and with coincident loss of offsite power (LOOP) simulation. Major consequences of LOOP are the immediate trip of RCP, reactor SCRAM, and isolation of SG secondary side.

Due to the closing of MSIV, the SG pressure increases fast, reaching the steam dump opening setpoint 5.3 MPa. In the calculation, the steam dump occurs in time interval 11-65 s. After closing of the valve (at 4.9 MPa), the secondary pressure is stabilized and slowly decreases due to heat losses and drop of parameters in primary circuit (reversed heat transfer at SG after 97 s).
Outflow of primary coolant through break with equivalent diameter 3 mm (7.4% of cold leg flow area) leads to fast decrease of primary pressure. After getting under 6.0 MPa, the hydroaccumulators start to inject cold water into UP and DC.

As there is no HPIS available in the test T2.2, end of HA injection (at 965 s, with primary pressure about 2 MPa, i.e. substantially higher than LPIS shut-off head of 0.7 MPa) means further decrease of primary inventory and finally deep core uncovery and heat-up.
At time 900 s secondary bleed initiation is predefined. Unfortunately, both the experiment and the calculation show that the secondary bleed had almost no effect on the heater rod temperature. Primary pressure is about 2 MPa and its decrease towards LPIS pump shut-off head (0.7 MPa) is very slow.

So the primary inventory depletion continues and at 1460 s of calculation the final core uncovery and heat up starts (there were some temporary heat-ups before in earlier phase of the process). Consequently, when the clad temperature reaches 300 °C, primary bleed is initiated by operator. However opening of PRZ relief valve has also minimal effect on behavior of the system and core cooling (both in experiment and in calculation).

So ultimately, the PMK facility core protection stops the core power after clad temperature reaches setpoint 600 °C and the same measure is modeled in the RELAP5 calculation. After that, clad temperatures and other primary parameters starts to decrease. After primary pressure decrease to 0.7 MPa the clad temperature decrease is strongly accelerated by start of LPIS injection into DC.

5.3 Comparison of results

The most important comparison plots of the measured data and the post-test UJV calculations are shown in **Figure 11 - Figure 17**. Complete set of comparison plots can be found in Appendix IV.

Most of the calculated parameters is in very good agreement with measured data, especially the most important system parameters like primary and sec. pressure, clad temperature etc.
The integrated break flow is slightly overpredicted in the first 300 s of the transient and on the contrary, substantially underpredicted after 400 s. The difference between measured and calculated leak is after 800 s more or less constant and amounts approximately 20 kg (15% of steady state inventory).

As the prediction of primary pressure course is pretty good, also the step-wise injection from the HAs is predicted well by the code, but there is some difference in the timing and the amount injected in the different steps. In the facility the HA valves are opened by the primary pressure signal and they remain then open, after a discharge phase significant reverse flows from the primary can be seen in the measured HA level curves. In the RELAP hydroaccumulator model, that valve is a check valve, which does not enable reverse flow in the hydroaccumulator line.

The reverse flow brings warmer water into HA that would warm up very cold HAs (subcooled by gas expansion) and thus accelerate later HA injection. So the HA injection in experiment is naturally little bit faster than injection predicted in calculation.

Both the experiment and calculations show that in this LOCA scenario the Accident Management measures can't reduce the primary pressure fast enough to prevent substantial overheating of the reactor core.

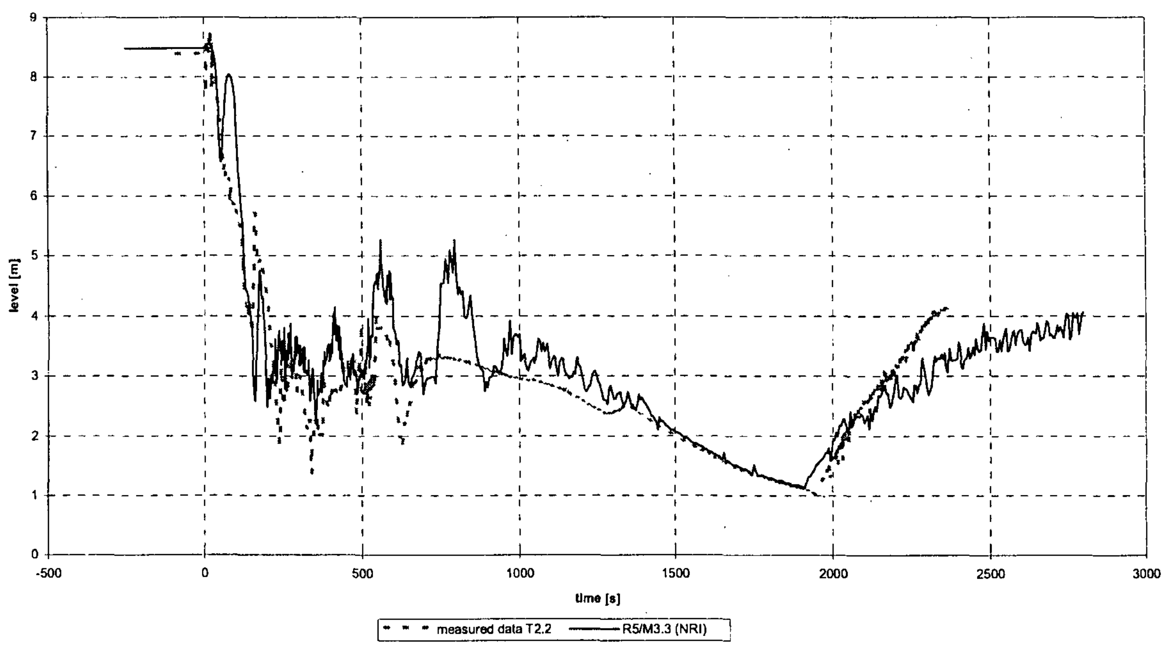

Figure 15 Collapsed level in reactor (T2.2)

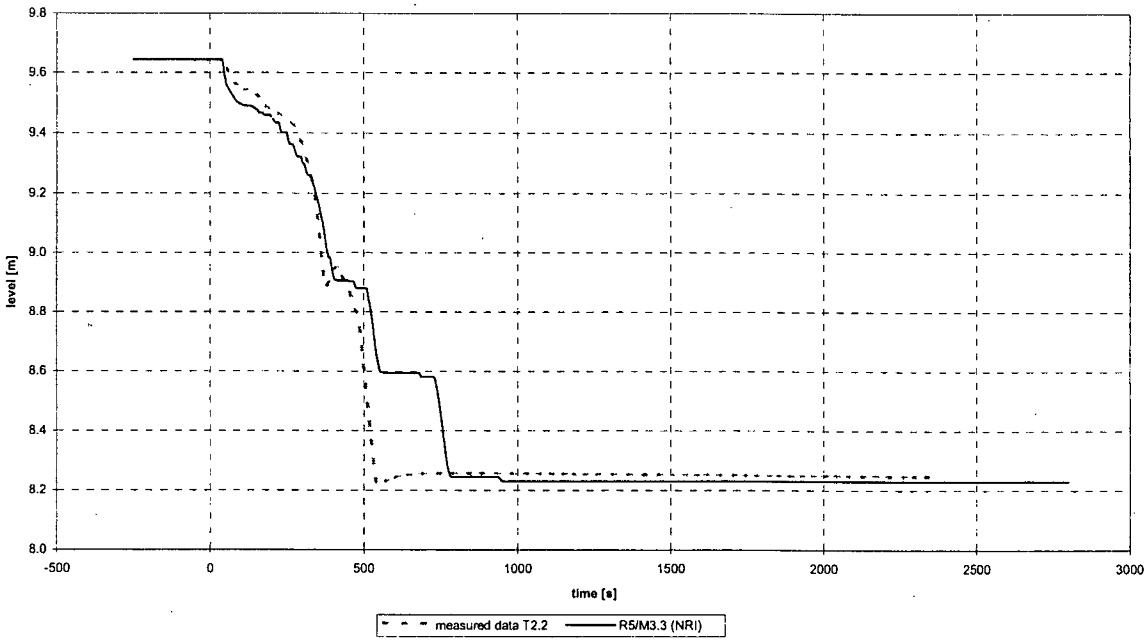

Figure 16 Collapsed level in hydroaccumulator SIT-1 (T2.2)

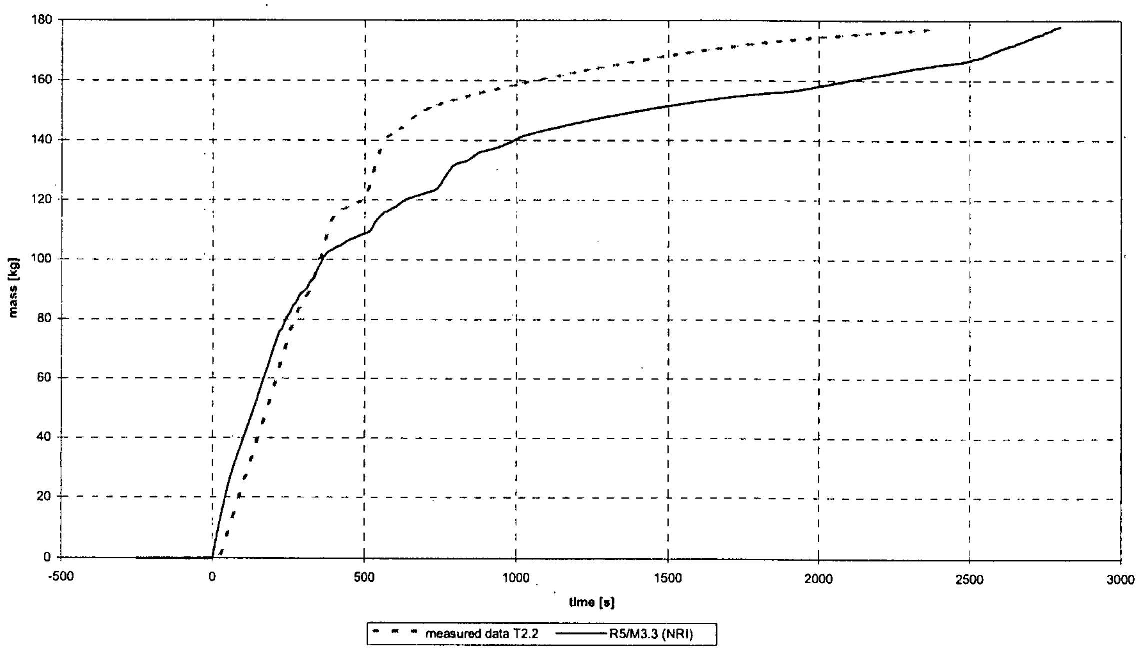

Figure 17 Integrated break mass flow rate (T2.2)

6. POST-TEST ANALYSIS OF T2.3 EXPERIMENT

6.1 Experiment description

The Test 2.3 (T2.3-BF) [5, 6] experiment simulated a medium-break LOCA without high pressure injection and the basic question was whether the primary pressure can be reduced to the shut-off head of the pumps of the LPI systems. Earlier PMK tests had indicated that in these situations it is too late to start bleed and feed at superheated core outlet temperature if the SITs are no longer available. The significant loss of primary coolant may lead to core overheating before the system pressure decreases to the shut-off head of LPI systems. The specific features of the experiment is that the test is a counterpart test with PACTEL facility and that modified hydroaccumulator parameters were used.

The test is defined by the following steps:

- Experiment started from lower operating parameters of the facility by opening the 7.4% break in the cold leg (actually break line is connected not directly to the cold leg, but to the reactor downcomer top, close to cold leg inlet);
- SCRAM actuation simultaneously;
- Secondary side isolation simultaneously;
- Pressurizer heaters off simultaneously;
- Pump coast down simultaneously;
- 1 SIT to the upper plenum and 2 SITs to the downcomer, with reduced pressure 3.5 MPa;
- Secondary bleed starts at Tclad > 350 °C;
- Primary bleed starts at Tclad > 400 °C;
- LPIS starts at p < 0,7 MPa;
- Test is terminated at Tclad > 450 °C.

The main objective of the test was to get experimental evidence on the effectiveness of the secondary bleed and the primary bleed and feed to reduce the primary pressure to the setpoint pressure of LPIS without core damage. Further objectives were as follows:

- Assessment of the predictive capabilities of codes in the prediction of the complex transient scenario and identification of key events;
- Effect of initiation of secondary bleed and primary bleed and feed;
- Effect of reduced hydroaccumulator pressure;
- Effect of scaling ratio, PMK/PACTEL = 1:6,78.

The initial conditions of the test T2.3 at PMK were “synchronized” with PACTEL facility (esp. PACTEL limitation to max. primary pressure 8 MPa). In the table below these conditions are given. Specified data are compared with measured data and the steady-state calculation results.

Table 7 Initial conditions of test T2.3

	Unit	Specified	Measured	Calculation NRI
Primary system pressure (PR21)	MPa	7.7	7.71	7.69
Primary loop flow (FL53)	kg/s	1.1	1.21	1.21
Core inlet temperature (TE63)	K	528	524.3	518.1
Core power (PW01)	kW	138	136.2	136.3
Coolant level in PRZ (LE71)	m	9.1	8.93	8.95
SIT-1 initial pressure (PR91)	MPa	3,5	3.55	3.55
SIT-2 initial pressure (PR92)	MPa	3,5	3.56	3.56
SIT-1 initial level (LE91)	m	9,811	9.835	9.84
SIT-2 initial level (LE92)	m	10,128	10.118	10.13
Secondary pressure (PR81)	MPa	4,2	3.34	3.34
Feedwater flow (FL81)	kg/s	0,11	0.11	0.11
Feedwater temperature (TE81)	K	498	390.6	390.6
Coolant level in SG (LE81)	m	8,4	8.41	8.416

As boundary conditions it was decided to have the SCRAM, the RCP trip and the secondary side isolation together with the opening of the break valve. The secondary bleed starts when the heater rod surface temperature is more than 350°C (plus we used additional condition "not before 900 s" in our calculation), the primary bleed starts when the fuel surface temperature is more than 500°C and LPIS starts when the primary pressure is less than 0,7 MPa. The boundary conditions are listed in **Table 8** below:

Table 8 Boundary conditions of test T2.3

	Unit	Specified	Measured	Calculation NRI
Break orifice diameter	mm	3.0	3.0	3.0
Break valve opens at	s	0.0	2.0	2.0
Scram is initiated at	s	0.0	2.0	2.0
Isolation of feedwater and steam lines	s	0.0	3.0	3.0
Pump coast-down initiated at	s	0.0	7.0	7.0
Pump coast-down	s	150	120	150
Secondary bleed initiated at Twall >	°C	350	349.5	350 *
Primary bleed initiated at Twall >	°C	400	399.5	400
LPIS injection starts if primary pressure	MPa	0.7	0.7	0.7
LPIS flow rate (1 system assumed)	kg/s	0.042	0.0432	0.0432
SIT-1 injection ended at	m	8.24	8.22	8.22
SIT-2 injection ended at	m	9.34	9.26	9.28

* Note: For start of operator initiated secondary bleed we applied additional condition of „time > 1200 s" to avoid its too early initiation by clad temperature peaks in first hundreds of seconds and to be realistic as for timing of first operator interventions.

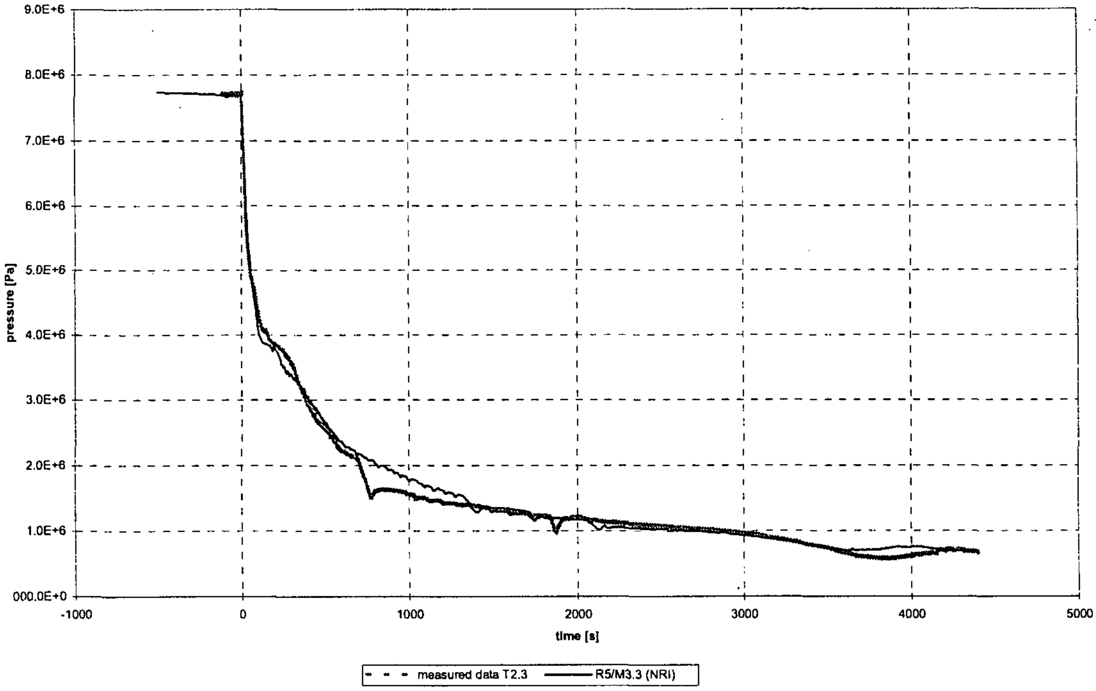

Figure 18 Primary pressure (T2.3)

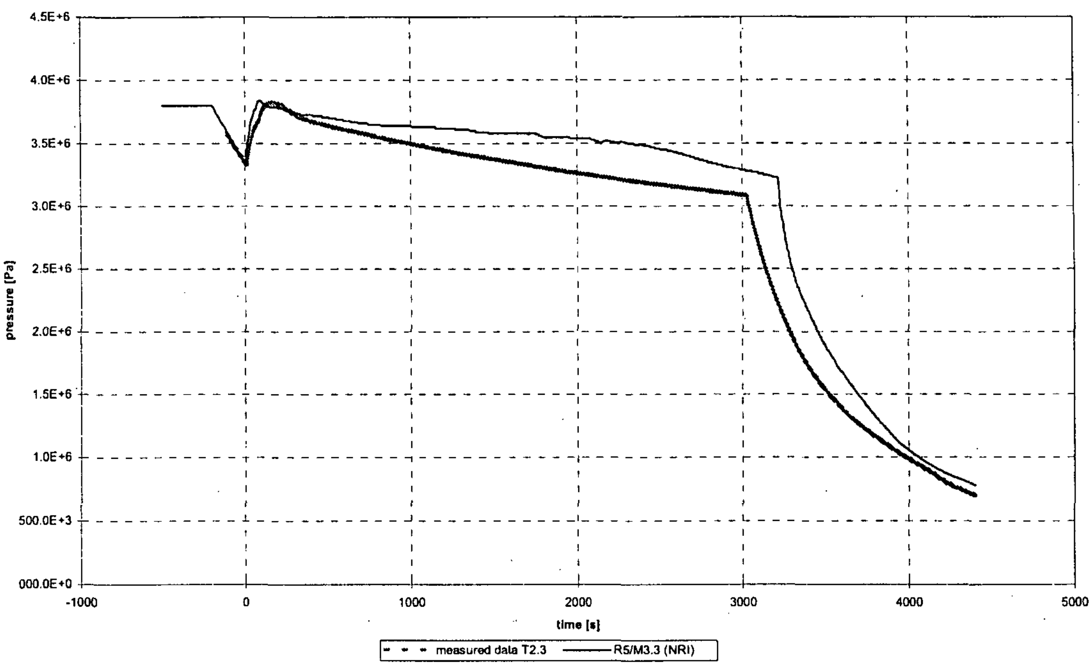

Figure 19 Secondary pressure (T2.3)

6.2 Results of calculation

The main events of the Test T2.3 and the RELAP5 calculations are listed in **Table 9** below:

Table 9 Timing of main events of test T2.3

Event	Timing [s]		Comment
	Measured	Calculation NRI	
Break valve opening	2	2	Break diameter is 3 mm (i.e. 7.4% of CL flow area)
SCRAM actuated	2	2	
Isolation of feedwater and steam lines initiated	3	3	
RCP trip	7	7	
Steam dump valve opening	-	-	No pressure increase to 5.3 MPa
Culmination of sec. pressure	90 (3.88 MPa)	170 (3.85 MPa)	
First clad overheating	235-270	175-195	
First reversal of heat transfer at SG	not measured	224	
SIT-1, SIT-2 injection start	314	235	
SIT-1 injection to upper plenum end	1865	2140	
SIT-2 injection to downcomer end	1868	2550	
Final fuel rod overheating (TW01) start	2880	3120	
Secondary bleed initiation	3030	3220	At clad temp. 350 °C
Primary bleed initiation	3101	3260	At clad temp. 400 °C
Core power switching off	-	-	No temperature increase to 600°C
LPIS injection starts at	3533	3610	
Time of fuel rod temperature maximum	3540 (465 °C)	3630 (528 °C)	
Reactor level minimum	3530 (1.64 m)	3630 (1.31 m)	
Core fully flooded	3625	3650	
Transient end	4400	4400	

The PMK test T2.3 starts from specific initial conditions (parameters reduced due to parallel test with PACTEL facility: 20% power level, lower primary and sec. pressure, lower reactor flow etc.). The initial conditions are not fully stabilized before 0 s - see the course of measured sec. pressure, core inlet temperature etc. In our calculation we tried to simulate as good as possible this "dynamic" start of transient.

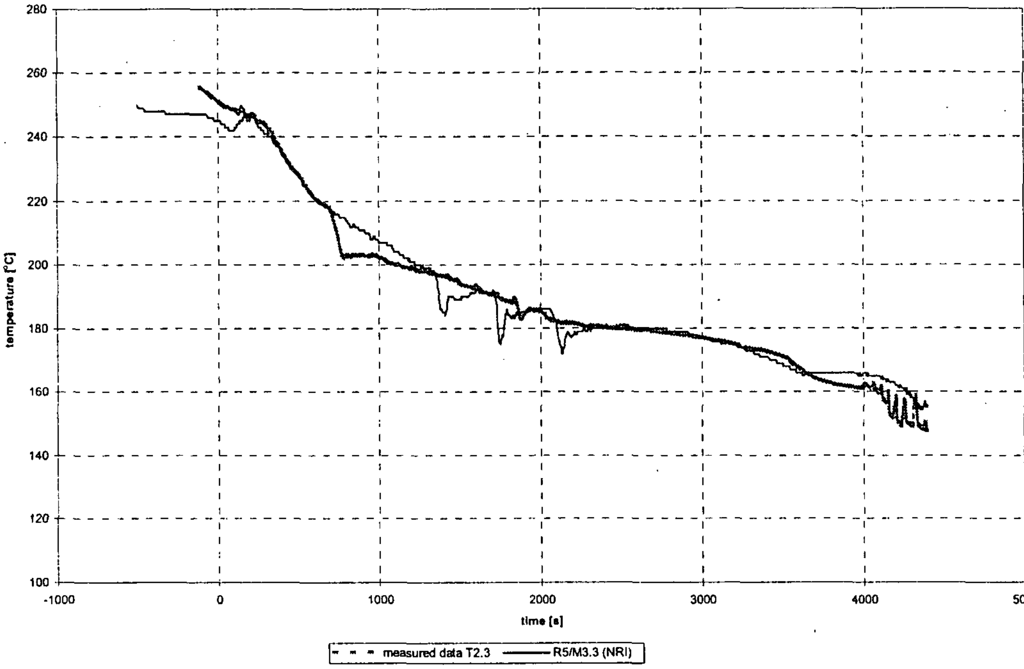

Figure 20 Core inlet temperature (T2.3)

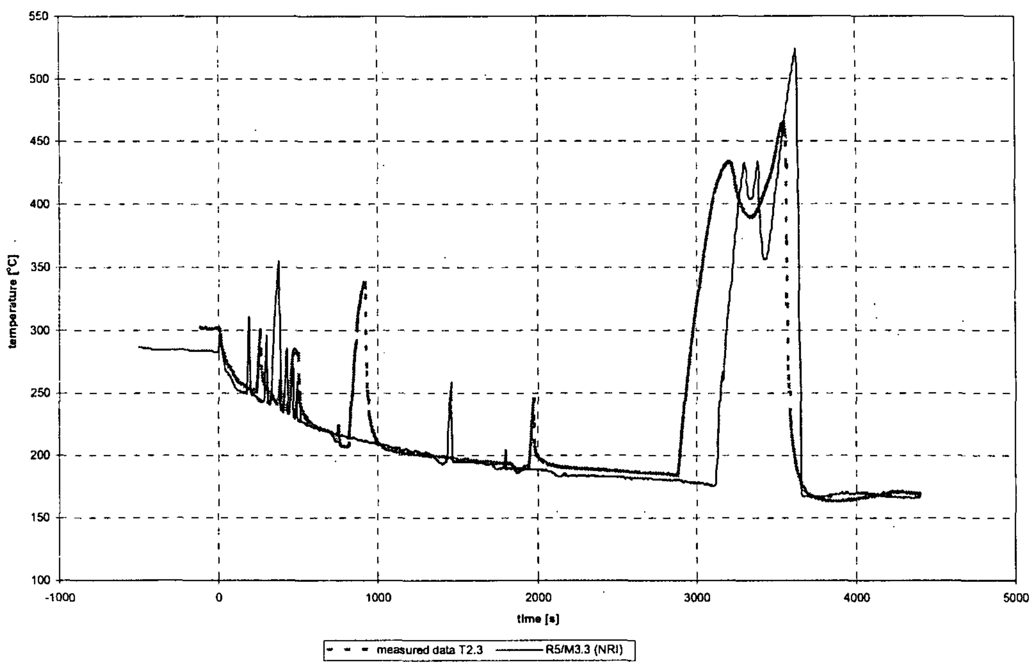

Figure 21 Cladding temperature (T2.3)

The selected medium-break LOCA scenario started with opening of the break valve (break diameter is 3 mm - i.e. 7.4% of CL flow area) at reactor downcomer top and with coincident loss of offsite power (LOOP) simulation. Major consequences of LOOP are the nearly immediate reactor SCRAM, and isolation of SG secondary side, and trip of RCP.

Due to the closing of MSIV, the SG pressure increases at first and after culmination at about 3.85 MPa (90 s in calc.) slowly decreases due to heat losses from SG secondary and due to drop of parameters in primary circuit. Heat transfer at SG tubing occurs at 224 s (in calc.). Outflow of primary coolant through break with equivalent diameter 3 mm (7.4% of cold leg flow area) leads to fast decrease of primary pressure. After getting under 3.5 MPa, the hydroaccumulators start to inject cold water into UP and DC (at 314 s of calc.).

There are some short-time core heat-up in first hundreds of seconds due to reactor level depressions and/or liquid hold up in UP. However the PCT in this period culminates in quite "low" temperature range 250-350 °C.

As there is no HPIS available in the test T2.3, the end of HA injection (at primary pressure about 1.2 MPa, i.e. higher then LPIS shut-off head of 0.7 MPa) means further decrease of primary inventory and finally a deeper core uncovery and heat-up.

The final core uncovery and heat-up starts at about 3000 s. After reaching of cladding temperature level 350 °C secondary bleed is initiated by opening of relief valve at SG top. Unfortunately, both the experiment and the calculation show that the secondary bleed had minimal or no effect on the core cooling.

So the core heat-up continued and when clad temperature reaches 400 °C, primary bleed was initiated. Shortly after that (circa 100 s in both exp. and calc.) the clad temperature course experienced a temporary partial decrease (by some 50 °C). But after another approximately 100 s the clad temperature returns to increase. The temporary reactor level increase and improvement of core cooling was caused by "draining" of hot leg after PRZ relief valve opening, so decreasing of delta-p at primary loop and relaxing level in inner reactor. There could be also minor influence of coolant flashing in lower plenum, but as the pressure decrease was slow, this phenomena was not so important.

Primary pressure decrease ("supported" by both sec. and prim. bleed) leads at about 3600 s to start of LPIS injection and consequently to ultimate core reflooding (3650 s). After that core cooling is stabilized and at 4400 s the post-test calculation was terminated.

6.3 Comparison of results

The most important comparison plots of the measured data and the post-test UJV calculations are shown in **Figure 18** - **Figure 24**. Complete set of comparison plots can be found in Appendix V.

Most of the calculated parameters is in very good agreement with measured data, especially the most important system parameters like primary pressure, reactor inlet temperature, clad temperature, reactor vessel level etc.

The integrated break flow is slightly overpredicted in the first 200 s of the transient and on the contrary, substantially underpredicted after 700 s. The difference between measured and calculated leak is after 800 s more or less constant and amounts approximately 20 kg (15% of steady state inventory).

As the prediction of primary pressure course is pretty good, also the step-wise injection from the HAs is predicted well by the code, but there is some difference in the timing and the amount injected in the different steps. In the PMK facility the HA valves are opened by the primary pressure signal and they remain then open, after a discharge phase significant reverse flows from the primary can be seen in the measured HA level curves. In the RELAP hydroaccumulator model, that valve is a check valve, which does not enable reverse flow in the hydroaccumulator line. The reverse flow in experiment brings warmer water into HA that would warm up very cold HAs (subcooled by gas expansion) and thus accelerate later HA injection. So the HA injection in experiment is naturally little bit faster than injection predicted in calculation.

Both the experiment and calculations show that in this LOCA scenario without HPIS the Accident Management measures can reduce the primary pressure fast enough to initiate LPIS injection and prevent substantial overheating of the reactor core.

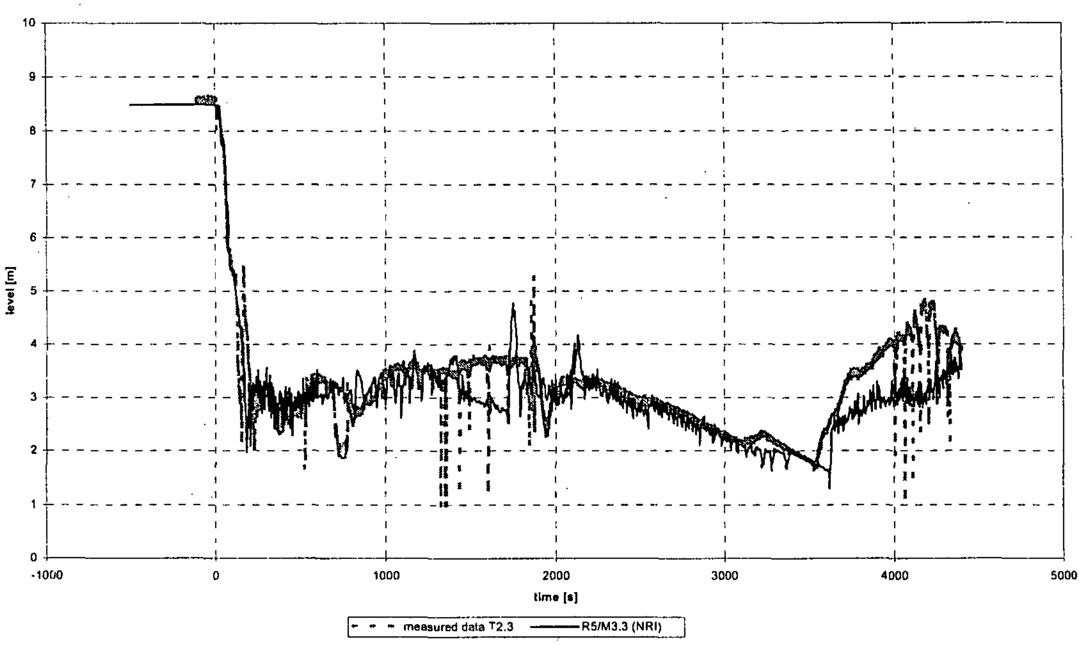

Figure 22 Collapsed level in reactor (T2.3)

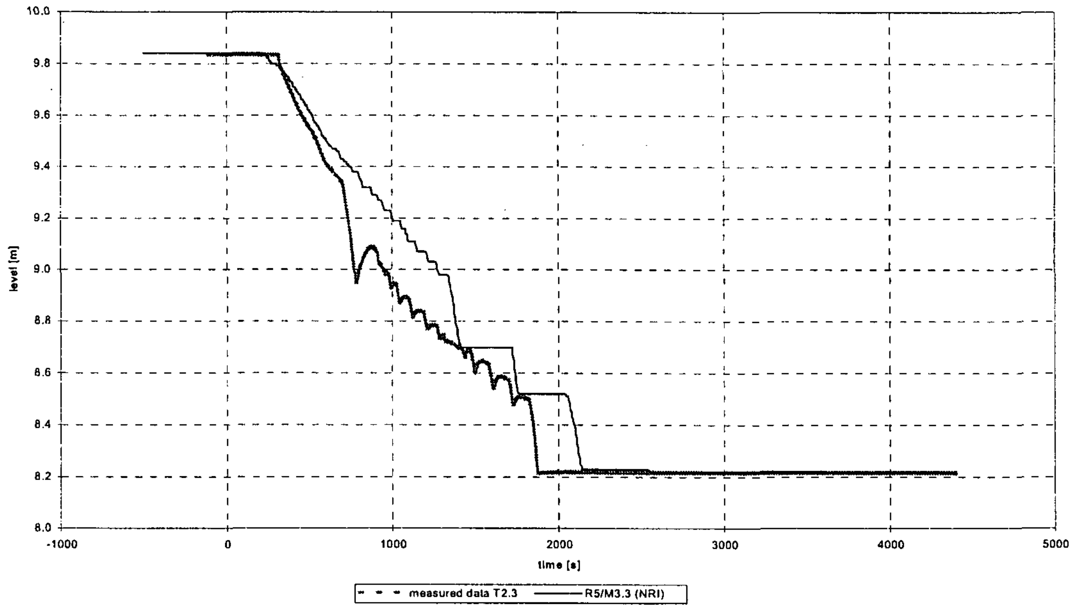

Figure 23 Collapsed level in hydroaccumulator SIT-1 (T2.3)

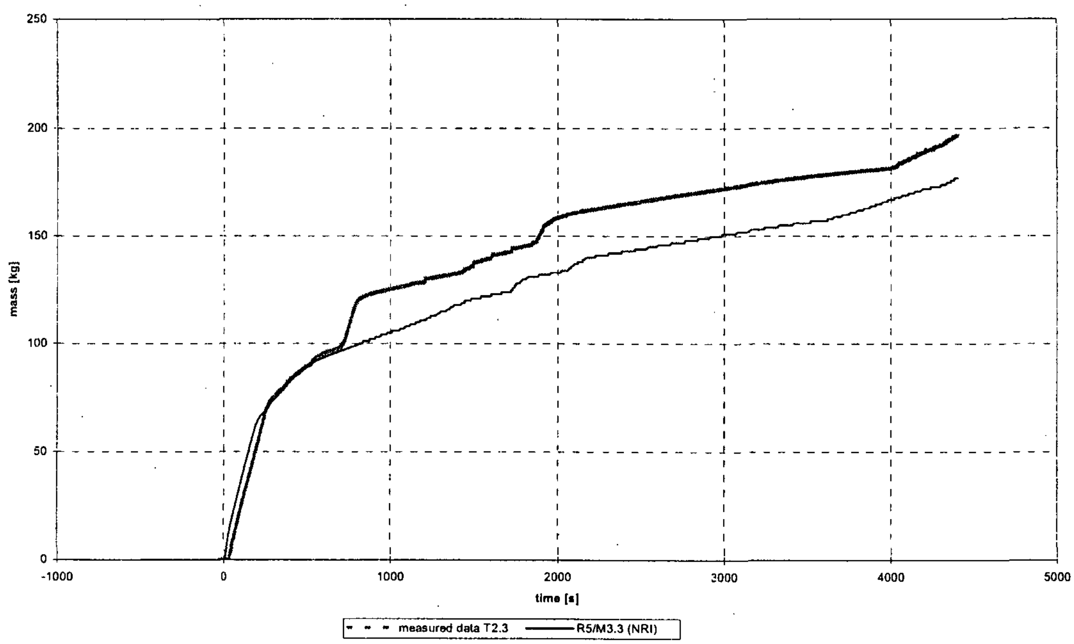

Figure 24 Integrated break mass flow rate (T2.3)

7. CONCLUSIONS

As a part of assessment of new version of RELAP5 (the MOD3.3) in UJV Rez, we have performed a set of post-test analyses of new PMK experiments. The analyzed tests T2.1, T2.2, and T2.3 were performed in 2003-2004 in frame of the IMPAM-VVER project.

The PMK facility is a scaled down model of the VVER-440/213 and it was primarily designed for investigating small-break loss of coolant accidents (SBLOCA) and transient processes of this type of NPP. The volume and power scaling of PMK facility are 1:2070. Transients can be started from nominal operating conditions. The ratio of elevations is 1:1 except for the lower plenum and pressurizer. The six loops of the plant are modeled by a single active loop. In the secondary side of the steam generator the steam/water volume ratio is maintained. The coolant is water under the same operating conditions as in the nuclear power plant.

All three tests T2.1, T2.2, and T2.3 were focused on medium-break LOCA without HPSI. Individual tests differentiated in initial conditions of primary and secondary system, hydroaccumulator parameters and timing of operator interventions. The issue of the tests was the core cooling problem in small and medium-break LOCA without HPSI, where after end of HA injection and before primary pressure drop under LPIS pumps shut-off head, there is a period without any ECCS, that could result in core uncovery and heat-up. The experiment studied effectiveness of operator interventions (secondary bleed and primary bleed) with various timing, that should accelerate decrease of pressure in RCS and so shorten the period without ECCS injection. In two tests the operator interventions were not fully successful (i.e. clad temperature rose above 600 °C, what is limiting value for PMK core simulator), in the last test the interventions were successful, i.e. LPSI was effectively initiated before overheating of the core simulator.

The RELAP5 input deck used for the post-test analyses is a modified version of the older UJV input deck used for modeling of PMK-NVH in early 90-ties, when we analyzed the IAEA organized SPE tests. Listing of the current version of the deck used for the presented analyses is in the Appendix I.

Comparison of the measured test data and the calculation results showed very good overall agreement of all major system parameters as primary pressure, reactor level, reactor coolant and clad temperature etc.

As for the revealed shortcomings of our RELAP5 simulation, in all three tests one can see certain overprediction of the break flow in the first 200-300 s and on the contrary break flow underprediction in period 700-800 s. Later on the difference between measured and calculated integrated leak is more or less constant and amounts approximately 20 kg (15% of steady state inventory). We used as default the Henry-Fauske critical flow model, but also with the original RELAP5 break flow model, the results showed similar trends. As the same discrepancy was shown in calculation of other participants of the IMPAM project with different computer codes, one can conclude, that the problem could be connected with complicated geometry of section "downcomer top", where are connected 3 important piping's – break valve piping, cold leg inlet and hydroaccumulator line.

As the prediction of primary pressure course was pretty good in all 3 tests, also the step-wise injection from the HAs was predicted well by the code, but there were some differences in the timing and the amount injected in the different steps. Here the explanation is quite simple. In the PMK facility the HA valves are opened by the primary pressure signal and they remain then open even in case when a reverse flows from the primary circuit occurs (as can be seen in the measured HA level curves). However, in the RELAP hydroaccumulator model, that valve is a check valve, which does not enable reverse flow in the hydroaccumulator line. This difference between object and model causes probably the small disagreement in results - the reverse flows in experiment bring warmer water into HA that warms up partially the very cold HA (subcooled by gas expansion) and thus accelerate consequent HA injection. So the HA injection in experiment is naturally little bit faster than injection predicted in calculation.

Additional notes to EOP:

Although the results of experiments T2.1 and T2.2 gave very pessimistic answer to the question if operator intervention, i.e. secondary and primary bleed initiated after start of core heat-up start, can be effective in situation of larger-small or medium break LOCA without HPSI, the issue is no so critical.

We made additional analyses without switch-off of core power at Tclad 600 °C and the results showed, that the cladding temperature wouldn't probably exceed 1200 °C in any of these tests. The PCT in these special analyses of T2.1 and T2.2 was 995 °C and 920 °C, respectively.

8. REFERENCES

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APPENDIX A LISTING OF UJV INPUT DECK OF PMK

```
*##############################################################################
*#
*#      RELAP5 INPUT MODEL OF PMK-NVH FACILITY
*#         NUCLEAR RESEARCH INSTITUTE REZ
*#
*##############################################################################
*
=id-pmk-51u.nrc  ... fine-node ID of PMK2 test T2.3
*
*##############################################################################
*# m i s c e l l a n e o u s   c o n t r o l   c a r d s        #
*##############################################################################
*
*    options card
001                    * no spec. options
*
*    problem type and option
*     pr.type   pr.option
100     new       transnt
*
*    input check or run option [opt.]
*     option
101     run
*
*    restart input file control card [not for "new"]
*     rest.numb.
*103
*
*    restart-plot file control card [not for "plot" and "reedit"]
*     act.or
*104     none
*
*    noncondensible gas type (max.5 norm.words)
*     type
110     nitrogen
*
*    initial mass fraction for each noncondensible gas type [opt.]
*     fraction
115     1.
*
121     002010000 0.095    h2o     "Prim-sys"
122     522010000 6.635    h2o     "Sec-sys"
*
*##############################################################################
*# t i m e   s t o p   c o n t r o l   c a r d s         #
*##############################################################################
*
*    initial time value
*     ini.time
200     0.
*
*    time step control
*   set.end  min.    max.st.  ctrl.  mined  majed   rst
*
201    990.   1.-8   0.4     00003  25    250     250
202    1000.   1.-8   0.4     00003  15    50000   50000
203    1100.   1.-8   1.0     00003  1     50000   50000
204    1600.   1.-8   1.0     00003  2     100     100
205    2000.   1.-8   1.0     00003  5     100     100
206    5400.   1.-8   1.0     00003  5     100     100
*
*
*==============================================================================
*
```

```
* run trip end
*
410   time      0        ge       null     0      2000.     l
410   httemp   044000604 ge       null     0      1473.     l
600   410
*
*=====================================================================
*
*
*
*####################################################################
*# m i n o r   e d i t s                        #
*####################################################################
*
*=======================================================================
* mass flows
*=======================================================================
*
0000301  dt       0
*
0000302  dtcrnt   0
*
0000303  emass    0
*
*   Loop flow (CL end)
0000304  mflowj   198010000
*
*   Break flow
0000305  mflowj   935000000
*
*   HPIS flow
0000306  mflowj   855000000
*
*   LPIS flow
0000307  mflowj   865000000
*
*   HA1 (to DC) flow
0000308  mflowj   810010000
*
*   HA2 (to UP) flow
0000309  mflowj   820010000
*
*=======================================================================
*
*=======================================================================
*
*   UP plenum pressure
0000310  p        052010000
*
*   SG secondary pressure
0000311  p        548010000
*
*      liquid level in sg secondary
0000312  cntrlvar  528
0000313  cntrlvar  828
*
*   FW flow
0000314  mflowj   505000000
0000315  mflowj   507000000
*
*   MSL flow
0000316  mflowj   555000000
*
*=======================================================================
* liquid levels
*=======================================================================
*
*      liquid level in reactor model
0000317  cntrlvar  817
0000318  cntrlvar  818
0000319  cntrlvar  819
*
```

```
*     level in hot leg loop seal (reactor side)
0000320  cntrlvar  823
*
*     level in sg primary + hot leg
0000321  cntrlvar  824
*
*     level in sg primary + cold leg
0000322  cntrlvar  822
*
0000323  cntrlvar  400   * PRZ level
*
*     liquid level in reactor downcomer
0000324  cntrlvar  825
*
*=====================================================================
* slabs temperatures
*=====================================================================
*
*     heater rod 5.part surface temperature
0000327  httemp    044000604
0000328  httemp    044000504
0000329  httemp    044000404
0000330  httemp    044000104
*
*     wall of downcomer upper part
0000331  httemp    014000104
*
0000332  httemp    064000104
*
0000333  httemp    044000601
*
*=====================================================================
* volume temperatures
*=====================================================================
*
*     core inlet temperature
0000334  tempf    026020000
*
*     core outlet temp.
0000335  tempf    052010000
*
0000336  tempf    014010000
*
0000340  tempf    140010000
*
0000341  tempf    524010000
*
0000342  tempg    052010000
*
0000343  tempg    140010000
*
*=====================================================================
* miscellaneous
*=====================================================================
*
0000346    cputime  0
*
0000347    dt       0
*
*     core heat production
0000352  cntrlvar  044
*
*     sg tubing heat transfer
0000353  cntrlvar  520*
*
0000357  voidf    420010000
*
0000358  voidg    044060000
*
0000359  voidg    062010000
*
0000360  voidg    064010000
```

```
*
0000361   voidg     068010000
*
**
***
*###########################################################################
*#trip  input data                         #
*###########################################################################
*
*       500             always true
*       501             always false
*       601             transient initiation
*       602             scram
*       603             pump trip
*       604             steam valve opens
*       605             steam valve closes
*       606             hpis
*       609             pump trip
*       610             (pump table off)
*       617             transient trip neg
*       644             prz relief valve open
*       648             prz spray valve open
*       658             prz el.heater in operation
*
*=======================================================================
*
*  always true trip
500  time    0      ge     null    0      -6.0    l
*
*  always false trip
501  time    0      lt     null    0      -6.0    l
*
*  stop of prz "make-up"
509  time    0      lt     null    0      990.0   n
*
*=======================================================================
*
*  transient initialization
401  time    0      ge     null    0      1000.   l
601  500     and    401    l
*
*  stacionary state run - controllers in action
617  -601    and    500    n
618  617     and    617    n
*
*  long stdy controllers (up to 900 ss):
418  time    0      le     null    0      900.    n
*
*
*=======================================================================
*
*  break opening trip
466  time    0      ge     null    0      1002.   l
666  500     and    466    l
*
*=======================================================================
*
*  scram
402  p       052010000 le     null    0      11.6e6   l

602  402     and    601    l *opt*= after pressure drop
602  601     and    601    l *opt*= at 0. s
*
*-------------------------------------------------------------
*
*  full power off trip (overheat protection)
590  cntrlvar 933   ge     null    0    873.   n
690  590     and    401    l
*
*=======================================================================
*
*  RCP trip
```

```
403  p       052010000 le      null    0       9.47e6   l

404  time    0       ge      null    0       1000.   l
404  time    0       ge      null    0       1007.   l

603  403     and     601     l *opt*= after pressure drop
603  601     and     601     l *opt*= at 0. s
603  404     and     404     l *opt*= at predefined time

*=====================================================================
*
*  hpis
406  time    0       ge      timeof  402     60.0     l

606  406     and     601     l  *opt*= BE
606  501     and     -501    l  *opt*= Deactivated

*=====================================================================
*
*  ACCUMs stop trips:

407  cntrlvar  810     ge      null    0       8.221    n
407  cntrlvar  810     ge      null    0       8.23     n
407  cntrlvar  810     ge      null    0       8.22     n
607  407     and     601     n

408  cntrlvar  812     ge      null    0       9.25     n
408  cntrlvar  812     ge      null    0       9.278    n
408  cntrlvar  812     ge      null    0       9.26     n
408  cntrlvar  812     ge      null    0       9.28     n
608  408     and     601     n

*=====================================================================
*
*  LPSI

411  p       064010000 lt      null    0       0.73+6   n
411  p       064010000 lt      null    0       0.7+6    n
611  411     and     601     l


*=====================================================================
*
*  pump trip
409  time    0       ge      timeof  403     147.5    l
409  time    0       ge      timeof  403     147.5    l
609  409     and     601     l
610  -603    and     500     n
*
*
*=====================================================================
*  temperary expanded FW source
521  time    0       ge      null    0       710.0    n
522  time    0       le      null    0       990.0    n
522  time    0       le      null    0       1010.0   n
522  time    0       le      null    0       1000.0   n
*

626  521     and     522     n
627  626     and     626     n
*
*
*=====================================================================
*
*  MSIV closing (SG isolation at steam side):
431  time    0       ge      timeof  601     12.      n  *opt*
431  time    0       ge      timeof  601     0.       n  *opt*
431  time    0       ge      timeof  601     3.       n  *opt*
631  431     and     601     l
*
*
*  Normal FW isolation:
```

```
433  time    0      ge     timeof  601     12.     n  *opt*
433  time    0      ge     timeof  601     0.     n  *opt*
433  time    0      ge     timeof  601     3.     n  *opt*
633  433     and     601     l
*
*  Normal FW on
634  -633     and     -633     n
*
*=====================================================================
*
* prz relief valve
540  p     420050000   gt   null   0     12.84+6   n
541  p     420050000   ge   null   0     12.32+6   n
640  540     or     644     n
644  541     and     640     n
*
*  Operator opening if Tclad high:
546  cntrlvar  933     ge     null   0     773.   n  *opt*= 500 C
546  cntrlvar  933     ge     null   0     573.   n  *opt*= 300 C
546  cntrlvar  933     ge     null   0     568.   n  *opt*= 295 C
546  cntrlvar  933     ge     null   0     673.   n  *opt*= 400 C
*
547  time    0      ge     null   0     3500.0  n  *= time conditioning
*
643  546     and     547     l     * high temp .and. time cond.
*
*  Final opening trip for PRZ RV:
646  644     or     643     n
*
*=====================================================================
*
* prz boundary valve (in action from trip "508" to 1000 s)
670  401     or     618     n
671  -670     or     -670     n
*
*=====================================================================
*
* prz make-up pump in action
673  617     and     618     n   *= only in STDY
*
*=====================================================================
*
* prz spray valve
542  p     052010000   gt   null   0     12.6509+6   n
543  p     052010000   ge   null   0     12.6507+6   n
645  542     or     648     n
648  543     and     645     n
*
*
*=====================================================================
*
* prz heater
550  p     052010000   gt   null   0     12.6502+6   n
551  p     052010000   lt   null   0     12.6500+6   n
650  551     or     651     n
651  -550     and     650     n
*
552  cntrlvar   400    ge   null   0    8.3       n
657  651     and     552     n
658  657     and     618     n
*
*
*
*=====================================================================
*
* Sec. side relief valve
421  p     548010000   gt   null   0     5.37+6  n
421  p     548010000   gt   null   0     5.3+6   n
*
422  p     548010000   ge   null   0     4.89+6  n
422  p     548010000   ge   null   0     4.9+6   n
*
```

```
621 422      and       622     n
*
622 421      and       -421     n   *opt*= Deactivated autom. operation
622 421      or       621     n   *opt*= BE autom. operation
*
423 cntrlvar 933      ge   null    0     623.    n   *= depress. by 350 C

424 time     0       ge   null    0     1900.0  n   *= time conditioning
424 time     0       ge   null    0     1889.0  n   *= time conditioning
424 time     0       ge   null    0     3500.0  n   *= time conditioning
*
624 424      and       424     l   *opt*= activated only from time
624 423      and       424     l   *opt*= activated from high temp .and. time
*
625 624      or       624     n   *= deactivated autom.opening (only operator)
625 501      and       -501     n   *= fully deactivated
625 622      or       624     n   *= BE final opening trip (automatics + operator)
*
629 -422     and       -625     n   *= final closing trip
*
*
*
*
*#####################################################################
*#i n t e r a c t i v e   i n p u t   d a t a              #
*#####################################################################
*
*       var.name  ini.val.  convers.f.  alph.part  integr.part
*0000801
*
*0000802
*
*
*#####################################################################
*#h y d r o d y n a n a m i c   c o m p o n e n t              #
*#####################################################################
*
*
*
*=====================================================================
*=====================================================================
*= reactor vessel
*= --------------
*=====================================================================
*=====================================================================
*
*=====================================================================
* downcomer top - upper part
* ------------------------
*=====================================================================
*
*     component name and type
*       comp.name   comp.type
0080000  r-input    branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 010n2..=ini.vel.]
0080001   1           1
*
*     branch volume geometry cards
*       area    length  vol.  az.ang.  inc.ang.  elv.chng.
0080101   2.01-2  0.112  0.    0.       -90.      -0.112
*
*       rough.  h.diam.  flags
0080102   3.-5    0.16    00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                  bor.con.[if]
*        ----   ----   ----   ----   ----
0080200   103   12.772+6  537.7
*
*     branch junction geometry cards
```

```
*       from       to         area    loss.c.  rev.loss.c.  flags
0081101  008010002  012010001  0.      0.        0.         00000
*
*     branch junction initial conditions [according to 0100001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*       ---          ---
0081201  0.0          0.           0.
***
*==================================================================
* input branch
* ------------
*==================================================================
*
*     component name and type
*       comp.name    comp.type
0120000  r-input      branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 012n2..=ini.vel.]
0120001  2             1
*
*     branch volume geometry cards
*       area    length  vol.  az.ang.  inc.ang.  elv.chng.
0120101  0.0201  0.116  0.    0.       -90.      -0.116
*
*       rough.  h.diam.  flags
0120102  3.-5    .16      00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                    bor.con.[if]
*       ----   ----    ----    ----   ----
0120200  103    12.772+6  537.7
*
*     branch junction geometry cards
*       from       to         area     loss.c.  rev.loss.c.  flags
0121101  198020002  012010003  1.7-3    10.      10.          00001
*
0122101  012010002  014010001  0.       0.5      0.5          100100
*
*     branch junction initial conditions [according to 0120001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*       ---          ---
0121201  4.73         0.           0.
0122201  4.73         0.           0.
***
*==================================================================
* downcomer
* ---------
*==================================================================
*
*     component name and type
*       comp.name   comp.type
0140000  r-downc     pipe
*
*     pipe information card
*       numb.of.vol.
0140001  8
*
*     pipe volune flow areas
*       area    vol.numb.   ____->____     ____->____
0140101  2.63-3  8
*
*     (internal) pipe junction flow areas [opt.]
*       area    jun.numb.   ____->____
*140201  2.63-3  7                *= 2.6 in 5-volume downcomer
*
*     pipe volume lenghts
*       lengh   vol.numb.   ____->____     ____->____
0140301  0.5695  1           0.5225  8
*
*     pipe volume volumes
*       vol.    vol.numb.   ____->____     ____->____
```

```
0140401
*
*    pipe volume vertical angles
*      inc.ang.  vol.numb.   ____->____    ____->____
0140601  -90.     8
*
*    pipe volume elevation change [opt.]
*      elev.chng.  vol.numb.   ____->____    ____->____
0140701  -0.5695  1          -0.5225  8
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
0140801  3.-5   5.755-2  8
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
0140901  0.      0.        7
*
*    pipe volume control flags
*      flags  vol.numb.   ____->____    ____->____
0141001  00    8
*
*    pipe junction control flags
*      flags  jun.numb.   ____->____    ____->____
0141101  00100  7
*
*    pipe volume initial conditions
*      ctrl.              (w4 or 0.)              vol.numb.
*            ----    ----  ----       ----  ----
0141201  103    12.52+6  537.7  0.      0.   0.      8
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 01413..=ini.vel.]
0141300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*        ---       ---
0141301  4.73      0.        0.        7
***
*=====================================================================
* downcomer bottom connection
* --------------------------
*=====================================================================
*
*     component name and type
*       comp.name   comp.type
0180000  r-down-c    branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 018n2..=ini.vel.]
0180001  3           1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
0180101  1.7-3  0.834  0.   0.       -10.      -0.35
*
*       rough.  h.diam.  flags
0180102  3.-5   4.654-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)    (temp)                     bor.con.[if]
*             ----    ----   ----   ----   ----
0180200  103    12.52+6  537.7
*
*     branch junction geometry cards
*       from        to         area   loss.c.  rev.loss.c.  flags
0181101  014080002  018010001  1.7-3  0.2     0.2        00100
*
0182101  018010002  024010001  0.9-3  14.     14.5       00000
*
0183101  018010002  002010002  0.8-3  15.     14.5       00000
```

```
*
*     branch junction initial conditions [according to 0180001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*          ---          ---
0181201  4.73         0.          0.
*
0182201  3.00         0.          0.
***
0183201  2.24         0.          0.
***
*
*==================================================================
* lower plenum bottom part
* ------------------------
*==================================================================
*
*     component name and type
*       comp.name   comp.type
0020000  r-lp-b     branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 002n2..=ini.vel.]
0020001  1           1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
0020101  7.3-3  0.19   0.    0.       90.       0.19
*
*       rough.  h.diam.  flags
0020102  3.-5   0.1088   00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                    bor.con.[if]
*              ----    ----   ----   ----   ----
0020200  103   12.73+6  537.7
*
*     branch junction geometry cards
*       from        to          area   loss.c.  rev.loss.c.  flags
0021101  002010002  024010001  0.     0.1      0.1          00100
*
*     branch junction initial conditions [according to 0020001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*          ---          ---
0021201  2.24         0.          0.
***
*==================================================================
* lower plenum middle part
* ------------------------
*==================================================================
*
*     component name and type
*       comp.name   comp.type
0240000  r-lp-b     branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 024n2..=ini.vel.]
0240001  1           1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
0240101  7.3-3  0.19   0.    0.       90.       0.19
*
*       rough.  h.diam.  flags
0240102  3.-5   0.1088   00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                    bor.con.[if]
*              ----    ----   ----   ----   ----
0240200  103   12.73+6  537.7
*
*     branch junction geometry cards
*       from        to          area   loss.c.  rev.loss.c.  flags
```

```
0241101  024010002 026010001 0.   1.    1.        00100
0241101  024010002 026010001 0.   0.2   0.2        00100
*
*    branch junction initial conditions [according to 0240001]
*      ini.f.flw.  ini.g.flw.  interf.vel.
*           ---        ---
0241201  4.73        0.        0.
***
*==================================================================
* lower plenum upper part
* ----------------------
*==================================================================
*
*    component name and type
*      comp.name  comp.type
0260000  r-lp-u    pipe
*
*    pipe information card
*      numb.of.vol.
0260001  2
*
*    pipe volune flow areas
*      area  vol.numb.  ____->____      ____->____
0260101  7.3-3 2
*
*    (internal) pipe junction flow areas [opt.]
*      area  jun.numb.     ____->____
0260201                          *= 2.6 in 5-volume downcomer
*
*    pipe volume lenghts
*      lengh   vol.numb.   ____->____     ____->____
0260301  0.307  2
*
*    pipe volume volumes
*      vol.    vol.numb.   ____->____     ____->____
0260401  0.     2
*
*    pipe volume vertical angles
*      inc.ang.  vol.numb.   ____->____     ____->____
0260601  +90.     2
*
*    pipe volume elevation change [opt.]
*      elev.chng.  vol.numb.   ____->____     ____->____
0260701  +0.307     2
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
0260801  3.-5   0.1003  2
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
0260901  0.       0.         1
*
*    pipe volume control flags
*      flags  vol.numb.   ____->____     ____->____
0261001  00    2
*
*    pipe junction control flags
*      flags  jun.numb.   ____->____     ____->____
0261101  01000  1
*
*    pipe volume initial conditions
*      ctrl.              (w4 or 0.)            vol.numb.
*          ----    ----  ----          ----  ----
0261201  103   12.52+6  537.7  0.        0.   0.     2
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 02613..=ini.vel.]
0261300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
```

```
*            ---       ---
0261301  4.73       0.        0.        1
***
*=====================================================================
* lower plenum - core connection
* ------------------------------
*=====================================================================
*
*     component name and type
*       comp.name  comp.type
0350000   upc-con   sngljun
*
*     single junction geometry cards
*       from       to         area   loss   rev.loss.   flgs.
0350101  026020002  044010001  0.     1.     1.          00100
*
*     single junction initial conditions [w1=0 -> w2,w3=vel.]
*       ctrl   ini.f.flw.   ini.g.flw.   interf.vel.
*                ----         ----
0350201   1     4.73          0.          0.
***
*=====================================================================
* reactor core
* ------------
*=====================================================================
*
*     component name and type
*       comp.name  comp.type
0440000   r-core    pipe
*
*     pipe information card
*       numb.of.vol.
0440001   6
*
*     pipe volume flow areas
*       area   vol.numb.   ____->____      ____->____
0440101   1.5-3  6
*
*     pipe volume lenghts
*       lengh    vol.numb.    ____->____      ____->____
0440301   0.5      4
0440302   0.25     6
*
*     pipe volume volumes
*       vol.  vol.numb.   ____->____      ____->____
0440401   0.    6
*
*     pipe volume vertical angles
*       inc.ang.  vol.numb.   ____->____      ____->____
0440601   90.      6
*
*     pipe volume elevation change [opt.]
*       elev.chng.  vol.numb.   ____->____      ____->____
0440701   +0.5        4
0440702   +0.25       6
*
*     pipe volume friction data
*       rough.  h.diam.  vol.numb.
0440801   3.-5    9.307-2  6
*
*     (internal) pipe junction loss coeffitients [opt.]
*       loss.c.   rev.loss.c.  jun.numb.
0440901   1.        1.           3
0440902   0.5       0.5          5
*
*     pipe volume control flags
*       flags  vol.numb.   ____->____      ____->____
0441001   00000  6
0441001   00100  6
*
*     pipe junction control flags
*       flags  jun.numb.   ____->____      ____->____
```

```
0441101  100100 5
*
*    pipe volume initial conditions
*      ctrl.              (w4 or 0.)             vol.numb.
*        ----    ----  ----       ----  ----
0441201  103    12.52+6  543.0  0.        0.   0.      1
*
0441202  103    12.52+6  548.3  0.        0.   0.      2
*
0441203  103    12.52+6  553.5  0.        0.   0.      3
*
0441204  103    12.52+6  558.6  0.        0.   0.      4
*
0441205  103    12.52+6  563.6  0.        0.   0.      6
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 04413..=ini.vel.]
0441300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*        ---       ---
0441301  4.73      0.        0.        5
***
*================================================================
* core outlet connections
* ---------------------
*================================================================
*
0490000  upc-con1   sngljun
0490101  044060002  052010001  0.    1.     1.        100100
0490201  1        4.73      0.   0.
*
*
***================================================================
*
0520000  core-out   pipe
0520001  2
0520101  7.3-3  2

0520301  0.260   1
0520302  0.190   2

0520401  0.      2     *= 6.105e-3

0520601  90.     2

0520801  3.-5    9.307-2  2
0520902  0.      0.     1

0521001  00000  2
0521101  100000  1
0521201  103   12.65+6  563.0  0.        0.   0.      2
0521300  1
0521301  4.73      0.        0.        1
***
*================================================================
* UP bottom connections
* ---------------------
*================================================================
*
0510000  upc-con1   sngljun
0510101  052010002  054010001  0.01-3 5.555   5.555      100002
0510201  1        0.73      0.   0.
**
0530000  upc-con2   sngljun
0530101  052020001  054010001  3.29-3 0.09    0.09       100002
0530201  1        4.      0.   0.
**
*================================================================
*
0540000  r-core    pipe
```

```
0540001  6
0540101  3.3-3  6

0540301  0.212   4
0540302  0.455   5
0540303  0.455   6

0540301  0.212   2
0540302  0.455   4
0540303  0.212   6

0540401  0.      6     *= 6.105e-3

0540601  0.      2
0540602  90.     4
0540603  0.      6

0540801  3.-5    0.046   6
0540902  0.      0.      5

0541001  00000  6
0541101  100000  5
0541201  103   12.52+6  563.0  0.       0.   0.      6
0541300  1
0541301  4.73       0.        0.        5
***
***=================================================================
* UP bottom connections
* ----------------------------
*=================================================================
*
0550000  upc-con   sngljun
0550101  054060002  058010002  3.3-3    0.125  0.125     100001
0550101  054060002  058010002  3.0-3    0.125  0.125     100001
0550101  054060002  058010002  1.515-3  0.125  0.125     100001
0550101  054060002  058010002  3.15-3   0.125  0.125     100001
0550201  1    4.0      0.        0.
*
0570000  upc-con   sngljun
0570101  054060002  058020001  1.515-3 0.125  0.125      100001
0570101  054060002  058020001  0.15-3  0.125  0.125      100001
0570201  1       0.73     0.     0.
**
*
**=================================================================
* upper plenum - lowermost part
* ----------------------------
*=================================================================
*
*     component name and type
*       comp.name  comp.type
0580000  r-up-bb    pipe
*
*     pipe information card
*       numb.of.vol.
0580001  2
*
*     pipe volume flow areas
*       area    vol.numb.   ____->____     ____->____
0580101  4.2-3   2
*
*     pipe volume lenghts
*       lengh  vol.numb.    ____->____     ____->____
0580301  0.17   2
*
*     pipe volume volumes
*       vol.  vol.numb.   ____->____     ____->____
0580401  0.   2
*
*     pipe volume vertical angles
*       inc.ang.  vol.numb.   ____->____     ____->____
0580601  90.     2
```

```
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
0580801  3.-5    0.0     2
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
0580901  0.        0.          1
*
*    pipe volume control flags
*      flags  vol.numb.    ____->____    ____->____
0581001  00    2
*
*    pipe junction control flags
*      flags  jun.numb.    ____->____
0581101  100100  1
*
*    pipe volume initial conditions
*      ctrl.              w4 or 0.   ->   ->     vol.numb.
*           ----       ----  ----       ----  ----
0581201  103    12.52+6  563.5  0.       0.   0.     2
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 06013..=ini.vel.]
0581300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*           ---        ---
0581301  4.73        0.         0.         1
***
***===============================================================
* UP  connection
*------------------------------
*================================================================
*
*     component name and type
*      comp.name  comp.type
0590000  upc-con   sngljun
*
*     single junction geometry cards
*      from       to         area   loss   rev.loss.  flgs.
0590101  058020002  060010001  1.66-3  0.     0.        100000
*
*     single junction initial conditions [w1=0 -> w2,w3=vel.]
*      ctrl  ini.f.flw.   ini.g.flw.   interf.vel.
*              ----        ----
0590201  1     4.73         0.          0.
**
*
*================================================================
* upper plenum - bottom part
*--------------------------
*================================================================
*
*     component name and type
*      comp.name  comp.type
0600000  r-up-b    pipe
*
*     pipe information card
*      numb.of.vol.
0600001  3
*
*     pipe volune flow areas
*      area   vol.numb.    ____->____    ____->____
0600101  1.66-3  2
0600102  4.2-3   3
*
*
*     pipe volume lenghts
*      lengh  vol.numb.    ____->____    ____->____
0600301  0.503  2
```

```
*
0600301  0.586  2
*
0600301  0.5   2
0600302  0.333  3
*
*    pipe volume volumes
*      vol.  vol.numb.   ____->____      ____->____
0600401  0.   3
*
*    pipe volume vertical angles
*      inc.ang.  vol.numb.   ____->____      ____->____
0600601  90.     3
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
0600801  3.-5   0.046   2
0600802  3.-5   0.073   3
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
0600901  0.      0.        2
*
*    pipe volume control flags
*      flags  vol.numb.    ____->____     ____->____
0601001  00    3
*
*    pipe junction control flags
*      flags  jun.numb.    ____->____
0601101  100100  2
*
*    pipe volume initial conditions
*      ctrl.              w4 or 0.   ->   ->     vol.numb.
*            ----      ----  ----       ----  ----
0601201  103    12.52+6  563.5  0.      0.   0.      3
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 06013..=ini.vel.]
0601300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*          ---       ---
0601301  4.73      0.        0.       2
***
*=================================================================
* upper plenum - middle part
* -------------------------
*=================================================================
*
*     component name and type
*      comp.name   comp.type
0620000  r-up-m     branch
*
*     branch information card
*      numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 062n2..=ini.vel.]
0620001  1           1
*
*     branch volume geometry cards
*      area    length  vol.  az.ang.  inc.ang.  elv.chng.
0620101  1.22-2  0.448  0.   0.       90.       0.448
0620101  5.1-3   0.448  0.   0.       90.       0.448
0620101  2.01-2  0.058  0.   0.       90.       0.058
*
*      rough.  h.diam.  flags
0620102  3.-5   0.160   00
*
*     branch volume initial conditions
*      ctrl.  (p)     (temp)                     bor.con.[if]
*            ----    ----    ----   ----   ----
0620200  103    12.52+6  563.5
*
```

```
*     branch junction geometry cards
*       from       to        area   loss.c.  rev.loss.c.  flags
0621101  060030002  062010001  4.2-3  0.      0.        100100
*
*    branch junction initial conditions [according to 0620001]
*      ini.f.flw.  ini.g.flw.  interf.vel.
*          ---        ---
0621201  5.24       0.         0.
***
*==================================================================
* upper plenum - middle part
* -------------------------
*==================================================================
*
*     component name and type
*       comp.name   comp.type
0640000  r-up-m     branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 064n2..=ini.vel.]
0640001  3            1
*
*     branch volume geometry cards
*       area    length  vol.  az.ang.  inc.ang.  elv.chng.
0640101  1.22-2  0.448  0.   0.       90.      0.448
0640101  5.1-3   0.448  0.   0.       90.      0.448
0640101  2.01-2  0.170  0.   0.       90.      0.170
*
*       rough.  h.diam.  flags
0640102  3.-5    0.160    00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                      bor.con.[if]
*       ----   ----    ----   ----   ----
0640200  103    12.52+6  563.5
*
*     branch junction geometry cards
*       from       to        area   loss.c.  rev.loss.c.  flags
0641101  062010002  064010001  2.01-2 0.     0.        100100
*
0642101  064010002  068010001  4.2-3  0.     0.        000100
*
0643101  064010001  102010001  1.66-3 2.     2.        000000
*
*    branch junction initial conditions [according to 0640001]
*      ini.f.flw.  ini.g.flw.  interf.vel.
*          ---        ---
0641201  5.24       0.         0.
*
0642201  0.         0.         0.
*
0643201  5.24       0.         0.
***
*==================================================================
* upper plenum - top part
* ----------------------
*==================================================================
*
*    component name and type
*      comp.name  comp.type
0680000  r-up-t    pipe
*
*    pipe information card
*      numb.of.vol.
0680001  4
*
*    pipe volune flow areas
*      area    vol.numb.   _____->_____    _____->_____
0680101  5.1-3  3
0680101  4.2-3  4
*
*    (internal) pipe junction flow areas [opt.]
```

```
*       area   jun.numb.      ____->____
*680201
*
*    pipe volume lenghts
*      lengh  vol.numb.      ____->____      ____->____
0680301   0.680  3
0680301   0.5225  4
*
*    pipe volume volumes
*      vol.  vol.numb.   ____->____      ____->____
0680401   0.    4
*
*    pipe volume vertical angles
*      inc.ang.  vol.numb.  ____->____      ____->____
0680601   90.      4
*
*    pipe volume elevation change [opt.]
*      elev.chng.  vol.numb.  ____->____      ____->____
0680701   0.680  3
0680701   0.5225   4
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
*
0680802   3.-5    73.00-3  4
*
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
0680901   0.       0.          3
*
*    pipe volume control flags
*      flags  vol.numb.     ____->____      ____->____
0681001   00     4
*
*    pipe junction control flags
*      flags  jun.numb.     ____->____
0681101   00100  3
*
*    pipe volume initial conditions
*      ctrl.                w4 or 0.    ->    ->      vol.numb.
*             ----       ----  ----          ----  ----
0681201   103    12.52+6  544.0  0.        0.   0.      1
*
0681202   103    12.52+6  540.0  0.        0.   0.      2
*
0681203   103    12.52+6  536.0  0.        0.   0.      3
*
0681204   103    12.52+6  532.0  0.        0.   0.      4
*
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 06813..=ini.vel.]
0681300   1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*             ---          ---
0681301   0.         0.          0.          3
*
*
*=================================================================
*=================================================================
*= hot leg
*= -------
*=================================================================
*=================================================================
*
*================================================================
* HL first part
* -------------
*================================================================
```

```
*
*     component name and type
*       comp.name   comp.type
1020000   hl1        branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 102n2..=ini.vel.]
1020001   1           1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1020101   1.7-3  0.75    0.    0.       0.       0.
*
*       rough.  h.diam.  flags
1020102   3.-5    4.654-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                     bor.con.[if]
*             ----     ----   ----   ----   ----
1020200   103     12.52+6  563.0
*
*     branch junction geometry cards
*       from       to          area    loss.c.  rev.loss.c.  flags
1021101   102010002  106010001  1.7-3  0.1       0.1          00100
*
*    branch junction initial conditions [according to 1020001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*          ---         ---
1021201   4.73        0.          0.
***
*=====================================================================
* hot leg from prz connection to sg inlet
* ---------------------------------------
*=====================================================================
*
*    component name and type
*       comp.name   comp.type
1060000   hl-pipe    pipe
*
*    pipe information card
*       numb.of.vol.
1060001   7
*
*    pipe volune flow areas
*       area   vol.numb.   ___->____      ____->____
1060101   1.7-3  7
*
*     ____->____        ____->____
1060102
*
*    pipe volume lenghts
*       lengh  vol.numb.      ____->____     ____->____
1060301   0.560  5        0.502  6       0.770  7
*
*     ____->____        ____->____
*1060302
*
*    pipe volume volumes
*       vol.  vol.numb.    ____->____     ____->____
1060401   0.    7
*
*    pipe volume vertical angles
*       inc.ang.  vol.numb.     ____->____     ____->____
1060601   -30.      5        0.  6       90.  7
*
*    pipe volume elevation change [opt.]
*       elev.chng.  vol.numb.   ____->____     ____->____
1060701   -0.28       5        0.  6       0.77  7
*
*     ____->____           ____->____
*1060702
*
```

```
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
1060801  3.-5    4.654-2  7
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
1060901  0.       0.         5
*
1060902  0.2      0.2        6
*
*    pipe volume control flags
*      flags  vol.numb.    ____->____    ____->____
1061001  00    7
*
*    pipe junction control flags
*      flags  jun.numb.    ____->____    ____->____
1061101  00100  6
*
*    pipe volume initial conditions
*      ctrl.            (w4 or 0.)              vol.numb.
*           ----    ----  ----       ----  ----
1061201  103    12.52+6  563.0  0.       0.   0.     7
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 10613..=ini.vel.]
1061300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*           ---        ---
1061301  4.73       0.         0.        6
***
*
*=====================================================================
*=====================================================================
*= sg primary side
*= --------------
*=====================================================================
*=====================================================================
*
*====================================================================
* sg primary side inlet
* --------------------
*====================================================================
*
*    component name and type
*      comp.name   comp.type
1200000  sgp-inl    branch
*
*    branch information card
*      numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 120n2..=ini.vel.]
1200001  2            1
*
*    branch volume geometry cards
*      area   length  vol.  az.ang.  inc.ang.  elv.chng.
1200101  4.2-3  0.77   0.   0.       90.      0.77
*
*      rough.  h.diam.  flags
1200102  3.-5    7.3-2    00
*
*    branch volume initial conditions
*      ctrl.  (p)     (temp)                    bor.con.[if]
*             ----     ----    ----   ----   ----
1200200  103    12.598+6  563.0
*
*    branch junction geometry cards
*      from       to        area   loss.c.  rev.loss.c.  flags
1201101  106070002  120010001  1.7-3  0.4      0.4        00100
*
1202101  120010002  122010001  3.8-3  0.       0.         00100
*
*    branch junction initial conditions [according to 1200001]
```

```
*      ini.f.flw.  ini.g.flw.   interf.vel.
*            ---          ---
1201201  4.73        0.            0.
*
1202201  4.73        0.            0.
***
*=====================================================================
* inlet collector - lower level
* -----------------------------
*=====================================================================
*
*     component name and type
*       comp.name   comp.type
1220000  sgp-ic-b    branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 122n2..=ini.vel.]
1220001  2              1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1220101  4.2-3  0.61    0.    0.       90.       0.61
*
*       rough.  h.diam.  flags
1220102  3.-5    7.315-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                        bor.con.[if]
*              ----    ----   ----   ----    ----
1220200  103     12.52+6  562.5
*
*     branch junction geometry cards
*       from        to          area   loss.c.  rev.loss.c.  flags
1221101  122010002  124010001  0.     0.       0.           00100
*
1222101  122010001  132010001  0.     10.      3.           00100
*
*    branch junction initial conditions [according to 1220001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*             ---          ---
1221201  4.24        0.            0.
*
1222201  1.          0.            0.
***
*=====================================================================
* inlet collector - middle level
* ------------------------------
*=====================================================================
*
*     component name and type
*       comp.name   comp.type
1240000  sgp-ic-m    branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 124n2..=ini.vel.]
1240001  2              1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1240101  4.2-3  0.61    0.    0.       90.       0.61
*
*       rough.  h.diam.  flags
1240102  3.-5    7.315-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                        bor.con.[if]
*              ----    ----   ----   ----    ----
1240200  103     12.52+6  562.5
*
*     branch junction geometry cards
*       from        to          area   loss.c.  rev.loss.c.  flags
1241101  124010002  126010001  0.     0.       0.           00100
```

```
*
1242101  124010001 134010001 0.    10.     8.         00100
*
*     branch junction initial conditions [according to 1240001]
*       ini.f.flw.  ini.g.flw.  interf.vel.
*          ---        ---
1241201  3.24        0.          0.
*
1242201  1.          0.          0.
***
*=====================================================================
* inlet collector - upper level
* ----------------------------
*=====================================================================
*
*      component name and type
*        comp.name   comp.type
1260000  sgp-ic-u    branch
*
*      branch information card
*        numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 126n2..=ini.vel.]
1260001  2             1
*
*      branch volume geometry cards
*        area   length  vol.  az.ang.  inc.ang.  elv.chng.
1260101  4.2-3  0.61    0.    0.       90.       0.61
*
*        rough.  h.diam.  flags
1260102  3.-5    7.315-2  00
*
*      branch volume initial conditions
*        ctrl.  (p)     (temp)                    bor.con.[if]
*               ----    ----   ----   ----   ----
1260200  103    12.52+6 561.5
*
*      branch junction geometry cards
*        from       to        area   loss.c.  rev.loss.c.  flags
1261101  126010002  128010001 0.     0.       0.           00100
*
1262101  126010002  136010001 0.     10.      12.5         00100
*
*     branch junction initial conditions [according to 1260001]
*       ini.f.flw.  ini.g.flw.  interf.vel.
*          ---        ---
1261201  0.          0.          0.
*
1262201  3.24        0.          0.
***
*=====================================================================
* inlet collector - blind end
* --------------------------
*=====================================================================
*
*      component name and type
*        comp.name   comp.type
1280000  sgp-ic-t    branch
*
*      branch information card
*        numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 128n2..=ini.vel.]
1280001  0             1
*
*      branch volume geometry cards
*        area   length  vol.  az.ang.  inc.ang.  elv.chng.
1280101  4.2-3  0.249   0.    0.       90.       0.249
*
*        rough.  h.diam.  flags
1280102  3.-5    7.315-2  00
*
*      branch volume initial conditions
*        ctrl.  (p)     (temp)                    bor.con.[if]
*               ----    ----   ----   ----   ----
1280200  103    12.52+6 560.5
```

```
*280200  104   12.52+6  533.7   0.1
*
*      branch junction geometry cards
*        from       to       area   loss.c.  rev.loss.c.  flags
*
*     branch junction initial conditions [according to 1280001]
*       ini.f.flw.  ini.g.flw.  interf.vel.
*          ---       ---
***
*====================================================================
* sg tubing - lower section
* ------------------------
*====================================================================
*
*     component name and type
*       comp.name  comp.type
1320000  sgp-tub1   pipe
*
*     pipe information card
*       numb.of.vol.
1320001  4
*
*     pipe volune flow areas
*       area   vol.numb.   ____->____      ____->____
1320101  5.65-4  4
*
*     (internal) pipe junction flow areas [opt.]
*       area  jun.numb.    ____->____
1320201
*
*     pipe volume lenghts
*       lengh  vol.numb.    ____->____      ____->____
1320301  0.978  4
1320301  0.929  4
*
*     pipe volume volumes
*       vol.  vol.numb.   ____->____      ____->____
1320401  0.    4
*
*     pipe volume vertical angles
*       inc.ang.  vol.numb.   ____->____      ____->____
1320601  0.       4
*
*     pipe volume elevation change [opt.]
*       elev.chng.  vol.numb.   ____->____      ____->____
1320701  0.        4
*
*     pipe volume friction data
*       rough.  h.diam.  vol.numb.
1320801  3.-5    6.-3     4
1320801  3.-5    0.       4                  *=along sirkia
*
*     (internal) pipe junction loss coeffitients [opt.]
*       loss.c.   rev.loss.c.  jun.numb.
1320901  0.1      0.1        3                 *=along sirkia
*1320901  0.1      0.1        3
*
*     pipe volume control flags
*       flags  vol.numb.    ____->____      ____->____
1321001  00     4
*
*     pipe junction control flags
*       flags  jun.numb.    ____->____
1321101  00100  3
*
*     pipe volume initial conditions
*       ctrl.             w4 or 0.   ->    ->     vol.numb.
*       ----    ----  ----          ----  ----
1321201  103    12.52+6  552.  0.        0.   0.      1
*
1321202  103    12.52+6  545.  0.        0.   0.      2
*
```

```
1321203  103   12.52+6  541.  0.      0.  0.    3
*
1321204  103   12.52+6  538.  0.      0.  0.    4
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 13213..=ini.vel.]
1321300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*        ---        ---
1321301  1.         0.          0.        3
***
*=====================================================================
* sg tubing - middle section
* -------------------------
*=====================================================================
*
*    component name and type
*      comp.name  comp.type
1340000  sgp-tub2   pipe
*
*    pipe information card
*      numb.of.vol.
1340001  4
*
*    pipe volume flow areas
*      area    vol.numb.   ____->____     ____->____
1340101  8.48-4  4
*
*    (internal) pipe junction flow areas [opt.]
*      area  jun.numb.   ____->____
1340201
*
*    pipe volume lenghts
*      lengh  vol.numb.   ____->____     ____->____
1340301  0.929  4
*
*    pipe volume volumes
*      vol.  vol.numb.   ____->____     ____->____
1340401  0.   4
*
*    pipe volume vertical angles
*      inc.ang.  vol.numb.   ____->____     ____->____
1340601  0.       4
*
*    pipe volume elevation change [opt.]
*      elev.chng.  vol.numb.   ____->____     ____->____
1340701  0.         4
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
1340801  3.-5    6.-3     4
1340801  3.-5    0.       4                  *=sirkia
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
1340901  0.1       0.1         3
*
*    pipe volume control flags
*      flags  vol.numb.   ____->____     ____->____
1341001  00    4
*
*    pipe junction control flags
*      flags  jun.numb.   ____->____
1341101  00100  3
*
*    pipe volume initial conditions
*      ctrl.            w4 or 0.   ->   ->     vol.numb.
*        ----     ----  ----       ---- ----
1341201  103   12.52+6  552.  0.      0.  0.    1
*
```

```
1341202  103   12.52+6  545.  0.      0.  0.    2
*
1341203  103   12.52+6  541.  0.      0.  0.    3
*
1341204  103   12.52+6  538.  0.      0.  0.    4
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 13413..=ini.vel.]
1341300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*            ---        ---
1341301  1.        0.         0.        3
***
*==================================================================
* sg tubing - upper section
* ----------------------
*==================================================================
*
*    component name and type
*      comp.name  comp.type
1360000  sgp-tub3  pipe
*
*    pipe information card
*      numb.of.vol.
1360001  4
*
*    pipe volune flow areas
*      area   vol.numb.  ____->____    ____->____
1360101  8.48-4  4
*
*    (internal) pipe junction flow areas [opt.]
*      area  jun.numb.   ____->____
1360201
*
*    pipe volume lenghts
*      lengh  vol.numb.   ____->____    ____->____
1360301  0.929  4
*
*    pipe volume volumes
*      vol.  vol.numb.  ____->____    ____->____
1360401  0.   4
*
*    pipe volume vertical angles
*      inc.ang.  vol.numb.  ____->____    ____->____
1360601  0.      4
*
*    pipe volume elevation change [opt.]
*      elev.chng.  vol.numb.  ____->____    ____->____
1360701  0.        4
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
1360801  3.-5   6.-3    4
1360801  3.-5   0.      4
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
1360901  0.1      0.1         3
*
*    pipe volume control flags
*      flags  vol.numb.   ____->____    ____->____
1361001  00    4
*
*    pipe junction control flags
*      flags  jun.numb.   ____->____
1361101  00100  3
*
*    pipe volume initial conditions
*      ctrl.            w4 or 0.   ->   ->     vol.numb.
*          ----    ----  ----      ----  ----
```

```
1361201  103   12.52+6  550.  0.      0.  0.    1
*
1361202  103   12.52+6  543.  0.      0.  0.    2
*
1361203  103   12.52+6  539.  0.      0.  0.    3
*
1361204  103   12.52+6  538.  0.      0.  0.    4
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 13613..=ini.vel.]
1361300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*      ---         ---
1361301  3.24      0.        0.       3
***
*=================================================================
* outlet collector - blind end
* ----------------------------
*=================================================================
*
*     component name and type
*       comp.name   comp.type
1480000  sgp-oc-t   branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 148n2..=ini.vel.]
1480001  1          1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1480101  4.2-3  0.249  0.   0.      -90.     -0.249
*
*       rough.  h.diam.  flags
1480102  3.-5   7.315-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)    (temp)                bor.con.[if]
*       ----   ----   ----   ----   ----
1480200  103    12.52+6  532.
*
*     branch junction geometry cards
*       from       to        area   loss.c.  rev.loss.c.  flags
1481101  148010002  146010001  0.     0.      0.         00100
*
*    branch junction initial conditions [according to 1480001]
*      ini.f.flw.   ini.g.flw.   interf.vel.
*      ---          ---
1481201  0.          0.          0.
***
*=================================================================
* outlet collector - upper level
* ------------------------------
*=================================================================
*
*     component name and type
*       comp.name   comp.type
1460000  sgp-oc-u    branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 146n2..=ini.vel.]
1460001  2          1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1460101  4.2-3  0.61   0.   0.      -90.     -0.61
*
*       rough.  h.diam.  flags
1460102  3.-5   7.315-2  00
*
*     branch volume initial conditions
```

```
*       ctrl.  (p)     (temp)                        bor.con.[if]
*              ----    ----    ----    ----    ----
1460200  103    12.52+6  538.0
*
*     branch junction geometry cards
*       from        to         area   loss.c.  rev.loss.c.  flags
1461101  136040002  146010001  0.     10.      12.5         00100
*
1462101  146010002  144010001  0.     0.       0.           00100
*
*     branch junction initial conditions [according to 1460001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*              ---          ---
1461201  3.24        0.          0.
*
1462201  3.24        0.          0.
***
*=======================================================================
* outlet collector - middle level
* ------------------------------
*=======================================================================
*
*     component name and type
*       comp.name   comp.type
1440000  sgp-oc-m   branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 144n2..=ini.vel.]
1440001  2            1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1440101  4.2-3  0.61    0.    0.       -90.      -0.61
*
*       rough.  h.diam.  flags
1440102  3.-5   7.315-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                        bor.con.[if]
*              ----    ----    ----    ----    ----
1440200  103    12.52+6  538.0
*
*     branch junction geometry cards
*       from        to         area   loss.c.  rev.loss.c.  flags
1441101  134040002  144010002  0.     10.      8.           00100
*
1442101  144010002  142010001  0.     0.       0.           00100
*
*     branch junction initial conditions [according to 1440001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*              ---          ---
1441201  1.          0.          0.
*
1442201  4.24        0.          0.
***
*=======================================================================
* outlet collector - lower level
* ------------------------------
*=======================================================================
*
*     component name and type
*       comp.name   comp.type
1420000  sgp-oc-l   branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 142n2..=ini.vel.]
1420001  2            1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1420101  4.2-3  0.61    0.    0.       -90.      -0.61
*
```

```
*       rough.  h.diam.  flags
1420102  3.-5   7.315-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                      bor.con.[if]
*              ----    ----   ----   ----   ----
1420200  103    12.52+6  538.0
*
*     branch junction geometry cards
*       from        to          area   loss.c.  rev.loss.c.  flags
1421101  132040002  142010002  0.     10.      3.           00100
*
1422101  142010002  140010001  0.     0.       0.           00100
*
*    branch junction initial conditions [according to 1420001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*       ---          ---
1421201  1.         0.          0.
*
1422201  4.24        0.          0.
***
*=======================================================================
* sg primary side outlet
* ----------------------
*=======================================================================
*
*     component name and type
*       comp.name   comp.type
1400000  sgp-out    branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 140n2..=ini.vel.]
1400001  1             1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1400101  4.2-3  0.77   0.    0.       -90.      -0.77
*
*       rough.  h.diam.  flags
1400102  3.-5   7.3-2    00
*
*     branch volume initial conditions
*       ctrl.  (p)      (temp)                     bor.con.[if]
*              ----     ----   ----   ----   ----
1400200  103    12.598+6  538.
*
*     branch junction geometry cards
*       from        to          area    loss.c.  rev.loss.c.  flags
1401101  140010002  154010001  1.7-3   0.       0.           00100
*
*    branch junction initial conditions [according to 1400001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*       ---          ---
1401201  4.73        0.          0.
***
*
*=======================================================================
*=======================================================================
*= cold leg
*= --------
*=======================================================================
*=======================================================================
*
*=======================================================================
* part from sg outlet to "before rcp" branching
* -------------------------------------------- ----------------------
*=======================================================================
*
*    component name and type
*       comp.name  comp.type
1540000  cl-1p-1    pipe
*
```

```
*     pipe information card
*       numb.of.vol.
1540001   4
*
*     pipe volune flow areas
*       area    vol.numb.    ____->____      ____->____
1540101   1.7-3   4
*
*     (internal) pipe junction flow areas [opt.]
*       area  jun.numb.    ____->____
1540201
*
*     pipe volume lenghts
*       lengh  vol.numb.    ____->____      ____->____
1540301   0.5925 4
*
*     pipe volume volumes
*       vol.  vol.numb.    ____->____      ____->____
1540401   0.    4
*
*     pipe volume vertical angles
*       inc.ang.  vol.numb.    ____->____      ____->____
1540601   -90.      4
*
*     pipe volume friction data
*       rough.  h.diam.  vol.numb.
1540801   3.-5    4.654-2  4
*
*     (internal) pipe junction loss coeffitients [opt.]
*       loss.c.   rev.loss.c.  jun.numb.
1540901   0.       0.           3
*
*     pipe volume control flags
*       flags  vol.numb.    ____->____      ____->____
1541001   00     4
*
*     pipe junction control flags
*       flags  jun.numb.    ____->____
1541101   00100  3
*
*     pipe volume initial conditions
*       ctrl.                w4 or 0.   ->   ->      vol.numb.
*             ----    ----  ----     ----  ----
1541201   103    12.52+6  538.  0.       0.    0.       4
*
*     pipe junction conditions control word [opt.]
*       ctrl. [_ or 0 -> w1,w2 of 15413..=ini.vel.]
1541300   1
*
*     pipe junction initial conditions
*       ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*             ---       ---
1541301   4.73       0.         0.         3
***
*=================================================================
* "before rcp" branching
* ----------------------------------------
*=================================================================
*
*       component name and type
*         comp.name   comp.type
1560000   cl-1p-2     branch
*
*       branch information card
*         numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 154n2..=ini.vel.]
1560001   1             1
*
*       branch volume geometry cards
*         area   length  vol.  az.ang.  inc.ang.  elv.chng.
1560101   1.7-3  0.605   0.    0.       90.       0.1
*
*         rough.  h.diam.  flags
```

```
1560102  3.-5   4.654-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                       bor.con.[if]
*             ----    ----   ----   ----   ----
1560200   103    12.547+6  538.
*
*     branch junction geometry cards
*       from       to         area   loss.c.  rev.loss.c.  flags
1561101   154040002  156010001  0.    0.       0.          00100
*
*    branch junction initial conditions [according to 1560001]
*       ini.f.flw.   ini.g.flw.   interf.vel.
*             ---          ---
1561201   4.73         0.         0.
*
*=================================================================
* by-pass valve
* -------------
*=================================================================
*
*     component name and type
*       comp.name  comp.type
1550000   cl-v-by1   valve
*
*     valve junction geometry cards
*       from       to         area   loss   rev.loss   flgs.
1550101   156010002  192010001  1.5-3  0.    0.         00100
*
*     valve junction initial conditions
*       ctrl.  ini.f.flw.    ini.g.flw.    interf.vel.
*              ----          ----
1550201   1    0.            0.            0.
*
*     valve type card
*       type
1550300   mtrvlv
*
*     valve data and initial conditions [according to 1550300]
*       open     close
*       ----   ----   ----   ----   ----   ----   ----   ----
1550301   609    501    0.5    0.
*
***
*=================================================================
* part before valve "165"
* -------------------------
*=================================================================
*
*     component name and type
*       comp.name   comp.type
1580000   cl-1p-3     branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 154n2..=ini.vel.]
1580001   1             1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1580101   4.2-3  0.71    0.    0.       -90.      -0.703
*
*       rough.  h.diam.  flags
1580102   3.-5    0.       00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                       bor.con.[if]
*             ----    ----   ----   ----   ----
1580200   103    12.547+6  538.
*
*     branch junction geometry cards
*       from       to         area   loss.c.  rev.loss.c.  flags
1581101   154040002  158010001  0.    0.       0.          00100
```

```
*
*    branch junction initial conditions [according to 1580001]
*      ini.f.flw.  ini.g.flw.   interf.vel.
*        ---          ---
1581201  4.73        0.          0.
*
*=================================================================
* "pre-pump" valve
* ---------------
*=================================================================
*
*     component name and type
*       comp.name  comp.type
1650000  cl-v-pre   valve
*
*     valve junction geometry cards
*       from        to          area   loss   rev.loss   flgs.
1650101  158010002  166010001  1.5-3  0.     0.         00100
*
*     valve junction initial conditions
*       ctrl.  ini.f.flw.   ini.g.flw.   interf.vel.
*                ----          ----
1650201  1      4.73          0.           0.
*
*     valve type card
*       type
1650300  mtrvlv
*
*     valve data and initial conditions [according to 1650300]
*       open   close
*       ----   ----   ----   ----   ----   ----   ----   ----
1650301  501    609    0.5    1.
***
*=================================================================
* suction leg
* -----------
*=================================================================
*
*    component name and type
*       comp.name  comp.type
1660000  cl-suc     pipe
*
*    pipe information card
*       numb.of.vol.
1660001  4
*
*    pipe volune flow areas
*       area   vol.numb.   ____->____      ____->____
1660101  4.2-3  3          8.-3  4
*
*    (internal) pipe junction flow areas [opt.]
*       area   jun.numb.   ____->____
1660201  4.2-3  3
*
*    pipe volume lenghts
*       lengh  vol.numb.   ____->____      ____->____
1660301  1.767  1          1.5  3          1.62  4
*
*       ____->____         ____->____
*1660302
*
*    pipe volume volumes
*       vol.  vol.numb.   ____->____      ____->____
1660401  0.   4
*
*    pipe volume vertical angles
*       inc.ang.  vol.numb.   ____->____      ____->____
1660601  -90.     4
*
*    pipe volume elevation change [opt.]
*       elev.chng.  vol.numb.   ____->____      ____->____
1660701  -0.495     1           -0.51  2        -0.85  3
```

```
*
*          ->                  ____->____
1660702  -0.985 4
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
1660801  3.-5   7.315-2 3
*
1660802  3.-5   0.101   4
*
*1660803
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.  rev.loss.c.  jun.numb.
1660901  0.      0.        3
*
*    pipe volume control flags
*      flags  vol.numb.   ____->____   ____->____
1661001  00   4
*
*    pipe junction control flags
*      flags  jun.numb.   ____->____   ____->____
1661101  00100  3
*
*    pipe volume initial conditions
*      ctrl.               (w4 or 0.)          vol.numb.
*          ----   ----  ----      ----  ----
1661201  103    12.52+6  538.  0.       0.   0.     4
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 16613..=ini.vel.]
1661300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*          ---        ---
1661301  4.73       0.        0.       3
***
*==================================================================
* pump
* ----
*==================================================================
*
*    component name and type
*      comp.name  comp.type
1700000  cl-pump   pump
*
*    pump volume geometry cards
*      area   length  vol.    az.ang.  incl.ang.  el.chng.  flgs.
1700101  1.66-3  0.    7.529-3  0.      90.       1.85     00
*
*    pump inlet (suction) junction card
*      con.vol.   area   loss   rev.loss   flgs.
1700108  166040002  1.7-3  0.8    0.8       00000
*
*    pump outlet (discharge) junstion card
*      con.vol.   area   loss   rev.loss   flgs.
1700109  182010001  1.7-3  1.3    1.3       00000
*
*    pump volume initial conditions
*      ctrl.                           bor.con.[if]
*          ----   ----  ----  ----  ----
1700200  103    12.52+6  538.
*
*    pump inlet junction initial conditions [ if w1=1 -> flw. ]
*      ctrl.  ini.f.flw.   ini.g.flw.   interf.vel.
*               ----         ----
1700201  1    4.73         0.          0.
*
*    pump outlet junction initial conditions [ -"- ]
*      ctrl.  ini.f.flw.   ini.g.flw.   interf.vel.
*               ----         ----
```

```
1700202  1    4.73       0.        0.
*
*     pump index and option card
*       indic. t.ph.index dif.in. torq.in. vel.in. tr.n. rev.ind.
1700301  0    0        0     -1     0     603   0
*
*     pump description card
*       vel.   vel.ratio    flow    head    torque   inertia
1700302  155.   1.          5.8-3   100.    100.      100.
*
*       dens.   m.torq.   fric.c.tf2   tf0    tf1    tf3
1700303  780.   747.3    0.           0.    0.    0.
*
*     pump variable inertia card [if not w6 of 1700302]
*       rel.sp.  i3      i2    i1    i0
*1700308
*
*     pump-shaft connection card [if]
*       shaft.num.   discon.trip
*1700309
*
*     pump stop data card
*       time    max.vel.   max.rev.vel.
1700310  0.     890.118    -890.118
*
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*   single phase head curves
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*
*  head 1
1701100  1       1
1701101  0.0     1.055
1701102  0.05    1.064
1701103  0.10    1.079
1701104  0.20    1.102
1701105  0.30    1.120
1701106  0.40    1.131
1701107  0.50    1.131
1701108  0.60    1.123
1701109  0.70    1.104
1701110  0.80    1.0785
1701111  0.90    1.043
1701112  1.00    1.00
*
*  head 2
1701200  1       2
1701201  0.0    -0.780
1701202  0.10   -0.6285
1701203  0.20   -0.478
1701204  0.30   -0.323
1701205  0.31   -0.308
1701206  0.35   -0.248
1701207  0.40   -0.169
1701208  0.45   -0.084
1701209  0.5015  0.0
1701210  0.55   0.082
1701211  0.6    0.173
1701213  0.70    0.365
1701214  0.75   0.461
1701215  0.80    0.556
1701217  0.90    0.7680
1701218  0.95    0.881
1701219  1.0     1.000
*
*  head 3
1701300  1       3
1701301 -1.0     2.110
1701302 -0.90    1.9270
1701303 -0.80    1.759
1701304 -0.70    1.6105
1701305 -0.60    1.489
1701306 -0.50    1.380
```

```
1701307 -0.40   1.282
1701308 -0.30   1.2000
1701309 -0.20   1.133
1701310 -0.10   1.0805
1701311 -0.05   1.0615
1701312 0.0    1.055
*
* head 4
1701400 1      4
1701401 -1.0   2.110
1701402 -0.90   1.862
1701403 -0.80   1.650
1701404 -0.70   1.474
1701405 -0.60   1.332
1701406 -0.50   1.212
1701407 -0.40   1.105
1701408 -0.30   1.002
1701409 -0.20   0.911
1701410 -0.10   0.830
1701411 0.0    0.761
*
* head 5
1701500 1      5
1701501 0.00   0.424
1701502 0.10   0.489
1701503 0.20   0.543
1701504 0.30   0.603
1701505 0.40   0.6600
1701506 0.50   0.7095
1701507 0.60   0.7495
1701508 0.70   0.777
1701509 0.80   0.804
1701510 0.90   0.861
1701511 1.0    0.948
*
* head 6
1701600 1      6
1701601 0.0    0.761
1701602 0.10   0.710
1701603 0.20   0.664
1701604 0.30   0.644
1701605 0.40   0.653
1701606 0.50   0.6795
1701607 0.60   0.707
1701608 0.70   0.746
1701609 0.80   0.799
1701610 0.90   0.861
1701611 1.00   0.948
*
* head 7
1701700 1      7
1701701 -1.0   -1.300
1701702 -0.90   -0.85
1701703 -0.60   -0.283
1701704 -0.50   -0.147
1701705 -0.45   -0.081
1701706 -0.384   0.0
1701707 -0.35   0.041
1701708 -0.30   0.106
1701709 -0.25   0.17
1701710 -0.20   0.233
1701711 -0.15   0.290
1701712 -0.10   0.3395
1701713 -0.05   0.384
1701714 0.00   0.424
*
* head 8
1701800 1      8
1701801 -1.0   -1.300
1701802 -0.8   -1.29
1701803 -0.50   -1.20
1701804 -0.20   -1.00
```

```
1701805  0.00   -0.780
*
************************************
*  single phase torque curves
************************************
*
*  torque 1
1701900  2      1
1701901  0.0     0.439
1701902  0.05    0.442
1701903  0.10    0.460
1701904  0.20    0.515
1701905  0.30    0.5825
1701906  0.40    0.647
1701907  0.50    0.706
1701908  0.60    0.764
1701909  0.70    0.823
1701910  0.80    0.882
1701911  0.90    0.9415
1701912  1.0     1.0
*  torque 2
1702000  2      2
1702001  0.0    -0.518
1702002  0.10   -0.350
1702003  0.20   -0.184
1702004  0.30   -0.0180
1702005  0.31   0.0
1702006  0.35   0.066
1702007  0.40   0.151
1702008  0.45   0.238
1702009  0.5015  0.320
1702010  0.55    0.396
1702011  0.6000  0.464
1702013  0.70    0.5985
1702016  0.75    0.666
1702017  0.80    0.731
1702019  0.90    0.864
1702020  0.95    0.9305
1702021  1.0     1.000
*  torque 3
1702100  2      3
1702101  -1.0    1.182
1702102  -0.90   1.0370
1702103  -0.80   0.911
1702104  -0.70   0.804
1702105  -0.60   0.712
1702106  -0.50   0.632
1702107  -0.40   0.567
1702108  -0.30   0.513
1702109  -0.20   0.473
1702110  -0.10   0.4495
1702111  -0.05   0.441
1702112  0.00    0.439
*  torque 4
1702200  2      4
1702201  -1.0    1.182
1702202  -0.90   1.120
1702203  -0.80   1.093
1702204  -0.70   1.104
1702205  -0.60   1.240
1702206  -0.50   1.323
1702207  -0.40   1.340
1702208  -0.30   1.256
1702209  -0.20   1.122
1702210  -0.10   1.041
1702211  0.00    0.948
*  torque 5
1702300  2      5
1702301  0.0    -0.569
1702302  0.10   -0.439
1702303  0.20   -0.318
1702304  0.30   -0.202
```

```
1702305  0.40   -0.098
1702306  0.50    0.013
1702307  0.60    0.121
1702308  0.70    0.229
1702309  0.80    0.345
1702310  0.90    0.474
1702311  1.0    0.630
* torque 6
1702400  2      6
1702401  0.0    0.984
1702402  0.10    0.9505
1702403  0.20    0.929
1702404  0.30    0.905
1702405  0.40    0.873
1702406  0.50    0.840
1702407  0.60    0.802
1702408  0.70    0.761
1702409  0.80    0.7205
1702410  0.90    0.678
1702411  0.95    0.653
1702412  1.00    0.630
*  torque 7
1702500  2     7
1702501  -1.0  -2.200
1702502  -0.6  -1.59
1702503  -0.5  -1.39
1702507  -0.45 -1.297
1702509  -0.384 -1.18
1702510  -0.35 -1.1205
1702511  -0.30 -1.04
1702512  -0.25 -0.956
1702513  -0.20 -0.870
1702514  -0.15 -0.7905
1702515  -0.10 -0.716
1702516  -0.05 -0.640
1702517   0.0  -0.569
*  torque 8
1702600  2     8
1702601 -1.0   -2.200
1702602  0.0   -0.518
*
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*  two-phase multiplier data
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*
*  head
1703000  0
1703001  0.0     0.0
1703002  0.20    0.0
1703003  0.43    1.00
1703004  0.86    1.00
1703005  1.00    0.0
* torque
1703100  0
1703101  0.0    0.0
1703102  1.0    0.0
*
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*  two-phase difference data
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
*
*  head 1
1704100  1      1
1704101  0.0    0.165
1704102  0.05    0.774
1704103  0.1    0.81
1704104  0.3    0.773
1704105  0.5    0.804
1704106  0.7    0.828
1704108  1.0    0.816
* head 2
1704200  1      2
```

```
1704201  0.0    0.22
1704202  0.1    0.2285
1704203  0.3    0.248
1704205  0.5    0.331
1704206  0.7    0.487
1704208  1.0    0.816
*  head 3
1704300  1      3
1704301  -1.0   -0.82
1704302  -0.8   -1.491
1704303  -0.7   -1.6695
1704304  -0.5   -1.78
1704305  -0.3   -1.50
1704306  -0.2   -1.137
1704307  -0.1   -0.5895
1704308  0.0    0.165
*  head 4
1704400  1      4
1704401  -1.0   -0.82
1704402  -0.9   -0.538
1704403  -0.8   -0.33
1704404  -0.6   -0.098
1704405  -0.4   -0.045
1704406  -0.2   -0.039
1704407  0.0    -0.039
*  head 5
1704500  1      5
1704501  0.0    -0.046
1704503  0.2    -0.366
1704505  0.4    -0.58
1704507  0.6    -0.6805
1704509  0.8    -0.676
1704511  1.0    -0.482
*  head 6
1704600  1      6
1704601  0.0    -0.039
1704603  0.2    -0.066
1704605  0.4    -0.097
1704607  0.6    -0.173
1704609  0.8    -0.331
1704611  1.0    -0.482
*  head 7
1704700  1      7
1704701  -1.0   0.8
1704705  -0.6   0.797
1704707  -0.4   0.51
1704709  -0.2   0.233
1704711  0.0    -0.046
*  head 8
1704800  1      8
1704801  -1.0   0.8
1704806  -0.5   0.45
1704809  -0.2   0.29
1704811  0.0    0.22
*  torque 1
1704900  2      1
1704901  0.0    0.0
1704902  1.0    0.0
*  torque 2
1705000  2      2
1705001  0.0    0.0
1705002  1.0    0.0
*  torque 3
1705100  2      3
1705101  -1.0   0.0
1705102  0.0    0.0
*  torque 4
1705200  2      4
1705201  -1.0   0.0
1705202  0.0    0.0
*  torque 5
1705300  2      5
```

```
1705301  0.0     0.0
1705302  1.0     0.0
* torque 6
1705400  2      6
1705401  0.0     0.0
1705402  1.0     0.0
*  torque 7
1705500  2     7
1705501  -1.0    0.0
1705502  0.0     0.0
*  torque 8
1705600  2     8
1705601  -1.0    0.0
1705602  0.0     0.0
*
*  pump velocity table
*
1706100  610     cntrlvar   902
*
1706101  0.       0.
*
1706102  300.    300.
*
*=================================================================
* pump discharge (heater)
* ----------------------
*=================================================================
*
*    component name and type
*      comp.name   comp.type
1820000  cl-heat    snglvol
*
*    single volume geometry cards
*      area    length  vol.  az.ang.  inc.ang.  elv.ch
1820101  4.735-3  1.795  0.   0.      0.       0.
*
*      rough.  h.diam.  flags
1820102  3.-5   0.1022   00
*
*    single volume initial conditions
*      ctrl.                              bor.con.[if]
*         ----    ----   ----   ----    ----
1820200  103     12.52+6  538.
***
*=================================================================
* pump discharge valve
* ----------------
*=================================================================
*
*    component name and type
*      comp.name  comp.type
1850000  cl-v-p0s  valve
*
*    valve junction geometry cards
*      from       to         area   loss  rev.loss  flgs.
1850101  182010002  190010001  1.5-3  0.   0.        00100
*
*    valve junction initial conditions
*      ctrl.  ini.f.flw.   ini.g.flw.    interf.vel.
*              ----          ----
1850201  1     4.73          0.          0.
*
*    valve type card
*      type
1850300  srvvlv
*
*    valve data and initial conditions [according to 1850300]
*
*      ----  ----  ----  ----  ----  ----  ----  ----
1850301  191
***
*=================================================================
```

```
* volume from "post" valve
* ------------------------
*=====================================================================
*
*     component name and type
*       comp.name   comp.type
1900000  cl-2p-1    snglvol
*
*     snglvol volume geometry cards
*       area    length  vol.  az.ang.  inc.ang.  elv.chng.
1900101   1.622-2  2.354   0.    0.       90.       1.793
*
*       rough.  h.diam.  flags
1900102   3.-5    4.789-2  00
*
*     snglvol volume initial conditions
*       ctrl.  (p)     (temp)                        bor.con.[if]
*              ----    ----    ----    ----    ----
1900200   103     12.52+6  538.
***
*=====================================================================
* volume from "by-pass" valve
* ---------------------------
*=====================================================================
*
*     component name and type
*       comp.name   comp.type
1920000  cl-2p-2    branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 192n2..=ini.vel.]
1920001   2              1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1920101   1.7-3  0.95    0.    0.       0.        0.
*
*       rough.  h.diam.  flags
1920102   3.-5    4.654-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)     (temp)                        bor.con.[if]
*              ----    ----    ----    ----    ----
1920200   103     12.52+6  538.
*
*     branch junction geometry cards
*       from       to         area  loss.c.  rev.loss.c.  flags
1921101   190010002  192010002  0.    0.       0.           00100
*
1922101   192010002  194010001  0.    0.       0.           00100
*
*     branch junction initial conditions [according to 1920001]
*       ini.f.flw.  ini.g.flw.  interf.vel.
*       ---         ---
1921201   4.73       0.          0.
*
1922201   4.73       0.          0.
***
*=====================================================================
* cold leg - part3
* ---------------------------
*=====================================================================
*
*     component name and type
*       comp.name   comp.type
1940000  cl-2p-3    pipe
*
*     pipe information card
*       numb.of.vol.
1940001   4
*
*     pipe volune flow areas
```

```
*      area   vol.numb.   ____->____     ____->____
1940101  1.7-3  4
*
*    pipe volume lenghts
*      lengh  vol.numb.    ____->____    ____->____
1940301  0.5   3        0.555 4
*
*    pipe volume volumes
*      vol.  vol.numb.  ____->____     ____->____
1940401  0.   4
*
*    pipe volume vertical angles
*      inc.ang.  vol.numb.   ____->____   ____->____
1940601  90.     3        0.   4
*
*    pipe volume elevation change [opt.]
*      elev.chng.  vol.numb.   ____->____   ____->____
1940701  0.5      3        0.   4
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
1940801  3.-5   4.654-2  4
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
1940901  0.      0.        3
*
*    pipe volume control flags
*      flags  vol.numb.   ____->____    ____->____
1941001  00    4
*
*    pipe junction control flags
*      flags  jun.numb.   ____->____
1941101  00100  3
*
*    pipe volume initial conditions
*      ctrl.              w4 or 0.   ->    ->     vol.numb.
*             ----   ----  ----       ----  ----
1941201   103    12.52+6  538.  0.      0.   0.      4
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 19413..=ini.vel.]
1941300   1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*             ---        ---
1941301  4.73       0.        0.        3
***
*=================================================================
* cold leg - part with eccs and prz spray line connections
* ---------------------------------------------------------
*=================================================================
*
*     component name and type
*       comp.name   comp.type
1960000  cl-con     branch
*
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of cccn2..=ini.vel.]
1960001  3            1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
1960101  1.7-3  0.561  0.   0.       0.       0.
*
*       rough.  h.diam.  flags
1960102  3.-5    4.654-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)    (temp)                  bor.con.[if]
```

```
*              ----    ----   ----   ----    ----
1960200  103    12.52+6  538.
*
*      branch junction geometry cards
*        from        to         area   loss.c.  rev.loss.c.  flags
1961101  194040002  196010001  0.    0.1      0.1          00100
*
1962101  196010002  198010001  0.    0.1      0.1          00100
*
1963101  196010002  440010001  0.    2.2      2.2          00102
*
*     branch junction initial conditions [according to 1960001]
*        ini.f.flw.   ini.g.flw.   interf.vel.
*              ---        ---
1961201  4.73        0.          0.
*
1962201  4.73        0.          0.
*
1963201  0.          0.          0.
***
*==================================================================
* cold leg - last part
* ------------------
*==================================================================
*
*     component name and type
*        comp.name  comp.type
1980000  cl-end     pipe
*
*     pipe information card
*        numb.of.vol.
1980001  2
*
*     pipe volume flow areas
*        area    vol.numb.   _____->_____     _____->_____
1980101  1.7-3   2
*
*     pipe volume lenghts
*        lengh  vol.numb.    _____->_____     _____->_____
1980301  0.56   2
*
*     pipe volume volumes
*        vol.  vol.numb.    _____->_____     _____->_____
1980401  0.   2
*
*     pipe volume vertical angles
*        inc.ang.  vol.numb.    _____->_____     _____->_____
1980601  0.      2
*
*     pipe volume elevation change [opt.]
*        elev.chng.  vol.numb.    _____->_____     _____->_____
1980701
*
*     pipe volume friction data
*        rough.  h.diam.  vol.numb.
1980801  3.-5    4.654-2  2
*
*     (internal) pipe junction loss coeffitients [opt.]
*        loss.c.   rev.loss.c.   jun.numb.
1980901  0.       0.            1
*
*     pipe volume control flags
*        flags  vol.numb.    _____->_____     _____->_____
1981001  00    2
*
*     pipe junction control flags
*        flags  jun.numb.    _____->_____
1981101  00100  1
*
*     pipe volume initial conditions
*        ctrl.            w4 or 0.    ->    ->       vol.numb.
*           ----    ----  ----      ----  ----
```

```
1981201   103    12.52+6  538.  0.        0.  0.      2
*
*     pipe junction conditions control word [opt.]
*       ctrl. [_ or 0 -> w1,w2 of 19813..=ini.vel.]
1981300   1
*
*     pipe junction initial conditions
*       ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*                 ---       ---
1981301   4.73       0.         0.         1
***
*
*======================================================================
*======================================================================
*= pressurizer
*= -----------
*======================================================================
*======================================================================
*
**=====================================================================
* prz-HL connection
* -----------------
*======================================================================
*
*     component name and type
*       comp.name  comp.type
4070000   prz-con    sngljun
*
*     single junction geometry cards
*       from        to        area    loss   rev.loss.  flgs.
4070101   106060001 410010001 4.15-4  2.55   2.55       00102
*
*     single junction initial conditions [w1=0 -> w2,w3=vel.]
*       ctrl   ini.f.flw.   ini.g.flw.   interf.vel.
*                ----          ----
4070201   1     0.           0.           0.
*
*======================================================================
* prz-hot leg connection pipe
* -------------------------
*======================================================================
*
*     component name and type
*       comp.name  comp.type
4100000   prz-con    pipe
*
*     pipe information card
*       numb.of.vol.
4100001   6
*
*     pipe volune flow areas
*       area    vol.numb.    ____-> ____      ____->____
4100101   4.15-4  1
4100102   3.80-4  4
4100103   6.61-4  5
4100104   14.7-3  6
*
*     pipe volume lenghts
*       lengh  vol.numb.     ____-> ____      ____->____
4100301   0.15   1
4100302   0.76   2
4100303   1.57   3
4100304   1.57   4
4100305   0.350  5
4100306   0.250  6
*
*     pipe volume volumes
*       vol.  vol.numb.    ____->____      ____->____
4100401   0.   6
*
*     pipe volume vertical angles
*       inc.ang.  vol.numb.   ____->____      ____->____
```

```
4100601  0.      1
4100602  90.     2
4100603  45.     4
4100604  0.      5
4100605  90.     6
*
*    pipe volume elevation change [opt.]
*      elev.chng.  vol.numb.   ____->____   ____->____
4100701  0.        1
4100702  0.76      2
4100703  1.069     3
4100704  1.069     4
4100705  0.0       5
4100706  0.250     6
*
*    pipe volume friction data
*      rough.  h.diam.  vol.numb.
4100801  3.-5   0.023   1
4100802  3.-5   0.022   4
4100803  3.-5   0.029   5
4100804  3.-5   0.025   6
*
*
*    (internal) pipe junction loss coeffitients [opt.]
*      loss.c.   rev.loss.c.  jun.numb.
4100901  0.5     0.5      5
*
*    pipe volume control flags
*      flags  vol.numb.    ____->____   ____->____
4101001  00   6
*
*    pipe junction control flags
*      flags  jun.numb.    ____->____
4101101  00100 5
*
*    pipe volume initial conditions
*      ctrl.             w4 or 0.   ->   ->     vol.numb.
*        ----   ----  ----     ---- ----
4101201  103    12.45+6  555.  0.      0.  0.    5
4101202  103    12.40+6  599.  0.      0.  0.    6
*
*    pipe junction conditions control word [opt.]
*      ctrl. [_ or 0 -> w1,w2 of 41013..=ini.vel.]
4101300  1
*
*    pipe junction initial conditions
*      ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*        ---       ---
4101301  0.        0.         0.         5
*
*=====================================================================
* PRZ surge line - vessel connection
* ---------------------------------
*=====================================================================
*
*     component name and type
*       comp.name  comp.type
4150000  prz-con   sngljun
*
*     single junction geometry cards
*       from      to        area   loss  rev.loss.  flgs.
4150101  410060002 420010001 0.   0.5   1.0       00100
*
*     single junction initial conditions [w1=0 -> w2,w3=vel.]
*       ctrl  ini.f.flw.  ini.g.flw.  interf.vel.
*               ----        ----
4150201  1    0.          0.          0.
***
*=====================================================================
* pressurizer vessel
* ----------------
*=====================================================================
```

```
*
*   component name and type
*     comp.name  comp.type
4200000  prz-ves   pipe
*
*   pipe information card
*     numb.of.vol.
4200001  5
*
*   pipe volune flow areas
*     area   vol.numb.   ___->____      ____->____
4200101  8.01-3  5
*
*   pipe volume lenghts
*     lengh  vol.numb.   ____->____     ____->____
4200301  0.225  1
*
4200302  0.557  2
*
4200303  0.600  4
*
4200304  0.305  5
*
*   pipe volume volumes
*     vol.  vol.numb.  ____->____     ____->____
4200401  0.   5
*
*   pipe volume vertical angles
*     inc.ang.  vol.numb.   ____->____    ____->____
4200601  90.     5
*
*   pipe volume friction data
*     rough.  h.diam.  vol.numb.
4200801  3.-5   0.101   5
*
*   (internal) pipe junction loss coeffitients [opt.]
*     loss.c.   rev.loss.c.  jun.numb.
4200901  0.       0.          4
*
*   pipe volume control flags
*     flags  vol.numb.   ____->____    ____->____
4201001  00    5
*
*   pipe junction control flags
*     flags  jun.numb.   ____->____    ____->____
4201101  00100  4
*
*   pipe volume initial conditions
*     ctrl.            (w4 or 0.)             vol.numb.
*         ----    ----  ----         ----  ----
4201201  102    12.39+6  0.    0.         0.   0.      1
4201202  102    12.39+6  0.    0.         0.   0.      2
4201203  102    12.39+6  0.    0.         0.   0.      3
4201204  102    12.39+6  0.1   0.         0.   0.      4
4201204  102    12.39+6  1.    0.         0.   0.      5
*
*   pipe junction conditions control word [opt.]
*     ctrl. [_ or 0 -> w1,w2 of 42013..=ini.vel.]
4201300  1
*
*   pipe junction initial conditions
*     ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*       ---        ---
4201301  0.        0.         0.         4
*
*=================================================================
* prz inner connection
* -----------------
*=================================================================
*
*    component name and type
*     comp.name  comp.type
```

```
4250000  prz-con   sngljun
*
*     single junction geometry cards
*       from      to        area   loss   rev.loss.   flgs.
4250101  430020002  420010001  0.    0.1    0.1       00100
*
*     single junction initial conditions [w1=0 -> w2,w3=vel.]
*       ctrl   ini.f.flw.   ini.g.flw.   interf.vel.
*               ----        ----
4250201  1     0.          0.          0.
***
*===================================================================
* pressurizer vessel
* ------------------
*===================================================================
*
*     component name and type
*       comp.name   comp.type
4300000  prz-ves    pipe
*
*     pipe information card
*       numb.of.vol.
4300001  2
*
*     pipe volune flow areas
*       area  vol.numb.    ___->____      ____->____
4300101  6.1-3 2
*
*     pipe volume lenghts
*       lengh  vol.numb.    ____->____     ____->____
4300301  0.150  1
4300302  0.085  2
*
*     pipe volume volumes
*       vol.  vol.numb.    ____->____     ____->____
4300401  0.   2
*
*     pipe volume vertical angles
*       inc.ang.  vol.numb.    ____->____     ____->____
4300601  90.      2
*
*     pipe volume elevation change [opt.]
*       elev.chng.  vol.numb.    ____->____     ____->____
4300701  0.150      1
4300702  0.085      2
*
*     pipe volume friction data
*       rough.  h.diam.  vol.numb.
4300801  3.-5   0.      2
*
*     (internal) pipe junction loss coeffitients [opt.]
*       loss.c.   rev.loss.c.  jun.numb.
4300901  0.      0.          1
*
*     pipe volume control flags
*       flags  vol.numb.    ____->____     ____->____
4301001  00    2
*
*     pipe junction control flags
*       flags  jun.numb.    ____->____     ____->____
4301101  00100  1
*
*     pipe volume initial conditions
*       ctrl.              (w4 or 0.)              vol.numb.
*              ----   ----  ----       ----  ----
4301201  102   12.39+6  0.    0.        0.   0.      1
4301202  102   12.39+6  0.    0.        0.   0.      2
*
*     pipe junction conditions control word [opt.]
*       ctrl. [_ or 0 -> w1,w2 of 43013..=ini.vel.]
4301300  1
*
```

```
*     pipe junction initial conditions
*       ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
*          ---         ---
4301301  0.         0.         0.         1
*
*======================================================================
* PRZ spray line
* -------------------------
*======================================================================
*
*     component name and type
*       comp.name  comp.type

4400000   spray-l    pipe
*
*     pipe information card
*       numb.of.vol.
4400001   3
*
*     pipe volune flow areas
*       area    vol.numb.   ____->____     ____->____
4400101   7.85-5  3
*
*     (internal) pipe junction flow areas [opt.]
*       area   jun.numb.    ____->____
4400201   7.85-5 2
*
*     pipe volume lenghts
*       lengh  vol.numb.    ____->____     ____->____
4400301   1.412  1          3.5   2       0.8   3
*
*     pipe volume volumes
*       vol.  vol.numb.   ____->____     ____->____
4400401   0.   3
*
*     pipe volume vertical angles
*       inc.ang.  vol.numb.   ____->____     ____->____
4400601   90.      3
*
*     pipe volume elevation change [opt.]
*       elev.chng.  vol.numb.   ____->____     ____->____
4400701   1.412  1           3.5   2     0.523   3
*
*     pipe volume friction data
*       rough.  h.diam.  vol.numb.
4400801   3.-5    0.01     3
*
*     (internal) pipe junction loss coeffitients [opt.]
*       loss.c.   rev.loss.c.  jun.numb.
4400901   0.1      0.1         1
*
4400902   0.3      0.3         2
*
*     pipe volume control flags
*       flags  vol.numb.    ____->____     ____->____
4401001   00     3
*
*     pipe junction control flags
*       flags  jun.numb.    ____->____
4401101   00100  2
*
*     pipe volume initial conditions
*       ctrl.              w4 or 0.   ->    ->     vol.numb.
*            ----    ----   ----       ---- ----
4401201   103    12.52+6  534.  0.       0.   0.      3
*
*     pipe junction conditions control word [opt.]
*       ctrl. [_ or 0 -> w1,w2 of 44013..=ini.vel.]
4401300   1
*
*     pipe junction initial conditions
*       ini.f.flw.  ini.g.flw.  intrf.vel.  jun.numb.
```

```
*         ---        ---
4401301  0.        0.        0.        2
*
*=================================================================
* prz spray valve
* ---------------
*=================================================================
*
*     component name and type
*       comp.name  comp.type
4450000  prz-topv  valve
*
*     valve junction geometry cards
*       from       to        area   loss  rev.loss   flgs.
4450101  440030002 420050002 7.8-5 20.   500.      00100
*
*     valve junction initial conditions
*       ctrl.  ini.f.flw.   ini.g.flw.    interf.vel.
*             ----         ----
4450201  1    0.          0.          0.
*
*     valve type card
*       type
4450300  trpvlv
*
*     valve data and initial conditions [according to 4350300]
*
*       ----  ----  ----  ----  ----  ----  ----  ----
4450301  501
*
*=================================================================
* aux. make-up water
* ------------------
*=================================================================
*
*     component name and type
*       comp.name   comp.type
4500000  auxwater   tmdpvol
*
*     time dependent volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.ch
4500101  8.-3   0.615  0.   0.      90.      0.615
*
*       rough.  h.diam.  flags
4500102  0.3-5   0.101   00
*
*     time dependent volume data control word
*       ctrl.
4500200  102
*
*     time dependent volume cards [according to 4500200 ctrl.]
*       var.                              bor.con.[if]
*         ~~~~       ~~~~      ~~~~      ~~~~
4500201  0.   12.585+6  0.
4500201  0.   7.6+6     0.
***
*=================================================================
* aux. make-up water pump - steady state controller
* ----------------------   ########################
*=================================================================
*
*     component name and type
*       comp.name  comp.type
4550000  aux-pump  tmdpjun
*
*     tmdpjun geometry card
*       from       to        area
4550101  450000000 430010001 6.6-4
*
*     tmdpjun control word
*       ctrl.  trip.numb.  alph.part  num.part
4550200  1     673        cntrlvar  400    *opt*= BE
```

```
4550200  1     418       cntrlvar  400    *opt*= long STDY
*
*     tmdpjun data [according to 4550200 ctrl.]
*       var.   f.     g.     int.vel.(=0.)
*              ~~~    ~~~
4550201  -1.+75  0.     0.     0.
4550202  0.      0.     0.     0.
4550203  7.8     100.   0.     0.
4550204  9.33    0.     0.     0.
4550205  10.26   -100.  0.     0.
*
4550201  -1.+75  0.     0.     0.
4550202  0.      0.     0.     0.
4550203  7.7     100.   0.     0.
4550204  9.1     0.     0.     0.
4550205  9.7     -100.  0.     0.
*
*==========================================================================
* prz relief valve
* ----------------
*==========================================================================
*
4650000  prz-topv   valve

4650101  420050003 460000000 6.6-4   0.    0.      00100
4650101  420050002 460000000 0.      0.    0.      00100
4650101  420050002 460000000 1.77-4  0.    0.      00100
4650101  420050002 460000000 0.785-6 0.    0.      00100
4650101  420040002 460000000 0.785-6 0.    0.      00100

4650201  1    0.        0.        0.
4650300  trpvlv
4650301  644    *opt*= BE (old)
4650301  501    *opt*= Deactivated
4650301  646    *opt*= BE (new)
*
*==========================================================================
* prz dump volume
* ---------------
*==========================================================================
*
*     component name and type
*       comp.name   comp.type
4600000  prz-topv   tmdpvol
*
*     time dependent volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.ch
4600101  0.1   0.615   0.    0.       90.       0.615
*
*       rough.  h.diam.  flags
4600102  3.-5   0.101    00
*
*     time dependent volume data control word
*       ctrl.  trip
4600200  102   603
*
*     time dependent volume cards [according to 4600200 ctrl.]
*       var.                               bor.con.[if]
*              ~~~~     ~~~~    ~~~~    ~~~~
4600201  -1.      1.+5     0.250
4600202  0.0      1.+5     0.250
4600203  1.000    1.+5     0.197
4600204  2.500    1.+5     0.153
4600205  5.000    1.+5     0.124
4600206  8.500    1.+5     0.103
4600207  13.00    1.+5     0.088
4600208  18.00    1.+5     0.080
4600209  23.50    1.+5     0.070
4600210  29.50    1.+5     0.063
4600211  37.00    1.+5     0.056
4600212  44.50    1.+5     0.051
4600213  53.00    1.+5     0.045
```

```
4600214  62.00   1.+5    0.041
4600215  72.00   1.+5    0.037
4600216  82.00   1.+5    0.034
4600217  92.00   1.+5    0.029
4600218  102.0   1.+5    0.026
4600219  112.0   1.+5    0.024
4600220  122.0   1.+5    0.020
4600221  132.0   1.+5    0.018
4600222  142.0   1.+5    0.014
4600223  147.5   1.+5    0.000
***
*=================================================================
* artifitial prz boundary volume
* ---------------------------
*     (required pressure in upper plenum is 12.65 mpa)
*=================================================================
*
4700000  prz-cntr   tmdpvol
4700101  8.-3  0.615  0.   0.     90.     0.615
4700102  3.-5   0.101   00
4700200  102

4700201  0.   12.5957+6  1.

4700201  0.   12.37+6    1.

4700201  0.   12.315+6   1.

4700201  0.   12.315+6   1.
4700202  400.  12.315+6   1.
4700203  500.  7.70+6     1.
4700204  1000. 7.645+6    1.
*
*
4750000  prz-topv   valve
4750101  470000000  420050002  0.    0.    0.      00100
4750201  1     0.          0.          0.
4750300  trpvlv
4750301  618
*
*
*=================================================================
*=================================================================
*= Emergency Core Cooling System (ECCS)
*= ------------------------------------
*=================================================================
*=================================================================
*
*=================================================================
* HPIS
* ----
*=================================================================
*
8500000  hpis-tv    tmdpvol
8500101  4.5-3  0.34   0.   0.     0.      0.
8500102  3.-5   7.571-2  00
8500200  101
8500201  0.   293.   0.
*
8550000  hpis-tj    tmdpjun
8550101  850000000  196010001  7.85-5
8550200  1     606
8550201  -1.   0.     0.     0.
8550202  0.    0.028   0.     0.
8550203  3000.  0.028   0.     0.
*
**===============================================================
* LPIS
* ----
*=================================================================
*
*
```

```
8600000  Lpis-tv    tmdpvol
8600101  4.5-3 0.34  0.   0.     0.      0.
8600102  3.-5   7.571-2  00
8600200  101
8600201  0.   293.   0.
*
*
8650000  Lpis-tj   tmdpjun
8650101  860000000 012010003  7.85-5

8650200  1     611
8650201  -1.   0.     0.     0.
8650202  0.    0.0432  0.     0.
8650203  3000.  0.0432  0.     0.

8650200  1     611
8650201  -1.   0.     0.     0.
8650202  0.    0.07   0.     0.
8650203  3000.  0.07   0.     0.
*
*=================================================================
* accumulator no.1 (inserted into downcomer)
* ----------------
*=================================================================
*
*     component name and type
*       comp.name  comp.type
8100000   accu-1     accum
*
*     volume geometry cards
*       area    length   vol.   az.ang.   inc.ang.   elev.chng.
8100101   3.048-2  2.47    0.    0.        90.        2.47
*
*       roug.   h.diam.   flgs.
8100102   4.-5    0.        00
*
*     accumulator tank initial thermodynamic conditions
*       press.    temp.  boron
8100200   3.55+6    293.   0.
*
*     accumulator junction geometry cards
*       to          area     loss   rev.loss.  flgs.
8101101   012010003  7.85-5  15.6   2000.      00001
*
*     accumulator tank initial conditions, standpipe line length/
*     elevation and tank wall heat transfer terms
*       f.vol.  lev.  leng.  elev.  thick.  flg.  dens.  cap.  trip
8102200   0.      1.86  5.167  3.15   0.011   0     7800.  620.  607   *opt*= BE
*
*=================================================================
* accumulator no.2 (inserted into upper plenum)
* ----------------
*=================================================================
*
*     component name and type
*       comp.name  comp.type
8200000   accu-2     accum
*
*     volume geometry cards
*       area    length   vol.   az.ang.   inc.ang.   elev.chng.
8200101   3.048-2  2.47    0.    0.        90.        2.47
*
*       roug.   h.diam.   flgs.
8200102   4.-5    0.        00
*
*     accumulator tank initial thermodynamic conditions
*       press.    temp.  boron
8200200   3.56+6    293.   0.
*
*     accumulator junction geometry cards
*       to          area     loss   rev.loss.  flgs.
8201101   062010002  7.85-5  14.4   2000.      00000
```

```
*
*     accumulator tank initial conditions, standpipe line length/
*    elevation and tank wall heat transfer terms
*      f.vol.  lev.  leng.  elev.  thick.  flg.  dens.  cap.  trip
8202200   0.     2.153 4.8    1.75   0.011   0    7800.  620.  608   *opt*= BE
*
*
*=================================================================
*=================================================================
* auxiliary systems
*=================================================================
*=================================================================
*
*=================================================================
* ambient volumes
* ---------------
*=================================================================
*
*     component name and type
*        comp.name   comp.type
9800000   amb-room    snglvol
*
*     single volume geometry cards
*        area   length  vol.  az.ang.  inc.ang.  elv.ch
9800101   100.   10.     0.   0.       0.        0.
*
*        rough.  h.diam.  flags
9800102   3.-5    0.       00
*
*     single volume initial conditions
*       ctrl.                              bor.con.[if]
*             ----   ----   ----   ----   ----
9800200   101    293.    0.
***
*=================================================================
* artifitial junction
* -------------------
*=================================================================
*
*     component name and type
*        comp.name  comp.type
9850000   art-jun    tmdpjun
*
*     tmdpjun geometry card
*        from        to          area
9850101   980000000  002010001  0.0001
*
*     tmdpjun control word
*        ctrl.  trip.numb.  alph.part  num.part
9850200   1
*
*     tmdpjun data [according to 9850200 ctrl.]
*        var.   f.      g.      int.vel.(=0.)
*              ~~~     ~~~
9850201   0.    0.      0.      0.
*
*
*=================================================================
*=================================================================
* steam generator - secondary side
*=================================================================
*=================================================================
*
*
*=================================================================
* feed water source
* -----------------
*=================================================================
*
5000000   sgs-fwt    tmdpvol
5000101   0.01    0.5   0.   0.      0.      0.
5000102   3.-5    7.571-2  00
```

```
5000200  003
5000201  0.   5.0+6  491.4  *opt*
5000201  0.   5.0+6  478.8  *opt*
5000201  0.   5.0+6  390.6  *opt*
*
5020000  sgs-wv-l   branch
5020001  1          0
5020101  0.01  0.5   0.   0.      0.      0.
5020102  3.-5   0.04   00
5020200  003   5.0+6  491.8
5021101  500010002 502010001 0.   0.35   0.35      00100
5021201  6.36-2     0.36       0.
*
*=====================================================================
* feedwater pump
* --------------
*=====================================================================
*
*    component name and type
*      comp.name  comp.type
5050000  sgs-fwp   tmdpjun
*
*    tmdpjun geometry card
*      from      to       area
5050101  502010002 510000000 0.
*
*    tmdpjun control word
*      ctrl. trip.numb. alph.part  num.part
*
5050200  1    634     cntrlvar  828
5050201  -1.  0.     0.    0.
5050202  0.   0.11    0.    0.
5050203  8.41  0.11    0.     0.
5050204  8.42  0.      0.     0.
5050205  9.   0.     0.    0.
*
*=====================================================================
* feedwater pump - steady state controller    proper level = 8.58m
* --------------  ########################                 2.25m
*=====================================================================
*
5060000  sgs-fwt    tmdpvol
5060101  0.01   0.5   0.   0.      0.      0.
5060102  3.-5   7.571-2  00

5060200  002  0     p     532010000
5060201  4.0+6  4.0+6   0.
+       6.0+6  6.0+6   0.

5060200  003
5060201  0.    5.0+6   491.8

5060200  003
5060201  0.    5.0+6   390.6

*--------------------------------------------------
*
5070000  sgs-fwp   tmdpjun
5070101  506000000 532000000  0.
*
5070200  1    627     cntrlvar  828   *= Deactivated (zero flow)
5070201  -1.   0.     0.    0.
5070202  0.    0.     0.    0.
5070203  8.62   0.     0.     0.
5070204  8.63   0.     0.     0.
5070205  9.4    0.     0.    0.
*
5070200  1    627     cntrlvar  828
5070201  -1.   0.     0.    0.
5070202  0.    5.     0.    0.
5070203  8.41   0.3    0.     0.
5070204  8.42   0.     0.     0.
```

```
5070205  9.4    0.     0.     0.
*
*=================================================================
* feedwater pipe
* --------------
*=================================================================
*
*     component name and type
*       comp.name   comp.type
5100000  sgs-fwpi   branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 518n2..=ini.vel.]
5100001  1          1
*
*     branch volume geometry cards
*       area  length  vol.  az.ang.  inc.ang.  elv.chng.
5100101  5.-4  3.    0.   0.      90.      3.
*
*       rough.  h.diam.  flags
5100102  3.-5   2.524-2  00
*
*     branch volume initial conditions
*       ctrl.  (p)    (temp)                  bor.con.[if]
*             ----    ----   ----   ----   ----
5100200  102   4.67+6  0.
*
*     branch junction geometry cards
*       from       to        area  loss.c.  rev.loss.c.  flags
5101101  510010002  532010002  5.-4  0.2      2.0        00100
*
*     branch junction initial conditions [according to 5180001]
*       ini.f.flw.  ini.g.flw.  interf.vel.
*             ---         ---
5101201  0.377       0.         0.
***
*=================================================================
* sg water volume - lower part
* ----------------------------
*=================================================================
*
*     component name and type
*       comp.name   comp.type
5220000  sgs-wv-l   branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 522n2..=ini.vel.]
5220001  1          0
*
*     branch volume geometry cards
*       area  length  vol.  az.ang.  inc.ang.  elv.chng.
5220101  0.108  0.61   0.   0.      90.      0.61
*
*       rough.  h.diam.  flags
5220102  3.-5   0.04     00100
*
*     branch volume initial conditions
*       ctrl.  (p)    (quale)                 bor.con.[if]
*             ----    ----   ----   ----   ----
5220200  102   4.67+6  2.44-3
*
*     branch junction geometry cards
*       from       to        area  loss.c.  rev.loss.c.  flags
5221101  522010002  524010001  0.    0.35     0.35       00100
*
*     branch junction initial conditions [according to 5220001]
*       ini.f.vel.  ini.g.vel.  interf.vel.
*             ---         ---
5221201  6.36-2      0.36       0.
***
*=================================================================
* sg water volume - middle part
```

```
* ----------------------------
*=============================================================
*
*     component name and type
*       comp.name   comp.type
5240000  sgs-wv-m   branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 524n2..=ini.vel.]
5240001   1           0
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
5240101  0.108  0.61   0.    0.       90.      0.61
*
*       rough.  h.diam.  flags
5240102  3.-5    0.04    00100
*
*     branch volume initial conditions
*       ctrl.  (p)    (quale)                     bor.con.[if]
*              ----   ----   ----   ----   ----
5240200  102   4.67+6  8.40-3
*
*     branch junction geometry cards
*       from      to        area  loss.c.  rev.loss.c.  flags
5241101  524010002  526010001  0.   0.35    0.35        00100
*
*     branch junction initial conditions [according to 5240001]
*       ini.f.vel.  ini.g.vel.  interf.vel.
*          ---       ---
5241201  9.55-2     0.35       0.
***
*=============================================================
* sg water volume - lower part
* ----------------------------
*=============================================================
*
*     component name and type
*       comp.name   comp.type
5260000  sgs-wv-u   branch
*
*     branch information card
*       numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 526n2..=ini.vel.]
5260001   0           1
*
*     branch volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.chng.
5260101  0.108  0.61   0.    0.       90.      0.61
*
*       rough.  h.diam.  flags
5260102  3.-5    0.04    00100
*
*     branch volume initial conditions
*       ctrl.  (p)    (quale)                     bor.con.[if]
*              ----   ----   ----   ----   ----
5260200  102   4.67+6  9.35-3
*
*     branch junction geometry cards
*       from      to        area  loss.c.  rev.loss.c.  flags
*
*     branch junction initial conditions [according to 5260001]
*       ini.f.vel.  ini.g.vel.  interf.vel.
*          ---       ---
*
*=============================================================
* SG volume abore TB
* ----------------------------
*=============================================================
*
5280000  sgs-wv-u   branch
5280001  1          1
5280101  0.108  0.2   0.   0.     90.     0.2
```

```
5280102  3.-5   0.04    00100
5280200  102   4.67+6  9.35-3
5281101  526010002 528010001 0.   0.35    0.35        00100
5281201  9.55-2      0.35        0.
*
*=================================================================
* SG volume abore DC
* -------------------------
*=================================================================
*
5380000  sgs-wv-u    branch
5380001  1              1
5380101  0.066  0.2   0.   0.     -90.     -0.2
5380102  3.-5   0.04    00100
5380200  102   4.67+6  9.35-3
5381101  538010002 536010001 0.   0.35    0.35        00100
5381201  9.55-2      0.35        0.
*
*=================================================================
* sg downcomer - upper part
* -------------------------
*=================================================================
*
*     component name and type
*        comp.name   comp.type
5360000  sgs-down    branch
*
*     branch information card
*        numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 536n2..=ini.vel.]
5360001  2             0
*
*     branch volume geometry cards
*        area   length  vol.  az.ang.  inc.ang.  elv.chng.
5360101  0.054  0.61    0.    0.       -90.      -0.61
*
*        rough.  h.diam.  flags
5360102  3.-5    0.       00
*
*     branch volume initial conditions
*        ctrl.  (p)                              bor.con.[if]
*        ----   ----   ----   ----   ----
5360200  102    4.67+6   7.66-3
*
*     branch junction geometry cards
*        from       to         area   loss.c.  rev.loss.c.  flags
5361101  536010002  534010001  0.     0.3      1.02         00100
*
5362101  536010003  526010003  0.486  16.      16.          00003
*
*     branch junction initial conditions [according to 5360001]
*        ini.f.vel.   ini.g.vel.   interf.vel.
*        ---          ---
5361201  0.65         0.45         0.
*
5362201  -1.6-2       -2.5-2       0.
*
*=================================================================
* sg downcomer - middle part
* -------------------------
*=================================================================
*
*     component name and type
*        comp.name   comp.type
5340000  sgs-down    branch
*
*     branch information card
*        numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 534n2..=ini.vel.]
5340001  2             0
*
*     branch volume geometry cards
*        area   length  vol.  az.ang.  inc.ang.  elv.chng.
5340101  0.054  0.61    0.    0.       -90.      -0.61
```

```
*
*      rough.  h.diam.  flags
5340102  3.-5   0.     00
*
*     branch volume initial conditions
*      ctrl.  (p)                        bor.con.[if]
*      ----   ----   ----   ----   ----
5340200  102   4.67+6  7.69-3
*
*     branch junction geometry cards
*      from      to       area   loss.c.  rev.loss.c.  flags
5341101  534010002  532010001  0.    0.3     1.02        00100
*
5342101  534010003  524010003  0.496  14.     14.        00003
*
*    branch junction initial conditions [according to 5340001]
*      ini.f.vel.  ini.g.vel.  interf.vel.
*      ---         ---
5341201  0.50       0.18       0.
*
5342201  6.3-3      1.04-2     0.
*
*==================================================================
* sg downcomer - lower part
* -------------------------
*==================================================================
*
*     component name and type
*      comp.name  comp.type
5320000  sgs-down   branch
*
*     branch information card
*      numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 532n2..=ini.vel.]
5320001   2          0
*
*     branch volume geometry cards
*      area   length  vol.  az.ang.  inc.ang.  elv.chng.
5320101  0.054  0.61   0.    0.      -90.      -0.61
*
*      rough.  h.diam.  flags
5320102  3.-5   0.     00
*
*     branch volume initial conditions
*      ctrl.  (p)    (temp)                  bor.con.[if]
*      ----   ----   ----   ----   ----
5320200  102   4.67+6  2.91-3
*
*     branch junction geometry cards
*      from      to       area   loss.c.  rev.loss.c.  flags
5321101  532010002  522010001  0.    0.3     1.02        00100
*
5322101  532010003  522010003  0.596  12.     12.        00003
*
*    branch junction initial conditions [according to 5320001]
*      ini.f.vel.  ini.g.vel.  interf.vel.
*      ---         ---
5321201  0.75       0.74       0.
*
5322201  -9.7-3     -1.7-2     0.
*
*==================================================================
* sg separator part
* -----------------
*==================================================================
*
*     component name and type
*      comp.name  comp.type
5440000  sgs-sep    separatr
5440000  sgs-sep    branch
*
*     separator information card
*      numb.of.jun.  ctrl. [_ or 0 -> w1,w2 of 544n2..=ini.vel.]
```

```
5440001  3        0
*
*     separator volume geometry cards
*       area  length  vol.  az.ang.  inc.ang.  elv.chng.
5440101  0.174 0.195  0.    0.      90.      0.195
*
*       rough.  h.diam.  flags
5440102  3.-5   0.4373  00
*
*     separator volume initial conditions
*       ctrl.  (p)    (quale)                    bor.con.[if]
*       ----   ----   ----   ----   ----
5440200  102    4.67+6  2.10-2
*
*     separator junction geometry cards
*       from       to        area   loss   rev.loss  flags  w7
5441101  544010002 546010001 0.     0.35   0.35      00000 *0.5
*
5442101  544010001 538010001 0.     0.35   0.35      00000 *0.15
*
5443101  528010002 544010001 0.     0.35   0.35      00000
*
*     separator junction initial conditions [according to 5440001]
*       ini.f.vel.   ini.g.vel.   interf.vel.
*       ---          ---
5441201  1.8-3       1.10         0.
*
5442201  0.38        -.25         0.
*
5443201  4.1-2       0.41         0.
***
*==================================================================
* sg steam volume - middle part
* ------------------------------
*==================================================================
*
5460000  spray-l  pipe
5460001  2
5460101  3.05-2 2
5460301  0.38   1       0.385   2
5460401  0.   2
5460601  90.     2
5460801  3.-5   0.198    2
5460901  0.1     0.1       1
5461001  00000 2
5461101  00100 1
5461201  102    4.67+6  2.92-2  0.      0.   0.     2
5461300  1
5461301  0.      1.02      0.      1
*
*
*==================================================================
* sg steam volume - top part
* ------------------------------
*==================================================================
*
5480000  sgs-s-t   branch
5480001  1          0
5480101  3.05-2 0.228 0.   0.     90.     0.228
5480102  3.-5   0.      00
5480200  102    4.67+6  0.99
5481101  546020002 548010001 0.    0.     0.        00100
5481201  1.9-3      1.02      0.
*
*
*
*
*==================================================================
*==================================================================
*  secondary side - steam part
* ============================
*==================================================================
```

```
*==============================================================
*
*==============================================================
* steam line valve
* ----------------
*==============================================================
*
*     component name and type
*       comp.name  comp.type
5550000  ss-sl-va   valve
*
*     valve junction geometry cards
*       from       to        area   loss   rev.loss   flgs.
5550101  548010002  558000000  4.5-5  0.     0.        00100
5550101  548010002  558000000  4.6-3  0.     0.        00100
5550101  548010001  558000000  4.6-3  0.     0.        00100
*
*     valve junction initial conditions
*       ctrl.  ini.f.vel.   ini.g.vel.   interf.vel.
*              ----         ----
5550201  0      0.26         0.46         0.
*
*     valve type card
*       type
5550300  mtrvlv
*
*     valve data and initial conditions [according to 5550300]
*       open   close   rate   ini
*       -----  ----   ----   ----   ----   ----   ----   ----
5550301  501    631    0.25   1.
***
*==============================================================
* steam line boundary
* -------------------
*==============================================================
*
*    component name and type
*       comp.name   comp.type
5580000  ss-sl-tv   tmdpvol
*
*    time dependent volume geometry cards
*       area   length  vol.  az.ang.  inc.ang.  elv.ch
5580101  0.1    0.34    0.    0.       0.        0.
*
*       rough.  h.diam.  flags
5580102  3.-5    7.571-2  00
*
*    time dependent volume data control word
*       ctrl.  trip
5580200  102
*
*    time dependent volume cards [according to 5580200 ctrl.]
*      var.                                    bor.con.[if]
*                ~~~~        ~~~~       ~~~~      ~~~~
5580201  0.       4.79973+6  1.
5580202  200.     4.79973+6  1.
5580203  400.     3.8+6      1.
5580204  800.     3.8+6      1.
5580205  1000.    3.34+6     1.


*==============================================================
* MSS relief valve
* ------------
*==============================================================
*
5850000  sec-RV     valve
5850101  548010002  588000000  0.1257-4  0.5   0.5    00100  *= D4mm
5850102  1.0        1.0
5850201  1    0.          0.          0.
5850300  mtrvlv
5850301  625   629    0.435   0.   *= opening time 2.3 s (closing 1.9 s)
```

```
*
*
*
5880000  ss-savab   tmdpvol
5880101  4.5-3 0.34   0.   0.      0.      0.
5880102  3.-5   7.571-2  00
5880200  102
5880201  0.   1.0+5   1.
*
*
*======================================================================
*======================================================================
*  break simulation
* =================
*======================================================================
*======================================================================
*
*
*=====================================================================
* break valve  cross-connection
*=====================================================================
*
*
9350000  breakvlv  valve
9350101  012010002 938000000 7.0686e-6 0.0      0.0      00102
9350102  1.15     0.14
9350201  1       0.0      0.0      0.0
9350300  trpvlv
9350301  666
*
*=====================================================================
* break boundary volume
*=====================================================================
*
*
9380000  containm  tmdpvol
9380101  1.666-3  0.348    0.000    0.000    0.000    0.000
9380102  .3000e-4  4.6-2    00
9380200  102  601
9380201  -1.0      1.0e+5   1.000
9380202  0.0      0.5e6    1.000
9380203  3.0      0.7e6    1.000
9380204  7.0      0.7e6    1.000
9380205  10.0     0.68e6   1.000
9380206  20.0     0.53e6   1.000
9380207  30.0     0.39e6   1.000
9380208  50.0     0.37e6   1.000
9380209  100.0    0.36e6   1.000
9380210  150.0    0.40e6   1.000
9380211  210.0    0.38e6   1.000
9380212  220.0    0.22e6   1.000
9380213  400.0    0.20e6   1.000
9380214  410.0    0.12e6   1.000
9380215  996.0    0.12e6   1.000
*
*
*
*####################################################################
*# h e a t   s t r u c t u r e s
*####################################################################
*
*======================================================================
*  downcomer top - upper plate
*======================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10080000  1      4       1       1       0.0
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
```

```
10080100 0          1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
10080101 3          40.0e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
10080201 1       3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->..........................
10080301 0.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*       ----
10080401 530.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.    type    ar.code   area     hsnumb.
10080501 008010000 0      1        1       2.1-2    1
*
*     right boundary condition cards
*       -"-      -"-      -"-      -"-      -"-      -"-
10080601 980010000 0      3933     1       2.1-2    1
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10080701 0        0.0      0.0      0.0      1
*
*     additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10080801 0        0.0      0.0      0.0      1
*
**
*     lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*       w1      w2      w3      w4      w5      w6      w7      w8      w9
10080801 0.      10.     10.     0.      0.      0.      0.      1.      1
*
*=====================================================================
*  downcomer top - cylinder
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10100000 2       4        2        1        80.0e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10100100 0          1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
10100101 3          130.0e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
10100201 1       3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->..........................
10100301 0.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*       ----
10100401 560.0    4
*
```

```
*      left boundary condition cards
*        bnd.vol.  incr.    type     ar.code   area     hsnumb.
10100501  008010000 0       1        1        0.112     1  * l(200)+hattu
*
10100502  012010000 0       1        1        0.116     2
*
*      right boundary condition cards
*        -"-       -"-      -"-      -"-      -"-      -"-
10100601  980010000 0       3933     1        0.112     1
*
10100602  980010000 0       3933     1        0.116     2
*
*      source data cards
*        type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10100701  0      0.0      0.0      0.0      2
*
*      additional left boundary cards
*        flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10100801  0      0.0      0.0      0.0      2
*
**
*      lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8      w9
10100801 0.     10.     10.     0.     0.     0.     0.     1.     2
*
*=================================================================
*        downcomer
*=================================================================
*
*
*      general hs data
*        ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10140000  8      4      2      1      36.5e-3
*
*      hs mesh flags
*        mesh.loc.flg.  mesh.form.flg.
10140100  0             1
*
*      hs mesh interval data (format 1 is used)
*        numb.of.int.  rght.coor. --->............................
10140101  3          44.5e-3
*
* hs composition data
*        compos.   int.numb. --->...............................
10140201  1        3
*
*      hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*        gam.a.c.  mesh.int.numb. --->..........................
10140301  0.0      3
*
*      initial temperature data [according to 1cccg400]
*        temp.
*                ----
10140401  560.0     4
*
*      left boundary condition cards
*        bnd.vol.  incr.    type     ar.code   area     hsnumb.
10140501  014010000 10000    1       1        0.5225    8
*
*      right boundary condition cards
*        -"-       -"-      -"-      -"-      -"-      -"-
10140601  980010000 0       3933     1        0.5225    8
*
*      source data cards
*        type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10140701  0    0.0      0.0                  0.0      8
*
*      additional left boundary cards
*        flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10140801  0    0.0            0.0             0.0    8
*
```

```
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5     w6     w7     w8       w9
10140801 0.      10.     10.     0.      0.     0.     0.     1.       8
*
*===================================================================
*      downcomer bottom
*===================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10180000  1      4        2        1        23.0e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10180100  1000
*
*     initial temperature flag
*       ini.temp.flg.
10180400  1000
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
10180501  018010000 0       1        1        0.836     1
*
*     right boundary condition cards
*       -"-      -"-      -"-      -"-      -"-      -"-
10180601  980010000 0       3933     1        0.836     1
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10180701  0       0.0      0.0      0.0      1
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10180801  0       0.0      0.0      0.0      1
*
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5     w6     w7     w8       w9
10180801 0.      10.     10.     0.      0.     0.     0.     1.       1
*
*===================================================================
* lower plenum - bottom plate
*===================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10020000  1      4        1        1        0.0
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10020100  0             1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
10020101  3           15.0e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
10020201  1       3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
10020301  0.0     3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*           ----
```

```
10020401 530.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.     type     ar.code   area      hsnumb.
10020501  002010000 0        1         1        9.5-3    1
*
*     right boundary condition cards
*       -"-       -"-       -"-       -"-       -"-        -"-
10020601  980010000 0        3930      1        9.5-3    1
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10020701  0        0.0       0.0       0.0       1
*
*     additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10020801  0        0.0       0.0       0.0       1
*
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*     w1      w2      w3      w4      w5      w6      w7      w8      w9
10020801 0.      10.     10.     0.      0.      0.      0.      1.      1
*
*=====================================================================
*       lower plenum
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10220000  2       4        2        1        50.5e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10220100  0              1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
10220101  3             157.0e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
10220201  1        3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
10220301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*       ----
10220401  560.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.     type     ar.code   area      hsnumb.
10220501  002010000 0        1         1        0.190    1
*
10220502  024010000 0        1         1        0.190    2
*
*     right boundary condition cards
*       -"-       -"-       -"-       -"-       -"-        -"-
10220601  980010000 0        3930      1        0.190    2
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10220701  0        0.0       0.0       0.0       2
*
*     additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10220801  0        0.0       0.0       0.0       2
*
```

```
**
*      lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8        w9
10220801 0.      10.     10.     0.      0.      0.      0.      1.        2
*
*========================================================================
*      core barrel
*========================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10260000 8       7        2        1        30.0e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10260100 0              1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
10260101 3            100.0e-3
10260102 3            133.0e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
10260201 2        3
10260202 1        6
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
10260301 0.0      6
*
*     initial temperature data [according to 1cccg400]
*       temp.
*       ----
10260401 560.0    7
*
*     left boundary condition cards
*       bnd.vol.  incr.     type     ar.code   area     hsnumb.
10260501 026010000 0        1        1        0.340    1
10260502 026020000 0        1        1        0.340    2
10260503 044010000 0        1        1        0.500    3
10260504 044020000 0        1        1        0.500    4
10260505 044030000 0        1        1        0.500    5
10260506 044040000 0        1        1        0.500    6
10260507 044050000 0        1        1        0.250    7
10260508 044060000 0        1        1        0.250    8
*
*     right boundary condition cards
*       -"-       -"-       -"-      -"-      -"-       -"-
10260601 980010000 0        3930     1        0.340    1
10260602 980010000 0        3930     1        0.340    2
10260603 980010000 0        3930     1        0.500    3
10260604 980010000 0        3930     1        0.500    4
10260605 980010000 0        3930     1        0.500    5
10260606 980010000 0        3930     1        0.500    6
10260607 980010000 0        3930     1        0.250    7
10260608 980010000 0        3930     1        0.250    8
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10260701 0    0.0       0.0                    0.0        8
*
*     additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10260801 0     0.0             0.0              0.0     8
*
**
*      lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8        w9
10260801 0.      10.     10.     0.      0.      0.      0.      1.        8
```

```
*
*======================================================================
*      core simulator
*======================================================================
*
*
*    general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10440000 6      4        2        1        3.55e-3
*
*    hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
10440100 0              1
*
*    hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->............................
10440101 3             4.550e-3
*
* hs composition data
*      compos.   int.numb. --->...............................
10440201 1        3
*
*    hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->.........................
10440301 1.0      3
*
*    initial temperature data [according to 1cccg400]
*      temp.
*            ----
10440401 575.0    4
*
*    left boundary condition cards
*      bnd.vol.  incr.    type    ar.code  area     hsnumb.
10440501 0        0        0       1        9.5      4
10440502 0        0        0       1        4.75     6
*
*    right boundary condition cards
*      -"-      -"-      -"-      -"-      -"-      -"-
10440601 044010000 10000   1        1        9.5      4
10440602 044050000 10000   1        1        4.75     6
*
*    source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10440701  10095   0.2     0.0     0.0     1
10440702  10095   0.2     0.0     0.0     2
10440703  10095   0.2     0.0     0.0     3
10440704  10095   0.2     0.0     0.0     4
10440705  10095   0.1     0.0     0.0     5
10440706  10095   0.1     0.0     0.0     6
*
*    additional right boundary cards
*      -"-   -"-          -"-          -"-    -"-
10440901 0       8.6e-3   0.0      0.0      6
*
**
*      rg.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1     w2     w3     w4     w5     w6     w7     w8     w9
10440901 0.     10.    10.    0.     0.     0.     0.     1.     6
*
*======================================================================
*      upper plenum - core outlet
*======================================================================
*
*
*    general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10520000 2      4        2        1        50.5e-3
*
*    hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
10520100 0              1
```

```
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->..............................
10520101  3          157.0e-3
*
* hs composition data
*       compos.   int.numb. --->..................................
10520201  1       3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->...........................
10520301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*            ----
10520401  560.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
10520501  052010000 0        1        1       0.26     1
10520502  052020000 0        1        1       0.19     2
*
*     right boundary condition cards
*       -"-       -"-      -"-      -"-      -"-      -"-
10520601  980010000 0       3930      1        0.26     1
10520602  980010000 0       3930      1        0.19     2
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10520701  0       0.0       0.0       0.0       2
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10520801  0       0.0       0.0       0.0       2
*
**
*      lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5     w6     w7     w8      w9
10520801 0.      10.     10.     0.      0.     0.     0.     1.      2
*
*=====================================================================
*        upper plenum    u-pipes
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10540000  6       4        2        1       23.0e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10540100  1000
*
*     initial temperature flag
*       ini.temp.flg.
10540400  1000
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
10540501  054010000 10000     1        1       0.212    2
10540502  054030000 10000     1        1       0.455    4
10540503  054050000 10000     1        1       0.212    6
*
*     right boundary condition cards
*       -"-       -"-      -"-      -"-      -"-      -"-
10540601  980010000 0       3930      1        0.212    2
10540602  980010000 0       3930      1        0.455    4
10540603  980010000 0       3930      1        0.212    6
*
*     source data cards
```

```
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10540701 0        0.0      0.0      0.0      6
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10540801 0        0.0      0.0      0.0      6
*
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*     w1      w2      w3      w4      w5      w6      w7      w8       w9
10540801 0.     10.     10.     0.      0.      0.      0.      1.      6
*
*=====================================================================
*       upper plenum   bottom part
*=====================================================================
*
*
*     general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10560000 2       4       2       1       36.5e-3
*
*     hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
10560100  0             1
*
*     hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->............................
10560101  3            127.0e-3
*
* hs composition data
*      compos.   int.numb. --->...............................
10560201  1       3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->.........................
10560301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*      temp.
*       ----
10560401  560.0     4
*
*     left boundary condition cards
*      bnd.vol.  incr.   type    ar.code   area     hsnumb.
10560501  058010000 10000    1       1      0.170    2
*
*     right boundary condition cards
*       -"-      -"-     -"-     -"-     -"-      -"-
10560601  980010000 0       3930     1       0.170    2
*
*     source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10560701  0       0.0      0.0      0.0      2
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10560801  0       0.0      0.0      0.0      2
*
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*     w1      w2      w3      w4      w5      w6      w7      w8       w9
10560801 0.     10.     10.     0.      0.      0.      0.      1.      2
*
*=====================================================================
*       upper plenum    tube 57x5.5 mm
*=====================================================================
*
*
*     general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10600000 2       4       2       1       23.0e-3
```

```
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10600100  0            1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
10600101  3           28.5e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
10600201  1       3
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
10600301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*             ----
10600401  560.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
10600501  060010000 10000    1        1        0.5      2
*
*     right boundary condition cards
*       -"-      -"-      -"-      -"-      -"-      -"-
10600601  980010000 0        3930     1        0.5      2
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10600701  0     0.0       0.0                  0.0        2
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10600801  0     0.0          0.0              0.0     2
*
**
*      lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8       w9
10600801 0.      10.     10.     0.      0.      0.      0.      1.       2
*
*=================================================================
*       upper plenum    tube Di=73 mm
*=================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10610000  1       4        2        1       36.5e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10610100  0            1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
10610101  3           56.5e-3  *= estimate incl. flange
*
* hs composition data
*       compos.   int.numb. --->...............................
10610201  1       3
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
10610301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
```

```
*             ----
10610401  560.0     4
*
*      left boundary condition cards
*        bnd.vol.  incr.    type     ar.code   area      hsnumb.
10610501  060030000 0        1        1        0.333     1
*
*      right boundary condition cards
*        -"-      -"-      -"-       -"-       -"-        -"-
10610601  980010000 0        3930     1         0.333     1
*
*      source data cards
*        type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10610701  0    0.0     0.0                  0.0        1
*
*       additional left boundary cards
*         flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10610801  0     0.0            0.0             0.0     1
*
**
*       lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*       w1      w2      w3      w4      w5     w6     w7     w8      w9
10610801 0.      10.     10.     0.      0.     0.     0.     1.      1
*
*=====================================================================
*        upper plenum   outlet part with d=160 mm
*=====================================================================
*
*
*      general hs data
*        ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10640000  2       4        2        1       80.0e-3
*
*      hs mesh flags
*        mesh.loc.flg.  mesh.form.flg.
10640100  0              1
*
*      hs mesh interval data (format 1 is used)
*        numb.of.int.  rght.coor. --->............................
10640101  3             130.0e-3
*
* hs composition data
*        compos.   int.numb. --->...............................
10640201  1        3
*
*      hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*        gam.a.c.  mesh.int.numb. --->.........................
10640301  0.0      3
*
*      initial temperature data [according to 1cccg400]
*        temp.
*             ----
10640401  560.0     4
*
*      left boundary condition cards
*        bnd.vol.  incr.    type     ar.code   area      hsnumb.
10640501  062010000 0        1        1        0.105     1
*
10640502  064010000 0        1        1        0.170     2
*
*      right boundary condition cards
*        -"-      -"-      -"-       -"-       -"-        -"-
10640601  980010000 0        3935     1         0.105     1
*
10640602  980010000 0        3935     1         0.170     2
*
*      source data cards
*        type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10640701  0    0.0     0.0                  0.0        2
*
*       additional left boundary cards
```

```
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10640801  0     0.0           0.0             0.0     2
*
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1        w2       w3       w4       w5      w6      w7      w8        w9
10640801 0.       10.     10.     0.       0.      0.      0.      1.        2
*
*=======================================================================
*      upper plenum top   part with d=73 mm
*=======================================================================
*
*
*     general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10682000  4       4       2       1       36.5e-3  1    0    4
*
*     hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
10682100  0             1
*
*     hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->...........................
10682101  3           44.50e-3
*
* hs composition data
*      compos.   int.numb. --->..............................
10682201  1        3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->........................
10682301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*      temp.
*             ----
10682401  560.0     4
*
*     left boundary condition cards
*      bnd.vol.  incr.     type      ar.code   area      hsnumb.
10682501  068010000 0        1         1        0.5225    1
10682502  068020000 0        1         1        0.5225    2
10682503  068030000 0        1         1        0.5225    3
10682504  068040000 0        1         1        0.5225    4
*
*     right boundary condition cards
*      -"-       -"-       -"-       -"-       -"-       -"-
10682601  980010000 0        3935      1        0.5225    1
10682602  980010000 0        3935      1        0.5225    2
10682603  980010000 0        3935      1        0.5225    3
10682604  980010000 0        3935      1        0.5225    4
*
*     source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10682701  0     0.0      0.0                  0.0        4
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10682801  0     0.0           0.0             0.0     4
*
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1        w2       w3       w4       w5      w6      w7      w8        w9
10682801 0.       10.     10.     0.       0.      0.      0.      1.        4
*
*=======================================================================
* upper plenum - top plate
*=======================================================================
*
*
*     general hs data
```

```
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
10683000  1      4       1       1       0.0
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
10683100  0            1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
10683101  3            30.0e-3
*
* hs composition data
*       compos.   int.numb. --->................................
10683201  1       3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->..........................
10683301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*                ----
10683401  560.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
10683501  068040000 0       1        1        6.22-3    1
*
*     right boundary condition cards
*       -"-      -"-      -"-      -"-      -"-      -"-
10683601  980010000 0       3935      1        6.22-3    1
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
10683701  0       0.0      0.0      0.0      1
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
10683801  0       0.0      0.0      0.0      1
*
**
*      lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5     w6     w7     w8      w9
10683801 0.      10.     10.     0.      0.     0.     0.     1.      1
*
*
*=====================================================================
*       hot leg
*=====================================================================
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11000000  8      4       2       1       23.0e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
11000100  0            1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
11000101  3            28.5e-3
*
* hs composition data
*       compos.   int.numb. --->................................
11000201  1       3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->..........................
11000301  0.0      3
*
```

```
*     initial temperature data [according to 1cccg400]
*       temp.
*        ----
11000401  560.0     4
*
*
*     left boundary condition cards
*       bnd.vol.  incr.   type      ar.code   area      hsnumb.
11000501  102010000 0      1        1        0.750    1
11000502  106010000 0      1        1        0.572    2
11000503  106020000 0      1        1        0.572    3
11000504  106030000 0      1        1        0.572    4
11000505  106040000 0      1        1        0.572    5
11000506  106050000 0      1        1        0.572    6
11000507  106060000 0      1        1        0.450    7
11000508  106070000 0      1        1        0.770    8
*
*     right boundary condition cards
11000601  980010000 0      3910     1        0.750    1
11000602  980010000 0      3910     1        0.572    2
11000603  980010000 0      3910     1        0.572    3
11000604  980010000 0      3910     1        0.572    4
11000605  980010000 0      3910     1        0.572    5
11000606  980010000 0      3910     1        0.572    6
11000607  980010000 0      3910     1        0.450    7
11000608  980010000 0      3910     1        0.770    8
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11000701  0     0.0       0.0                    0.0        8
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11000801  0     0.0             0.0              0.0     8
*
**
*      lf.h.dh.  heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1        w2       w3       w4      w5      w6      w7      w8      w9
11000801 0.      10.     10.      0.      0.      0.      0.      1.      8
*
*=================================================================
*       pressurizer surge line
*=================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
14100000  5        4        2        1       14.5e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
14100100  0              1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
14100101  3             19.0e-3
*
* hs composition data
*       compos.   int.numb. --->..............................
14100201  1       3
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
14100301  0.0     3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*        ----
14100401  560.0     4
*
*     left boundary condition cards
```

```
*      bnd.vol. incr.    type    ar.code  area    hsnumb.
14100501 410010000 0      1      1      0.15    1
14100502 410020000 0      1      1      0.76    2
14100503 410030000 0      1      1      1.57    3
14100504 410040000 0      1      1      1.57    4
14100505 410050000 0      1      1      0.15    5
*
*    right boundary condition cards
*      -"-      -"-      -"-      -"-      -"-      -"-
14100601 980010000 0      3940    1      0.15    1
14100602 980010000 0      3940    1      0.76    2
14100603 980010000 0      3940    1      1.57    3
14100604 980010000 0      3940    1      1.57    4
14100605 980010000 0      3940    1      0.15    5
*
*    source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
14100701 0    0.0      0.0                    0.0       5
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
14100801 0     0.0            0.0              0.0     5
*
**
*     lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*     w1      w2      w3      w4     w5     w6     w7     w8     w9
14100801 0.    10.    10.    0.     0.     0.     0.     1.     5
*
*=====================================================================
*      pressurizer,  420 - 426
*=====================================================================
*
*
*    general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
14200000 7      4        2        1        50.5e-3
*
*    hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
14200100 0            1
*
*    hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->............................
14200101 3           66.5e-3
*
* hs composition data
*      compos.   int.numb. --->...............................
14200201 1       3
*
*    hs source distribution data
*      format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->..........................
14200301 0.0     3
*
*    initial temperature data [according to 1cccg400]
*      temp.
*      ----
14200401 595.0    4
*
*    left boundary condition cards
*      bnd.vol. incr.    type    ar.code  area    hsnumb.
14200501 430010000 0      1      1      0.150   1
14200502 430020000 0      1      1      0.085   2
14200503 420010000 0      1      1      0.225   3
14200504 420020000 0      1      1      0.557   4
14200505 420030000 0      1      1      0.6     5
14200506 420040000 0      1      1      0.6     6
14200507 420050000 0      1      1      0.305   7
*
*    right boundary condition cards
*      -"-      -"-      -"-      -"-      -"-      -"-
14200601 980010000 0      3940    1      0.150   1
```

```
14200602 980010000 0     3940    1      0.085    2
14200603 980010000 0     3940    1      0.225    3
14200604 980010000 0     3940    1      0.557    4
14200605 980010000 0     3940    1      0.6      5
14200606 980010000 0     3940    1      0.6      6
14200607 980010000 0     3940    1      0.305    7
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
14200701 0    0.0       0.0                    0.0        7
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
14200801 0     0.0             0.0              0.0     7
*
**
*      lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1      w2      w3     w4     w5    w6    w7    w8     w9
14200801 0.       10.     10.    0.     0.    0.    0.    1.     7
*
*=======================================================================
*       prz heater simulator
*=======================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
14220000 2       4        2        1        0.
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
14220100 0             1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
14220101 3            12.5-3
*
* hs composition data
*       compos.  int.numb. --->...............................
14220201 1       3
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
14220301 1.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*       ----
14220401 600.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.   type    ar.code  area     hsnumb.
14220501 0        0       0       1        0.255    1
*
14220502 0        0       0       1        0.225    2
*
*     right boundary condition cards
*       -"-       -"-       -"-       -"-       -"-       -"-
14220601 410060000 0      1       1        0.255    1
*
14220602 420010000 0      1       1        0.225    2
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
14220701 422  0.        0.                     0.3        1
*
14220702 422  0.        0.                     0.7        2
*
*     additional right boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
14220901 0     0.              0.0              0.0     2
```

```
*
**
*     rg.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5     w6     w7     w8      w9
14220901 0.      10.     10.     0.     0.     0.     0.     1.     2
*
*====================================================================
* pressurizer - well between bottom blind end and surge line
*====================================================================
*
*
*    general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
14300000  2      4       2       1       2.4-2
*
*    hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
14300100  0            1
*
*    hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->............................
14300101  3            2.5-2
*
* hs composition data
*      compos.   int.numb. --->...............................
14300201  1        3
*
*    hs source distribution data
*      format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->.........................
14300301  0.0      3
*
*    initial temperature data [according to 1cccg400]
*      temp.
*          ----
14300401  560.0    4
*
*    left boundary condition cards
*      bnd.vol.  incr.     type     ar.code   area      hsnumb.
14300501  410060000 0        1        1         0.150     1
*
14300502  410060000 0        1        1         0.085     2
*
*    right boundary condition cards
*      -"-       -"-       -"-      -"-       -"-       -"-
14300601  430010000 0        1        1         0.150     1
*
14300602  430020000 0        1        1         0.085     2
*
*    source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
14300701  0    0.0     0.0                   0.0        2
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
14300801  0    0.0             0.0              0.0     2
*
*     additional right boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
14300901  0    0.              0.0              0.0     2
*
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5     w6     w7     w8      w9
14300801 0.      10.     10.     0.     0.     0.     0.     1.     2
*
*     rg.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5     w6     w7     w8      w9
14300901 0.      10.     10.     0.     0.     0.     0.     1.     2
*
*====================================================================
*     sg inlet collector slab
```

```
*========================================================================
*
*      general hs data
*        ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11200000  5       4        2        1        36.5e-3
*
*      hs mesh flags
*        mesh.loc.flg.  mesh.form.flg.
11200100  0              1
*
*      hs mesh interval data (format 1 is used)
*        numb.of.int.  rght.coor. --->............................
11200101  3             44.5e-3
*
* hs composition data
*        compos.   int.numb. --->...............................
11200201  1         3
*
*      hs source distribution data
*         format 1 [if w1 of 1cccg100=0.]
*        gam.a.c.  mesh.int.numb. --->..........................
11200301  0.0       3
*
*      initial temperature data [according to 1cccg400]
*        temp.
*        ----
11200401  560.0    4
*
*
*      left boundary condition cards
*        bnd.vol.  incr.   type     ar.code  area    hsnumb.
11200501  120010000 0       1        1        0.620   1
11200502  122010000 0       1        1        0.710   2
11200503  124010000 0       1        1        0.610   3
11200504  126010000 0       1        1        0.610   4
11200505  128010000 0       1        1        0.300   5
*
*      right boundary condition cards
*        -"-       -"-     -"-      -"-      -"-     -"-
11200601  980010000 0       3910     1        0.620   1
11200602  522010000 0       1        1        0.710   2
11200603  524010000 0       1        1        0.610   3
11200604  526010000 0       1        1        0.610   4
11200605  544010000 0       1        1        0.300   5
*
*      source data cards
*        type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11200701  0     0.0       0.0                    0.0        5
*
*       additional left boundary cards
*        flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11200801  0     0.0             0.0              0.0     5
*
*       additional right boundary cards
*        flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11200901  0     0.0             0.0              0.0     5
*
**
*       lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*       w1      w2     w3     w4     w5     w6     w7     w8      w9
11200801 0.     10.    10.    0.     0.     0.     0.     1.      5
*
*       rg.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*       w1      w2     w3     w4     w5     w6     w7     w8      w9
11200901 0.     10.    10.    0.     0.     0.     0.     1.      5
*

*========================================================================
* lower section of sg tubing
*========================================================================
*
*
```

```
*     general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11320000 4       4        2        1        3.0e-3
*
*     hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
11320100  0              1
*
*     hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->............................
11320101  3           4.0e-3
*
* hs composition data
*      compos.   int.numb. --->...............................
11320201  1        3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->.........................
11320301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*      temp.
*               ----
11320401  530.0    4
*
*     left boundary condition cards
*      bnd.vol.  incr.    type    ar.code  area     hsnumb.
11320501  132010000 10000   1       1       19.96    4      *=changed
*
*     right boundary condition cards
*      -"-       -"-      -"-     -"-      -"-      -"-
11320601  522010000 0       1       1       19.96    4
*
*     source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11320701  0    0.00     0.0                  0.0         4
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11320801  0    6.0e-3         0.0             0.0      4
*
*     additional right boundary cards
*      -"-   -"-              -"-             -"-     -"-
11320901  0    40.e-3         0.0             0.0      4      *=original
*
**
*      lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8      w9
11320801 0.     10.     10.     0.      0.      0.      0.      1.      4
*
*
*      rg.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8      w9
11320901 0.     10.     10.     0.      0.      0.      0.      1.      4
*
*
*=========================================================================
* middle section of sg tubing
*=========================================================================
*
*     general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11340000 4       4        2        1        3.0e-3
*
*     hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
11340100  0              1
*
*     hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->............................
11340101  3           4.0e-3
```

```
*
* hs composition data
*      compos.   int.numb. --->..............................
11340201  1        3
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->........................
11340301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*      temp.
*         ----
11340401  530.0    4
*
*     left boundary condition cards
*      bnd.vol.  incr.     type      ar.code   area      hsnumb.
11340501  134010000 10000   1       1        29.93    4       *=changed
*
*     right boundary condition cards
*      -"-       -"-       -"-       -"-       -"-       -"-
11340601  524010000 0       1       1        29.93    4
*
*     source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11340701  0     0.00      0.0                 0.0        4
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11340801  0     6.0e-3         0.0              0.0     4
*
*     additional right boundary cards
*      -"-    -"-             -"-              -"-     -"-
11340901  0     40.e-3         0.0              0.0     4        *=original
*
**
*     lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*     w1       w2        w3       w4       w5      w6      w7      w8      w9
11340801 0.     10.      10.      0.      0.      0.      0.      1.      4
*
*     rg.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*     w1       w2        w3       w4       w5      w6      w7      w8      w9
11340901 0.     10.      10.      0.      0.      0.      0.      1.      4
*
*
*=====================================================================
* upper section of sg tubing
*=====================================================================
*
*     general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11360000  4        4        2        1       3.0e-3
*
*     hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
11360100  0              1
*
*     hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->............................
11360101  3            4.0e-3
*
* hs composition data
*      compos.   int.numb. --->..............................
11360201  1        3
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->........................
11360301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*      temp.
```

```
*              ----
11360401  530.0     4
*
*      left boundary condition cards
*        bnd.vol.  incr.     type      ar.code   area      hsnumb.
11360501  136010000 10000    1         1         31.93     4       *=changed
*
*      right boundary condition cards
*         -"-       -"-       -"-       -"-       -"-       -"-
11360601  526010000 0        1         1         31.93     4
*
*      source data cards
*        type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11360701  0     0.00      0.0                   0.0        4
*
*       additional left boundary cards
*        flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11360801  0     6.0e-3          0.0              0.0     4
*
*      additional right boundary cards
*         -"-   -"-             -"-              -"-     -"-
11360901  0     40.e-3          0.0              0.0     4         *=original
*
**
*       lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*       w1      w2      w3      w4      w5      w6      w7      w8      w9
11360801 0.     10.     10.     0.      0.      0.      0.      1.      4
*
*       rg.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*       w1      w2      w3      w4      w5      w6      w7      w8      w9
11360901 0.     10.     10.     0.      0.      0.      0.      1.      4
*
*=======================================================================
*       sg outlet collector slab
*=======================================================================
*
*      general hs data
*        ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11400000  5       4        2        1        36.5e-3
*
*      hs mesh flags
*        mesh.loc.flg.  mesh.form.flg.
11400100  0             1
*
*      hs mesh interval data (format 1 is used)
*        numb.of.int.  rght.coor. --->............................
11400101  3            44.5e-3
*
* hs composition data
*        compos.   int.numb. --->...............................
11400201  1        3
*
*      hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*        gam.a.c.  mesh.int.numb. --->.........................
11400301  0.0      3
*
*      initial temperature data [according to 1cccg400]
*        temp.
*              ----
11400401  530.0     4
*
*
*      left boundary condition cards
*        bnd.vol.  incr.     type      ar.code   area      hsnumb.
11400501  140010000 0        1         1         0.620     1
11400502  142010000 0        1         1         0.710     2
11400503  144010000 0        1         1         0.610     3
11400504  146010000 0        1         1         0.610     4
11400505  148010000 0        1         1         0.300     5
*
*      right boundary condition cards
```

```
*      -"-     -"-     -"-      -"-      -"-      -"-
11400601  980010000 0      3920     1      0.620    1
11400602  522010000 0      1       1      0.710    2
11400603  524010000 0      1       1      0.610    3
11400604  526010000 0      1       1      0.610    4
11400605  544010000 0      1       1      0.300    5
*
*     source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11400701  0    0.0     0.0               0.0     5
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11400801  0     0.0            0.0          0.0    5
*
*     additional right boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11400901  0     0.0            0.0          0.0    5
*
**
*     lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8      w9
11400801 0.     10.    10.     0.      0.      0.      0.      1.      5
*
*     rg.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8      w9
11400901 0.     10.    10.     0.      0.      0.      0.      1.      5
*
*=========================================================================
*      cold leg
*=========================================================================
*
*
*     general hs data
*      ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11500000  13     4      2      1      23.0e-3
*
*     hs mesh flags
*      mesh.loc.flg.  mesh.form.flg.
11500100  0          1
*
*     hs mesh interval data (format 1 is used)
*      numb.of.int.  rght.coor. --->............................
11500101  3          28.5e-3
*
* hs composition data
*      compos.  int.numb. --->...............................
11500201  1      3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->.........................
11500301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*      temp.
*          ----
11500401  530.0    4
*
*
*     left boundary condition cards
*      bnd.vol.  incr.   type    ar.code   area     hsnumb.
11500501  154010000 0      1       1      0.540    1
11500502  154020000 0      1       1      0.540    2
11500503  154030000 0      1       1      0.540    3
11500504  154040000 0      1       1      0.540    4
11500505  156010000 0      1       1      0.789    5
11500506  192010000 0      1       1      0.950    6
11500507  194010000 0      1       1      0.500    7
11500508  194020000 0      1       1      0.500    8
11500509  194030000 0      1       1      0.500    9
11500510  194040000 0      1       1      0.555    10
```

```
11500511  196010000 0      1      1       0.561    11
11500512  198010000 0      1      1       0.560    12
11500513  198020000 0      1      1       0.560    13
*
*     right boundary condition cards
*      -"-       -"-      -"-      -"-     -"-       -"-
11500601  980010000 0       3920    1       0.540    1
11500602  980010000 0       3920    1       0.540    2
11500603  980010000 0       3920    1       0.540    3
11500604  980010000 0       3920    1       0.540    4
11500605  980010000 0       3920    1       0.789    5
11500606  980010000 0       3920    1       0.950    6
11500607  980010000 0       3920    1       0.500    7
11500608  980010000 0       3920    1       0.500    8
11500609  980010000 0       3920    1       0.500    9
11500610  980010000 0       3920    1       0.555    10
11500611  980010000 0       3920    1       0.561    11
11500612  980010000 0       3920    1       0.560    12
11500613  980010000 0       3920    1       0.560    13
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11500701  0    0.0     0.0                    0.0       13
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11500801  0     0.0            0.0              0.0     13
*
**
*      lf.h.dh. heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8      w9
11500801 0.      10.     10.     0.      0.      0.      0.      1.      13
*
*=================================================================
*       pump seal, 165-168
*=================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11661000  4       4        2        1       36.5e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
11661100  0               1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
11661101  3           44.5e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
11661201  1       3
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
11661301  0.0      3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*             ----
11661401  540.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
11661501  158010000 0       1        1       0.810    1
11661502  166010000 0       1        1       1.767    2
11661503  166020000 0       1        1       1.500    3
11661504  166030000 0       1        1       1.500    4
*
*     right boundary condition cards
```

```
*       -"-      -"-      -"-      -"-      -"-      -"-
11661601  980010000 0       3920     1       0.810    1
11661602  980010000 0       3920     1       1.767    2
11661603  980010000 0       3920     1       1.500    3
11661604  980010000 0       3920     1       1.500    4
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11661701  0    0.0      0.0                   0.0       4
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11661801  0    0.0            0.0            0.0    4
*
**
*      lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*       w1      w2      w3      w4      w5      w6      w7      w8      w9
11661801 0.     10.     10.     0.      0.      0.      0.      1.      4
*
*=====================================================================
*       pump seal, 169
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11662000  1      4       2       1       50.5e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
11662100  0              1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
11662101  3              66.5e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
11662201  1       3
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->..........................
11662301  0.0     3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*               ----
11662401  540.0    4
*
*     left boundary condition cards
*       bnd.vol.  incr.   type     ar.code   area     hsnumb.
11662501  166040000 0      1        1       1.620    1
*
*     right boundary condition cards
*       -"-      -"-      -"-      -"-      -"-      -"-
11662601  980010000 0       3920     1       1.620    1
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11662701  0    0.0      0.0                   0.0       1
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11662801  0    0.0            0.0            0.0    1
*
**
*      lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8      w9
```

```
11662801 0.     10.    10.    0.     0.     0.     0.     1.     1
*
*=====================================================================
*     pump delivery line, 170 & 190
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11700000 2       4        2        1        23.9e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
11700100  1500
*
*     initial temperature flag
*       ini.temp.flg.
11700400  1500
*
*     left boundary condition cards
*       bnd.vol.  incr.     type     ar.code   area     hsnumb.
11700501  170010000 0       1        1         3.115    1
11700502  190010000 0       1        1         2.354    2
*
*     right boundary condition cards
*       -"-       -"-       -"-      -"-       -"-      -"-
11700601  980010000 0       3920     1         3.115    1
11700602  980010000 0       3920     1         2.354    2
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11700701 0    0.0       0.0                    0.0        2
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11700801 0     0.0             0.0              0.0     2
*
**
*      lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1       w2      w3      w4      w5     w6     w7     w8     w9
11700801 0.     10.     10.     0.      0.     0.     0.     1.     2
*
*=====================================================================
*      preheater  182
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
11820000 1       4        2        1        51.0e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
11820100  0             1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->.............................
11820101  3           63.5e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
11820201  1         3
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
11820301  0.0     3
*
*     initial temperature data [according to 1cccg400]
*       temp.
*              ----
11820401  540.0    4
```

```
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
11820501  182010000 0       1         1         2.170    1
*
*     right boundary condition cards
*       -"-       -"-      -"-      -"-       -"-
11820601  980010000 0       3920      1         2.170    1
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
11820701  0       0.0       0.0       0.0       1
*
*     additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
11820801  0       0.0       0.0       0.0       1
*
**
*     lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*     w1      w2      w3      w4      w5      w6      w7      w8      w9
11820801 0.     10.     10.     0.      0.      0.      0.      1.      1
*
*=====================================================================
*      steam generatorm - big cylinder
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
15300000  5       7        2        1       235.0e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
15300100  0            1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
15300101  1           238.0e-3
*
15300102  3           254.0e-3
*
15300103  2           314.0e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
15300201  1       1
*
15300202  3       4
*
15300203  4       6
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
15300301  0.0     6
*
*     initial temperature data [according to 1cccg400]
*       temp.
*         ----
15300401  560.0   7
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
15300501  544010000 0       1         1         0.190    1
15300502  538010000 0       1         1         0.200    2
15300503  532010000 0       1         1         0.610    3
15300504  534010000 0       1         1         0.610    4
15300505  536010000 0       1         1         0.610    5
*
*     right boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
15300601  980010000 0       3950      1         0.190    1
```

```
15300602  980010000 0      3950     1       0.200    2
15300603  980010000 0      3950     1       0.610    3
15300604  980010000 0      3950     1       0.610    4
15300605  980010000 0      3950     1       0.610    5
*
*      source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
15300701  0        0.0       0.0       0.0       5
*
*       additional left boundary cards
*        flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
15300801  0        0.0       0.0       0.0       5
*
**
*       lf.h.dh.  heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*       w1       w2       w3       w4       w5      w6      w7      w8        w9
15300801 0.      10.     10.      0.       0.      0.      0.      1.       5
*
*=====================================================================
*        steam generator - top plate
*=====================================================================
*
*
*      general hs data
*        ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
15440000  1       6        1        1       0.0
*
*      hs mesh flags
*        mesh.loc.flg.  mesh.form.flg.
15440100  0             1
*
*      hs mesh interval data (format 1 is used)
*        numb.of.int.  rght.coor. --->............................
15440101  3           95.0e-3
15440102  2           155.0e-3
*
* hs composition data
*        compos.   int.numb. --->...............................
15440201  3        3
15440202  4        5
*
*      hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*        gam.a.c.  mesh.int.numb. --->.........................
15440301  0.0      5
*
*      initial temperature data [according to 1cccg400]
*        temp.
*        ----
15440401  560.0    6
*
*      left boundary condition cards
*        bnd.vol.  incr.    type      ar.code   area      hsnumb.
15440501  544010000 0        1         1         0.234     1
*
*      right boundary condition cards
*        -"-       -"-       -"-       -"-       -"-       -"-
15440601  980010000 0        3950      1         0.234     1
*
*      source data cards
*        type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
15440701  0        0.0       0.0       0.0       1
*
*       additional left boundary cards
*        flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
15440801  0        0.0       0.0       0.0       1
*
**
*       lf.h.dh.  heated.lengths  grid.lengths   grid.losses   boil.f.  HS.no.
*       w1       w2       w3       w4       w5      w6      w7      w8        w9
15440801 0.      10.     10.      0.       0.      0.      0.      1.       1
*
```

```
*=====================================================================
*       steam generator - bottom plate
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
15220000  1      6       1       1      0.0
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
15220100  0            1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
15220101  3           95.0e-3
15220102  2           155.0e-3
*
* hs composition data
*       compos.   int.numb. --->...............................
15220201  3       3
15220202  4       5
*
*     hs source distribution data
*        format 1 [if w1 of 1cccg100=0.]
*       gam.a.c.  mesh.int.numb. --->.........................
15220301  0.0     5
*
*     initial temperature data [according to 1cccg400]
*       temp.
*             ----
15220401  560.0    6
*
*     left boundary condition cards
*       bnd.vol.  incr.    type     ar.code   area     hsnumb.
15220501  522010000 0       1       1       0.385    1
*
*     right boundary condition cards
*       -"-       -"-      -"-      -"-      -"-      -"-
15220601  980010000 0       3950     1        0.385     1
*
*     source data cards
*       type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
15220701  0       0.0      0.0      0.0      1
*
*      additional left boundary cards
*       flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
15220801  0       0.0      0.0      0.0      1
*
**
*      lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8       w9
15220801 0.      10.     10.     0.      0.      0.      0.      1.       1
*
*=====================================================================
*       steam generator - small cylinder
*=====================================================================
*
*
*     general hs data
*       ax.str.  rd.mesh  gm.type  ini.fl.  lft.bnd.  3*refl.w[opt]
15480000  3      6       2       1      98.5e-3
*
*     hs mesh flags
*       mesh.loc.flg.  mesh.form.flg.
15480100  0            1
*
*     hs mesh interval data (format 1 is used)
*       numb.of.int.  rght.coor. --->............................
15480101  3           109.5e-3
15480102  2           169.5e-3
*
```

```
* hs composition data
*       compos.  int.numb. --->...............................
15480201  3        3
15480202  4        5
*
*     hs source distribution data
*       format 1 [if w1 of 1cccg100=0.]
*      gam.a.c.  mesh.int.numb. --->.........................
15480301  0.0      5
*
*     initial temperature data [according to 1cccg400]
*      temp.
*            ----
15480401  560.0    6
*
*     left boundary condition cards
*      bnd.vol.  incr.     type     ar.code   area     hsnumb.
15480501  546010000 10000   1        1       0.38     2
*
15480502  548010000 0        1        1       0.228    3
*
*     right boundary condition cards
*      -"-       -"-       -"-       -"-       -"-       -"-
15480601  980010000 0        3950     1       0.38     2
*
15480602  980010000 0        3950     1       0.228    3
*
*     source data cards
*      type  multipl.  dir.heat.for.lft.bnd.  for.right  heat.str.numb.
15480701  0        0.0      0.0      0.0      3
*
*     additional left boundary cards
*      flgs.  ht.trn.h.diam.  heated.eq.diam.  length  ht.str.numb.
15480801  0        0.0      0.0      0.0      3
*
**
*     lf.h.dh. heated.lengths  grid.lengths  grid.losses  boil.f.  HS.no.
*      w1      w2      w3      w4      w5      w6      w7      w8      w9
15480801 0.      10.     10.     0.      0.      0.      0.      1.      3
*
*
*
*
*##############################################################################
*##############################################################################
*  heat structure thermal property data
*##############################################################################
*
*     composition type and data format
*      mat.type  con.flg.  cap.flg.
20100100  tbl/fctn  1        1        * stainless steel
20100200  tbl/fctn  1        1        * isolation material in the core
20100300  tbl/fctn  1        1        * mn-steel
20100400  tbl/fctn  1        1        * insulation material for piping etc.
*
*=============================================================================
*=============================================================================
*     stainless steel thermal conductivity
*=============================================================================
*
*     thermal conductivity data
*      temp.     cond.(or mole fract.)
20100101  293.     14.7
20100102  473.     17.3
20100103  773.     21.0
20100104  973.     21.0
*=============================================================================
*     stainless steel heat capacity
*=============================================================================
*     volumetric heat capacity data
*      temp.     cap.
20100151  293.     .3900e+7
```

```
20100152 773.     .4836e+7
20100153 973.     .4836e+7        *= ad-hoc extended
*
*
*=====================================================================
*=====================================================================
*       core isolation material thermal conductivity
*=====================================================================
*      thermal conductivity data
*       temp.     cond.(or mole fract.)
20100201 273.     2.558
20100202 473.     2.558
20100203 773.     2.558
*=====================================================================
*       core isolation material heat capacity
*=====================================================================
*
*      volumetric heat capacity data
*       temp.     cap.
20100251 293.     .2146e+7
20100252 773.     .2484e+7
*
*
*=====================================================================
*=====================================================================
*       mn-steel thermal conductivity
*=====================================================================
*      thermal conductivity data
*       temp.     cond.(or mole fract.)
20100301 373.     51.1
20100302 473.     47.7
20100303 573.     44.2
20100304 773.     42.2
*=====================================================================
*       mn-steel heat capacity
*=====================================================================
*      volumetric heat capacity data
*       temp.     cap.
20100351 293.     .3900e+7
20100352 773.     .3900e+7
*
*
**=====================================================================
*=====================================================================
*    system insulation material thermal conductivity
*=====================================================================
*      thermal conductivity data
*       temp.     cond.(or mole fract.)
20100401 273.     2.558
20100402 473.     2.558
20100403 773.     2.558
*=====================================================================
*      volumetric heat capacity data
*       temp.     cap.
20100451 293.     .2146e+7
20100452 773.     .2484e+7
*
*
*##################################################################
* g e n e r a l   t a b l e s
*##################################################################
*
*
*====================================================================
* pressurizer heater
* -----------------
*====================================================================
*
*      table type and multiplaier data
*        tab.type   tab.trip.number  factors
20242200  power     658          1.        1.
*
```

```
*       general table data
*        arg.val.  func.val.
20242201 -1.0       0.
*
20242202  0.0       3200.
20242202  0.0       2000.
*
*=====================================================================
* core simulator power
* ---------------------
*=====================================================================
*
*       table type and multiplaier data
*         tab.type   tab.trip.number  factors
20290000   power     602              1.        1000.
*
*       general table data
*        arg.val.  func.val.
20290001 -1.0       654.0          * SPE1 power curve
20290002  0.0       654.0
20290003  1.0       577.2
20290004  2.0       496.6
20290005  3.0       421.3
20290006  4.0       398.4
20290007  5.0       371.5
20290008  7.0       234.0
20290009  7.001      234.0
20290010  10.0      147.6
20290011  14.0      88.0
20290012  19.0      58.5
20290013  24.0      47.5
20290014  30.0      41.4
20290015  60.0      34.6
20290016  100.0      30.3
20290017  200.0      23.2
20290018  400.0      19.3
20290019  800.0      15.0
20290020  1000.0     15.0
*
20290001 -1.0       665.5          * T2.1 power curve
20290002  0.0       665.5
20290003  1.0       665.5
20290004  2.97      665.
20290005  3.95      637.3
20290006  4.94      574.8
20290007  6.92      421.3
20290008  9.89      261.9
20290009  11.8      187.9
20290010  14.9      119.9
20290011  19.8      65.1
20290012  24.7      44.3
20290013  30.6      35.2
20290014  50.4      31.3
20290015  100.0      25.3
20290016  200.0      19.5
20290017  400.0      15.4
20290018  800.0      15.4
20290019  1050.0     15.0
20290020  1500.0     15.0
20290021  1800.0     15.6
*
20290001 -1.0       136.3          * T2.3 power curve
20290002  0.0       136.3
20290003  1.0       136.1
20290004  2.97      135.6
20290005  3.95      121.7
20290006  4.94      109.2
20290007  6.92      84.0
20290008  9.89      61.6
20290009  11.8      51.6
20290010  14.9      42.8
20290011  19.8      36.5
```

```
20290012 24.7    34.2
20290013 30.6    33.4
20290014 50.4    30.4
20290015 100.0    25.5
20290016 200.0    19.5
20290017 400.0    16.2
20290018 800.0    15.7
20290019 1050.0    15.6
20290020 1500.0    15.5
20290021 1800.0    15.6
20290022 2500.0    15.4
20290023 3550.0    15.4
20290024 4000.0    15.0
20290025 4452.0    15.0
20290026 4454.0    0.0
*
*=====================================================================
* hot leg - heat transfer coefficient
*=====================================================================
*
*      table type and multiplaier data
*        tab.type   tab.trip.number  factors
20291000  htc-t
*
*      general table data
*        arg.val.   func.val.
20291001  0.       25.
***
*=====================================================================
* cold leg - heat transfer coefficient
*=====================================================================
*
*      table type and multiplaier data
*        tab.type   tab.trip.number  factors
20292000  htc-t
*
*      general table data
*        arg.val.   func.val.
20292001  0.       7.8
*

*=====================================================================
* reactor downcomer - heat transfer coefficient
*=====================================================================
*
*      table type and multiplaier data
*        tab.type   tab.trip.number  factors
20293300  htc-t
*
*      general table data
*        arg.val.   func.val.
20293301  0.       6.
*
*=====================================================================
* reactor vessel - heat transfer coefficient
*=====================================================================
*
*      table type and multiplaier data
*        tab.type   tab.trip.number  factors
20293000  htc-t
*
*      general table data
*        arg.val.   func.val.
20293001  0.       2.
20293001  0.       5.
20293001  0.       2.8
*=====================================================================
* reactor vessel upper part - heat transfer coefficient
*=====================================================================
*
*      table type and multiplaier data
*        tab.type   tab.trip.number  factors
```

```
20293500   htc-t
*
*     general table data
*       arg.val.   func.val.
20293501  0.       2.8
*
*
*=====================================================================
* pressurizer - heat transfer coefficient
*=====================================================================
*
*     table type and multiplaier data
*       tab.type   tab.trip.number  factors
20294000   htc-t
*
*     general table data
*       arg.val.   func.val.
20294001  0.       8.2
***
*=====================================================================
* steam generator secondary - heat transfer coefficient
*=====================================================================
*
*     table type and multiplaier data
*       tab.type   tab.trip.number  factors
20295000   htc-t
*
*     general table data
*       arg.val.   func.val.
20295001  0.       2.1
*
*
*######################################################################
*# c o n t r o l   s y s t e m
*######################################################################
*
*======================================================================
*  c.v. for core power
*======================================================================
*---- ----1---- ----2---- ----3---- ----4---- ----5---- ----6---- ----7
20509000  pow1     function  1.0      665.5     1
20509001  time     0         900

*---- ----1---- ----2---- ----3---- ----4---- ----5---- ----6---- ----7
20509100  pow-off  tripunit  1.       1.        1
20509101 -690
*
*---- ----1---- ----2---- ----3---- ----4---- ----5---- ----6---- ----7
20509500  sumpTQ20  mult     1.       665.5     1
20509501  cntrlvar  90
+         cntrlvar  91


*
*
*
*
*=====================================================================
*=====================================================================
*=  control variables for coast-down simulation valves
*=====================================================================
*=====================================================================
*
*
*=====================================================================
*  c.v. for valve "155"
*=====================================================================
*
*     control component type card
*       name     type      scal.  ini.val.  in.fl.  lim.ctrl.
20519000  mv11na   constant  0.0
*
```

```
*
*
*     control component type card
*      name     type     scal.  ini.val.  in.fl.  lim.ctrl.
*0519000 mv11na   sum      1.0    0.0      1      3    0.0  1.0
*
*0519001 0.0
*
*==================================================================
* c.v. for valve "185"
*==================================================================
*
*     control component type card
*      name     type     scal.  ini.val.  in.fl.  lim.ctrl.
20519100 pv11na   sum      1.0     0.25     0
*
*     control component data card
*
20519101 0.0      1.0      quale    460010000
*
*==================================================================
* c.v. for valve "165"
*==================================================================
*
*     control component type card
*      name     type     scal.  ini.val.  in.fl.  lim.ctrl.
20519200 mv12na   constant 1.0
*
*
*
*     control component type card
*      name     type     scal.  ini.val.  in.fl.  lim.ctrl.
*0519000 mv11na   sum      1.0    0.0      1      3    0.0  1.0
*
*     control component data card
*
*0519001 0.0
*
*==================================================================
*==================================================================
*= steady state control system
*==================================================================
*==================================================================
*
*==================================================================
* primary coolant pump speed controllers
*==================================================================
*
* calculate mass flow error
*
*     control component type card
*      name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20590100 mflowerr sum      1.0     0.0      1
*
*     control component data card
*
*       ----  ----  ----  ----     ----  ----  ----
*
20590101 4.7300   -1.0     mflowj   170010000
20590101 4.400    -1.0     mflowj   170010000
20590101 4.3400   -1.0     mflowj   170010000
20590101 1.210    -1.0     mflowj   170010000
* sp     xxxxxx
* sp - cold leg mass flow setpoint
*
*
*
* pump speed
*
*     control component type card
*      name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20590200 pcpspeed integral 8.2     155.0    1
```

```
*
20590201  cntrlvar  901
*
*
*
*======================================================================
*        pressurizer liquid level
**=====================================================================
*
*      control component type card
*        name       type      scal.    ini.val.  in.fl.  lim.ctrl.
20540000  preslqlv  sum       1.0        9.33      1
*
*      control component data card
*
20540001  7.95      0.085      voidf     430020000
20540002            0.225      voidf     420010000
20540003            0.557      voidf     420020000
20540004            0.600      voidf     420030000
20540005            0.600      voidf     420040000
*
*
*======================================================================
*  pressure difference in prz vessel
*======================================================================
*
*      control component type card
*        name       type      scal.    ini.val.  in.fl.  lim.ctrl.
20541000  ko-p-dif  sum       1.0        1.+4      1
*
*      control component data card
*
20541001  0.        1.         p         430020000
*
20541002            -1.        p         420050000
*
*
*======================================================================
*  prz level along pressure difference  ... repaired
*  ------==================---------          ========
*======================================================================
*
*      control component type card
*        name       type      scal.    ini.val.  in.fl.  lim.ctrl.
20542000  ko-p-lev  sum       1.         9.33      1
*
*      control component data card
*
20542001  7.95      1.30688-4  cntrlvar  410
20542001  7.95      1.50291-4  cntrlvar  410
*


*======================================================================
*======================================================================
*=     control variables for parameters to be calculated
*======================================================================
*======================================================================


*======================================================================
*     Time in seconds after transient start
*---- -----1---- -----2---- -----3---- -----4---- -----5---- -----6---- -----7
20513300  tran-sec  sum       1.0       0.0       1
20513301  -1000.    1.        time      0


*======================================================================
*  pressure drop in the core
*======================================================================
*
*      control component type card
```

```
*      name      type     scal.    ini.val.  in.fl.  lim.ctrl.
20581300 dpcore   sum      1.0      0.0      1
*
*      control component data card
*
20581301 0.0      1.0      p        026020000
20581302         -1.0      p        052010000

*=====================================================================
* pressure drop in sg's primery part
*=====================================================================
*
*      control component type card
*      name      type     scal.    ini.val.  in.fl.  lim.ctrl.
20581400 dpsgprim sum      1.0      0.0      1
*
*      control component data card
*
20581401 0.0      1.0      p        120010000
*
20581402         -1.0      p        140010000
*
*=====================================================================
* pressure difference between break point and steam dome
*=====================================================================
*
*      controi component type card
*      name      type     scal.    ini.val.  in.fl.  lim.ctrl.
20581500 dpbreak  sum      1.0      0.0      1
*
*      control component data card
*
20581501 0.0      1.0      p        128010000
*
20581502         -1.0      p        548010000
*
*
*=====================================================================
* liquid level in ACCUMs
*=====================================================================
*
*      control component type card
*      name      type     scal.    ini.val.  in.fl.  lim.ctrl.
*
20581000 L-SIT1dc sum      1.000    9.64     0
20581001 7.975    2.47     voidf    810010000
*
20581200 L-SIT2up sum      1.000    10.05    0
20581201 7.975    2.47     voidf    820010000
*
*
*=====================================================================
* liquid level in "reactor" vessel
*=====================================================================

20581600 L-LP     sum      1.000    0.0      1
20581601 0.0      0.190    voidf    002010000
20581602          0.190    voidf    024010000
20581603          0.307    voidf    026010000
20581604          0.307    voidf    026020000


20581700 L-core   sum      1.000    0.0      1
20581701 0.0      0.500    voidf    044010000
20581702          0.500    voidf    044020000
20581703          0.500    voidf    044030000
20581704          0.500    voidf    044040000
20581705          0.25     voidf    044050000
20581706          0.25     voidf    044060000


20581800 L-UP     sum      1.000    0.0      1
```

```
20581801 0.0      0.26     voidf    052010000
20581802          0.455    voidf    054030000
+          0.455    voidf    054040000
20581803          0.17     voidf    058020000
20581804          0.5      voidf    060010000
+          0.5      voidf    060020000
+          0.333    voidf    060030000
20581806          0.058    voidf    062010000
20581807          0.170    voidf    064010000
20581808          0.5225   voidf    068010000
20581809          0.5225   voidf    068020000
20581810          0.5225   voidf    068030000
20581811          0.5225   voidf    068040000

20581900 L-RV     sum      1.000    8.485    1
20581901 0.0      1.       cntrlvar 816
20581902          1.       cntrlvar 817
20581903          1.       cntrlvar 818
*
*======================================================================
* liquid level in head of "reactor" vessel
*======================================================================
*
*     control component type card
*       name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20582000 upliqlvl sum      1.000    8.485    0
*
*     control component data card
*
20582001 6.167    0.058    voidf    062010000
20582002          0.170    voidf    064010000
20582003          0.5225   voidf    068010000
20582004          0.5225   voidf    068020000
20582005          0.5225   voidf    068030000
20582006          0.5225   voidf    068040000
*
*
*
*
*======================================================================
* sg's outlet primary collector + adjacent part of cold leg liquid l.
*======================================================================
*
*     control component type card
*       name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20582200 clloopsl sum      1.0      8.445    0
*
*     control component data card
*
20582201 3.202    0.1100   voidf    156010000
20582202          0.5400   voidf    154010000
20582203          0.5400   voidf    154020000
20582204          0.5400   voidf    154030000
20582205          0.5400   voidf    154040000
20582206          0.7700   voidf    140010000
20582207          0.6100   voidf    142010000
20582208          0.6100   voidf    144010000
20582209          0.6100   voidf    146010000
20582210          0.2490   voidf    148010000
*
*======================================================================
* liquid level in the middle part of the hot leg
*======================================================================
*
*     control component type card
*       name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20582300 hllsreac sum      1.0      6.202    0
*
*     control component data card
*
20582301 4.802    0.28     voidf    106010000
20582302          0.28     voidf    106020000
```

```
20582303        0.28    voidf   106030000
20582304        0.28    voidf   106040000
20582305        0.28    voidf   106050000
*
*======================================================================
* sg's inlet primary collector + adjacent part of hot leg liquid level
*======================================================================
*
*     control component type card
*      name     type    scal.   ini.val.  in.fl.  lim.ctrl.
20582400 hllssgin  sum    1.06875   9.000    0
*
*     control component data card
*
20582401 4.802    0.770    voidf    106070000
20582402         0.770    voidf    120010000
20582403         0.610    voidf    122010000
20582404         0.610    voidf    124010000
20582405         0.610    voidf    126010000
20582406         0.249    voidf    128010000
*
*======================================================================
* liquid level in the "reactor" downcomer
*======================================================================
*
*     control component type card
*      name     type    scal.   ini.val.  in.fl.  lim.ctrl.
20582500 dcliqlvl  sum     1.0      4.995    0
*
*     control component data card
*
20582501 0.190    0.112    voidf    008010000
20582502         0.116    voidf    012010000
20582503         0.5695   voidf    014010000
20582504         0.5225   voidf    014020000
20582505         0.5225   voidf    014030000
20582506         0.5225   voidf    014040000
20582507         0.5225   voidf    014050000
20582508         0.5225   voidf    014060000
20582509         0.5225   voidf    014070000
20582510         0.5225   voidf    014080000
20582511         0.350    voidf    018010000
*
*======================================================================
* water level in sg
*======================================================================
*
*     control component type card
*      name     type    scal.   ini.val.  in.fl.  lim.ctrl.
20582800 sgliqlvl  sum     1.       8.58     1
*
20582801 6.33     1.0      cntrlvar  528
*
*
*
*======================================================================
* liquid level in "reactor" part of cold leg
*======================================================================
*
*     control component type card
*      name     type    scal.   ini.val.  in.fl.  lim.ctrl.
20582900 cllopslr  sum     1.0      4.705    0
*
*     control component data card
*
20582901 3.202    0.5000   voidf    194010000
20582902         0.5000   voidf    194020000
20582903         0.5000   voidf    194030000
*
*
*======================================================================
*======================================================================
```

```
* total (approximate) heat transfer in core simulator
*=================================================================
*
20504200 q-core   sum     1.0     654.5+3  0
20504201 0.     1.      q       044010000
20504202        1.      q       044020000
20504203        1.      q       044030000
20504204        1.      q       044040000
20504205        1.      q       044050000
20504206        1.      q       044060000
*
**================================================================
20504400 Q-core   sum     1.0     654.5+3  1
20504401 0.0      1.0     cntrlvar 042
20504402          1.0     cntrlvar 545
*
*=================================================================
* heat transfer in sg tubing and collectors
*=================================================================
*
*     control component type card
*      name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20552000 q-sg-tub sum     1.0      0.      1
*
*     control component data card
*
20552001 0.     1.      q       522010000
20552002        1.      q       524010000
20552003        1.      q       526010000
*
*
*=================================================================
*=================================================================
* heat loss at steam generator secondary
*=================================================================
*
*     control component type card
*      name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20553000 Qout-SG  sum     1.0      0.      1
*
*     control component data card
*
20553001 0.     1.      q       532010000
20553002        1.      q       534010000
20553003        1.      q       536010000
20553004        1.      q       544010000
20553005        1.      q       546010000
20553006        1.      q       546020000
20553007        1.      q       548010000
20553008        1.      q       538010000
*
*=================================================================
* heat losses from PRZ
*=================================================================
*
20554000 Qout-PRZ sum     1.0      0.      1
20554001 0.     0.0476  htrnr   420000100
+               0.0270  htrnr   420000200
+               0.0714  htrnr   420000300
+               0.1767  htrnr   420000400
+               0.1904  htrnr   420000500
+               0.1904  htrnr   420000600
+               0.0968  htrnr   420000700
*=================================================================
* heat losses from HL
*=================================================================
*
20554100 Qout-HL  sum     1.0      0.      1
20554101 0.     1.      q       106010000
20554102        1.      q       106020000
20554103        1.      q       106030000
```

```
20554104        1.    q     106040000
20554105        1.    q     106050000
20554106        1.    q     106060000
20554107        1.    q     106070000
*
20554108        1.    q     102010000
20554109        1.    q     120010000
*
*======================================================================
* heat losses from CL
*======================================================================
*
20554200 Qout-aux  sum      1.0     0.     1
20554201 0.     1.     q      140010000

20554202        1.    q     154010000
+           1.    q    154020000
+           1.    q    154030000
+           1.    q    154040000

20554203        1.    q     156010000

20554204        1.    q     158010000

20554205        1.    q     166010000
+           1.    q    166020000
+           1.    q    166030000
+           1.    q    166040000
*======================================================================
20554300 Qout-CL   sum      1.0     0.     1
20554301 0.     1.     cntrlvar  542

20554306        1.    q     170010000

20554307        1.    q     182010000
*
20554308        1.    q     190010000
+           1.    q    192010000
+           1.    q    194010000
+           1.    q    194020000
+           1.    q    194030000
+           1.    q    194040000

20554309        1.    q     196010000
+           1.    q    198010000
+           1.    q    198020000

*======================================================================
* heat losses from DC
*======================================================================
*
20554400 Qout-DC  sum      1.0     0.     1
20554401 0.     1.     q      008010000
+           1.    q    012010000

20554402        1.    q     014010000
+           1.    q    014020000
+           1.    q    014030000
+           1.    q    014040000
+           1.    q    014050000
+           1.    q    014060000
+           1.    q    014070000
+           1.    q    014080000

20554403        1.    q     018010000

*======================================================================
* heat losses from reactor upward part
*======================================================================
*
20554500 Qout-cor sum      1.0     0.     1
20554501 0.     0.0942   htrnr    026000300
```

```
+            0.0942   htrnr   026000400
+            0.0942   htrnr   026000500
+            0.0942   htrnr   026000600
+            0.0471   htrnr   026000700
+            0.0471   htrnr   026000800
*=====================================================================
20554600  Qout-COR  sum    1.0    0.     1
20554601  0.     1.     q      002010000
20554602         1.     q      024010000
+            1.     q      026010000
+            1.     q      026020000
20554603         1.     cntrlvar  545
20554604         1.     q      052010000
+            1.     q      052020000
+            1.     q      054010000
+            1.     q      054020000
+            1.     q      054030000
+            1.     q      054040000
+            1.     q      054050000
+            1.     q      054060000

*=====================================================================
* heat losses from reactor upward part
*=====================================================================
20554700  Qout-UP   sum    1.0    0.     1
20554701  0.     1.     q      058010000
+            1.     q      058020000

20554705         1.     q      060010000
+            1.     q      060020000
+            1.     q      060030000
+            1.     q      062010000
+            1.     q      064010000

20554706         1.     q      068010000
+            1.     q      068020000
+            1.     q      068030000
+            1.     q      068040000

*=====================================================================
* total heat losses from primary loop (i.e. not SG and not PRZ)
*=====================================================================
*
20554800  Qout-RCS  sum    1.0    0.     1
20554801  0.     1.     cntrlvar  541    * HL
+            1.     cntrlvar  543    * CL
+            1.     cntrlvar  544    * DC
+            1.     cntrlvar  546    * Core+
+            1.     cntrlvar  547    * UP

*=====================================================================
* total heat losses from the system (prim + sec)
*=====================================================================
*
20554900  Qout-ALL  sum    1.0    0.     1
20554901  0.     1.     cntrlvar  530   * SG sec
20554902         1.     cntrlvar  540   * PRZ
20554903         1.     cntrlvar  548   * R+loop

*=====================================================================
* water level in sg - pure value
* ------------------------------
*=====================================================================
*
*    control component type card
*     name     type    scal.   ini.val.  in.fl.  lim.ctrl.
20552800  sgliqlvl  sum     1.     2.25    1
*
20552801  0.     0.41    voidf   522010000
+            0.2     voidf   532010000
20552802         0.41    voidf   524010000
+            0.2     voidf   534010000
```

```
20552803        0.41    voidf   526010000
+            0.2     voidf   536010000
20552804        0.195   voidf   544010000
+            0.2     voidf   538010000
20552805        0.38    voidf   546010000
+            0.385   voidf   546020000
20552806        0.228   voidf   548010000
*
*=====================================================================
* time of scram
*=====================================================================
*
*     control component type card
*      name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20560200  scram-t  tripdlay  1.     4.3     1
*
*     control component data card
*
20560201  602
*
*=====================================================================
* time of pump cost-down
*=====================================================================
*
*     control component type card
*      name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20560300  pump-t   tripdlay  1.     12.0    1
*
*     control component data card
*
20560301  603
*
*=====================================================================
* time of pump cost-down
*=====================================================================
*
*     control component type card
*      name     type     scal.   ini.val.  in.fl.  lim.ctrl.
20565800  pump-t   tripunit  1.     0.      1
*
*     control component data card
*
20565801  658
*
*=====================================================================
* integrated mass flow through prz spray valve
*=====================================================================
*
*     control component type card
*       name     type     scal.  ini.val.  in.fl.  lim.ctrl.
20591100   int-leak  integral  1.   0.      0
*
*     control component data card
*
*      ----  ----  ----  ----      ----  ----  ----
*
20591101   mflowj       445000000
*
*
*=====================================================================
* integrated break flow
*=====================================================================
20591300   int-leak  integral  1.    0.      0
20591301   mflowj   935000000
*
*
*=====================================================================
* total ECCS flow CCs
*=====================================================================

20591900  mf-ACCs   sum      1.000    0.0    1
20591901  0.0      1.0     mflowj   810010000
```

```
20591902         1.0     mflowj   820010000

20592000 mf-ECCS  sum     1.000   0.0   1
20592001 0.0      1.0     mflowj   855000000
20592002          1.0     mflowj   865000000
20592003          1.0     cntrlvar  919

20592200 ma-ECCS  integral 1.    0.      0
20592201 cntrlvar 920

*===========================================================================
*   Maximum clad temperature
*---- ----1---- ----2---- ----3---- ----4---- ----5---- ----6---- ----7
20593300 TmaxCLAD stdfnctn 1.      0.      1
20593301 max      httemp   044000104
+                 httemp   044000204
+                 httemp   044000304
+                 httemp   044000404
+                 httemp   044000504
+                 httemp   044000604

*===========================================================================
*   Maximum "fuel" temperature
*---- ----1---- ----2---- ----3---- ----4---- ----5---- ----6---- ----7
20594400 TmaxFUEL stdfnctn 1.      0.      1
20594401 max      httemp   044000101
+                 httemp   044000201
+                 httemp   044000301
+                 httemp   044000401
+                 httemp   044000501
+                 httemp   044000601

. . . . . . . . . . . . . . . . . e n d . . . . . . . . . . . . . . .
```

APPENDIX B LISTING OF STRIP FILE

```
*##########################################################################
*##########################################################################
*
=stri.p07 ... stripping of PMK2 calculation results
*
*=========================================================================
*
100   strip   fmtout
*
103   0       ncmpress
103   0   *   ncmpress
*
*=========================================================================
*
*
*====================================
*====================================
* Common and "quick-overview" strips:
*====================================
*
1001     time      0          * calculation time
1002     cntrlvar  133          * transient time
1003     cputime    0
1004     emass      0
1005     dt       0
1006     dtcrnt    0

1007     cntrlvar  913          * integrated break flow
1008     cntrlvar  920          * total ECCS
1009     cntrlvar  922          * integrated ECCS flow

1010     p        052010000     * upper plenum pressure
1011     p        548010000     * sg secondary pressure

1012     mflowj   935000000      * break flow
1013     mflowj   855000000      * HPSI
1014     mflowj   865000000      * LPIS
1015     cntrlvar 919           * HAs injection

1016     mflowj   198010000      * CL flow
1017     mflowj   026010000      * R (LP) flow

1018     mflowj   505000000      * FW flow
1019     mflowj   555000000      * MSLIV flow
*
1020     cntrlvar 819           * liquid level in reactor model
1021     cntrlvar 820           * level in reactor UH
1022     cntrlvar 825           * liquid level in reactor downcomer

1023     cntrlvar 823           * level in hot leg loop seal (reactor side)
1024     cntrlvar 824           * level in sg primary + hot leg
1025     cntrlvar 822           * level in sg primary + cold leg

1026     cntrlvar 400           * liquid level in the PRZ
1027     cntrlvar 420           * PRZ level acc. to delta-p

1028     cntrlvar 528           * SG level
1029     cntrlvar 828           * SG level (with scaling 1.008x)

1030     tempf    026020000      * core inlet temperature
```

```
1031    tempf    052010000    * core outlet temp.
1032    tempf    056010000    * core outlet temp.
1033    tempf    014010000    * DC top temp.

1034    tempf    140010000    * SG prim. outlet temp.
1035    tempf    524010000    * SG sec. temp.

1036    tempg    052010000    * steam temp at core outlet (UP bottom)
1037    tempg    056010000    * core outlet temp.
1038    tempg    140010000    * steam temp at SG prim. outlet
1039    sattemp  052010000    * sat. temp. in UP

1040    httemp   044000604    * heater rod 5.part surface temperature
1041    httemp   044000504    *
1042    httemp   044000404    *
1043    httemp   044000304    *
1044    httemp   044000204    *
1045    httemp   044000104    *

1046    httemp   014000104    * wall of downcomer upper part
1047    httemp   064000104    *

1048    cntrlvar 933          * max clad temp
1049    cntrlvar 944          * max fuel centre temp
*
1051    cntrlvar 044          * core heat production
1052    cntrlvar 520          * sg tubing heat transfer
1058    mflowj   465000000    * PRZ RV flow
1059    mflowj   585000000    * SDA flow
*
1060    voidf    420010000    *
1061    voidg    044050000    *
1062    voidg    062010000    *
1063    voidg    064010000    *
1064    voidg    068010000    *
*
1070    cntrlvar 810          * level in SIT1
1071    cntrlvar 812          * level in SIT2
1072    mflowj   810010000    * SIT1 flow
1073    mflowj   820010000    * SIT2 flow
1074                 *
1075    cntrlvar 817          * level in core
1076    cntrlvar 818          * level in UP
*
1080    cntrlvar 822          * level in CLsg
1081    cntrlvar 823          * level in HLr
1082    cntrlvar 824          * level in HLsg
1083    cntrlvar 829          * level in CLrcp
1089    tempg    060010000    * core outlet temp.  2
*
*
*
**
***
**
*
. . end of strip input .
```

APPENDIX C COMPLETE SET OF COMPARISON PLOTS FOR CASE T2.1

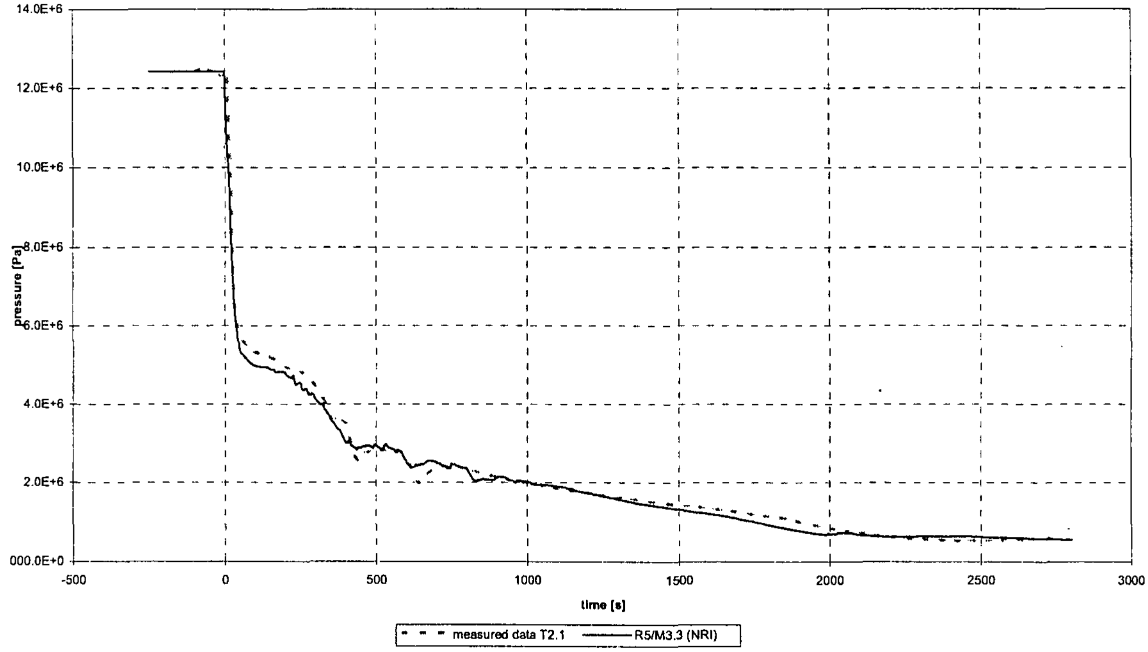

Fig.C-1 Primary pressure (T2.1)

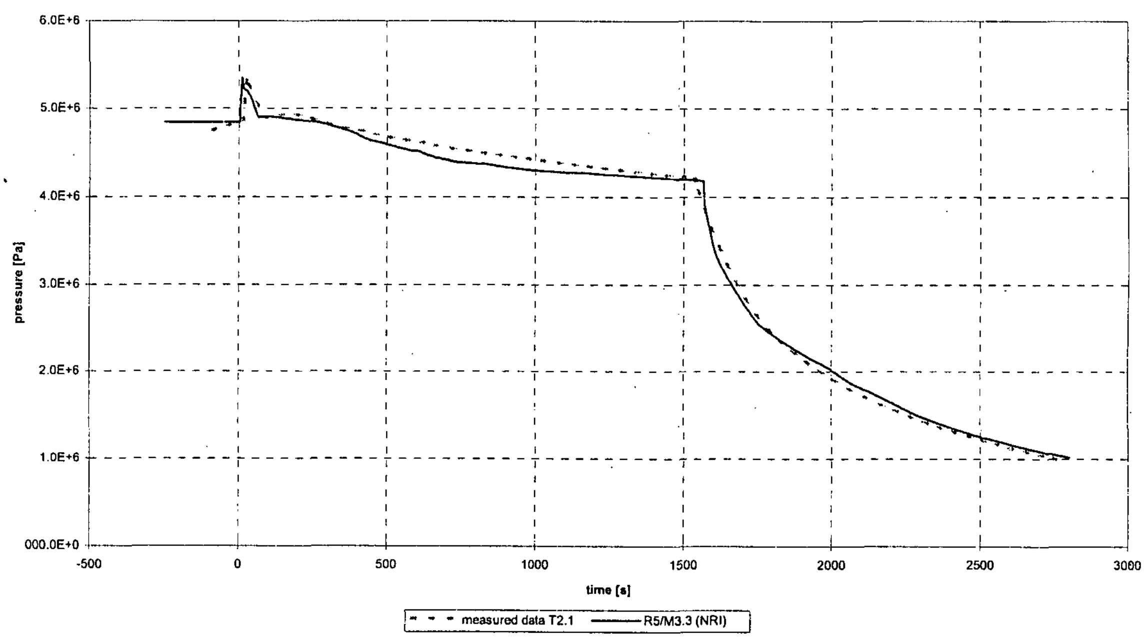

Fig.C-2 Secondary pressure (T2.1)

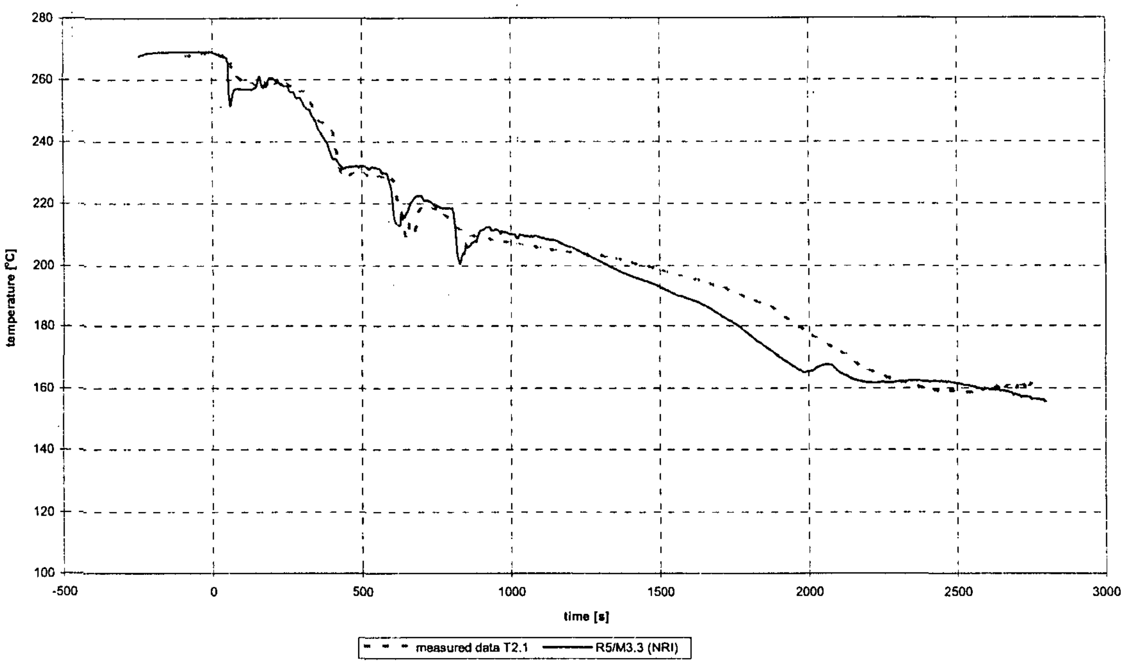

Fig.C-3 Core inlet temperature (T2.1)

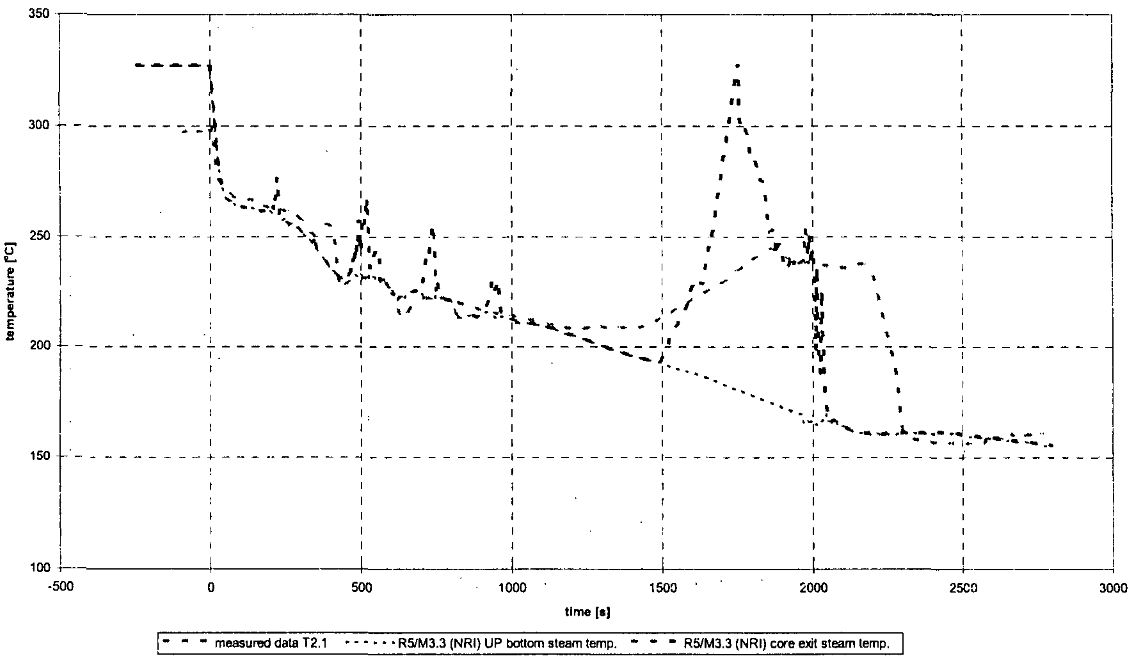

Fig.C-4 Core outlet temperature (T2.1)

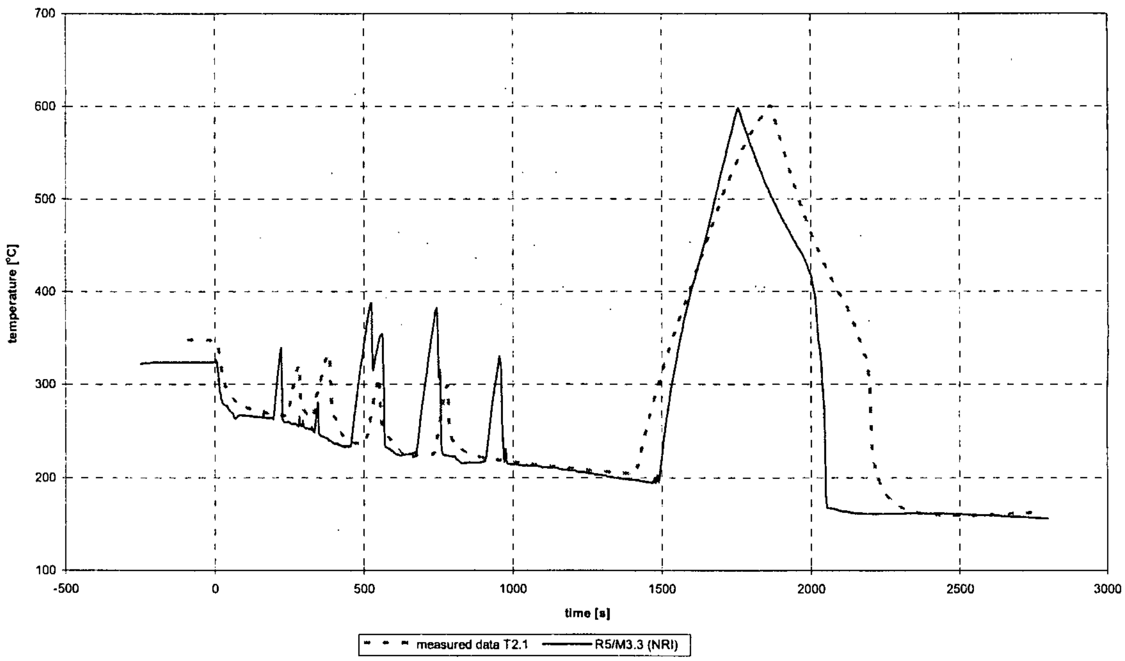

Fig.C-5 Cladding temperature (T2.1)

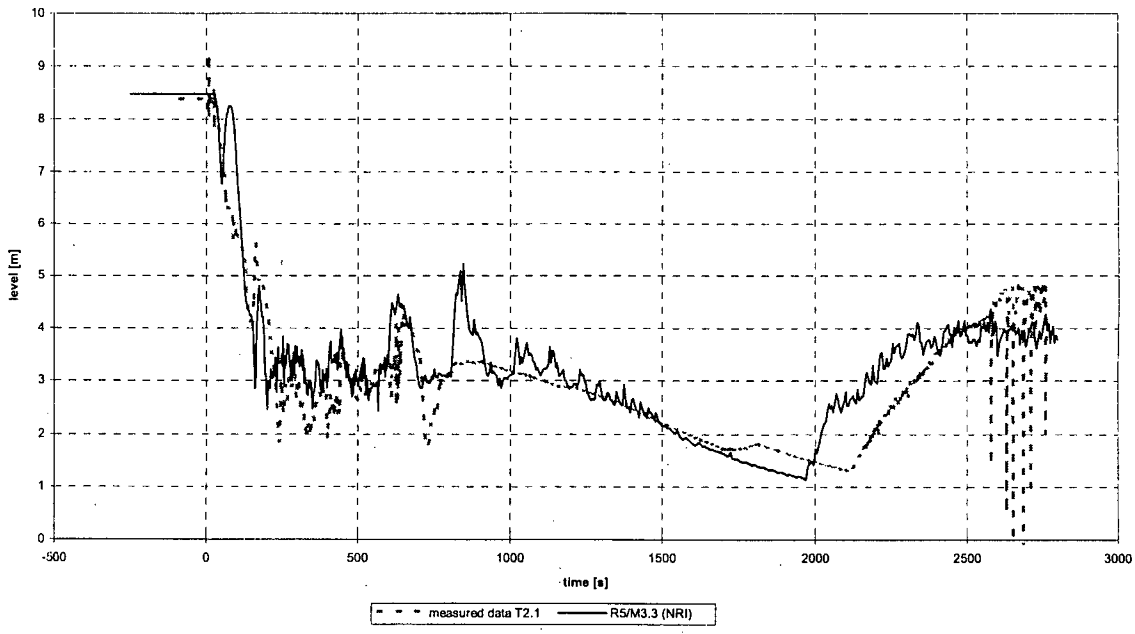

Fig.C-6 Collapsed level in reactor (T2.1)

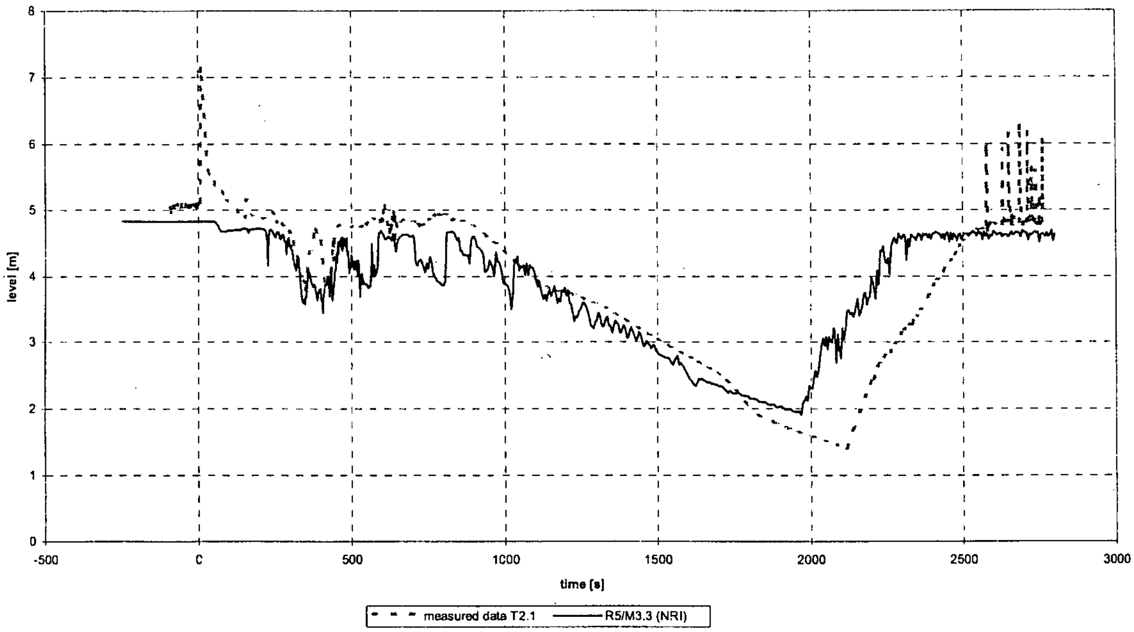

Fig.C-5 Collapsed level in reactor downcomer (T2.1)

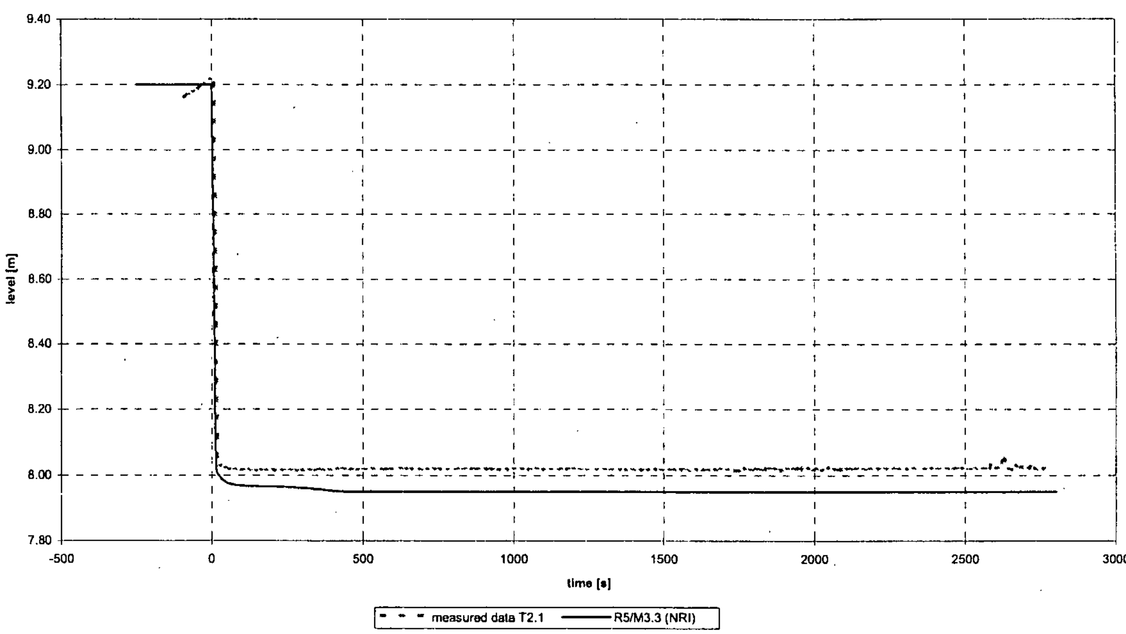

Fig.C-8 Collapsed level in PRZ (T2.1)

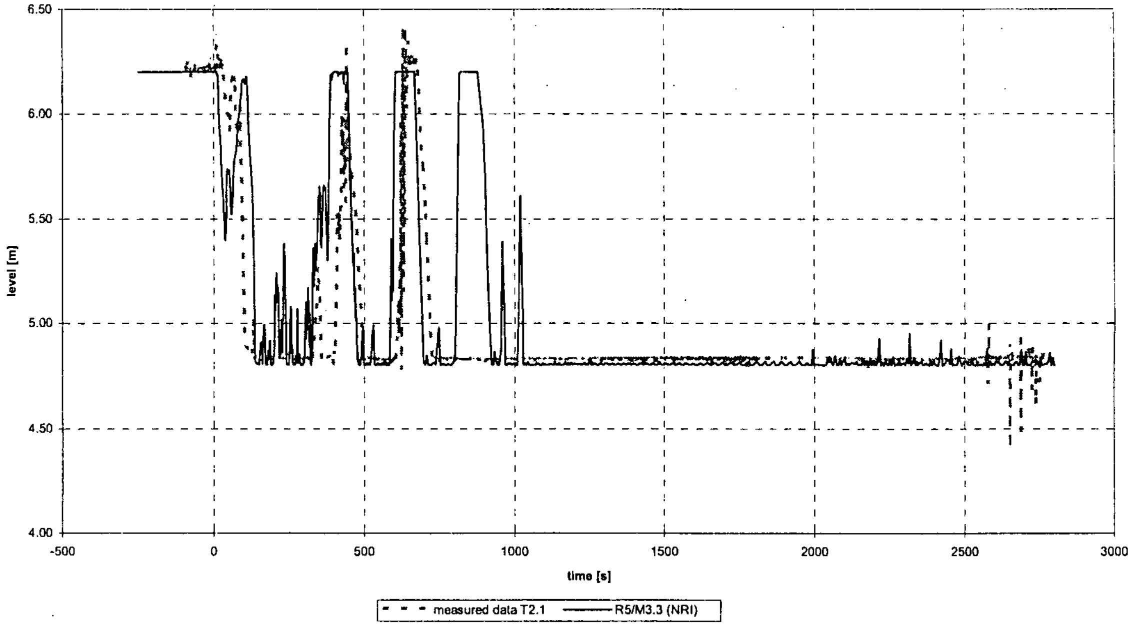

Fig.C-9 Collapsed level in hot leg loop seal – reactor side (T2.1)

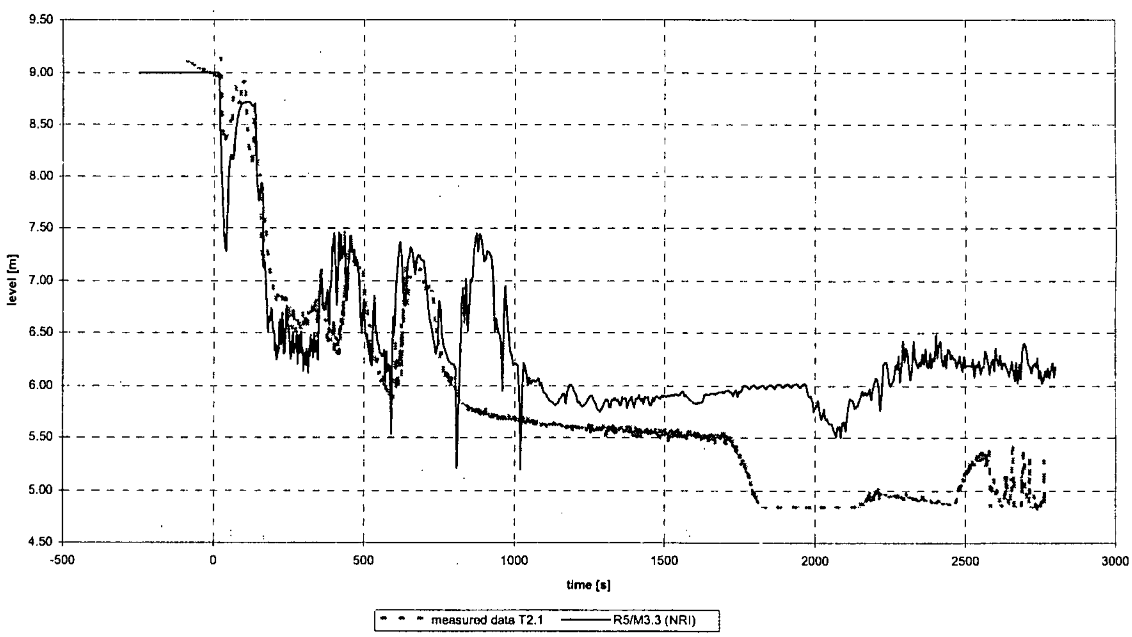

Fig.C-10 Collapsed level in hot leg loop seal – SG side (T2.1)

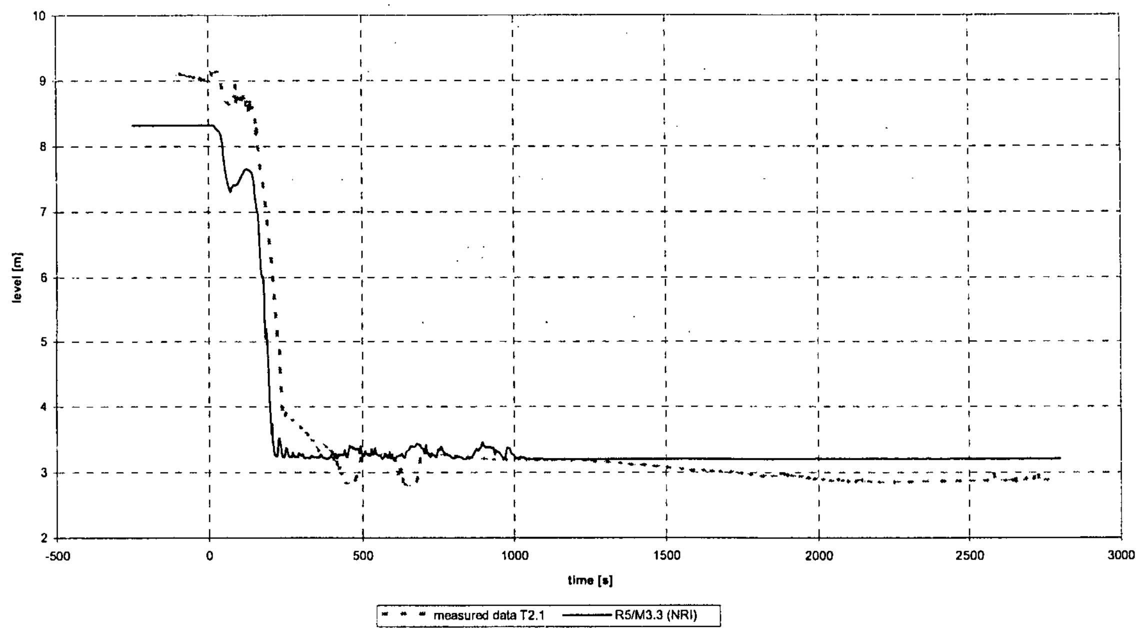

Fig.C-11 Collapsed level in cold leg loop seal – SG side (T2.1)

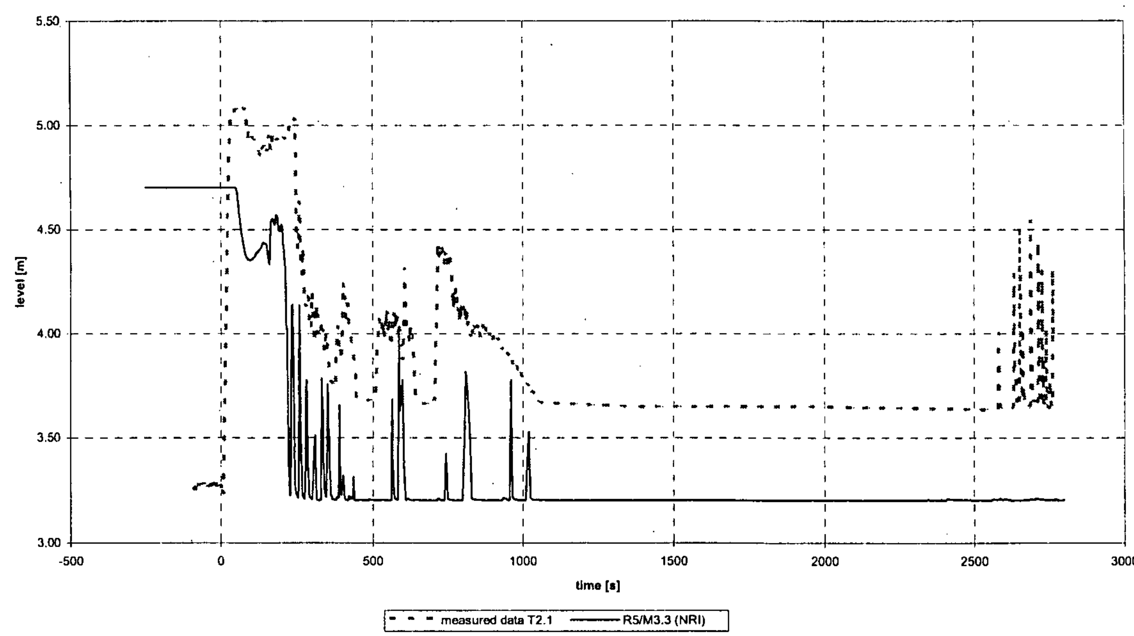

Fig.C-12 Collapsed level in cold leg loop seal – reactor side (T2.1)

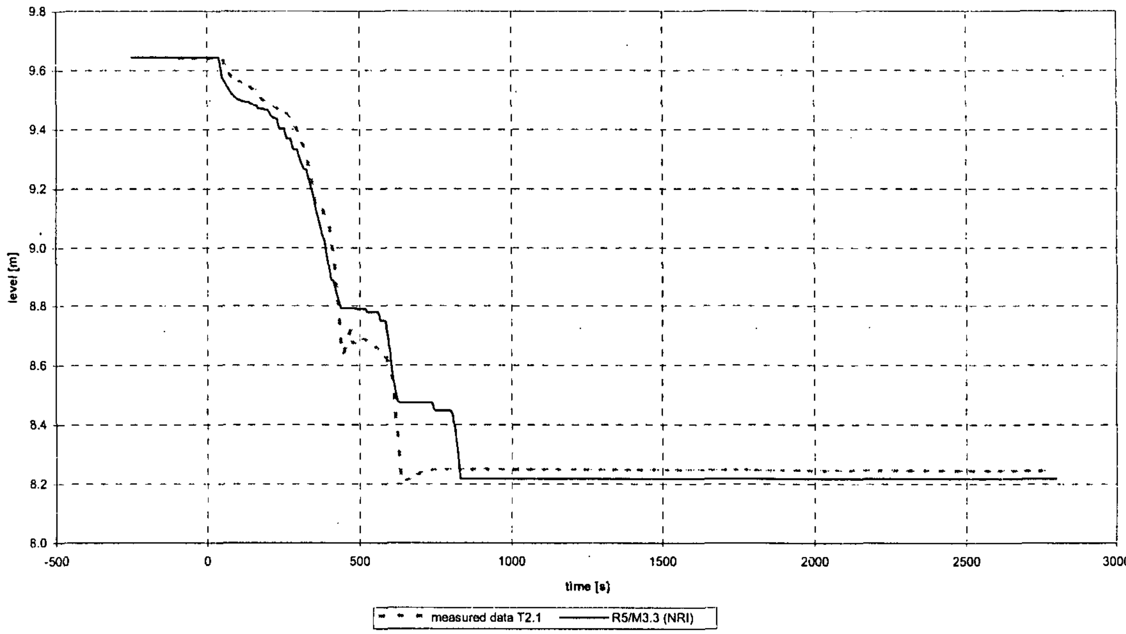

Fig.C-13 Collapsed level in hydroaccumulator SIT-1 (T2.1)

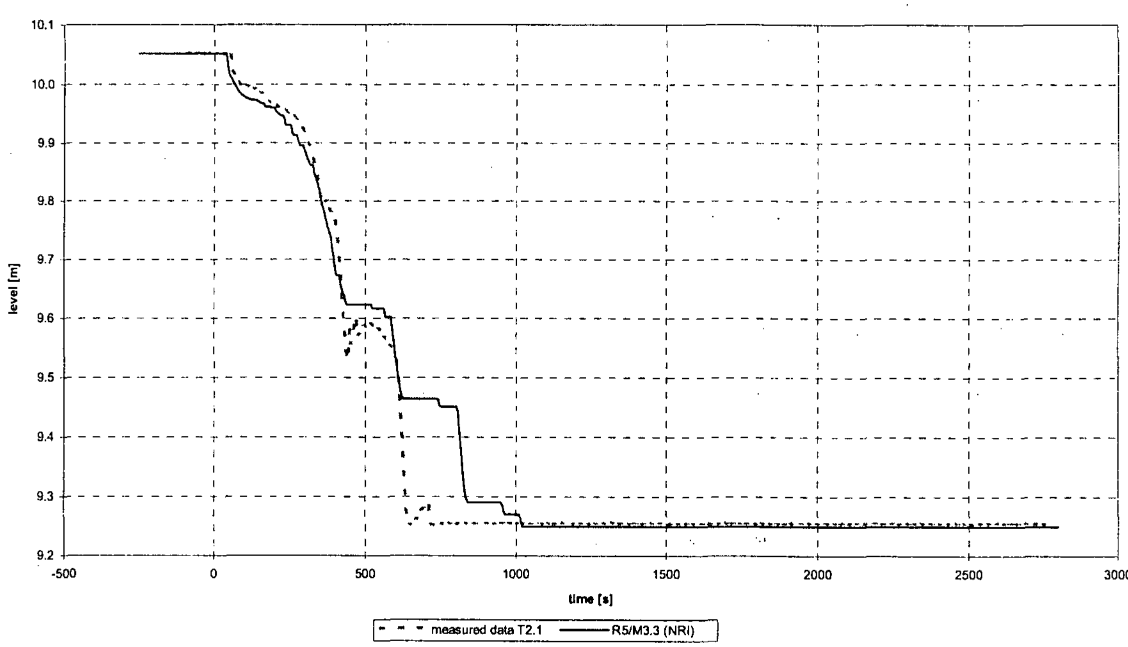

Fig.C-14 Collapsed level in hydroaccumulator SIT-2 (T2.1)

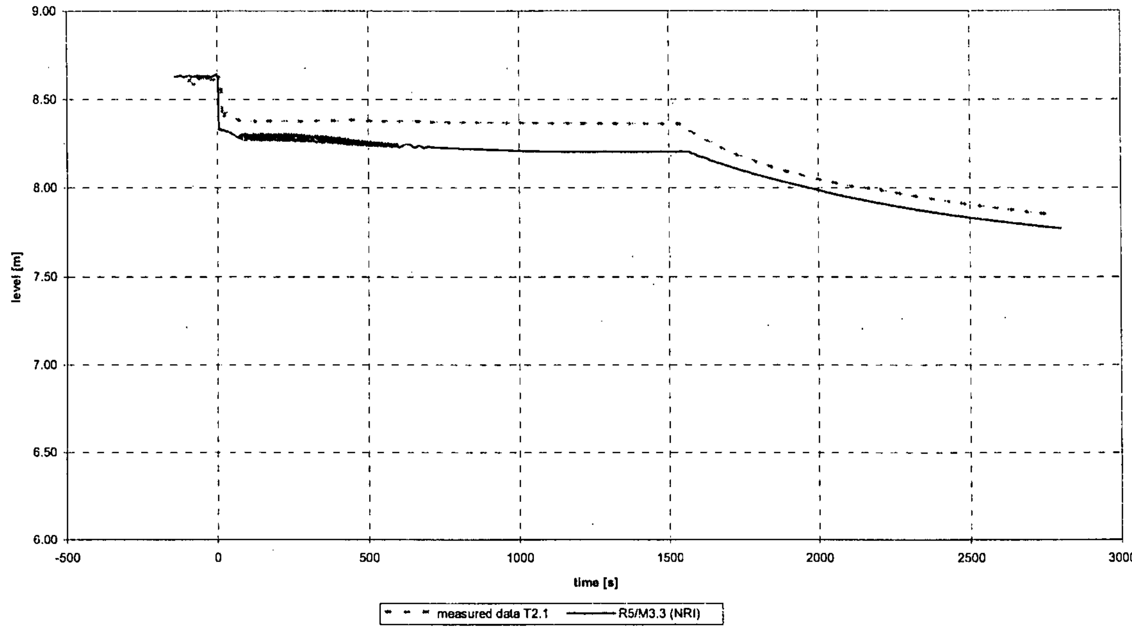

Fig.C-15 Collapsed level in SG secondary side (T2.1)

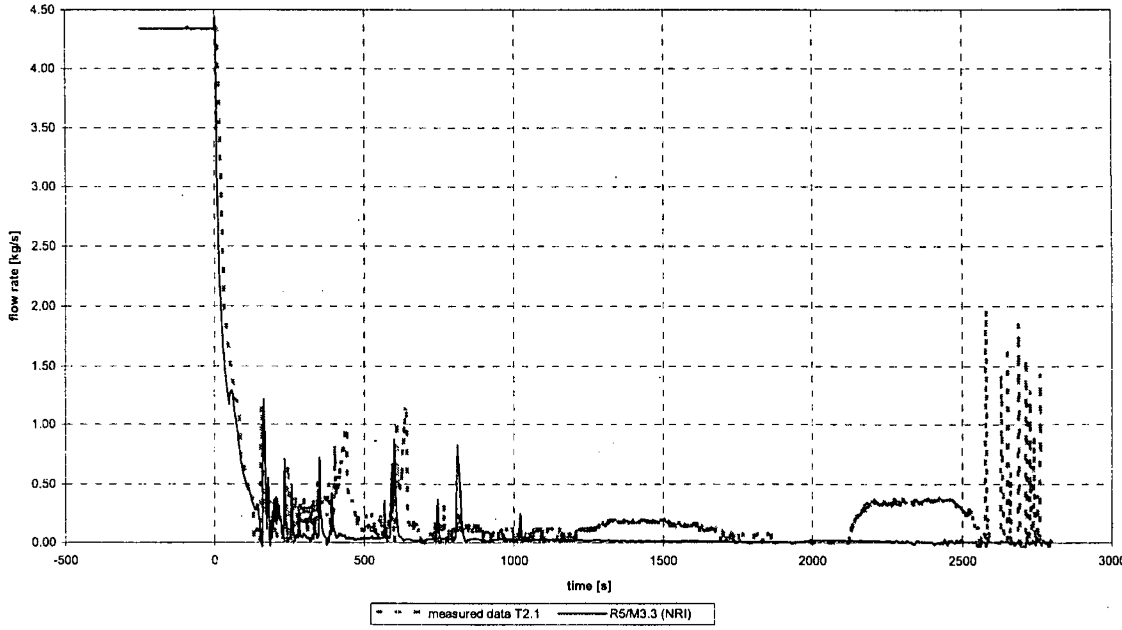

Fig.C-16 Loop mass flow rate (T2.1)

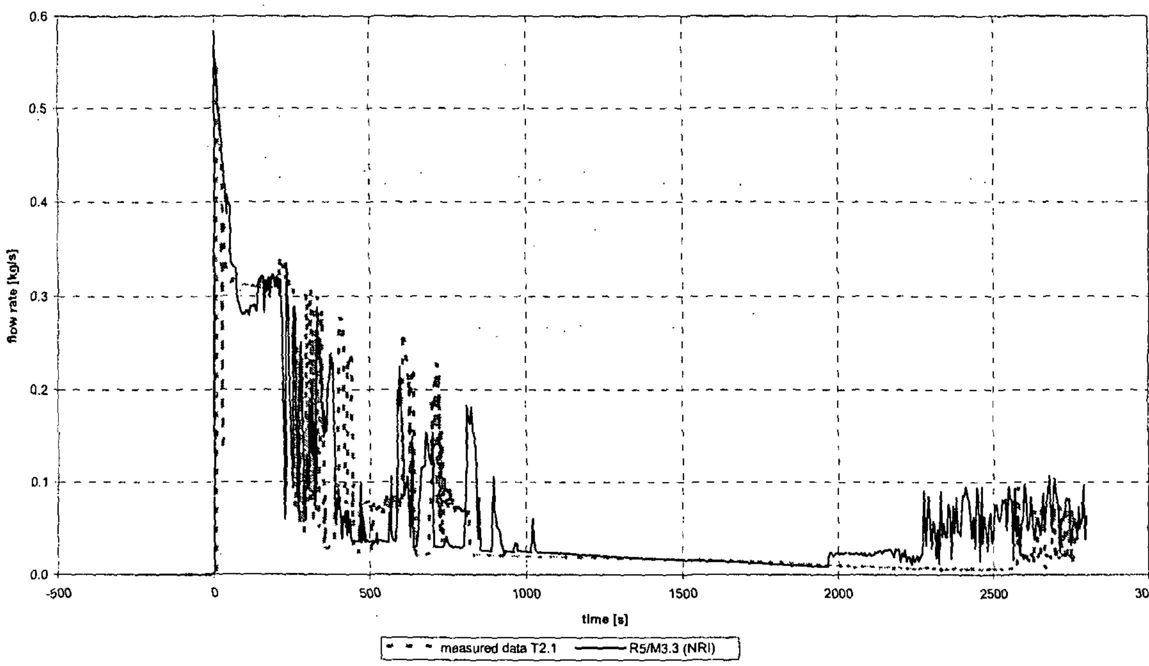

Fig.C-17 Break mass flow rate (T2.1)

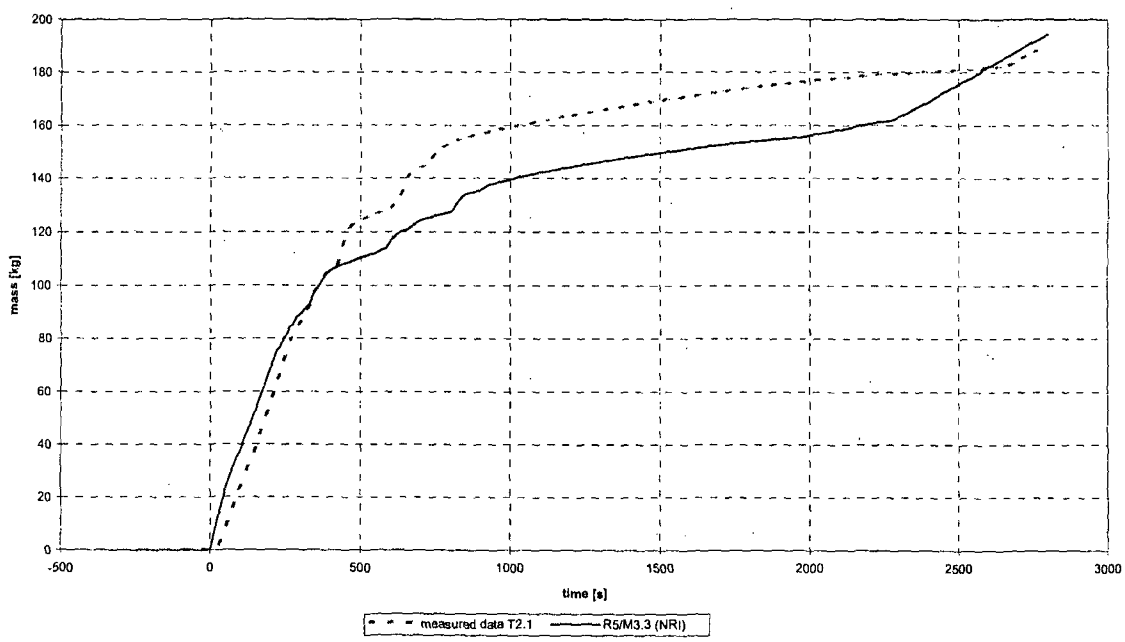

Fig.C-18 Integrated break mass flow rate (T2.1)

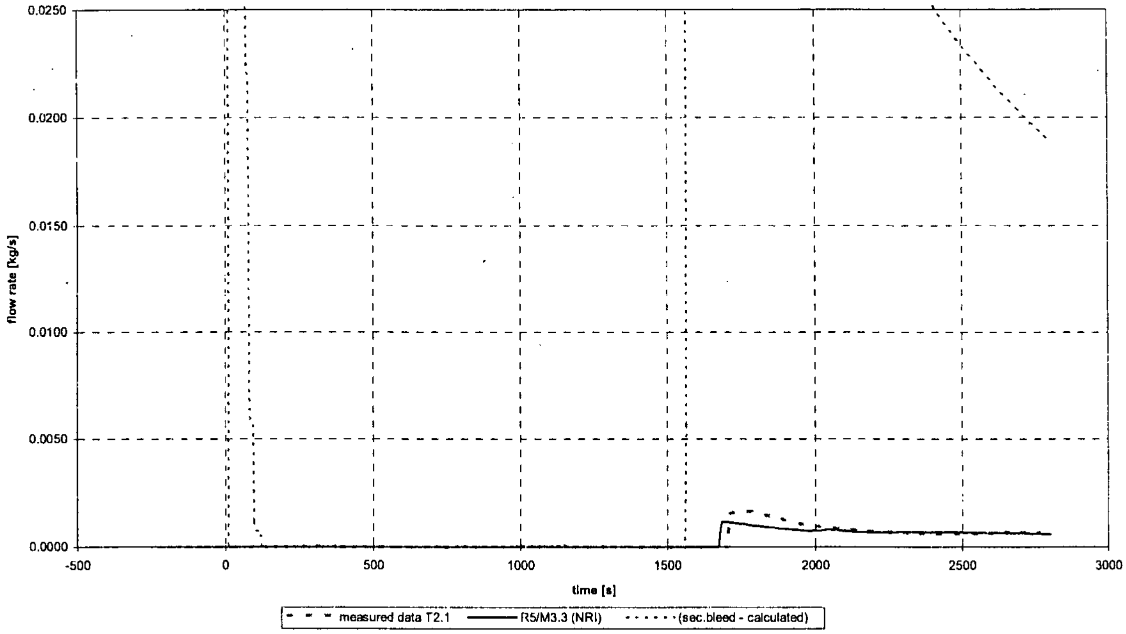

Fig.C-19 PRZ relief valve flow rate (T2.1)

APPENDIX D COMPLETE SET OF COMPARISON PLOTS FOR CASE T2.2

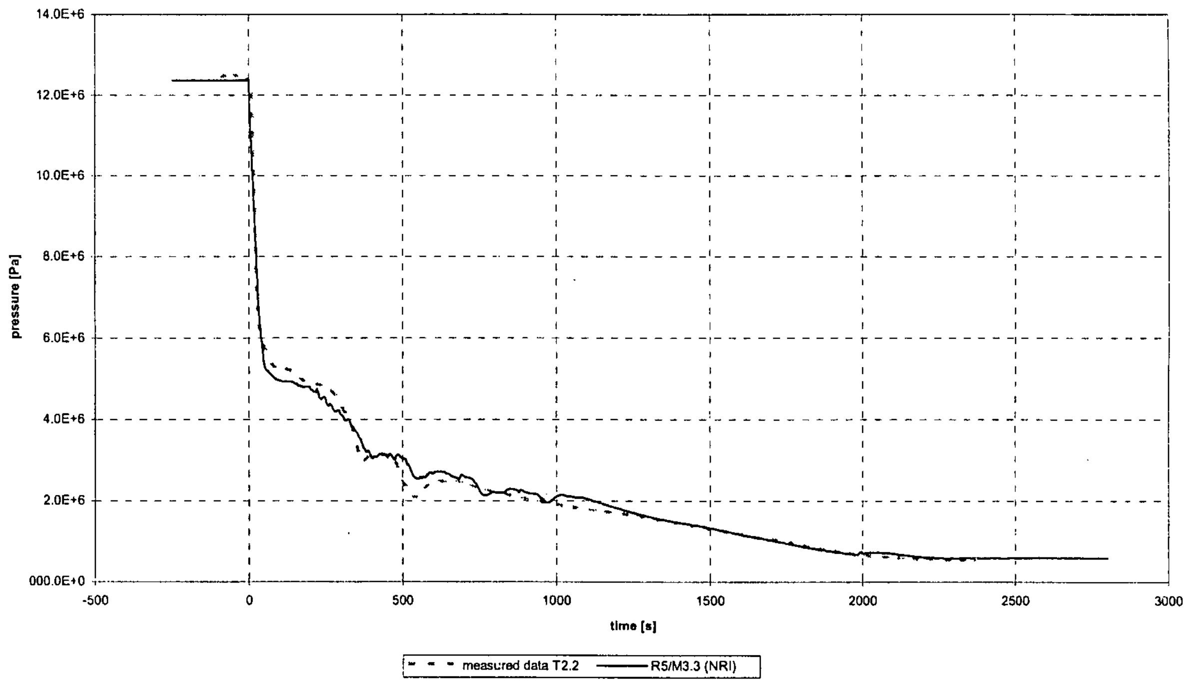

Fig.D-1 Primary pressure (T2.2)

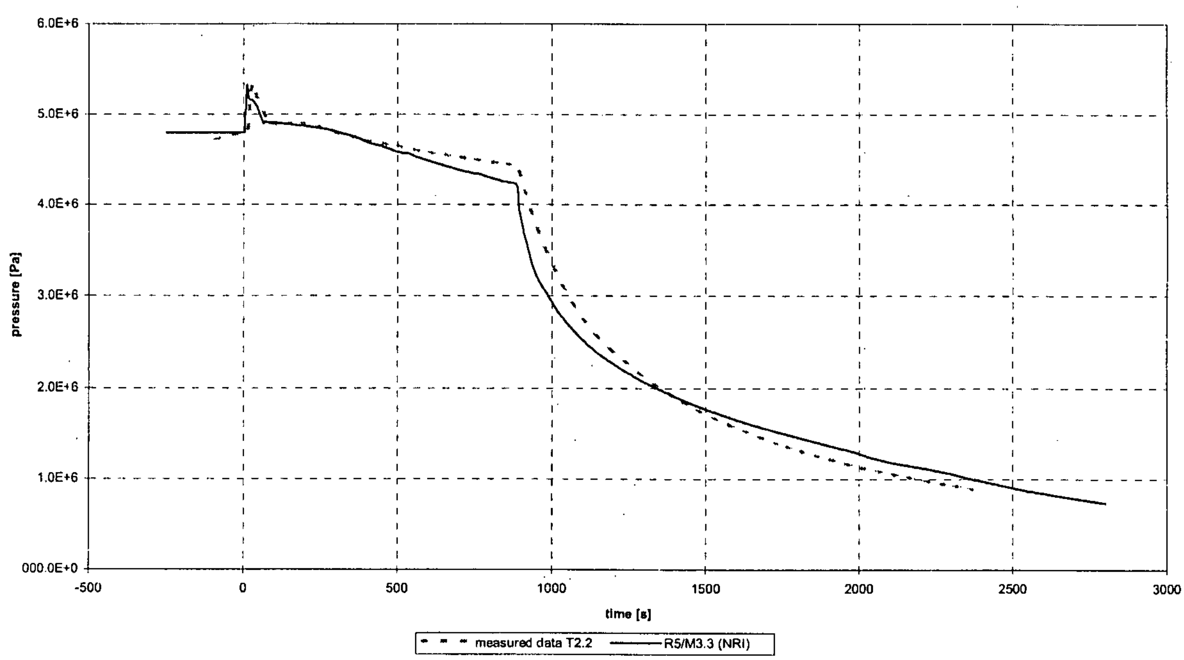

Fig.D-2 Secondary pressure (T2.2)

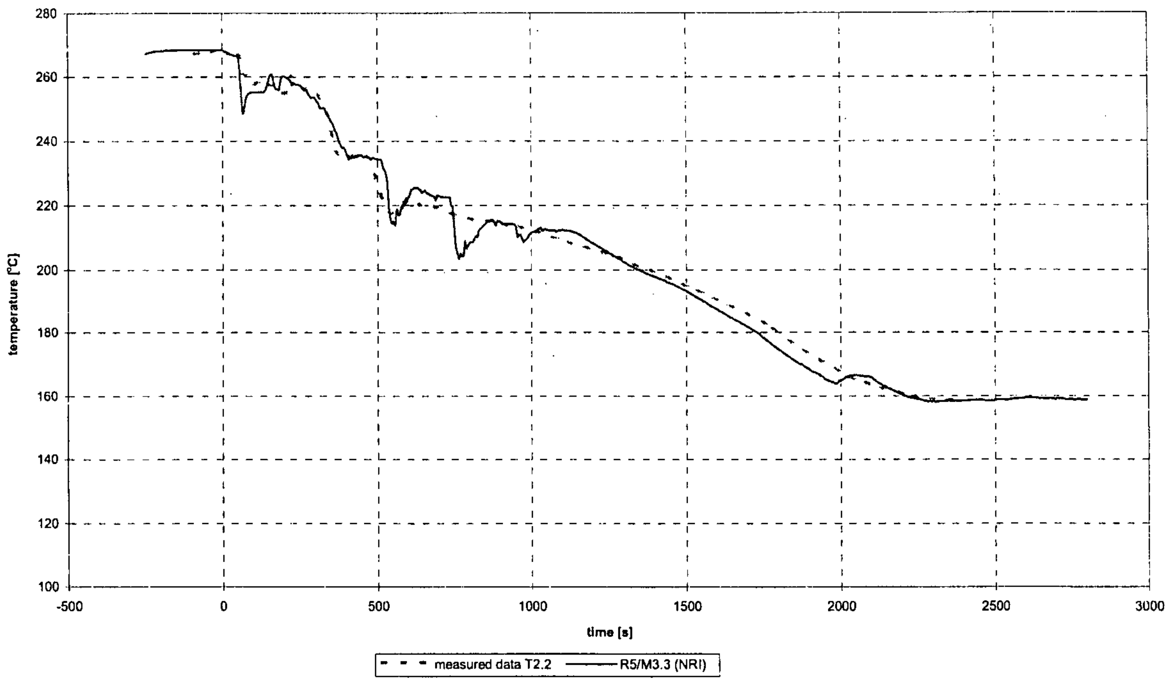

Fig.D-3 Core inlet temperature (T2.2)

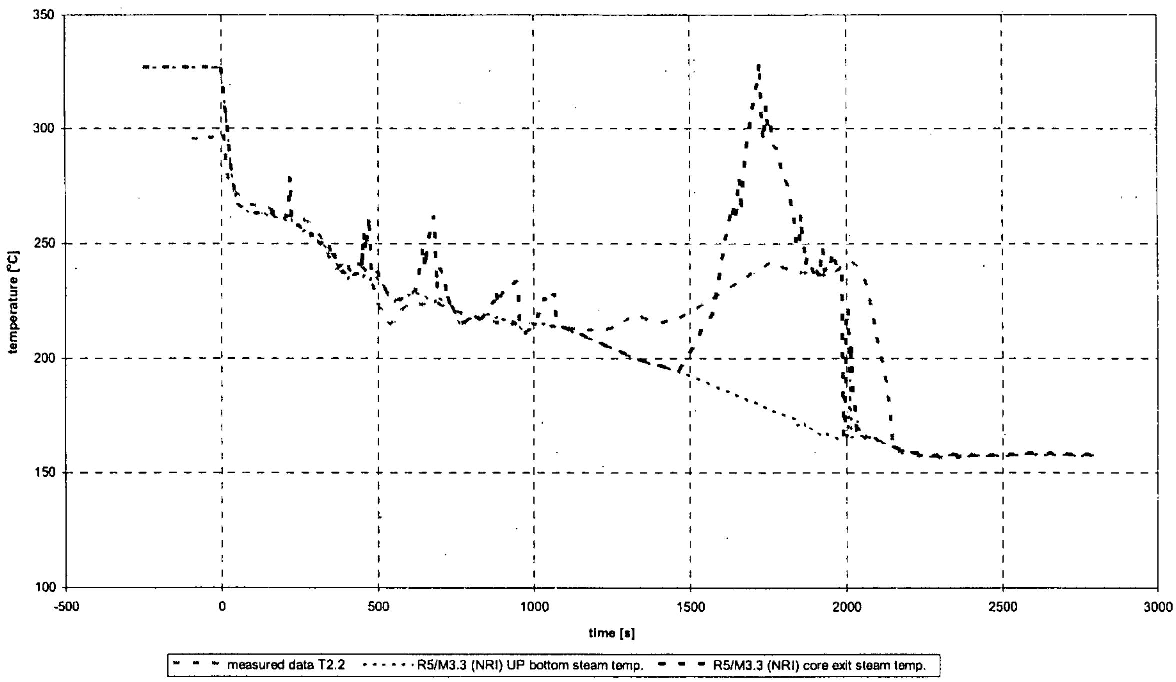

Fig.D-4 Core outlet temperature (T2.2)

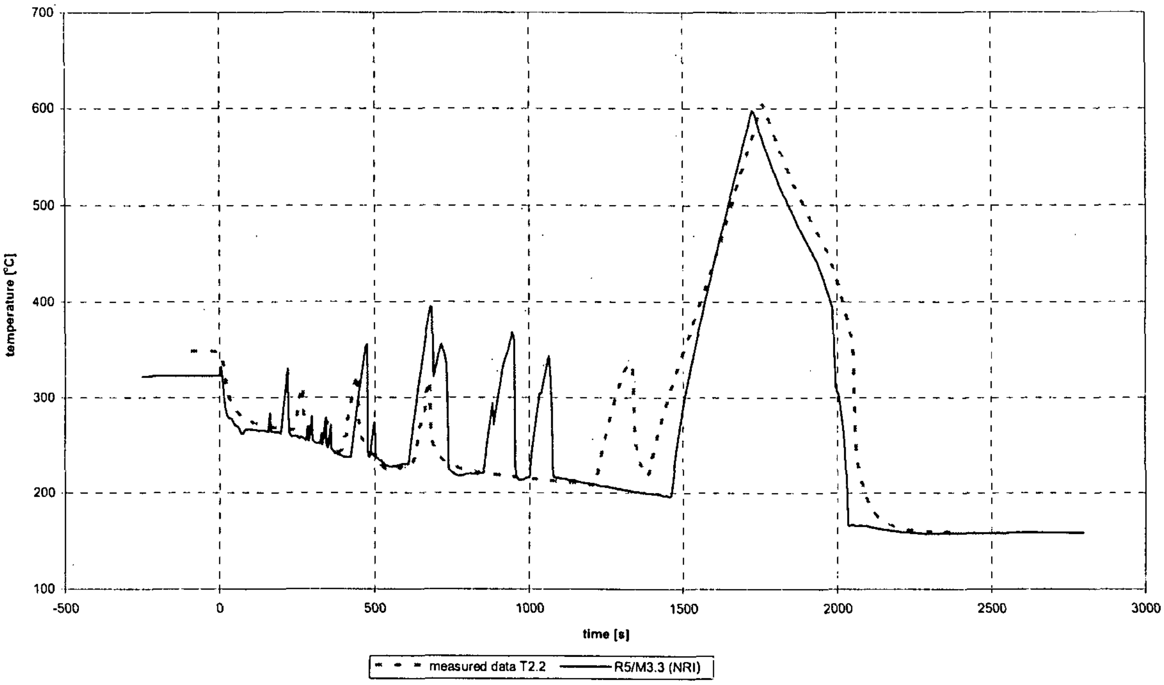

Fig.D-5 Cladding temperature (T2.2)

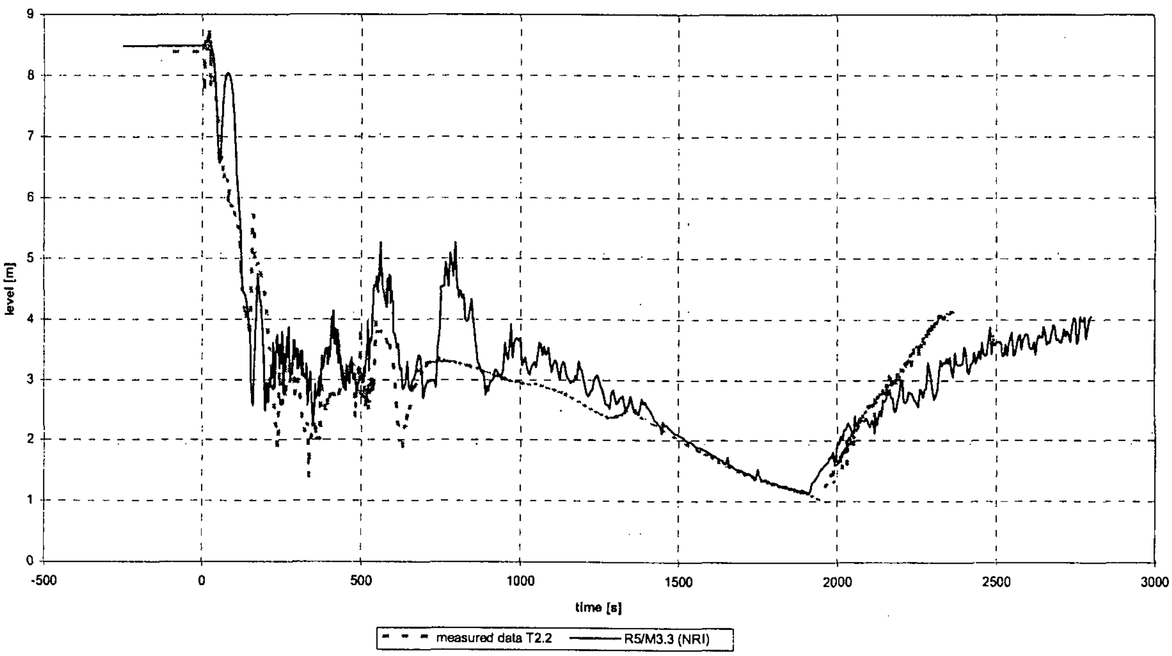

Fig.D-6 Collapsed level in reactor (T2.2)

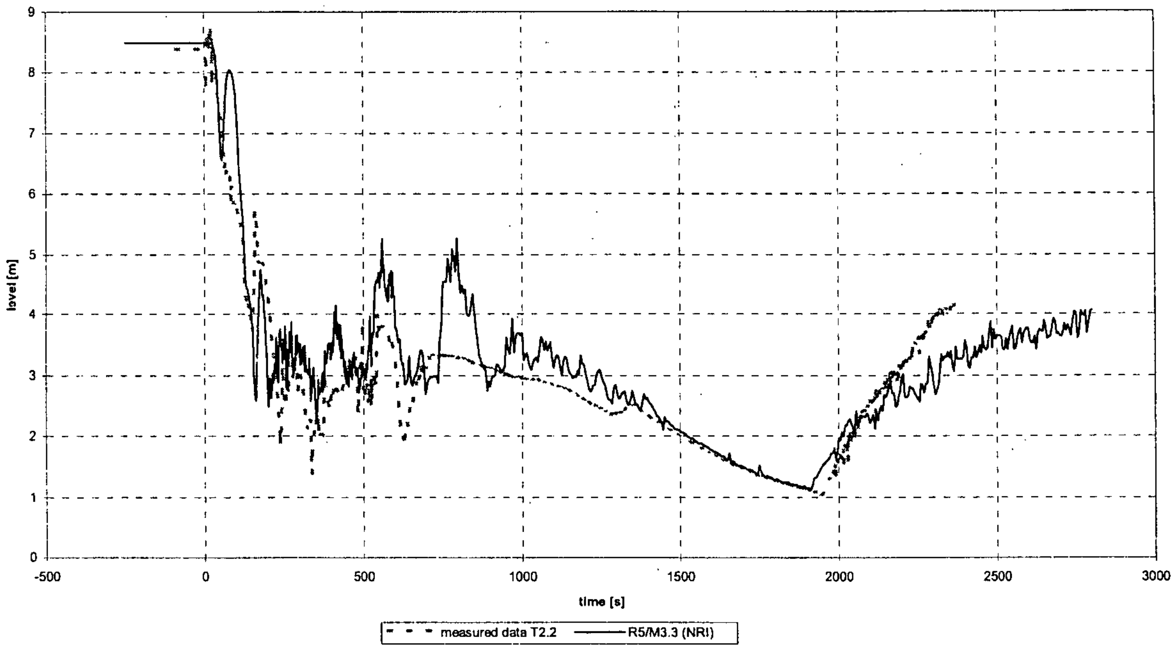

Fig.D-7 Collapsed level in reactor downcomer (T2.2)

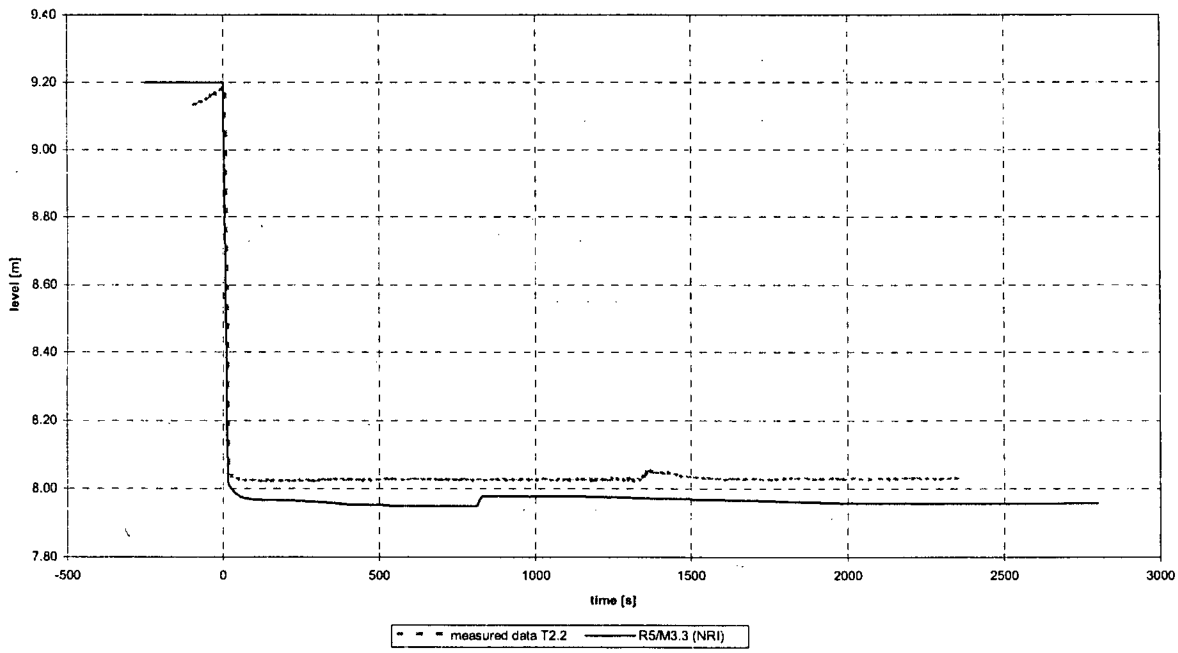

Fig.D-8Collapsed level in PRZ (T2.2)

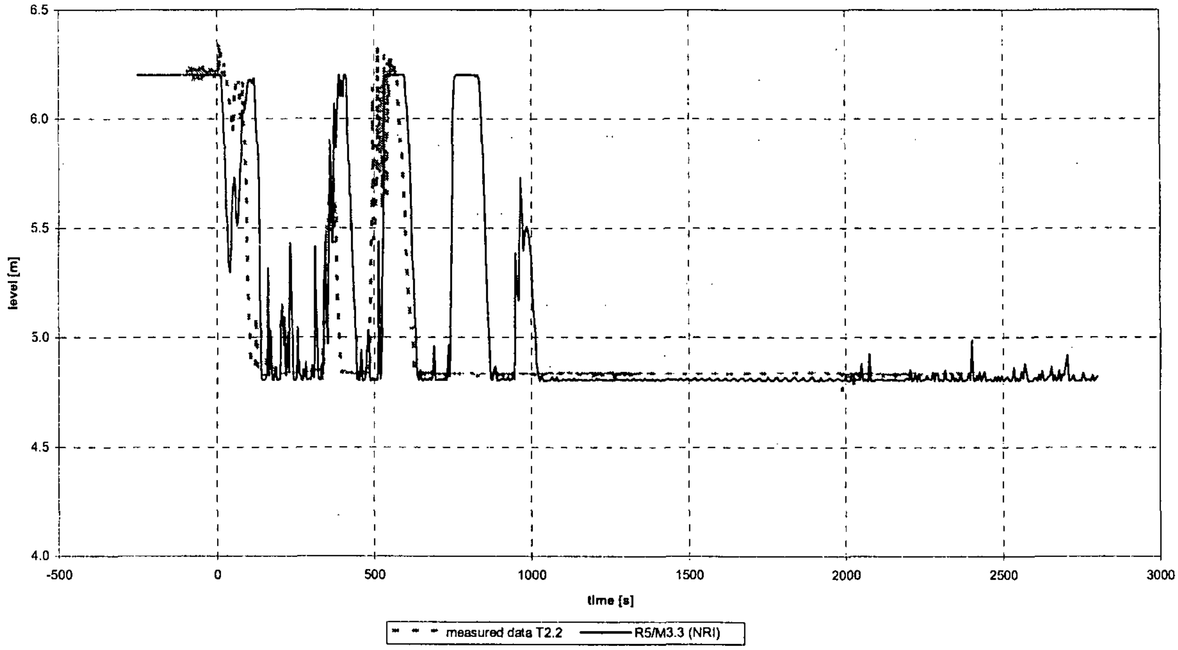

Fig.D-9 Collapsed level in hot leg loop seal – reactor side (T2.2)

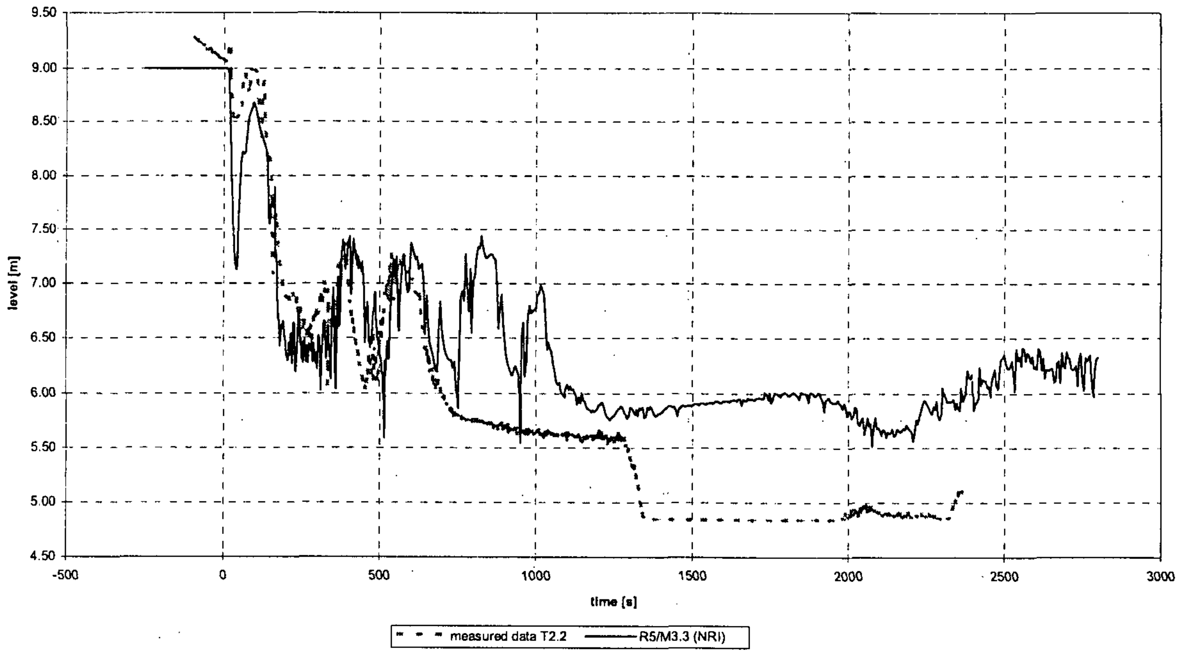

Fig.D-10 Collapsed level in hot leg loop seal – SG side (T2.2)

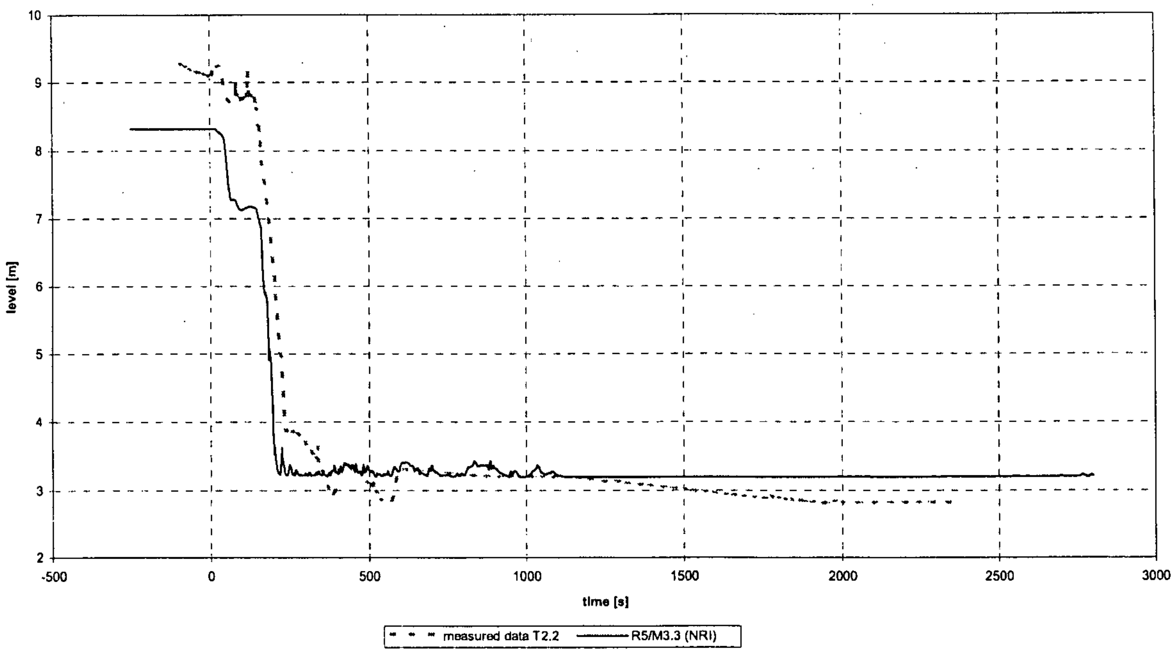

Fig.D-11 Collapsed level in cold leg loop seal – SG side (T2.2)

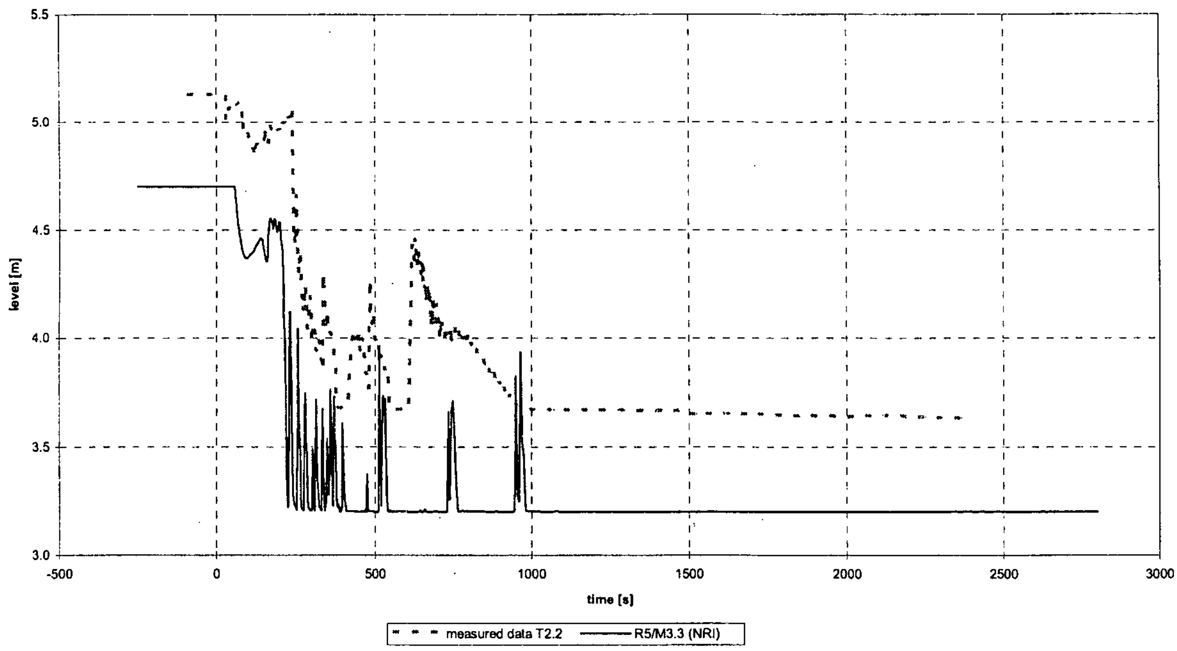

Fig.D-11 Collapsed level in cold leg loop seal – reactor side (T2.2)

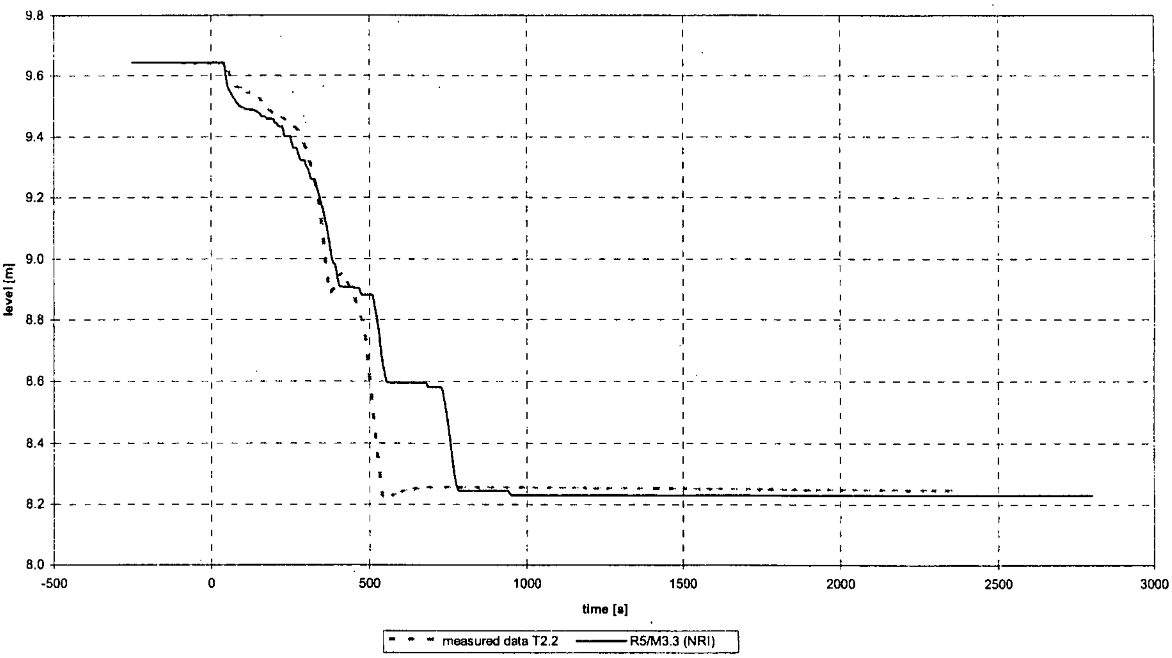

Fig.D-13 Collapsed level in hydroaccumulator SIT-1 (T2.2)

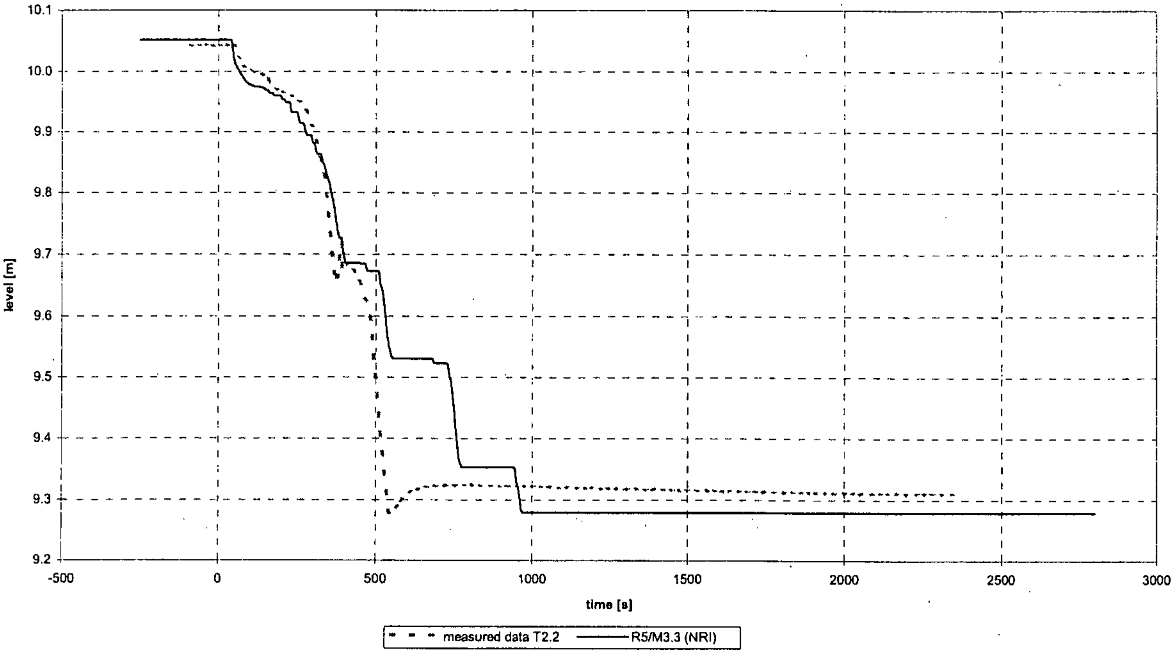

Fig.D-14 Collapsed level in hydroaccumulator SIT-2 (T2.2)

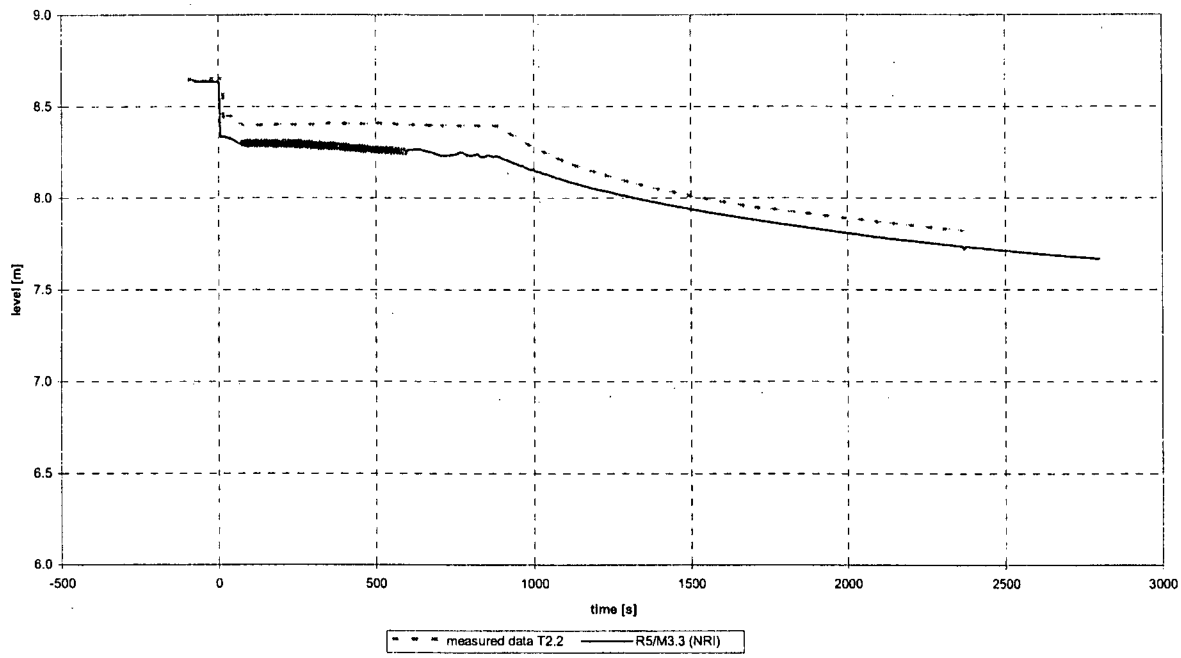

Fig.D-15 Collapsed level in SG secondary side (T2.2)

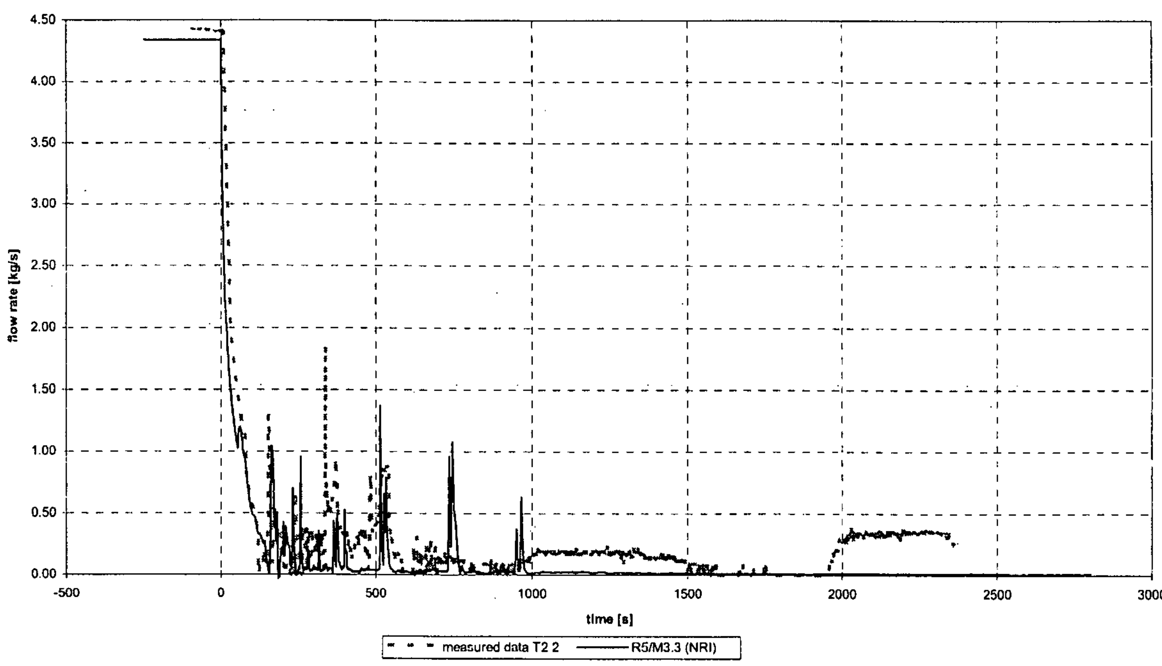

Fig.D-16 Loop mass flow rate (T2.2)

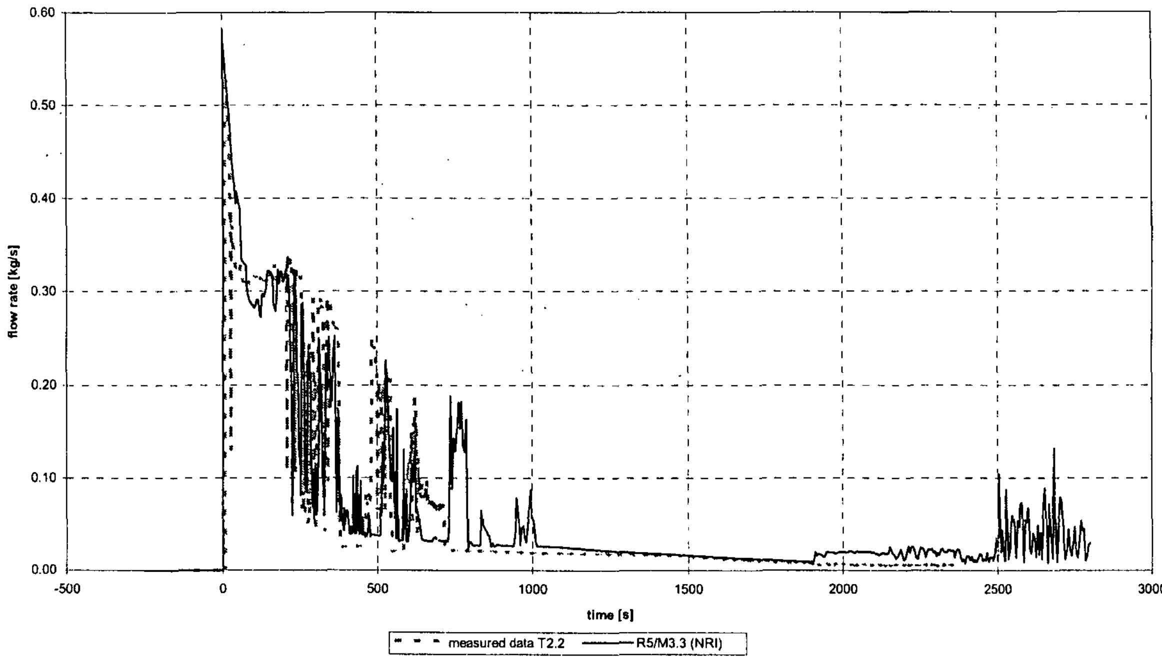

Fig.D-17 Break mass flow rate (T2.2)

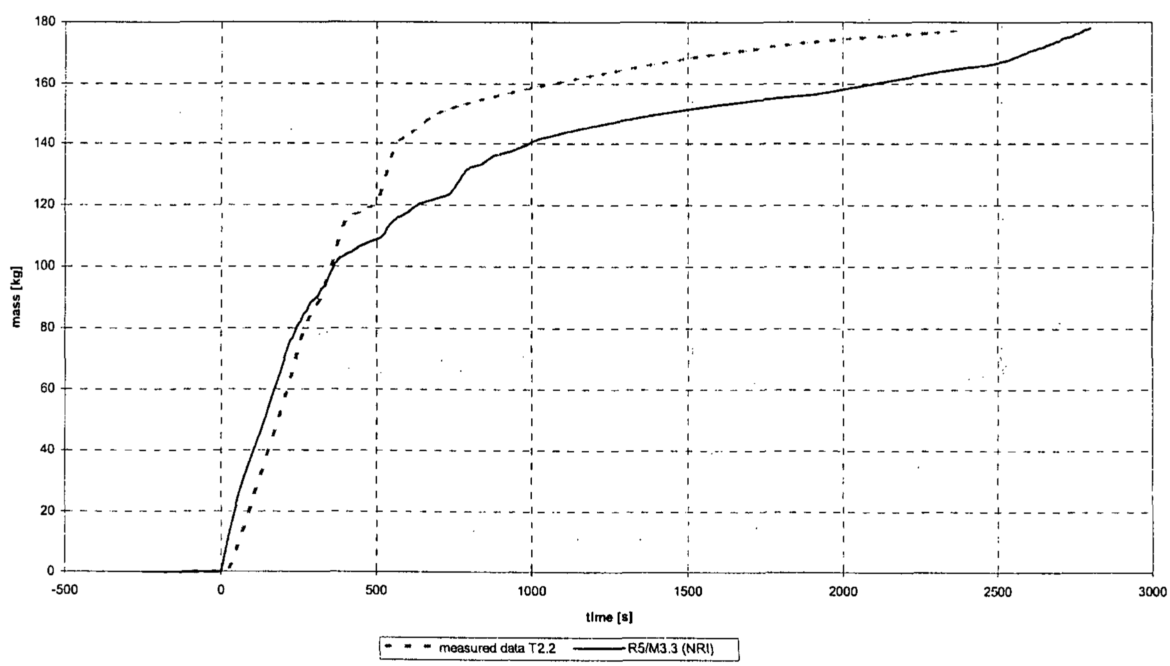

Fig.D-18 Integrated break mass flow rate (T2.2)

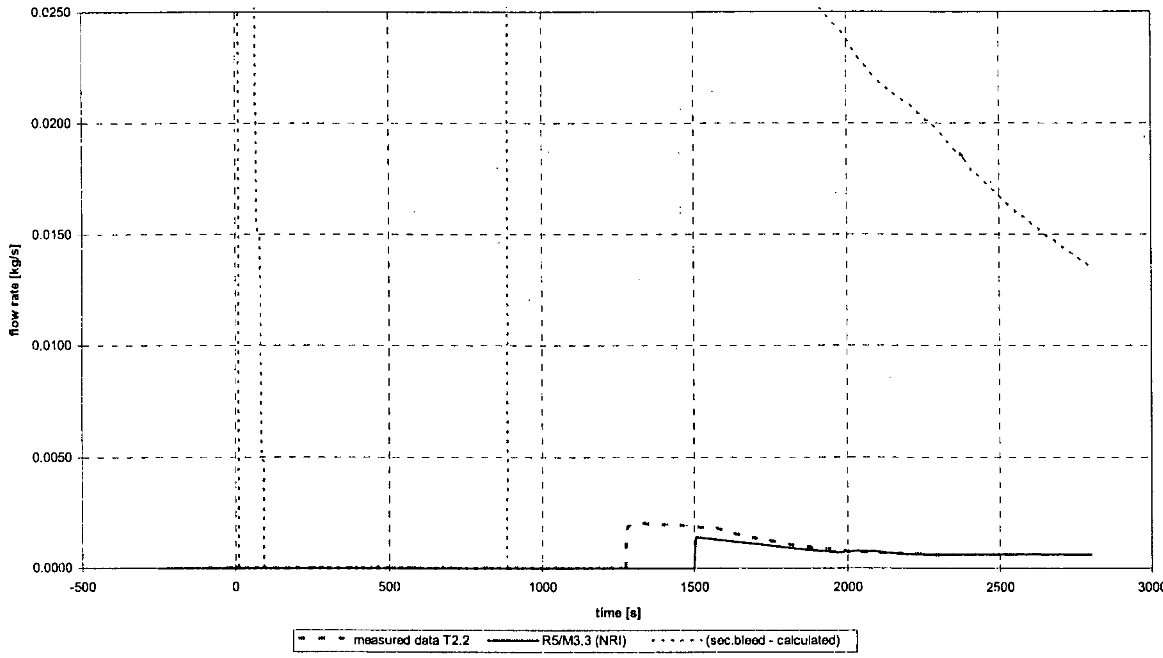

Fig.D-19 PRZ relief valve flow rate (T2.2)

APPENDIX E COMPLETE SET OF COMPARISON PLOTS FOR CASE T2.3

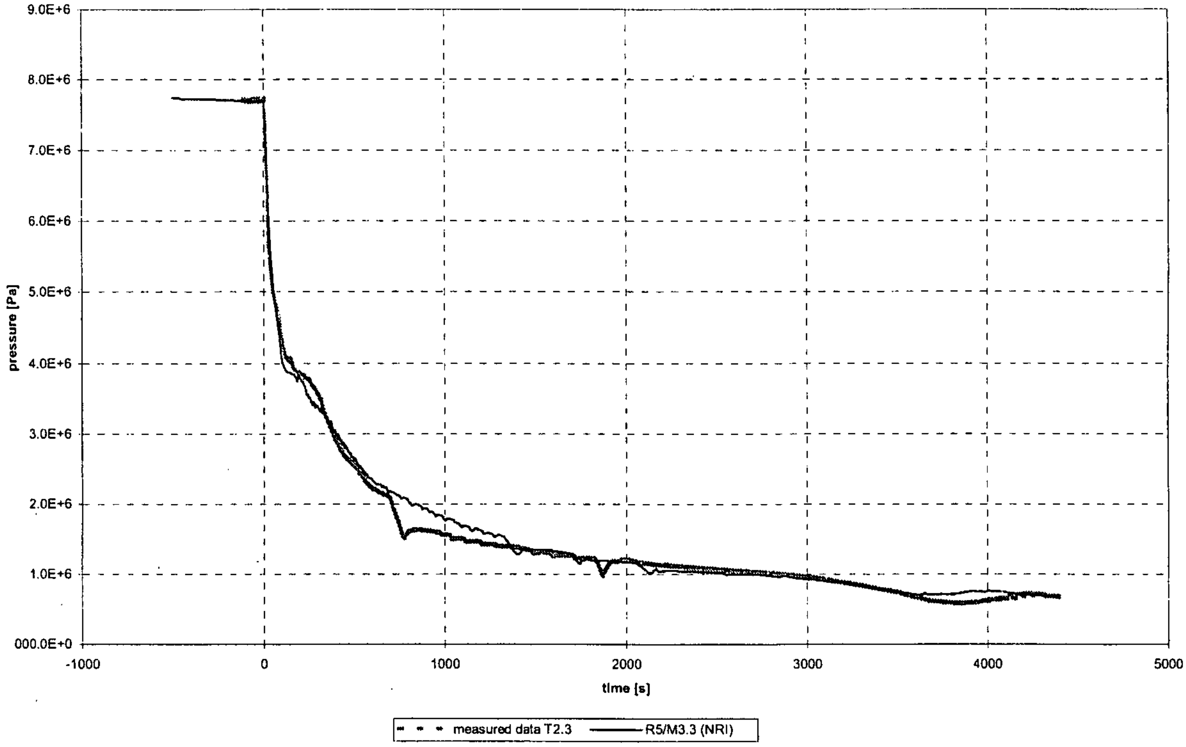

Fig.E-1 Primary pressure (T2.3)

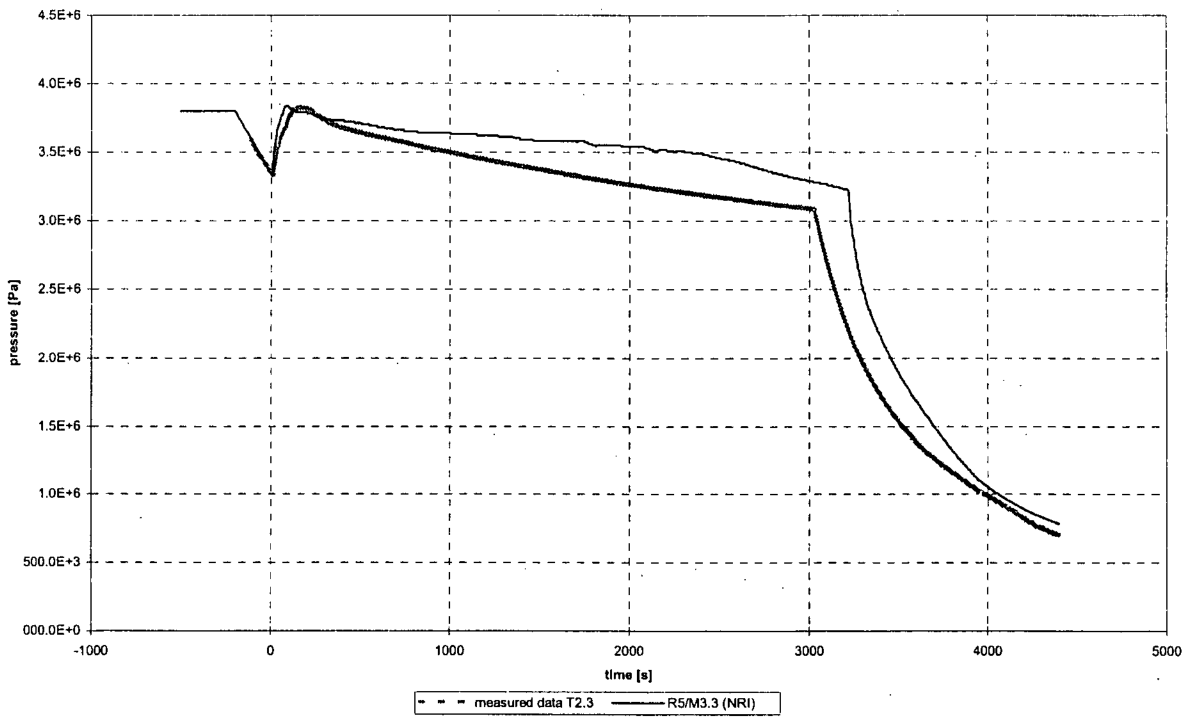

Fig.E-2 Secondary pressure (T2.3)

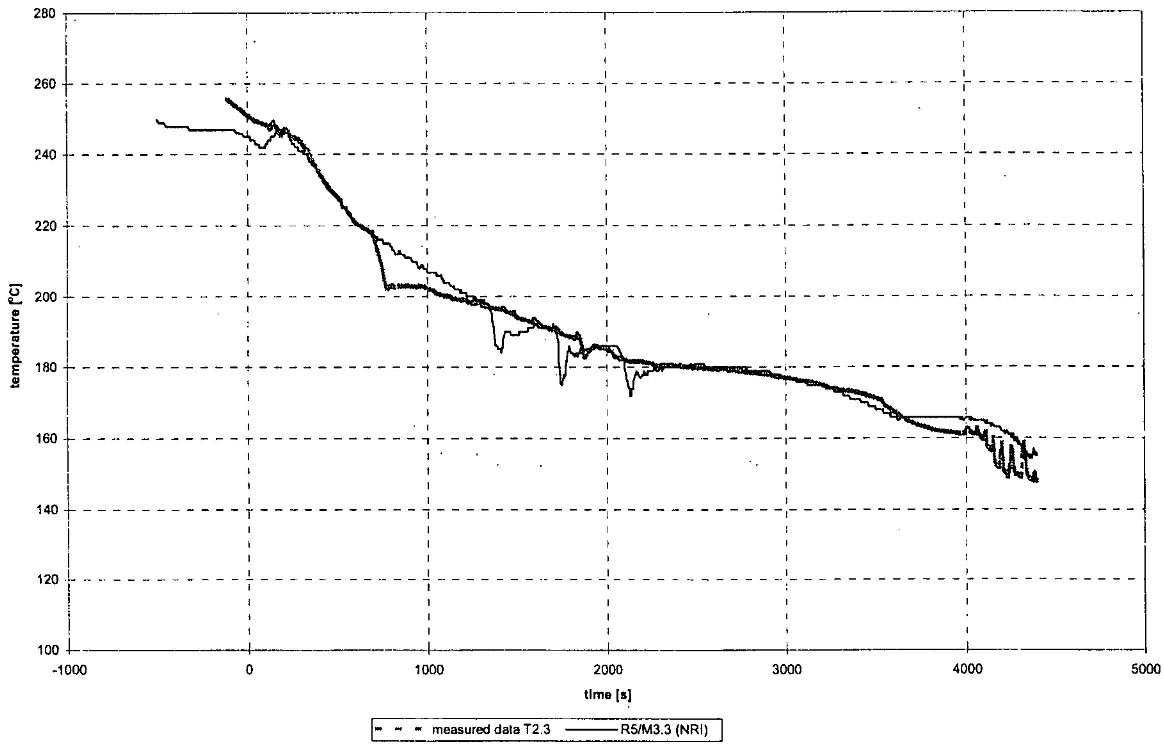

Fig.E-3 Core inlet temperature (T2.3)

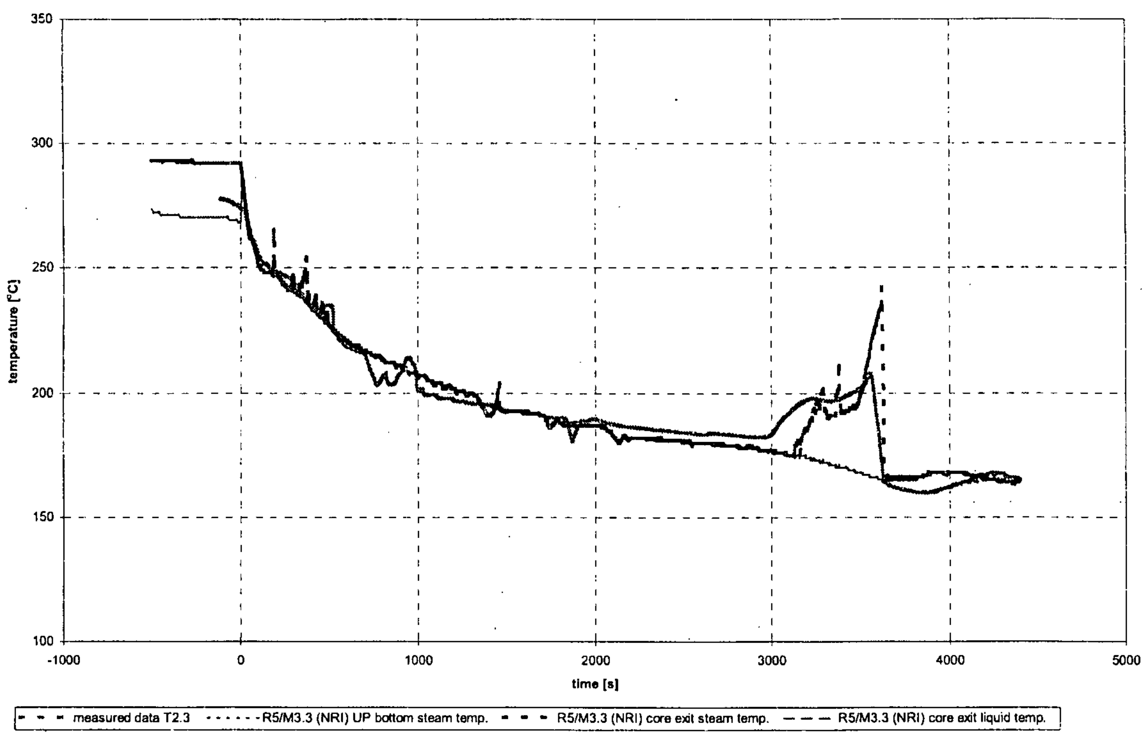

Fig.E-4 Core outlet temperature (T2.3)

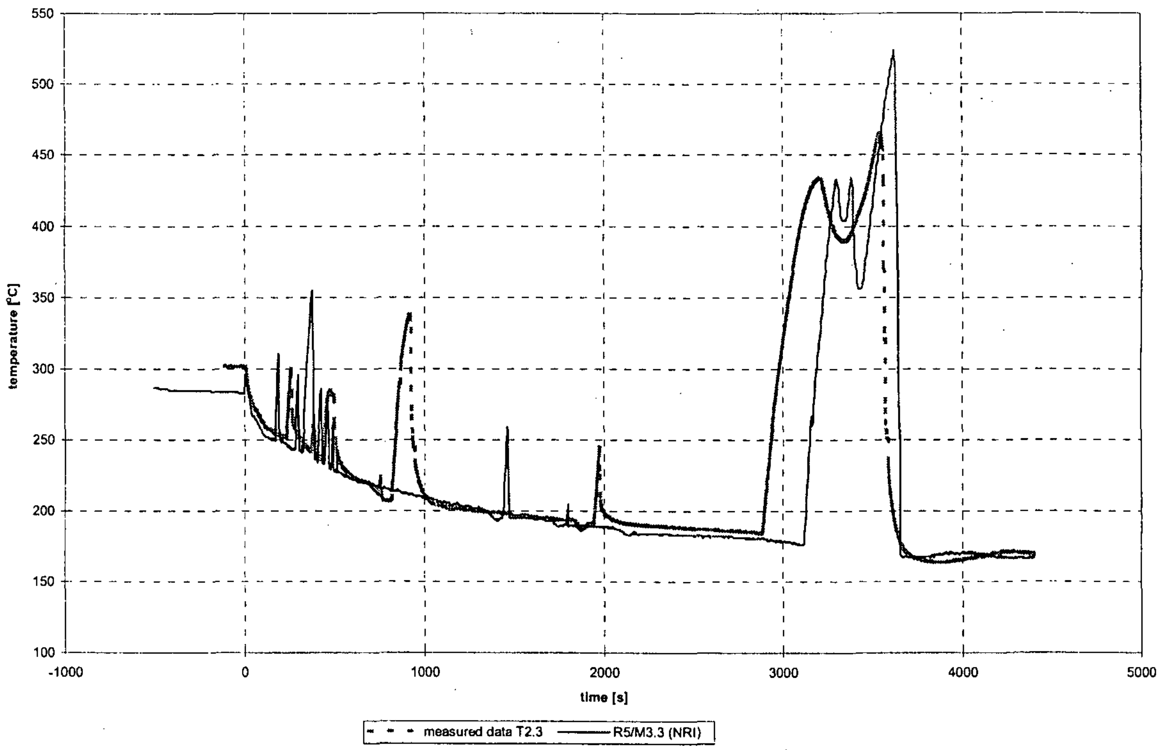

Fig.E-5 Cladding temperature (T2.3)

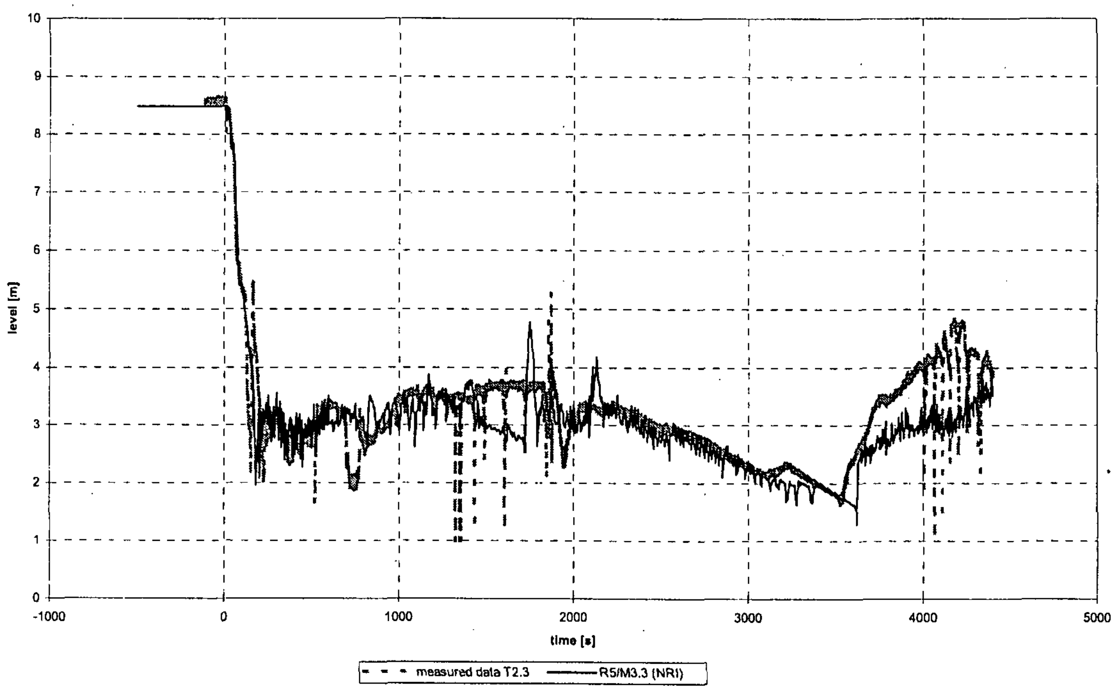

Fig.E-6 Collapsed level in reactor (T2.3)

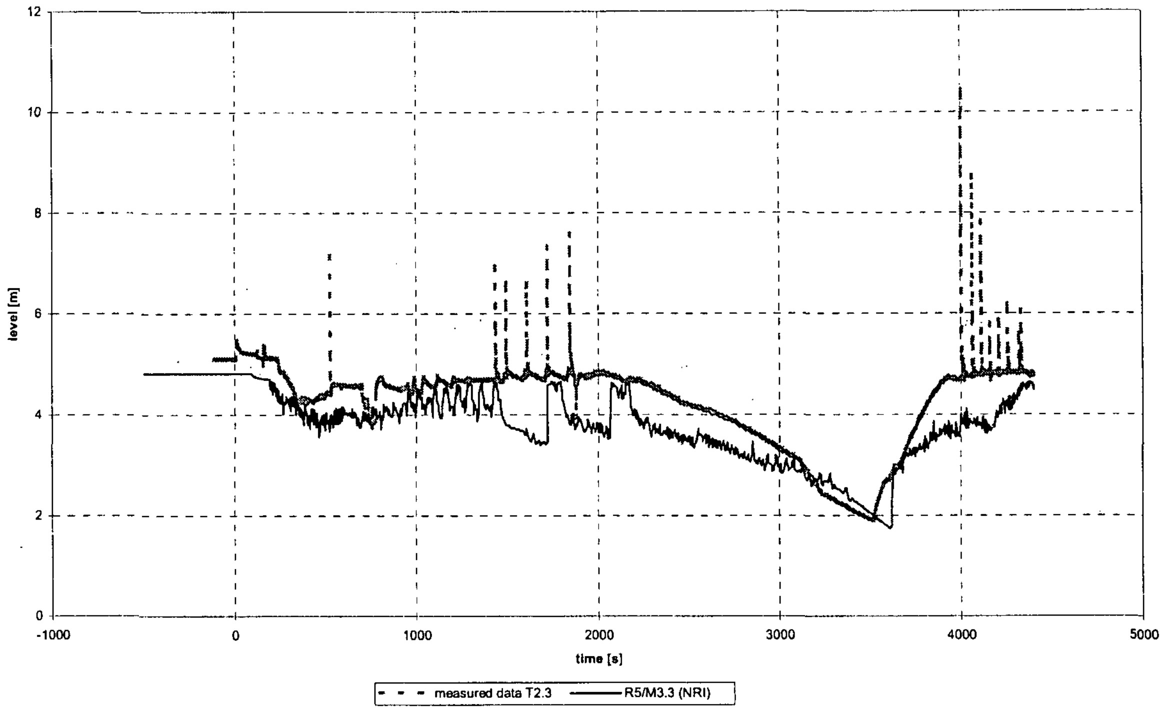

Fig.E-7 Collapsed level in reactor downcomer (T2.3)

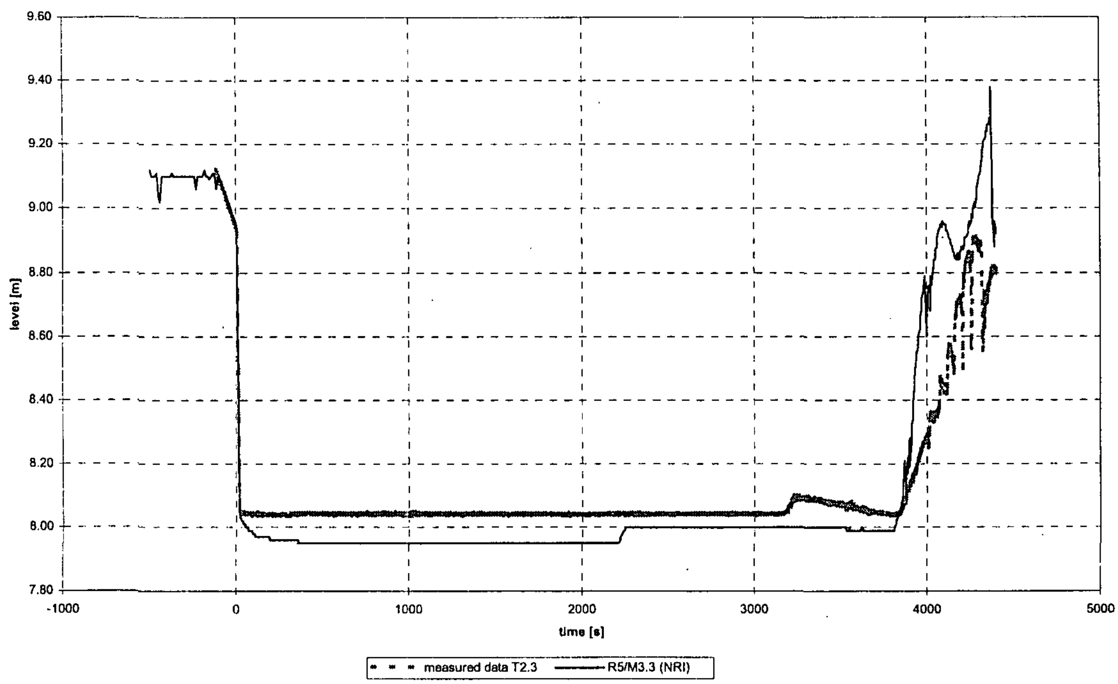

Fig.E-8 Collapsed level in PRZ (T2.3)

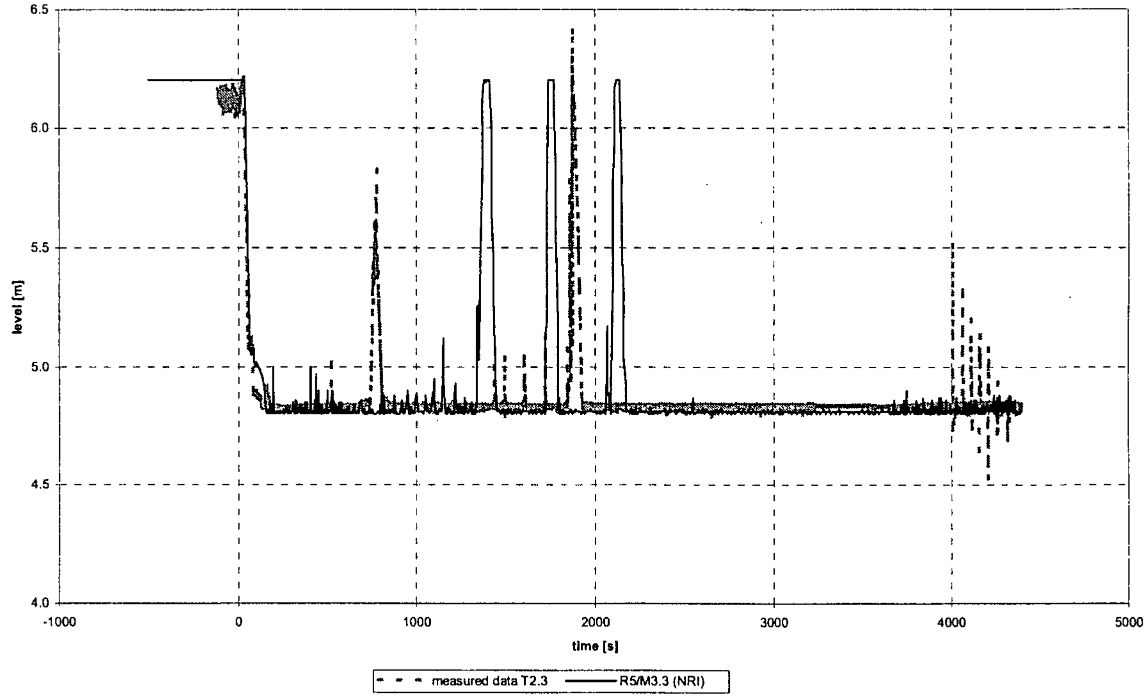

Fig.E-9 Collapsed level in hot leg loop seal – reactor side (T2.3)

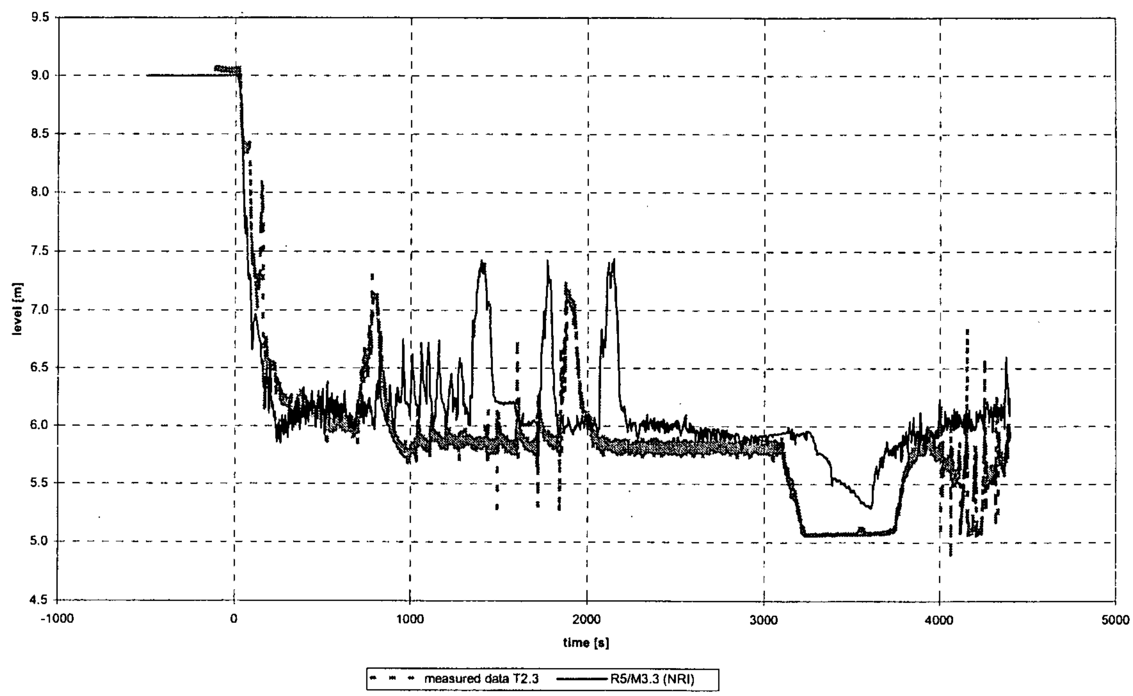

Fig.E-10 Collapsed level in hot leg loop seal – SG side (T2.3)

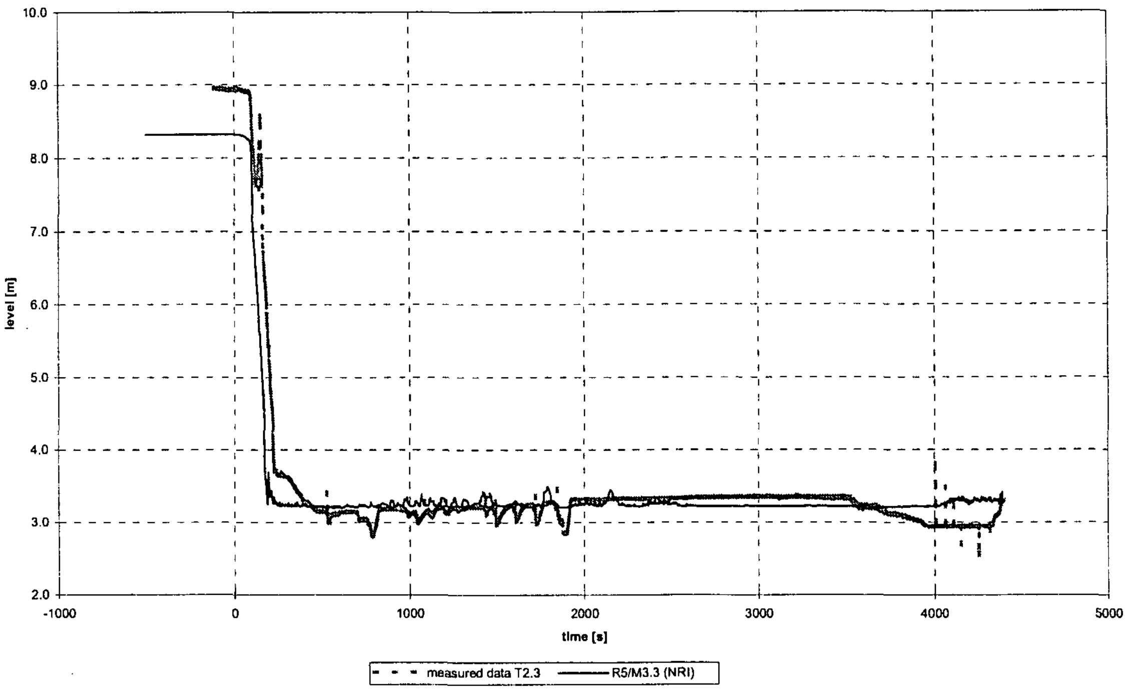

Fig.E-11 Collapsed level in cold leg loop seal – SG side (T2.3)

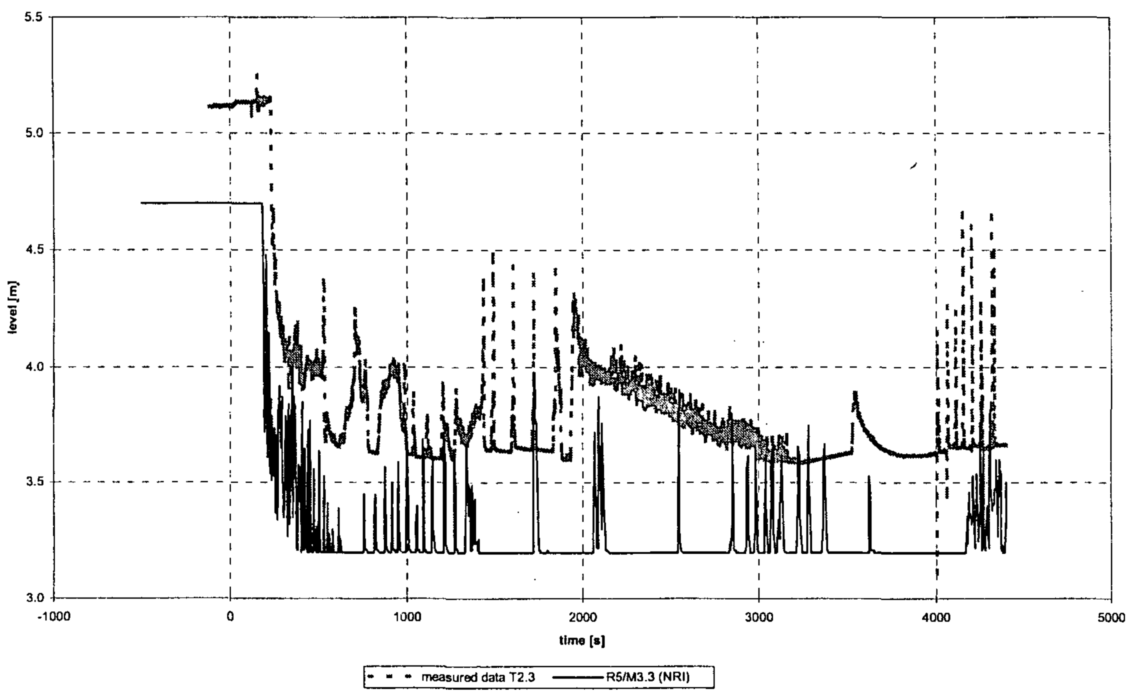

Fig.E-12 Collapsed level in cold leg loop seal – reactor side (T2.3)

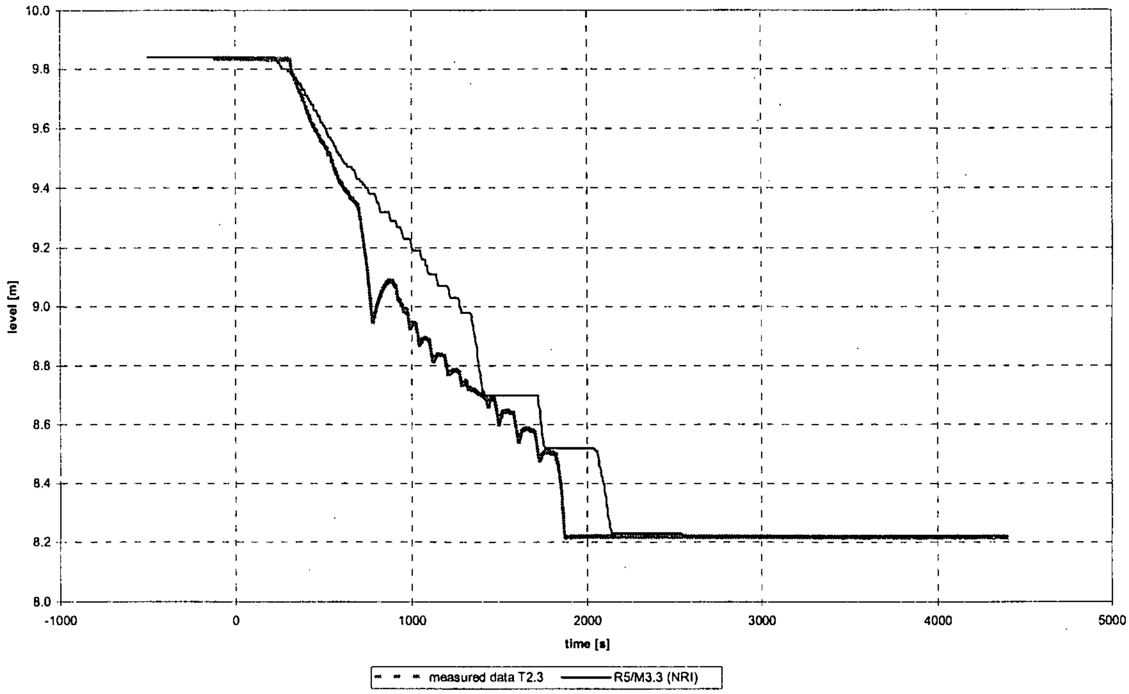

Fig.E-13 Collapsed level in hydroaccumulator SIT-1 (T2.3)

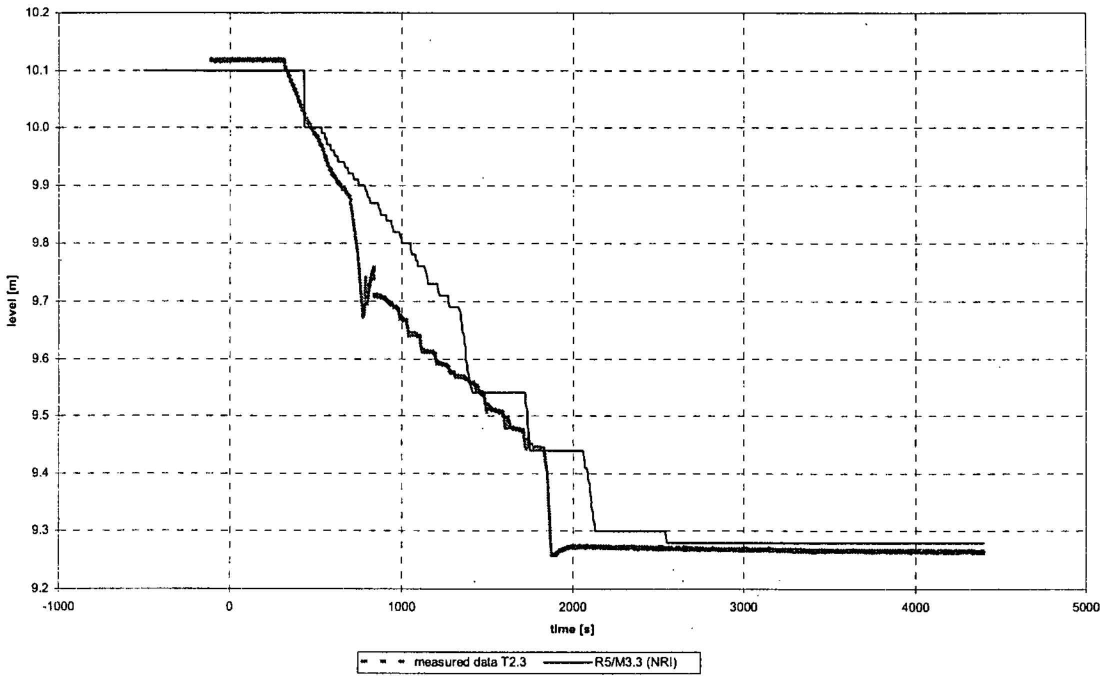

Fig.E-14 Collapsed level in hydroaccumulator SIT-2 (T2.3)

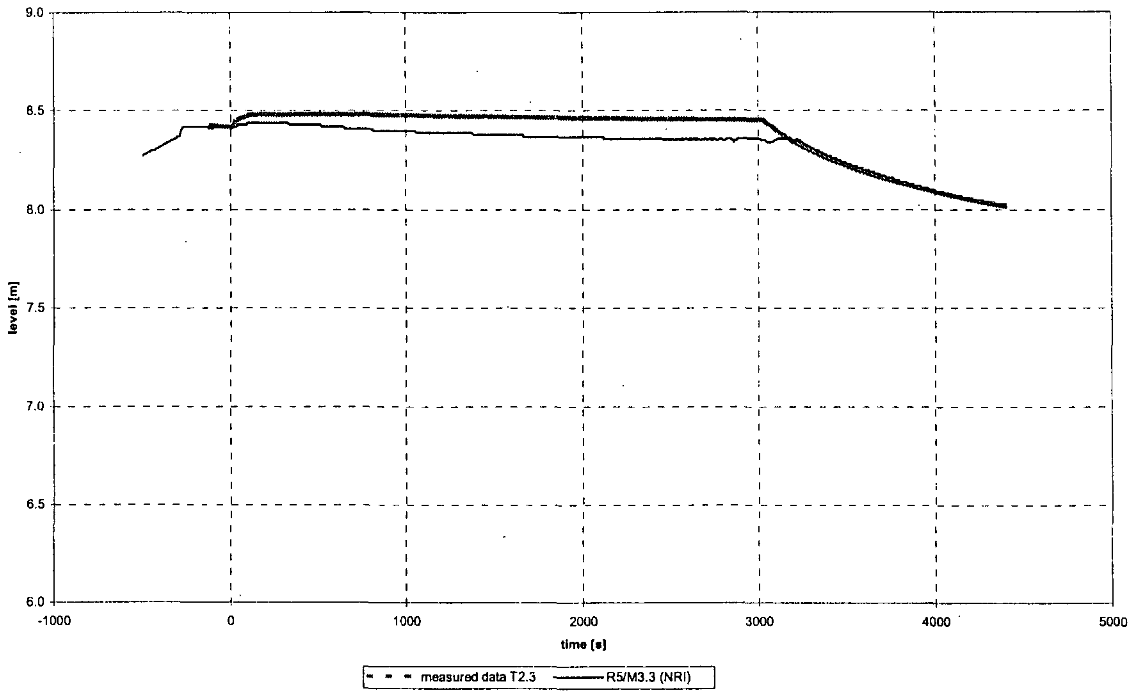

Fig.E-15 Collapsed level in SG secondary side (T2.3)

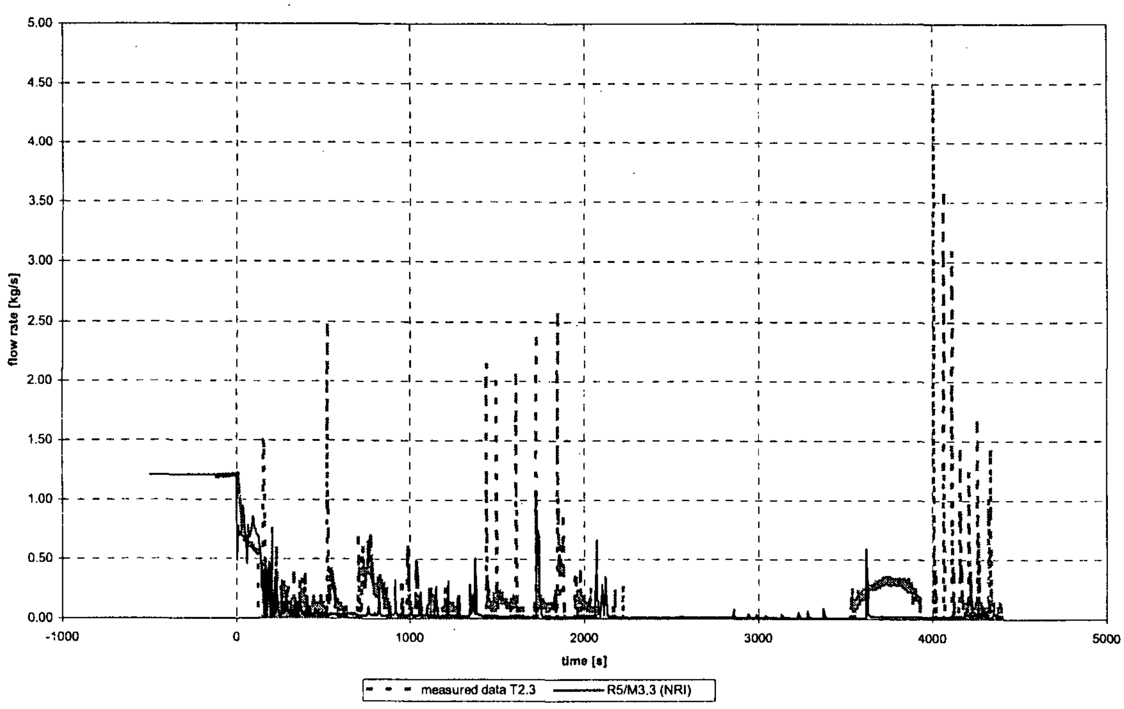

Fig.E-16 Loop mass flow rate (T2.3)

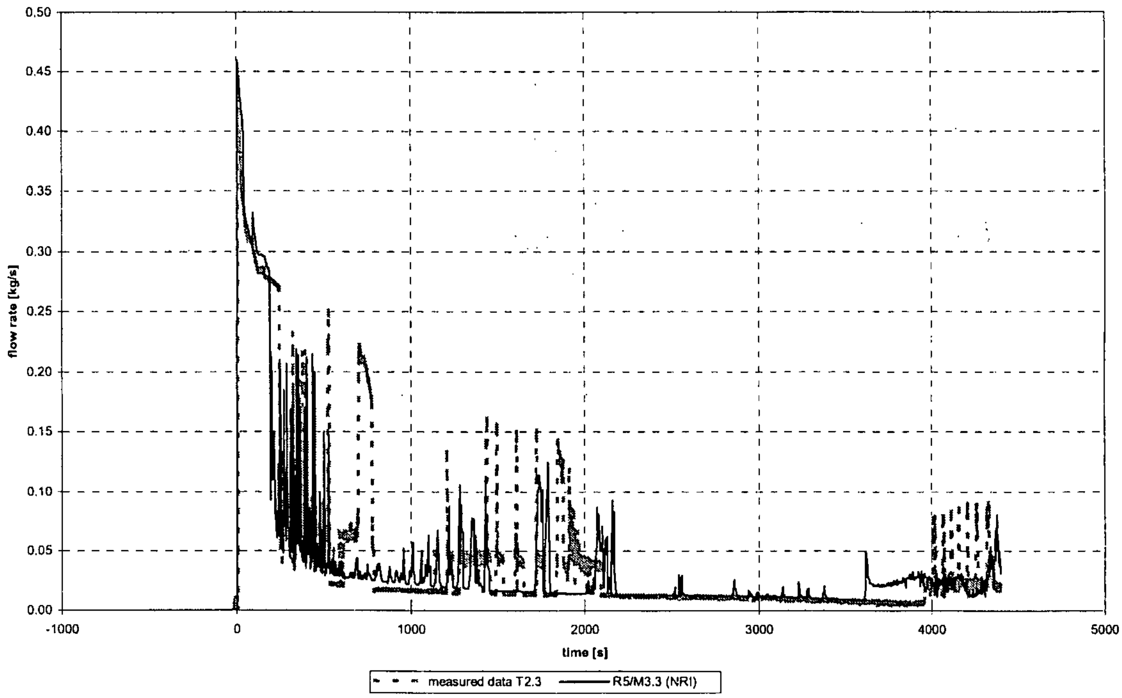

Fig.E-17 Break mass flow rate (T2.3)

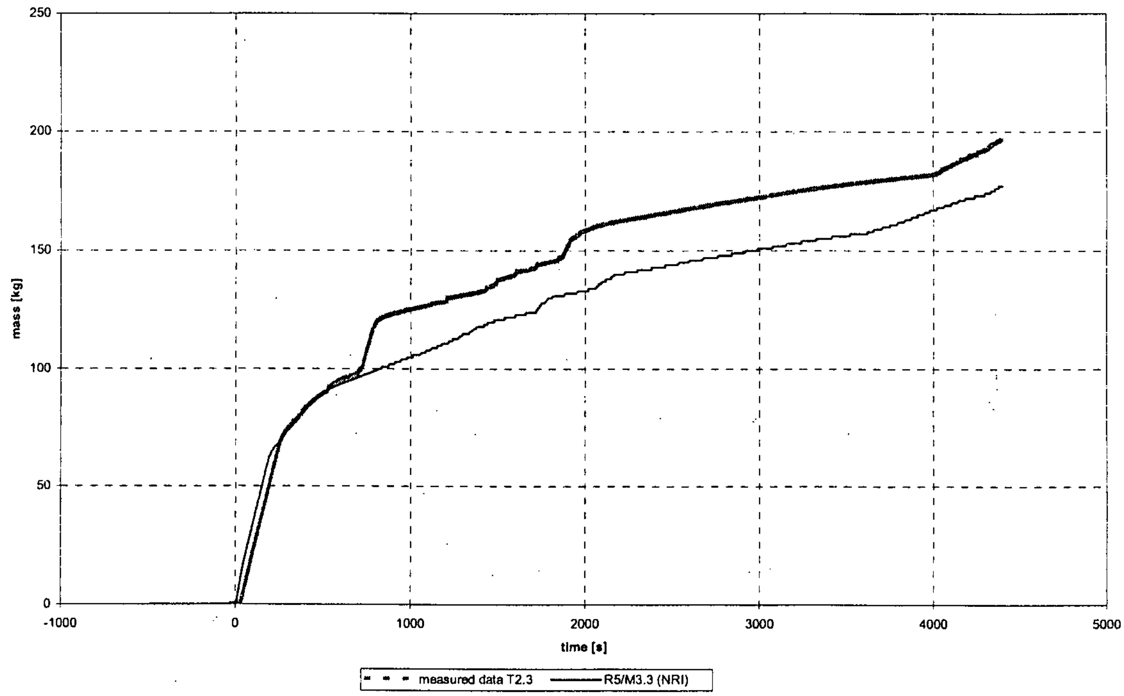

Fig.E-18 Integrated break mass flow rate (T2.3)

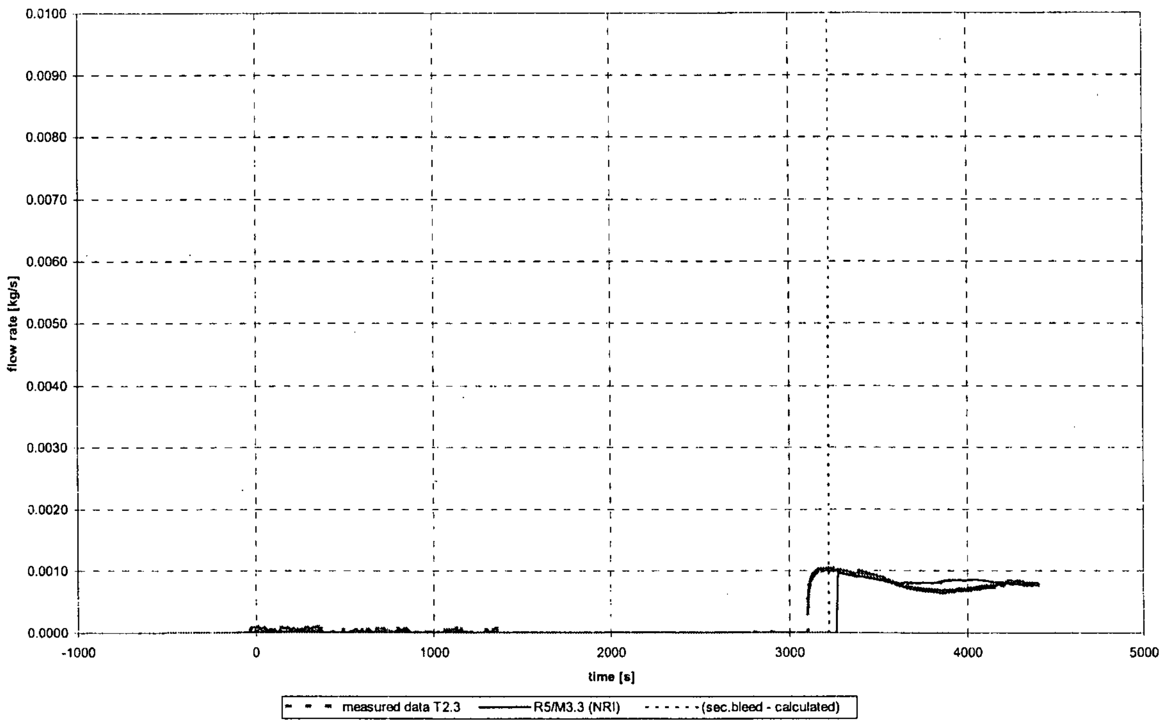

Fig.E-19 PRZ relief valve flow rate (T2.3)

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10. SUPPLEMENTARY NOTES
A. Calvo, NRC Project Manager

11. ABSTRACT *(200 words or less)*
The results of RELAP5 post-test analysis of 3 tests performed on the PMK integral test facility are presented and discussed. The Hungarian facility PMK is a scaled-down model of NPP with VVER-440/213 reactor. The code version RELAP5/MOD3.3 Path02 has been assessed against the experimental data from the tests T2.1, T2.2, and T2.3. The tests were focused on medium-break LOCA without HPSI. Generally, RELAP5 predictions are in very good agreement with the measured data.

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