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Assessment of ISLOCA Risk–Methodology and Application to a Babcock and Wilcox Nuclear Power Plant

Appendices I–M

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Prepared for
U.S. Nuclear Regulatory Commission

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ABSTRACT

This document presents information essential to understanding the risk associated with inter-system loss-of-coolant accidents (ISLOCAs). The methodology developed and presented in this document provides a state-of-the-art method for identifying and evaluating plant-specific hardware designs, human performance issues, and accident consequence factors relevant to the prediction of the ISLOCA risk. This ISLOCA methodology was developed and then applied to a Babcock and Wilcox (B&W) nuclear power plant. The results from this application are described in detail. For this particular B&W reference plant, the assessment indicated that the probability of a severe ISLOCA is approximately 2.2E − 06/reactor-year.

FIN B5699—Inter-System LOCA

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CONSEQUENCE CALCULATIONS

I.1 Discussion

The purpose of this appendix is to provide an estimate of the radiological consequences associated with an Interfacing System Loss-of-Coolant Accident. These hypothetical accidents have been postulated to occur in light water reactor (LWR).

The MELCOR Accident Consequence Code System (MACCS) was selected for radiological consequence modeling. The construction of a complete MACCS model for the specific plant under study was not considered desirable. This is because of the generic nature of the ISLOCA analysis. It was determined that plant specific source terms and accident sequences could be normalized to a nation-wide average site using an existing MACCS model.[I-1] This model is also adequate for determining the effectiveness of potential accident management strategies (i.e., modifications in accident sequences and decontamination factors) through sensitivity calculations.

The readily-available MACCS models were limited to those used in NUREG-1150 (second draft). The model selection is of importance because predicted consequences are model dependent. The selection objective was to find a model that would represent a nation-wide average for all U.S. plants. It was assumed that the radiological consequences were primarily dependent on population density when implementing this model selection objective.

Site population factors (SPFs) were developed by the NRC to provide a method for comparing populations surrounding nuclear plant sites.[I-2] The factors are intended to be dimensionless measures of total risk within specified radial distances from a given reactor site. Because correlations between population distribution and wind direction may significantly influence risk at some sites, a wind rose weighted formulation of the SPF (or WRSPF) was also developed.

The SPFs and WRSPFs were calculated for 91 U.S. reactor sites at radii of 5, 10, 20, and 30 mi[I-2] using 1970 census data. The average values of SPF and WRSPF were then determined for the 91 sites. The difference between the average values and the values for the five NUREG-1150 (second draft) sites were then determined. These difference are shown below in Table I-1. The differences represent the deviation of the NUREG sites from average values for U.S. plants. The smallest deviation is associated with the NUREG site that is closest to average risk conditions.

The Surry 1 site is closest to average risk conditions with respect to WRSPF data at radii greater than 5 miles. Within a 5-mile radius, differences between NUREG sites are insignificant with the exception of the Zion 1 site. Since the WRSPF is a better measure of consequence risk and the Surry 1 site is closest to average for this measure, it was decided that the Surry 1 MACCS model would be adequate for use in the ISLOCA program. The most recent version of the draft NUREG-1150 MACCS 1.5.11 input decks for Surry were utilized. These files differ in some places from those used in the pre-decisional second draft of NUREG-1150. The pre-decisional draft utilized version 1.5.5 of MACCS. These changes reflect additions to support code improvements and input error corrections. The second draft NUREG-1150 input files for Surry were obtained from Sandia National Laboratories.

Table I-1. Site population factors and wind rose weighted SPFs

Site Name	SPF5*	SPF10*	SPF20*	SPF30*
Grand Gulf 1	0.064631	0.069299	0.091110	0.110164
Peach Bottom 2	0.055659	0.042620	0.006532	0.021141
Sequoyah 1	0.002281	0.003744	0.053928	0.012281
Surry 1	0.065422	0.012330	0.016468	0.007101
Zion 1	0.636709	0.617710	0.471118	0.423291

SPFxx* = ABS ((SPFxx)avg of 91 - (SPFxx)named site)

Site Name	WRSPF5*	WRSPF10*	WRSPF20*	WRSPF30*
Grand Gulf 1	0.056091	0.072459	0.097906	0.115450
Peach Bottom 2	0.053448	0.052079	0.015018	0.022470
Sequoyah 1	0.032236	0.004121	0.127492	0.080040
Surry 1	0.054780	0.002804	0.001998	0.012580
Zion 1	0.809106	0.745092	0.566652	0.517020

WRSPFxx* = ABS ((WRSPFxx)avg of 91 - (WRSPFxx)named site)

A source term and accident sequence for the plant were needed for incorporation into the Surry MACCS model. Published data for an ISLOCA at the reference B&W plant are not available. An ISLOCA was analyzed in a probabilistic risk assessment (PRA) for the B&W plant Oconee 3;[I-3] and this information employed because

a.) Oconee 3 is also a B&W plant and,
b.) both units have a similar thermal power (2772 MWt and 2568 Mwt, for the reference plant and Oconee, respectively).

It was then possible to scale the Oconee 3 ISLOCA source term to the B&W reference plant. This scaling was accomplished by using the associated ISLOCA accident sequence modified by the ratio of the thermal powers. This scaling should not significantly misrepresent the reference B&W plant ISLOCA source term. On this basis the appropriate modifications of the Oconee 3 PRA data were incorporated into the Surry 1 MACCS model for ISLOCA consequence analysis of the reference B&W plant.

Radionuclide release during the B&W reference plant's ISLOCA sequences can occur through a submerged breach in a flooded ECCS pump room. A scrubbing decontamination factor (DF) will reduce the actual release from the auxiliary building. Credit was not taken for radionuclide removal by this scrubbing mechanism in the ISLOCA sequences in the Oconee source terms. The scrubbing decontamination factor thus needs to be included in the reference plant's consequence analysis. A great deal of uncertainty is associated with the selection of the appropriate decontamination factor to model this effect.[I-4] Table C-20 of NUREG/CR-4551, Volume 1, provides a summary of expert opinion for the scrubbing DF for the containment bypass sequence (ISLOCA) when the release occurs in a potentially flooded area. These decontamination factors are presented as distributions for each reviewer and the composite distribution is reproduced as follows:

Table I-2. Scrubbing decontamination factor for the containment bypass sequence with overlying water

DF Level	Composite Weighing Factor
100	0.13
12	0.26
5	0.38
2	0.23

These DF values pertain to the V Sequence analysis for Surry. However, for the purpose of this analysis, it is assumed that they are generically applicable to a V Sequence for a typical LWR.

To evaluate the effect of decontamination factors on the consequence measures, ten MACCS cases were run using a range of decontamination factors from 1 to infinity. The Dfs were applied uniformly to all the radionuclide groups except the nobel gases. This calculation is scoping in nature and as such does not take into account any changes in the emergency response scenario, time of release, duration of release, or accident alarm times for each source term. The source term timing data were obtained from release category 2 of the Oconee 3 PRA, which assumes a 3.5-hour release duration beginning 1.5 hours following accident initiation and a 30-minute delay after accident initiation before general emergency conditions are reached. In accordance with the second draft NUREG-1150 analysis, 99.5% of the population within the affected zone is assumed to follow the Surry site evacuation model, which assumes a 1.8 m/s radial evacuation speed beginning 2.0 hours following the declaration of general emergency conditions, with 0.05% of the population maintaining normal activity within the 10-mile evacuation zone.

A PC version of the MELCOR Accident Consequence Code System Version 1.5.11 (MACCS 1.5.11) was used for this analysis.[I-5] The computer code is comprised of a single FORTRAN77 program that consists of three basic modules, ATMOS, EARLY, and CHRONC, which are exercised in sequence. This program has been developed for the purpose of evaluating the severe accident consequences at commercial LWR power plants. MACCS 1.5 incorporates several improvements over earlier modeling capabilities available in CRAC2 for the treatment of variable and/or long-term releases, deposition modeling, dosimetry, emergency response, long-term mitigative actions, radiological health effects, and economic impacts.

1.2 Detailed Input Description

Of the six input files required by MACCS, only the ATMOS input file was modified from the Draft NUREG-1150 MACCS 1.5.11 Surry Model. These changes include case-specific input representing the ISLOCA source terms for a range of decontamination factors. A detailed description of the ATMOS input file follows:

Variable Name - **ATNAM1**
Purpose - Identifier for specific ATMOS case (Case Specific).

CASE 1: 20RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-001'

CASE 2: RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-002'

CASE 3: RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-003'

CASE 4: RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-004'

CASE 5: RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-005'

CASE 6: RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-006'

CASE 7: RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-007'

CASE 8: RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-008'

CASE 9: RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-009'

CASE 10:RIATNAM1001 'IN1A.INP, SURRY, USING B&W PLANT SOURCE TERMS CASE-010'

Variable Name - **NUMRAD**
Purpose - Number of radial spatial elements defined in the model.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

GENUMRAD001 26

Variable Name - **SPAEND**
Purpose - Distance in meters to the end of the spacial intervals.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
*  SURRY
*
GESPAEND001      .16       .52      1.21      1.61      2.13
GESPAEND002     3.22      4.02      4.83      5.63      8.05
GESPAEND003    11.27     16.09     20.92     25.75     32.19
GESPAEND004    40.23     48.28     64.37     80.47    112.65
GESPAEND005   160.93    241.14    321.87    563.27    804.67
GESPAEND006  1609.34
```

Variable Name - **CWASH1**
Purpose - Linear term of the washout factor.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
WDCWASH1001  9.5E-5   (JON HELTON AFTER JONES, 1986)
```

Variable Name - **CWASH2**
Purpose - The exponential term for the washout factor.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
WDCWASH2001  0.8      (JON HELTON AFTER JONES, 1986)
```

Variable Name - **NPSGRP**
Purpose - The number of particle size groups that are used for dry deposition.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
DDNPSGRP001   1
```

Variable Name - **VDEPOS**
Purpose - The representative dry deposition velocities associated with each of the particle size groups.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
DDVDEPOS001   0.01
```

Variable Name - **CYSIGA**
Purpose - The linear term in the expression for sigma-y for 6 stability classes.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
* STABILITY CLASS: A        B        C        D        E        F
*
DPCYSIGA001   0.3658   0.2751   0.2089   0.1474   0.1046   0.0722
```

Variable Name - **CYSIGB**
Purpose - The exponential term of the expression for sigma-y, 6 stability classes.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
* STABILITY CLASS: A        B        C        D        E        F
*
DPCYSIGB001    .9031    .9031    .9031    .9031    .9031    .9031
```

Variable Name - **CZSIGA**
Purpose - The linear term of the expression for sigma-z, 6 stability classes.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
* STABILITY CLASS: A        B        C        D        E        F
*
DPCZSIGA001   2.5E-4   1.9E-3      .2       .3       .4       .2
```

Variable Name - **CZSIGB**

Purpose - The exponential term of the expression for sigma-z, 6 stability classes.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
* STABILITY CLASS; A        B         C         D         E         F
*
DPCZSIGB001    2.125   1.6021     .8543    .6532    .6021    .6020
```

Variable Name - **YSCALE**
Purpose - The linear scaling factor for the sigma-y function.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

DPYSCALE001 1.

Variable Name - **ZSCALE**
Purpose - The linear scaling factor for the sigma-z function.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

DPZSCALE001 1.27

Variable Name - **TIMBAS**
Purpose - The time base for the expansion factor (seconds).
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

PMTIMBAS001 600. (10 MINUTES)

Variable Name - **BRKPNT**
Purpose - The break point in the formula used for calculating the plume meander expansion factor.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

PMBRKPNT001 3600. (1 HOUR)

Variable Name - **XPFAC1**
Purpose - Exponential expansion factor number 1.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

PMXPFAC1001 0.2

Variable Name - **XPFAC2**
Purpose - Exponential expansion factor number 2.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

PMXPFAC2001 0.25

Variable Name - **SCLCRW**
Purpose - Scaling factor for the critical wind speed for entrainment of a buoyant plume.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

PRSCLCRW001 1.

Variable Name - **SCLADP**
Purpose - Scaling factor for the a-d stability plume rise formula.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

PRSCLADP001   1.

Variable Name   - **SCLEFP**
Purpose   - Scaling factor for the e-f stability plume rise formula.
Source   - NUREG-1150 MACCS 1.5.11 Surry Model.

PRSCLEFP001   1.

Variable Name   - **BUILDW**
Purpose   - Width of the reactor building in meters.
Source   - NUREG-1150 MACCS 1.5.11 Surry Model.

WEBUILDW001   40. * SURRY

Variable Name   - **BUILDH**
Purpose   - Height of the reactor building in meters.
Source   - NUREG-1150 MACCS 1.5.11 Surry Model.

WEBUILDH001   50. * SURRY

Variable Name   - **ENDAT1**
Purpose   - Flag to indicate that this is the last program in the series to be run.
Source   - NUREG-1150 MACCS 1.5.11 Surry Model.

OCENDAT1001 .FALSE. (SET THIS VALUE TO .TRUE. TO SKIP EARLY AND CHRONC)

Variable Name   - **IDEBUG**
Purpose   - Debug output flag (0 - no debug).
Source   - NUREG-1150 MACCS 1.5.11 Surry Model.

OCIDEBUG001 0

Variable Name   - **METCOD**
Purpose   - Meteorological sampling option code.
metcod = 1, user specified day and hour in the year,
2, weather category bin sampling,
3, 120 hours of weather specified on the atmos user input file,
4, constant met,
5, stratified random samples for each day of the year.
Source   - NUREG-1150 MACCS 1.5.11 Surry Model.

M1METCOD001 2

Variable Name   - **LIMSPA**
Purpose   - Last Spacial Interval for Measured Weather
Source   - NUREG-1150 MACCS 1.5.11 Surry Model.

M2LIMSPA001 25

Variable Name   - **BNDMXH**
Purpose   - Boundary weather mixing layer height.
Source   - NUREG-1150 MACCS 1.5.11 Surry Model.

M2BNDMXH001 1000. (METERS)

Variable Name - **IBDSTB**
Purpose - Boundary weather stability class index.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M2IBDSTB001 4 (D-STABILITY)

Variable Name - **BNDRAN**
Purpose - Boundary weather rain rate.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M2BNDRAN001 5. (MM/HR)

Variable Name - **BNDWND**
Purpose - Boundary weather wind speed.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M2BNDWND001 4. (M/S)

Variable Name - **NSMPLS**
Purpose - Number of samples per bin.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M4NSMPLS001 4 (THIS NUMBER SHOULD BE SET TO 4 FOR RISK ASSESSMENT)

Variable Name - **NRNINT**
Purpose - Number of rain distance intervals for binning.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M4NRNINT001 6

Variable Name - **RNDSTS**
Purpose - Endpoints of the rain distance intervals (kilometers)
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M4RNDSTS001 3.22 5.63 11.27 20.92 40.23 80.47

Variable Name - **RNRATE**
Purpose - Number of rain intensity breakpoints.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M4NRINTN001 3

Variable Name - **RNRATE**
Purpose - Rain intensity breakpoints for weather binning (millimeters per hour).
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M4RNRATE001 2. 4. 6.

Variable Name - **IRSEED**
Purpose - Initial seed for random number generator.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

M4IRSEED001 79

Variable Name - **NUMISO**
Purpose - Number of nuclides defined in the model.
Source - Oconee Unit 3 PRA, NSAC/60.
ISNUMISO001 54

Variable Name - **MAXGRP**
Purpose - Number of nuclide groups defined in the model.
Source - Oconee Unit 3 PRA, NSAC/60.

ISMAXGRP001 7

Variable Name - **WETDEP**
Purpose - Logical flag for each of the nuclide groups that indicate whether they are subject to wet deposition.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

Variable Name - **DRYDEP**
Purpose - Logical flag for each of the nuclide groups that indicate whether they are subject to dry deposition.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

*	WETDEP	DRYDEP
*		
ISDEPFLA001	.FALSE.	.FALSE.
ISDEPFLA002	.TRUE.	.TRUE.
ISDEPFLA003	.TRUE.	.TRUE.
ISDEPFLA004	.TRUE.	.TRUE.
ISDEPFLA005	.TRUE.	.TRUE.
ISDEPFLA006	.TRUE.	.TRUE.
ISDEPFLA007	.TRUE.	.TRUE.

Variable Name - **NUCNAM**
Purpose - Identifying name associated with each on the nuclides.
Source - Oconee Unit 3 PRA, NSAC/60.

Variable Name - **PARENT**
Purpose - Name of parent nuclide if any.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

Variable Name - **IGROUP**
Purpose - Chemical group to which nuclide is assigned.
Source - Oconee Unit 3 PRA, NSAC/60.

Variable Name - **HAFLIF**
Purpose - Half-life of the isotope in seconds.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

*	NUCNAM	PARENT	IGROUP	HAFLIF(S)
*				
ISOTPGRP001	CO-58	NONE	6	6.160E+06
ISOTPGRP002	CO-60	NONE	6	1.660E+08
ISOTPGRP003	KR-85	NONE	1	3.386E+08
ISOTPGRP004	KR-85M	NONE	1	1.613E+04

ISOTPGRP005	KR-87	NONE	1	4.560E+03
ISOTPGRP006	KR-88	NONE	1	1.008E+04
ISOTPGRP007	RB-86	NONE	3	1.611E+06
ISOTPGRP008	SR-89	NONE	5	4.493E+06
ISOTPGRP009	SR-90	NONE	5	8.865E+08
ISOTPGRP010	SR-91	NONE	5	3.413E+04
ISOTPGRP011	Y-90	SR-90	7	2.307E+05
ISOTPGRP012	Y-91	SR-91	7	5.080E+06
ISOTPGRP013	NB-95	ZR-95	7	3.033E+06
ISOTPGRP014	ZR-95	NONE	7	5.659E+06
ISOTPGRP015	ZR-97	NONE	7	6.048E+04
ISOTPGRP016	MO-99	NONE	6	2.377E+05
ISOTPGRP017	TC-99M	MO-99	6	2.167E+04
ISOTPGRP018	RU-103	NONE	6	3.421E+06
ISOTPGRP019	RU-105	NONE	6	1.598E+04
ISOTPGRP020	RU-106	NONE	5	3.188E+07
ISOTPGRP021	RH-105	RU-10[illegible]	[illegible]	1.278E+05
ISOTPGRP022	SB-127	NONE	4	3.283E+05
ISOTPGRP023	SB-129	NONE	4	1.562E+04
ISOTPGRP024	TE-127	SB-127	4	3.366E+04
ISOTPGRP025	TE-127M	NONE	4	9.418E+06
ISOTPGRP026	TE-129	SB-129	4	4.200E+03
ISOTPGRP027	TE-129M	NONE	4	2.886E+06
ISOTPGRP028	TE-131M	NONE	4	1.080E+05
ISOTPGRP029	TE-132	NONE	4	2.808E+05
ISOTPGRP030	I-131	TE-131M	2	6.947E+05
ISOTPGRP031	I-132	TE-132	2	8.226E+03
ISOTPGRP032	I-133	NONE	2	7.488E+04
ISOTPGRP033	I-134	NONE	2	3.156E+03
ISOTPGRP034	I-135	NONE	2	2.371E+04
ISOTPGRP035	XE-133	I-133	1	4.571E+05
ISOTPGRP036	XE-135	I-135	1	3.301E+04
ISOTPGRP037	CS-134	NONE	3	6.501E+07
ISOTPGRP038	CS-136	NONE	3	1.123E+06
ISOTPGRP039	CS-137	NONE	3	9.495E+08
ISOTPGRP040	BA-140	NONE	5	1.[illegible]05E+06
ISOTPGRP041	LA-140	BA-140	7	1.448E+05
ISOTPGRP042	CE-141	NONE	7	2.811E+06
ISOTPGRP043	CE-143	NONE	7	1.188E+05
ISOTPGRP044	CE-144	NONE	7	2.457E+07
ISOTPGRP045	PR-143	CE-143	7	1.173E+06
ISOTPGRP046	ND-147	NONE	7	9.495E+05
ISOTPGRP047	PU-238	CM-242	7	2.809E+09
ISOTPGRP048	PU-239	NP-239	7	7.700E+11
ISOTPGRP049	PU-240	CM-244	7	2.133E+11
ISOTPGRP050	PU-241	NONE	7	4.608E+08
ISOTPGRP051	NP-239	NONE	7	2.030E+05
ISOTPGRP052	AM-241	PU-241	7	1.366E+10
ISOTPGRP053	CM-242	NONE	7	1.408E+07
ISOTPGRP054	CM-244	NONE	7	5.712E+08

Variable Name - **ATNAM2**
Purpose - Descriptive text identifying the source term. This text is used to identify specific source terms in the output.

Case 1:
RDATNAM2001 'B&W PLANT SOURCE TERM AS SCALED FROM OCONEE PRA DF=1.0'

Case 2:
RDATNAM2001 'B&W PLANT SOURCE TERM AS SCALED FROM OCONEE PRA DF=2.0'

Case 3:
RDATNAM2001 'B&W PLANT SOURCE TERM AS SCALED FROM OCONEE PRA DF=5.0'

Case 4:
RDATNAM2001 'B&W PLANT SOURCE TERM AS SCALED FROM OCONEE PRA DF=10.'

Case 5:
RDATNAM2001 'B&W PLANT SOURCE TERM AS SCALED FROM OCONEE PRA DF=20.'

Case 6:
RDATNAM2001 'B&W PLANT SOURCE TERM AS SCALED FROM OCONEE PRA DF=50.'

Case 7:
RDATNAM2001 'B&W PLANT SOURCE TERM AS SCALED FROM OCONEE PRA DF=100.'

Case 8:
RDATNAM2001 'B&W PLANT SOURCE TERM SCALED FROM OCONEE PRA DF=1000.'

Case 9:
RDATNAM2001 'B&W PLANT SOURCE TERM SCALED FROM OCONEE PRA DF=10000.'

Case 10:
RDATNAM2001 'B&W PLANT SOURCE TERM AS SCALED FROM OCONEE PRA DF=inf'

Variable Name - **OALARM**
Purpose - Time after accident initiation when the accident reaches general emergency conditions (as defined in NUREG-0654), or when plant personnel can reliably predict that general emergency conditions will be attained
Source - Oconee Unit 3 PRA, NSAC/60.

RDOALARM001 1800.0

Variable Name - **NUMREL**
Purpose - Number of plume segments that are released.
Source - Oconee Unit 3 PRA, NSAC/60.

RDNUMREL001 1

Variable Name - **MAXRIS**
Purpose - Selection of risk dominant plume.
Source - Single plume release.

RDMAXRIS001 1

Variable Name - **REFTIM**
Purpose - Reference time for dispersion and radioactive decay.
Source - A value of 0.0 is assumed for this analysis. This results in the trailing edge of the plume's release period being

used as the representative time point for the dispersion, dry deposition and radioactive decay models, resulting in a conservative calculation.

RDREFTIM001 0.0

Variable Name - **PLHEAT**
Purpose - Heat content of plume release (w).
Source - Oconee Unit 3 PRA, NSAC/60.

RDPLHEAT001 9.66E+06

Variable Name - **PLHITE**
Purpose - Height of plume segments at release (m).
Source - Oconee Unit 3 PRA, NSAC/60.

RDPLHITE001 0.0

Variable Name - **PLUDUR**
Purpose - Duration of plume segments (s).
Source - Oconee Unit 3 PRA, NSAC/60.

RDPLUDUR001 12600.0

Variable Name - **PDELAY**
Purpose - Time of release for each plume segment (s).
Source - Oconee Unit 3 PRA, NSAC/60.

RDPDELAY001 5400.0

Variable Name - **PSDIST**
Purpose - Particle size distribution for each nuclide group.
Source - NUREG-1150 MACCS 1.5.11 Surry Model.

```
RDPSDIST001  1.0
RDPSDIST002  1.0
RDPSDIST003  1.0
RDPSDIST004  1.0
RDPSDIST005  1.0
RDPSDIST006  1.0
RDPSDIST007  1.0
```

Variable Name - **CORINV**
Purpose - Defines the total core inventory for each nuclide, NUCNAM
Source - Oconee Unit 3 PRA, NSAC/60.
OCONEE 3 CORE INVENTORY FROM A LOR2 CALCULATION
B&W PWR, 177 FUEL ASSEMBLIES, 2568 Mwt, 421 EFPD BURNUP

```
*               NUCNAM     CORIN (CI)
*
RDCORINV001     CO-58      8.00E+05
RDCORINV002     CO-60      3.00E+05
RDCORINV003     KR-85      5.45E+05
RDCORINV004     KR-85M     1.80E+07
RDCORINV005     KR-87      3.33E+07
```

RDCORINV006	XR-88	4.72E+07
RDCORINV007	RB-86	9.99E+04
RDCORINV008	SR-89	6.51E+07
RDCORINV009	SR-90	4.43E+06
RDCORINV010	SR-91	8.14E+07
RDCORINV011	Y-90	4.57E+06
RDCORINV012	Y-91	8.44E+07
RDCORINV013	NB-95	1.16E+08
RDCORINV014	ZR-95	1.16E+08
RDCORINV015	ZR-97	1.17E+08
RDCORINV016	MO-99	1.29E+08
RDCORINV017	TC-99M	1.11E+08
RDCORINV018	RU-103	1.11E+08
RDCORINV019	RU-105	7.72E+07
RDCORINV020	RU-106	3.26E+07
RDCORINV021	RH-105	7.06E+07
RDCORINV022	SB-127	6.28E+06
RDCORINV023	SB-129	2.24E+07
RDCORINV024	TE-127	6.28E+06
RDCORINV025	TE-127M	9.11E+05
RDCORINV026	TE-129	2.09E+07
RDCORINV027	TE-129M	5.67E+06
RDCORINV028	TE-131M	1.02E+07
RDCORINV029	TE-132	9.95E+07
RDCORINV030	I-131	6.92E+07
RDCORINV031	I-132	1.01E+08
RDCORINV032	I-133	1.42E+08
RDCORINV033	I-134	1.55E+08
RDCORINV034	I-135	1.33E+08
RDCORINV035	XE-133	1.43E+08
RDCORINV036	XE-135	5.72E+07
RDCORINV037	CS-134	1.26E+07
RDCORINV038	CS-136	4.57E+06
RDCORINV039	CS-137	6.16E+06
RDCORINV040	BA-140	1.24E+08
RDCORINV041	LA-140	1.26E+08
RDCORINV042	CE-141	1.16E+08
RDCORINV043	CE-143	1.07E+08
RDCORINV044	CE-144	7.69E+07
RDCORINV045	PR-143	1.05E+08
RDCORINV046	ND-147	4.57E+07
RDCORINV047	PU-238	1.92E+05
RDCORINV048	PU-239	3.92E+04
RDCORINV049	PU-240	3.00E+04
RDCORINV050	PU-241	7.54E+06
RDCORINV051	NP-239	1.66E+09
RDCORINV052	AM-241	6.21E+03
RDCORINV053	CM-242	1.96E+06
RDCORINV054	CM-244	1.15E+05

Variable Name - **SCLCRW**
Purpose - Scaling factor to adjust the core inventory.
Source - SCLCRW includes a conversion from curies to becquerels and the ratio of reference plant's thermal power (2772 mwt) to the thermal power of Oconee 3 (2568 Mwt). SCLCR is then:

```
SCLCRW = 2772 Mwth / 2568 Mwth * 3.7E10 bq/ci
SCLCRW = 3.99E+10
```

```
RDCORSCA001  3.99E+10
```

Variable Name - **RELFAC**
Purpose - Release fractions for isotope groups in release (Case Dependant).
Sources - The release fractions for Case 1 are based upon the Oconee Unit 3 PRA values for Release Category 2 which includes Interfacing LOCA events. The remaining nine cases represent application of uniform decontamination factors to the non-Noble gas release fractions of Case 1.

```
Case 1:
*  ISOTOPE GROUPS:
*           XE/KR    I      CS      TE      SR      RU      LA
* DF=1.0
RDRELFRC001 1.0 3.1E-01 3.2E-01 3.0E-01 3.6E-02 2.7E-02 4.1E-03

Case 2:
* DF=2.0
RDRELFRC001 1.0 1.5E-01 1.6E-01 1.5E-01 1.8E-02 1.3E-02 2.1E-03

Case 3:
* DF=5.0
RDRELFRC001 1.0 6.2E-02 6.4E-02 6.0E-02 7.2E-03 5.4E-03 8.2E-04

Case 4:
* DF=10.
RDRELFRC001 1.0 3.1E-02 3.2E-02 3.0E-02 3.6E-03 2.7E-03 4.1E-04


Case 5:
* DF=12.
RDRELFRC001 1.0 2.6E-02 2.7E-02 2.5E-02 3.0E-03 2.2E-03 3.4E-04

Case 6:
* DF=50.
RDRELFRC001 1.0 6.2E-03 6.4E-03 6.0E-03 7.2E-04 5.4E-04 8.2E-05

Case 7:
* DF=100.
RDRELFRC001 1.0 3.1E-03 3.2E-03 3.0E-03 3.6E-04 2.7E-04 4.1E-05

Case 8:
* DF=1000.
RDRELFRC001 1.0 3.1E-04 3.2E-04 3.0E-04 3.6E-05 2.7E-05 4.1E-06

Case 9:
* DF=10000.
RDRELFRC001 1.0 3.1E-05 3.2E-05 3.0E-05 3.6E-06 2.7E-06 4.1E-07
```

Case 9:

```
* DF= infinite
RDRELFRC001 1.0 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00 0.0E+00
```

Additional Input Files

The ATMOS module requires a site meteorological data file. The NUREG-1150 MACCS 1.5.11 Surry Model site meteorological data file was utilized.

The EARLY and CHRONC modules each require their own input files as well as two auxiliary data files, a site data file and a dose conversion file. The EARLY and CHRONC input files were obtained from the NUREG-1150 MACCS 1.5.11 Surry Model and did not require modification for this analysis. The dose conversion file "MACCS DOSE CONVERSION FILE: MOD SER #32, 6-JUL-89, 15:59:19 SANDIA NATIONAL LABORATORIES, J. JOHNSON" was utilized. This is the most recent dosimetry file provided by Sandia National Laboratory for MACCS 1.5. The site data file used was also from the NUREG-1150 MACCS 1.5.11 Surry Model.

I.3 Results

The mean values obtained for four measures of accident consequence are summarized in Table I-3 for each of the ten cases run. These include the total number of early fatalities, the total number of latent cancer fatalities within a 50 and a 1000 mile radius of the calculational grid, the total population dose within 50 miles in seiverts, and the total economic cost in dollars. These results are also presented in Figures I-1 through I-4.

An effort has been made to estimate the effect of overlying water at the location of the break in scrubbing the release and reducing the radiological consequences. The NUREG/CR-4551 composite DF weighing factors described earlier were applied to the MACCS results to obtain the consequence measures presented in Table I-4.

Table I-3. MACCS results for ISLOCA analysis for a range of decontamination factors

DF	Total Number Early Fatalities	Total Number of Latent Cancer Fatalities 1000 Mi.	Total Number of Latent Cancer Fatalities 50 Mi.	Total Population Dose (Sv.) 50 Mi.	Total Economic Cost ($)
1.00	3.58E-02	4.47E+03	5.25E+02	2.79E+04	1.11E+10
2.00	2.45E-03	2.84E+03	3.50E+02	1.98E+04	5.11E+09
5.00	2.97E-04	1.46E+03	2.23E+02	1.32E+04	2.29E+09
10.00	5.80E-05	8.92E+02	1.62E+02	9.73E+03	1.28E+09
12.00	3.49E-05	7.83E+02	1.52E+02	9.11E+03	1.09E+09
50.00	2.03E-06	2.56E+02	7.55E+01	4.52E+03	2.38E+08
100.00	1.21E-06	1.43E+02	4.89E+01	2.91E+03	1.27E+08
1000.00	7.88E-07	2.24E+01	1.16E+01	6.70E+02	5.23E+06
10000.00	7.65E-07	5.38E+00	3.32E+00	1.75E+02	4.80E+04
-INFINITE-	7.63E-07	3.05E+00	1.97E+00	9.59E+01	2.69E+03

Table I-4. ISLOCA results using NUREG/CR-4551 composite DF weighing factors for a V sequence with overlying water

Total Number of Early Fatalities	6.86E-04
Total Number of Latent Cancer Fatalities	
1000 Miles	1.43E+03
50 Miles	[illegible].11E+02
Total 50 Mile Population Dose (Sv.)	1.23E+04
Total Economic Cost ($)	2.35E+09

The total economic costs are calculated by the CHRONC module of MACCS and as a result the economic costs associated with different EARLY cohorts are not determined by the code. MACCS somewhat arbitrarily uses the results from the last EARLY cohort run as a basis for calculating the evacuation and relocation costs in CHRONC. This is contrary to what the user might assume, that the overall EARLY results combined using the emergency response scenario weighing fractions would be used as a basis for calculating the evacuation and relocation costs in CHRONC. This distinction is not pointed out by the users manual for MACCS 1.5. For the cases run, these costs are relatively small in comparison to the total economic costs and do not impact the results reported in Table I-3.

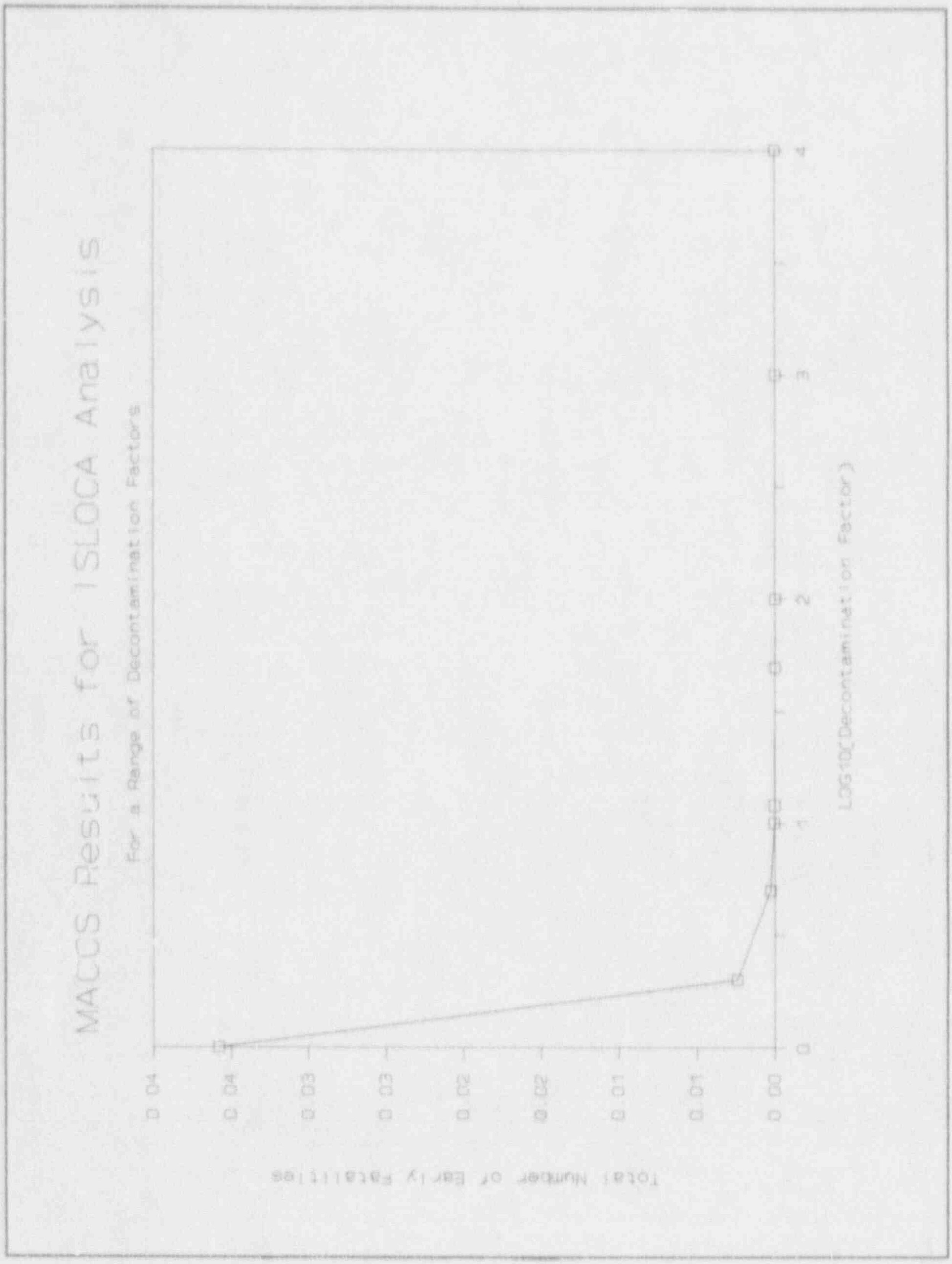

Figure I-1. Early Fatality Consequences for B&W plant ISLOCA normalized to a nationwide-average site.

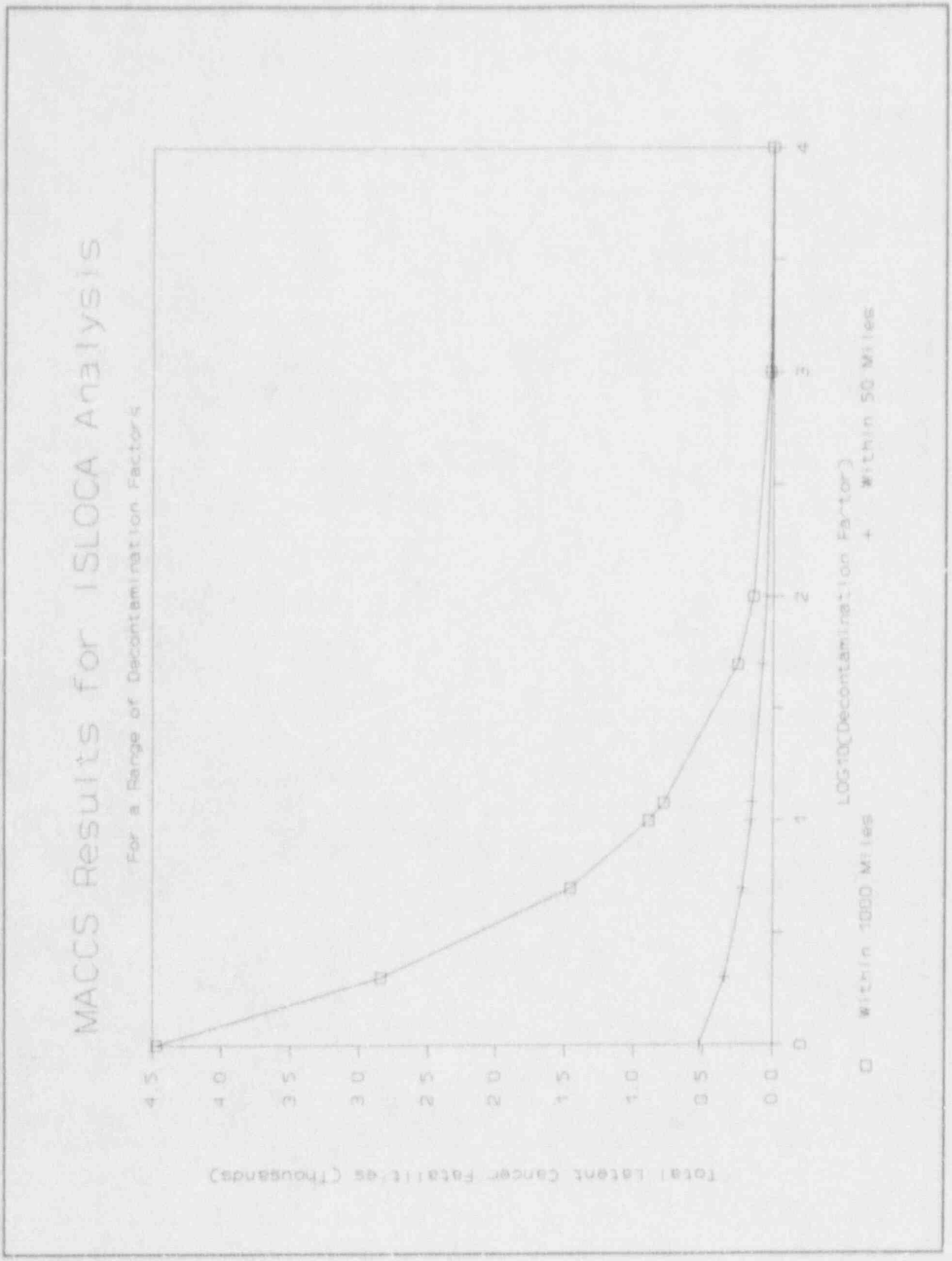

Figure I-2. Latent Cancer Fatality Consequences for B&W plant ISLOCA normalized to a nationwide-average site.

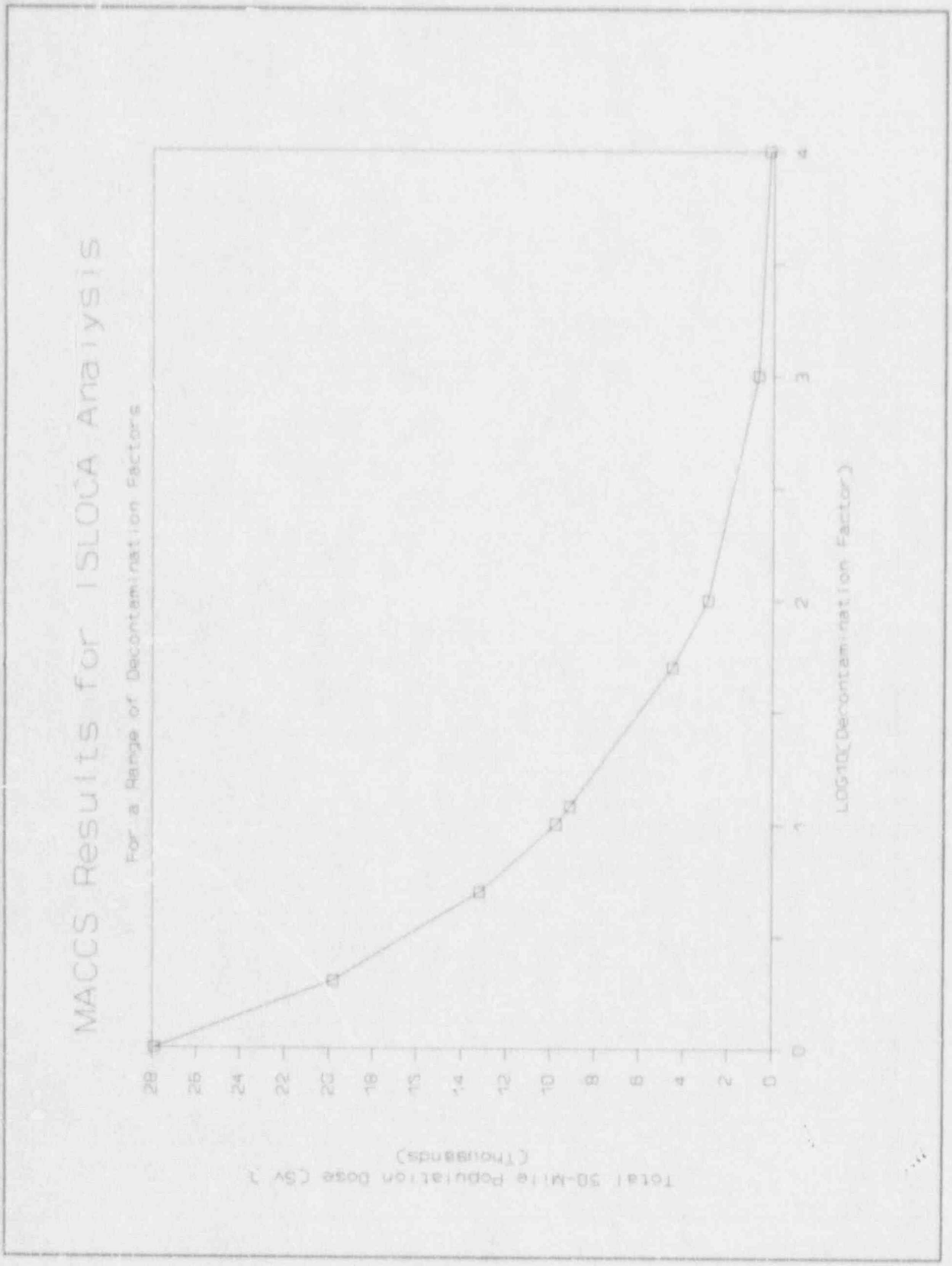

Figure I-3. Population Dose Consequences for B&W plant ISLOCA, normalized to a nationwide-average site.

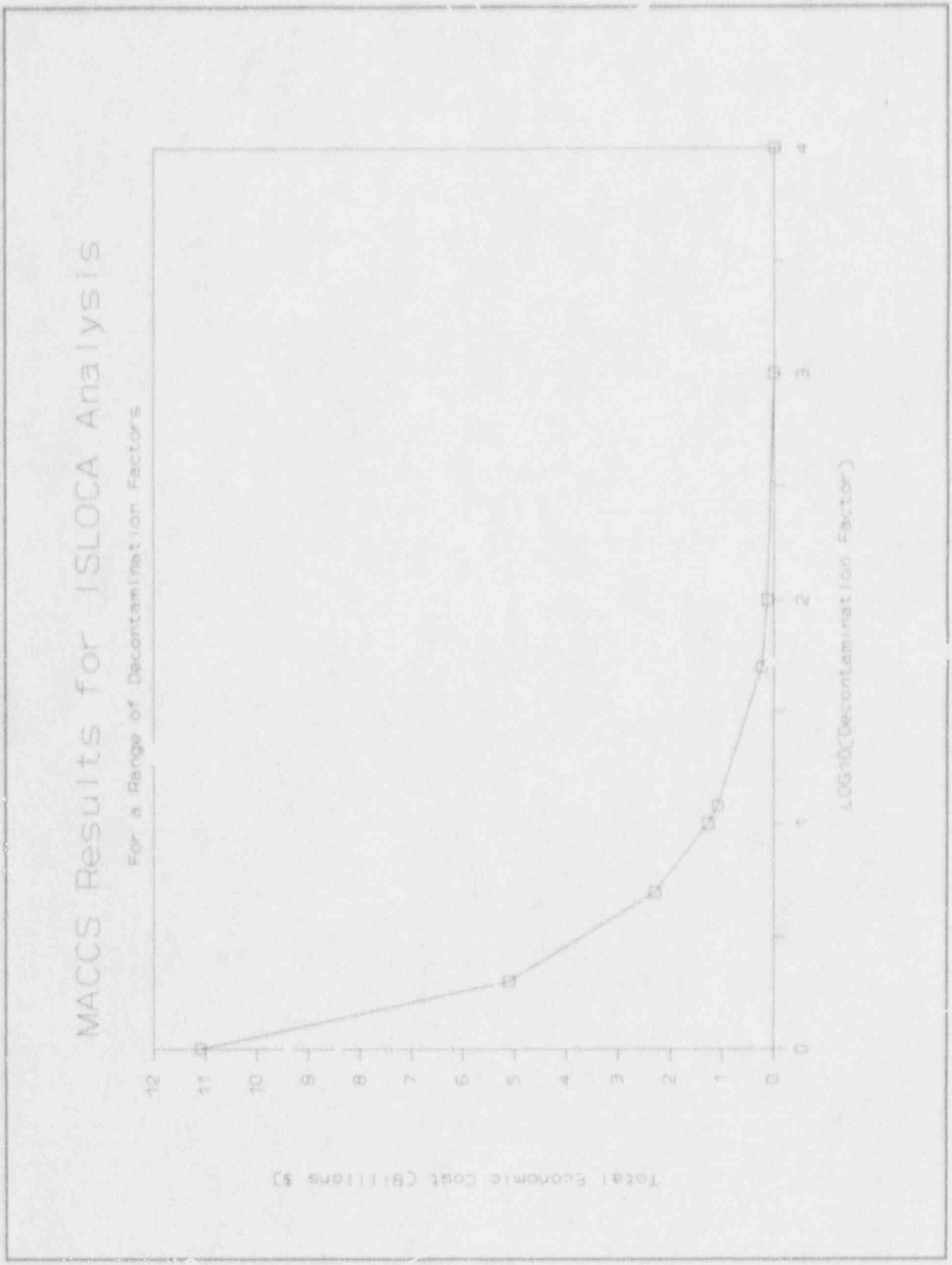

Figure I-4. Total Cost Consequences for B&W Plant ISLOCA, normalized to a nationwide-average site.

1.4 References

I-1. D. I. Chanin, *MELCOR Accident Consequence Code System, MACCS Version 1.5 User's Manual*, Draft NUREG/CR-4691, 21 September 1988.

I-2. D.C. Aldrich et al., *Technical Guidance for Siting Criteria Development*, NUREG/CR-2239, SAND81-1549, 1982.

I-3. Nuclear Safety Analysis Center (Electric Power Research Institute) and Duke Power Company, *Oconee PRA: A Probabilistic Risk Assessment of Oconee Unit 3*, NSAC-60, June 1984.

I-4. Sandia National Laboratories, *Evaluation of Severe Accident Risks and the Potential For Risk Reduction: Surry Power Station, Unit 1*, Draft NUREG/CR-4551, SAND86-1309, Volume 1, July 1989.

I-5. K. R. Jones and C. A. Dobbe, *Documentation of the INEL PC Version of MACCS 1.5.11*, 3 November 1989.

Appendix J

External Events Analysis of ISLOCA Sequences

J. A. Schroeder

CONTENTS

FIGURES

TABLES

APPENDIX J
EXTERNAL EVENTS ANALYSIS OF ISLOCA SEQUENCES

J.1. Introduction

This appendix describes the ISLOCA analysis of the external events at the B&W reference plant. These external events were examined with respect to their potential to cause an inter-system loss-of-coolant accident. The analysis was completed in two phases, a screening analysis and a bounding analysis. (Because of the low risk calculated in the bounding analysis, a detailed analysis was not required.)

J.1.1. Screening Analysis

A systematic screening of the external events was made to eliminate events that are not likely to be a threat to the plant. The external events were screened from further consideration when the median frequency was qualitatively predicted to be low. Section J.3 contains the details of this screening.

A coordinated evaluation of all nonnegligible external events was also made to minimize data gathering efforts. For example, it was determined that the design basis for seismic Class I structures was controlled by tornado loads rather than wind loads.

J.1.2. Bounding Analysis

A bounding analysis was performed for the external events after the negligible events were eliminated in the screening analysis. This analysis utilized generic data to generate an upper bound on the ISLOCA core damage frequency resulting from external events. The surviving events for which bounding analyses were performed are fire, flood, and seismic events.

J.2. Interfacing Systems

J.2.1. HPI System Interface

The HPI system consists of two pump trains, each of which branch into two injection legs. Each injection leg then discharges into one of the four RCS cold legs. The pressure isolation boundary is maintained by two check valves that are welded together, a normally closed MOV and, the HPI pump discharge check valve HP-23 (or HP-22). Because the HPI pressure isolation check valves (PIV's HP-57/59, HP-56/58, HP48/50, and HP-49/51) are welded together, leak testing cannot be performed on the individual check valves. Therefore, these valves were treated as a single check valve for analytical purposes. Since the MOVs (HP-2A, B, C, and D) are maintained with their control and motive power circuits always energized, they are considered susceptible to external events causing spurious operation.

J.2.2. DHR System Interface

The DHR System could be over-pressurized if the DHR letdown line remains open while the RCS is being heated and pressurized, or if the isolation valves are opened after operating temperature and pressure are reached. There are two ways RCS water can enter the DHR system via the letdown line:

1. Through the normal letdown MOV's DH-11 and DH-12 and,
2. Through the MOV-bypass valves DH-21 and DH-23, which are local-manually operated valves.

DH-11 and DH-12 are interlocked to automatically close when the RCS pressure is above 300 psig. However, the interlocks are normally disabled (per plant tech specs) to prevent inadvertent operation. Normal plant procedure is to maintain DH-11 and DH-12 in a disabled state by removing their control power (the valve position indicators remain functional with control power removed) and racking out their motive power supply breakers. The only time valve control power is energized and motive power is returned to the motors is when the valves are to be operated.

Given that the power supply breakers to DH-11 and 12 are normally racked out, and that DH-21 and DH-23 are manual valves, there are no credible external event induced failure modes that could affect the DHR system interface. Therefore an external event induced ISLOCA challenge at the DHR interface is not considered further.

J.2.3. LPI System Interface

This interface is formed by two check valves (CF-30 and DH-76) in series. These two check valves form the pressure isolation boundary between the RCS and the LPI systems. The system consists of two redundant trains, with each injection line being shared with one core flood tank.

If CF-30 and DH-76 fail, RCS water will back-leak into the LPI system and over-pressurize it. LPI over-pressurization at full RCS operating temperature and pressure will result in certain rupture. The DHR heat exchanger is the most likely failure location. If CF-30 and CF-28 fail the RCS will back-leak into the Core Flood Tank. However, because these potential scenarios only include the failure of check valves (assumed not to be susceptible to external event induced failures), they are not further discussed here.

J.3. Screening of External Events

A review of information on the site region and plant design was made to identify all external events to be considered. The data in the B&W Final Safety Analysis Report (FSAR), Fire Hazards Analysis Report (FHAR), and other sources were reviewed for the purpose of minimizing the possibility of omitting significant external events while narrowing the scope of the analysis to only those events that are credible.

The following sections describe the screening analysis performed to eliminate insignificant external events from consideration as ISLOCA initiators.

J.3.1. Aircraft Impact

The closest airport serving commercial airlines is located 38 miles west of the B&W site. The nearest airport with a paved runway is located east-southeast, 13 miles from the site. The two nearest VHF Omni-Directional Radio Range Airways are designated V232 and V-45 and are located seven miles from the site.[J-1]

There are no low-level flight patterns or airport facilities in the proximity of the station site. The existence of the restricted air space in the area of the site reduces the amount of low-level aircraft operations that could be expected.[J-1]

J.3.2. Avalanche

There are no mountains in the area of the B&W site, therefore an avalanche is not possible.

J.3.3. External Flood

The station structures are over 3,000 feet from the lake's shoreline. All station grade floors are at elevation 585 feet Internal Great Lakes Datum (I.G.L.D.) and the station is designed for normal power generation at water levels from 562 feet (I.G.L.D.) up to this elevation. In addition, a breakwater dike is installed along the north and east side of the station to protect it against flooding due to waves and wave run-up during a probable maximum meteorological event.

The maximum wave run-up on this breakwall will be 6.6 feet above the probable maximum static water level of 583.7 feet (I.G.L.D.). This will give a maximum water run-up level on the breakwall of 590.3 feet (I.G.L.D.). As a result, no large unbroken waves should reach the station's buildings and none should top the wave protection dike.

The intake structure is designed to accept the wave action directly. The cooling tower is located outside the diked area and could be subjected to wave action. This wave action might require the cooling tower to be taken out of service. In this event, the station can be brought to a safe and orderly shutdown condition and maintained in this condition because all other systems are fully protected.

If for any possible reason the main discharge pipe in the sewer system fails to handle the estimated probable maximum runoff effluent into the river, the runoff water will build up in the sewer system and on the ground around the station.

Because all structures are protected against water buildup and flooding up to 585.0 feet (I.G.L.D.), there will be no threat to the structure from this probable maximum buildup runoff water.[J-1]

J.3.4. Fire

A bounding analysis was performed for this event.

J.3.5. Forest Fire

There are no forests in the immediate area of the B&W site, therefore forest fires are not a concern.

J.3.6. Hail

Tornado generated missiles govern this event.

J.3.7. Ice Cover

The adjoining lake is subject to extensive ice formations. However, the depth of the intake structure precludes blockage of intake flow from normal ice formations. The shore area of the station's site is subject to ice pileup from northeast wind-driven lake ice. The rockfill barrier beyond the intake structure and the rockfill around the structure itself provides protection from ice chunks that could be forced to and along the bottom surface by this piling action. If ice pileup should extend to the lake bottom in the area of the intake structure, it is extremely unlikely that all intake ports could be covered completely and the conservative design of the intake areas provides

J.3.13. Low lake/River level

All cooling water requirements for the B&W plant are taken from the surrounding lake. The cooling water is supplied to the station's intake canal. This canal is fully closed and is connected to the lake via a submerged 96 inch conduit. This conduit extends approximately 3,300 feet into the lake. The water flow into the conduit is through an intake crib. The intake crib is at an elevation of 561.85 feet. The intake canal will be completely cutoff from the lake if the water level falls below this elevation. However, there is sufficient water impounded in the Class I portion of the intake structure forebay to provide sufficient cooling water to provide for an orderly shutdown and to maintain the plant in a safe condition for at least 30 days if the intake canal is isolated from the lake.[J-1]

J.3.14. Lightning

Lightning is not a concern. The valves and associated control centers and relays are located well within the auxiliary building or the containment structure and are adequately shielded from the threat of a lightning strike.

J.3.15. Meteorite

The probability of a meteorite impacting a nuclear power plant is negligible.[J-2]

J.3.16. Missiles

The station was designed so that the Seismic Class I structures would withstand tornado effects. These effects include credible missiles generated by a tornado. An exception to the Class I structures is the Borated Water Storage Tank.[J-1]

A National Guard training center is located 4.5 miles southeast of the site. The training center is immediately adjacent to the east of the industrial park. This training installation is used extensively by the National Guard. The training includes small arms firing and limited firing of 40 mm anti-aircraft ordnance.[J-1]

All Seismic Class I structures are designed and are capable of withstanding an end-on impact of internally generated missiles. All walls and slabs of the B&W reference plant have more than double the thickness required to prevent missile penetrations. This design aspect of the facility prevents spalling of the concrete and generation of secondary missiles.[J-1]

J.3.17. Pipeline Accidents

There are no oil or gas pipelines within five miles of the B&W site.[J-1]

J.3.18. Seismic

The maximum probable operating basis earthquake (OBE) is 0.08g; the maximum possible safe shutdown earthquake (SSE) is 0.15g.[J-1]

A bounding analysis was performed for this event.

J.3.19. Transportation Accidents

Transportation accidents on the adjoining state highway could involve trucks carrying flammables or explosives. The arrangement of the entrance roadways, rail line, and site topography adjacent to this highway is such that it precludes a vehicle from accidently traveling for any distance onto the site from the highway. A fire or explosion resulting from a truck accident will have no effect on the safety of the station. This is because the distance of the station structures from the highway is 2,600 feet.

The drainage of this portion of the site is away from the site area containing the station structures. The elevation of this area of the site is 6 to 14 feet above the natural site elevation. This topography feature of the site precludes the spread of burning flammables to the station buildings.

No credible highway transportation accident could adversely affect the safety of the station.[J-1]

J.3.20. Tornado

Tornados are common in the state in which the B&W reference plant is located. The probability of a tornado striking a point within the one-degree square in which the site is located is 6.3E-4 (per year). The associated recurrence interval is once in approximately 1,590 years.[J-1]

The station was designed so that the Seismic Class I structures would withstand tornado effects. These effects include credible missiles generated by a tornado. The BWST is an exception to this generalization.[J-1]

J.3.21. Volcanic Activity

Volcanic activity is not possible at the site. There are no active volcanos in the area of the B&W site.

J.3.22. Wind

The design basis for seismic Class I structures was controlled by tornado loads rather than wind loads.[J-1]

J.4. Bounding Analysis

An analysis of the external events that contribute to the plant's risk is included in this section. The events that survived the screening analysis are fire, internal flood, and seismic events.

J.4.1. Analysis of Fire Events

The search for ISLOCA challenges that might result from a fire event is based on two assumptions. First, fires will not affect the structural integrity of the RCS pressure boundary. Second, fires will not cause the operators to mistakenly open a valve that might contribute to an ISLOCA event. The only failure mechanism where fire is postulated to cause an ISLOCA event is by fire induced failures within valve motor control centers, control circuitry, or cabling.

The ISLOCA event trees from Appendix D were used to identify which valves should be included in the bounding analysis. In the makeup and purification event tree, MOV HP-2A could be affected by fire induced failures. Additional non-fire related failures would also be required before an ISLOCA could occur. In the high-pressure injection system ISLOCA event tree, MOVs HP-2B, C, or D could also be affected by fire. Additional non-fire related failures would also have to occur in this case. In the two DHR letdown trees, only DH-11 and DH-12 could be affected, however, the valve motor power supply breakers are racked out, making inadvertent operation of the valves incredible. Finally, the LPI event tree was examined and found to contain no valves that would be affected by a fire.

For the analysis that follows, the makeup and purification interface is used as the model to represent all four of the high-pressure injection interfaces. For a failure of any one of the boundary MOVs (HP-2A, B, C, D) to lead to an ISLOCA challenge, the corresponding pressure isolation check valves would have to fail along with either the HPI/BWST vent line or the pump discharge check valve. Because the failure mechanism for the A-line check valves is failure-to-close on demand (rather than a time based leakage failure) it represents the bounding case for the four lines. Therefore it was used in the present analysis. An event tree modeling the failures associated with a fire induced ISLOCA is shown in Figure J-1. The events shown in Figure J-1 are explained in the following sections.

IE-F. This event represents the occurrence of a fire in room 236 (where both HP-2A and its control circuit are located). Previous studies, which used License Event Report (LER) data from the Nuclear Regulatory Commission (NRC), indicate that the overall frequency of fires for nuclear power plants is approximately 0.16 per reactor year on a plant-wide basis[J-3,J-4]. This number was divided by the total number of rooms in the plant (approximately 300) to obtain a per-room frequency of 5.3E-4 per reactor year.

HM1. This event represents the probability that a fire in room 236 will cause HP-2A to open. A bounding probability of 0.10 is used. A more detailed analysis would require knowledge of fire size and location. It would also require detailed modeling of the controls and cabling, all of which would likely reduce the probability of the valve opening.

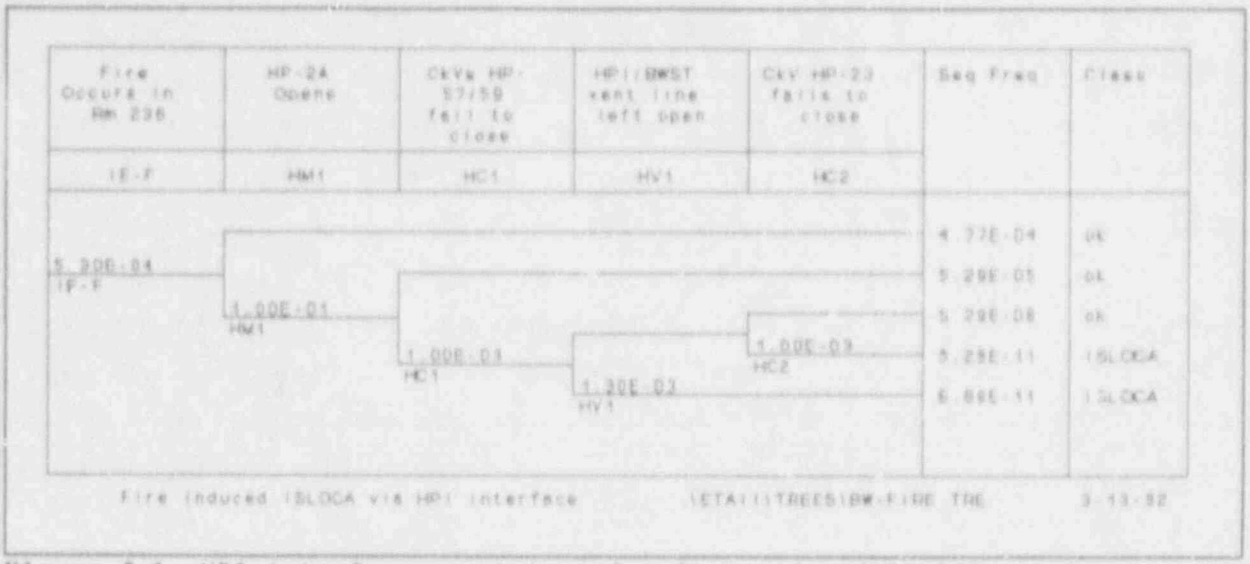

Figure J-1. HPI interface event tree for fire induced ISLOCA events.

HC1. The probability that check valves HP-57 and HP-59 (treated as a single valve because they are welded together) fail to close when demanded (i.e. when HP-2A opens and makeup flow is diverted) is assumed to be 1E-3. This event was taken from Appendix D. Makeup and purification flow normally keeps these valves open.

HV1. This event is modeled the same as for the internal events analysis. Specifically, the possibility that the recirculation line from the HPI pump discharge to the BWST being left open after completion of the pump test is estimated at 1.3E-3.

HC2. The probability that check valve HP-23 fails to close on demand is estimate at 1.0E-3, and was taken from Appendix D. This is a demand failure probability because this valve is normally free and not seated unless HP2-A opens.

The above probabilities were used in the event tree shown in Figure J-1. The quantification of this event tree results in an ISLOCA frequency of failure of HP-2A of 1.2E-10/reactor year. Because HP-2B, C, and D, were assumed to provide identical, independent contributions, the total frequency for ISLOCA challenges at the high-pressure injection system interface is then four times this number, or 4.9E-10.

J.4.2. Analysis of Internal Flooding

The B&W plant has four rooms where flooding could result in possible damage to the HPI isolation valves and associated equipment. Each room was looked at in detail to identify the possible sources of flooding.

An internal flood can contribute to an ISLOCA event at the high-pressure injection system interface by causing motor operated valves HP-2A, B, C, or D to open. For one of these events to lead to an ISLOCA the corresponding injection check valves would have to fail, and either the pump discharge check valve or the HPI/BWST vent line would have to be left open. The event tree is shown in Figure J-2 for the failures required when HP-2A is affected by internal flood. The events shown in Figure J-2 are explained in the following sections. As for the fire analysis, the flood analysis models only the HP-2A line to estimate the ISLOCA risk from all four injection legs.

IE-IF. Internal flood in room 209 or 236. Room 209 is a corridor located inside the Auxiliary building next to the BWST heater at elevation 565 feet. HP-2C and HP-2D are located in this room with the Motor Control Center for these two valves. A 6-in., 30 psia process steam line to the Borated Water Storage Tank heat exchanger and a 3-in. condensate line from the heat exchanger run through this room. Jet impingement and steam flooding could affect operation of essential MCCs and other equipment. Two inch and smaller piping for the Reactor Coolant Pump (RCP) seal supply water system are also present. The failure of this line could result in jet impingement forces affecting essential equipment.

Room 236, No. 2 mechanical penetration room, is located inside the Auxiliary building adjacent to the containment structure at elevation 565 feet. HP-2A and HP-2B are located in this room along with the Motor Control Center (MCC), transfer switch cabinet, and electrical trays for these valves. A continuous blowout area of 15 ft^2 is provided to prevent a buildup of flood waters. Two 6-in. steam supply lines to the AFW pump turbines in the room could cause steam flooding and jet impingement and possible damage to the MCC and other equipment.

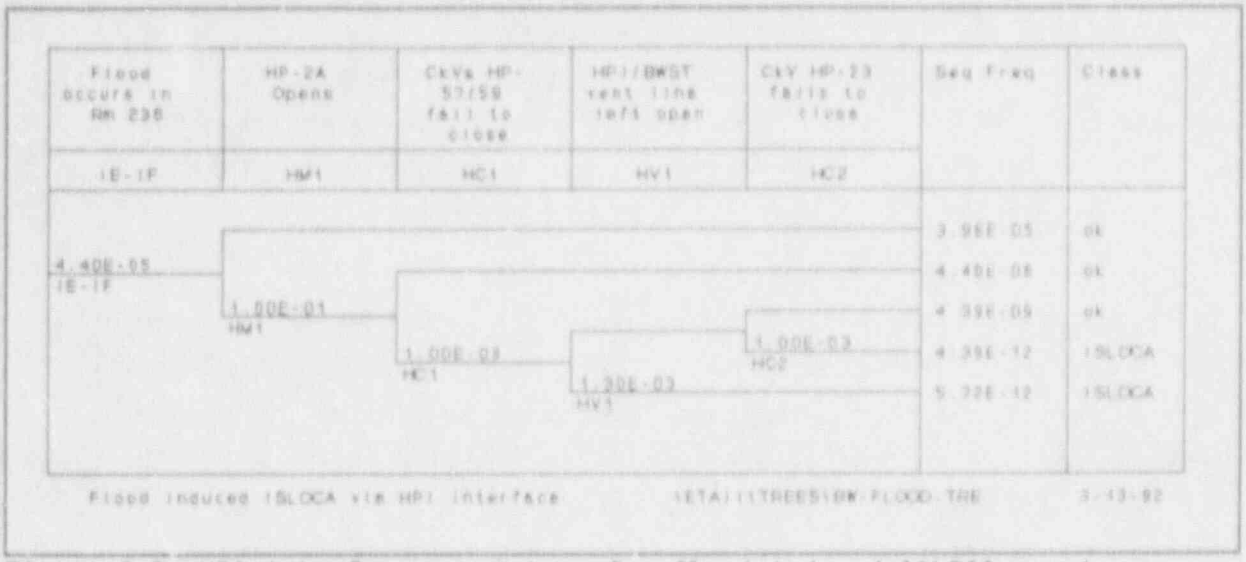

Figure J-2. HPI interface event tree for flood induced ISLOCA events.

Quantification of pipe rupture in these rooms is based on a random pipe break frequency of 5.0E-11/hr-ft.[J-5] Assuming 100 feet of pipe in each room gives:

Frequency = (5.0E-11/hr-ft)(100ft)(8760hr/ry) = 4.4E-5/ry

HM1. The probability that an internal flood in room 236 causes HP-2A to open is estimated at 0.10. This event is described in more detail in the fire analysis.

HC1. The probability that check valves HP-57 and HP-59 (treated as a single valve because they are welded together) fail to close when demanded (i.e. when HP-2A opens and makeup flow is diverted) is assumed to be 1E-3. This event was taken from Appendix D. Makeup and purification flow normally keeps these valves open.

HV1. This event is modeled the same as for the internal events analysis. Specifically, the possibility that the recirculation line from the HPI pump discharge to the BWST being left open after completion of the pump test is estimated at 1.3E-3.

HC2. The probability that check valve HP-23 fails to close on demand is estimate at 1.0E-3, and was taken from Appendix D. This is a demand failure probability because this valve is normally free and not seated unless HP2-A opens.

The above probabilities were used in the event tree shown in Figure J-2. The quantification of the event tree results in a frequency of 1.0E-11/Rx-yr. This frequency is for ISLOCA challenges resulting from failure of HP-2A. Because HP-2B, C, and D, are assumed to provide identical, independent contributions, the total frequency for ISLOCA challenges at the high-pressure injection system interface is then four times this number, or 4.0E-11/Rx-yr.

J.4.3. Analysis of Seismic Events

The seismicity of the site is evaluated on the basis of the Seismic-Risk Map of the United States. This map shows that the site is located within Zone 1. The minimum distance from the site to a Zone 2 boundary is 40 miles and to a Zone 3 boundary, 75 miles.

Zone 1 is described as follows: "Minor damage; distant earthquakes may cause damage to structures with fundamental periods greater than 1.0 seconds; corresponds to intensities V and VI of the MM Scale (Modified Mercalli Intensity Scale of 1931)."

The failure scenario most likely to result in a seismic induced ISLOCA begins with the failure of the open relay in one of the interfacing system MOVs due to relay chatter. The normally-open relay contacts are postulated to close during a seismic event allowing power to be applied to the valve motor and opening the valve.

Seismicity and Hazard Curves

The hazard curves used in this analysis were taken from a US NRC sponsored study. This study was preformed by the Lawrence Livermore National Laboratory. The curves were taken from the Eastern U.S. Seismic Hazard Characterization Program[J-6]. The use of the LLNL seismic curves in the external event analysis does not imply that other hazard curves are invalid or not appropriate for ISLOCA analysis. Table J-1 contains the numeric values obtained from the hazard curve shown in Figure J-3.

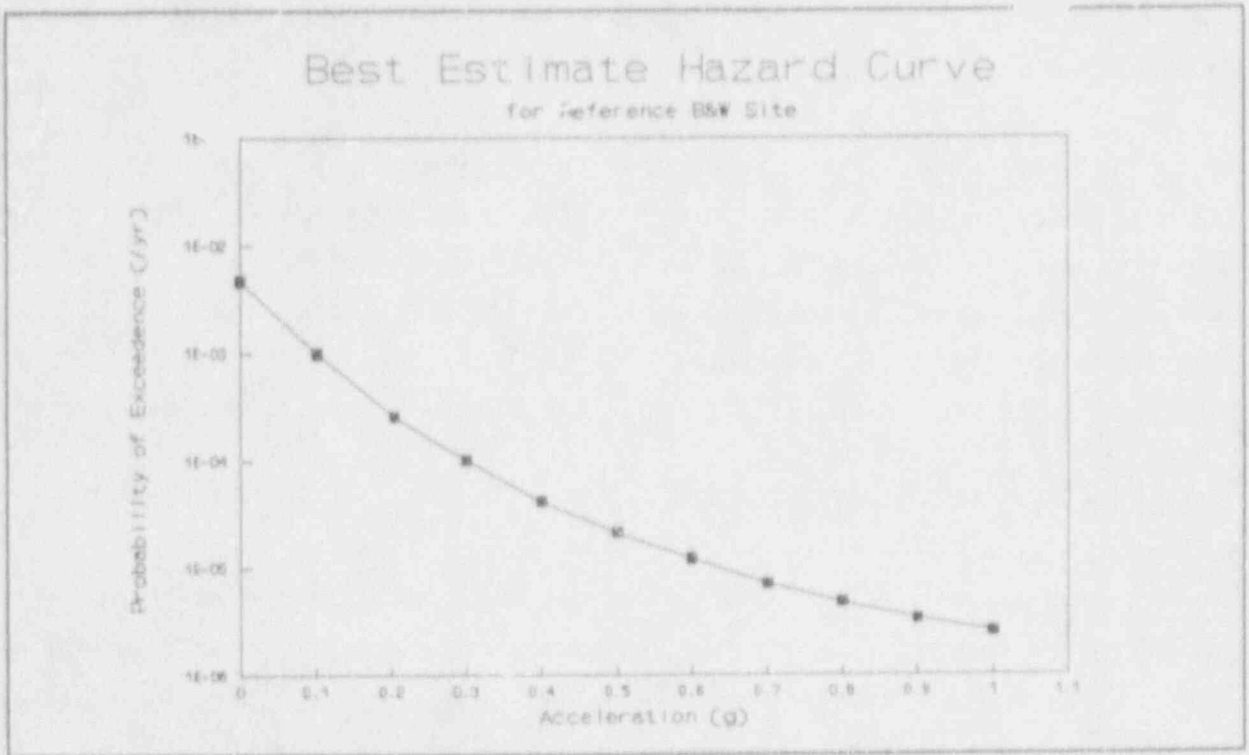

Figure J-3. Seismic hazard curve for the B&W study plant.

Table J-1. Median Hazard Curve Values

PGA Bin (g)	Bin Freq per year	Conditional Probability of Relay Chatter
.10	3.7E-3	0.025
.20	7.4E-4	0.041
.30	1.6E-4	0.14
.40	6.0E-5	0.35
.50	2.0E-5	0.62
.60	9.2E-6	0.82
.70	5.1E-6	0.93
.80	2.3E-6	0.97
.90	1.4E-6	0.99
1.0	8.2E-7	1.00
Total	4.7E-3	

Relay Fragility Data

The seismic fragility estimate for the relays in the valve motor control centers were developed using generic relay data[J-7] together with cabinet amplification and structural response spectra for the B&W reference plant.

Fragilities were estimated for four types of relays. As a bounding estimate the least rugged of the four types is used in the present analysis. Specifically, the values for socket-type auxiliary relays normally de-energized are given below.

Median	0.42
Beta (R)	0.33
Beta (U)	0.30
HCLPF (g)	0.15

Failure mode: relay chatter in excess of two milliseconds

The probability that the relay failure frequency (p_f) exceeds $p_{f'}$ for an acceleration A" given the best estimate of the median ground acceleration capacity A is given by:

$$P(p_f \geq p_{f'}|_{A''}) = \Phi\left[\frac{\ln(A''/A)}{\beta_U}\right]$$

where:

ϕ = standard Gaussian cumulative function
β_u = uncertainty concerning the ground motion capacity
p_f = failure frequency based on the underlying random variable associated with ground acceleration A
$p_{f'}$ = given failure frequency value (0.5 in this case)
A" = given ground acceleration value.

A seismic event can contribute to an ISLOCA at the HPI interface by causing any of the normally closed MOVs (HP-2A, B, C, or D) to fail open by inducing chatter in the normally-open relay. For an ISLOCA to occur, the corresponding injection check valve would have to fail, and either the pump discharge check valve or the HPI/BWST vent line would have to be left open. The event tree used to model the failures at the HPI interface is shown in Figure J-4.

All four MOV's are treated in an identical fashion, and the total frequency is the sum of the four contributors. The events shown in Figure J-4 are discussed below.

IE-S. Seismic frequency of occurrence obtained by differentiation of the hazard curve shown in Figure J-3. Table J-1 contains the individual

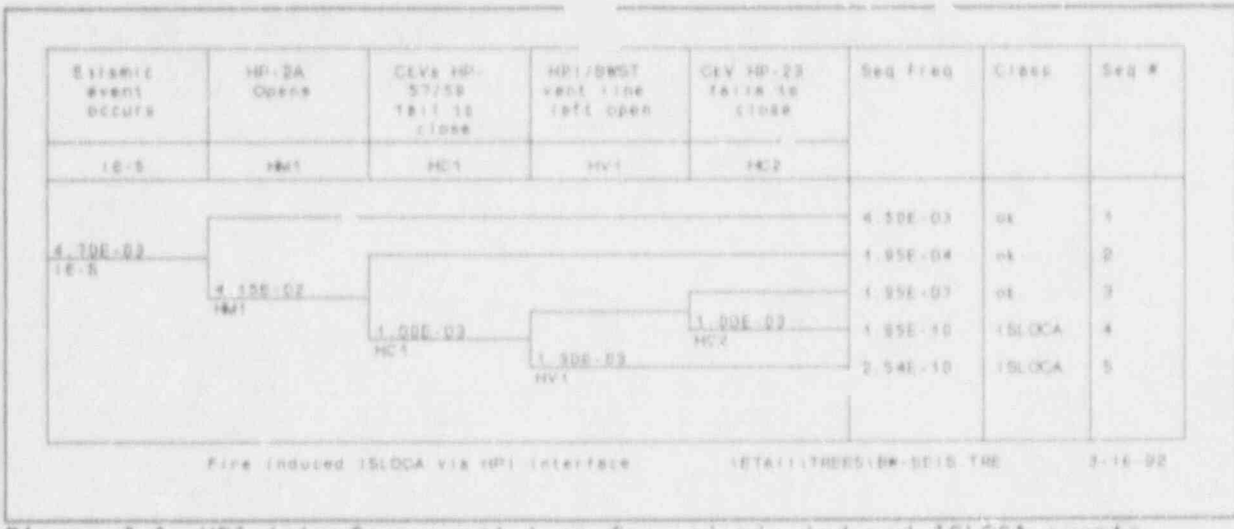

Figure J-4. HPI interface event tree for seismic induced ISLOCA events.

frequencies for each PGA interval. Value on the event tree represents the frequency of an earthquake of any magnitude.

HM1. Probability that HP-2A opens as a result of a seismic event. The probability of this event for each PGA interval is shown in Table J-1. The value shown on the event tree is an average, weighted over all seismic bins.

HC1. The probability that check valves HP-57 and HP-59 (treated as a single valve because they are welded together) fail to close when demanded (i.e. when HP-2A opens and makeup flow is diverted) is assumed to be 1E-3. This event was taken from Appendix D. Makeup and purification flow normally keeps these valves open.

HV1. This event is modeled the same as for the internal events analysis. Specifically, the possibility that the recirculation line from the HPI pump discharge to the BWST being left open after completion of the pump test is estimated at 1.3E-3.

HC2. The probability that check valve HP-23 fails to close on demand is estimate at 1.0E-3, and was taken from Appendix D. This is a demand failure probability because this valve is normally free and not seated unless HP2-A opens.

Evaluating sequences 4 and 5 of the event tree shown in Figure J-4 at each PGA shown in Table J-1, and summing over all PGA values results in a frequency of 4.5E-10/Rx-yr. The total frequency for a seismic induced ISLOCA at the HPI interface is four times this number, or 1.8E-9/Rx-yr.

J.5. B&W Results

An ISLOCA challenge resulting from external events depends on the probability that MOV failure resulting from the event will, combined with other failures, cause the pressurization of low-pressure rated systems. The screening analysis from Section J.3 excluded from further consideration all external events not likely to be a threat to plant systems. The events retained after screening included fire, internal flood, and seismic. The bounding analysis from Section J.4 then determined the frequency of ISLOCA challenges from each external event.

A fire can contribute to an ISLOCA event at the high pressure injection interface by causing motor operated valves HP-2A, B, C, or D to open. For a failure of one of these events to lead to an ISLOCA challenge, (i.e, pressurization of low-pressure rated piping) the corresponding pressure isolation check valves would have to fail, and either the pump discharge check valve would have to fail. The total fire-induced ISLOCA frequency for the high pressure injection system interface was calculated to be 4.9E-10/ry.

An internal flood can contribute to an ISLOCA event at the high pressure injection system interface by causing motor operated valves HP-2A, B, C, or D to open. The logic used for this calculation was identical to that used in the fire analysis. Only the interpretation of some basic events changed. The resulting ISLOCA frequency is 4.0E-11.

The affect of a seismic event on the ISLOCA challenge frequency was also calculated. The high pressure injection system interface was considered vulnerable to MOV opening as a result of relay chatter. The seismic-induced ISLOCA frequency was calculated to be 1.8E-9.

The overall frequency of an ISLOCA due to external events was obtained by summing the failure frequencies for each event that survived the screening analysis. An upper bound estimate of the total external events initiated ISLOCA frequency is 2.3E-09.

J.6. References

J-1. B&W Nuclear Power Station *Updated Safety Analysis Report*.

J-2. K. A. Soloman et al., *Estimate of the Hazards to a Nuclear Reactor From the Random Impact of Meteorites*, UCLA-ENG-7426, March 1974.

J-3. M. P. Bohn and J. A. Lambright, *Recommended Procedures for Simplified External Event Risk Analyses*, NUREG/CR-4840, Sandia National Laboratories, Albuquerque, NM, February 1988.

J-4. M. P. Bohn et al., *NUREG-1150 External Event Risk Analysis Surry Power Station*, NUREG/CR-4550, Rev.1, Vol.3, Part 3, Sandia National Laboratories, Albuquerque, NM, November 1989.

J-5. S. A. Eide et al., *Generic Component Failure Data Base for Light Water and Liquid Sodium Reactor PRA's*, EGG-SSRE-8875, February 1990.

J-6. D. L. Bernreuter et al., *Seismic Hazard Characterization of 69 Nuclear Plant Sites East of the Rocky Mountains*, NUREG/CR-5250 Vol.1-8, January 1989.

J-7. K. K. Bandyopadhyay et al., *Seismic Fragility of Nuclear Power Plant Components (Phase II), Switchgear, I&C Panels (NSSS) and Relays*, NUREG/CR-4659, February 1990.

Appendix K

Review of Pressure Fragility Calculations

APPENDIX K
REVIEW OF PRESSURE FRAGILITY CALCULATIONS

As part of the ISLOCA program, a subcontract was negotiated between EG&G Idaho, Inc. and ABB Impell. This subcontract was for the development of the fluid system component pressure fragilities for the reference B&W plant that was used as the model for this study. This work, which is documented in a separate report (D. A. Wesley et al., *Pressure-Dependent Fragilities for Piping Components*, NUREG/CR-5603), was used to calculate the probability of an overpressure ruptures in secondary systems. At the request of Dr. John O'Brien (U.S. NRC/RES), an independent review of the pressure fragility calculation, methodology and results, was performed. This review was conducted by Dr. Everett C. Rodabaugh. The product of that review is contained in this appendix, specifically two letters dated February 2, 1989 and February 17, 1990.

Appendix L

Uncertainty Analysis

CONTENTS

TABLES

APPENDIX L
UNCERTAINTY ANALYSIS

L.1 Introduction

An uncertainty analysis was performed in order to provide a more complete understanding of the risk attributable to ISLOCAs for the reference B&W plant. This analysis required two calculational steps. The first involved estimating the uncertainty associated with the individual event probabilities. In the second effort, cutsets (Boolean equations) were developed using IRRAS[L-1] for the event trees end-states. IRRAS was used for the uncertainty analysis rather than ETA-II[L-2] because ETA-II does not possess the capability for doing uncertainty analyses. However, ETA-II is much simpler and easier to use when performing point estimate quantification. As a result, the ETA-II software was used for the bulk of the quantification. After the end-state equations were loaded into IRRAS, the individual event uncertainties were then propagated through the logic equations using IRRAS' Latin Hypercube simulation feature. Both failure and success events are included in the logic equations. Because ETA-II generates end-state equations in terms of failure events only, once the equations were loaded into IRRAS the successes were added manually. Two sets of Latin Hypercube simulations were run. The first was performed at the event tree end-state level; the second at the PDS level.

L.2 Results

Table L-1 presents the uncertainty analysis results generated on the PDS calculations. These calculations were performed on a group level whereby all end-state equations classified with the same PDS were quantified collectively. Table L-2 displays the results of the uncertainty calculations performed on the individual end-state equations.

L.3 References

L-1. K. D. Russell et al., *Integrated Reliability and Risk Analysis System (IRRAS) Version 2.5, Volume 1 - Reference Manual*, NUREG/CR-5300, February 1991.

L-2. Science Applications International Corporation, *ETA-II User's Manual*, November 1987.

Table L-1. Uncertainty estimates for the Reference B&W plant PDS frequency (per Rx-yr)

PDS Name	Mean Median	MinCut Stand. Dev.	5th Perc. 95th Perc.	Minimum Maximum	Seed Size
LK-NCD	1.477E-003 8.941E-004	1.461E-003 2.289E-003	2.823E-004 4.339E-003	7.529E-005 7.618E-002	54321 10000
LOCA-IC	8.214E-008 6.624E-009	2.340E-008 8.440E-007	5.908E-010 1.681E-007	1.104E-011 4.263E-005	54321 10000
OK-OP	1.108E-002 9.348E-003	1.106E-002 7.785E-003	3.966E-003 2.385E-002	1.071E-003 2.994E-001	54321 10000
REL-LG	2.332E-006 4.470E-007	1.294E-006 1.492E-005	4.497E-008 7.031E-006	5.322E-009 6.425E-004	54321 10000
REL-MIT	+0.000E+000 +0.000E+000	+0.000E+000 +0.000E+000	+0.000E+000 +0.000E+000	+0.000E+000 +0.000E+000	54321 10000

Table L-2. Uncertainty results for event tree end-states (sequences).

Seq. No.	Event Tree Name Sequence Name	Mean Median	MinCut Stand. Dev.	5th Perc. 95th Perc.	Minimum Maximum	Seed Size
1	HPMU	3.949E-003	3.958E-003	4.907E-004	3.788E-005	54321
	HPMU-03	2.458E-003	4.915E-003	1.224E-002	9.111E-002	10000
2	HPMU	3.185E-005	3.191E-005	2.782E-006	3.506E-007	54321
	HPMU-04	1.759E-005	4.818E-005	1.046E-004	9.975E-004	10000
3	HPMU	3.185E-005	3.191E-005	2.782E-006	3.506E-007	54321
	HPMU-06	1.759E-005	4.818E-005	1.046E-004	9.975E-004	10000
4	HPMU	1.023E-007	3.993E-008	6.136E-010	3.714E-012	54321
	HPMU-07	1.534E-008	5.043E-007	3.836E-007	2.223E-005	10000
5	HPMU	6.844E-007	2.795E-007	1.861E-009	1.41[illegible]-011	54321
	HPMU-08	6.769E-008	4.564E-006	2.427E-006	2.[illegible]E-004	10000
6	HPMU	9.400E-006	3.634E-006	5.558E-008	+0.000E+000	54321
	HPMU-09	1.394E-006	4.989E-005	3.485E-005	2.733E-003	10000
7	HPMU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPMU-10	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
8	HPMU	1.906E-008	7.284E-009	7.477E-011	8.477E-013	54321
	HPMU-11	2.241E-009	1.615E-007	6.575E-008	1.349E-005	10000
9	HPMU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPMU-12	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
10	HPMU	5.518E-008	2.198E-008	3.325E-011	1.358E-013	54321
	HPMU-13	2.169E-009	5.099E-007	1.492E-007	2.333E-005	10000
11	HPMU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPMU-14	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
12	HPMU	2.967E-008	1.028E-008	4.420E-011	2.375E-013	54321
	HPMU-15	1.867E-009	3.177E-007	8.840E-008	2.286E-005	10000
13	HPMU	5.152E-003	5.152E-003	1.415E-003	3.223E-004	54321
	HPMU-17	4.155E-003	3.775E-003	1.223E-002	5.671E-002	10000
14	HPMU	4.143E-005	4.154E-005	7.499E-006	1.216E-006	54321
	HPMU-18	2.999E-005	4.070E-005	1.124E-004	8.911E-004	10000
15	HPMU	4.478E-006	4.518E-006	3.179E-007	+0.000E+000	54321
	HPMU-19	2.217E-006	7.476E-006	1.521E-005	1.622E-004	10000
16	HPMU	6.679E-007	6.751E-007	2.834E-008	1.526E-009	54321
	HPMU-20	2.703E-007	1.420E-006	2.440E-006	4.241E-005	10000

Table L-2. (continued)

Seq. No.	Event Tree Name / Sequence Name	Mean / Median	MinCut / Stand. Dev.	5th Perc. / 95th Perc.	Minimum / Maximum	Seed / Size
17	HPMU	5.198E-010	5.137E-010	4.492E-012	+0.000E+000	54321
	HPMU-21	9.579E-011	2.319E-009	1.959E-009	9.106E-008	10000
18	HPMU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	543[illegible]
	HPMU-22	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
19	HPMU	1.068E-012	1.029E-012	6.661E-015	+0.000E+000	54321
	HPMU-23	1.554E-013	5.759E-012	3.757E-012	2.634E-010	10000
20	HPMU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPMU-24	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
21	HPMU	3.474E-012	3.107E-012	2.664E-015	+0.000E+000	54321
	HPMU-25	1.518E-013	4.935E-011	8.193E-012	3.004E-009	10000
22	HPMU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPMU-26	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
23	HPMU	1.596E-012	1.454E-012	3.552E-015	+0.000E+000	54321
	HPMU-27	1.287E-013	1.967E-011	5.015E-012	1.574E-009	10000
24	HPMU	1.288E-010	5.198E-011	5.440E-013	6.217E-015	54321
	HPMU-28	1.617E-011	6.304E-010	4.722E-010	2.259E-008	10000
25	HPMU	8.893E-010	3.639E-010	1.613E-012	2.264E-014	54321
	HPMU-29	7.060E-011	6.716E-009	2.850E-009	4.352E-007	10000
26	HPMU	1.256E-008	4.731E-009	5.034E-011	+0.000E+000	54321
	HPMU-30	1.467E-009	7.598E-008	4.464E-008	3.426E-006	10000
27	HPMU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPMU-31	+0.000E+000	+0.000E+000	+[illegible]000E+000	+0.000E+000	10000
28	HPMU	2.442E-011	9.481E-012	6.261E-014	4.440E-016	54321
	HPMU-32	2.348E-012	1.608E-010	8.098E-011	1.016E-008	10000
29	HPMU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPMU-33	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
30	HPMU	8.429E-011	2.861E-011	3.241E-014	+0.000E+000	54321
	HPMU-34	2.315E-012	1.134E-009	1.744E-010	7.096E-008	10000
31	HPMU	+0.000E+000	+0.000E+000	+0.000E+[illegible]00	+0.000E+000	54321
	HPMU-35	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
32	HPMU	4.195E-011	1.339E-011	3.819E-014	4.440E-016	54321
	HPMU-36	1.965E-012	6.258E-010	1.034E-010	3.635E-008	10000

Table L-2. (continued)

Seq. No.	Event Tree Name / Sequence Name	Mean / Median	MinCut / Stand. Dev.	5th Perc. / 95th Perc.	Minimum / Maximum	Seed / Size
33	HPMU	8.834E-004	8.800E-004	3.308E-005	1.585E-006	54321
	HPMU-37	3.304E-004	2.306E-003	3.305E-003	1.274E-001	10000
34	HPI	1.515E-003	1.520E-003	5.703E-005	2.434E-006	54321
	HPI-03	5.709E-004	3.501E-003	5.710E-003	1.074E-001	10000
35	HPI	1.511E-008	1.522E-008	2.176E-010	5.278E-012	54321
	HPI-04	3.495E-009	4.959E-008	5.954E-008	1.295E-006	10000
36	HPI	1.021E-007	1.065E-007	6.166E-010	1.090E-011	54321
	HPI-05	1.517E-008	4.637E-007	3.749E-007	1.723E-005	10000
37	HPI	1.398E-006	1.387E-006	1.863E-008	+0.000E+000	54321
	HPI-06	3.241E-007	5.043E-006	5.240E-006	2.473E-004	10000
38	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-07	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
39	HPI	2.719E-009	2.780E-009	2.653E-011	+0.000E+000	54321
	HPI-08	5.124E-010	1.003E-008	1.104E-008	3.241E-007	10000
40	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-09	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
41	HPI	7.681E-009	8.390E-009	1.055E-011	7.460E-014	54321
	HPI-10	5.140E-010	5.520E-008	2.424E-008	2.924E-006	10000
42	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-11	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
43	HPI	1.916E-009	1.960E-009	4.937E-012	5.195E-014	54321
	HPI-12	1.810E-010	1.678E-008	6.499E-009	1.364E-006	10000
44	HPI	1.693E-006	1.721E-006	3.978E-008	+0.000E+000	54321
	HPI-13	5.185E-007	4.585E-006	6.364E-006	1.290E-004	10000
45	HPI	2.521E-007	2.573E-007	3.859E-009	1.748E-010	54321
	HPI-14	6.267E-008	8.440E-007	9.585E-007	3.590E-005	10000
46	HPI	2.373E-010	1.960E-010	7.793E-013	+0.000E+000	54321
	HPI-15	2.159E-011	4.791E-009	6.854E-010	4.659E-007	10000
47	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-16	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
48	HPI	3.775E-013	3.930E-013	1.332E-015	+0.000E+000	54321
	HPI-17	3.597E-014	2.961E-012	1.279E-012	2.303E-010	10000

Table L-2. (continued)

Seq. No.	Event Tree Name / Sequence Name	Mean / Median	MinCut / Stand. Dev.	5th Perc. / 95th Perc.	Minimum / Maximum	Seed / Size
49	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-18	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
50	HPI	1.214E-012	1.185E-012	+0.000E+000	+0.000E+000	54321
	HPI-19	3.463E-014	2.835E-011	2.744E-012	2.730E-009	10000
51	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-20	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
52	HPI	2.970E-013	2.771E-013	+0.000E+000	+0.000E+000	54321
	HPI-21	1.199E-014	5.808E-012	6.781E-013	5.546E-010	10000
53	HPI	1.939E-011	1.981E-011	1.878E-013	3.996E-015	54321
	HPI-22	3.657E-012	7.358E-011	7.812E-011	2.362E-009	10000
54	HPI	1.353E-010	1.387E-010	5.342E-013	9.325E-015	54321
	HPI-23	1.594E-011	7.667E-010	4.812E-010	3.553E-008	10000
55	HPI	1.754E-009	1.805E-009	1.650E-011	+0.000E+000	54321
	HPI-24	3.350E-010	6.226E-009	7.190E-009	1.936E-007	10000
56	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-25	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
57	HPI	3.417E-012	3.618E-012	2.398E-014	+0.000E+000	54321
	HPI-26	5.382E-013	1.451E-011	1.356E-011	6.242E-010	10000
58	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-27	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
59	HPI	9.287E-012	1.092E-011	9.325E-015	+0.000E+000	54321
	HPI-28	5.475E-013	6.738E-011	2.974E-011	3.136E-009	10000
60	HPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	HPI-29	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
61	HPI	2.345E-012	2.552E-012	3.996E-015	+0.000E+000	54321
	HPI-30	1.878E-013	1.884E-011	7.776E-012	1.107E-009	10000
62	DHR-SD	3.670E-004	3.623E-004	8.506E-006	+0.000E+000	54321
	DHR-D-02	1.259E-004	1.037E-003	1.414E-003	5.751E-002	10000
63	DHR-SD	2.219E-004	2.230E-004	6.828E-006	1.561E-007	54321
	DHR-D-03	7.703E-005	5.398E-004	8.617E-004	1.435E-002	10000
64	DHR-SD	7.354E-005	7.352E-005	1.664E-006	+0.000E+000	54321
	DHR-D-04	2.234E-005	2.212E-004	2.893E-004	9.089E-003	10000

Table L-2. (continued)

Seq. No.	Event Tree Name Sequence Name	Mean Median	MinCut Stand. Dev.	5th Perc. 95th Perc.	Minimum Maximum	Seed Size
65	DHR-SD	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-D-05	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
66	DHR-SD	5.676E-007	5.929E-007	5.351E-009	1.602E-010	54321
	DHR-D-06	1.097E-007	2.305E-006	2.140E-006	9.578E-005	10000
67	DHR-SD	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-D-07	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
68	DHR-SD	4.051E-007	4.473E-007	8.517E-010	7.970E-012	54321
	DHR-D-08	3.519E-008	2.380E-006	1.358E-006	8.067E-005	10000
69	DHR-SD	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-D-09	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
70	DHR-SD	1.582E-008	1.491E-008	4.931E-011	4.167E-013	54321
	DHR-D-10	1.598E-009	1.209E-007	5.012E-008	7.124E-006	10000
71	DHR-SU	1.986E-004	1.987E-004	2.583E-005	3.076E-006	54321
	DHR-S-02	1.254E-004	2.417E-004	6.081E-004	4.704E-003	10000
72	DHR-SU	5.930E-007	5.902E-007	2.422E-008	1.514E-009	54321
	DHR-S-03	2.335E-007	1.438E-006	2.160E-006	5.834E-005	10000
73	DHR-SU	7.758E-009	7.774E-009	2.353E-010	1.135E-011	54321
	DHR-S-04	2.666E-009	2.205E-008	2.960E-008	1.079E-006	10000
74	DHR-SU	6.472E-011	5.980E-011	1.481E-013	9.992E-016	54321
	DHR-S-05	5.513E-012	5.384E-010	1.990E-010	2.857E-008	10000
75	DHR-SU	5.839E-007	5.920E-007	2.452E-008	9.867E-010	54321
	DHR-S-06	2.332E-007	1.282E-006	2.067E-006	3.399E-005	10000
76	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-07	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
77	DHR-SU	6.687E-009	6.915E-009	2.088E-010	+0.000E+000	54321
	DHR-S-08	2.316E-009	1.565E-008	2.603E-008	4.014E-007	10000
78	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-09	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
79	DHR-SU	4.475E-010	4.225E-010	4.245E-012	+0.000E+000	54321
	DHR-S-10	9.187E-011	1.964E-009	1.779E-009	8.986E-008	10000
80	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-11	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000

Table L-2. (continued)

Seq. No.	Event Tree Name / Sequence Name	Mean / Median	MinCut / Stand. Dev.	5th Perc. / 95th Perc.	Minimum / Maximum	Seed / Size
81	DHR-SU	4.150E-009	4.050E-009	1.139E-010	7.794E-012	54321
	DHR-S-12	1.301E-009	1.184E-008	1.609E-008	4.534E-007	10000
82	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-13	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
83	DHR-SU	6.436E-013	7.790E-013	8.881E-016	+0.000E+000	54321
	DHR-S-14	4.185E-014	4.085E-012	2.130E-012	1.865E-010	10000
84	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-15	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
85	DHR-SU	2.184E-010	2.181E-010	3.365E-012	+0.000E+000	54321
	DHR-S-16	6.301E-011	6.971E-010	8.407E-010	2.553E-008	10000
86	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-17	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
87	DHR-SU	2.765E-011	2.779E-011	2.041E-013	+0.000E+000	54321
	DHR-S-18	5.512E-012	1.475E-010	1.105E-010	1.163E-008	10000
88	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-19	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
89	DHR-SU	2.448E-010	2.459E-010	4.098E-012	+0.000E+000	54321
	DHR-S-20	7.208E-011	7.609E-010	9.421E-010	2.591E-008	10000
90	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-21	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
91	DHR-SU	5.303E-014	5.995E-014	1.110E-016	+0.000E+000	54321
	DHR-S-22	2.997E-015	4.984E-013	1.648E-013	3.343E-011	10000
92	DHR-SU	2.870E-007	2.584E-007	1.438E-009	2.135E-011	54321
	DHR-S-24	3.707E-008	2.385E-006	9.458E-007	1.709E-004	10000
93	DHR-SU	7.588E-010	7.701E-010	1.809E-012	1.720E-014	54321
	DHR-S-25	6.596E-011	5.404E-009	2.403E-009	3.162E-007	10000
94	DHR-SU	6.860E-012	7.153E-012	1.199E-014	1.110E-016	54321
	DHR-S-26	4.944E-013	5.252E-011	2.196E-011	2.427E-009	10000
95	DHR-SU	7.923E-014	7.771E-014	+0.000E+000	+0.000E+000	54321
	DHR-S-27	1.554E-015	1.335E-012	1.543E-013	1.065E-010	10000
96	DHR-SU	7.385E-010	7.720E-010	1.876E-012	2.276E-014	54321
	DHR-S-28	6.610E-011	5.211E-009	2.515E-009	2.756E-007	10000

Table L-2. (continued)

Seq. No.	Event Tree Name / Sequence Name	Mean / Median	MinCut / Stand. Dev.	5th Perc. / 95th Perc.	Minimum / Maximum	Seed / Size
97	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-29	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
98	DHR-SU	5.924E-012	5.007E-012	6.439E-015	+0.000E+000	54321
	DHR-S-30	3.307E-013	1.227E-010	1.566E-011	1.153E-008	10000
99	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-31	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
100	DHR-SU	1.409E-013	8.137E-014	1.110E-016	+0.000E+000	54321
	DHR-S-32	4.329E-015	6.354E-012	2.357E-013	6.319E-010	10000
101	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-33	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
102	DHR-SU	3.701E-012	2.07[illegible]	2.331E-015	+0.000E+000	54321
	DHR-S-34	1.251E-013	1.361E-010	6.202E-012	1.270E-008	10000
103	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-35	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
104	DHR-SU	6.547E-016	6.661E-016	+0.000E+000	+0.000E+000	54321
	DHR-S-36	+0.000E+000	1.788E-014	1.221E-015	1.661E-012	10000
105	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-37	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
106	DHR-SU	1.106E-013	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-38	6.661E-016	1.021E-012	3.338E-013	6.249E-011	10000
107	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-39	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
108	DHR-SU	3.124E-015	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-40	+0.000E+000	1.470E-013	4.551E-015	1.462E-011	10000
109	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-41	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
110	DHR-SU	6.518E-013	7.799E-013	9.992E-016	+0.000E+000	54321
	DHR-S-42	4.507E-014	5.737E-012	2.029E-012	3.978E-010	10000
111	DHR-SU	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	DHR-S-43	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
112	DHR-SU	5.523E-017	1.110E-016	+0.000E+000	+0.000E+000	54321
	DHR-S-44	+0.000E+000	7.184E-016	1.110E-016	3.452E-014	10000

Table L-2. (continued)

Seq. No.	Event Tree Name / Sequence Name	Mean / Median	MinCut / Stand. Dev.	5th Perc. / 95th Perc.	Minimum / Maximum	Seed / Size
113	LPI	6.567E-006	1.055E-006	1.386E-009	+0.000E+000	54321
	LPI-03	1.464E-007	8.042E-005	1.477E-005	5.164E-003	10000
114	LPI	5.789E-007	8.881E-008	4.685E-011	+0.000E+000	54321
	LPI-04	7.612E-009	1.516E-005	9.399E-007	1.422E-003	10000
115	LPI	7.530E-008	1.555E-008	5.038E-012	3.552E-015	54321
	LPI-05	8.597E-010	1.019E-006	1.312E-007	5.790E-005	10000
116	LPI	1.483E-010	1.043E-011	2.220E-016	+0.000E+000	54321
	LPI-06	6.661E-014	1.103E-008	3.049E-011	1.100E-006	10000
117	LPI	6.057E-011	1.043E-011	6.217E-015	+0.000E+000	54321
	LPI-07	8.340E-013	8.005E-010	1.092E-010	5.235E-008	10000
118	LPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	LPI-08	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
119	LPI	6.350E-006	9.756E-007	1.097E-009	+0.000E+000	54321
	LPI-09	1.336E-007	8.447E-005	1.348E-005	5.180E-003	10000
120	LPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	LPI-10	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
121	LPI	9.167E-007	1.694E-007	1.106E-010	+0.000E+000	54321
	LPI-11	1.469E-008	1.057E-005	1.913E-006	6.557E-004	10000
122	LPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	LPI-12	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
123	LPI	5.896E-008	1.156E-008	3.667E-012	3.552E-015	54321
	LPI-13	6.124E-010	7.564E-007	9.655E-008	4.225E-005	10000
124	LPI	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	54321
	LPI-14	+0.000E+000	+0.000E+000	+0.000E+000	+0.000E+000	10000
125	LPI	3.596E-008	4.062E-009	1.182E-012	1.332E-015	54321
	LPI-15	1.921E-010	1.140E-006	3.441E-008	1.042E-004	10000

Appendix M

Steam Propagation Analysis for the B&W Plant Auxiliary Building

J. A. Schroeder

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FIGURES

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LISTINGS

APPENDIX M
STEAM PROPAGATION CALCULATIONS FOR THE B&W PLANT AUXILIARY BUILDING

M.1 Analysis Objective

The objective of this calculation is to determine the environmental conditions in the B&W reference plant's auxiliary building during an interfacing system loss-of-coolant accident (ISLOCA). The parameters of interest are the pressure, temperature, relative humidity, and water level in affected emergency core cooling system (ECCS) equipment rooms. This data will be used, in a separate analysis, to determine the extent to which equipment in compartments adjacent to the break compartment fails from high temperature or submergence, and to determine the extent to which operator recovery actions will be limited by the steam and water that propagates through the auxiliary building.

M.2 Summary of Results

Five break sequences and three sensitivity cases were evaluated using a combination of RELAP5 and CONTAIN models (References 1 and 2). The five sequences involved breaks in different locations within the decay heat removal/low pressure injection (DHR/LPI) system and the high pressure injection (HPI) system, each sequence is described below.

1) The plant is operating at rated power and normal operating temperature and pressure. Isolation of the DHR letdown line fails, causing pressurization of the DHR system, which results in rupture of a 12-inch line and discharge into auxiliary building room 236.

2) The plant is operating at rated power and normal operating temperature and pressure. Isolation of the DHR letdown line fails, causing pressurization of the DHR system, which results in simultaneous rupture in both decay heat removal heat exchangers and discharge to room 113. The limiting flow area is in the 2.5-inch bypass lines around valves DH-1517 and DH-1518.

3) The plant is operating at rated power and normal operating temperature and pressure. Isolation of the DHR letdown line fails, causing pressurization of the DHR system, which results in simultaneous rupture in the low-pressure decay heat removal pump suction piping, resulting in discharge to both rooms 105 and 113.

The limiting flow area is in the 2.5-inch bypass lines around valves DH-1517 and DH-1518.

4) The plant is operating at rated power and normal operating temperature and pressure. The check valve isolation on the injection side of the LPI system fails, resulting in a rupture at the 1-2 decay heat cooler with discharge into room 113.

5) The plant is operating at rated power and normal operating temperature and pressure. The high pressure injection (HPI) discharge isolation check valves fail, resulting in a rupture in the suction piping to HPI pump 1-2 and discharge into room 115.

In order to evaluate the effects simple models and code uncertainties might have on the results, three sensitivity studies were performed for the last sequence. These sensitivity studies are further described on page M-9. The first sensitivity used a break discharge table from a best estimate Oconee small break loss-of-coolant accident (SBLOCA) analysis[a]. The second also used the Oconee discharge table, but the discharge steam quality was forced to 1.0. The third added metal masses to each compartment until a noticeable variation in the results was obtained.

Simplified RELAP5 models of the B&W reference plant were used as the bases for calculating the break flow rates and the enthalpies for each of the break sequences. The large break calculations (sequences 1 and 4) were generally representative with respect to break mass flow rates. These calculations may have resulted in a faster primary system cooldown than would be expected from more detailed calculations. If thus is true the result is that the enthalpies are slightly lower than what a best estimate calculation would predict. The small breaks (sequences 2, 3, and 5) were more difficult to represent with simple models and clearly over-predicted the RCS pressures. The simple primary system RELAP5 models fail to account for the secondary system behavior and operator actions. The result is that the RCS pressure predictions are much higher than calculated in a recent best estimate study of a B&W plant's response to SBLOCAs.[a] The resulting enthalpy of the discharge

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a. The results of the Oconee SBLOCA study will eventually be published. This work was sponsored by the USNRC and a draft report, *Code Scaling, Applicability, and Uncertainty Study of RELAP5/MOD3 Applied to a B&W SBLOCA Scenario*, has been distributed for review under EG&G letter number MGO-73-91, dated November 25, 1991. The break discharge data used in this report was obtained directly from the report authors, and does not all appear in the aforementioned draft report.

and mass flow rates, being dependent on system pressure, are likewise too high for most of the transient. These inaccuracies in the small break calculations were shown to have negligible impact on the calculated auxiliary building parameters.

The CONTAIN code predicted no significant pressurization (less than one psig) of the auxiliary building as a result of any of the break sequences evaluated. This lack of pressurization is a result of the large flow areas available along flow paths between the break area and the outside atmosphere. A more detailed modeling of the balance-of-plant in the CONTAIN model would produce higher pressure predictions. The detailed modeling effort was judged as unworthy because the increased modeling effort would not have a significant effect on the calculated room temperatures. The room temperature is the critical equipment qualification parameter that would be affected by pressure.

CONTAIN predicted temperatures of 212°F or less in the ECCS equipment rooms for prolonged portions of the ISLOCA for all of the break sequences addressed here. Given that the pressure calculation is reasonably certain, uncertainty in the temperature calculation is driven by the uncertainty in the break discharge enthalpy. If the break discharge enthalpy is less than 1150 Btu/lb the thermodynamics of the blowdown require the discharge temperature to be equal to the saturation temperature for the compartment pressure. If the break discharge enthalpy is higher than 1150 Btu/lb (assuming approximately atmospheric pressure in the auxiliary building), superheat can appear in the blowdown compartment. The results obtained in this analysis all indicate the discharge enthalpy is less than 1150 Btu/lb, however, this value is approached quite closely.

The relative humidity predictions were similar in each sequence. All the auxiliary building rooms that were evaluated experienced periods of 100% relative humidity.

The rate of flooding varied considerably between the sequences. In the sequences with large breaks (sequences 1 and 4), flooding propagated from one compartment to the next. The flood propagated through pipe chases and over flood walls. The result was flooding of ECCS equipment in rooms initially isolated from the break location. In these sequences flooding led to ECCS equipment submergence in 20-30 minutes. The flood propagation was the result of the dispersal of the unflashed portion of the break discharge. Sump pump operation is insignificant in these sequences.

In the sequences with small breaks (sequences 2, 3, and 5), flooding was minimal. The primary reason is that the discharge from the break was small and much of the discharge flashed to steam. The steam was then carried throughout the building. The steam was released to the atmosphere through blowouts or was condensed well away from the break location. Additionally, the sump pumps, had they been included in the model, would have further slowed pool growth and delayed the threat to ECCS equipment operation. The flooding is primarily the result of firewater discharging from the sprinkler systems and its draining into the ECCS compartments.

The three sensitivity studies were performed to estimate the effect of using relatively simple models and of uncertainties in the codes. Specifically, the following issues were examined in the sensitivity studies:

1) The sensitivity of the auxiliary building results to refined reactor coolant system discharge data was determined by making additional CONTAIN runs using break discharge data from the aforementioned Oconee SBLOCA study.

2) The sensitivity of the auxiliary building results to high enthalpy (dry) steam in the break discharge was determined by making additional CONTAIN runs with the break discharge data from the aforementioned Oconee SBLOCA study adjusted to a quality of 1.0.

3) The sensitivity of the auxiliary building results to neglecting compartment metal masses was determined by making additional CONTAIN runs with large metal masses added to the model.

The first sensitivity study showed that the rate of flooding was significantly different when the break discharge data from the Oconee best-estimate SBLOCA study were used. For the small break ISLOCA evaluated, the flooding rate remained small even with the Oconee data. The flooding rate was driven by the firewater release and not break discharge. As a result, an improvement in the small break primary system RELAP5 model would not produce significantly different auxiliary building environmental conditions.

The second sensitivity study showed that the auxiliary building temperature response is relatively insensitive o variations in the discharge enthalpy. This is true as long as the blowdown remained a wet two-phase mixture with the discharge enthalpy below 1150 Btu/lb. The auxiliary building temperatures did not exceed 212°F in these cases. However, when the blowdown mixture dried (steam quality of 1.0), the temperatures in the auxiliary building approached 276°F. This sensitivity study was based on the Oconee SBLOCA discharge results. It is postulated that the break discharge may approach dryout very near the onset of core damage.

The last sensitivity showed that including metal masses of up to 100,000 lb per compartment had a negligible impact on compartment temperatures and flooding.

M.3 Method of Calculation

The calculation of auxiliary building pressures, temperatures, and water levels depends on the steam flow rate into the building, the steam energy, the volume of the auxiliary building, the flow paths though the building, and the rate of heat removal by condensation of steam on structural materials and equipment, and fire sprays. The steam flow rate and energy into the building was calculated with the simple RELAP5 models of the RCS. The resulting steam source data were used as boundary conditions. The boundary conditions were then applied to the CONTAIN calculations to predict the auxiliary building's response to the ISLOCA's break discharge.

The RELAP5 models treated the RCS as five volumes; cold leg, lower plenum, core, upper plenum, and hot leg. The decay heat was modeled with a best estimate Oconee core model normalized to the B&W reference plant operating power level. ECCS injection was included using pressure dependent flow tables. The pressure losses between the RCS and the break location were estimated by including detailed models of the piping run. The purpose of this approach was to obtain a first order approximation of RCS behavior on the premise that the auxiliary building response to the ISLOCA is not strongly dependent on the RCS behavior.

The CONTAIN computer code was used to calculate the time response of the auxiliary building parameters. The CONTAIN software is a containment modeling code that has adequate steam condensing heat transfer models for the scenarios of interest. The software also provides adequate engineered system models that allow modeling of fire sprays, compartment sumps, and drainage paths among compartments. The approach used in this calculation was to construct detailed CONTAIN models of compartments with ECCS equipment that might be affected by the ISLOCA. These compartments were auxiliary building rooms 105, 113, 115, and 236. The rest of the auxiliary building (sometimes referred to as balance-of-plant) was then treated as a boundary condition for the detailed portion of the model.

CONTAIN required, as input, the gas volume of each compartment, the area and flow loss characteristics of flow paths between each compartment, and a description of heat transfer surfaces within each compartment. CONTAIN also required a description of drainage paths among compartments. The code tracked the pool depths in each compartment. These pools resulted from both condensation of steam and drainage of fire sprays or condensate from adjacent rooms. This flood propagation is an important aspect of the larger break sequences, because the high break discharge flow rate will quickly fill the compartment sumps. This phenomena will allow flooding of the lower or adjacent compartments to occur. Only one compartment in this analysis (room 236) has fire sprays. Since the fire sprays can be expected to trip early in the break sequence, aggravating the flooding problem, they were included in the model.

The compartment sump pumps, the fan coolers, and pump heat were excluded from the model. The sump pumps were excluded because they do not have adequate capacity to remove the break discharge and condensate. Also, extended periods of firewater discharge can exceed the capacity of the sumps. In the small break sequences where the combined accumulation of water from these sources was close to the sump pump capacity, the impact of sump pump operation was evaluated qualitatively. The pump heat was neglected because it would be removed by the fan coolers, and the fan coolers were not modeled because a large fraction of the cooler's capacity would be used to remove pump heat.

M.4 Modeling Data

The modeling data required for this analysis consisted of both RELAP5 and CONTAIN input data. The RELAP5 data described the RCS and attached interfacing system piping between the RCS and the break location. The CONTAIN modeling data described the auxiliary building. The RELAP5 data describing the RCS was taken from Reference 3. This simplified RCS model was combined with piping models described in Reference 4 for each break sequence. The CONTAIN data was extracted from the B&W reference plant HELB analysis (References 5 and 6).

M.4.1 RELAP5 Modeling Data

The RELAP5 RCS model for each sequence combines the RCS volumes shown in Figure M-1 with the detailed piping models shown in Figures M-3, M-5, M-8, M-9 and M-11. The fluid volume data for the RCS portion of the model included the reactor vessel volume, the loop volume, and the pressurizer volume. The fluid available for injection consisted of the CFT and BWST volumes. A simple control model kept track of the water injected into the RCS through the injection flow table. When the contents of the BWST were completely injected, the transient was considered over, as core damage could result thereafter. The total water inventory available for discharge into the auxiliary building is summarized as follows:

Loop Volume (one loop)	= 3,025 ft^3
Pressurizer volume	= 1,542 ft^3
Vessel volume	= 3,797 ft^3
CFT volume (combined)	= 2,080 ft^3
BWST volume	= 64,550 ft^3

The following describes the specific break sequence RCS models.

M.4.1.1 Break Sequence 1. Break Sequence 1 (BS-1) is a rupture in the decay heat removal system piping between DH-11 and the piping separation to valves DH-1518 and DH-1517. The break is located in auxiliary building room

236 and does not disable LPI. A simplified drawing showing the flow path between the RCS and the break is shown in Figure M-2. Figure M-3 shows the piping model combined with the RCS model in Figure M-1. This information was used to obtain the RELAP5 model for calculation of the room 236 source term. A input listing of the RELAP5 model is provided by Listing 1.

M.4.1.2 Break Sequence 2. Break Sequence 2 (BS-2) is a rupture in decay heat coolers 1-2 and 1-1. The breaks are located in room 113 and are assumed to fail LPI. A simplified drawing of the flow path between the RCS and the break is shown in Figure M-4. Figure M-5 shows the piping model combined with the RCS model. All dead legs, and flow paths associated only with system relief valves have been eliminated from the model to improve computational efficiency. Piping downstream of the 2.5 inch diameter choke plane in the DH-1517 and DH-1518 bypass piping has been included in the model, although, on review of the results, it could have been eliminated. The RELAP5 listing for the combined model is provided in Listing 2.

M.4.1.3 Break Sequence 3. Break Sequence 3 (BS-3) is a rupture in the suction lines to the DHR pumps 1-2 and 1-1. The breaks are located in rooms 105 and 113 as shown in Figure M-6. Since the break occurs on the path between the BWST and the LPI pumps, the LPI system is assumed to fail. The RELAP5 piping model combined with the RCS model in Figure M-1 is shown in Figure M-8. The combined RELAP5 listing is provided in Listing 3.

M.4.1.4 Break Sequence 4. Break Sequence 4 (BS-4) is a rupture in DHR cooler 1-2. The break is located in room 113 and is assumed to disable one train of LPI. This sequence involves backflow from the RCS through the decay heat cooler discharge piping as shown in Figure M-7. The piping nodalization for this sequence is shown in Figure M-9. The RELAP5 input listing is provided in Listing 4.

M.4.1.5 Break Sequence 5. Break Sequence 5 (BS-5) is a rupture in the HPI pump 1-2 suction piping. The break is located in room 115 and is assumed to disable only one train of HPI. This sequence involves backflow from the

RCS through the HPI 1-2 discharge piping as shown in Figure M-10. The nodalization diagram for the piping portion of the model is shown in Figure M-10. The RELAP5 listing is provided in Listing 5.

M.4.2 CONTAIN Modeling Data

The CONTAIN model used in this analysis consists of five volumes representing the auxiliary building and a sixth volume representing the environment. Figure M-12 shows the CONTAIN nodalization diagram for the model. Auxiliary building rooms 105, 113, 115, and 236 are modeled as separate compartments while the rest of the auxiliary building (including turbine building and containment annulus) is treated as a single compartment. Each compartment includes a sump volume. This volume is determined by the maximum height a pool forming on the floor could reach before a flow path to another compartment is found. The nodalization diagram shows the vapor flow paths connecting each compartment. Each flow path represents an opening such as a pipe chase or doorway. For simplicity, the CONTAIN model includes only one junction between each volume. The multiple flowpaths shown in Figure M-12 were combined to form junctions. Each of the auxiliary building rooms modeled, with the exception of the balance-of-plant, include heat structures representing the concrete in walls, floor, and ceiling. The metal mass in each compartment is neglected. The influence of the compartment's metal mass was investigated through separate sensitivity calculations.

Water aerosol data was not developed because impingement of the break discharge on surfaces within each break compartment is expected to remove most suspended moisture from the atmosphere at the release point.

M.4.2.1 Compartment Gas Volume Data. The essential volume information includes the floor elevation in each room, the distance from floor to ceiling, the total floor area, and the total free volume. The volume of a given compartment is not always the product of the floor area and compartment height. Sometimes the HELB analysis (Reference 5) from which the following data were extracted included a reduction factor to eliminate from the gas volume that volume occupied by piping and equipment. Where Reference 5 applied reduction factors, they are included in the following data.

Room 105.

Floor elevation	= 545 ft	= 166. m	(Ref 7)
Ceiling height	= 18 ft	= 5.49 m	(Ref 5, pg. 54)
Total floor area	= 3180 ft^2	= 295. m^2	(Ref 5, pg. 54)
Free volume	= 40068 ft^3	= 1134 m^3	(Ref 5, pg. 54)

Room 113.

Floor elevation	= 545 ft	= 166. m	(Ref 7)
Ceiling Height	= 18 ft	= 5.49 m	(Ref 5, pg. 57)
Total floor area	= 930 ft^2	= 86.4 m^2	(Ref 5, pg. 57)
Free volume	= 13400 ft^3	= 379. m^3	(Ref 5, pg. 57)

Room 115.

Floor elevation	= 545 ft	= 166. m	(Ref 7)
Ceiling Height	= 18 ft	= 5.49 m	(Ref 5, pg. 61)
Total floor area	= 1150 ft^2	= 107. m^2	(Ref 5, pg. 61)
Free volume	= 18600 ft^3	= 526. m^3	(Ref 5, pg. 61)

Room 236.

Floor elevation	= 565 ft	= 172. m	(Ref 7)
Ceiling Height	= 18 ft	= 5.49 m	(Ref 5, pg. 82)
Total floor area	= 990 ft^2	= 92.0 m^2	(Ref 5, pg. 82)
Free volume	= 8910 ft^3	= 252. m^3	(Ref 5, pg. 82)

Balance-of-Plant. The volume of the auxiliary building can be broken down as shown in Table M-1 (Reference 6). Table M-1 does not include the entire auxiliary building. It includes only the rooms affected by a HELB in room 235 as determined in Reference 5. These are the appropriate volumes for the five break sequences considered in this analysis. The total floor area is not readily available so

Table M-1. Summary of plant volumes used in the HELB analysis.

Room	Volume (ft^3)	Volume (m^3)
225	3,100	88
208	23,300	659
236	20,000	566
Containment Annulus	465,000	13,160
303	35,100	993
Turbine building	5,810,000	164,400
314	22,900	648
501	28,000	792
427	19,500	552
100	13,600	348
105	40,100	1,134
113	13,400	379
500	40,800	1,155
115	18,600	526
515	36,100	1,022
237	6,610	187
238	8,930	253
Sum =>	6,592,000	186,555

Floor elevation = 545 ft = 166. m (Ref 7)

Ceiling Height = 127.2 ft = 38.8 m

Free volume = 6.59E6 ft^3 = 1.87E5 m^3

Total floor area = Volume/height

Total floor area = 51800 ft^2 = 4814. m^2

M.4.2.2 Compartment Sump and Drainage Data. The CONTAIN lower cell model includes the floor concrete mass and pool description. Water sprayed or condensed into each compartment will collect on the compartment floor and drain to collection sumps. Each sump is equipped with level actuated pumps. If the condensation rate is small, water will not collect on the floor surface until the pumps fail and the sump is filled. Because the condensation rate is initially unknown, the calculation was run without condensate removal. In this case the sump area included in the model is the floor area of the compartment. Note that firespray and condensate from the rest of the auxiliary building is not included in the calculation. This is a modeling weakness that could be significant in the small break sequences since many rooms in the auxiliary building drain to the ECCS sump in room 105. This is of particular concern for the rooms containing sprinkler systems that could be triggered by the presence of steam. To show the size of the neglected water source, Table M-2 summarizes the sprinkler discharge capacities and floor drainage capacities available in rooms in the auxiliary building, that drain to ECCS sump 1-1 (located in room 105).

Room 105. If water overflows the sump in this compartment, drainage into room 100 is possible. Room 105 is separated from room 100 by fire doors that are not water tight and will not stand up to pressure differentials greater than 1 psid. The maximum water depth these doors can support is about 5.7 feet. The ECCS sump 1-1 is located in this room and has a total sump discharge capacity of 183 gpm. This sump also collects water from a large number of rooms not included in the model.

Floor surface area= 3180. ft^2 = 295. m^2 (Ref 5, pg. 54)
Floor thickness = 2.00 ft = .610 m (Ref 5, pg. E2)
Maximum pool depth= 0.50 ft = .015 m (Ref 7)
Concrete mass = (295 m^2)(.610 m)(240 kg/m^3) = 43,188. kg

Room 113. This room includes the ECCS sump 1-3 with discharge capacity of 183 gpm.

Floor surface area= 930. ft^2 = 86.4 m^2 (Ref 5, pg. E3)
Floor thickness = 3.00 ft = .914 m (Ref 5, pg. E3)
Maximum pool depth= 10.0 ft = 3.05 m (Ref 7)
Concrete mass = (86.4 m^2)(.914 m)(240 kg/m^3) = 18,953. kg

Room 115. This room includes ECCS sump 1-2 which has a discharge capacity of 150 gpm.

Floor surface area= 1150. ft^2 = 107. m^2 (Ref 5, pg. E4)
Floor thickness = 3.00 ft = .914 m (Ref 5, pg. E4)
Maximum pool depth= 10.0 ft = 3.05 m (Ref 7)
Concrete mass = (107 m^2)(.914 m)(240 kg/m^3) = 23,472. kg

Table M-2. Sprinkler and drain capacities for rooms that drain to the ECCS sump in room 105.

Room Number	Sprinkler Capacity (gpm)	Drain Capacity (gpm)
208/202	594	364
303	594	364
501	900	364
207/209	240	364
304	348	546
405	60	182

Room 236. The floor thickness is two feet. Half of this floor mass is assigned to the ceiling of the compartment below. This room has a floor drain capable of discharging 182 gpm to the Miscellaneous Waste Drain Tank. This drain is normally isolated by a spring loaded wafer check valve that opens when the water depth reaches 1 inch. Since it would be difficult to accurately split the flow between the Miscellaneous Waste Drain Tank and the pipe chase to room 115 below, the pipe chase is assumed to drain all fire spray, condensate, and break discharge into room 115.

Floor surface area = 990. ft^2 = 91.9 m^2 (Ref 5, pg. 82)

Floor thickness = 1.00 ft = .305 m (Ref 5, pg. E4)

Maximum pool depth = 0.08 ft = .025 m

Concrete mass = (91.9 m^2)(.305 m)(240 kg/m^3) = 6,727. kg

M.4.2.3 Compartment Condensing Surface Data. The heat sinks available for steam condensing in each compartment were taken from the Reference 5. The reference plant data did not include metal mass. In the following data the floor was not included as a heat sink because CONTAIN divides each compartment into an upper and lower cell volume. The upper cell volume includes the compartment gas volume and heat structures affecting the gas volume. The lower cell includes the sump volume, and any debris or heat structures that would affect heat transfer into the sump water volume. For this reason the wall, ceiling, and equipment heat sinks (if any) are described in this section, and the sump parameters in the preceding section.

Room 105.

Wall surface area = 3213. ft^2 = 298. m^2 (Ref 5, pg. E2)
Wall thickness = 2.30 ft = .701 m (Ref 5, pg. E2)
Ceiling area = 3180. ft^2 = 295. m^2 (Ref 5, pg. E2)
Ceiling thickness = 3.00 ft = .914 m (Ref 5, pg. E2)

Room 113.

Wall surface area = 2736. ft^2 = 254. m^2 (Ref 5, pg. E3)
Wall thickness = 2.60 ft = .792 m (Ref 5, pg. E3)
Ceiling area = 930. ft^2 = 86.4 m^2 (Ref 5, pg. E3)
Ceiling thickness = 2.00 ft = .610 m (Ref 5, pg. E3)

Room 115.

Wall surface area = 2592. ft^2 = 241. m^2 (Ref 5, pg. E4)
Wall thickness = 2.00 ft = .610 m (Ref 5, pg. E4)
Ceiling area = 1150. ft^2 = 107. m^2 (Ref 5, pg. E4)
Ceiling thickness = 2.00 ft = .610 m (Ref 5, pg. E4)

Room 236. Reference 5 did not include heat structure data sheets for room 236. The heat structure data for this compartment is based on a RELAP4 input deck used in the HELB analysis (Reference 6). Therefore the breakdown between wall, ceiling, and floor surface areas is not known. The entire surface described in Reference 6 is assumed to be wall surface.

Wall surface area = 4840 ft^2 = 450. m^2 (Ref 6)
Wall thickness = 0.50 ft = .152 m (Ref 6)

M.4.2.4 Flow Path Data. The compartments in the auxiliary building are connected by a variety of doorways, pipe tunnels, and ventilation paths. The pipe chases are always open in the compartments of interest, while the doors, if closed, have a relatively low pressure capacity. Blowout panels are also present in some compartments. The input required to describe a flow path consists of the path area, the ratio of area to flow length, the turbulent flow coefficient, and optionally, the elevation of each end of the flow junction. A further simplification used in the following is to include only one path between any two compartments. In the following each flow path is described, then the flow paths are combined, and the combined flow path is referred to as a flow junction. All of the modeling parameters are readily available in Reference 5 except the flow coefficient. The flow coefficient value will be 1.0 in the model, flow areas, A/L, and elevations are representative of the plant geometry. Detailed evaluation of specific flow paths resulted in flow coefficients from .7 to .9. Because of the difficulty of modeling the effect of partial flow path blockage (as occurs in pipe chases) more detailed flow coefficient calculations were not performed.

Path 1. The double doors (82"x84") connecting room 105 to room 100. These doors are normally closed but will fail at a differential pressure of 1.0 psid. These doors provide a horizontal connection between 100 and 105 at floor level (el. 545 ft). The thickness of the wall (L) at this level is 2 feet.

Flow area	= 48.0 ft^2	= 4.46. m^2	(Ref 5, pg. 52)
Elevation	= 548.5 ft	= 167. m	(Ref 7)
A/L	= 24.0 ft	= 7.32 m	

Path 2. Path 2 is a pipe chase that connects room 105 to room 208. This pipe chase provides a vertical connection with the BOP at elevation 565 ft. Reference 5 indicates that the pipe chase opening is 8' x 8', but that it is assumed to be 40% blocked by the piping that runs through the opening. The Ceiling is 3 feet thick

Flow area	= 38.0 ft^2	= 3.53 m^2	(Ref 5, pg. 55)
Elevation	= 565. ft	= 172. m	(Ref 7)
A/L	= 38/3 ft	= 3.86 m	

Path 3. Path 3 is the pipe chase connecting room 105 to room 225. This pipe chase provides a vertical connection at elevation 565 ft. Reference 5 indicates that the pipe chase opening is 4' x 4', but that it is assumed to be 40% blocked by the piping that runs through the opening. The ceiling is 3 feet thick.

Flow area	= 9.60 ft^2	= .892 m^2	(Ref 5, pg. 55)
Elevation	= 565. ft	= 172.m	(Ref 7)
A/L	= 9.6/3 ft	= .975 m	

Path 4. The open door and pipe chase connecting room 105 to room 113 is path 4. The pipe chase is 16' x 12 ' and 40% blocked by piping. The door is 7x3 ft. The total area is then 136 ft^2. The wall is 2 feet thick, the center of the door is at elevation 545 + 10 + 7/2 = 558 feet.

Flow area	= 136. ft^2	= 12.6 m^2	(Ref 5, pg. 55)
Elevation	= 558. ft	= 170. m	(Ref 7)
A/L	= 136/2 ft	= 20.7 m	

Path 5. The pipe chase connecting room 113 to room 225 is path 5. This pipe chase provides a 4' x 4' vertical connection to room 225. As with the other chases, the opening is assumed to be 40 % blocked. The ceiling is 2 feet thick (p. E-3 of Ref. 5).

Flow area	= 9.60 ft^2	= .892 m^2	(Ref 5, pg. 58)
Elevation	= 565 ft	= 172. m	(Ref 7)
A/L	= 9.6/2 ft	= 1.46 m	

Path 6. The 3' x 7' door connecting room 113 to room 115 is path 6. The elevation is 545 + 10 +7/2 = 558 feet. The wall is two feet thick.

Flow area	= 21.0 ft^2	= 1.95 m^2	(Ref 5, pg. 58)
Elevation	= 558. ft	= 170. m	(Ref 7)
A/L	= 21/2 ft	= 3.2 m	

Path 7. Path 7 is the single closed door connecting room 115 to room 114. The door is 3′ x 7′ and has a blowout pressure of 1.7 psig. The doors provide a horizontal connection at level 558 ft (assumes a 10 foot flood wall).

Flow area	= 21.0 ft^2	= 1.95 m^2	(Ref 5, pg. 59)
Elevation	= 558. ft	= 170. m	(Ref 7)
A/L	= 10.5 ft	= 3.20 m	

Path 8. The 9′x 6′ pipe chase that connects room 115 to room 236 is path 8. This pipe chase is about 40% blocked by piping.

Flow area	= 32.0 ft^2	= 2.97 m^2	(Ref 5, pg. 61)
Elevation	= 565. ft	= 172. m	(Ref 7)
A/L	= 32/2 ft	= 4.88 m	

Path 9. This flow path connects room 236 to the turbine building through blowout panels. The panels are normally closed but open when differential pressure reaches 0.5 psig. The blowouts are assumed to occur at floor level plus two feet. The wall is two feet thick.

Flow area	= 250. ft^2	= 23.2 m^2	(Ref 5, pg. 83)
Elevation	= 567. ft	= 173. m	(Ref 7)
A/L	= 250/2 ft	= 38.1 m	

Path 10. Flow path 10 is a 15 ft^2 blowout panel connecting room 236 to room 235. The blowout direction appears to be from room 235 to room 236. The panels open at a pressure of 1.0 psig. It is assumed the panels open to reverse flow at the same pressure.

Flow area	= 15.0 ft^2	= 1.39 m^2	(Ref 5, pg. 80)
Elevation	= 567. ft	= 173. m	(Ref 7)
A/L	= 15/2 ft	= 2.29 m	

Path 11. The closed door that connects room 236 to room 227 is flow path 11. This door is normally closed. The door will fail at a differential pressure of 1.7 psig away from the jam. This provides a horizontal connection at floor level (el. 565 + 7/? ft). The wall is assumed to be 2 feet thick.

Flow area	= 21.0 ft^2	= 1.95 m^2	(Ref 5, pg. E2)
Elevation	= 568.5 ft	= 173. m	
A/L	= 21/2 ft	= 3.20 m	

Path 12. This flow path connects room 236 to the containment annulus. The wall is 2 feet thick.

Flow area	= 12.6 ft^2	= 1.17 m^2	(Ref 5, pg. 83)
Elevation	= 567. ft	= 173. m	
A/L	= 12.6/2 ft	= 1.92 m	

Path 13. The pipe chase that connects room 236 to room 314 is flow path 13.

Flow area	= 15.0 ft^2	= 1.39 m^2	(Ref 5, pg. 83)
Elevation	= 585. ft	= 178. m	
A/L	= 15/2 ft	= 2.29 m	

The above flow path data is summarized in Table M-3.

M.4.2.5 Spray Data. The firewater sprays in room 236 are included in the model. The sprays are activated by fusible links (at 212°F). The sprays provide 336 gpm of water from heads scattered around the room at different elevations. The droplet size is not known, and is assumed to be .001 meters. The spray fall height is 18 feet (5.49 m).

M.4.3 Material Properties

The material properties required for this analysis are those of steam, water and concrete. Material properties for steam, water, concrete and steel are built into the CONTAIN code. The material property data for the RELAP5 models was documented in References 3 and 4.

Table M-3. Summary of CONTAIN flow path and flow junction data.

Junction	Paths	Area (m^2)	A/l (m)
1	1,2,3	8.88	14.6
2	4	12.6	20.7
3	5	.892	1.46
4	6	1.95	3.20
5	7	1.95	3.20
6	8	2.97	4.88
7	9,10,11,12,13	29.1	157.

M.5 Results

M.5.1 Break Sequence 1

The RELAP5 calculations provided the reactor coolant system response data shown in Figures M-13 through M-16. Figure M-13 shows the RCS pressure plotted against time. The pressure drops from normal operating pressure to about 100 psia in about 10 minutes. At 10 minutes, system pressure is determined by the pump characteristics and by head losses between the pump and the break. Because the flows are large (nearly runout flow for two LPI pumps) the RCS cools to about 100°F in the same time frame (see Figure M-14). The resulting break flows and enthalpies are shown in Figures M-15 and M-16. Break flows are initially very large, but as saturated conditions are reached in the RCS, break flow drops off. The break flows plotted in Figure M-15 are both the liquid and vapor flow rates. The increase in vapor flow rate shows the onset of saturation, while the decrease to zero shows the eventual subcooling of the system during refill. The total break flow is reduced during refill, but eventually returns to essentially the runout flow of the ECCS systems. The contents of the CFTs and BWST are injected in 48 minutes, at this time injection stops.

The auxiliary building response to this blowdown is shown in Figures M-17 and M-18. The temperature, shown in Figure 16, increases to a maximum of about 212°F in a few minutes, and stays there until cooling of the RCS discharge causes temperature to drop. This occurs early in the transient. The pressure predictions (not shown) indicate an increase in auxiliary building pressure of less than 1 psig.

The last parameter of interest shown in figure M-18 is pool depth. During the first few minutes of the transient flooding is a minor problem. The flooding becomes serious as the RCS cools. Most of the water released in the break compartment is carried though the auxiliary building as steam. The condensation rate in most compartments is small. In room 236 (the break compartment) fire sprays, condensate, and that portion of the break discharge that does not flash to steam drains through the pipe chase in the floor to room 115 below. This results in a rapid filling of room 115. Room 115 is separated from room 113 by a 10-foot high flood wall, and is filled to the top of the flood wall in 20 minutes. Spillage from room 115 into room 113 begins and causes room 113 to be flooded to the top of the flood wall into room 105 by 30 minutes. Room 105 then starts to fill, and by 50 minutes into the transient, room 105 has filled sufficiently to burst the doorway into room 100.

M.5.2 Break Sequence 2

The predicted RCS response during this sequence is shown in Figures M-19 through 21. This sequence, like break sequence 1, was run for 1 hour of transient time. Unlike the previous transient, this sequence could continue for some time after the one hour cutoff (in the previous sequence the BWST would be exhausted in one hour). However, the auxiliary building results, shown in Figures M-23 and M-24, indicate the clear trend. Temperatures are going to reach 212°F very quickly and remain there until the RCS is cooled down. The cooling that begins at 20 minutes reflects the cooling of the RCS, and the establishment of natural circulation paths in the model.

The flooding that results from the break is shown in Figure M-23. Note that Room 115 shows the greatest fill rate. In this sequence, the primary contributor to flooding is the drainage of firespray water from room 236 above. The condensate is the next significant contributor, resulting in similar fill rates in the remaining compartments.

M.5.3 Break Sequence 3

In this sequence the piping breaks in both rooms 105 and 113. The RCS conditions are shown in Figures M-25 through M-28. There is essentially no difference between the RCS performance for this sequence and for sequence 2 because the choke plane is in exactly the same place in both models. The auxiliary building response differs because the two breaks are in separate rooms instead of the same room as in sequence 2. The pressures in the auxiliary building are again limited to near atmospheric pressure.

The temperatures, shown in Figure M-29, in rooms 105 and 113 rise to 212°F in several minutes and remain there for about 20 minutes before starting to cool. The other rooms in the model reach a maximum temperature of 198°F. Since temperatures in room 236 never exceed 212°F, the sprinkler system does not trip.

The relative humidity remains high, having saturated steam in rooms 105 and 113 for twenty minutes, after that the relative humidity remains near 100% for a long period of time.

The flooding, shown in Figure M-30, is a slow process in this sequence. There is less than a foot of accumulated water in any compartment at the end of one hour. The maximum flooding occurs in room 113. Flooding in room 115 is less than in other cases because the sprinklers in room 236 do not activate. The maximum flooding rate in this sequence is close to the capacity of the sump pumps. For example, in room 105 at approximately 5 minutes into the transient, the total flooding rate is about 244 gpm. The sump discharge capacity is only 183 gpm. The result is that flooding in this compartment will occur much slower than shown in the figures.

M.5.4 Break Sequence 4

The RELAP5 predictions of pressure, temperature, break flow and break enthalpy are shown in Figures M-31 through M-34. The pressures in the auxiliary building are again low.

The auxiliary building temperatures are shown in Figure M-35. Again, saturated steam conditions are predicted to appear immediately and to last for twenty minutes. At this time the discharge is predicted to cool, resulting in lowering temperatures in the auxiliary building. Fire sprays will release in room 236 and contribute to the cooling process. The relative humidity is 100%.

Flooding, as shown in Figure M-36, occurs at a high rate. No spillage from one compartment to another occurs in the first hour, but will likely occur soon thereafter.

M.5.5 Break Sequence 5

The RELAP5 predictions of pressure, temperature, and break flow and enthalpy are shown in Figures M-37 through M-40. This sequence offers the possibility for benchmark comparison with more detailed calculations because of the CSAU study of B&W plants. This sequence is nearly identical to the CSAU Nominal SBLOCA case.

Comparison of RCS pressure (Figure M-36) with CSAU predictions (Figure M-43) shows that the simplified model predicts pressures that are too high. This results because energy removal mechanisms are neglected. Steam generator heat removal would remove much additional energy not accounted for in the simplified model.

Comparison of RCS temperature (Figure M-38) with CSAU predictions (Figure M-44) shows that model predictions are too high early in the transient, and too low late in the transient. This is because steam generator heat removal removes energy early, while later, it provides a source of stored energy. Both phenomena are neglected by the simplified model.

For easy reference, comparisons of pressure, temperature, break discharge flow, and break enthalpy are shown in Figures M-48, M-49, M-50, and M-51.

CONTAIN runs were made using the break discharge data from both the simple primary coolant system RELAP5 calculation, and from the Oconee CSAU calculations. The CONTAIN temperature and pool depths for the simplified model source term are plotted in Figures M-41 and M-42. Figures M-52 and M-53 show the same parameters calculated by CONTAIN when the Oconee steam source is used. Note that despite the inaccuracies in the simplified RCS model results, the CONTAIN predictions have similar implications for the risk analysis these calculations support. Temperatures peak at 211°F and pool depths are only different by about 2 feet after 2 hours. Percentage wise, the difference in pool depths is significant, however, both calculations show that the time required to fail ECCS equipment from submergence is long compared to the time required for the operators to recover the plant (i.e., the additional time available before ECCS submergence will have no affect on the likelihood the operators will successfully recover the plant). This demonstrates the relative insensitivity of auxiliary building conditions to the source term for the small breaks.

The high void fractions shown in Figure M-47 might be a cause for some concern. If the steam void fraction reaches .994 (the Oconee model predicts .95 to .99 for much of the transient) the constant enthalpy expansion that is assumed by the CONTAIN code will cause auxiliary building temperature predictions much higher than the 211°F predicted for both the previous cases. To determine the potential impact of dry steam in the discharge an additional sensitivity case was run. This case used the Oconee best estimate break discharge data from the preceding sensitivity with the steam quality set to 1.0 during the high void fraction portion of the transient. The resulting temperatures and flooding predictions are shown in Figures M-54 and M-55. Note that the resulting temperatures reach a maximum of about 276°F.

This result has significant implications. While the blowdown predicted in the Oconee model is never completely dry, it is so close that code uncertainties do not justify concluding that the discharge cannot become dry. Additional calculations are not likely to resolve this issue, and test data have not been published in sufficient detail to decide this issue. Therefore there remains some uncertainty about the maximum temperatures that can appear in the auxiliary building.

Besides the dry discharge sensitivity, runs were made that incorporated 1000 lb, 10,000 lb, 100,000 lb, and 1,000,000 lb of metal mass into each compartment. The dry discharge sensitivity above was modified to include the metal mass. The results showed the metal mass had a minimal impact on calculated temperatures up to a metal mass of 100,000 lb. The results for the 100,000 lb run are shown in Figures M-56 and M-57.

M.6 Findings

A number of generalizations can be made from the results described in the preceding section.

The break discharge calculated with simplified RELAP5 models of the reference plant RCS provided a rough estimate of the steam source in the auxiliary building. Benchmark comparisons and sensitivity calculations have shown that, for a small break, the auxiliary building conditions are not strongly dependent on the discharge. For a large break the break discharge will be more important, but the large break results are believed to be more accurate than the small break calculations. Therefore the existing break calculations are sufficient for the purposes of this analysis.

The pressurization of auxiliary building is limited to less than 1 psig. This result occurs because auxiliary building compartments are very well connected. The modeling parameters that affect the calculated pressure rise between compartments are flow area, discharge coefficient, and L/D. These parameters are all accurately known for the ECCS rooms, so any uncertainties in the flow model (and hence the pressure calculation) would depend on the number of flow junctions neglected in the balance-of-plant model. The largest pressure drop in the model should occur as the fluid passes from the break compartment to the adjacent compartments (assuming roughly equal flow areas connecting each compartment). At each successive flow junction the mass flow will be reduced by the mass condensed in passing through each compartment, and the effective area associated with the flow will increase as more and more parallel flow paths become available to the fluid. Therefore pressure drops at each junction will decrease with increasing distance from the break. This leads to the conclusion that model refinements affecting the pressure calculation are unwarranted.

Temperatures in the auxiliary building do not exceed 212°F. There is one modeling uncertainty that could change this result. The modeling uncertainty is the quality of the steam mixture discharged into the auxiliary building. For all of the break sequences evaluated in this analysis, the break discharge is a two-phase mixture with steam quality no higher than roughly 0.9. The CONTAIN treatment of the break discharge is essentially that of an isenthalpic expansion from RCS pressure to compartment pressure. Given this characterization of the process, the resulting compartment temperatures will always be at, or very near, the saturation temperature for the calculated compartment pressure, unless the break quality exceeds about 0.93 (a void fraction of 0.994). When this occurs, the discharged fluid will have sufficient enthalpy (greater than 1150 Btu/lb) to drive the steam in the compartment atmosphere into superheat. The maximum temperature obtainable by this process is about 320°F and this occurs when the RCS discharge is dry saturated steam at about 500 psia. It must be emphasized that none of simplified model predictions, or the best estimate Oconee predictions used in this analysis predict the existence of dry steam in the break discharge, however, THE OCONEE RESULTS SHOW PROLONGED PERIODS DURING WHICH THE DISCHARGE IS VERY NEARLY DRY. Given the uncertainty inherent in any RELAP5 calculation, it is hard to rule out the possibility that high quality steam will be discharged long enough to drive the steam in the break compartment into superheat.

The relative humidity in the ECCS rooms will be 100% for much of the transient in all the break sequences analyzed here.

The pool depth results described in the previous section can be summarized with two generalizations

1) For break sequences 1 and 4, flooding will occur in the break compartment and the adjacent compartments at a rate that will cover essential ECCS components within one hour.

2) For break sequences 2, 3, and 5 flooding will occur slowly and could be delayed by operation of the compartment sumps, requiring a period of many hours before essential ECCS components would be covered.

Of the different factors controlling pool formation, there are two factors that dominate. The first is the rate of discharge of unflashed fluid from the break, the second is the extent to which firewater and condensate from the rest of the auxiliary building finds its way into rooms 105, 113, and 115. For the large breaks, the principal contributor to the pool formation is the discharge that does not flash. For the break sequences ' and 4, as the RCS cools down, this becomes essentially the run out flow of the surviving ECCS. In sequences 2, 3, and 5, the discharge of firesprays provides a greater flooding hazard than the accumulation of condensate or unflashed break discharge.

M.7 References

1. K. E. Carlson et al., *RELAP5/MOD3 Code Manual Volume III: Developmental Assessment and Solution Methods*, NUREG/CR-5535, EGG-2596, Draft, (available from EG&G Idaho, Inc. P.O. Box 1625, Idaho Falls, ID 83415-2404), June 1990.

2. K. K. Murata et al., *User's Manual for CONTAIN 1.1: A Computer Code for Severe Nuclear Reactor Accident Containment Analysis*, NUREG/CR-5026, SAND87-2309, November 1989.

3. C. M. Kullberg, Calculation Notebook for Core Uncovery Time Estimates for the B&W Reference Nuclear Power Plant.

4. W. J. Galyean and D. I. Gertman, *Assessment of ISLOCA Risks—Methodology and Application to a Babcock and Wilcox Nuclear Power Plant*, NUREG/CR-5604, EGG-2608, Appendix F, April 1992.

5. The B&W Reference Plant's Energy Line Break Analysis.

6. The B&W Reference Plant's HELB Analysis, RELAP4 input, Job Number 1040-039-1662, EDS Calc NO. 1040-039-004, ADCONLA, BREAK.BW5CO.

7. The B&W Reference Plant's Drawing Number M-130, Rev. 4.

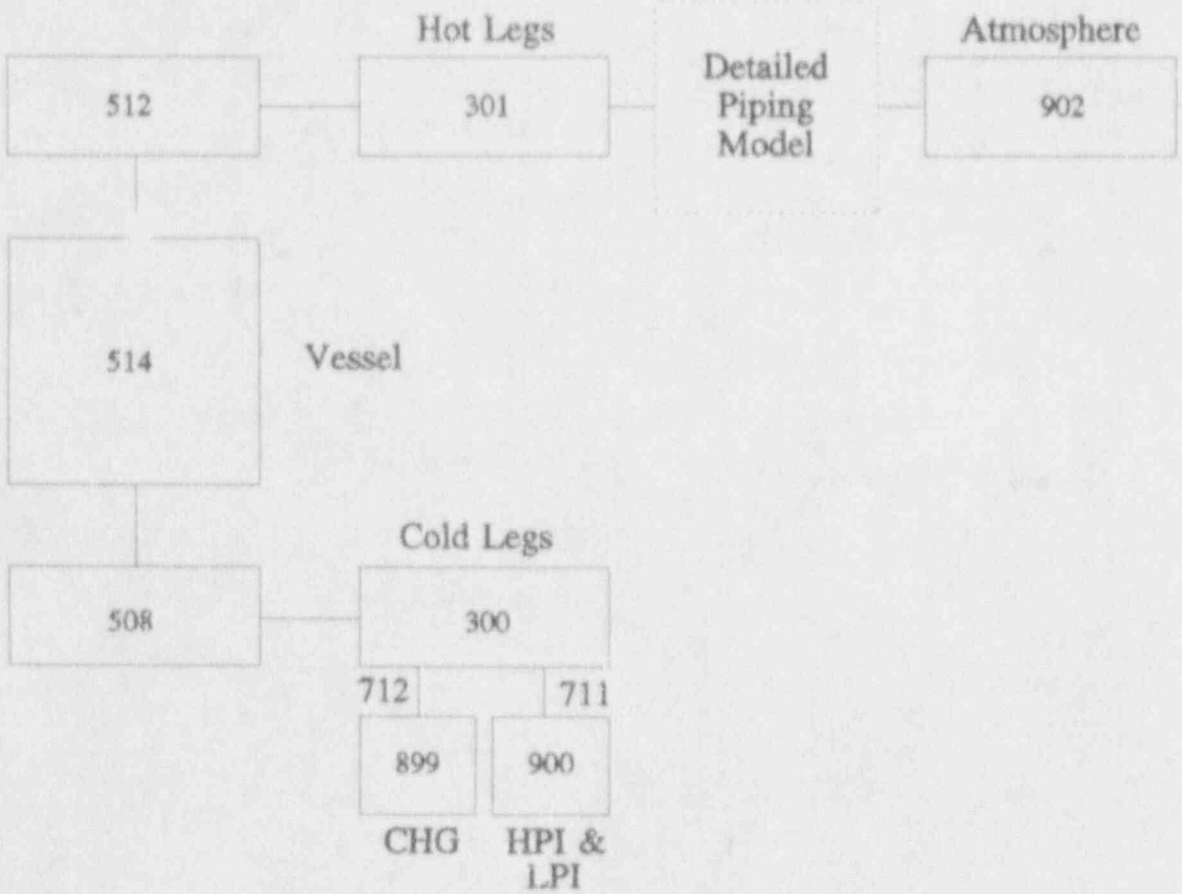

Figure M-1. RELAP5/MOD3 Nodalization for the simplified reactor coolant system model.

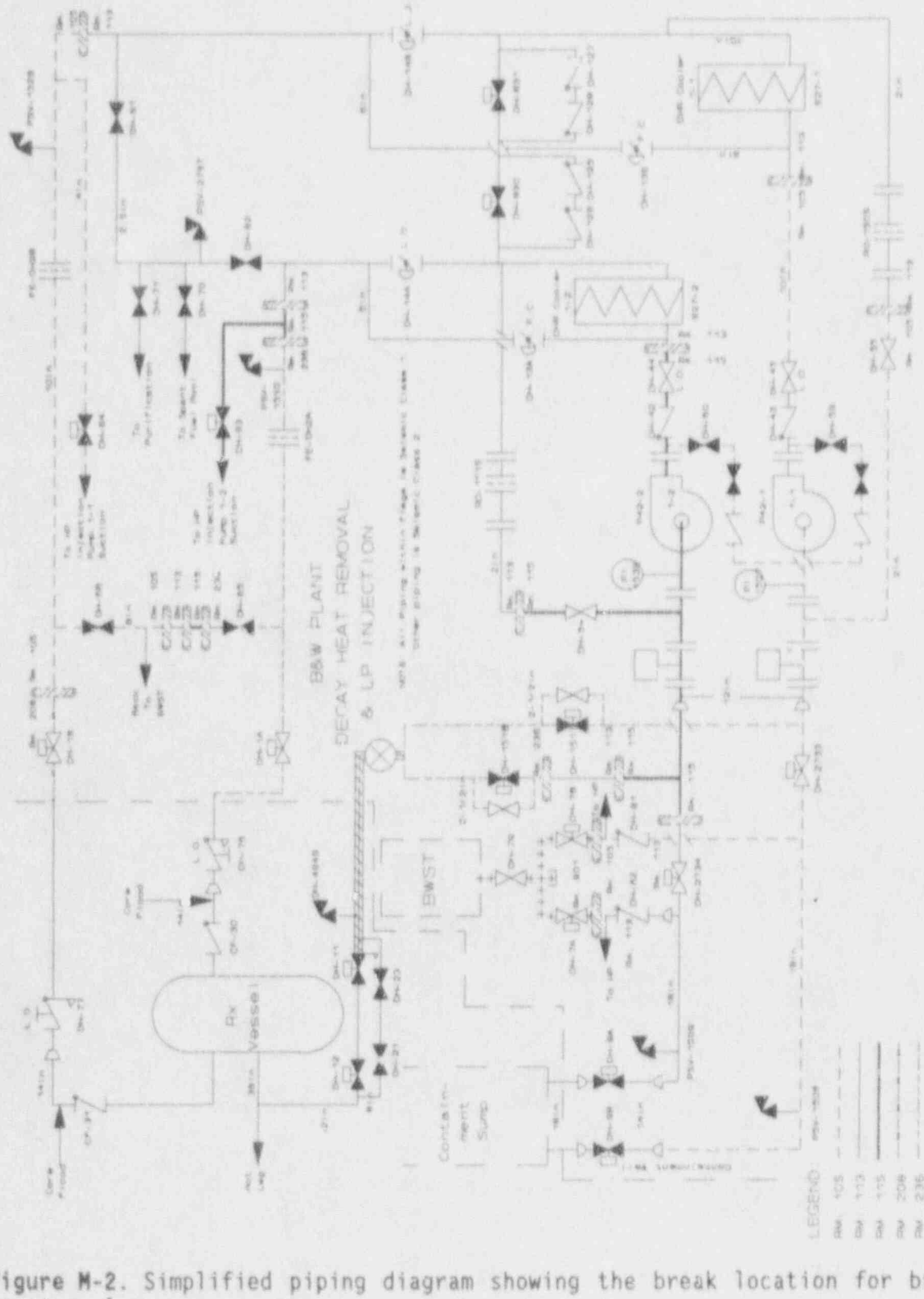

Figure M-2. Simplified piping diagram showing the break location for break sequence 1.

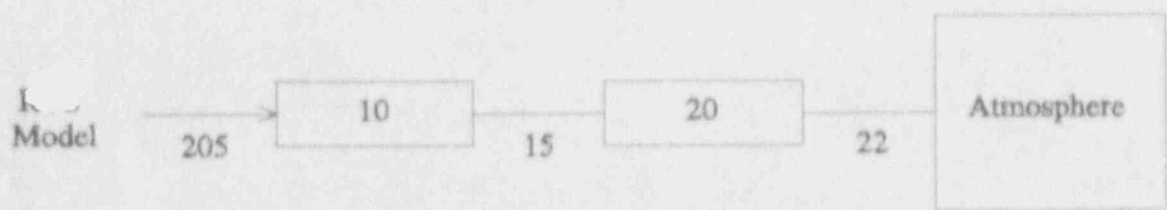

Figure M-3. RELAP5/MOD3 Piping model for break sequence 1.

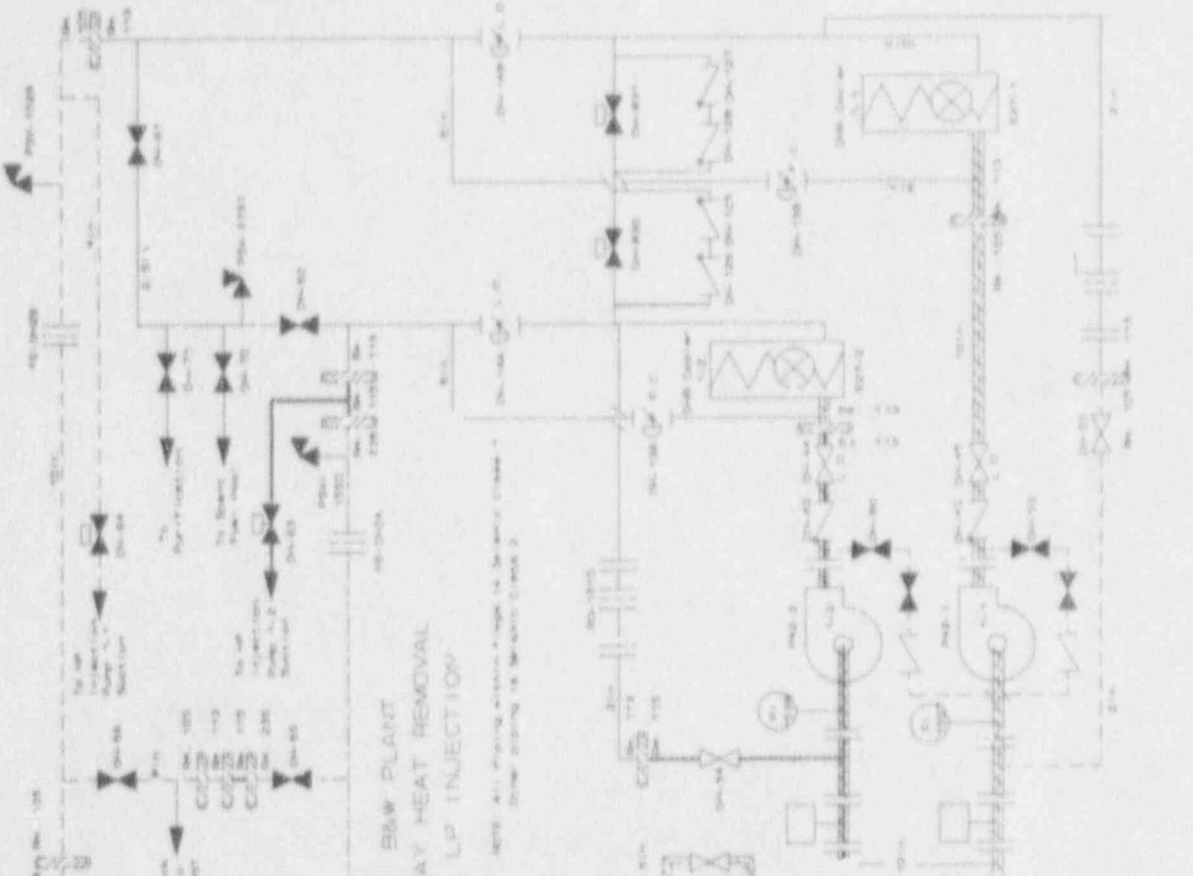

Figure M-4. Simplified piping diagram showing the break locations for break sequence 2.

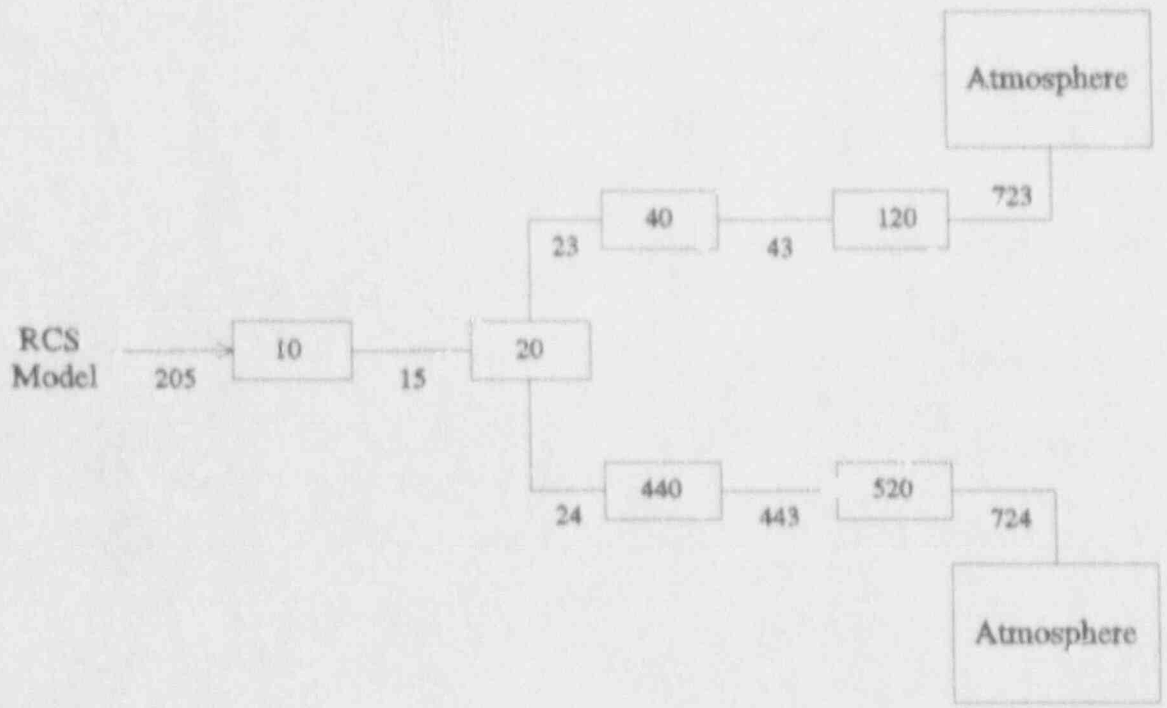

Figure M-5. RELAP5/MOD3 piping model for break sequence 2.

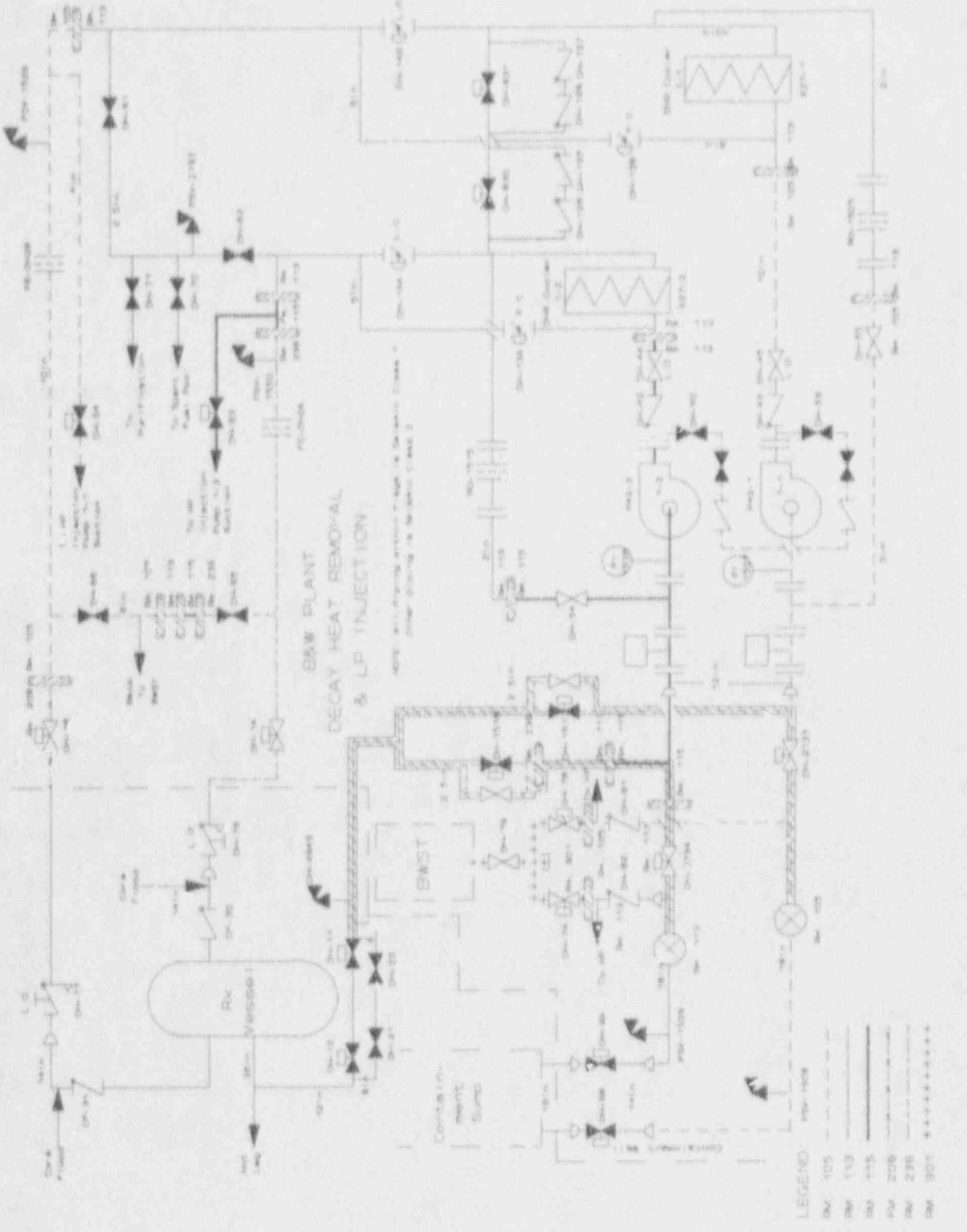

Figure M-6. Simplified piping diagram showing break location for break sequence 3.

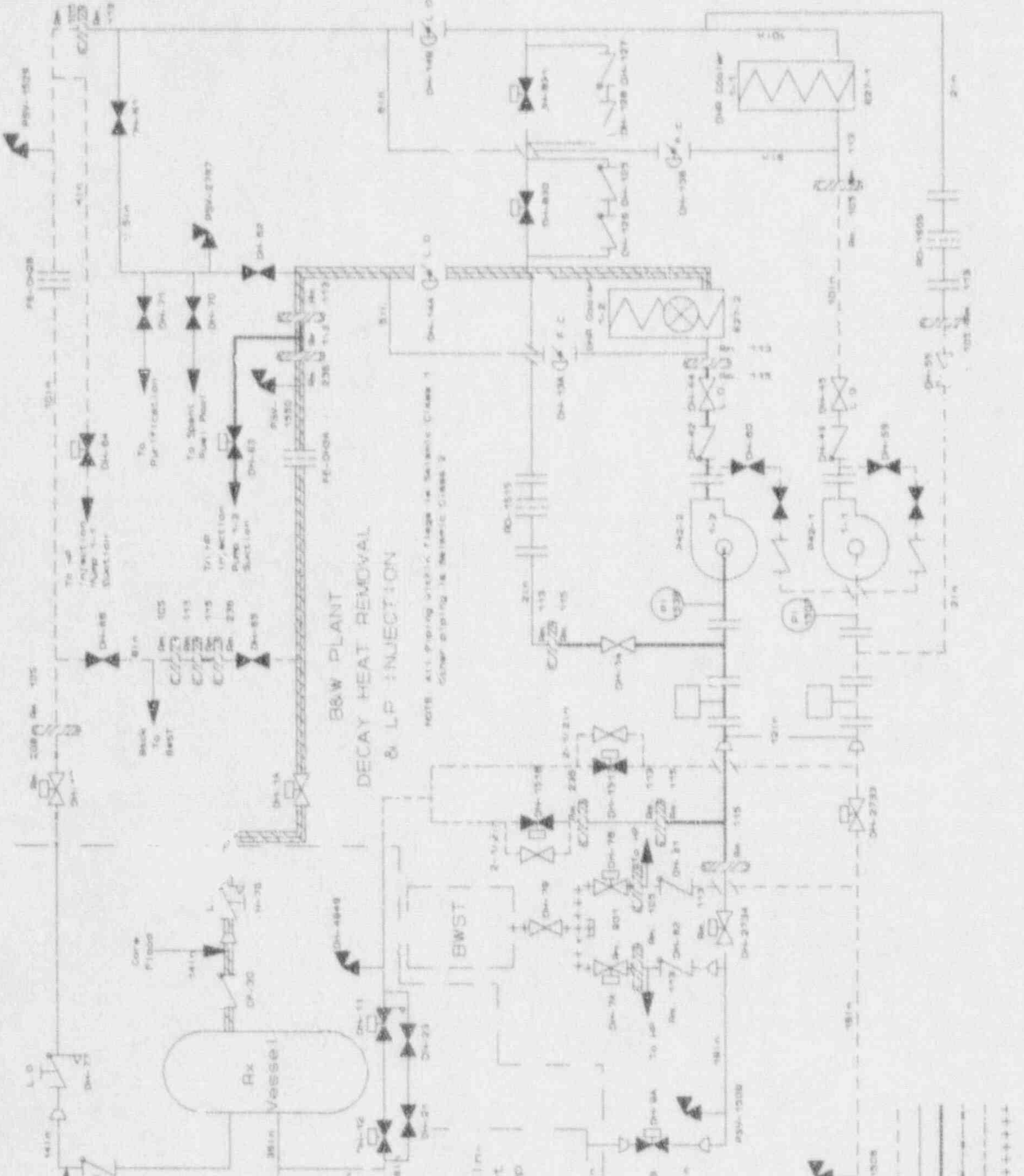

Figure M-7. Simplified piping diagram showing break location for break sequence 4.

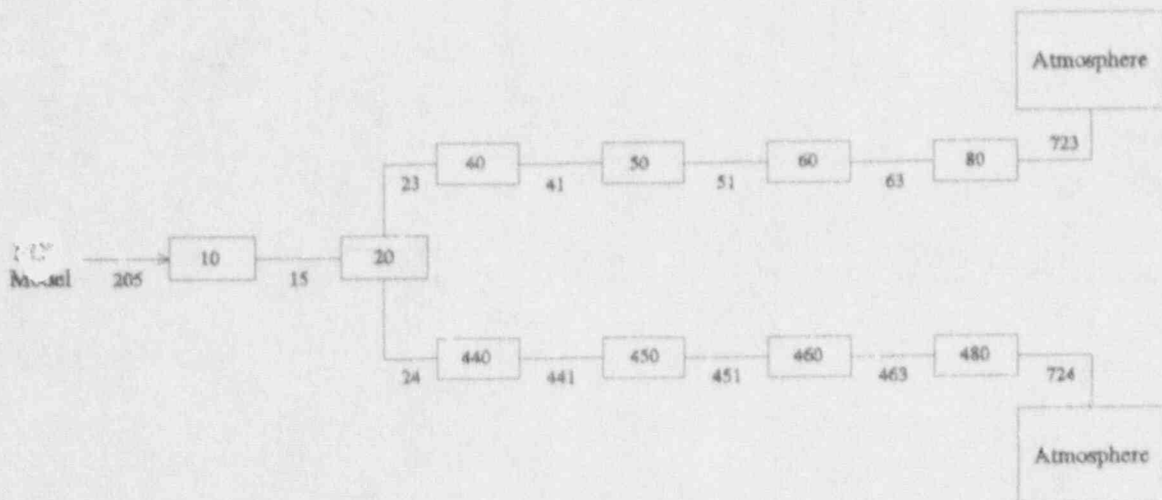

Figure M-8. RELAP5/MOD3 piping model for break sequence 3.

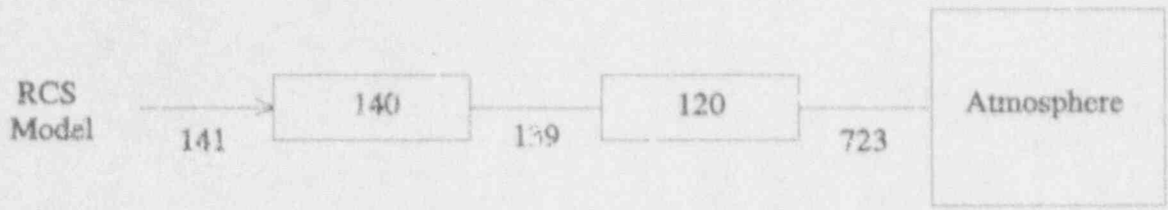

Figure M-9. RELAP5/MOD3 piping model for break sequence 4.

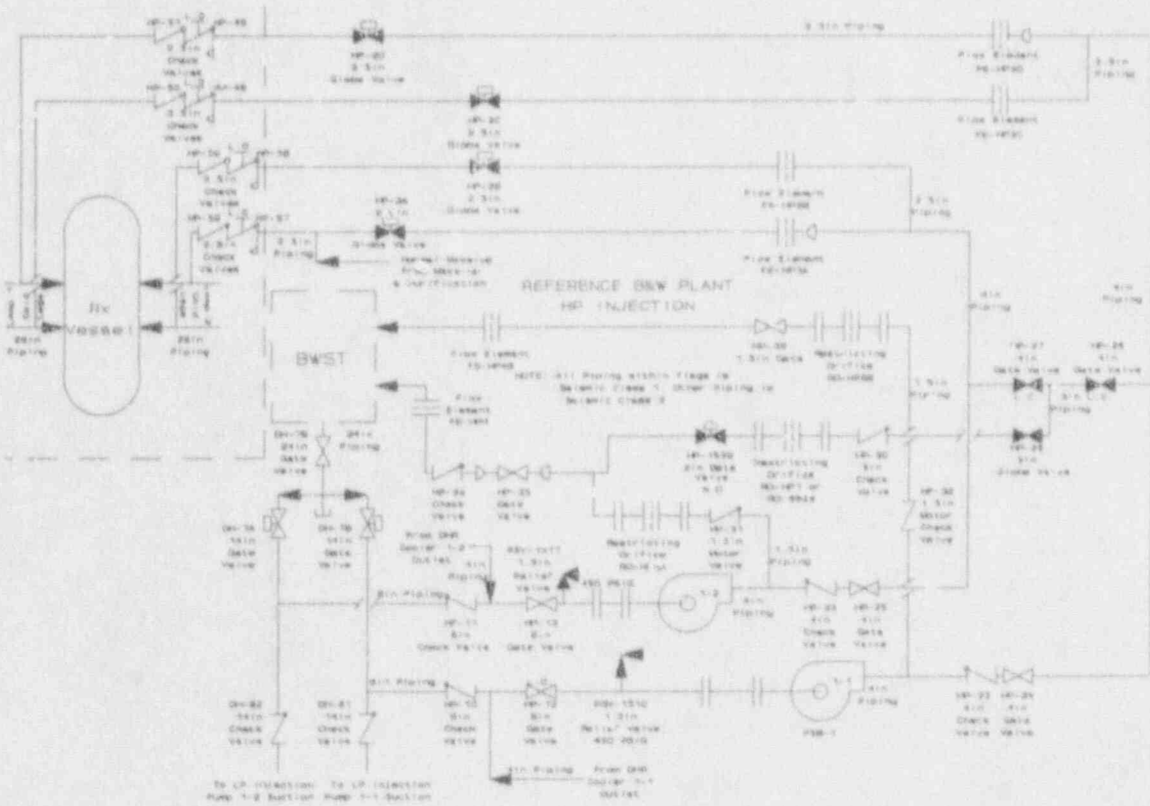

Figure M-10. Simplified piping diagram showing the break location for break sequence 5.

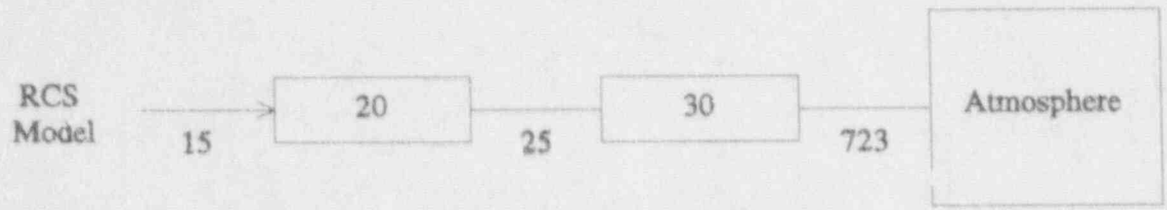

Figure M-11. RELAP5/MOD3 piping model for break sequence 5.

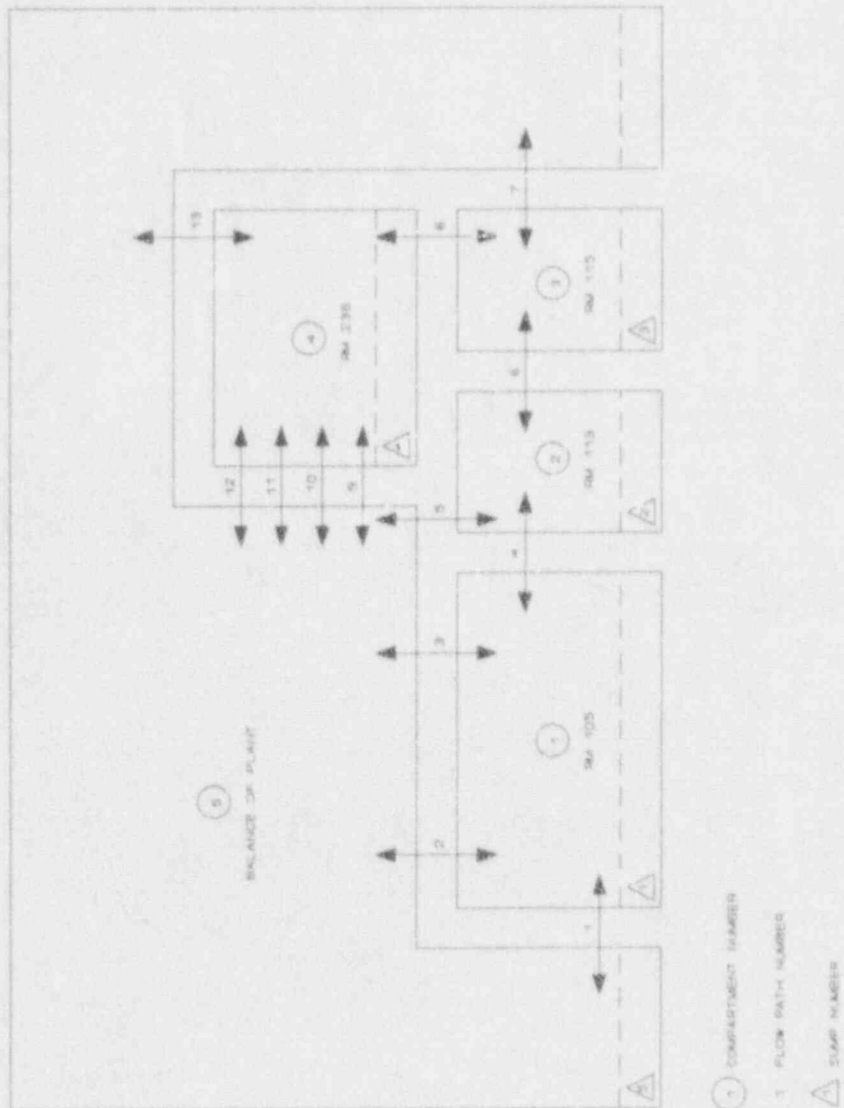

Figure M-12. CONTAIN nodalization diagram for the B&W Plant Auxiliary building

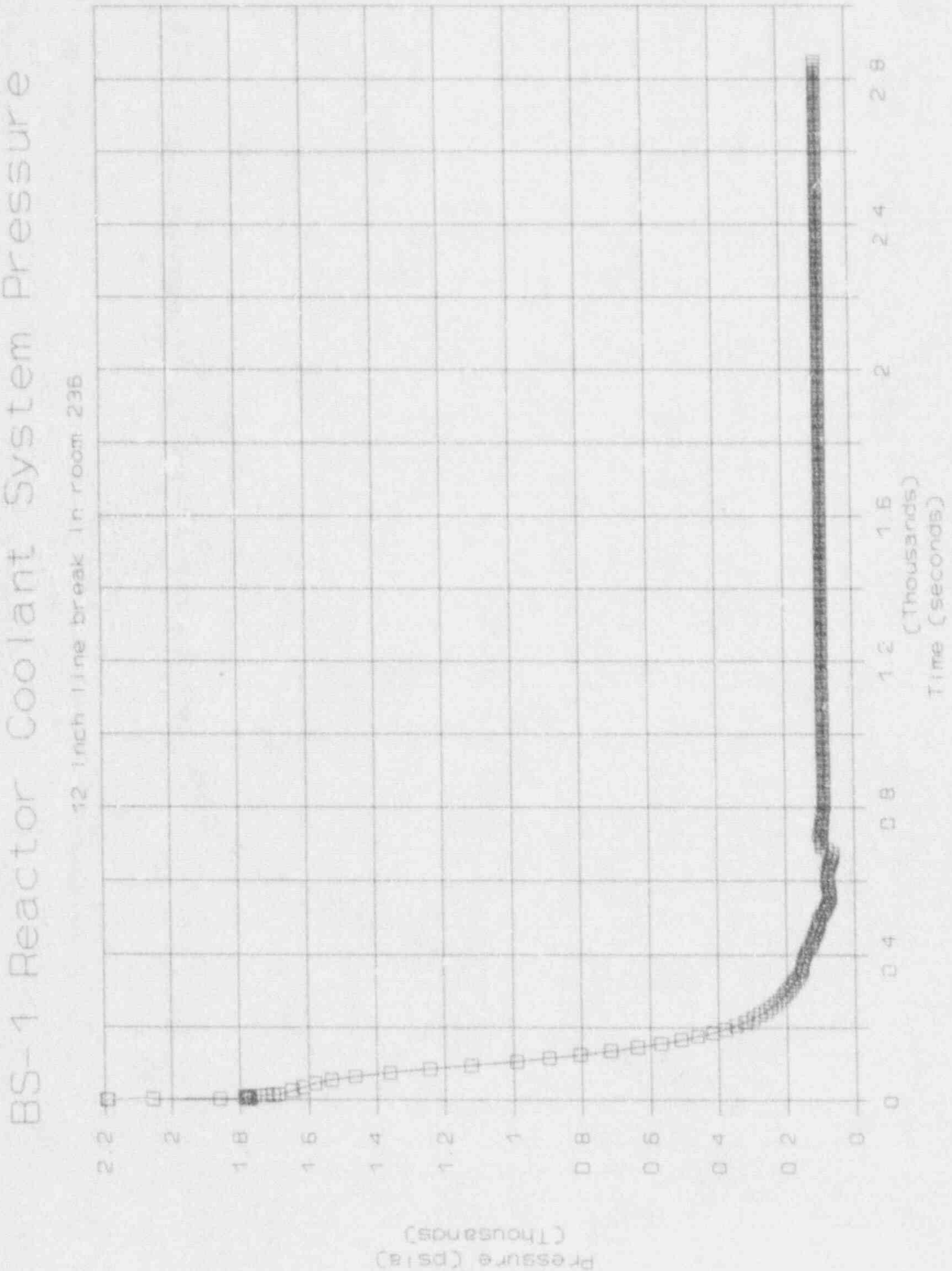

Figure M-13. Reactor coolant system pressure for break sequence 1.

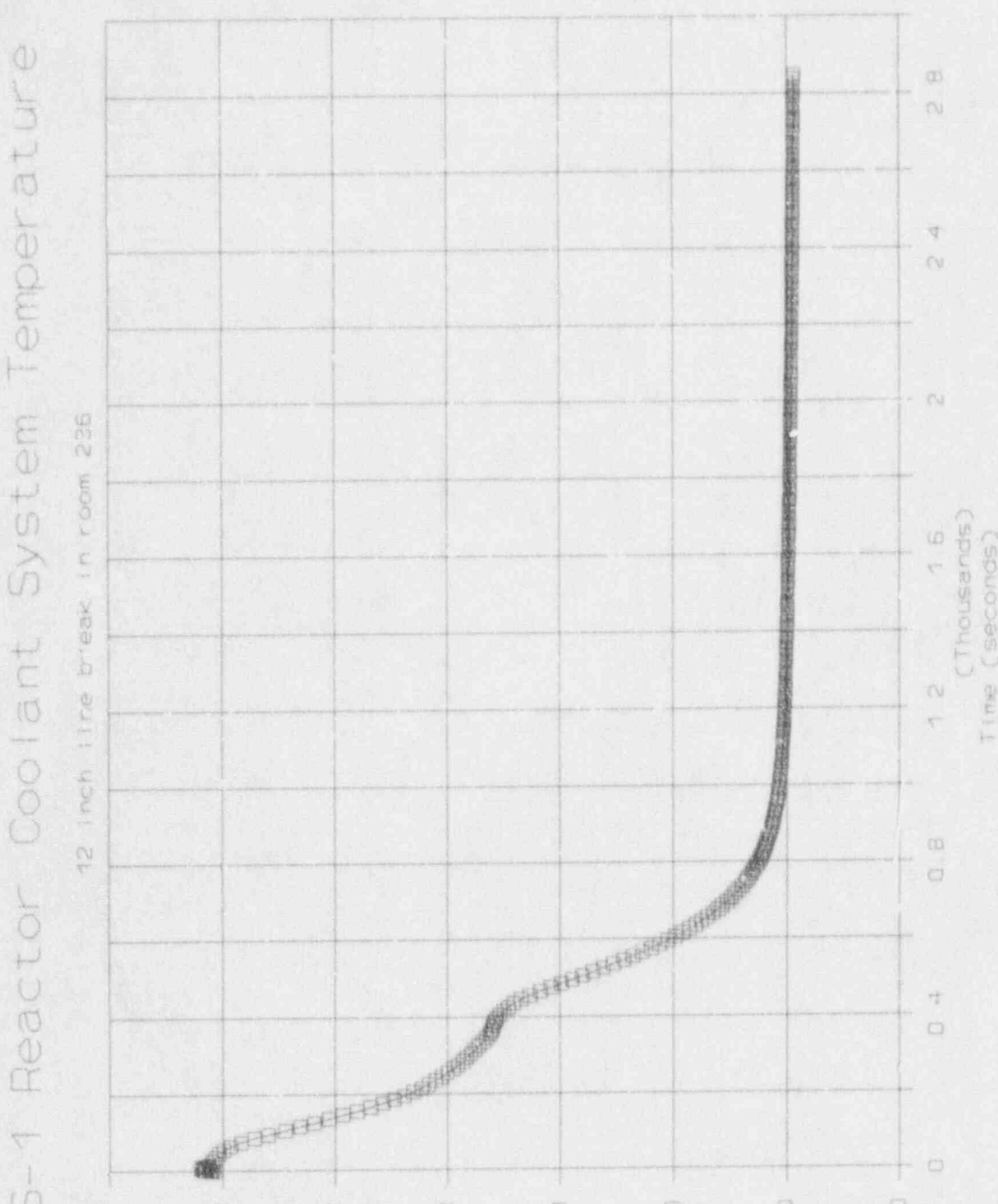

Figure M-14. Reactor coolant system temperature for break sequence 1.

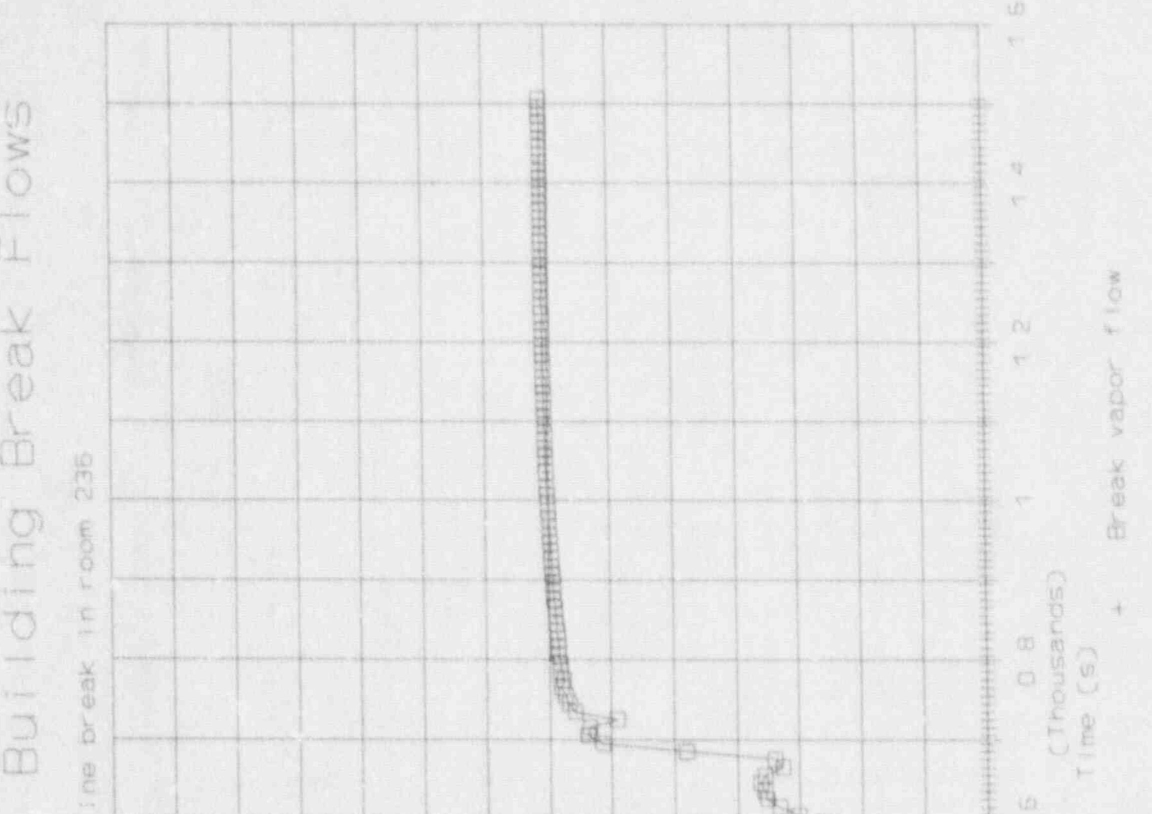

Figure M-15. Mass flow rates to auxiliary building room 236 resulting from break sequence 1.

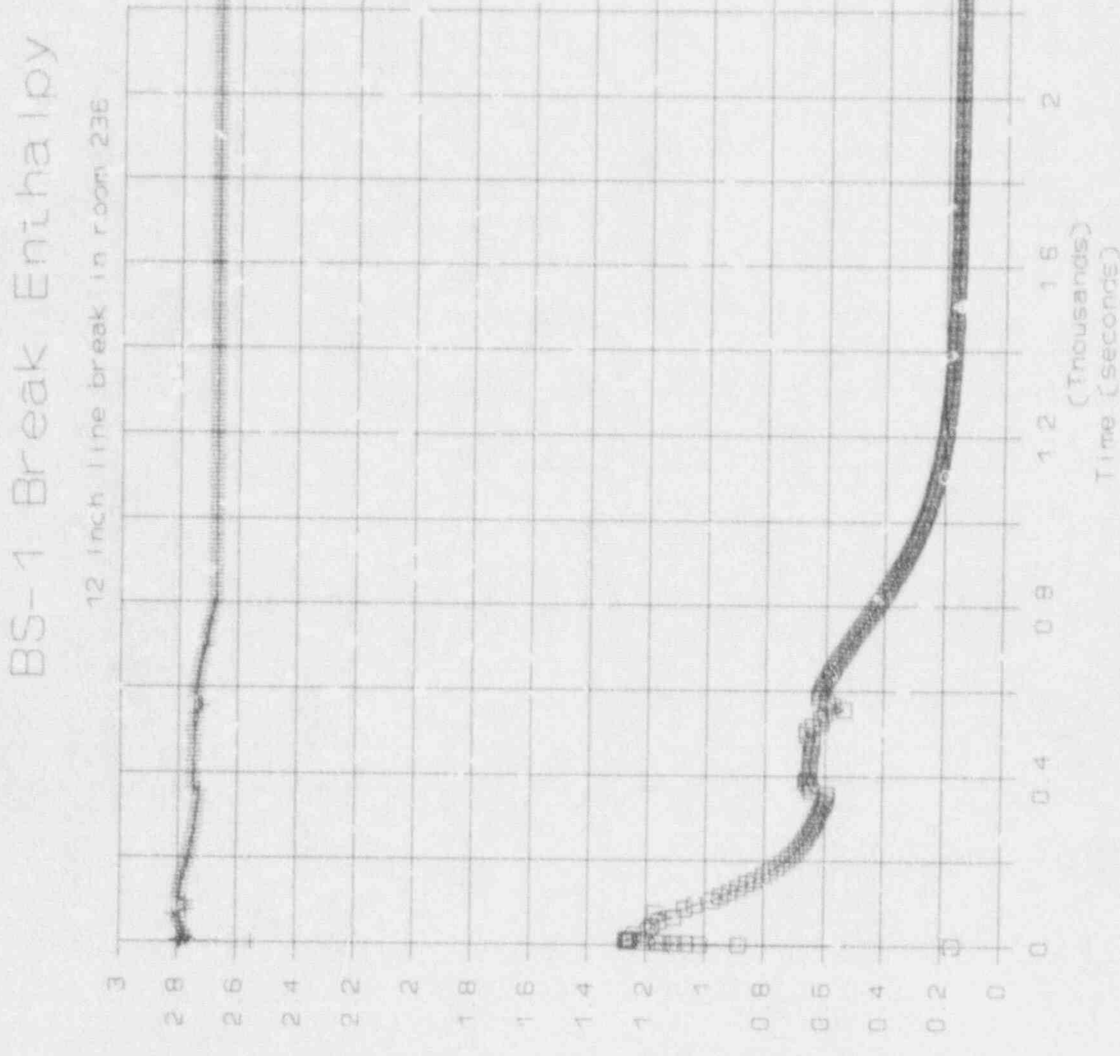

Figure M-16. Break enthalpy for steam released to auxiliary building room 236.

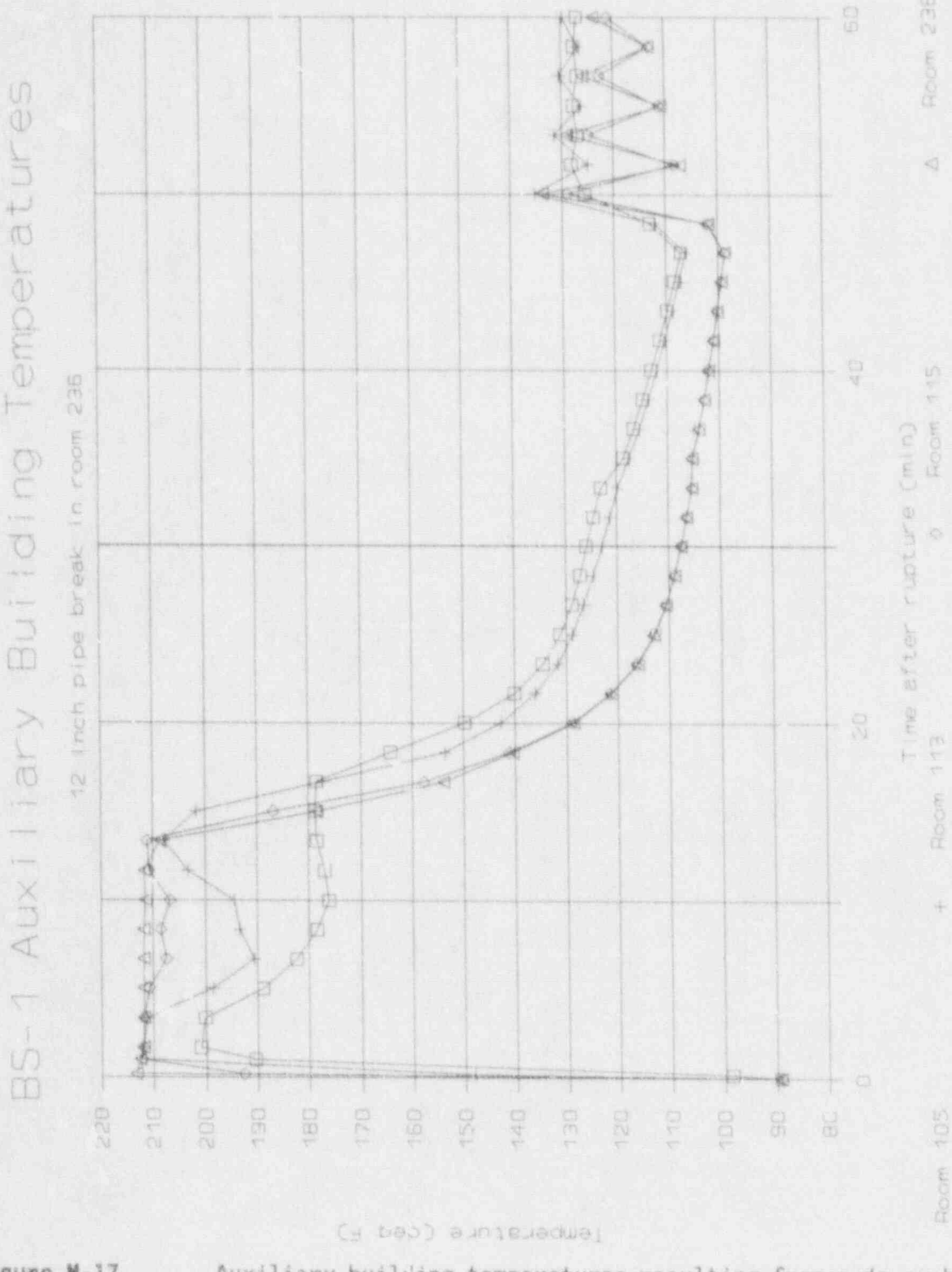

Figure M-17. Auxiliary building temperatures resulting from a decay heat removal system piping rupture in Room 236 (break sequence 1). The discharge limiting flow area is 0.6013 ft^2.

Figure M-18. Auxiliary building pool depths resulting from a decay heat removal system piping rupture in Room 236 (break sequence 1). The discharge limiting flow area is 0.6012 ft^2.

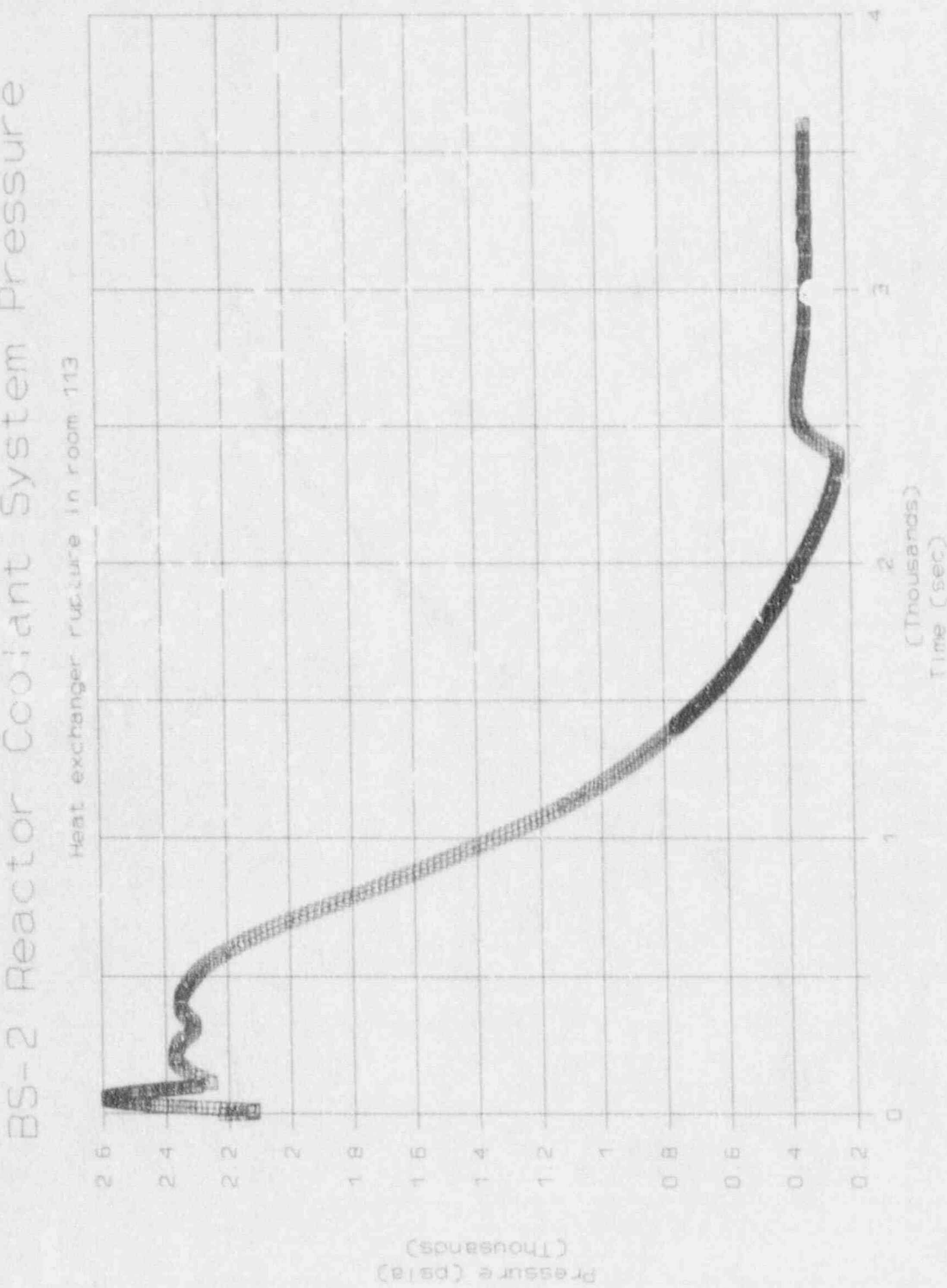

Figure M-19. Reactor coolant system pressure for break sequence 2.

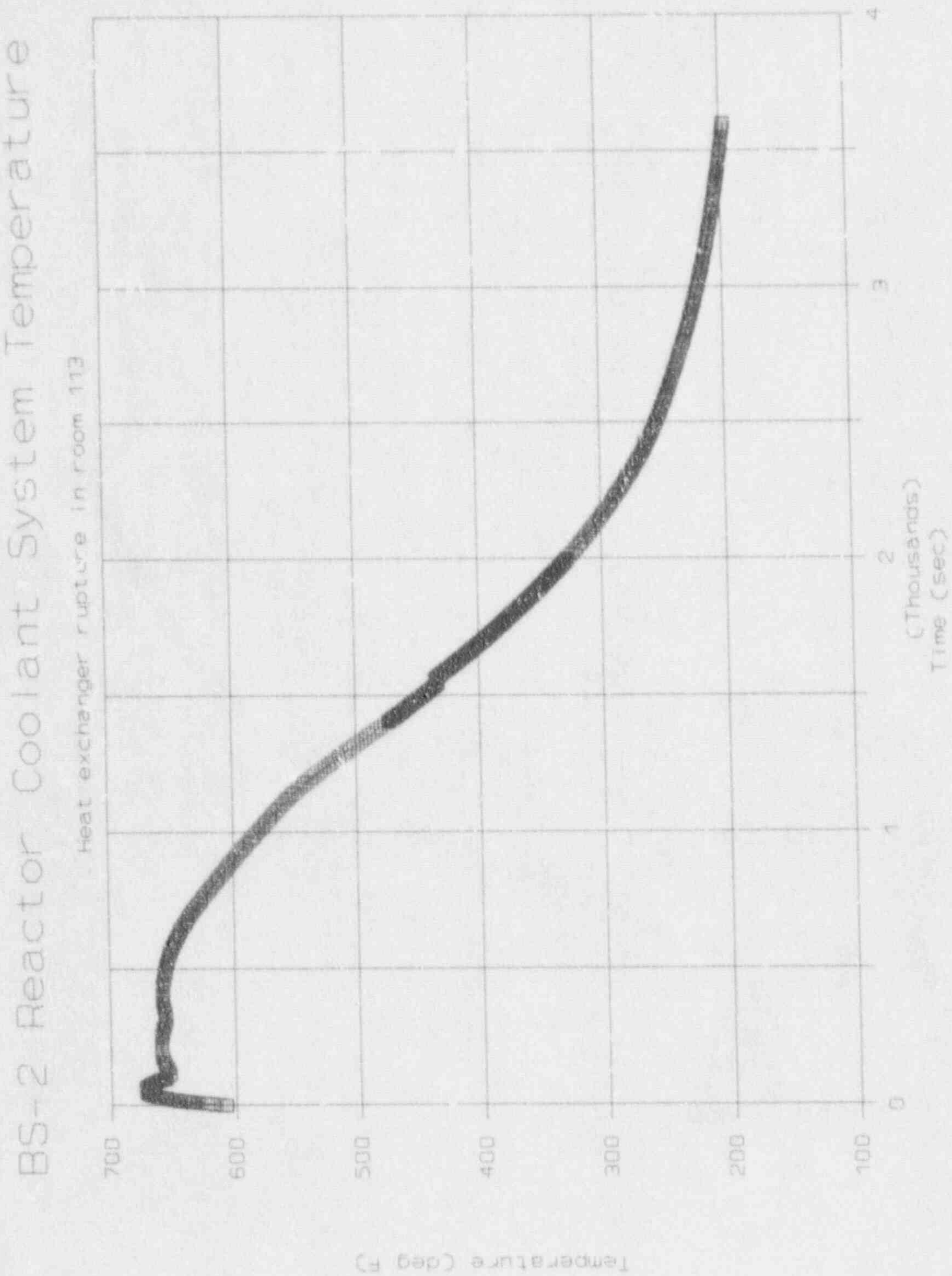

Figure M-20. Reactor coolant system temperature for break sequence 2.

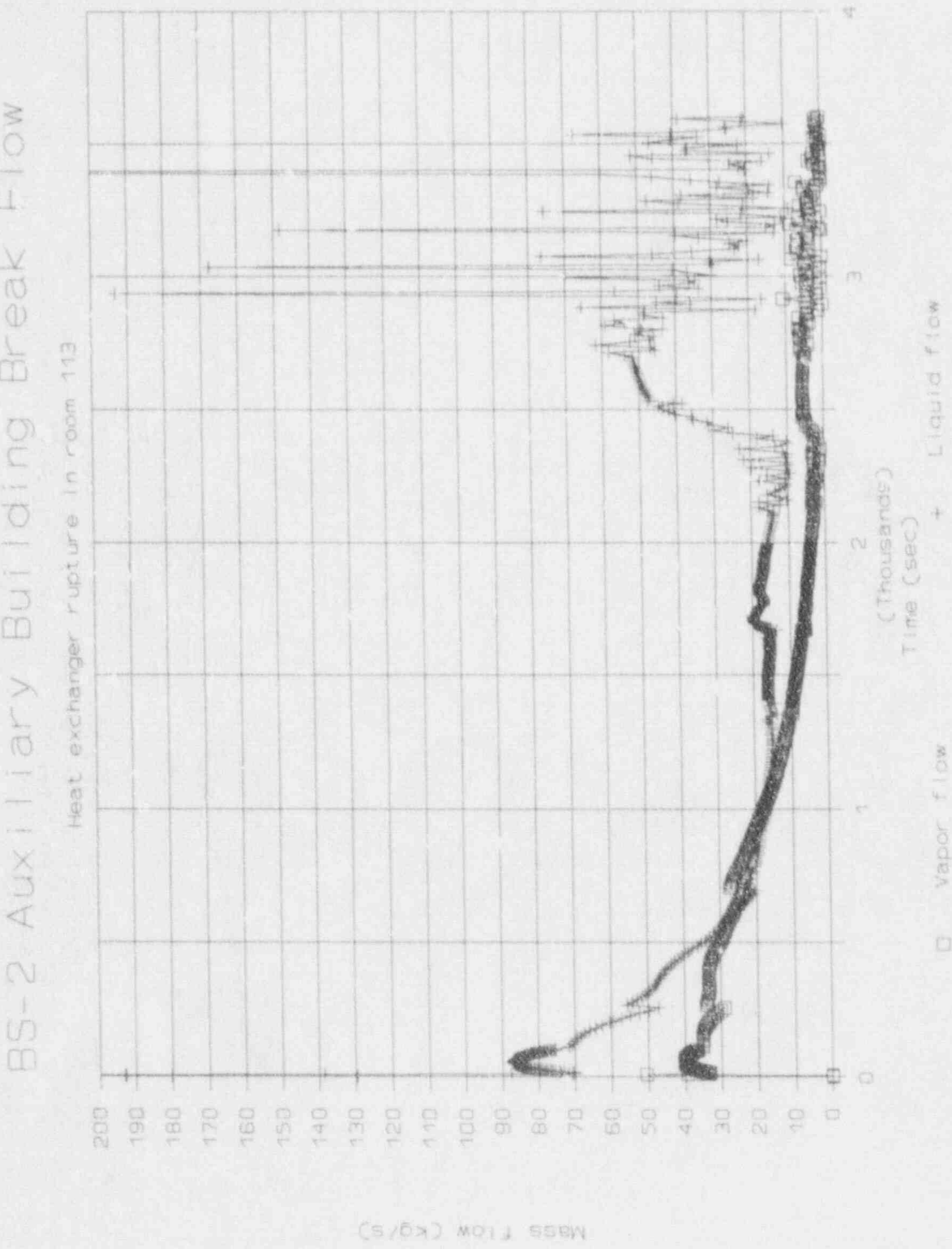

Figure M-21. Auxiliary building break flow for sequence 2.

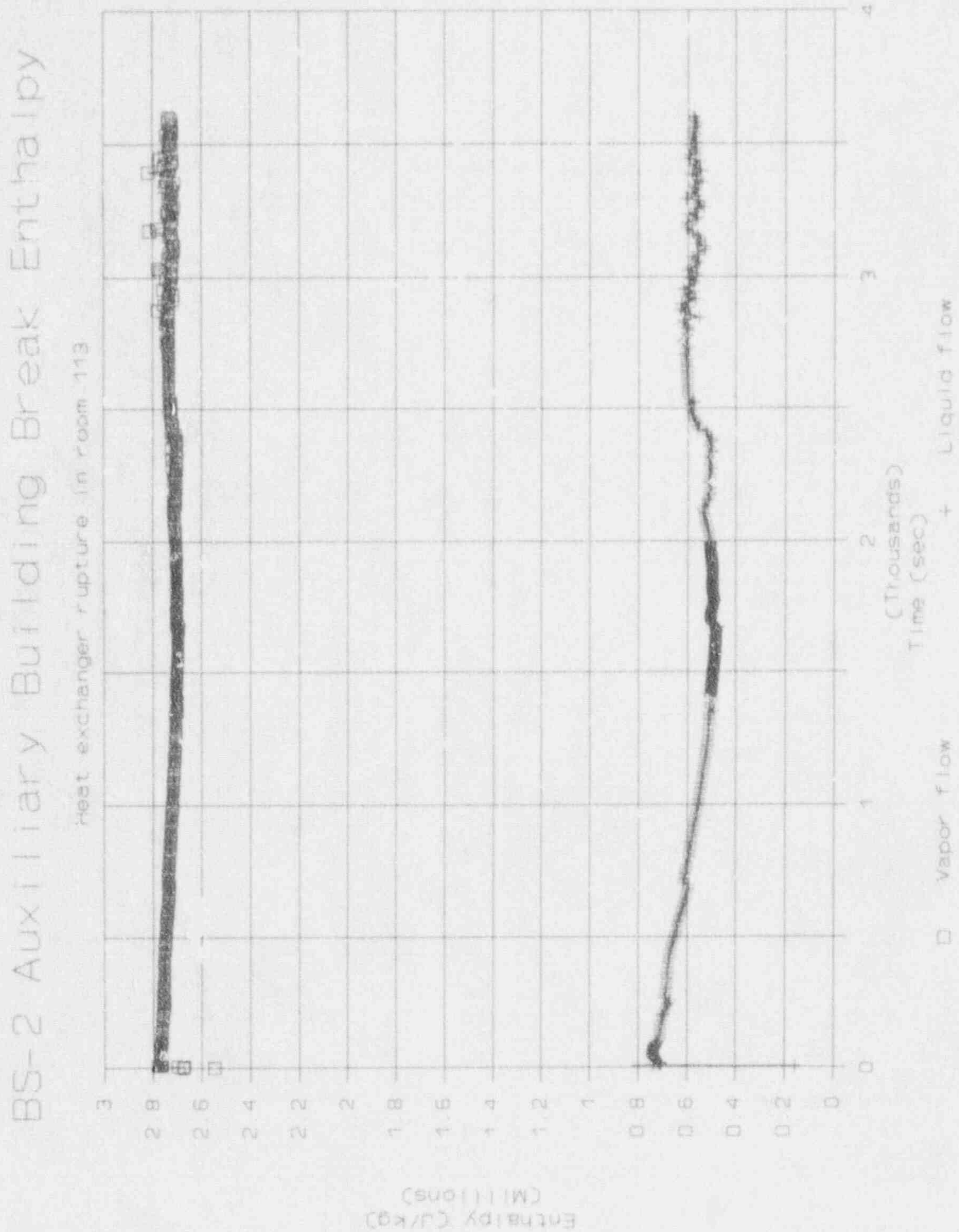

Figure M-22. Auxiliary building break enthalpy for break sequence 2.

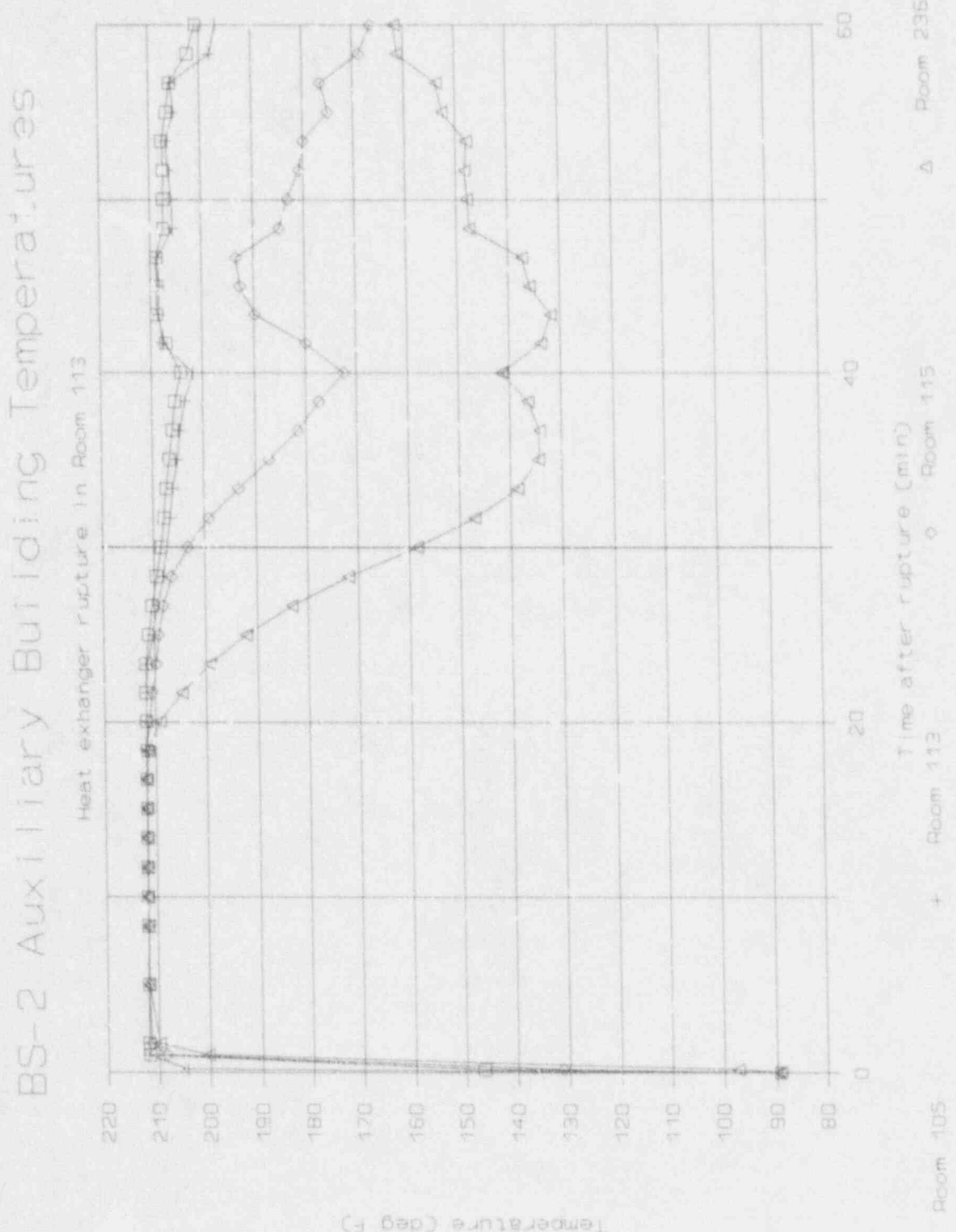

Figure M-23. Auxiliary building temperatures resulting from a decay heat removal system heat exchanger rupture in Room 113 (break sequence 2). The discharge limiting flow area totals 0.0443 ft^2.

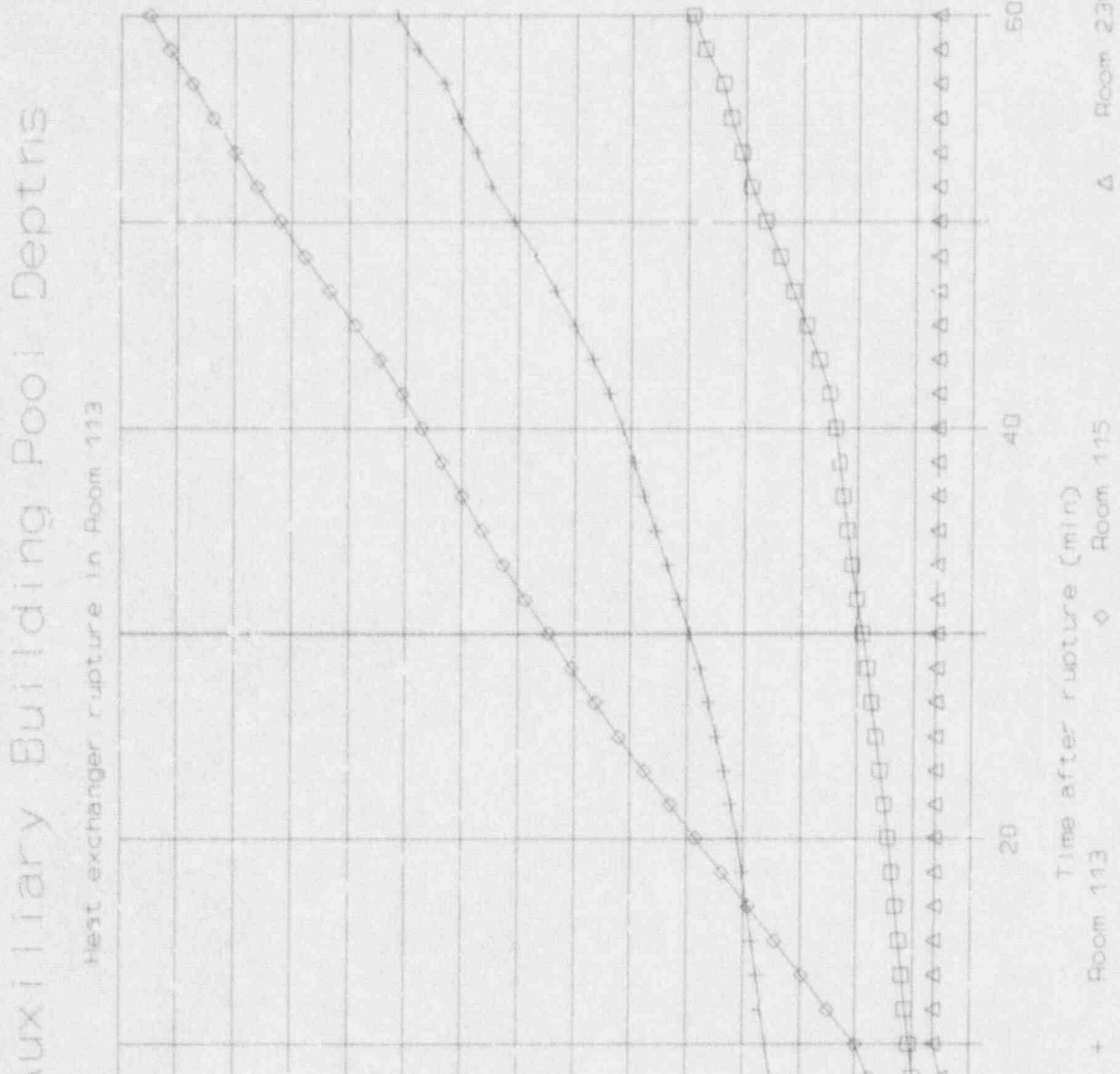

Figure M-24. Auxiliary building pool depths resulting from a rupture in the decay heat removal system heat exchangers in Room 113 (break sequence 2). The discharge limiting flow area is 0.0443 ft^2.

Figure M-25. Reactor coolant system pressure for break sequence 3.

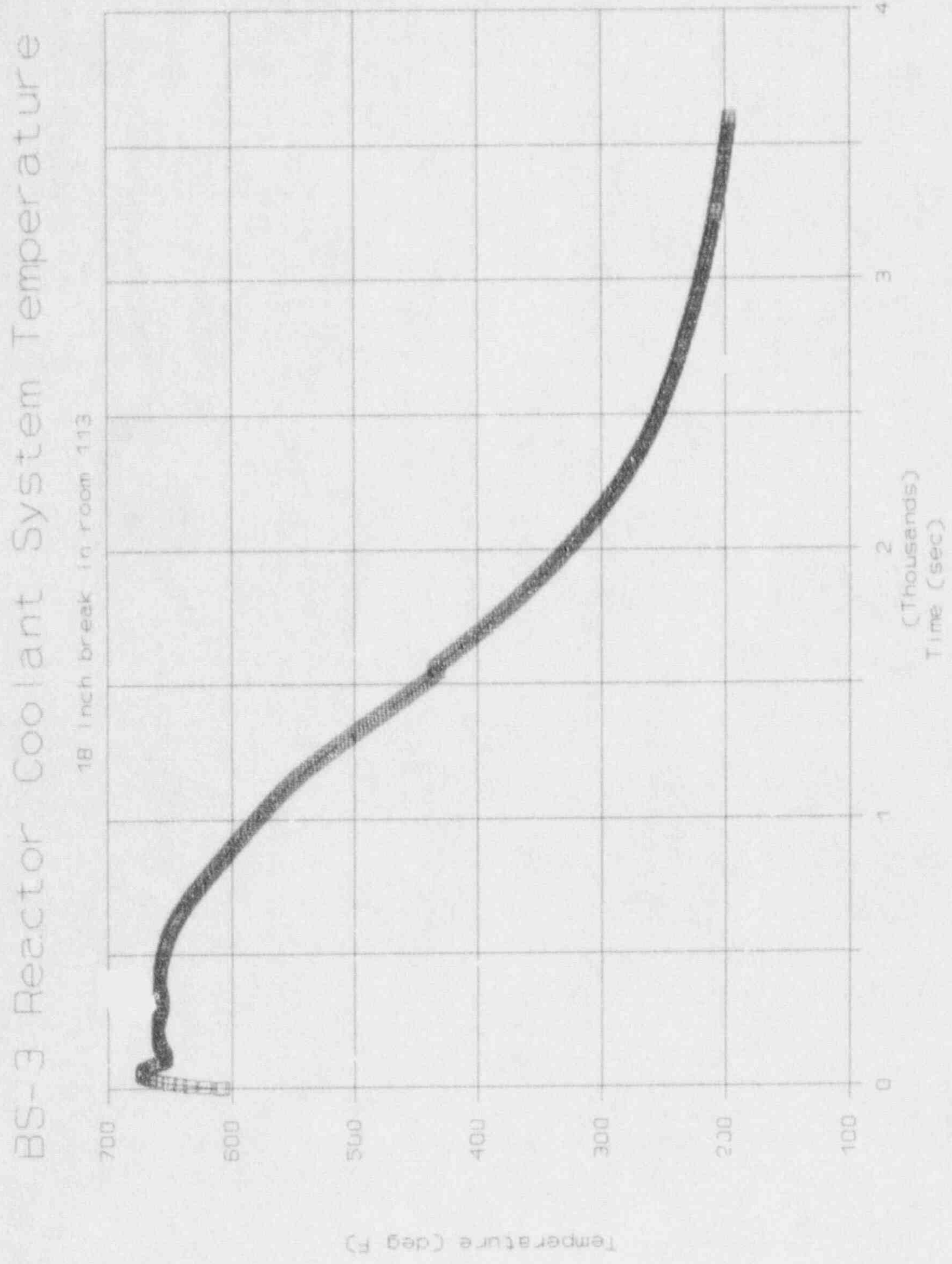

Figure M-26. Reactor coolant system temperature during break sequence 3.

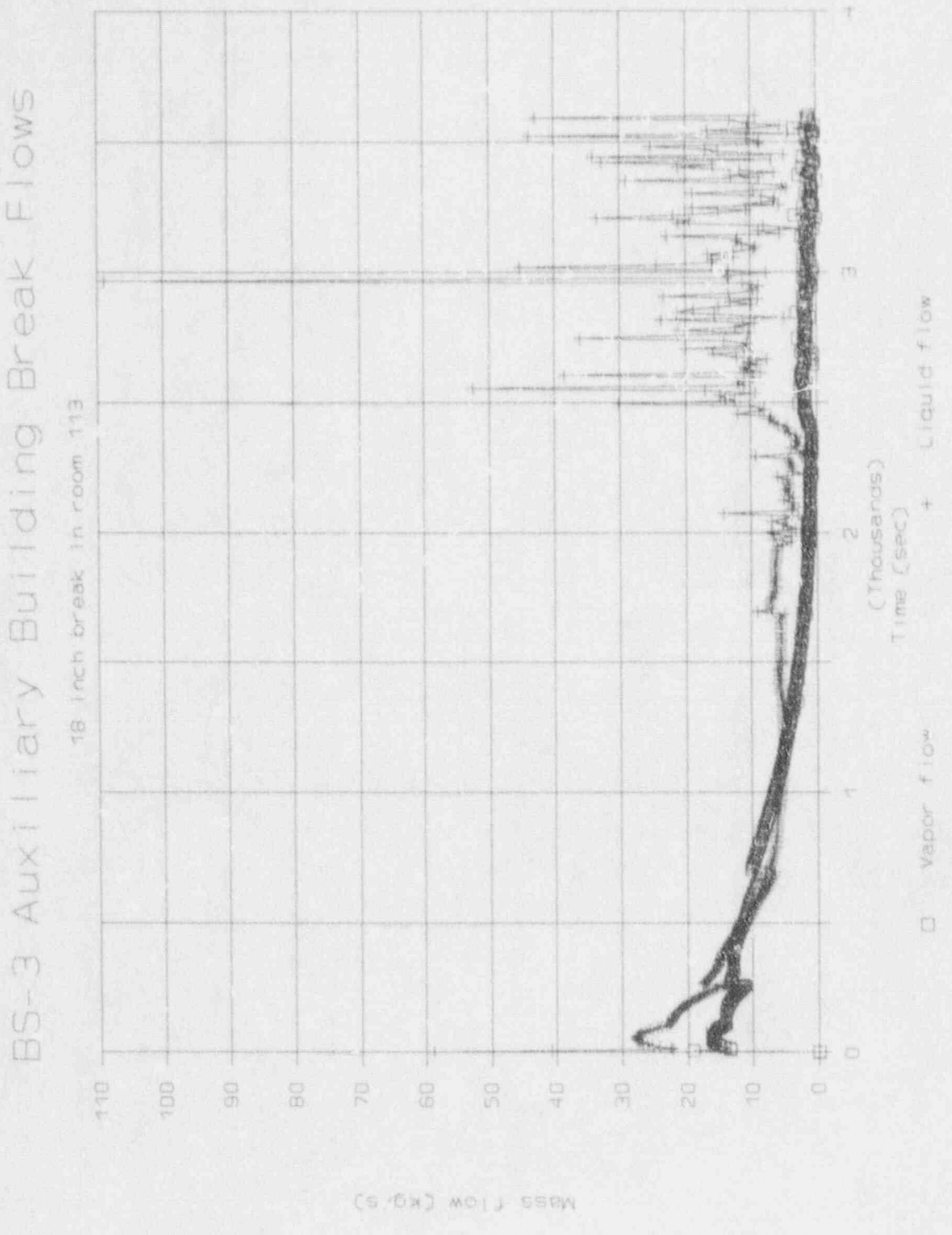

Figure M-27. Auxiliary building break flow during break sequence 3.

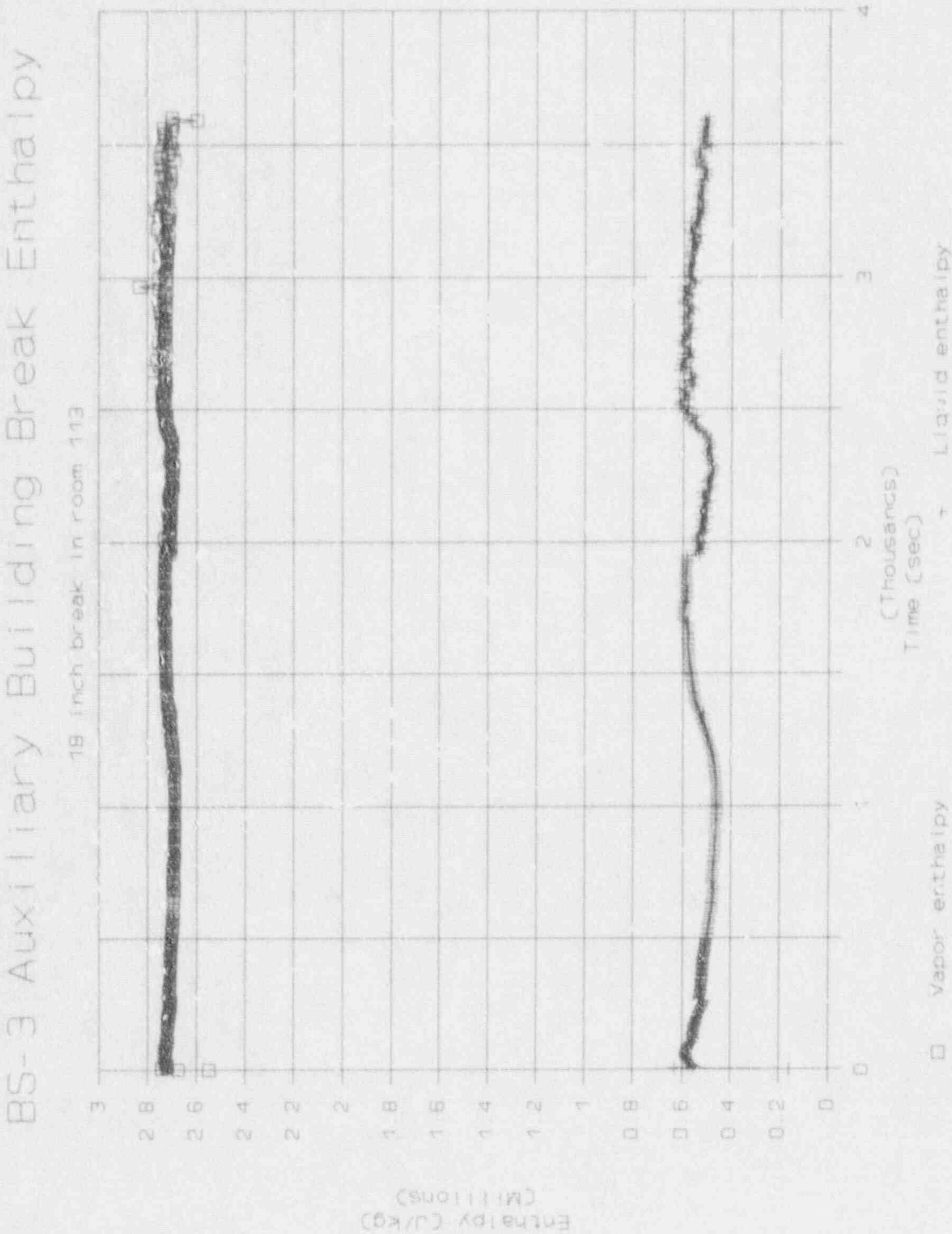

Figure M-28. Auxiliary building break enthalpy during break sequence 3.

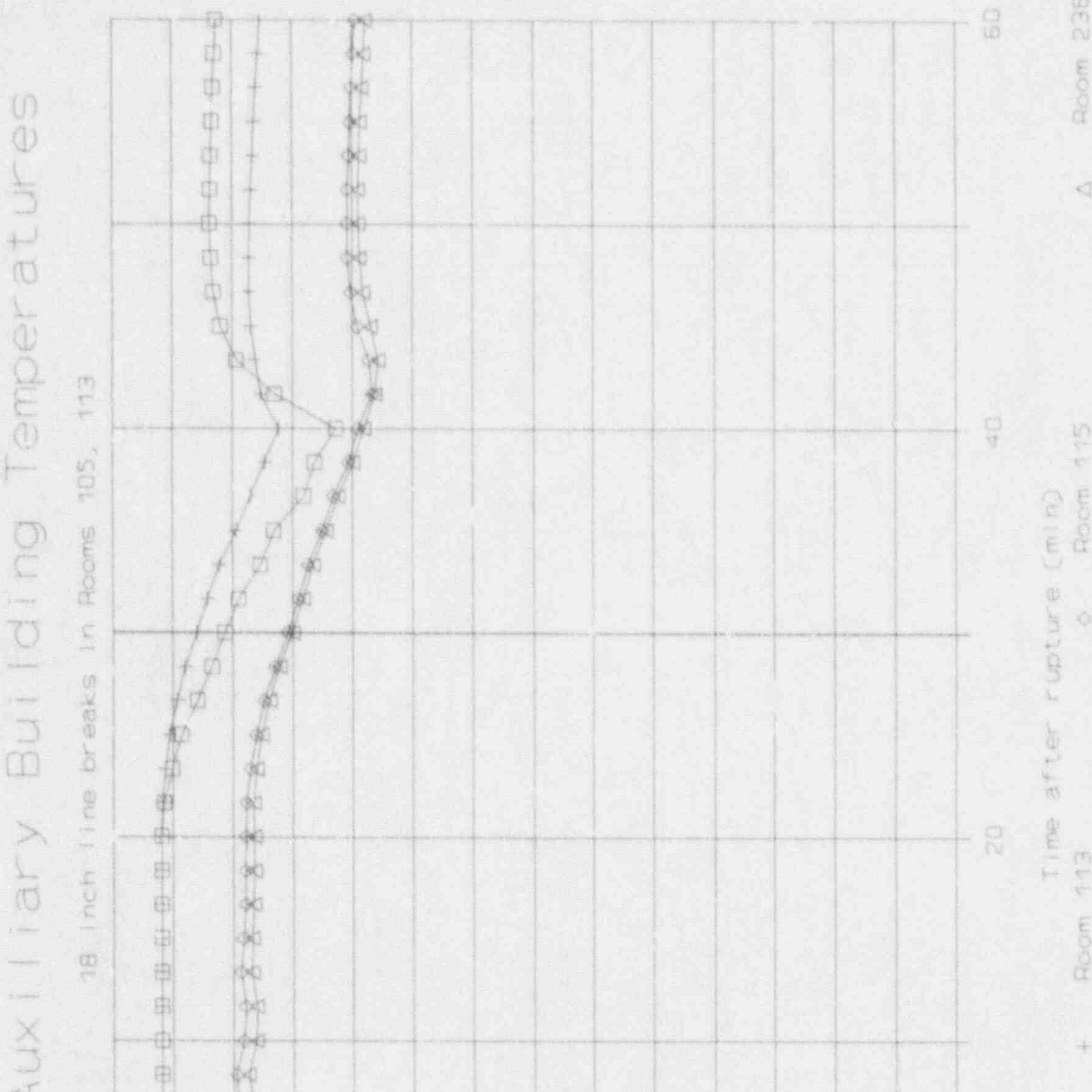

Figure M-29. Auxiliary building temperatures resulting from an LPI pump suction piping rupture in Rooms 105 and 113 (break sequence 3). The discharge limiting flow area totals 0.0443 ft^2.

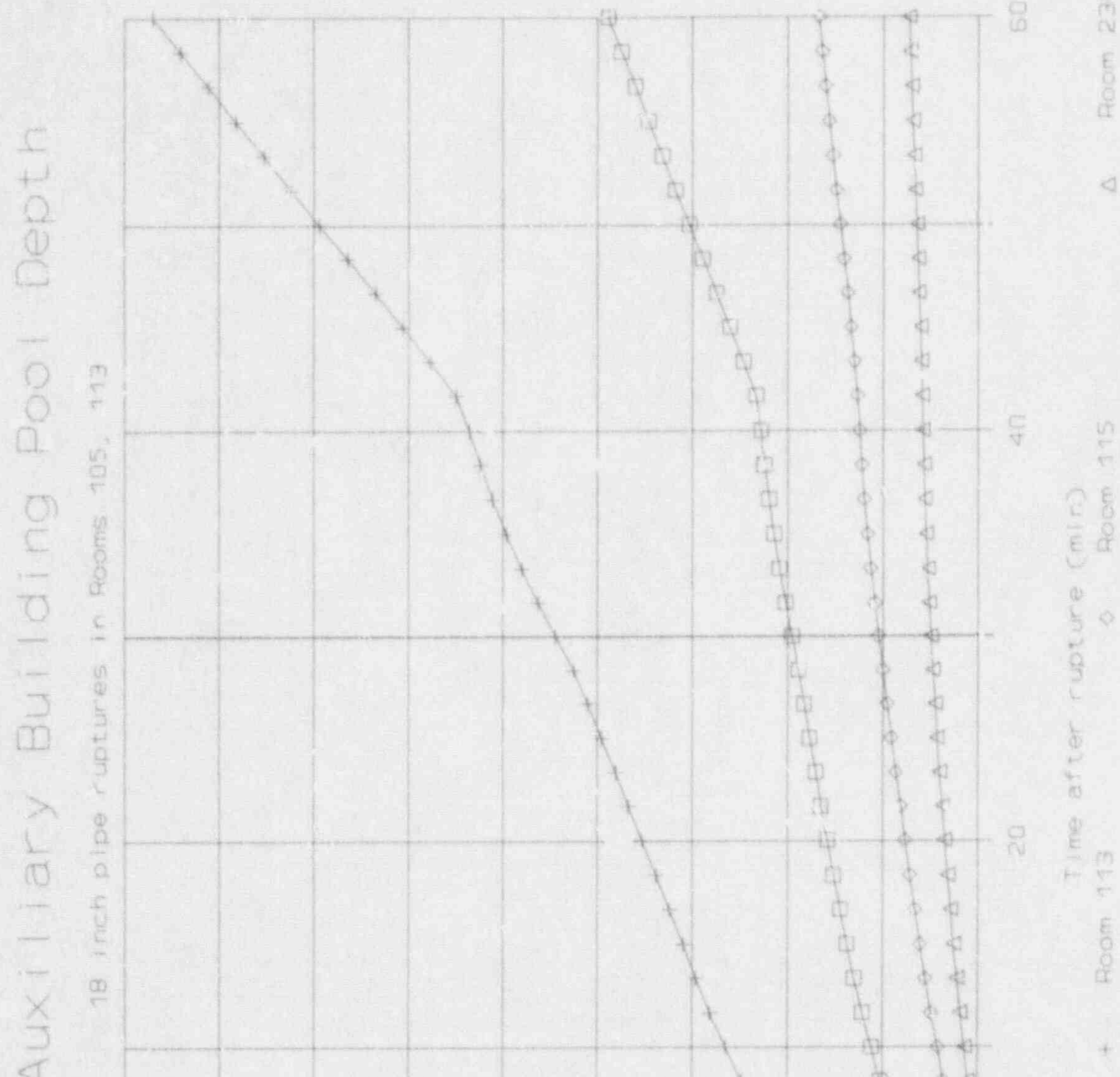

Figure M-30. Auxiliary building pool depths resulting from an LPI pump suction piping rupture in Rooms 105 and 113 (break sequence 3). The discharge limiting flow area totals 0.0443 ft^2.

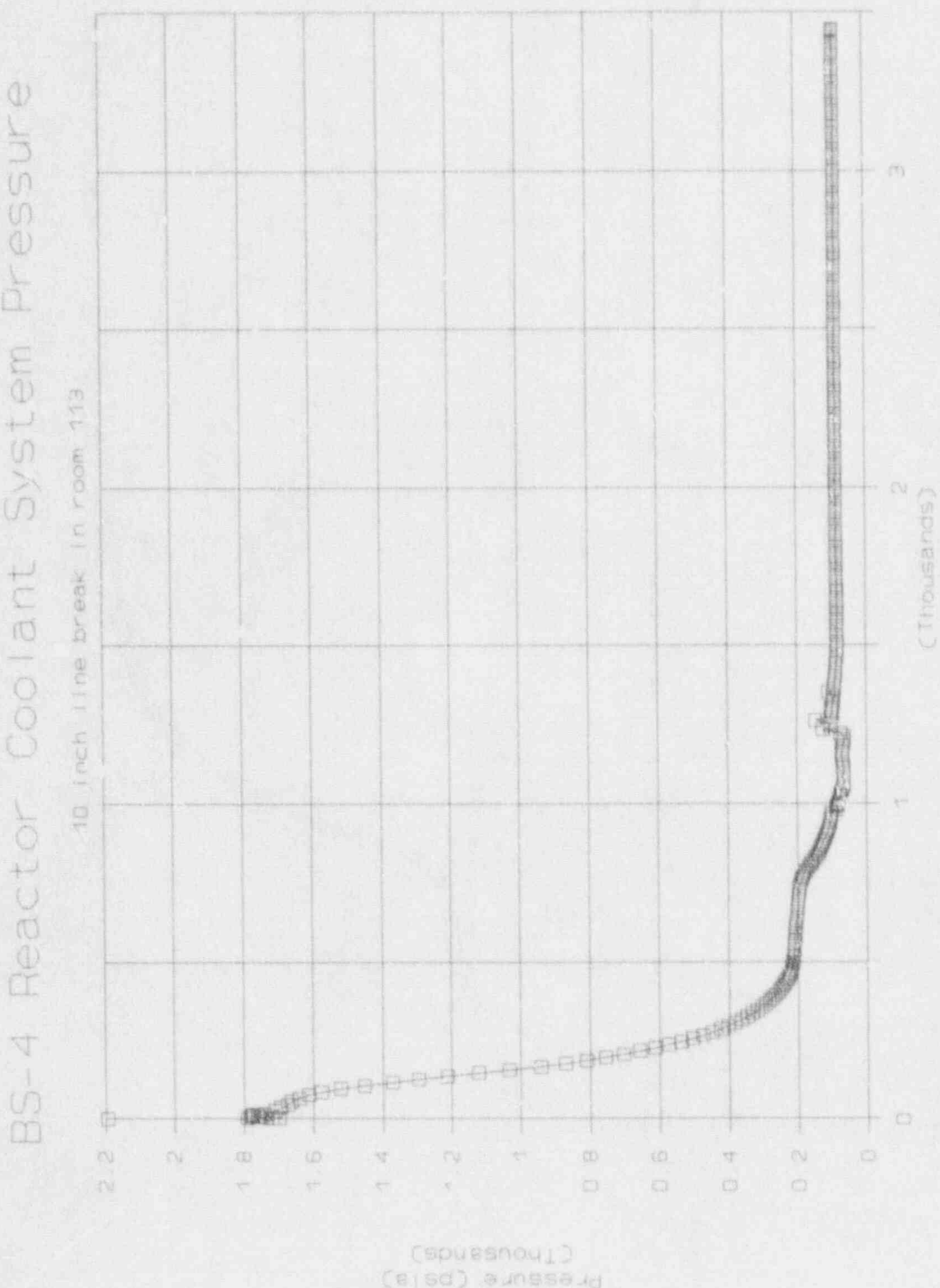

Figure M-31. Reactor coolant system pressure during break sequence 4.

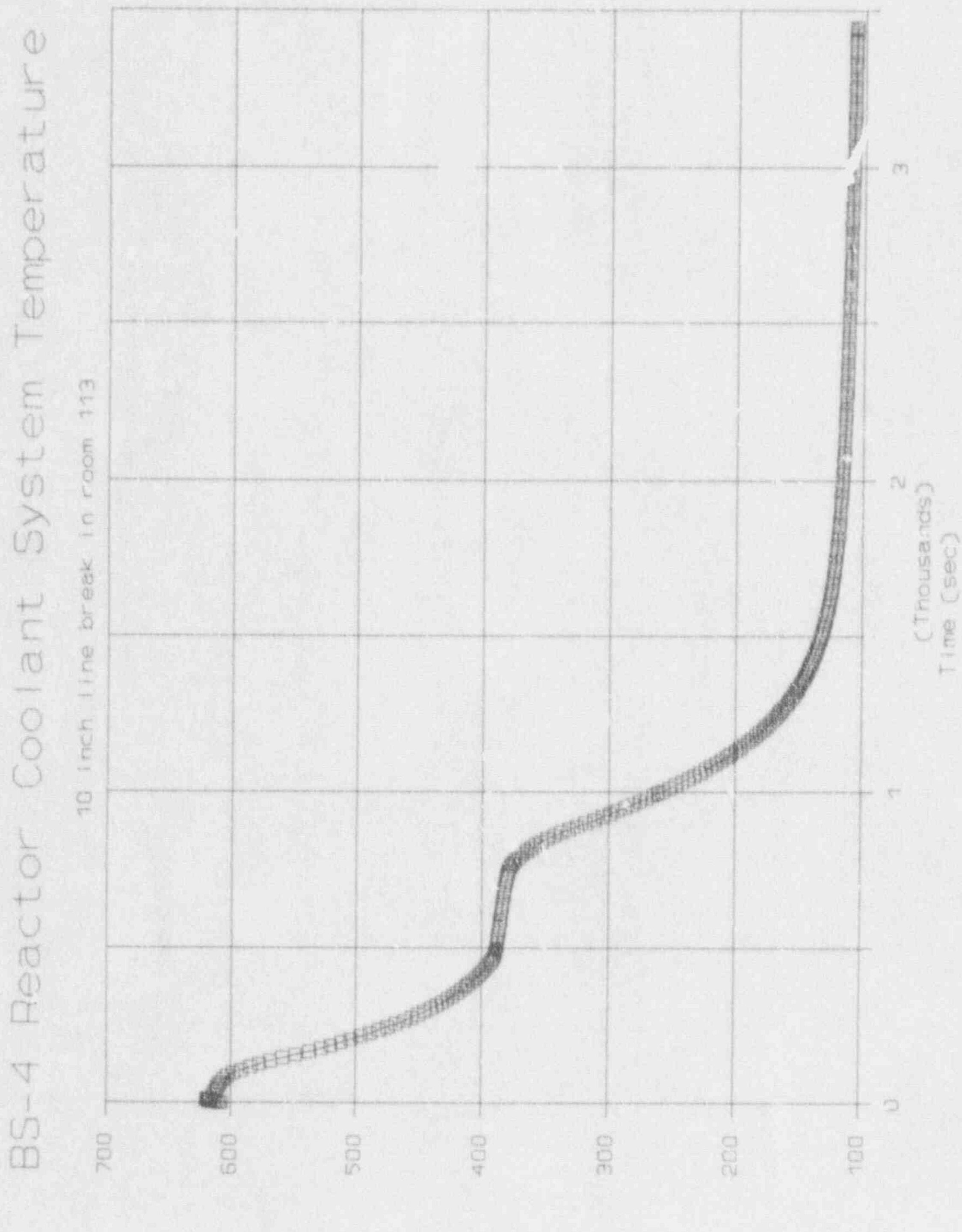

Figure M-32. Reactor coolant system temperature during break sequence 4.

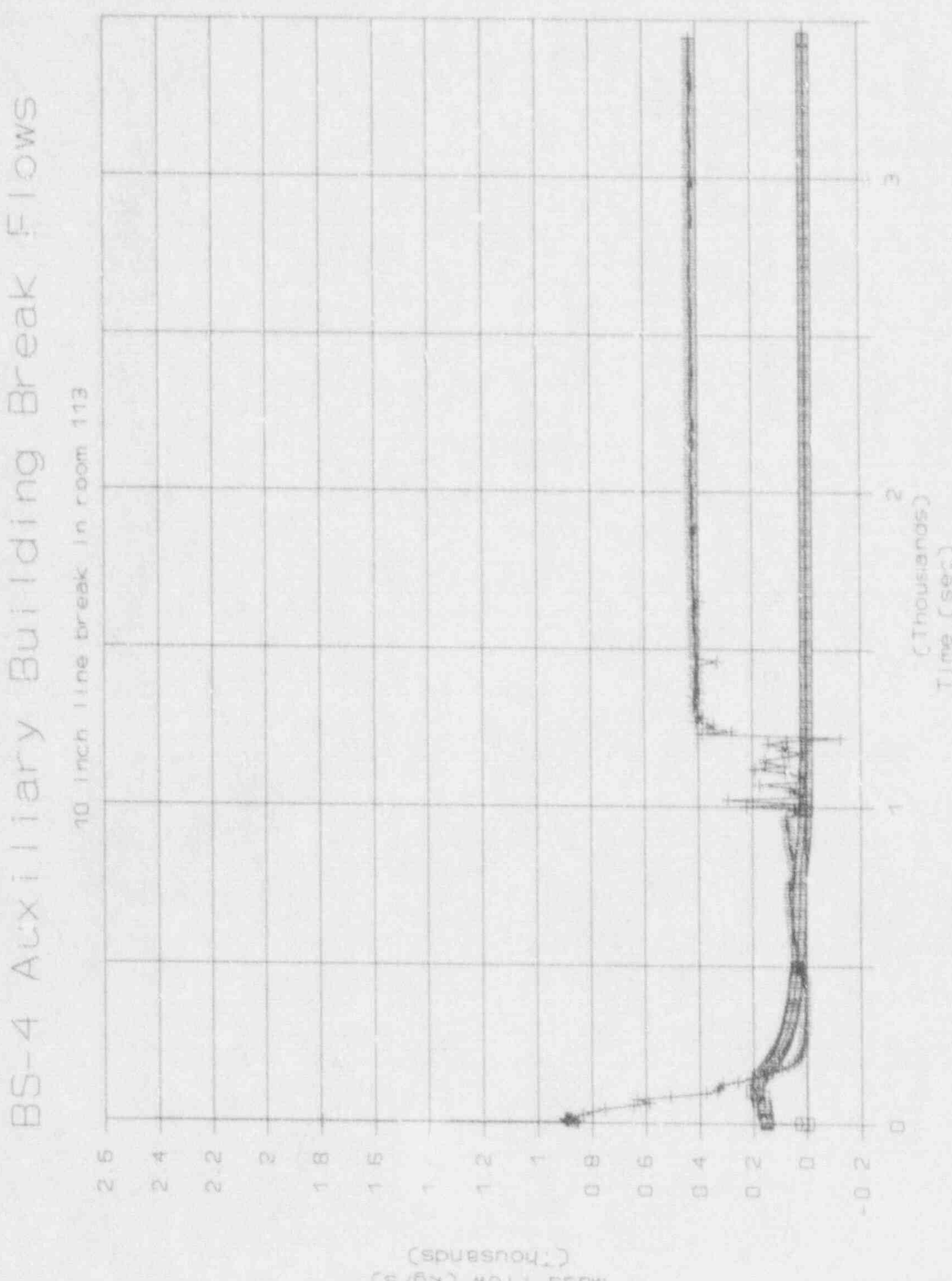

Figure M-33. Mass flow rates to auxiliary building room 113 resulting from break sequence 4.

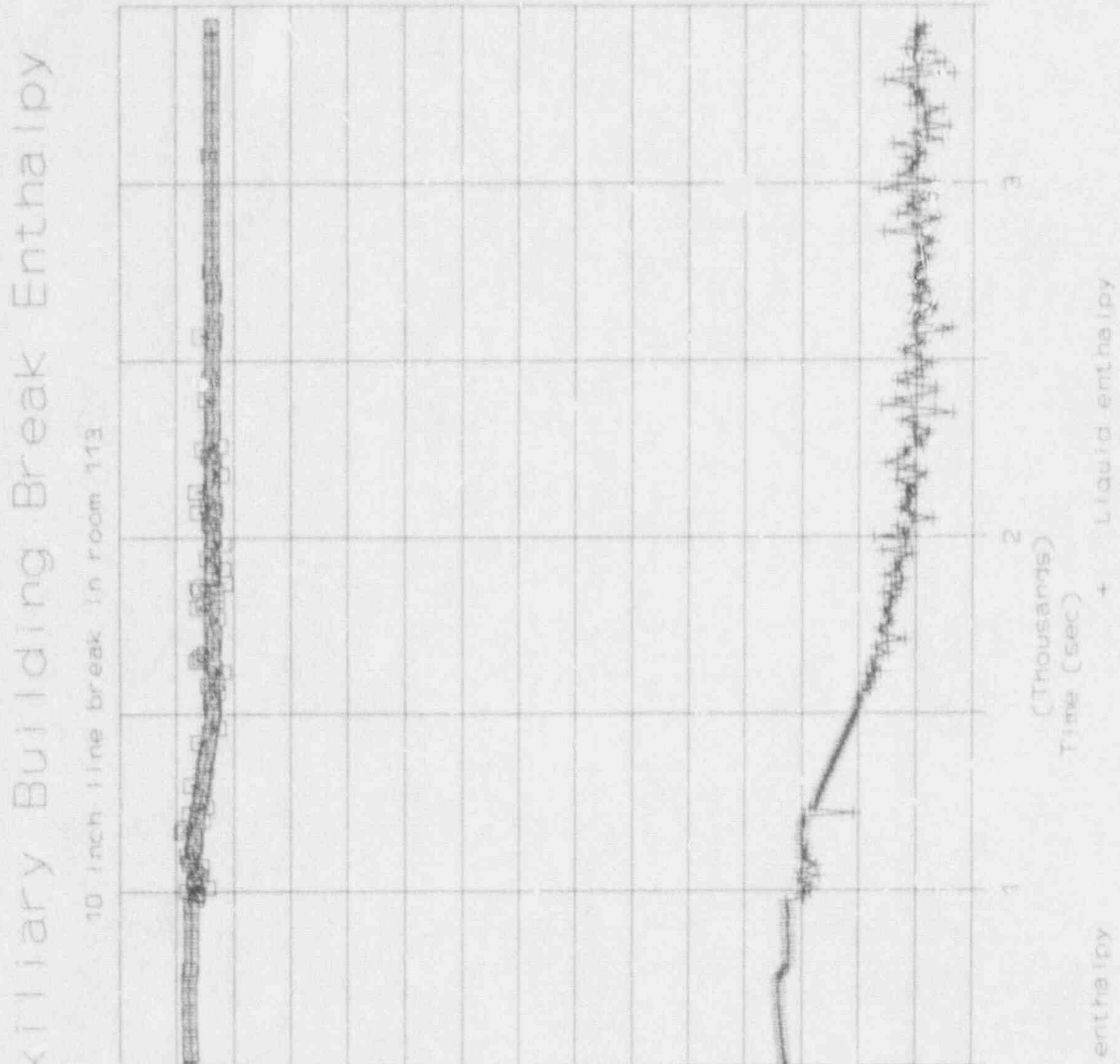

Figure M-34. Enthalpy of break flow to auxiliary building room 113 resulting from break sequence 4.

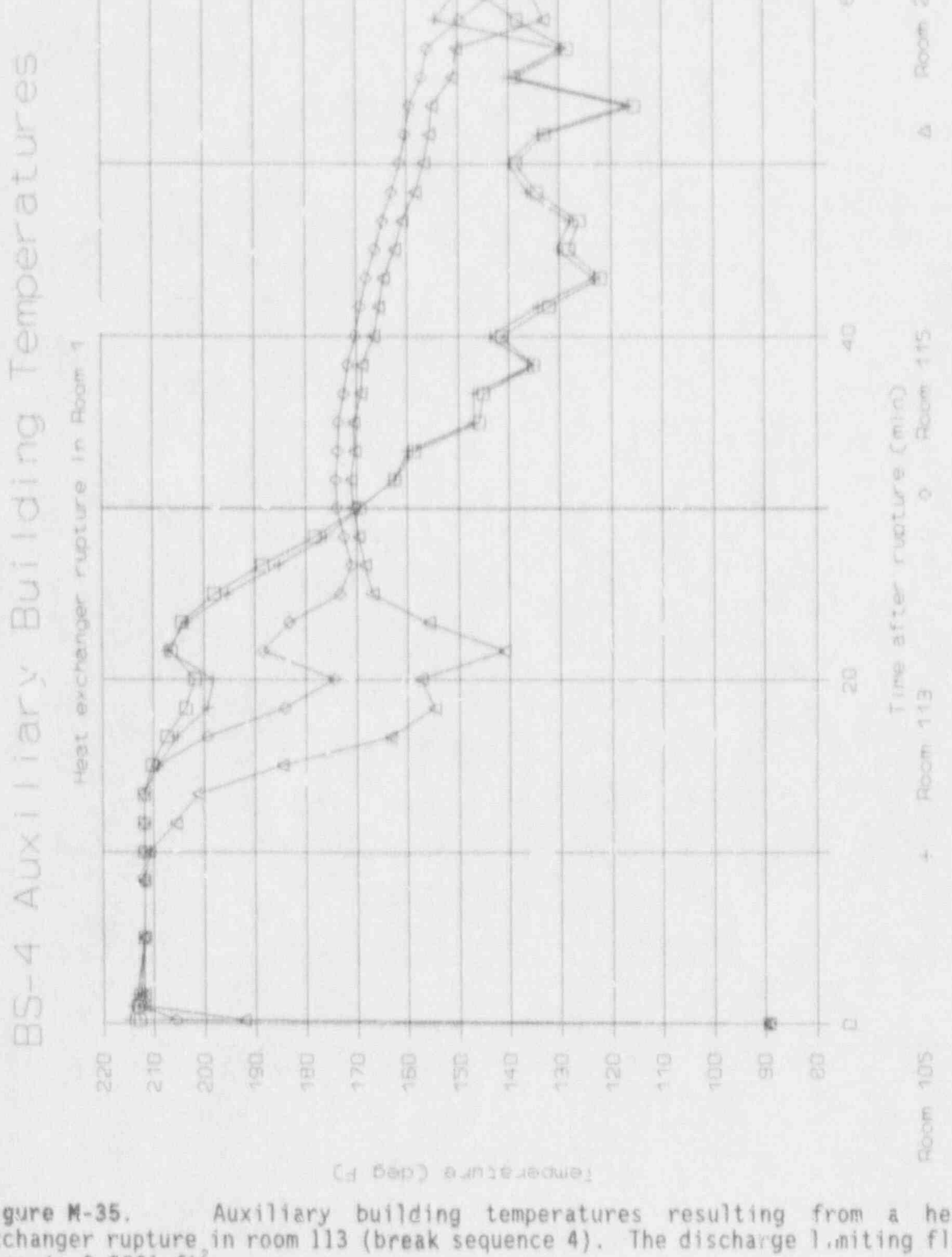

Figure M-35. Auxiliary building temperatures resulting from a heat exchanger rupture in room 113 (break sequence 4). The discharge limiting flow area is 0.3821 ft^2.

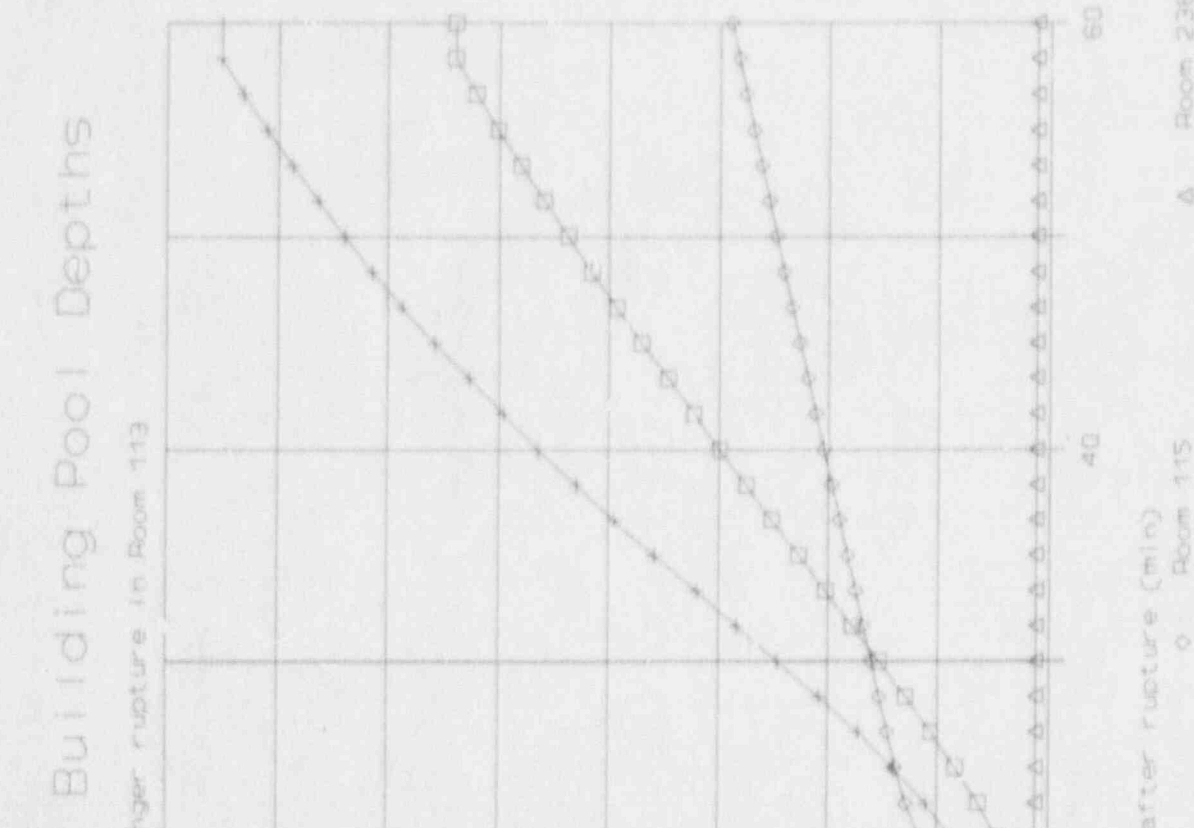

Figure M-36. Auxiliary building pool depths resulting from a heat exchanger rupture in room 113 (break sequence 4). The discharge limiting flow area is 0.3821 ft^2.

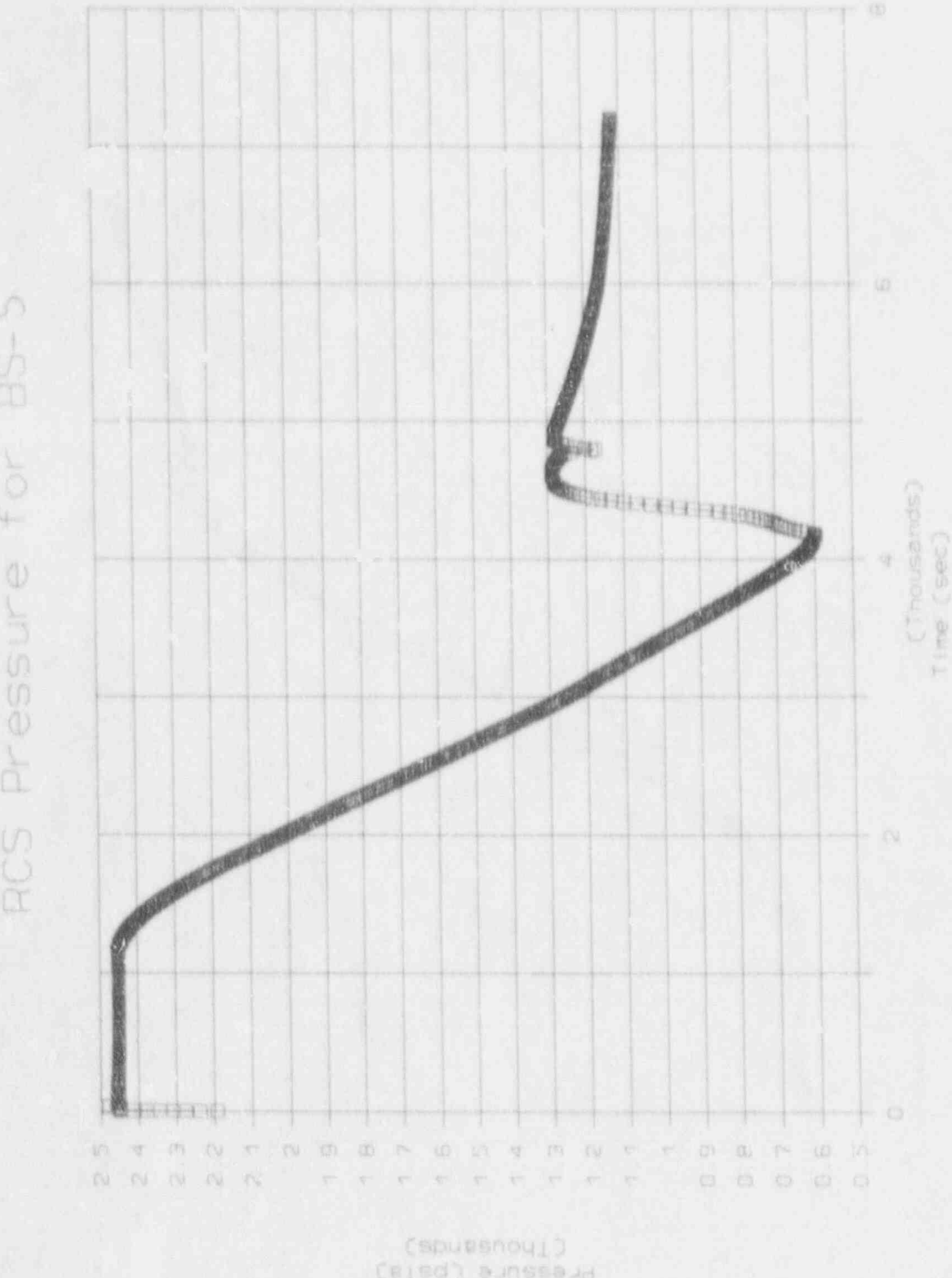

Figure M-37. Reactor coolant system pressure plotted against transient time for break sequence 5

Figure M-38. Reactor coolant system temperature plotted against transient time for break sequence 5.

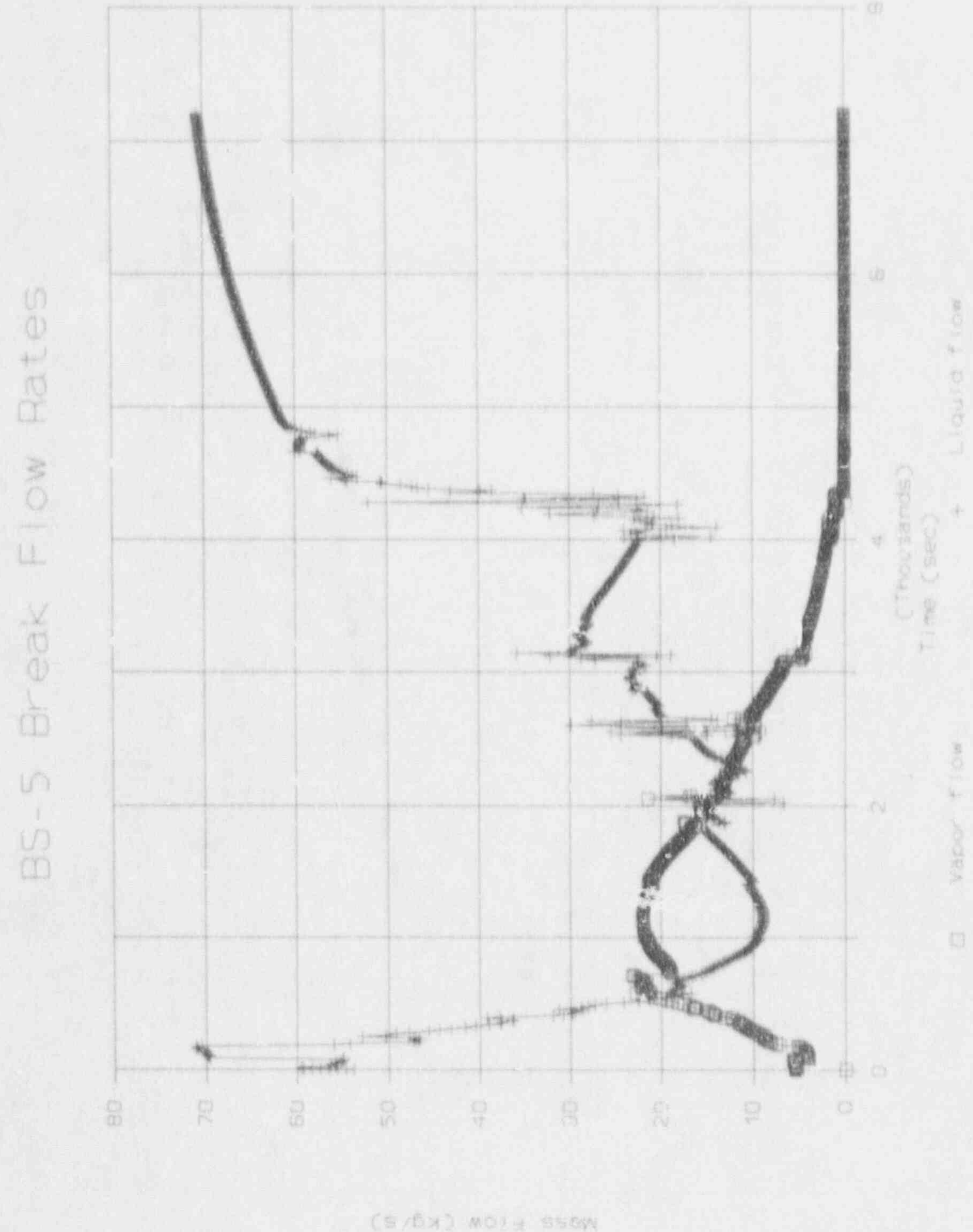

Figure M-39. Auxiliary building break flows plotted as a function of time for break sequence 5.

Figure M-40. Auxiliary building break enthalpies for break sequence 5.

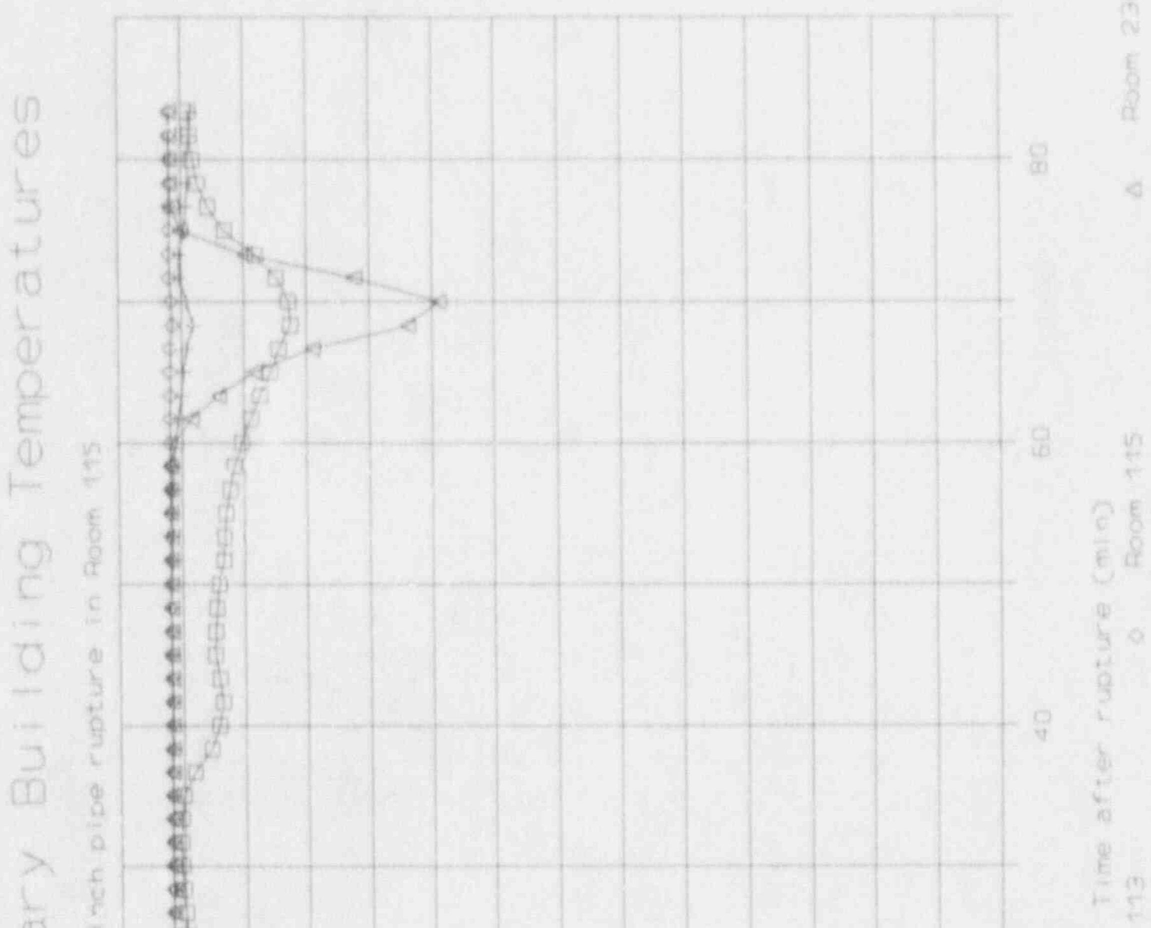

Figure M-41. Auxiliary building temperatures resulting from an HPI pump suction line rupture (break sequence 5). The discharge limiting flow area is 0.02463 ft^2.

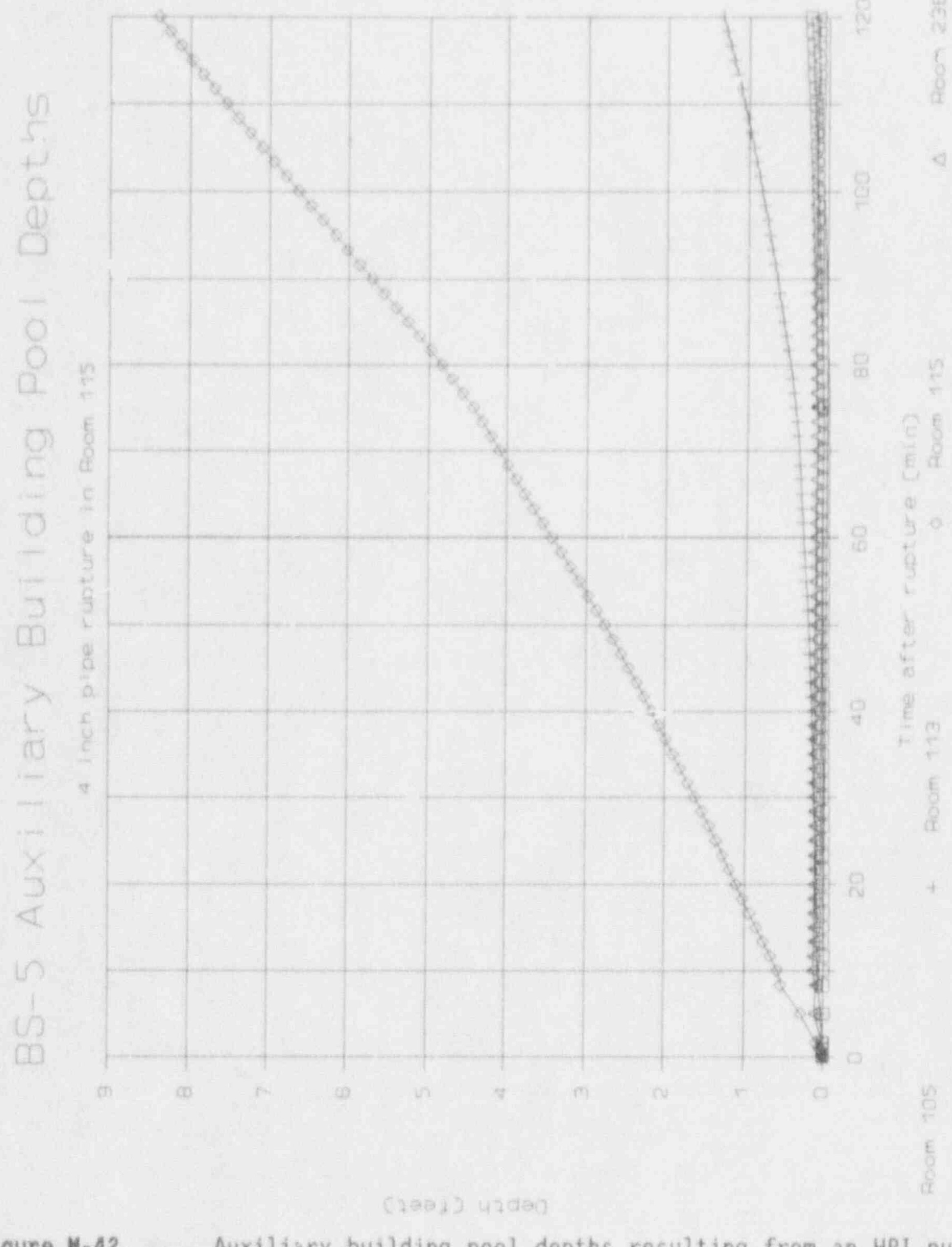

Figure M-42. Auxiliary building pool depths resulting from an HPI pump suction line rupture (break sequence 5). The discharge limiting flow area is 0.02463 ft^2.

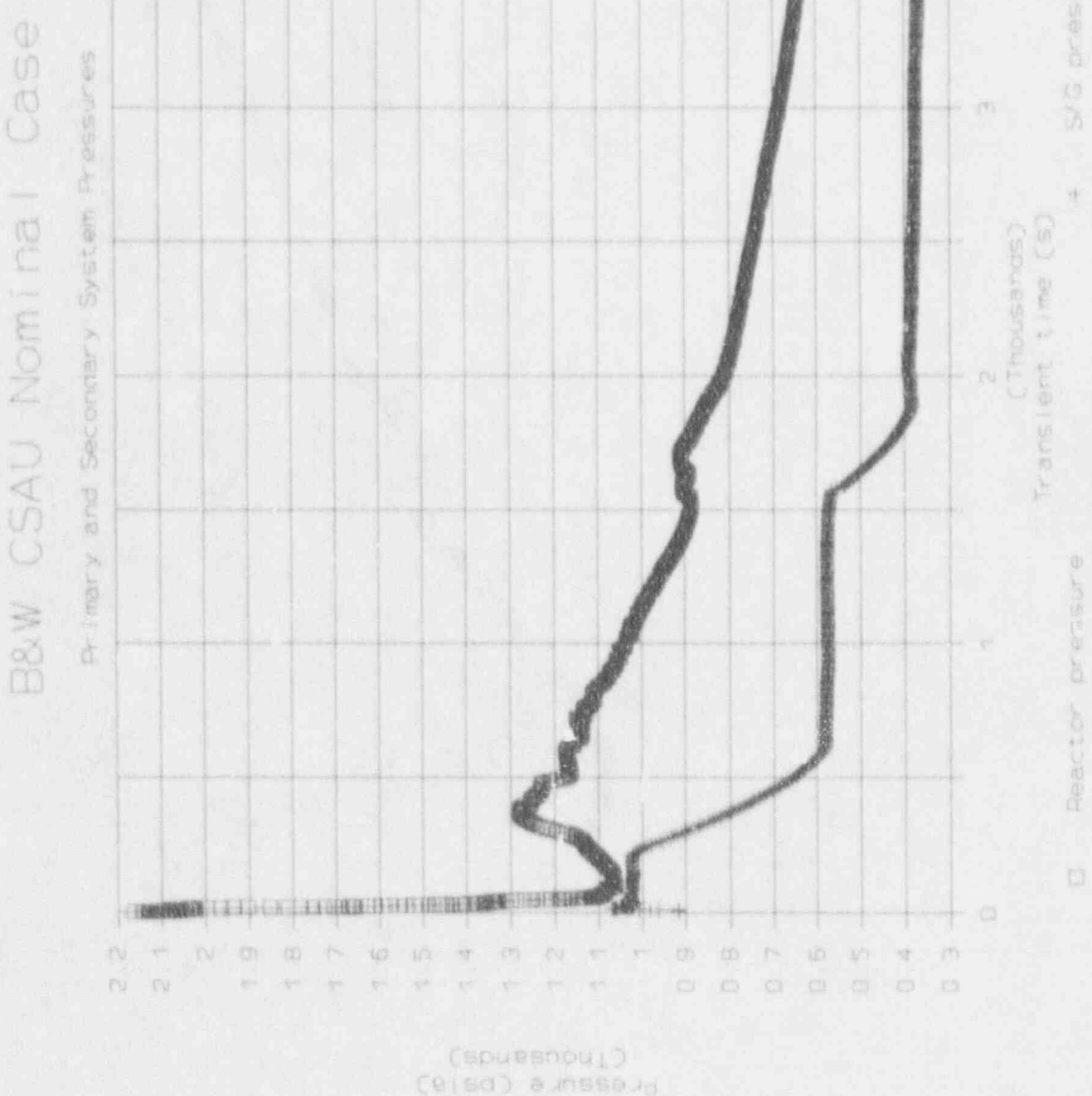

Figure M-43. B&W CSAU SBLOCA nominal case primary and secondary pressures plotted against transient time.

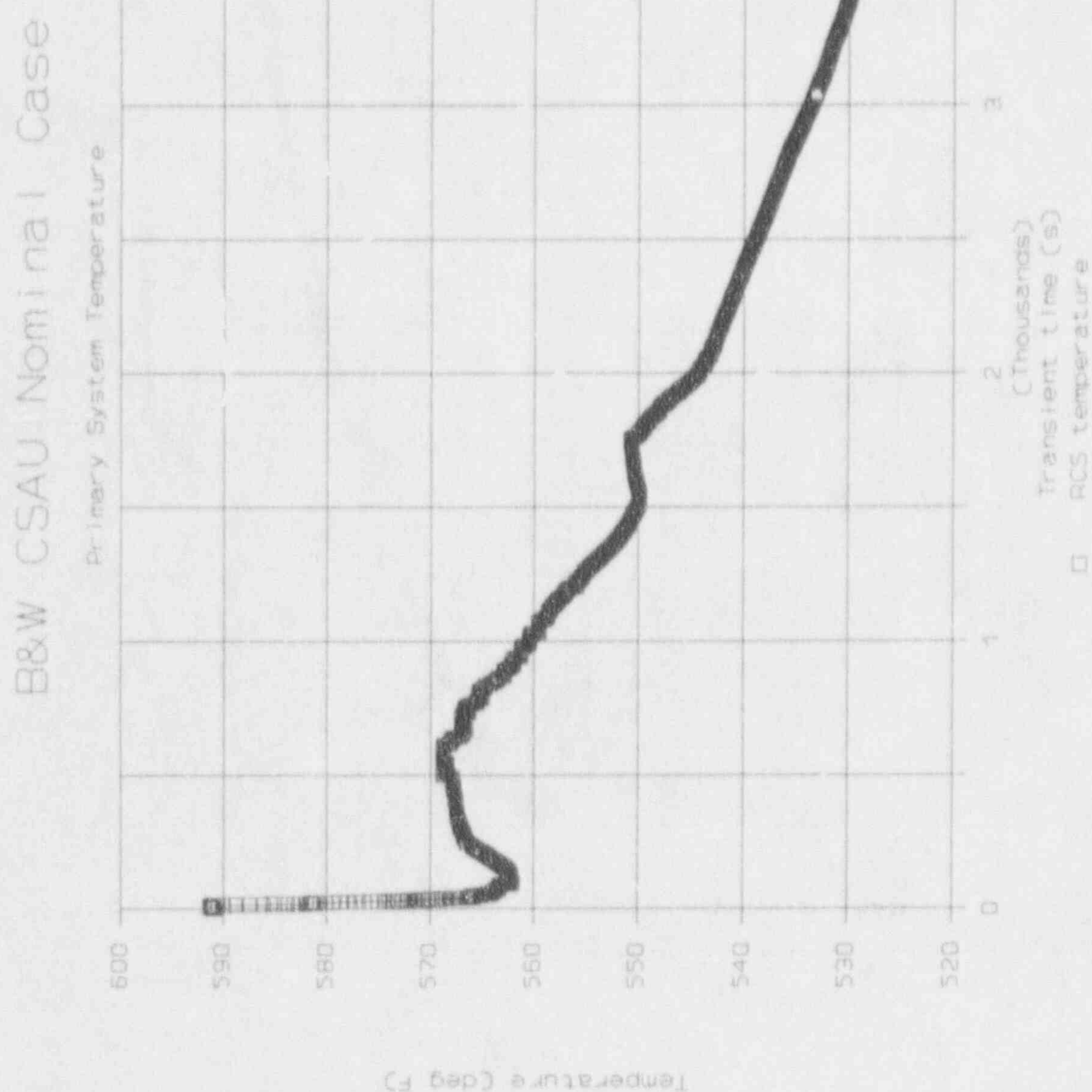

Figure M-44. B&W CSAU study SBLOCA nominal case primary loop temperatures plotted against transient time.

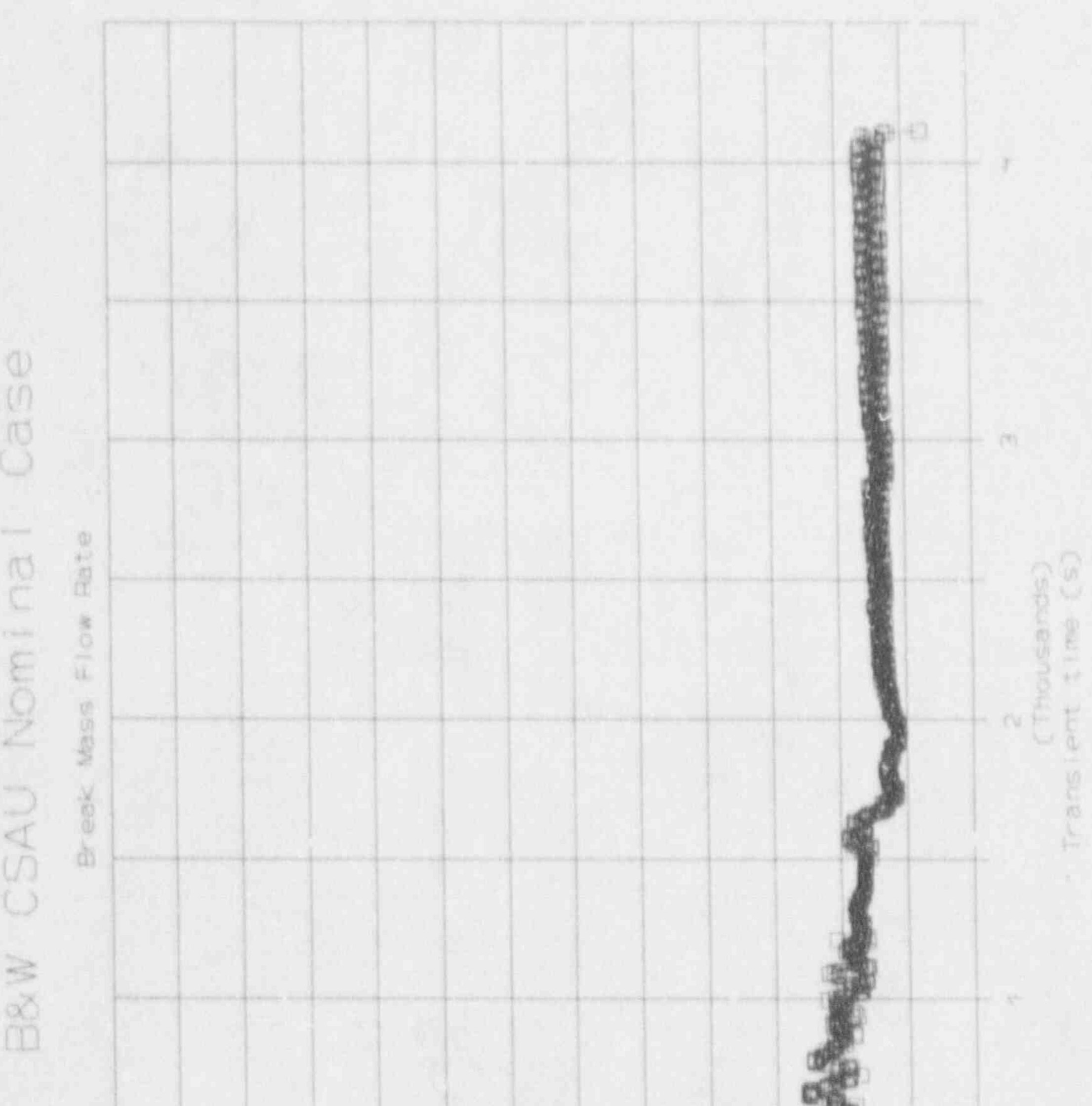

Figure M-45. B&W CSAU study SBLOCA nominal case break mass flow rate plotted against transient time.

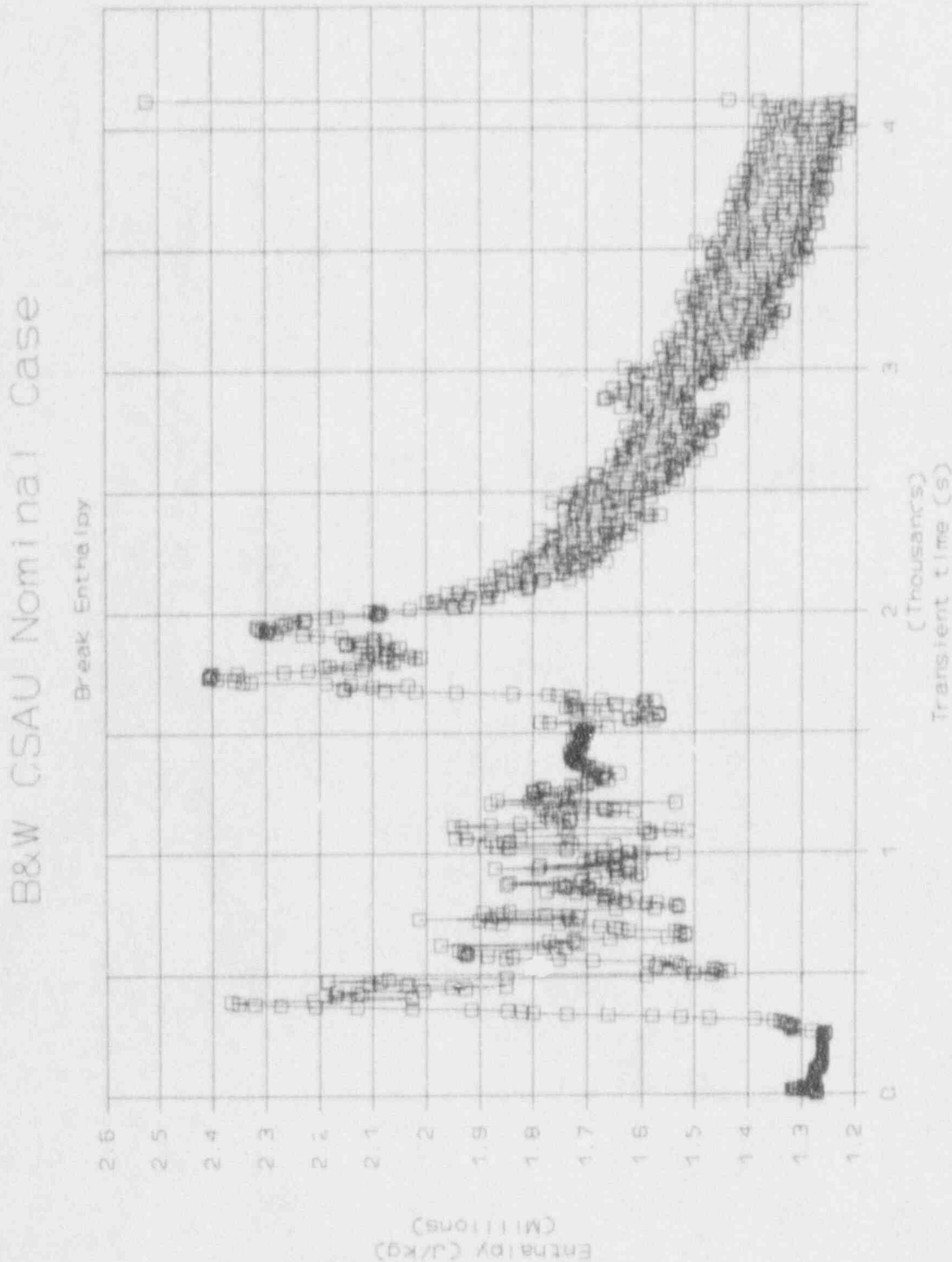

Figure M-45. B&W CSAU SBLOCA nominal case break enthalpy plotted against transient time.

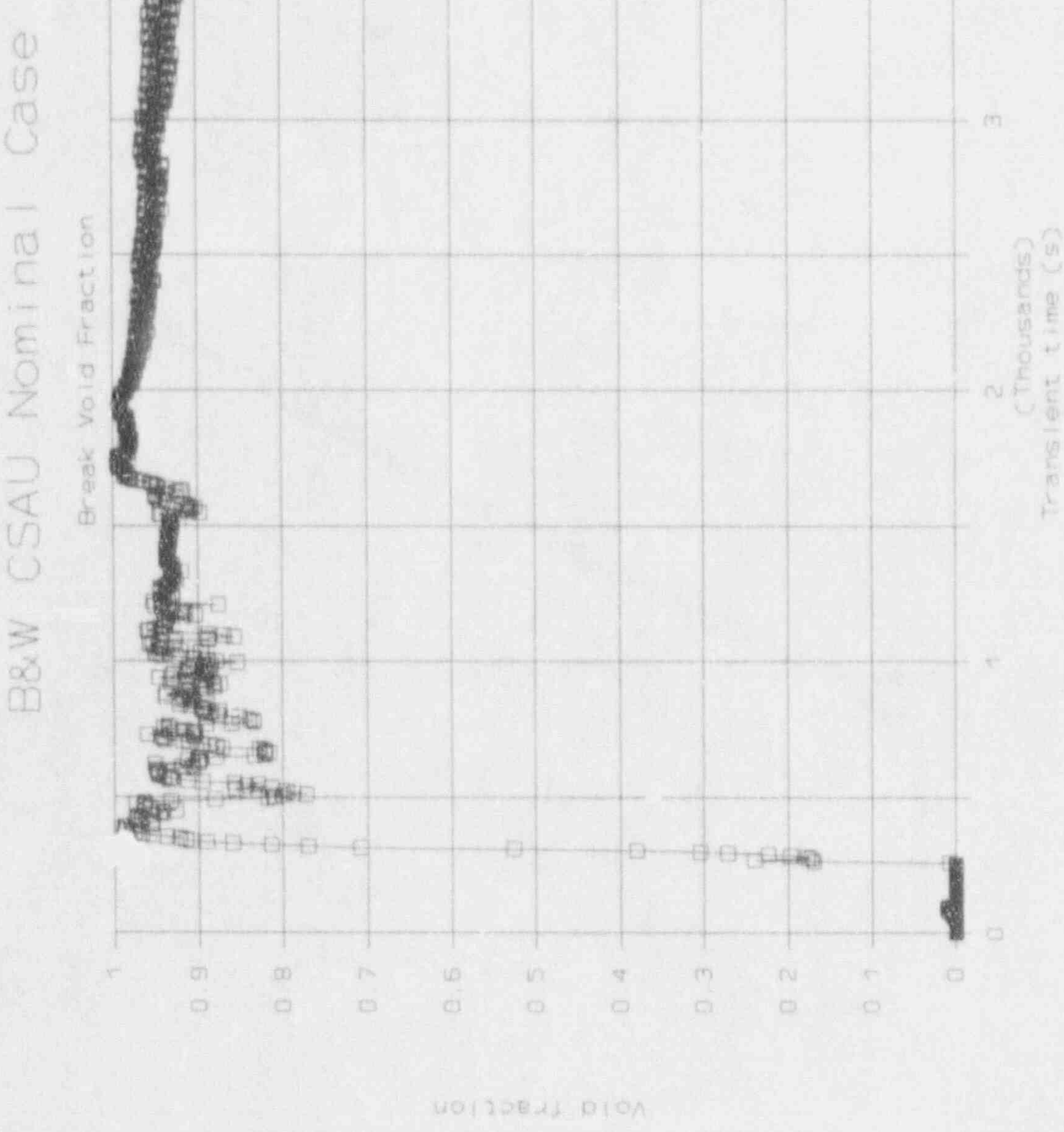

Figure M-47. B&W CSAU study SBLOCA nominal case break void fraction plotted against transient time.

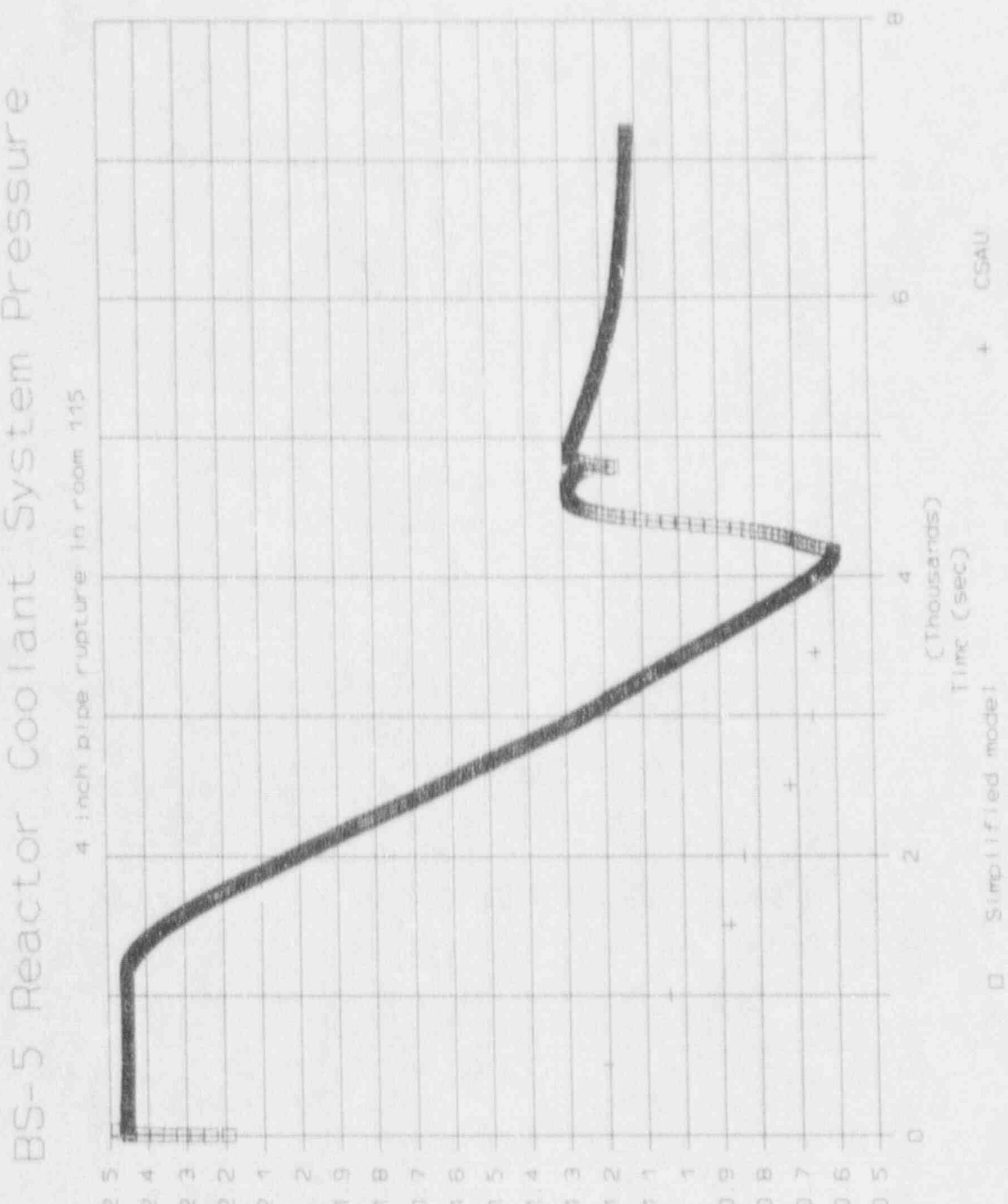

Figure M-48. Reactor coolant system pressure for break sequence 5 compared to the B&W CSAU SBLOCA predictions.

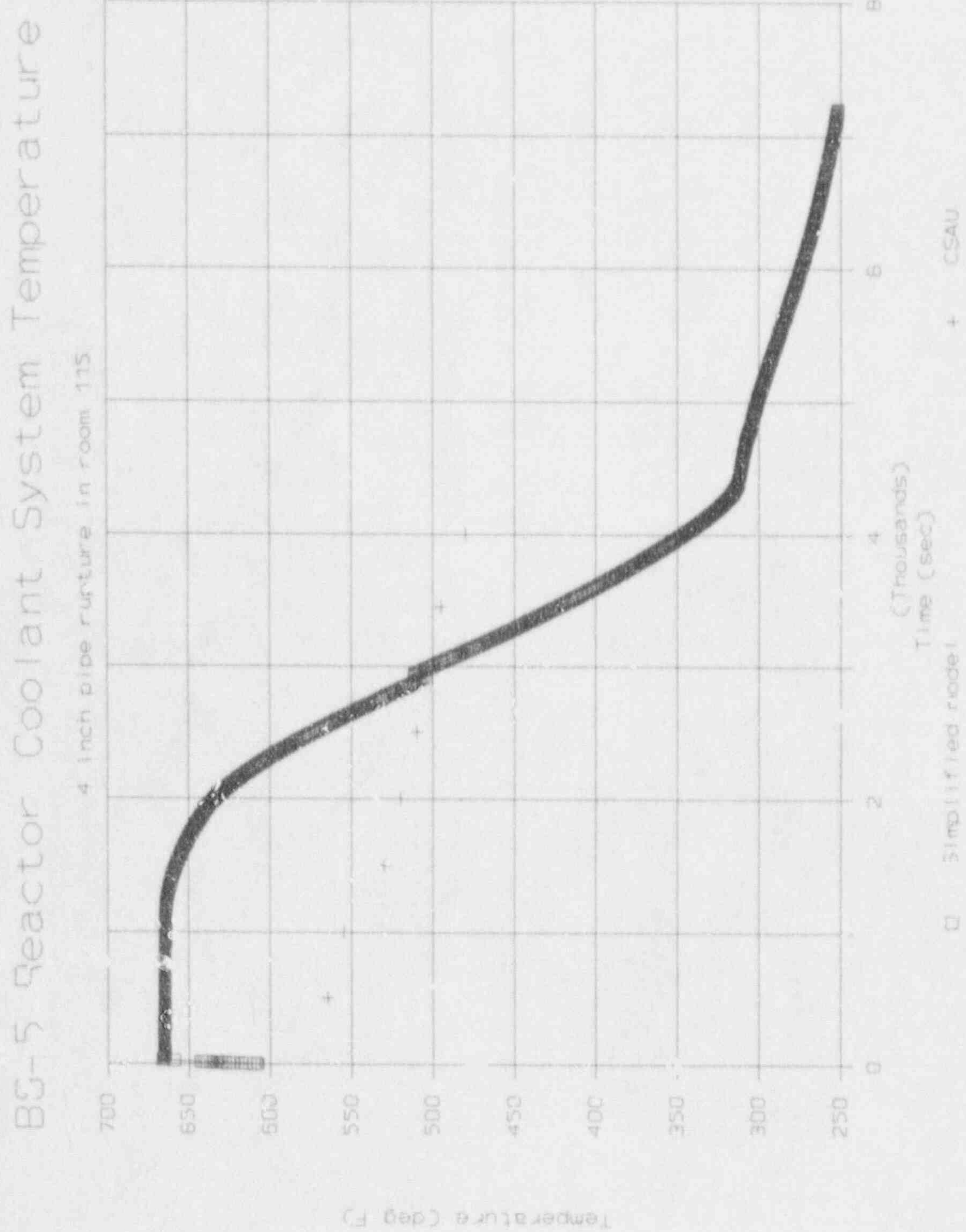

Figure M-49. Simplified reactor coolant system model temperature predictions compared to the B&W CSAU SBLOCA predictions.

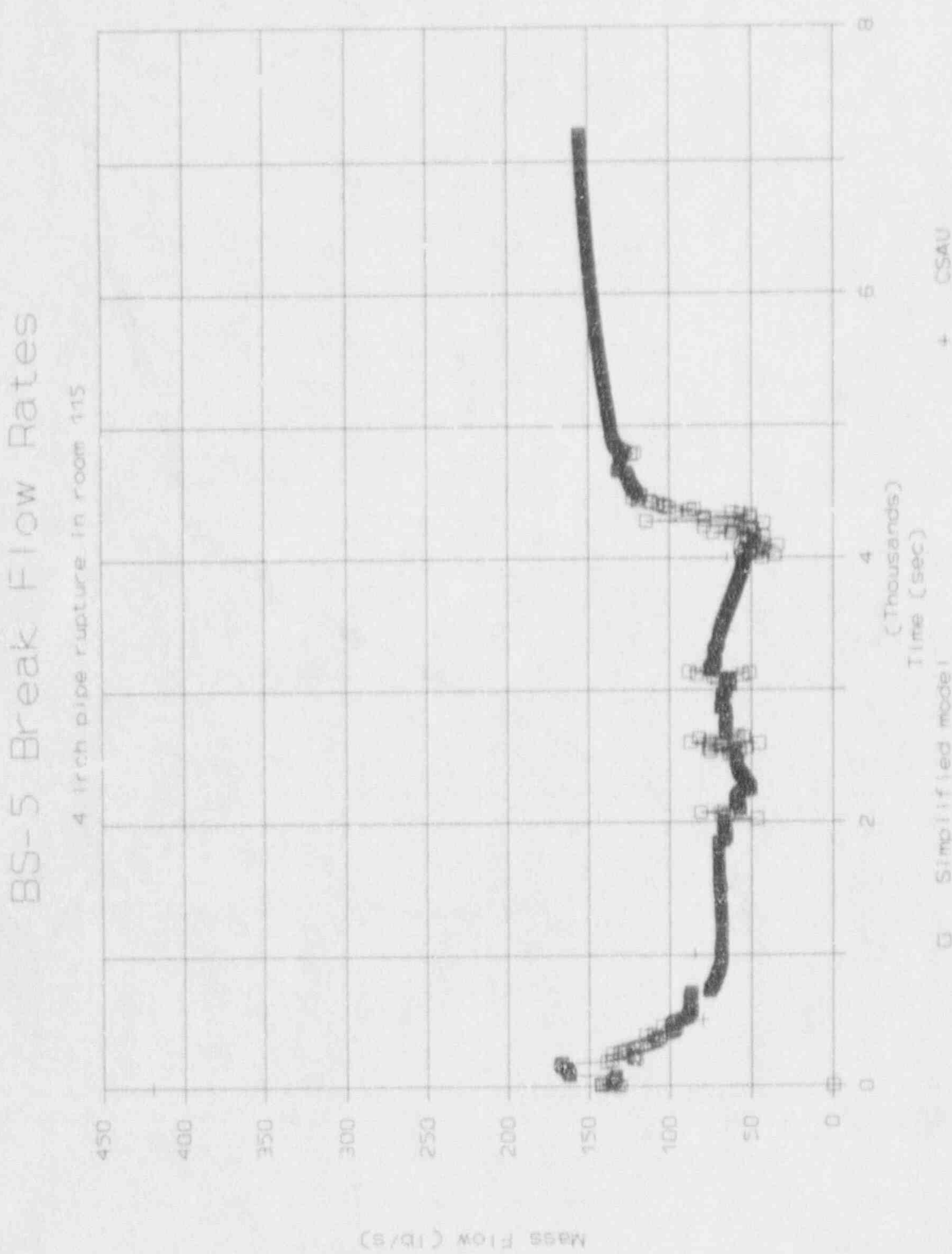

Figure M-50. Simplified model break discharge mass flow rate predictions compared to B&W CSAU SBLOCA predictions.

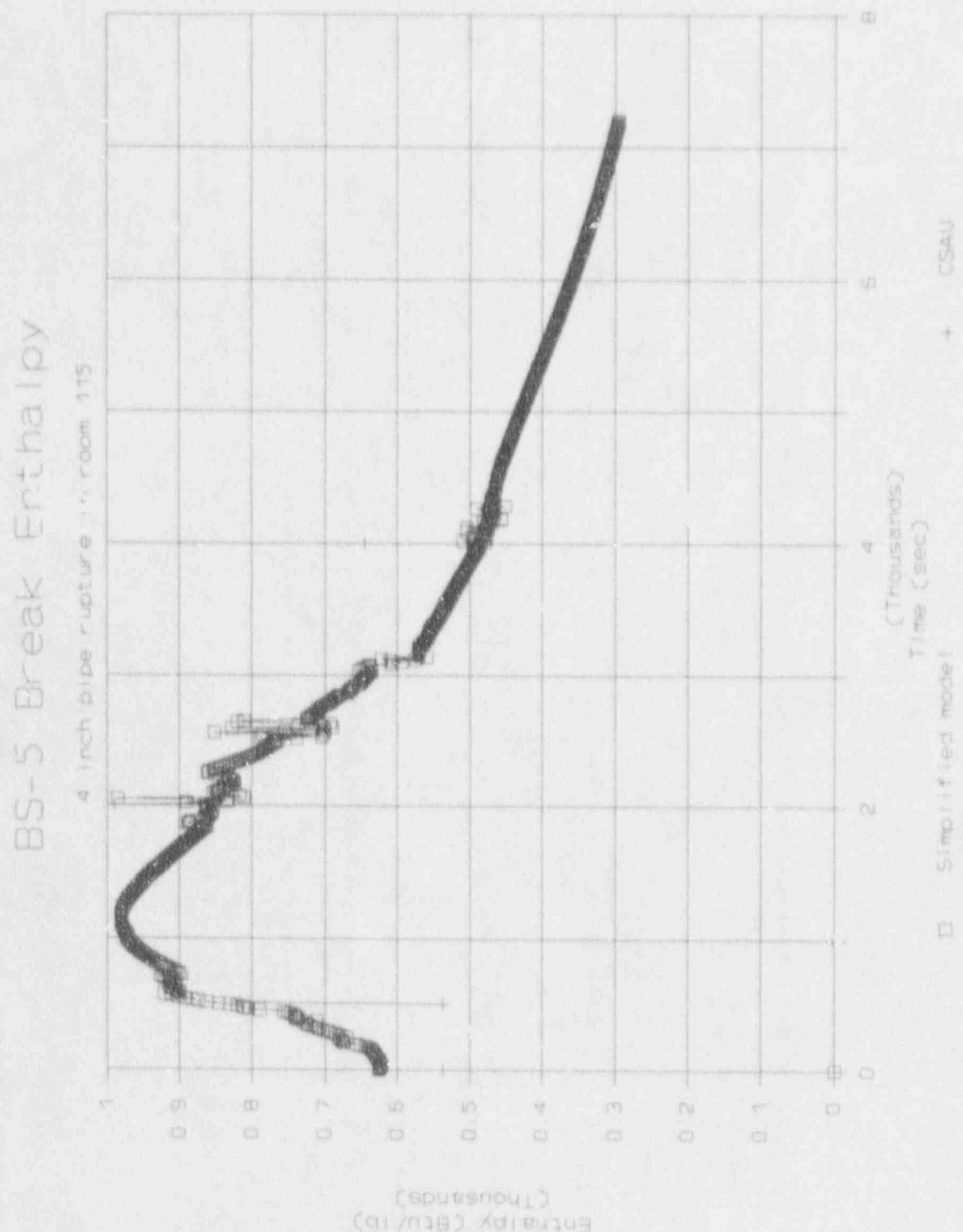

Figure M-51. Simplified RCS model beak discharge enthalpy predictions compared to B&W CSAU SBLOCA predictions.

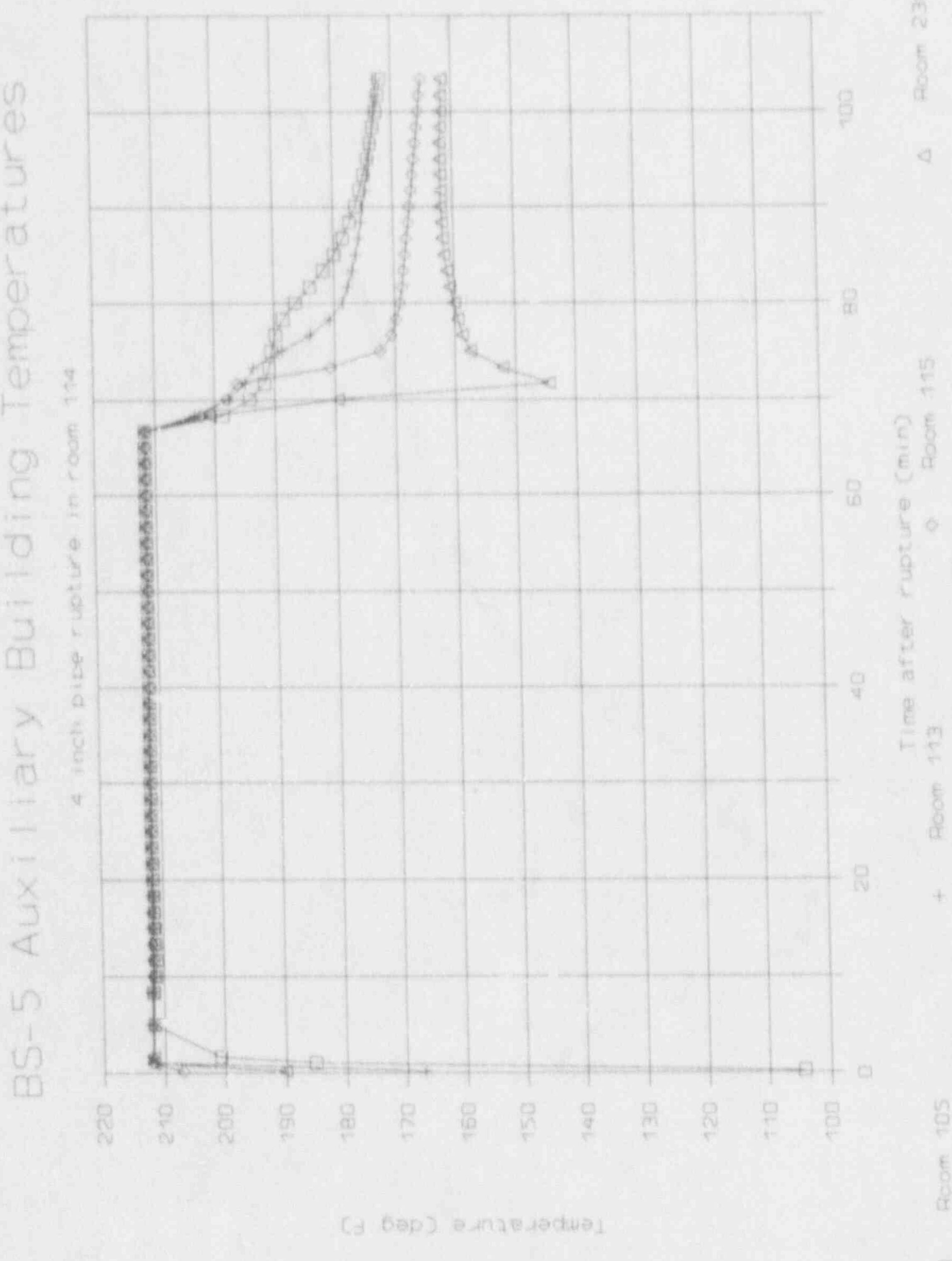

Figure M-52. Auxiliary building temperatures for break sequence 5 that result when using a break discharge from the Oconee SBLOCA study.

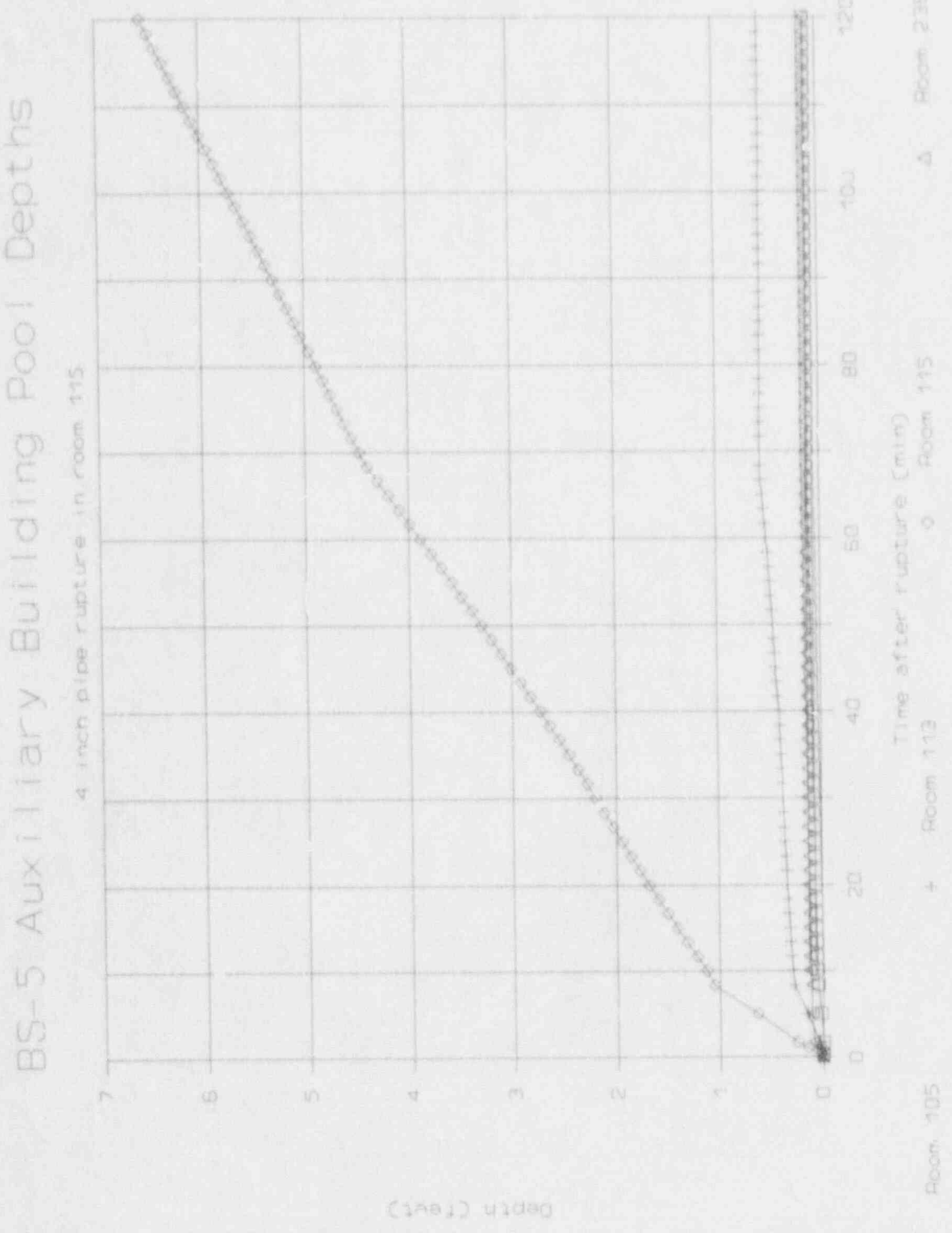

Figure M-53. Auxiliary building pool depths resulting from the break discharge from the Oconee SBLOCA study.

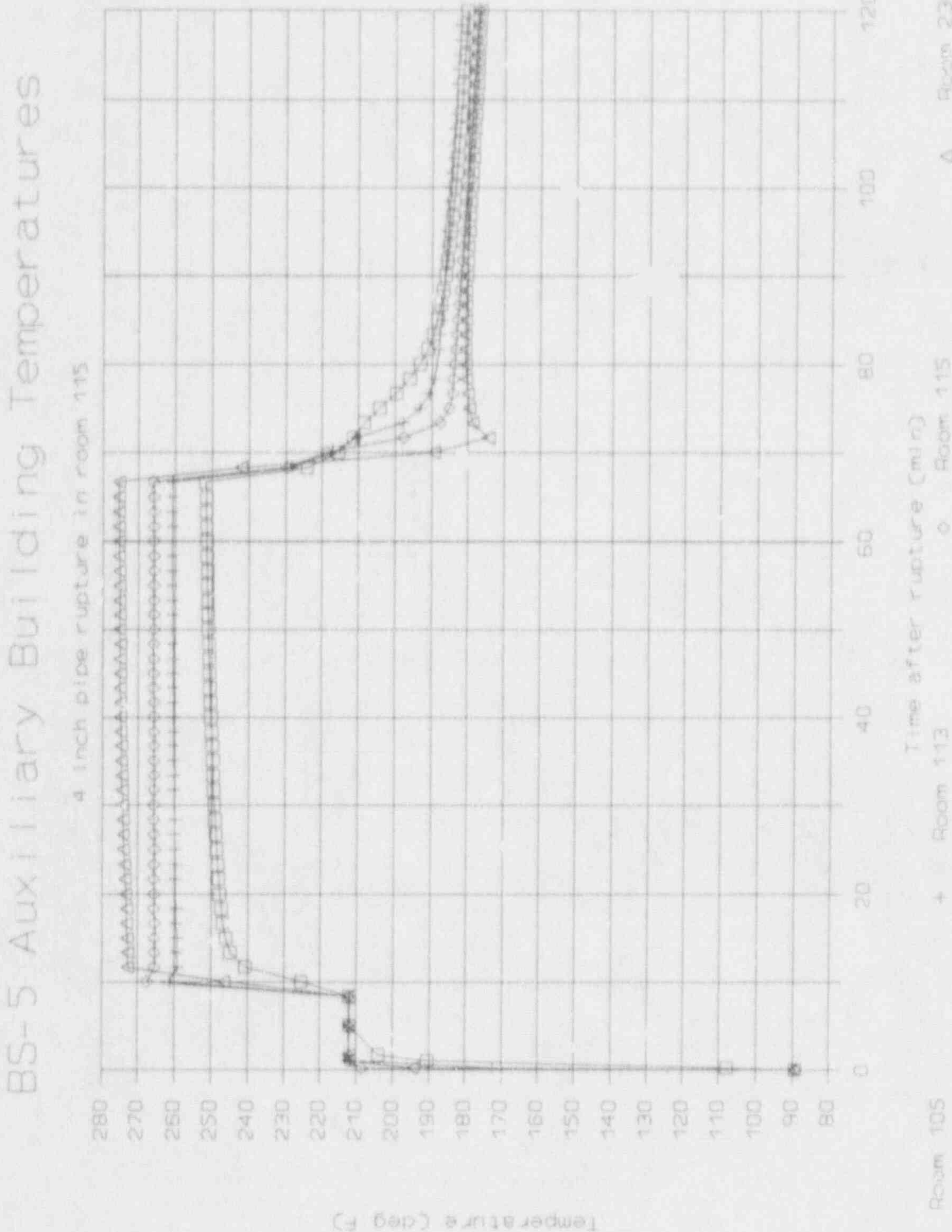

Figure M-54. Auxiliary building temperatures for break sequence 5 that result when using a break discharge from the Oconee SBLOCA study. In this case the discharge was adjusted to reflect a dry blowdown after 8 minutes.

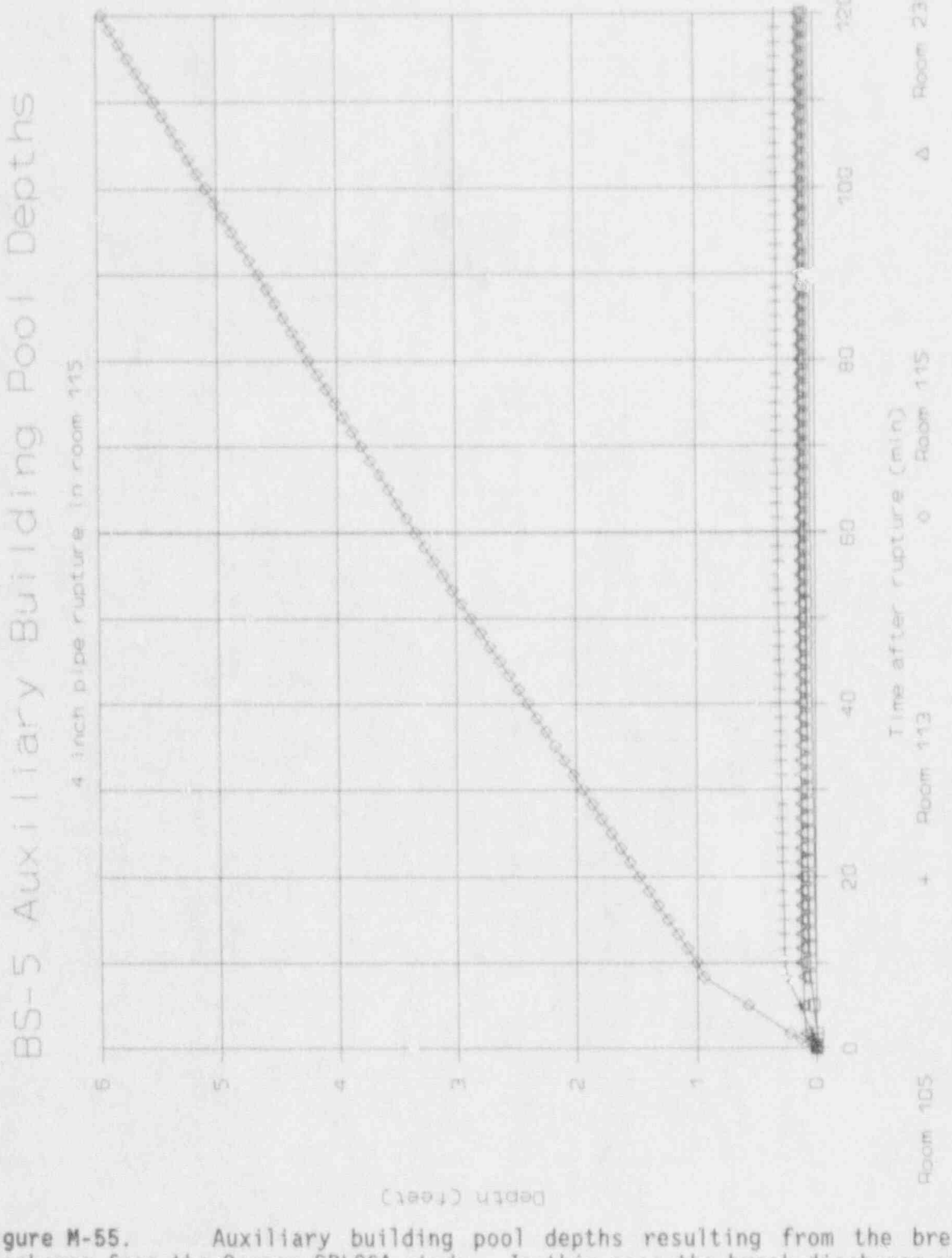

Figure M-55. Auxiliary building pool depths resulting from the break discharge from the Oconee SBLOCA study. In this case the break discharge was adjusted to reflect dry steam in the blowdown after 8 minutes.

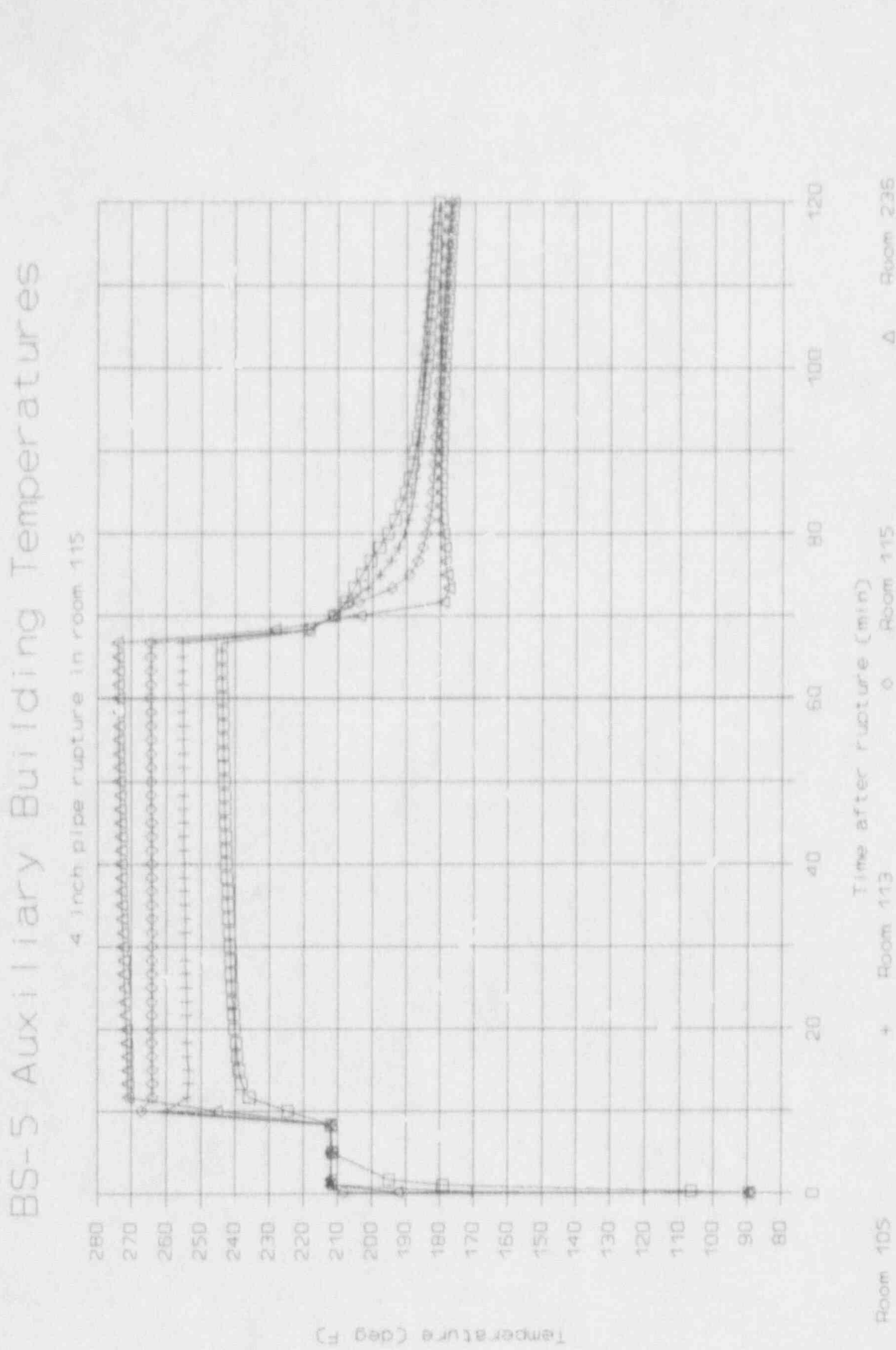

Figure M-56. Auxiliary building temperatures for break sequence 5, using the Oconee SBLOCA discharge adjusted to a break quality of 1.0 after 8 minutes. This case includes 100,000 lb of metal mass in each compartment.

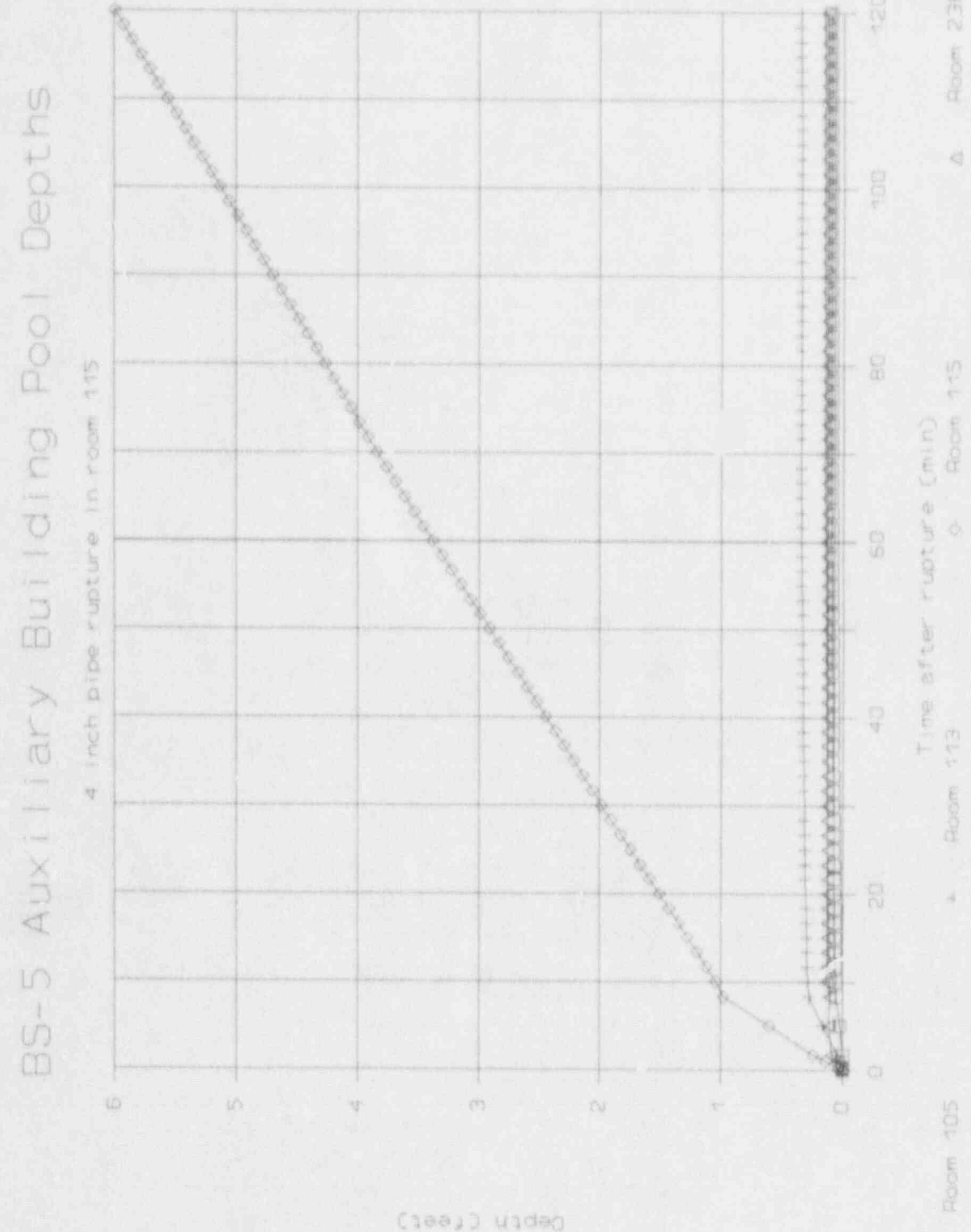

Figure M-57. Auxiliary building pool depths resulting from the B&W CSAU SBLOCA break discharge adjusted for a steam quality of 1.0. Each compartment includes 100,000 lb of metal mass.

LISTING 1 - RELAP5 Input for BS-1

```
*   B&W Plant DHR LETDOWN INTERFACING LOCA - BS-1
*
*
  100     new       transnt
  101     run
  102     british   british
* 104     none                * No restart file
*
*                             alloc
  105     1.0       2.0       10800.
*
  110     air
  115     1.0
*
*         end       min       max       opt       minor     major     restart
  201     1.        1.0e-4    0.0010    3         10000     10000     50000
  202     15.       1.0e-4    0.0100    3         100       1000      5000
  203     3000.     1.0e-4    0.1000    3         100       1000      5000
  204     10000.    1.0e-4    1.0000    3         100       1000      5000
*
* ============================== Minor Edits ================================
*
  301     p         020060000 * Pressure at break
  302     tempf     020060000 * Temperature at break
  303     tempg     020060000 * Temperature at break
  304     mflowj    020050000 * Total break flow rate
* 305     mflowj    021000000 *
  306     mflowj    022000000
  307     cntrlvar  190       * Break vapor mass flow rate
  308     cntrlvar  130       * Break vapor enthalpy
  309     cntrlvar  200       * Break liquid mass flow rate
  310     cntrlvar  180       * Break liquid anthalpy
*
  311     cputime   0
  312     tmass     0
  314     p         512010000 *  tp of vessel
  315     mflowj    712000000 * chg
  316     mflowj    711000000 * hpi
  317     q         514010000 * mid plane energy
  318     p         300010000 *
  [illegible] p         301010000 *
* [illegible] cntrlvar  110
  [illegible] cntrlvar  120
*
* ================================ Trips =====================================
*
*   501 trip card starts transient by opening motor operated valve
*   502 trip card keeps valve open for a long time
*   Trip 502 exists only to meet code requirement for a closing trip.
*   503 opens the 1st relief valve PSV4849 on 320 psia
*   504 opens the 2nd relief valve FV5A on 75 psia
*   505 opens the 3rd relief valve PSV1550 on 450 psia
*
  501     time      0         ge  null  0   0.0   n    * open boundary MOV
  502     time      0         ge  null  0   1.e6  n
* 503     p         30010000  ge  null  0   320.  n
  506     time      0         ge  null  0   0.0   n    * open break at time 0.
*
  598     time      0         lt  null  0   1.e6  n
  599     time      0         gt  null  0   1.e6  n
*
*
* ========================= Hydrodynamic Components ========================
*
```

```
*   Time dependent volume for charging junction
*
8990000   vesin     tmdpvol
8990101   12.00     0.        3000.
8990102   0.        0.        0.
8990103   0.        0.        10
8990200   03        0
8990201   -1.0e99   2000.     70.
8990202   0.0       2000.     70.
*
*                  CHARGING FLOW RATE
*                  PERFORMANCE CURVES NOT AVAILABLE
*                  APPROXIMATED TO  300 GPM AT 2200 PISA
*                  AND 700 GPM AT 200 PSIA
*
*  at power chg rate                        = 300*62.4*.00223 = 41.74
*  run out mass flow rate, mass flow rate = 700*62.4*.00223=97.4  lbs/sec
*
*
7120000   chglow    tmdpjun              * LOOP chg FLOWRATE
7120101   899000000 300000000 .0500
7120200   1         598       p          300010000
7120201   -1.00e+00 0.0       0.0        0.0
7120202   20.       97.4      0.0        0.0
7120203   200.      97.4      0.0        0.0
7120204   2200.     41.74     0.0        0.0
*
*   Time dependent volume for HPI and LPI junction
*
9000000   vesin     tmdpvol
9000101   12.00     0.0       3000.
9000102   0.        0.        0.
9000103   0.        0.        10
9000200   03        0
9000201   -1.0e99   2000.     70.
9000202   0.0       2000.     70.
*
*                Sum of Lpi and Hpi mass flow rates
*
7110000   eccflow   tmdpjun              * LOOP HPI FLOWRATE+LPI flow rate
7110101   900000000 300000000            1.4
7110200   1         598       p          300010000
7110201   -1.00e+00 0.        0.0        0.0
7110202   0.        1469.     0.0        0.0
7110203   115.      1469.     0.0        0.0
7110204   155.      1188.     0.0        0.0
7110206   192.      492.      0.0        0.0
7110207   197.      214.      0.0        0.0
7110208   1614.     160.      0.0        0.0
* 7110209   1.4537e+3 113.2     0.0        0.0
* 7110210   1.5636e+3 84.8      0.0        0.0
* 7110211   1.6239e+3 56.8      0.0        0.0
* 7110212   1.6409e+3 28.8      0.0        0.0
* 7110213   1.6421e+3 .00e+00   0.0        0.0
**
*   component 300:
*      loops cold leg junction connection
*
3000000 COLDLG  pipe
3000001 1
3000101 12.00    1
3000301 0.0      1
3000401 3024.    1
3000601 0.0      1
3000801 0.00015 2.42     1
3001001 00       1
3001201 003      2260.   557.   0.     0.    0.     1
*
```

```
*  component 508:                                                  *
*  the following data represent the downcomer and lower plenum *
*                                                                  *
*
5080000               lowplup              branch
5080001                                   2                    0
5080101      0.0               12.000            1266.
5080102       0.0                 0.0                0.0
5080103    0.00015                5.6655          00
5080200    003         2260.  557.
*crdno    from            to            area   f loss     r loss     cahs
5081101   300010000      508010000  12.0000  1.3180     1.3180   10100
5082101   508010000      514000000  32.8781  0.0          0.0    10100
*cardno.      f vel.    v vel.     i vel.
* 5081201    23.195696 23.195696 0.0                          * 37994.087
* 5082201    23.195696 23.195696 0.0                          * 37994.087
5081201    0. 0. 0.                        * 37994.087
5082201    0.  0.  0.                        * 37994.087
*
*  component 514:                                        *
*  the following data represent the core and upper plenum
*
5140000                  core                 pipe
5140001                     1
5140101         0.0                                              1
5140301       12.                                            1
5140401      1265.                                           1
5140601          90.0                                            1
5140701         12.                                          1
5140801        0.00015           0.040092                        1
5141001       00                                                 1
5141201    003        2194. 608. 0.  0.    0.       1
*
*    Core heat structure
*
15151000     12     9     2     1           0.
15151100              0                 1
15151101      5   0.01542           1   0.01571          2   0.01792
15151201      2       5       3     6      4     8
15151301       .85      2   .9 3   1. 4   1.4 5   0. 8
15151400      0
15151401    2000.       6        760. 7  710. 8  650. 9
15151501           0           0     0     0     0.            12
15151601  514010000        00000     1     0   4144.5          12
15151701  1      0.0778 0. 0. 1
15151702  1      0.0885 0. 0. 2
15151703  1      0.0877 0. 0. 3
15151704  1      0.0860 0. 0. 4
15151705  1      0.0847 0. 0. 5
15151706  1      0.0839 0. 0. 6
15151707  1      0.0840 0. 0. 7
15151708  1      0.0848 0. 0. 8
15151709  1      0.0862 0. 0. 9
15151710  1      0.0879 0. 0. 10
15151711  1      0.0859 0. 0. 11
15151712  1      0.0627 0. 0. 12
*           dia  htlngf htlngr glngf glngr glossf glorsr boilf strno      * 902000
15151801    0.   100.   100.   0.     0.    0.     0.     1.   12        * 902000
15151901 0.0415  100.   100.   0.     0.    0.     0.     1.   12        * 902000
*
*
****************************************************************************
* thermal properties of uo2 - composition 2
*---------------------------------------------------------------------------
*crdno   mtrl type      th.con    ht.cap         material
20100200 tbl/fctn         1         1          * uo2
*---------------------------------------------------------------------------
*  thermal properties of uo2
```

```
*----------------  ------------------------------------------------------
*
*crdno              temperature          th.cond
* 20100201              188.6                1.284e-3
20100201              0.                  1.284e-3
20100202            332.6                 1.1235e-3
20100203            440.6                 9.951e-4
20100204            500.0                 9.2806e-4
20100205            650.0                 7.4194e-4
20100206            800.0                 7.4361e-4
20100207            950.0                 6.7750e-4
20100208           1100.0                 6.2278e-4
20100209           1250.0                 5.7722e-4
20100210           1400.0                 5.3889e-4
20100211           1500.0                 5.0639e-4
20100212           1700.0                 4.7889e-4
20100213           1850.0                 4.5528e-4
20100214           2000.0                 4.3556e-4
20100215           2150.0                 4.1861e-4
20100216           2300.0                 4.0472e-4
20100217           2450.0                 3.9306e-4
20100218           2600.0                 3.8389e-4
20100219           3100.0                 3.6750e-4
20100220           3600.0                 3.7028e-4
20100221           4100.0                 3.9056e-4
20100222           4600.0                 4.2722e-4
20100223           5100.0                 4.8056e-4
*
*crdno              temperature          vol ht cap
* 20100251              32.0                 34.45
20100251              0.                  34.45
20100252            122.0                 38.35
20100253            212.0                 40.95
20100254            392.0                 43.55
20100255            752.0                 46.80
20100256           2012.0                 51.35
20100257           2732.0                 52.65
20100258           3092.0                 56.55
20100259           3452.0                 63.05
20100260           3812.0                 72.80
20100261           4352.0                 89.70
20100262           4532.0                 94.25
20100263           4712.0                 98.15
20100264           4892.0                100.10
20100265           5144.0                101.40
20100266           8000.0                101.40
*
*************************************************************************
* thermal properties of fuel gap - composition 3
*************************************************************************
*crdno   mtrl type      th.con    ht.cap          material
20100300 tbl/fctn         1          1          * fuel gap
*------------------------------------------------------------------------
*  thermal properties of fuel gap
*------------------------------------------------------------------------
*values of thermal conductivity were derived from matpro and a frapcon
*computer run at constant power over the total burnup interval
*
*burnup =     0.00000 pressure =  .12362e+04  gap width =       .00213
* he frac =  .10000e+01  kr frac = 0.             xe frac = 0.
*crdno             temperature            th. cond.
*  20100301              70.000             2.52892e-05
20100301              0.000             2.52892e-05
20100302            300.000             3.14014e-05
20100303            500.000             3.70561e-05
20100304            700.000             4.23747e-05
20100305            900.000             4.74311e-05
20100306           1100.000             5.22745e-05
```

```
20100307          1300.000          5.69395e-05
20100308          1500.000          6.14522e-05
20100309          1700.000          6.58324e-05
20100310          1900.000          7.00957e-05
20100311          2100.000          7.42548e-05
20100312          2300.000          7.83201e-05
20100313          2500.000          8.23004e-05
20100314          2700.000          8.62029e-05
20100315          2900.000          9.00341e-05
20100316          3100.000          9.37993e-05
20100317          3300.000          9.75033e-05
20100318          3500.000          1.01150e-04
20100319          3700.000          1.04744e-04
20100320          3900.000          1.08288e-04
20100321          4100.000          1.11784e-04
20100322          4300.000          1.15236e-04
20100323          4500.000          1.18646e-04
20100324          4700.000          1.22017e-04
20100325          4900.000          1.25349e-04
20100326          5100.000          1.28645e-04
20100327          5300.000          1.31907e-04
*
*crdno            temperature         vol ht cap
20100351            0.0                 0.000075
20100352          5400.0                0.000075
*
****************************** ****************************************
* thermal properties of cladding - composition 4
************ *********************************************************
*crdno   mtrl type      th.con    ht.cap         material
20100400 tbl/fctn         1         1          * cladding
*---------------------------------------------------------------------
*  thermal properties of cladding
*---------------------------------------------------------------------
*
*crdno              temperature         th.cond
*  20100401            50.0                1.9267e-3
20100401              0.0               1.9267e-3
20100402            392.0               1.9267e-3
20100403            752.0               2.2478e-3
20100404           1112.0               2.7297e-3
20100405           1472.0               3.0509e-3
20100406           1832.0               3.5325e-3
20100407           2192.0               4.0142e-3
20100408           2552.0               4.8169e-3
20100409           2912.0               5.7803e-3
20100410           3272.0               7.0647e-3
20100411           3632.0               8.8311e-3
20100412           3992.0               1.0918e-2
*
*crdno             te                   vol ht cap
20100451                                  28.392
20100452            [illegible]0.3        34.476
20100453           [illegible]5.00        85.176
20100454           1787.5                 34.370
20100455           3500.0                 34.476
*
* ------------------- -----------------------------------------------
* table number 1 - core power vs. time
* -------------------------------------------------------------------
* this table represents a best-estimate of fission product decay
* heat using the ans standard plus a contribution from actinides.
* table is activated by trip 540. reference: work by c. b. davis
*
* card       type         trip    time factor   power(mw)
20200100    power          0       1.0          2772.
*
*                 sec      normalized power
```

```
20200101        -1.          .0        * start at one second
* 20200101        -1.          1.0
* 20200102         0.          1.0
* 20200103          .1         .8382
* 20200104          .2         .5720
* 20200105          .3         .3806
* 20200106          .4         .2792
* 20200107          .5         .2246
* 20200108          .6         .1904
* 20200109          .7         .1672
* 20200110          .8         .1503
* 20200111          .9         .1376
20200112        1.0        .1275
20200113        1.5        .1032
20200114        2.         .09884
20200115        3.         .09209
20200116        4.         .08690
20200117        5.         .08271
20200118        6.         .07922
20200119        8.         .07375
20200120       10.         .06967
20200121       15.         .06251
20200122       20.         .05751
20200123       30.         .05060
20200124       40.         .04591
20200125       50.         .04246
20200126       60.         .03977
20200127       80.         .03604
20200128      100.         .03357
20200129      125.         .03145
20200130      150.         .02997
20200131      200.         .02798
20200132      300.         .02565
20200133      400.         .02418
20200134      500.         .02307
20200135      600.         .02217
20200136      800.         .02073
20200137     1000          .01959
20200138     1250.         .01844
20200139     1500          .01749
20200140     2000.         .01600
20200141     2500.         .01489
20200142     3000.         .01401
20200143     3500.         .01331
20200144     4000.         .01274
20200145     5000.         .01185
20200146     6000.         .01118
20200147     7000.         .01067
20200148     8000.         .01025
20200149     9000.         .009895
20200150    10000.         .009596
20200151    15000.         .008553
20200152    20000.         .007902
*
*  component 512:
*  the following data represent the upper head and pressurizer
*
5120000              corein1              branch
5120001   1          0
5120101    0.0             12.000             2808.
5120102    0.0                90.0              12.00
5120103   0.00015             10.0           00
5120200   003        2194.   608.
5121101   514010000      51.000000   0.0      0.1979    0.1979   10100
5121201   0.  0.  0.                            * 36815.350
*
*
9240000   upjun          sngljun
```

```
9240101   512010000     301000000  12.00  0.1200    0.1200    00002
9240201   0         0. 0. 0.0
*
*   component 301:
*   4 loops cold leg junction connection
*
3010000                 1h13                pipe
3010001                    1
3010101           12.00                                        1
3010301        0.0                                        1
3010401        3025.                                            1
3010601            0.0                                         1
3010801         0.00015            2.42                        1
3011001        00                                              1
3011201    003        2194. 608. 0.  0.    0.       1
*
*   Single Junction (Component 205)
*
2050000 inletjun       sngljun
2050101 301010000  010000000  0.0  0.0  0.0  01100
2050201 1  0.0      0.0     0.0
*
*   Pipe    (Component 10)
*
0100000 "12-CCA-4"      pipe
0100001 19
0100101 0.6013  19
0100301 4.0     19
0100601 0.0
0100801 1.5e-4 0.0      19
0100901 0.0    0.0      1
0100902 0.108  0.108    2
0100903 0.108  0.108    3
0100904 0.0    0.0      4
0100905 0.216  0.216    5
0100906 0.0    0.0      6
0100907 0.0    0.0      9
0100908 0.108  0.108    10
0100909 0.0    0.0      11
0100910 0.324  0.324    12
0100911 0.0    0.0      13
0100912 0.216  0.216    14
0100913 0.0    0.0      15
0100914 0.0    0.0      16
0100915 0.216  0.216    17
0100916 0.0    0.0      18
0101001  00    19
0101101  0100    18
0101201  003  2194.   608.  0.    0.    0.    19
0101301  0.0    0.0  0.0   18
*
*   Valve DH12 (Component 15)
*
0150000 DH12            valve
0150101 010010000  020000000  0.6013  1.0    1.0       00100
0150201 1    0.0      0.0      0.0
0150300 mtrvlv
0150301 501    502  0.1  0.0
*
*   Pipe    (Component 20)
*
0200000 "12-GCB-7"      pipe
0200001 6
0200101 0.8185  6
0200301 4.0     6
0200601 0.0     6
0200801 1.5e-4 0.0      6
0200901 0.0    0.0      1
```

```
0200902 1.216  1.216    2
0200903 0.0    0.0      3
0200904 0.216  0.216    4
0200905 1.0    1.0      5
0201001  00      6
0201101  01000   5
0201201  003     50. 100.    0.    0.    0.    6
0201301  0.0   0.0  0.0   5
*
*   Break for BS-1, located at end of 12 inch piping.
*
0220000 break        valve
0220101 020010000    902000000   0.  0.  0.  000100
0220201 1        0.        0.       0.
0220300 trpvlv
0220301 506
*
*   Time-dependent volume downstream of the leak
*
9020000               vesout                tmdpvol
9020101   18.40                0.0                 3000.
9020102      0                     0                  0
9020103     0                        0            10
9020200     03      0
9020201     0.0      15.         213.
*
* ============================ Control Variables ==============================
*
20500000  4095
*
*    Sum of total eccs
*
*ctlvar      name        type     factor    init   f c
20501100   "ecctot"     sum       2.2046     0.0     1
*
*ctlvar             a0       coeff        variable name  parameter no.
20501101        0.0          1.0          mflowj       711000000
20501102                     1.0          mflowj       712000000
*
*integrate eccs mass flow rate
*
**ctlvar      name       type     factor    init   f c     min    max
20501200 "inteccs"  integral        1.0     0.0   0 3     0.0     4.8e6
*
*ctlvar      integrand name   integrand no.
20501201        cntrlvar          110
*
*   Controller for break vapor enthalpy - output SI units, break conditions
*   taken from donor volume.
*
*   hg = ug + p*vg
*
20501300  "v-enth"  sum       1.       0.       1
20501301  0.        1.        ug       020060000
20501302            1.        cntrlvar 140
*
20501400  "v-p*vg"  mult      1.       0.       1
20501401                      p        020060000
20501402                      cntrlvar 150
*
20501500  "v-1/rho" div       1.       1.       1
20501501                      rhog     020060000
*
*   Controller for break liquid enthalpy
*
*   hf = uf + p*vf
*
20501600  "f-enth"  sum       1.       0.       1
```

```
20501601  0.        1.        uf        020060000
20501602            1.        cntrlvar  170
*
20501700  "f-pv"    mult      1.        0.        1
20501701                      p         020060000
20501702                      cntrlvar  180
*
20501800  "1/rho"   div       1.        1.        1
20501801                      rhof      020060000
*
*   Controller for break vapor mass flow rate
*
20501900  mflowg    mult      0.07604   0.        1
20501901                      voidgj    022000000
20501902                      rhogj     022000000
20501903                      velgj     022000000
*
*   Controller for break fluid mass flow rate
*
20502000  mflowf    mult      0.07604   0.        1
20502001                      voidfj    022000000
20502002                      rhofj     022000000
20502003                      velfj     022000000
*
.End
```

LISTING 2 - RELAP5 Input for BS-2

```
*   B&W Plant DHR LETDOWN INTERFACING LOCA - BS-2
*
*   File:
*
*      rlp002.mdl
*
*   Description:
*
*      This RELAP5/MOD2 input deck is used to obtain the steam source term
*      resulting from an ISLOCA in the B&W Plant decay heat removal pump
*      discharge line.  The break occurs in auxilliary building room 113.
*      This model was constructed from a long-term cooling deck written by
*      Craig Kullberg, a low-pressure injection system piping model written
*      by Everet Gruen, and an Oconee "generic" core decay heat model.
*
*   Written by:
*
*      John Schroeder  6/91
*
 100     new        transnt
 101     run
 102     british    british
* 104    none                  * No restart
*
*                              alloc
 105     1.0        2.0        10800.
*
 110     air
 115     1.0
*
*        end        min        max        opt        minor      major      restart
 201     .5         1.0e-4     0.0010     3          10000      10000      50000
 202     100.       1.0e-4     0.0050     3          200        20000      10000
 203     500.       1.0e-4     0.0100     3          1000       10000      10000
 204     3600.      1.0e-4     0.1000     3          100        1000       5000
*
* ================================ Minor Edits ================================
*
 301     p          120360000 * Pressure at break
 302     tempf      120360000 * Temperature at break
 303     tempg      120360000 * Temperature at break
 304     mflowj     723000000 * Total break flow rate
* 305    mflowj     021000000 *
 306     mflowj     724000000
 307     cntrlvar   190        * Break vapor mass flow rate
 308     cntrlvar   130        * Break vapor enthalpy
 309     cntrlvar   200        * Break liquid mass flow rate
 310     cntrlvar   160        * Break liquid enthalpy
*
 311     cputime    0
 312     tmass      0
 314     p          512010000 * top of vessel
 315     mflowj     712000000 * chg
 316     mflowj     711000000 * hpi
 317     q          514010000 * mid plane energy
 318     p          300010000 *
 319     p          301010000 *
* 320    cntrlvar   110
 321     cntrlvar   120        * Integrated injection flow
*
* ================================== Trips ==================================
*
*    501 trip card starts transient by opening motor operated valve
*    502 trip card keeps valve open for a long time
```

```
*   Trip 502 exists only to meet code requirement for a closing trip.
*   503 opens the 1st relief valve PSV4849 on 320 psia
*   504 opens the 2nd relief valve FV5A on 75 psia
*   505 opens the 3nd relief valve PSV1550 on 450 psia
*
  501     time      0          ge  null  0   0.0   n    * open boundary MOV
  502     time      0          ge  null  0   1.e6  n
* 503     p         30010000   ge  nu''  0   320.  n
  506     time      0          ge  null  0   0.0   n    * open break at time 0.
*
  598     time      0          lt  null  0   1.e6  n
  599     time      0          gt  null  0   1.e6  n
*
*
* ========================== Hydrodynamic Components ==========================
*
*   Time dependent volume for charging junction
*
8990000   TDVCHG    tmdpvol
8990101   12.00     0.        3000.
8990102   0.        0.        0.
8990103   0.        0.        10
8990200   03        0
8990201   -1.0e99   2000.     70.
8990202   0.0       2000.     70.
*
*   CHARGING FLOW RATE
*   PERFORMANCE CURVES NOT AVAILABLE
*   APPROXIMATED TO  300 GPM AT 2200 PISA
*   AND 700 GPM AT 200 PSIA.
*
*   at power chg rate                        = 300*62.4*.00223 = 41.74
*   run out mass flow rate, mass flow rate = 700*62.4*.00223=97.4 lbs/sec
*
*
7120000   CHGFLOW   tmdpjun              * LOOP chg FLOWRATE
7120101   899000000 300000000 .0500
7120200   1         598       p         300010000
7120201   -1.00e+00 0.0       0.0       0.0
7120202   20.       97.4      0.0       0.0
7120203   200.      97.4      0.0       0.0
71''204   2200.     41.74     0.0       0.0
*
*   Time dependent volume for HPI and LPI junction
*
9000000   TDVLPI    tmdpvol
9000101   12.00     0.0       3000.
9000102   0.        0.        0.
9000103   0.        0.        10
9000200   03        0
9000201   -1.0e99   2000.     70.
9000202   0.0       2000.     70.
*
*   Sum of Lpi and Hpi mass flow rates
*
7110000   ECCSFLOW  tmdpjun              * LOOP HPI FLOWRATE
7110101   900000000 300000000           1.4
7110200   1         598       p         300010000
7110201   -1.00e+00 0.        0.0       0.0
7110202   0.        214.      0.0       0.0
7110203   115.      214.      0.0       0.0
7110204   155.      214.      0.0       0.0
7110206   192.      214.      0.0       0.0
7110207   197.      214.      0.0       0.0
7110208   1614.     160.      0.0       0.0
*
*   Component 300:
*       4 loops cold leg junction connection
```

```
*
3000000   COLDLG  pipe
3000001   1
3000101   12.00   1
3000301   0.0     1
3000401   3024.   1
3000601   0.0     1
3000801   0.00015 2.42     1
3001001   00      1
3001201   003     2260.    557.   0.     0.    0.     1
*
*   Component 508:
*       the following data represent the downcomer and lower plenum
*
5080000   LOWRPLM    branch
5080001   2          0
5080101   0.0        12.000    1265.
5080102   0.0        0.0       0.0
5080103   0.00015    5.6655    00
5080200   003        2260.     557.
*         from       to        area       f loss     r loss     vcahs
5081101   300010000 508010000 12.0000    1.3180     1.3180     10100
5082101   508010000 514000000 32.8781    0.0         0.0       10100
*         f vel.     v vel.    i vel.
5081201   0.         0.        0.         * 37994.087
5082201   0.         0.        0.         * 37994.087
*
*   Component 514:
*       the following data represent the core and upper plenum
*
5140000   CORE       pipe
5140001   1
5140101   0.0        1
5140301   12.        1
5140401   1265.      1
5140601   90.0       1
5140701   12.        1
5140801   0.00015    0.040092  1
5141001   00                   1
5141201   003        2194.     608.       0.         0.         0.         1
*
*   Component 512:
*       the following data represent the upper head and pressurizer
*
5120000   UPPRPLM    branch
5120001   1          0
5120101   0.0        12.000    2808.
5120102   0.0        90.0      12.00
5120103   0.00015    10.0      00
5120200   003        2194.     608.
5121101   514010000 512000000 0.0        0.1979     0.1979     10100
5121201   0.         0.        0.         * 36815.350
*
*
9240000   VESSLOUT  sngljun
9240101   512010000 301000000  12.00  0.1200    0.1200    00002
9240201   0          0. 0. 0.0
*
*   Component 301
*
3010000   HOTLEG     pipe
3010001   1
3010101   12.00      1
3010301   0.0        1
3010401   3025.      1
3010601   0.0        1
3010801   0.00015    2.42      1
3011001   00         1
```

```
3011201   003       2194.     608.      0.        0.        0.        1
*
*   Single Junction -- decay heat removal pump suction line
*
2050000   DHRINLET  sngljun
2050101   301010000 010000000 0.0       0.0       0.0       01100
2050201   1         0.0       0.0       0.0
*
*   Pipe
*
0100000 "12-CCA-4"     pipe
0100001 19
0100101 0.6013  19
0100301 4.0     19
0100601 0.0     19
0100801 1.5e-4 0.0      19
0100901 0.0    0.0      1
0100902 0.108  0.108    2
0100903 0.108  0.108    3
0100904 0.0    0.0      4
0100905 0.216  0.216    5
0100906 0.0    0.0      6
0100907 0.0    0.0      9
0100908 0.108  0.108    10
0100909 0.0    0.0      11
0100910 0.324  0.324    12
0100911 0.0    0.0      13
0100912 0.216  0.216    14
0100913 0.0    0.0      15
0100914 0.0    0.0      16
0100915 0.216  0.216    17
0100916 0.0    0.0      18
0101001  00     19
0101101  01000   18
0101201  003  2194.  608.  0.    0.    0.    19
0101301  0.0   0.0  0.0   18
*
*   Valve DH12
*
0150000 DH12           valve
0150101 010010000  020000000    6013  1.0    1.0       00100
0150201 1   0.0      0.0     0.0
0150300 mtrvlv
0150301 501   502  0.1  0.0
*
*   Pipe -- suction line, 12 inch GCB-7
*
0200000 "12-GCB-7"     pipe
0200001 6
0200101 0.8185  6
0200301 4.0     6
0200601 0.0     6
0200801 1.5e-4 0.0      6
0200901 0.0    0.0      1
0200902 1.216  1.216    2
0200903 0.0    0.0      3
0200904 0.216  0.216    4
0200905 1.0    1.0      5
0201001  00     6
0201101  01000   5
0201201  003    50. 100.    0.    0.    0.    6
0201301  0.0   0.0  0.0   5
*
*   Junction of suction line with train 1-2
*
0230000 inletjun      sngljun
0230101 020010000  040000000  0.0  0.0  0.0  01100
0230201 1  0.0     0.0     0.0
```

```
*
*   Junction of suction line with train 1-1
*
0240000 inletjun      sngljun
0240101 020010000  440000000  0.0  0.0  0.0  01100
0240201 1  0.0     0.0     0.0
*
*   Piping to train 1-2 pump suction -- includes 2 1/2 inch bypass line
*   around valve DH-1518.
*
0400000 "2.5GCB-7"     pipe
0400001 13
0400101 0.8185  1
0400102 0.03322 2
0400103 0.03322 7
0400104 0.81850 13
0400201 0.03322 3
0400202 0.02215 4
0400203 0.03322 12
0400301 4.0     13
0400601 0.0     13
0400801 1.5e-4 0.0      13
0400901 1.0    1.0      1
0400902 0.216  0.216    2
0400903 0.648  0.648    3
0400904 0.0    0.0      4
0400905 0.648  0.648    5
0400906 0.216  0.216    6
0400907 1.216  1.216    7
0400908 0.0    0.0      8
0400909 0.216  0.216    9
0400910 0.216  0.216    10
0400911 0.0    0.0      11
0400912 1.216  1.216    12
0401001  00      13
0401101  01000   3
0401102  00000   4
0401103  01000   6
0401104  00000   7
0401105  01000   12
0401201  003     50. 100.    0.    0.    0.    13
0401301  0.0   0.0  0.0   12
*
*   Single Junction (Component 43)
*
0430000 inletjun      sngljun
0430101 040010000  120000000  0.0  0.0  0.0  01100
0430201 1  0.0     0.0     0.0
*
*   pipe    (Component 120) INCLUDES 18, 12, AND 10 INCH PIPE
*
1200000 "12-GBC-8"     pipe
1200001 36
1200101 1.6467  1
1200102 0.8150  12
1200103 0.5731  36
1200301 4.0     36
1200601 0.0     36
1200801 1.5e-4 0.0      36
1200901 0.316  0.316    1
1200902 0.0    0.0      2
1200903 0.216  0.216    3
1200904 0.0    0.0      6
1200905 0.216  0.216    7
1200906 0.0    0.0      9
1200907 0.216  0.216    10
1200908 0.0    0.0      11
1200909 3.0    3.0      12    * P42-2 decay heat/LPI pump
```

```
1200910 0.216  0.216    13
1200911 1.0    1.0      14
1200912 0.0    0.0      15
1200913 0.0    0.0      19
1200914 0.216  0.216    20
1200915 0.0    0.0      21
1200916 0.0    0.0      22
1200917 0.216  0.216    23
1200918 0.0    0.0      24
1200919 0.216  0.216    25
1200920 0.216  0.216    26
1200921 0.0    0.0      29
1200922 0.216  0.216    32
1200923 0.0    0.0      34
1200924 0.216  0.216    35
1201001  00      36
1201101  01000   35
1201201  003     50. 100.    0.    0.    0.    36
1201301  0.0   0.0  0.0   35
*
* Second parallel piping run begins here.
*
* pipe    (Component 440)
*
4400000 "2.5GCB-7"      pipe
4400001 13
4400101 0.8185  1
4400102 0.03322 2
4400103 0.03322 7
4400104 0.81850 13
4400201 0.03322 3
4400202 0.02215 4
4400203 0.03322 12
4400301 4.0     13
4400601 0.0     13
4400801 1.5e-4 0.0      13
4400901 1.0    1.0      1
4400902 0.216  0.216    2
4400903 0.648  0.648    3
4400904 0.0    0.0      4
4400905 0.648  0.648    5
4400906 0.216  0.216    6
4400907 1.216  1.216    7
4400908 0.0    0.0      8
4400909 0.216  0.216    9
4400910 0.216  0.216    10
4400911 0.0    0.0      11
4400912 1.216  1.216    12
4401001  00      13
4401101  01000   6
4401102  00000   7
4401103  01000   12
4401201  003     50. 100.    0.    0.    0.    13
4401301  0.0   0.0  0.0   12
*
*   Single Junction (Component 43)
*
4430000 inletjun      sngljun
4430101 440010000  520000000  0.0  0.0  0.0  01100
4430201 1  0.0      0.0      0.0
*
*   Pipe    INCLUDES 18, 12, AND 10 INCH PIPE
*
5200000 "12-GBC-8"      pipe
5200001 36
5200101 1.6487  1
5200102 0.8150  12
5200103 0.5731  36
```

```
5200301 4.0      36
5200601 0.0      36
5200801 1.5e-4 0.0      36
5200901 0.316  0.316    1
5200902 0.0    0.0      2
5200903 0.216  0.216    3
5200904 0.0    0.0      6
5200905 0.216  0.216    7
5200906 0.0    0.0      9
5200907 0.216  0.216    10
5200908 0.0    0.0      11
5200909 3.0    3.0      12     * P42-1 decay heat/LPI pump
5200910 0.216  0.216    13
5200911 1.0    1.0      14
5200912 0.0    0.0      15
5200913 0.0    0.0      19
5200914 0.216  0.216    20
5200915 0.0    0.0      21
5200916 0.0    0.0      22
5200917 0.216  0.216    23
5200918 0.0    0.0      24
5200919 0.216  0.216    25
5200920 0.216  0.216    26
5200921 0.0    0.0      29
5200922 0.216  0.216    32
5200923 0.0    0.0      34
5200924 0.216  0.216    35
5201001  00     36
5201101  01000   35
5201201  003     50. 100.    0.    0.    0.    36
5201301  0.0    0.0  0.0   35
*
*   Break for BS-2, located at DHR cooler 1-2
*
7230000    BREAK-1   valve                                      * fvcahs
7230101    120010000 902000000 0.5731    0.         0.          000100
7230201    1         0.        0.        0.
7230300    trpvlv
7230301    506
*
*   Break for BS-2, located at DHR cooler 1-1
*
7240000    BREAK-2   valve                                      * fvcahs
7240101    520010000 902000000 0.5731    0.         0.          000100
7240201    1         0.        0.        0.
7240300    trpvlv
7240301    506
*
*   Time-dependent volume downstream of the leak
*
9020000    AUXBLDG   tmdpvol
9020101    18.40     0.        3000.
9020102    0         0         0
9020103    0         0         10
9020200    03        0
9020201    0.0       15.       213.
*
* ============================ Heat Structures ==============================
*
*    Core heat structure
*
15151000  12        9         2         1         0.
15151100  0         1
15151101  5         0.01542   1         0.01571   2         0.01792
15151201  2         5         3         6         4         6
15151301  .85       2   .9 3   1. 4   1.4 5   0. 8
15151400  0
15151401  2000      6         760.      7         710.      8         650. 9
```

```
15151501  0          0          0          0          0.         12
15151601  514010000 00000       1          0          4144.5     12
15151701  1      0.0778 0. 0. 1
15151702  1      0.0885 0. 0. 2
15151703  1      0.0877 0. 0. 3
15151704  1      0.0860 0. 0. 4
15151705  1      0.0847 0. 0. 5
15151706  1      0.0839 0. 0. 6
15151707  1      0.0840 0. 0. 7
15151708  1      0.0846 0. 0. 8
15151709  1      0.0862 0. 0. 9
15151710  1      0.0879 0. 0. 10
15151711  1      0.0859 0. 0. 11
15151712  1      0.0627 0. 0. 12
*           dia  htlngf htlngr glngf glngr glossf glossr boilf strno      * 902000
15151801     0.   100.   100.   0.    0.    0.     0.     1.    12       * 902000
15151901 0.0415   100.   100.   0.    0.    0.     0.     1.    12       * 902000
*
*
**********************************************************************
* thermal properties of uo2 - composition 2
*---------------------------------------------------------------------
*          mtrl type       th.con     ht.cap         material
20100200 tbl/fctn          1          1           * uo2
*---------------------------------------------------------------------
*  thermal properties of uo2
*---------------------------------------------------------------------
*
*                   temperature          th.cond
* 20100201             188.6               1.284e-3
20100201               0.                  1.284e-3
20100202               332.6               1.1235e-3
20100203               440.6               9.951e-4
20100204               500.0               9.2806e-4
20100205               650.0               7.4194e-4
20100206               800.0               7.4361e-4
20100207               950.0               6.7750e-4
20100208              1100.0               6.2278e-4
20100209              1250.0               5.7722e-4
20100210              1400.0               5.3889e-4
20100211              1500.0               5.0639e-4
20100212              1700.0               4.7889e-4
20100213              1850.0               4.5528e-4
20100214              2000.0               4.3556e-4
20100215              2150.0               4.1861e-4
20100216              2300.0               4.0472e-4
20100217              2450.0               3.9306e-4
20100218              2600.0               3.8389e-4
20100219              3100.0               3.6750e-4
20100220              3600.0               3.7028e-4
20100221              4100.0               3.9056e-4
20100222              4600.0               4.2722e-4
20100223              5100.0               4.8056e-4
*
*                   temperature          vol ht cap
* 20100251             32.0                34.45
20100251               0.                  34.45
20100252               122.0               38.35
20100253               212.0               40.95
20100254               392.0               43.55
20100255               752.0               46.80
20100256              2012.0               51.35
20100257              2732.0               52.65
20100258              3092.0               56.55
20100259              3452.0               63.05
20100260              3812.0               72.80
20100261              4352.0               89.70
20100262              4532.0               94.25
```

```
20100263            4712.0             98.15
20100264            4892.0            100.10
20100265            5144.0            101.40
20100266            8000.0            101.40
*
**********************************************************************
* thermal properties of fuel gap - composition 3
**********************************************************************
*         mtrl type      th.con    ht.cap          material
20100300 tbl/fctn          1          1          * fuel gap
*---------------------------------------------------------------------
*  thermal properties of fuel gap
*---------------------------------------------------------------------
*values of thermal conductivity were derived from matpro and a frapcon
*computer run at constant power over the total burnup interval
*
*burnup =     0.00000 pressure =  .12362e+04  gap width =       .00213
* he frac =  .10000e+01  kr frac = 0.          xe frac = 0.
*                  temperature          th. cond.
*  20100301              70.000          2.52892e-05
20100301              0.000          2.52892e-05
20100302            300.000          3.14014e-05
20100303            500.000          3.70561e-05
20100304            700.000          4.23747e-05
20100305            900.000          4.74311e-05
20100306           1100.000          5.22745e-05
20100307           1300.000          5.69395e-05
20100308           1500.000          6.14522e-05
20100309           1700.000          6.58324e-05
20100310           1900.000          7.00957e-05
20100311           2100.000          7.42548e-05
20100312           2300.000          7.83201e-05
20100313           2500.000          8.23004e-05
20100314           2700.000          8.62029e-05
20100315           2900.000          9.00341e-05
20100316           3100.000          9.37993e-05
20100317           3300.000          9.75033e-05
20100318           3500.000          1.01150e-04
20100319           3700.000          1.04744e-04
20100320           3900.000          1.08288e-04
20100321           4100.000          1.11784e-04
20100322           4300.000          1.15236e-04
20100323           4500.000          1.18646e-04
20100324           4700.000          1.22017e-04
20100325           4900.000          1.25349e-04
20100326           5100.000          1.28645e-04
20100327           5300.000          1.31907e-04
*
*                  temperature          vol ht cap
20100351              0.0               0.000075
20100352           5400.0               0.000075
*
**********************************************************************
* thermal properties of cladding - composition 4
**********************************************************************
*crdno   mtrl type      th.con    ht.cap          material
20100400 tbl/fctn          1          1          * cladding
*---------------------------------------------------------------------
*  thermal properties of cladding
*---------------------------------------------------------------------
*
*                  temperature          th.cond
*  20100401              50.0            1.9267e-3
20100401              0.0            1.9267e-3
20100402            392.0            1.9267e-3
20100403            752.0            2.2478e-3
20100404           1112.0            2.7297e-3
20100405           1472.0            3.0508e-3
```

```
20100406          1832.0              3.5325e-3
20100407          2182.0              4.0142e-3
20100408          2552.0              4.8169e-3
20100409          2912.0              5.7803e-3
20100410          3272.0              7.0647e-3
20100411          3632.0              8.8311e-3
20100412          3992.0              1.0918e-2
*
*                 temperature         vol ht cap
20100451             0.0               28.392
20100452          1480.3               34.476
20100453          1675.0               85.176
20100454          1787.5               34.370
20100455          3500.0               34.476
*
* ------------------------------------------------------------------
* table number 1 - core power vs. time
* ------------------------------------------------------------------
* this table represents a best-estimate of fission product decay
* heat using the ans standard plus a contribution from actinides.
* reference: work by c. b. davis
*
*   Model modified to reflect the B&W Plant power level - John Schroeder
*
*          type      trip       factor     power(mw)
20200100   power     0          1.0        2772.
*
*                    sec        normalized power
20200101             -1.        0.         * start at one second
* 20200101           -1.        1.0
* 20200102           0.         1.0
* 20200103            .1        .6382
* 20200104            .2        .5720
* 20200105            .3        .3806
* 20200106            .4        .2792
* 20200107            .5        .2246
* 20200108            .6        .1904
* 20200109            .7        .1672
* 20200110            .8        .1503
* 20200111            .9        .1376
 20200112          1.0        .1275
 20200113          1.5        .1032
 20200114          2.         .09884
 20200115          3.         .09209
 20200116          4.         .08690
 20200117          5.         .08271
 20200118          6.         .07922
 20200119          8.         .07375
 20200120         10.         .06967
 20200121         15.         .06251
 20200122         20.         .05751
 20200123         30.         .05060
 20200124         40.         .04591
 20200125         50.         .04246
 20200126         60.         .03977
 20200127         80.         .03604
 20200128        100.         .03357
 20200129        125.         .03145
 20200130        150.         .02997
 20200131        200.         .02798
 20200132        300.         .02565
 20200133        400.         .02418
 20200134        500.         .02307
 20200135        600.         .02217
 20200136        800.         .02073
 20200137       1000.         .01959
 20200138       1250.         .01844
 20200139       1500.         .01749
```

```
20200140      2000.        .01600
20200141      2500.        .01489
20200142      3000.        .01401
20200143      3500.        .01331
20200144      4000.        .01274
20200145      5000.        .01185
20200146      6000.        .01118
20200147      7000.        .01067
20200148      8000.        .01025
20200149      9000.        .009895
20200150     10000.        .009596
20200151     15000.        .008553
20200152     20000.        .007902
*
* ========================== Control Variables ==============================
*
20500000  4095
*
*   Sum of total eccs
*
*           name      type      factor    init      f         c
20501100 "ecctot"   sum       2.2046    0.0       1

*           a0        coeff     name      parameter no
20501101  0.0       1.0       mflowj    711000000
20501102            1.0       mflowj    712000000
*
*   Integrate eccs mass flow rate
*
*           name      type      factor    init      f c       min       max
20501200 "inteccs"  integral  1.0       0.0       0 3       0.0       4.8e6
*
*           name      no.
20501201  cntrlvar  110
*
*   Controller for break vapor enthalpy - output SI units, break conditions
*   taken from donor volume.
*
*   hg = ug + p*vg
*
20501300  "v-enth"  sum       1.        0.        1
20501301  0.        1.        ug        120360000
20501302            1.        cntrlvar  140
*
20501400  "v-p*vg"  mult      1.        0.        1
20501401                      p         120360000
20501402                      cntrlvar  150
*
20501500  "v-1/rho" div       1.        1.        1
20501501                      rhog      120360000
*
*   Controller for break liquid enthalpy
*
*   hf = uf + p*vf
*
20501600  "f-enth"  sum       1.        0.        1
20501601  0.        1.        uf        120360000
20501602            1.        cntrlvar  170
*
20501700  "f-pv"    mult      1.        0.        1
20501701                      p         120360000
20501702                      cntrlvar  180
*
20501800  "1/rho"   div       1.        1.        1
20501801                      rhof      120360000
*
    Controller for break vapor mass flow rate
*
```

```
20501900  mflowg    mult      0.05324   0.         1
20501901                      voidgj    723000000
20501902                      rhogj     723000000
20501903                      velgj     723000000
*
*   Controller for break fluid mass flow rate
*
20502000  mflowf    mult      0.05324   0.         1
20502001                      voidfj    723000000
20502002                      rhofj     723000000
20502003                      velfj     723000000
*
 end
```

LISTING 3 - RELAP5 Input for BS-3

```
*   B&W Plant DHR LETDOWN INTERFACING LOCA - BS-3
*
*   File:
*
*      rlp003.mdl
*
*   Description:
*
*      This RELAP5/MOD3 input deck is used to obtain the steam source term
*      resulting from an ISLOCA in the B&W Plant decay heat removal pump
*      discharge line.  The break occurs in auxilliary building room 113.
*      This model was constructed from a long-term cooling deck written by
*      Craig Kullberg, a low-pressure injection system piping model written
*      by Everet Gruen, and an Oconee "generic" core decay heat model.
*
*   Written by:
*
*       John Schroeder  6/91
*
  100     new        transnt
  101     run
  102     british    british
* 104     none                   * No restart file
*
*                                alloc
  105     1.0        2.0         10800.
*
  110     air
  115     1.0
*
*         end        min         max        opt       minor      major      restart
  201     1.         1.0e-4      0.0010     3         10000      100000     50000
  202     15.        1.0e-4      0.0050     3         1000       10000      10000
  203     500.       1.0e-4      0.0100     3         500        10000      10000
  204     3600.      1.0e-4      0.1000     3         100        1000       5000
*
* =============================== Minor Edits ===============================
*
  301     p          080020000 * Pressure at break
  302     tempf      080020000 * Temperature at break
  303     tempg      080020000 * Temperature at break
  304     mflowj     723000000 * Total break flow rate
* 305     mflowj     021000000 *
  306     mflowj     724000000
  307     cntrlvar   190         * Break vapor mass flow rate
  308     cntrlvar   130         * Break vapor enthalpy
  309     cntrlvar   200         * Break liquid mass flow rate
  310     cntrlvar   160         * Break liquid enthalpy
*
  311     cputime    0
  312     tmass      0
  314     p          512010000 * top of vessel
  315     mflowj     712000000 * chg
  316     mflowj     711000000 * hpi
  317     q          514010000 * mid plane energy
  318     p          300010000 *
  319     p          301010000 *
* 320     cntrlvar   110
  321     cntrlvar   120         * Integrated injection flow
*
* ================================= Trips ==================================
*
*   501 trip card starts transient by opening motor operated valve
*   502 trip card keeps valve open for a long time
```

```
*   Trip 502 exists only to meet code requirement for a closinr    p.
*   503 opens the 1st relief valve PSV4849 on 320 psia
*   504 opens the 2nd relief valve F*5A on 75 psia
*   505 opens the 3nd relief valvr PSV1550 on 450 psia
*
  501     time      0         ge  null  0   0.0   n    * open boundary MOV
  502     time      0         ge  null  0   1.e6  n
* 503     p         30010000  cs  null  0   320.  n
  506     time      0         ge  null  0   0.0   n    * open break at time 0.
*
  598     time      0         lt  null  0   1.e6  n
  599     time      0         gt  null  0   1.e6  n
*
*
* ========================= Hydrodynamic Components =========================
*
*   Time dependent volume for charging junction
*
8990000   TDVCHG    tmdpvol
8990101   12.00     0.        3000.
8990102   0.        0.        0.
8990103   0.        0.        10
8990200   03        0
8990201   -1.0e99   2000.     70.
8990202   0.0       2000.     70.
*
*   CHARGING FLOW RATE
*   PERFORMANCE CURVES NOT AVAILABLE
*   APPROXIMATED TO  300 GPM AT 2200 PISA
*   AND 700 GPM AT 200 PSIA.
*
*   at power chg rate                       = 300*62.4*.00223 = 41.74
*   run out mass flow rate, mass flow rate = 700*62.4*.00223=97.4 lbs/sec
*
*
7120000   CHGFLOW   tmdpjun             * LOOP chg FLOWRATE
7120101   899000000 300000000 .0500
7120200   1         598       p         300010000
7120201   -1.00e+00 0.0       0.0       0.0
7120202   20.       97.4      0.0       0.0
7120203   200.      97.4      0.0       0.0
7120204   2200.     41.74     0.0       0.0
*
*   Time dependent volume for HPI and LPI junction
*
9000000   TDVLPI    tmdpvol
9000101   12.00     0.0       3600.
9000102   0.        0.        0.
9000103   0.        0.        10
9000200   03        0
9000201   -1.0e99   2000.     70.
9000202   0.0       2000.     70.
*
*   Sum of Lpi and Hpi mass flow rates
*
7110000   ECCSFLOW  tmdpjun             *    2 HPI FLOWRATE + 0 LPI flow rate
7110101   900000000 300000000           1.4
7110200   1         598       p         300010000
7110201   -1.00e+00 0.        0.0       0.0
7110202   0.        214.      0.0       0.0
7110203   115.      214.      0.0       0.0
7110204   155.      214.      0.0       0.0
7110206   192.      214.      0.0       0.0
7110207   197.      214.      0.0       0.0
7110208   1614.     160.      0.0       0.0
*
*   Component 300:
*       4 loops cold leg junction connection
```

```
*
3000000   COLDLG  pipe
3000001   1
3000101   12.00   1
3000301   0.0     1
3000401   3024.   1
3000601   0.0     1
3000801   0.00015 2.42     1
3001001   00      1
3001201   003     2260.   557.   0.     0.    0.     1
*
*   Component 508:
*       the following data represent the downcomer and lower plenum
*
5080000   LOWRPLM   branch
5080001   2         0
5080101   0.0       12.000    1266.
5080102   0.0       0.0       0.0
5080103   0.00015   5.6655    00
5080200   003       2260.     557.
*         from      to        area      f loss    r loss    vcahs
5081101   300010000 508010000 12.0000   1.3180    1.3180    10100
5082101   508010000 514000000 32.8781   0.0        0.0      10100
*         f vel.    v vel.    i vel.
5081201   0.        0.        0.        * 37994.087
5082201   0.        0.        0.        * 37994.087
*
*   Component 514:
*       the following data represent the core and upper plenum
*
5140000   CORE      pipe
5140001   1
5140101   0.0       1
5140301   12.       1
5140401   1265.     1
5140601   90.0      1
5140701   12.       1
5140801   0.00015   0.040092  1
5141001   00                  1
5141201   003       2194.     608.      0.        0.        0.        1
*
*  Component 512:
*       the following data represent the upper head and pressurizer
*
5120000   UPPRPLM   branch
5120001   1         0
5120101   0.0       12.000    2808.
5120102   0.0       90.0      12.00
5120103   0.00015   10.0      00
5120200   003       2194.     608.
5121101   514010000 512000000 0.0       0.1979    0.1979    10100
5121201   0.        0.        0.        * 36815.350
*
*
9240000   VESSLOUT  sngljun
9240101   512010000 301000000  12.00  0.1200    0.1200    00002
9240201   0         0. 0. 0.0
*
*   Component 301
*
3010000   HOTLEG    pipe
3010001   1
3010101   12.00     1
3010301   0.0       1
3010401   3025.     1
3010601   0.0       1
3010801   0.00015   2.42      1
3011001   00        1
```

```
3011201   003       2194.     608.      0.        0.        0.        1
*
*   Single Junction -- decay heat removal pump suction line
*
2050000   DHRINLET  sngljun
2050101   301010000 010000000 0.0       0.0       0.0       01100
2050201   1         0.0       0.0       0.0
*
*   Pipe
*
0100000 "12-CCA-4"      pipe
0100001 19
0100101 0.6013  19
0100301 4.0     19
0100601 0.0     19
0100801 1.5e-4 0.0      19
0100901 0.0    0.0      1
0100902 0.108  0.108    2
0100903 0.108  0.108    3
0100904 0.0    0.0      4
0100905 0.216  0.216    5
0100906 0.0    0.0      6
0100907 0.0    0.0      9
0100908 0.108  0.108   10
0100909 0.0    0.0     11
0100910 0.324  0.324   12
0100911 0.0    0.0     13
0100912 0.216  0.216   14
0100913 0.0    0.0     15
0100914 0.0    0.0     16
0100915 0.216  0.216   17
0100916 0.0    0.0     18
0101001  00     19
0101101  01000   18
0101201  003  2194.  608.  0.    0.    0.    19
0101301  0.0   0.0  0.0   18
*
*   Valve DH12
*
0150000 DH12            valve
0150101 010010000  020000000  0.6013  1.0    1.0       00100
0150201 1    0.0      0.0      0.0
0150300 mtrvlv
0150301 501   502  0.1  0.0
*
*   Pipe -- suction line, 12 inch GCB-7
*
0200000 "12-GCB-7"     pipe
0200001 6
0200101 0.8185  6
0200301 4.0     6
0200601 0.0     6
0200801 1.5e-4 0.0      6
0200901 0.0    0.0      1
0200902 1.216  1.216    2
0200903 0.0    0.0      3
0200904 0.216  0.216    4
0200905 1.0    1.0      5
0201001  00     6
0201101  01000   5
0201201  003    50. 100.    0.    0.    0.    6
0201301  0.0   0.0  0.0   5
*
*   Junction of suction line with train 1-2
*
0230000 inletjun      sngljun
0230101 020010000  040000000  0.0  0.0  0.0  01100
0230201 1  0.0     0.0     0.0
```

```
*
*
*   Junction of suction line with train 1-1
*
0240000 inletjun      sngljun
0240101 020010000  440000000  0.0  0.0  0.0  01100
0240201 1  0.0     0.0     0.0
*
*   Piping to train 1-2 pump suction -- includes 2 1/2 inch bypass line
*   around valve DH-1518.
*
0400000 "2.5GCB-7"     pipe
0400001 13
0400101 0.8185  1
0400102 0.03322 2
0400103 0.03322 7
0400104 0.81850 13
0400201 0.03322 3
0400202 0.02215 4
0400203 0.03322 12
0400301 4.0     13
0400601 0.0     13
0400801 1.5e-4 0.0      13
0400901 1.0    1.0      1
0400902 0.216  0.216    2
0400903 0.648  0.648    3
0400904 0.0    0.0      4
0400905 0.648  0.648    5
0400906 0.216  0.216    6
0400907 1.216  1.216    7
0400908 0.0    0.0      8
0400909 0.216  0.216    9
0400910 0.216  0.216    10
0400911 0.0    0.0      11
0400912 1.216  1.216    12
0401001  00     13
0401101  01000   3
0401102  00000   4
0401103  01000   6
0401104  00000   7
0401105  01000   12
0401201  003    50. 100.    0.    0.    0.    13
0401301  0.0   0.0  0.0   12
*
*   Single Junction (Component 41)
*
0410000 inletjun      sngljun
0410101 040010000  050000000  0.0  0.0  0.0  01100
0410201 1  0.0     0.0     0.0
*
*   pipe    (Component 50)
*
0500000 "18-GCB-8"     pipe
0500001  3
0500101 1.6467  3
0500301 4.0     3
0500601 0.0     3
0500801 1.5e-4 0.0      3
0500901 1.216  1.216    1
0500902 1.0    1.0      2
0501001  00     3
0501101  01000   2
0501201  003    50. 100.    0.    0.    0.    3
0501301  0.0   0.0  0.0   2
*
*   Single Junction (Component 51)
*
0510000 inletjun      sngljun
```

```
0510101 050010000  060000000  0.0  0.0  0.0  01100
0510201 1  0.0     0.0     0.0
*
*   pipe    (Component 60)
*
0600000 "18-HCB-1"     pipe
0600001  1
0600101 1.6941  1
0600301 4.0     1
0600601 0.0     1
0600801 1.5e-4 0.0       1
0601001  00     1
0601201  003     50. 100.    0.    0.    0.    1
*
*   Single Junction (Component 63)
*
0630000 inletjun      sngljun
0630101 060010000  080000000  0.0  0.0  0.0  01100
0630201 1  0.0     0.0     0.0
*
*   pipe    (Component 80)
*
0800000 "18-GCB-8"     pipe
0800001  2
0800101 1.6467  2
0800301 4.0     2
0800601 0.0     2
0800801 1.5e-4 0.0       2
0800901 0.0    0.0       1
0801001  00     2
0801101  01000   1
0801201  003     50. 100.    0.    0.    0.    2
0801301  0.0   0.0  0.0   1
*
* Second parallel piping run begins here
*
* pipe    (Component 440)
*
4400000 "2.5GCB-7"     pipe
4400001 13
4400101 0.8185  1
4400102 0.03322 2
4400103 0.03322 7
4400104 0.81850 13
4400201 0.03322 3
4400202 0.0[illegible]5 4
4400203 0.0332[illegible] 12
4400301 4.0     13
4400601 0.0     13
4400801 1.5e-4 0.0      13
4400901 1.0    1.0      1
4400902 0.216  0.216    2
4400903 0.648  0.648    3
4400904 0.0    0.0      4
4400905 0.648  0.648    5
4400906 0.216  0.216    6
4400907 1.216  1.216    7
4400908 0.0    0.0      8
4400909 0.216  0.216    9
4400910 0.216  0.216    10
4400911 0.0    0.0      11
4400912 1.216  1.216    12
4401001  00     13
4401101  01000   6
4401102  00000   7
4401103  01000   12
4401201  003     50. 100.    0.    0.    0.    13
4401301  0.0   0.0  0.0   12
```

```
*
*   Single Junction (Component 41)
*
4410000 inletjun      sngljun
4410101 440010000  450000000  0.0  0.0  0.0  01100
4410201 1  0.0     0.0     0.0
*
*   pipe    (Component 50)
*
4500000 "18-GCB-8"     pipe
4500001  3
4500101 1.6467  3
4500301 4.0     3
4500601 0.0     3
4500801 1.5e-4 0.0      3
4500901 1.216  1.216    1
4500902 1.0    1.0      2
4501001  00     3
4501101  01000   2
4501201  003    50. 100.    0.    0.    0.    3
4501301  0.0   0.0  0.0   2
*
*   Single Junction (Component 51)
*
4510000 inletjun      sngljun
4510101 450010000  460000000  0.0  0.0  0.0  01100
4510201 1  0.0     0.0     0.0
*
*   pipe    (Component 60)
*
4600000 "18-HCB-1"     pipe
4600001  1
4600101 1.6941  1
4600301 4.0     1
4600601 0.0     1
4600801 1.5e-4 0.0      1
4601001  00     1
4601201  003    50. 100.    0.    0.    0.    1
*
*   Single Junction (Component 63)
*
4630000 inletjun   sngljun
4630101 460010000  480000000  0.0  0.0  0.0  01100
4630201 1  0.0     0.0     0.0
*
*   pipe    (Component 80)
*
4800000 "18-GCB-8"     pipe
4800001  2
4800101 1.6467  2
4800301 4.0     2
4800601 0.0     2
4800801 1.5e-4 0.0      2
4800901 0.0    0.0      1
4801001  00     2
4801101  01000   1
4801201  003    50. 100.    0.    0.    0.    2
4801301  0.0   0.0  0.0   1
*
*   Break for BS-2, located at DHR cooler 1-2
*
7230000   BREAK-1   valve                                 * fvcahs
7230101   080010000 902000000 1.6467    0.        0.        000100
7230201   1         0.        0.        0.
7230300   trpvlv
7230301   506
*
*   Break for BS-2, located at DHR cooler 1-1
```

```
*
7240000   BREAK-2   valve                                  * fvcahs
7240101   480010000 90200000u 1.6467    0.        0.        000100
7240201   1         0.        0.        0.
7240300   trpvlv
7240301   506
*
*   Time-dependent volume downstream of the leak
*
9020000   AUXBLDG   tmdpvol
9020101   18.40     0.        3000.
902C102   0         0         0
9020103   0         0         10
9020200   03        0
9020201   0.0       15.       213.
*
* ========================== Heat Structures ==============================
*
*    Core heat structure
*
15151000  12        9         2         1         0.
15151100  0         1
15151101  5         0.01542   1         0.01571   2         0.01792
15151201  2         5         3         6         4         8
15151301  .85       2   .9 3   1. 4   1.4 5   0. 8
15151400  0
15151401  2000.     6         760.      7         710.      8         650. 9
15151501  0         0         0         0         0.        12
15151601  514010000 00000     1         0         4144.5    12
151"'701  1     0.0778 0. 0. 1
15151702  '     0.0885 0. 0. 2
15151703  1     0.0877 0. 0. 3
15151704  1     0.0860 0. 0. 4
15151705  1     0.0847 0. 0. 5
15151706  1     0.0839 0. 0. 6
15151707  1     0.0840 0. 0. 7
15151708  1     0.0848 0. 0. 8
15151709  1     0 0862 0. 0. .
15151710  1     0.0879 0. 0. 10
15151711  1     0.0859 0. 0. 11
15151712  1     0.0627 0. 0. 12
*          dia   htlngf htlngr glngf glngr glossf glossr boilf strno     * 902000
15151801    0.   100.   100.   0.    0.    0.     0.     1.    12       * 902000
15151901 0.0415  100.   100.   0.    0.    0.     0.     1.    12       * 902000
*
*
**************************************************************************
* thermal properties of uo2 - c mposition 2
*-------------------------------------------------------------------------
*         mtrl type       th.con     ht.cap          material
20100200 tbl/fctn         1          1           * uo2
*-------------------------------------------------------------------------
*  thermal properties of uo2
*-------------------------------------------------------------------------
*
*                  temperature         th.cond
* 20100201            188.6              1.284e-3
20100201             0.                  1.284e-3
20100202             332.6               1.1235e-3
20100203             440.6               9.951e-4
20100204             500.0               9.2806e-4
20100205             650.0               7.4194e-4
20100206             800.0               7.4361e-4
20100207             950.0               6.7750e-4
20100208            1100.0               6.2278e-4
20100209            1250.0               5.7722e-4
20100210            1400.0               5.3889e-4
20100211            1500.0               5.0639e-4
```

```
20100212            1700.0              1.7889e-4
20100213            1850.0              4.5528e-4
20100214            2000.0              4.3556e-4
20100215            2150.0              4.1861e-4
20100216            2300.0              4.0472e-4
20100217            2450.0              3.9306e-4
20100218            2600.0              3.8389e-4
20100219            3100.0              3.6750e-4
20100220            3600.0              3.7028e-4
20100221            4100.0              3.9056e-4
20100222            4600.0              4.2722e-4
20100223            5100.0              4.805[illegible]4
*
*                   temperature         vol ht ca[illegible]
* 20100251             32.0               34.45
20100251              0.               34.45
20100252            122.0              38.35
20100253            212.0              40.95
20100254            392.0              43.55
20100255            752.0              46.80
20100256           2012.0              51.35
20100257           2732.0              52.65
20100258           3092.0              56.55
20100259           3452.0              63.05
20100260           3812.0              [illegible].80
20100261           4352.0              [illegible].70
20100262           4532.0              94.25
20100263           4712.0              98.15
20100264           4892.0             100.10
20100265           5144.0             101.40
20100266           8000.0             101.40
*
*******************************************************************
* thermal properties of fuel gap - composition 3
*******************************************************************
*        mtrl type      th.con    ht.cap         material
20100300 tbl/fctn         1         1          * fuel gap
*------------------------------------------------------------------
*  thermal properties of fuel gap
*------------------------------------------------------------------
*values of thermal conductivity were derived from matpro and a frapcon
*computer run at constant power over the total burnup interval
*
*burnup =      0.00000 pressure =  .12362e+04  gap width =       .00213
* he frac =  .10000e+01  kr frac = 0.          xe frac = 0.
*                  temperature          th. cond.
*  20100301             70.000            2.52892e-0[illegible]
20100301             0.000            2.52892e-05
20100302           300.000            3.14014e-0[illegible]
20100303           500.000            3.70561e-05
20100304           700.000            4.23747e-05
20100305           900.000            4.74311e-05
20100306          1100.000            5.22745e-05
20100307          1300.000            5.69395e-05
20100308          1500.000            6.14522e-05
20100309          1700.000            6.58324e-05
20100310          1900.000            7.00957e-05
20100311          2100.000            7.42548e-05
20100312          2300.000            7.83201e-05
20100313          2500.000            8.23004e-05
20100314          2700.000            8.62029e-05
20100315          2900.000            9.00341e-05
20100316          3100.000            9.37993e-05
20100317          3300.000            9.75033e-05
20100318          3500.000            1.01150e-04
20100319          3700.000            1.04744e-04
20100320          3900.000            1.08288e-04
20100321          4100.000            1.11784e-04
```

```
20100322          4300.000          1.15236e-04
20100323          4500.000          1.18646e-04
20100..4          4700.000          1.22017e-04
20100325          4900.000          1.25349e-04
20100326          5100.000          1.28645e-04
20100327          5300.000          1.31907e-04
*
*                 temperature        vol ht cap
20100351            0.0                0.000075
20100352          5400.0               0.000075
*
**********************************************************************
* thermal properties of cladding - composition 4
**********************************************************************
*crdno   mtrl type      th.con    ht.cap        material
20100400 tbl/fctn         1         1           * cladding
*---------------------------------------------------------------------
*  thermal properties of cladding
*---------------------------------------------------------------------
*
*                 temperature        th.cond
*  20100401          50.0               1.9267e-3
20100401            0.0              1.9267e-3
20100402          392.0              1.9267e-3
20100403          752.0              2.2478e-3
20100404         1112.0              2.7297e-3
20100405         1472.0              3.0508e-3
20100406         1832.0              3.5325e-3
20100407         2192.0              4.0142e-3
20100408         2552.0              4.8169e-3
20100409         2912.0              5.7803e-3
20100410         3272.0              7.0647e-3
20100411         3632.0              8.8311e-3
20100412         3992.0              1.0918e-2
*
*                 temperature        vol ht cap
20100451            0.0              28.392
20100452         1480.3              34.476
20100453         1675.00             85.176
20100454         1787.5              34.370
20100455         3500.0              34.476
*
* ---------------------------------------------------------------
* table number 1 - core power vs. time
* ------------------------------------------    -----------------
* this table represents a best-estimate of fission product decay
* heat using the ans standard plus a contribution from actinides.
* reference: work by c. b. davis
*
*   Model modified to reflect the B&W Plant power level - John Schroeder
*
*         type      trip      factor    power(mw)
20200100  power     0         1.0       2772.
*
*                   sec       normalized power
20200101           -1.        0.        * start at one second
* 20200101         -1.        1.0
* 20200102          0.        1.0
* 20200103          .1        .8382
* 20200104          .2        .5720
* 20200105          .3        .3806
* 20200106          .4        .2792
* 20200107          .5        .2246
* 20200108          .6        .1904
* 20200109          .7        .1672
* 20200110          .8        .1503
* 20200111          .9        .1376
20200112        1.0       .1275
```

```
20200113        1.5       .1032
20200114        2.        .09884
20200115        3.        .09209
20200116        4.        .08690
20200117        5.        .08271
20200118        6.        .07922
20200119        8.        .07375
20200120       10.        .06967
20200121       15.        .06251
20200122       20.        .05751
20200123       30.        .05060
20200124       40.        .04591
20200125       50.        .04246
20200126       60.        .03977
20200127       80.        .03604
20200128      100.        .03357
20200129      125.        .03145
20200130      150.        .02997
20200131      200.        .02798
20200132      300.        .02565
20200133      400.        .02418
20200134      500.        .02307
20200135      600.        .02217
20200136      800.        .02073
20200137     1000.        .01959
20200138     1250.        .01844
20200139     1500.        .01749
20200140     2000.        .01600
20200141     2500.        .01489
20200142     3000.        .01401
20200143     3500.        .01331
20200144     4000.        .01274
20200145     5000.        .01185
20200146     6000.        .01118
20200147     7000.        .01067
20200148     8000.        .01025
20200149     9000.        .009895
20200150    10000.        .009596
20200151    15000.        .008553
20200152    20000.        .007902
*
* ========================== Control Variables ==============================
*
20500000  4095
*
*   Sum of total eccs
*
*          name       type       factor     init       f          c
20501100 "ecctot"    sum        2.2046     0.0        1
*
*          a0         coeff      name       parameter no.
20501101  0.0        1.0        mflowj     711000000
20501102             1.0        mflow_     712000000
*
*   Integrate eccs mass flow rate
*
*          name       type       factor     init       f c        min        max
20501200 "inteccs"   integral   1.0        0.0        0 3        0.0        4.8e6
*
*          name       no.
20501201  cntrlvar   110
*
*   Controller for break vapor enthalpy - output SI units, break conditions
*   taken from donor volume.
*
*   hg = ug + p*vg
*
20501300  "v-enth"   sum        1.         0.         1
```

```
20501301  0.        1.        ug        080020000
20501302            1.        cntrlvar  140
*
20501400  "v-p*vg"  mult      1.        0.        1
20501401                      p         080020000
20501402                      cntrlvar  150
*
20501500  "v-1/rho" div       1.        1.        1
20501501                      rhog      080020000
*
*   Controller for break liquid enthalpy
*
*   hf = uf + p*vf
*
20501600  "f-enth"  sum       1.        0.        1
20501601  0.        1.        uf        080020000
20501602            1.        cntrlvar  170
*
20501700  "f-pv"    mult      1.        0.        1
20501701                      p         080020000
20501702                      cntrlvar  180
*
20501800  "1/rho"   div       1.        1.        1
20501801                      rhof      080020000
*
*   Controller for break vapor mass flow rate
*
20501900  mflowg    mult      0.05324   0.        1
20501901                      voidgj    723000000
20501902                      rhogj     723000000
20501903                      velgj     723000000
*
*   Controller for break fluid mass flow rate
*
20502000  mflowf    mult      0.05324   0.        1
20502001                      voidfj    723000000
20502002                      rhofj     723000000
20502003                      velfj     723000000
*
.end
```

LISTING 4 - RELAP5 Input for BS-4

```
*   B&W Plant DHR LETDOWN INTERFACING LOCA - BS-2
*
*   File:
*
*     rlp004.mdl
*
*   Description:
*
*     This RELAP5/MOD3 input deck is used to obtain the    m source term
*     resulting from   n ISLOCA in the B&W Plant decay hea. removal pump
*     discharge line.  The break occurs in auxilliary building room 113.
*     This model was constructed from a long-term cooling deck written by
*     Craig Kullberg, a low-pressure injection system piping model written
*     by Everet Gruen, and an Oconee "generic" core decay heat model.
*
*   Written by:
*
*       John Schroeder  6/91
*
 100     new       transnt
 101     run
 102     british   british
* 104    none                 * No restart file
*
*                             alloc
 105     1.0       2.0        10800.
*
         air
         1.0
*
*        end       min        max        opt       minor     major     restart
 201     1.        1.0e-4     0.0010     3         10000     10000     50000
 202     15.       1.0e-4     0.0100     3         100       1000      5000
 203     1500.     1.0e-4     0.1000     3         100       1000      5000
 204     3000.     1.0e-4     1.0000     3         100       1000      5000
*
* ============================== Minor Edits ==============================
*
 301     p         120010000 * Pressure at break
 302     tempf     120010000 * Temperature at break
 303     tempg     120010000 * Temperature at break
 304     mflowj    723000000 * Total break flow rate
* 305    mflowj    021000000 *
* 306    mflowj    724000000
 307     cntrlvar  190        * Break vapor mass flow rate
 308     cntrlvar  130        * Break vapor enthalpy
 309     cntrlvar  200        * Break liquid mass flow rate
 310     cntrlvar  160        * Break liquid enthalpy
*
 311     cputime   0
 312     tmass     0
 314     p         512010000 * top of vessel
 315     mflowj    712000000 * chg
 316     mflowj    711000000 * hpi
 317     q         514010000 * mid plane energy
 318     p         300010000 *
 319     p         301010000 *
* 320    cntrlvar  110
 321     cntrlvar  120        * Integrated injection flow
*
* ================================= Trips =================================
*
*   501 trip card starts transient by opening motor operated valve
*   502 trip card keeps valve open for a long time
```

```
*   Trip 502 exists only to meet code requirement for a closing trip.
*   503 opens the 1st relief valve PSV4849 on 320 psia
*   504 opens the 2nd relief valve FV5A on 75 psia
*   505 opens the 3nd relief valve PSV1550 on 450 psia
*
  501     time     0          ge  null  0   0.0   n    * open boundary MOV
  502     time     0          ge  null  0   1.e6  n
* 503     p        30010000   ge  null  0   320.  n
  506     time     0          ge  null  0   0.0   n    * open break at time 0.
*
  598     time     0          lt  null  0   1.e6  n
  599     time     0          gt  null  0   1.e6  n
*
*
* ======================== Hydrodynamic Components ========================
*
*   Time dependent volume for charging junction
*
8990000   TDVCHG     tmdpvol
8990101   12.00      0.         3000.
8990102   0.         0.         0.
8990103   0.         0.         10
8990200   03         0
8990201   -1.0e99    2000.      70.
8990202   0.0        2000.      70.
*
*   CHARGING FLOW RATE
*   PERFORMANCE CURVES NOT AVAILABLE
*   APPROXIMATED TO  300 GPM AT 2200 PISA
*   AND 700 GPM AT 200 PSIA.
*
*   at power chg rate                      = 300*62.4*.00223 = 41.74
*   run out mass flow rate, mass flow rate = 700*62.4*.00223=97.4 lbs/sec
*
*
7120000   CHGFLOW    tmdpjun              * LOOP chg FLOWRATE
7120101   899000000 300000000 .0500
7120200   1          598        p          300010000
7120201   -1.00e+00  0.0        0.0        0.0
7120202   20.        97.4       0.0        0.0
7120203   200.       97.4       0.0        0.0
7120204   2200.      41.74      0.0        0.0
*
*   Time dependent volume for HPI and LPI junction
*
9000000   TDVLPI     tmdpvol
9000101   12.00      0.0        3000.
9000102   0.         0.         0.
9000103   0.         0.         10
9000200   03         0
9000201   -1.0e99    2000.      70.
9000202   0.0        2000.      70.
*
*   Sum of Lpi and Hpi mass flow rates
*
7110000   ECCSFLOW   tmdpjun              *    2 HPI + 1 LPI flow rate
7110101   900000000 300000000             1.4
7110200   1          598        p          300010000
7110201   -1.00e+00  0.         0.0        0.0
7110202   0.         843.       0.0        0.0
7110203   115.       843.       0.0        0.0
7110204   156.       701.       0.0        0.0
7110206   192.       353.       0.0        0.0
7110207   197.       214.       0.0        0.0
7110208   1615.      160.       0.0        0.0
*
*   Component 300:
*       4 loops cold leg junction connection
```

```
*
3000000   COLDLG  pipe
3000001   1
3000101   12.00    1
3000301   0.0      1
3000401   3024.    1
3000601   0.0      1
3000801   0.00015 2.42     1
3001001   00       1
3001201   003      2260.   557.   0.     0.     0.     1
*
*   Component 508:
*       the following data represent the downcomer and lower plenum
*
5080000   LOWRPLM   branch
5080001   2         0
5080101   0.0       12.000    1266.
5080102   0.0       0.0       0.0
5080103   0.00015   5.6655    00
5080200   003       2280.     557.
*         from      to        area      f loss    r loss    vcahs
5081101   300010000 508010000 12.0000   1.3180    1.3180    10100
5082101   508010000 514000000 32.8781   0.0        0.0      10100
*         f vel.    v vel.    i vel.
5081201   0.        0.        0.        * 37994.087
5082201   0.        0.        0.        * 37994.087
*
*   Component 514:
*       the following data represent the core and upper plenum
*
5140000   CORE      pipe
5140001   1
5140101   0.0       1
5140301   12.       1
5140401   1265.     1
5140601   90.0      1
5140701   12.       1
5140801   0.00015   0.040092  1
5141001   00                  1
5141201   003       2194.     608.      0.        0.        0.        1
*
*  Component 512:
*      the following data represent the upper head and pressurizer
*
5120000   UPPRPLM   branch
5120001   1         0
5120101   0.0       12.000    2808.
5120102   0.0       90.0      12.00
5120103   0.00015   10.0      00
5120200   003       2194.     608.
5121101   514010000 512000000 0.0       0.1979    0.1979    10100
5121201   0.        0.        0.        * 36815.350
*
*
9240000   VESSLOUT  sngljun
9240101   512010000 301000000  12.00  0.1200    0.1200    00002
9240201   0         0. 0. 0.0
*
*   Pipe
*
3010000   HOTLEG    pipe
3010001   1
3010101   12.00     1
3010301   0.0       1
3010401   3025.     1
3010601   0.0       1
3010801   0.00015   2.42      1
3011001   00        1
```

```
3011201 [illegible]      2194.    608.     0.       0.       0.       1
*
*  pipe [illegible] nent 120) INCLUDES 18, 12, AND 10 INCH PIPE
*
1200000 [illegible]      pipe  * first 35 volumes removed !
1200001 25
1200103 0.5731  25
1200301 4.0     25
1200601 0.0     25
1200801 1.5e-4 0.0      25
1200925 0.0    0.0        1
1200926 3.0    3.0        2
1200927 0.216  0.216      4
1200928 0.0    0.0        5
1200929 1.0    1.0        6
1200930 0.0    0.0        8
1200931 0.216  0.216      9
1200932 0.0    0.0        10
1200933 0.216  0.216      11
1200934 0.0    0.0        13
1200935 0.216  0.216      14
1200936 0.0    0.0        15
1200937 0.216  0.216      16
1200938 0.0    0.0        20
1200939 0.216  0.216      21
1200940 0.0    0.0        24
1201001  00     25
1201101  01000   24
1201201  003     50. 100.   0.   0.   0.   25
1201301  0.0   0.0  0.0   24
*
*  Single Junction
*
1390000 inletjun      sngljun
1390101 120010000  140000000  0.0  0.0  0.0  01100
1390201 1  0.0     0.0     0.0
*
*  LPI discharge piping
*
1400000 "10-CCB-6"     pipe
1400001  41
1400101 0.5731  41
1400201 0.3821  1
1400202 0.5731  40
1400301 4.0     41
1400601 0.0     41
1400801 1.5e-4 0.0     41
1400901 0.0    0.0     2
1400902 0.216  0.216   3
1400903 0.0    0.0     5
1400904 0.216  0.216   6
1400905 0.0    0.0     7
1400906 1.0    1.0     8
1400907 0.0    0.0     10
1400908 0.216  0.216   11
1400909 0.0    0.0     13
1400910 0.216  0.216   14
1400911 0.108  0.108   16
1400912 0.0    0.0     22
1400913 0.108  0.108   23
1400914 0.0    0.0     27
1400915 0.216  0.216   28
1400916 0.0    0.0     32
1400917 0.216  0.216   33
1400918 0.0    0.0     35
1400919 0.216  0.216   36
1400920 0.0    0.0     40
1401001  00     41
```

```
1401101  01000   40
1401201  003     50. 100.    0.    0.    0.    41
1401301  0.0   0.0  0.0   40
*
*  Single Junction -- inlet to LPI discharge, check valves have failed
*
1410000 inletjun      sngljun
1410101 140010000  301010000  0.0  0.0  0.0  01100
1410201 1  0.0     0.0     0.0
*
*   Break for BS-2, located at DHR cooler 1-2
*
7230000   BREAK-1   valve                               * fvcahs
7230101   902000000 120000000 0.5731    0.        0.        000100
7230201   1         0.        0.        0.
7230300   trpvlv
7230301   506
*
*   Time-dependent volume downstream of the leak
*
9020000   AUXBLDG   tmdpvol
9020101   18.40     0.        3000.
9020102   0         0         0
9020103   0         0         10
9020200   03        0
9020201   0.0       15.       213.
*
* ========================== Heat Structures ==============================
*
*    Core heat structure
*
15151000  12        9         2         1         0.
15151100  0         1
15151101  5         0.01542   1         0.01571   2         0.01792
15151201  2         5         3         6         4         8
15151301  .85       2   .9 3   1. 4   1.4 5   0. 8
15151400  0
15151401  2000.     6         760.      7         710.      8         650. 9
15151501  0         0         0         0         0.        12
15151601  514010000 00000     1         0         4144.5    12
15151701  1     0.0778 0. 0. 1
15151702  1     0.0885 0. 0. 2
15151703  1     0.0877 0. 0. 3
15151704  1     0.0860 0. 0. 4
15151705  1     0.0847 0. 0. 5
15151706  1     0.0839 0. 0. 6
15151707  1     0.0840 0. 0. 7
15151708  1     0.0848 0. 0. 8
15151709  1     0.0862 0. 0. 9
15151710  1     0.0879 0. 0. 10
15151711  1     0.0859 0. 0. 11
15151712  1     0.0627 0. 0. 12
*          dia  htlngf htlngr glngf glngr glossf glossr boilf strno     * 902000
15151801    0.   100.   100.   0.    0.    0.     0.     1.    12      * 902000
15151901 0.0415  100.   100.   0.    0.    0.     0.     1.    12      * 902000
*
*
***********************************************************************
* thermal properties of uo2 - composition 2
*----------------------------------------------------------------------
*          mtrl type      th.con     ht.cap          material
20100200 tbl/fctn           1          1           * uo2
*----------------------------------------------------------------------
*  thermal properties of uo2
*----------------------------------------------------------------------
*
*                    temperature          th.cond
* 20100201               188.6               1.284e-3
```

```
20100201            0.                 1.284e-3
20100202          332.6                1.1235e-3
20100203          440.6                9.951e-4
20100204          500.0                9.2806e-4
20100205          650.0                7.4194e-4
20100206          800.0                7.4361e-4
20100207          950.0                6.7750e-4
20100208         1100.0                6.2278e-4
20100209         1250.0                5.7722e-4
20100210         1400.0                5.3889e-4
20100211         1500.0                5.0639e-4
20100212         1700.0                4.7889e-4
20100213         1850.0                4.5528e-4
20100214         2000.0                4.3556e-4
20100215         2150.0                4.1861e-4
20100216         2300.0                4.0472e-4
20100217         2450.0                3.9306e-4
20100218         2600.0                3.8389e-4
20100219         3100.0                3.6750e-4
20100220         3600.0                3.7028e-4
20100271         41[illegible].0                3.9056e-4
20100222         4600.0                4.2722e-4
20100223         5100.0                4.8056e-4
*
*                temperature          vol ht cap
* 20100251          32.0                 34.45
20100251            0.                 34.45
20100252          122.0                38.35
20100253          212.0                40.95
20100254          392.0                43.55
20100255          752.0                46.80
20100256         2012.0                51.35
20100257         2732.0                52.65
20100258         3092.0                56.55
20100259         3452.0                63.05
20100260         3812.0                72.80
20100261         4352.0                89.70
20100262         4532.0                94.25
20100263         4712.0                98.15
20100264         4892.0               100.10
20100265         5144.0               101.40
20100266         8000.0               101.40
*
************************************************************************
* thermal properties of fuel gap - composition 3
************************************************************************
*         mtrl type      th.con    ht.cap        material
20100300 tbl/fctn          1         1          * fuel gap
*-----------------------------------------------------------------------
*  thermal properties of fuel gap
*-----------------------------------------------------------------------
*values of thermal conductivity were derived from matpro and a frapcon
*computer run at constant power over the total burnup interval
*
*burnup =      0.00000 pressure =  .12362e+04  gap width =       .00213
* he frac =  .10000e+01  kr frac = 0.           xe frac = 0.
*                 temperaturu            th  cond.
*  20100301            70.000              5289[illegible]e-05
20100301             0.000           2.5[illegible]02e-05
20100302           300.000           3.1[illegible]14e-05
20100303           500.000           3.70561e-05
20100304           700.000           4.23747e-05
20100305           [illegible]0.000           4.74311e-05
20100306          1100.000           5.22745e-05
20100307          1300.000           5.69395e-05
20100308          1500.000           6.14522e-05
20100309          1700.000           6.58324e-05
2010[illegible]10          1900.000           7.00957e-05
```

```
20100311           2100.000         7.42548e-05
20100312           2300.000         7.83201e-05
20100313           2500.000         8.23004e-05
20100314           2700.000         8.62029e-05
20100315           2900.000         9.00341e-05
20100316           3100.000         9.37993e-05
20100317           3300.000         9.75033e-05
20100318           3500.000         1.01150e-04
20100319           3700.000         1.04744e-04
20100320           3900.000         1.08288e-04
20100321           4100.000         1.11784e-04
20100322           4300.000         1.15236e-04
20100323           4500.000         1.18646e-04
20100324           4700.000         1.22017e-04
20100325           4900.000         1.25349e-04
20100326           5100.000         1.28645e-04
20100327           5300.000         1.31907e-04
*
*                  temperature        vol ht cap
20100351              0.0              0.000075
20100352           5400.0              0.000075
*
*************************************************************************
* thermal properties of cladding - composition 4
*************************************************************************
*crdno   mtrl type      th.con    ht.cap          material
20100400 tbl/fctn         1         1           * cladding
*------------------------------------------------------------------------
*  thermal properties of cladding
*------------------------------------------------------------------------
*
*                   temperature        th.cond
*  20100401              50.0               1.9267e-3
20100401              0.0              1.9267e-3
20100402            392.0              1.9267e-3
20100403            752.0              2.2478e-3
20100404           1112.0              2.7297e-3
20100405           1472.0              3.0508e-3
20100406           1832.0              3.5325e-3
20100407           2192.0              4.0142e-3
20100408           2552.0              4.8169e-3
20100409           2912.0              5.7803e-3
20100410           3272.0              7.0647e-3
20100411           3632.0              8.8311e-3
20100412           3992.0              1.0918e-2
*
*                   temperature        vol ht cap
20100451              0.0              28.392
20100452           1480.3              34.476
20100453           1675.00             85.176
20100454           1787.5              34.370
20100455           3500.0              34.476
*
* ---------------------------------------------------------------------
* table number 1 - core power vs. time
* ---------------------------------------------------------------------
* this table represents a best-estimate of fission product decay
* heat using the ans standard plus a contribution from actinides.
* reference: work by c. b. davis
*
*   Model modified to reflect the B&W Plant power level - John Schroeder
*
*         type      trip      factor     power(mw)
20200100  power     0         1.0        2772.
*
*                   sec       normalized power
20200101           -1.        0.          * start at one second
* 20200101         -1.        1.0
```

```
* 20200102          0.          1.0
* 20200103           .1         .8382
* 20200104           .2         .5720
* 20200105           .3         .3806
* 20200106           .4         .2793
* 20200107           .5         .2246
* 20200108           .6         .1904
* 20200109           .7         .1672
* 20200110           .8         .1503
* 20200111           .9         .1376
20200112         1.0          .1275
20200113         1.5          .1032
20200114         2.           .09884
20200115         3.           .09209
20200116         4.           .08690
20200117         5.           .08271
20200118         6.           .07922
20200119         8.           .07375
20200120        10.           .06967
20200121        15.           .06251
20200122        20.           .05751
20200123        30.           .05080
20200124        40.           .04591
20200125        50.           .04246
20200126        60.           .03977
20200127        80.           .03604
20200128       100.           .03357
20200129       125.           .03145
20200130       150.           .02997
20200131       200.           .02798
20200132       300.           .02565
20200133       400.           .02418
20200134       500.           .02307
20200135       600.           .02217
20200136       800.           .02073
20200137      1000.           .01959
20200138      1250.           .01844
20200139      1500.           .01749
20200140      2000.           .01600
20200141      2500.           .01489
20200142      3000.           .01401
20200143      3500.           .01331
20200144      4000.           .01274
20200145      5000.           .01185
20200146      6000.           .01118
20200147      7000.           .01067
20200148      8000.           .01025
20200149      9000.           .009895
20200150     10000.           .009596
20200151     15000.           .008553
20200152     20000.           .007902
*
* =========================== Control Variables ================================
*
20500000  4095
*
*   Sum of total eccs
*
*          name       type       factor     init       f          c
20501100 "ecctot"   sum        2.2046     0.0        1
*
*          a0         coeff      name       parameter no.
20501101 0.0        1.0        mflowj     711000000
20501102            1.0        mflowj     712000000
*
*   Integrate eccs mass flow rate
*
*          name       type       factor     init       f c        min        max
```

```
20501200 "inteccs"  integral  1.0       0.0       3       0.0       4.8e6
*
*         name      no.
20501201  cntrlvar  110
*
*   Controller for break vapor enthalpy - output SI units, break conditions
*   taken from donor volume.
*
*   hg = ug + p*vg
*
20501300  "v-enth"  sum       1.        0.        1
20501301  0.        1.        ug        120010000
20501302            1.        cntrlvar  140
*
20501400  "v-p*vg"  mult      1.        0.        1
20501401                      p         120010000
20501402                      cntrlvar  150
*
20501500  "v-1/rho" div       1.        1.        1
20501501                      rhog      120010000
*
*   Controller for break liquid enthalpy
*
*   hf = uf + p*vf
*
20501600  "f-enth"  sum       1.        0.        1
20501601  0.        1.        uf        120010000
20501602            1.        cntrlvar  170
*
20501700  "f-pv"    mult      1.        0.        1
20501701                      p         120010000
20501702                      cntrlvar  180
*
20501800  "1/rho"   div       1.        1.        1
20501801                      rhof      120010000
*
*   Controller for break vapor mass flow rate
*
20501900  mflowg    mult      0.05324   0.        1
20501901                      voidgj    723000000
20501902                      rhogj     723000000
20501903                      velgj     723000000
*
*   Controller for break fluid mass flow rate
*
20502000  mflowf    mult      0.05324   0.        1
20502001                      voidfj    723000000
20502002                      rhofj     723000000
20502003                      velfj     723000000
*
.end
```

LISTING 5 - RELAP5 Input for BS-5

```
*   B&W Plant INTERFACING LOCA - BS-5
*
*   File:
*
*      rlp005.mdl
*
*   Description:
*
*      This RELAP5/MOD3 input deck is used to obtain the steam source term
*      resulting from an ISLOCA in the B&W Plant high pressure injection
*      pump suction line.  The break occurs in auxiliary building room 115.
*      This model was constructed from a long-term cooling deck written by
*      Craig Kullberg, a low-pressure injection system piping model written
*      by Everet Gruen, and an Oconee "generic" core decay heat model.
*
*   Written by:
*
*       John Schroeder  6/91
*
 100     new        transnt
 101     run
 102     british    british
*
*                              alloc
 105     1.0        2.0        3600.
*
 110     air
 115     1.0
*
*        end        min        max        opt        minor      major      restart
 201     1.         1.0e-4     0.0010     3          10000      10000      50000
 202     15.        1.0e-4     0.0100     3          100        1000       5000
 203     1500.      1.0e-4     0.1000     3          100        1000       5000
 204     3600.      1.0e-4     1.0000     3          100        1000       5000
*
* =============================== Minor Edits ===============================
*
 301     p          514010000 * RCS Pressure
 302     tempf      514010000 * RCS Temperature
 303     tempg      514010000 * RCS Temperature
 304     mflowj     723000000 * Total break flow rate
*305     mflowj     021000000 *
*306     mflowj     724000000
 307     cntrlvar   190       * Break vapor mass flow rate
 308     cntrlvar   130       * Break vapor enthalpy
 309     cntrlvar   200       * Break liquid mass flow rate
 310     cntrlvar   160       * Break liquid enthalpy
*
*311     cputime    0
*312     tmass      0
*313     tmass      0
*314     p          512010000 * top of vessel
 315     mflowj     712000000 * chg
 316     mflowj     711000000 * hpi
*317     q          514010000 * mid plane energy
*318     p          300010000 *
*319     p          301010000 *
*320     cntrlvar   110
*
 321     cntrlvar   120       * Integrated injection flow
*
* ================================== Trips ==================================
*
 501     time       0         ge  null  0   0.0   n    * open MOV, break
```

```
 502      time       0          ge  null  0   1.e6  n
*
 503      t          301010000 ge  null  0   2450. n     * PORV
*
* ========================== Hydrodynamic Components ==========================
*
*   Time dependent volume for charging junction
*
8990000   TDVCHG     tmdpvol
8990101   12.00      0.         3000.
8990102   0.         0.         0.
8990103   0.         0.         10
8990200   03         0
8990201   -1.0e99    2000.      70.
8990202   0.0        2000.      70.
*
*   Charging flow rate
*   approximated to  300 gpm at 2200 psia
*   and 700 gpm at 200 psia.
*
*   at power chg rate                        = 300*62.4*.00223 = 41.74
*   run out mass flow rate, mass flow rate = 700*62.4*.00223 = 97.4 lbs/sec
*
7120000   CHGFLOW   tmdpjun              * LOOP chg FLOWRATE
7120101   899000000 300000000 .0500
7120200   1         501       p          300010000
7120201   -1.00e+00 0.0       0.0        0.0
7120202   20.       97.4      0.0        0.0
7120203   200.      97.4      0.0        0.0
7120204   2200.     41.74     0.0        0.0
*
*   Time dependent volume for HPI and LPI junction
*
9000000   TDVLPI     tmdpvol
9000101   12.00      0.0        3000.
9000102   0.         0.         0.
9000103   0.         0.         10
9000200   03         0
9000201   -1.0e99    2000.      70.
9000202   0.0        2000.      70.
*
*   Sum of LPI and HPI mass flow rates.
*
7110000   ECCSFLOW  tmdpjun              *    1 HPI + 2 LPI flow rate
7110101   900000000 300000000            1.4
7110200   1         501       p          300010000
7110201   -1.00e+00 0.        0.0        0.0
7110202   0.        1361.     0.0        0.0
7110203   115.      1361.     0.0        0.0
7110204   134.      1220.     0.0        0.0
7110206   156.      1081.     0.0        0.0
7110207   166.      942.      0.0        0.0
7110208   177.      8[illegible]      0.0        0.0
7110209   184.      664.      0.0        0.0
7110210   188.      524.      0.0        0.0
7110211   192.      385.      0.0        0.0
7110212   197.      107.      0.0        0.0
7110213   215.      107.      0.0        0.0
7110214   615.      102.      0.0        0.0
7110215   1615.     80.0      0.0        0.0
*
*   Cold leg -- 4 loops combined
*
3000000   COLDLG    pipe
3000001   1
3000101   12.00     1
3000301   0.0       1
3000401   3024.     1
```

```
3000601   0.0       1
3000801   0.00015   2.42      1
3001001   00        1
3001201   003       2260.     557.      0.        0.        0.        1
*
*   The downcomer and lower plenum
*
5080000   LOWRPLM   branch
5080001   2         0
5080101   0.0       12.000    1266.
5080102   0.0       0.0       0.0
5080103   0.00015   5.6655    00
5080200   003       2260.     557.
*         from      to        area      f loss    r loss    vcahs
5081101   300010000 508010000 12.5000   1.3180    1.3180    10100
5082101   508010000 514000000 32.8781   0.0       0.0       10100
*         f vel.    v vel.    i vel.
5081201   0.        0.        0.        * 37994.087
5082201   0.        0.        0.        * 37994.087
*
*   The core and upper plenum
*
5140000   CORE      pipe
5140001   1
5140101   0.0       1
5140301   12.       1
5140401   1265.     1
5140601   90.0      1
5140701   12.       1
5140801   0.00015   0.040092  1
5141001   00                  1
5141201   003       2194.     608.      0.        0.        0.        1
*
*   The upper head and pressurizer
*
5120000   UPPRPLM   branch
5120001   1         0
5120101   0.0       12.000    2808.
5120102   0.0       90.0      12.00
5120103   0.00015   10.0      00
5120200   003       2194.     608.
5121101   514010000 512000000 0.0       0.1979    0.1979    10100
5121201   0.        0.        0.        * 36815.350
*
*   Vessel outlet to hotleg
*
9240000   VESSLOUT  sngljun
9240101   512010000 301000000  12.00  0.1200    0.1200    00002
9240201   0         0. 0. 0.0
*
*   Hotleg -- all loops combined
*
3010000   HOTLEG    pipe
3010001   1
3010101   12.00     1
3010301   0.0       1
3010401   3025.     1
3010601   0.0       1
3010801   0.00015   2.42      1
3011001   00        1
3011201   003       2194.     608.      0.        0.        0.        1
*
*   Hotleg to high-pressure injection piping.  The injection point should be
*   the vessel downcomer but is placed on the hotleg to provide a continuous
*   flow path from injection point to break.
*
0150000   inletjun  sngljun
0150101   301010000 020000000 0.0       0.0       0.0       01100
```

```
0150201   1         0.0       0.0       0.0
*
*  83 ft of 2 1/2 inch pipe between the RCS and HP-2A
*
0200000   upstream  pipe
0200001   10
0200101   0.02463   10
0200301   8.3       10
0200601   0.0       10
0200801   1.5e-4    0.0       10
0200901   0.864     0.864     1
0200902   0.0       0.0       9
0201001   00        10
0201101   00000     9
0201201   003       2194.     608.      0.        0.        0.        10
0201301   0.0       0.0       0.0       9
*
*  2 1/2 inch valve HP-2A
*
0250000   HP-2A     valve
0250101   020010000 030000000 0.02463   0.144     0.144     01100
0250201   1         0.0       0.0       0.0
0250300   mtrvlv
0250301   501       502       1.0       1.0
*
*  Piping between HP-2A and break at suction of pump 1-2.  Total length of
*  piping is about 72 feet.  Pressure losses from bends and valves is
*  neglected.  This will produce a conservative break flow.
*
0300000   HPI       pipe
0300001   3
0300101   0.02463   3         * Flow area (ft2) 2.5 inch pipe
0300301   7.2       3         * Volume lengths (ft)
0300601   0.0       3
0300801   1.5e-4    0.0       3
0300901   0.0       0.0       2         * Loss coefficents
0301001   00        3
0301101   00000     2
0301201   003       50.       100.      0.        0.        0.        3
0301301   0.0       0.0       0.0       2
*
*  Break, located at suction to HPI pump 1-2
*
7230000   BREAK-5   valve                                     * fvcahs
7230101   030010000 902000000 0.02463   0.        0.        000100
7230201   1         0.        0.        0.
7230300   trpvlv
7230301   501
*
*  PORV - area does not matter so long as pressure is controlled
*
7240000   PORV      valve                                     * fvcahs
7240101   301010000 902000000 0.05      0.        0.        000100
7240201   1         0.        0.        0.
7240300   trpvlv
7240301   503
*
*  Time-dependent volume downstream of the leak
*
9020000   AUXBLDG   tmdpvol
9020101   18.40     0.        3000.
9020102   0         0         0
9020103   0         0         10
9020200   03        0
9020201   0.0       15.       213.
*
* ============================ Heat Structures ==============================
*
```

```
*    Core heat structure
*
15151000  12        9         2         1         0.
15151100  0         1
15151101  5         0.01542   1         0.01571   2         0.C   2
15151201  2         5         3         6         4         8
15151301  .85       2   .9 3   1. 4   1.4 5   0. 8
15151400  0
15151401  2000.     6         700.      7         710.      8         650. 9
15151501  0         0         0         0         0.        12
15151601  514010000 00000     1         0         4144.5    12
15151701  1         0.0778    0.        0.        1
15151702  1         0.0885    0.        0.        2
15151703  1         0.0877    0.        0.        3
15151704  1         0.0860    0.        0.        4
15151705  1         0.0847    0.        0.        5
15151706  1         0.0839    0.        0.        6
15151707  1         0.0840    0.        0.        7
15151708  1         0.0848    0.        0.        8
15151709  1         0.0862    0.        0.        9
15151710  1         0.0879    0.        0.        10
15151711  1         0.0859    0.        0.        11
15151712  1         0.0627    0.        0.        12
*          dia  htlngf htlngr glngf glngr glossf glossr boilf strno     * 902000
15151801    0.   100.   100.   0.    0.    0.    0.     1.    12      * 902000
15151901 0.0415  100.   100.   0.    0.    0.    0.     1.    12      * 902000
*
*
*   thermal properties of uo2 - composition 2
*
*        mtrl type      th.con    ht.cap         material
20100200 tbl/fctn         1         1           * uo2
*
*                 temperature         th.cond
* 20100201           188.6               1.284e-3
20100201              0.                 1.284e-3
20100202            332.6                1.1235e-3
20100203            440.6                9.951e-4
20100204            500.0                9.2806e-4
20100205            650.0                7.4194e-4
20100206            800.0                7.4361e-4
20100207            950.0                6.7750e-4
20100208           1100.0                6.2278e-4
20100209           1250.0                5.7722e-4
20100210           1400.0                5.3889e-4
20100211           1500.0                5.0639e-4
20100212           1700.0                4.7889e-4
20100213           1850.0                4.5528e-4
20100214           2000.0                4.3556e-4
20100215           2150.0                4.1861e-4
20100216           2300.0                4.0472e-4
20100217           2450.0                3.9306e-4
20100218           2600.0                3.8389e-4
20100219           3100.0                3.6750e-4
20100220           3600.0                3.7028e-4
20100221           4100.0                3.9056e-4
20100222           4600.0                4.2722e-4
20100223           5100.0                ' 8056e-4
*
*                 temperature           ht cap
* 20100251            32.0               34.45
20100251              0.                34.45
20100252            122.0               38.35
20100253            212.0               40.95
20100254            392.0               43.55
20100255            752.0               46.80
20100256           2012.0               51.35
20100257           2732.0               52.65
```

```
20100258            3082.0               56.55
20100259            3452.0               63.05
20100260            3812.0               72.80
20100261            4352.0               89.70
20100262            4532.0               94.25
20100263            4712.0               98.15
20100264            4892.0              100.10
20100265            5144.0              101.40
20100266            8000.0              101.40
*
*
*   thermal properties of fuel gap - composition 3
*
*        mtrl type      th.con    ht.cap          material
20100300 tbl/fctn          1         1          * fuel gap
*
*   values of thermal conductivity were derived from matpro and a frapcon
*   computer run at constant power over thu total burnup interval
*
*   burnup =     0.00000 pressure =  .12362e+04  gap width =       .00213
*   he frac =  .10000e+01  kr frac = 0.              xe frac = 0.
*                temperature          th. cond.
*  20100301            70.000            2.52892e-05
20100301             0.000           2.52892e-05
20100302           300.000           3.14014e-05
20100303           500.000           3.70561e-05
20100304           700.000           4.23747e-05
20100305           900.000           4.74311e-05
20100306          1100.000           5.22745e-05
20100307          1300.000           5.69395e-05
20100308          1500.000           6.14522e-05
20100309          1700.000           6.58324e-05
20100310          1900.000           7.00957e-05
20100311          2100.000           7.42548e-05
20100312          2300.000           7.83201e-05
20100313          2500.000           8.23004e-05
20100314          2700.000           8.62029e-05
20100315          2900.000           9.00341e-05
20100316          3100.000           9.37993e-05
20100317          3300.000           9.75033e-05
20100318          3500.000           1.01150e-04
20100319          3700.000           1.04744e-04
20100320          3900.000           1.08288e-04
20100321          4100.000           1.11784e-04
20100322          4300.000           1.15236e-04
20100323          4500.000           1.18646e-04
20100324          4700.000           1.22017e-04
20100325          4900.000           1.25349e-04
20100326          5100.000           1.28645e-04
20100327          5300.000           1.31907e-04
*
*                 temperature          vol ht cap
20100351             0.0                 0.000075
20100352            5400.0               0.000075
*
*
*   thermal properties of cladding - composition 4
*
*crdno   mtrl type      th.con    ht.cap          material
20100400 tbl/fctn          1         1          * cladding
*
*                 temperature         th.cond
*  20100401            50.0             1.9267e-3
20100401             0.0             1.9267e-3
20100402           392.0             1.9267e-3
20100403           752.0             2.2478e-3
20100404          1112.0             2.7297e-3
20100405          1472.0             3.0508e-3
```

```
20100406            1832.0              3.5325e-3
20100407            2192.0              4.0142e-3
20100408            2552.0              4.8169e-3
20100409            2912.0              5.7803e-3
20100410            3272.0              7.0647e-3
20100411            3632.0              8.8311e-3
20100412            3992.0              1.0918e-2
*
*                  temperature         vol ht cap
20100451               0.0              28.392
20100452            1480.3              34.476
20100453            1675.00             85.176
20100454            1787.5              34.370
20100455            3500.0              34.476
*
* -----------------------------------------------------------------------
*
*   Table Number 1 - Core Power vs. Time
*
*   this table represents a best-estimate of fission product decay
*   heat using the ans standard plus a contribution from actinides.
*   reference: work by c. b. davis
*
*   Model modified to reflect the B&W Plant power level - John Schroeder
*
*         type      trip      factor    power(mw)
20200100  power     0         1.0       2772.
*
*                   sec       normalized power
20200101           -1.        0.         * start at one sec[illegible]nd
* 20200101         -1.         1.0
* 20200102          0.         1.0
* 20200103           .1        .8382
* 20200104           .2        .5720
* 20200105           .3        .3806
* 20200106           .4        .2792
* 20200107           .5        .2246
* 20200108           .6        .1904
* 20200109           .7        .1672
* 20200110           .8        .15[illegible]3
* 20200111           .9        .1376
20200112         1.0       .1275
20200113         1.5       .1032
20200114         2         .09884
20200115         3.        .09209
20200116         4.        .08690
20200117         5.        .08[illegible]71
20200118         6.        .07922
20200119         8.        .07375
20200120        10.        .06967
20200121        15.        .06251
20200122        20.        .05751
20200123        30.        .05060
20200124        40.        .04591
20200125        50.        .04246
20200126        60.        .03977
20200127        80.        .03604
20200128       100.        .03357
20200129       125.        .03145
20200130       150.        .02997
20200131       200.        .02798
20200132       300.        .02565
20200133       400.        .02418
20200134       500.        .02307
20200135       600.        .02217
20200136       800.        .02073
20200137      1000.        .01959
20200138      1250.        .01844
```

```
20200139     1500.       .01749
20200140     2000.       .01600
20200141     2500.       .01489
20200142     3000.       .01401
20200143     3500.       .01331
20200144     4000.       .01274
20200145     5000.       .01185
20200146     6000.       .01118
20200147     7000.       .01067
20200148     8000.       .01025
20200149     9000.       .009895
20200150    10000.       .009596
20200151    15000.       .008553
20200152    20000.       .007902
*
* ========================== Control Variables ==============================
*
20500000  4095
*
*   Sum of total eccs
*
*           name      type      factor    init      f         c
20501100 "ecctot"   sum       2.2046    0.0       1
*
*           a0        coeff     name      parameter no.
20501101  0.0       1.0       mflowj    711000000
20501102            1.0       mflowj    712000000
*
*   Integrate eccs mass flow rate
*
*           name      type      factor    init      f c       min       max
20501200 "inteccs"  integral  1.0       0.0       0 3       0.0       4.8e6
*
*           name      no.
20501201  cntrlvar  110
*
*   Controller for break vapor enthalpy - output SI units, break conditions
*   taken from donor volume.
*
*   hg = ug + p*vg
*
20501300  "v-enth"  sum       1.        0.        1
20501301  0.        1.        ug        030030000
20501302            1.        cntrlvar  140
*
20501400  "v-p*vg"  mult      1.        0.        1
20501401                      p         030030000
20501402                      cntrlvar  150
*
20501500  "v-1/rho" div       1.        1.        1
20501501                      rhog      030030000
*
*   Controller for break liquid enthalpy
*
*   hf = uf + p*vf
*
20501600  "f-enth"  sum       1.        0.        1
20501601  0.        1.        uf        030030000
20501602            1.        cntrlvar  170
*
20501700  "f-pv"    mult      1.        0.        1
20501701                      p         030030000
20501702                      cntrlvar  180
*
20501800  "1/rho"   div       1.        1.        1
20501801                      rhof      030030000
*
*   Controller for break vapor mass flow rate
```

```
*
20501900  mflowg    mult      0.00229   0.        1
20501901                      voidgj    723000000
20501902                      rhogj     723000000
20501903                      velgj     723000000
*
*   Controller for break fluid mass flow rate
*
20502000  mflowf    mult      0.00229   0.        1
20502001                      voidfj    723000000
20502002                      rhofj     723000000
20502003                      velfj     723000000
*
.end
```

LISTING 6 - CONTAIN Input for BS-1

```
&& ========================== Model Description ==============================
&&
&& File:
&&
&&     cnt001.mdl
&&
&& Description:
&&
&&     BS-1.  This input deck describes a five volume model of the B&W Plant
&&     auxiliary building.  The rooms modeled are 105, 113, 115, and 236.
&&     The steam source is a 12 inch break in the decay heat removal
&&     pump suction piping located in room 236.  This model does not include
&&     water aerosols (the dropout option is used).
&&
&& Written by:
&&
&&     John Schroeder  6/91
&&
&& ========================= Machine Control Input ===========================
cray
eoi
&& ============================ Global Input =================================
&&
&& Section 3.2, p. 3-11
&&
&&     Atmospheric Gases
&&
&&     Material     Description
&&     --------     -----------
&&     o2           oxygen
&&     n2           nitrogen
&&     h2ov         steam
&&     h2ol         water
&&
control
    ncells    = 6       && Number of cells
    ntitl     = 2       && Number of title lines
    ntzone    = 5       && Number of time zones
    nac       = 0       && Number of aerosol groups
    nsectn    = 0       && Number of aerosol sections
eoi
&&
&& -------------- Material, Fission Product, and Aerosol Names ---------------
&&
&& Section 3.2.1, p. 3-13
&&
material
    compound
        n2 o2           && Air
        h2ov h2ol       && Steam and water
        conc            && Structural materials
&&
&& ---------------------------- Reactor Type ---------------------------------
&&
&& Section 3.2.2, p. 3-17
&&
thermal                 && Water-cooled reactor
&&
&& ---------------------------- Flow Options ---------------------------------
&&
&& Section 3.2.3, p. 3-17
&&
flows
&&
```

```
&& Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&             1, 2, 3.
&&
   area(1,5) = 8.88    && Cross-sectional area of flow path           (m2)
   avl(1,5)  = 14.6    && Ratio of area to inertial length, A/L       (m)
   cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&& Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
   area(1,2) = 12.6
   avl(1,2)  = 20.7
   cfc(1,2)  = 1.00
&&
&& Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
   area(2,5) = 0.892
   avl(2,5)  = 1.46
   cfc(2,5)  = 1.0
&&
&& Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
   area(2,3) = 1.95
   avl(2,3)  = 3.2
   cfc(2,3)  = 1.0
&&
&& Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
   area(3,5) = 1.95
   avl(3,5)  = 3.2
   cfc(3,5)  = 1.00
&&
&& Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
   area(3,4) = 2.97
   avl(3,4)  = 4.88
   cfc(3,4)  = 1.00
&&
&& Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&             10, 11, 12, and 13.
&&
   area(4,5) = 29.1
   avl(4,5)  = 157.
   cfc(4,5)  = 1.00
&&
&& Junction 8 - Balance of Plant to environment, includes only blowout
&&             paths.
&&
   area(5,6) = 46.5
   avl(5,6)  = 250.
   cfc(5,6)  = 1.00
&&
   implicit
   dropout
&&
&& Compartment and junction elevation data
&&
&& Compartments
&&
   elevcl(1)  = 169.   && Center of mass elevation for Rm 105         (m)
   elevcl(2)  = 169.   && Center of mass elevation for Rm 113         (m)
   elevcl(3)  = 169.   && Center of mass elevation for Rm 115         (m)
   elevcl(4)  = 175.   && Center of mass elevation for Rm 236         (m)
   elevcl(5)  = 185.   && Center of mass elevation for Rm BOP         (m)
   elevcl(6)  = 185.   && Center of mass elevation for Environment    (m)
&&
&& Junctions
&&
   elevfp(1,5)= 167.
```

```
   elevfp(5,1)= 167.

   elevfp(1,2)= 170.
   elevfp(2,1)= 170.

   elevfp(2,5)= 172.
   elevfp(5,2)= 172.

   elevfp(2,3)= 170.
   elevfp(3,2)= 170.

   elevfp(3,5)= 170.
   elevfp(5,3)= 170.

   elevfp(3,4)= 172.
   elevfp(4,3)= 172.

   elevfp(4,5)= 173.
   elevfp(5,4)= 173.

   elevfp(5,6)= 211.
   elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ------------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& -------------------------------- Times ------------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
    3600.                && Maximum CPU time limit                    (s)
    0.                   && Problem start time                        (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&  Max Ts    Ts     Zone
&&  ------  ------  ------                                            (s)
       1.     10.     10.
       5.     50.    100.
      10.    100.   1000.
      50.    100.   2000.
     100.    100.   3600.
&& ----------------------
eoi
&&
&& --------------------------- Output Control ------------------------------
&&
&&  Section 3.2.7, p. 3-38
&&
shortedt      = 1      && System ts between short edits
longedt       = 1      && Ts edits between long edits
prflow                 && Print intercell flow data
praer                  &&       detailed aerosol inventories
prlow-cl               &&       lower cell model
prheat                 &&       heat transfer structure model
prengsys               &&       engineered system model
title
          B&W Plant Auxilliary Building Steam Propagation Model
                     Five Compartment Model -- BS-1
&&
&&
&& ===================== Cell Input and Cell Control ========================
```

```
&&
&& Section 3.3, p. 3-40
&&
&& ---------------------------- Cell 1, Room 105 --------------------------------
cell 1
control
   nhtm=2  mxslab=11  nsoatm=0  nspatm=7  nnensy=1  jconc=1  jpool=1
eoi
title
      Cell 1, Room 105
&&
&& Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                    (m3, m)
   atmos     = 3        && Number of materials
               1.01e5   && Pressure                                   (Pa)
               305.     && Temperature                                (K)
      n2    = 0.75      && Initial nitrogen fraction
      o2    = 0.20      && Initial oxygen fraction
      h2ov  = 0.05      && Initial water vapor fraction
struc
   name      = Ceiling       && Name of structure
   type      = roof          && Type of structure
   shape     = slab          && Shape of structure
   nslab     = 10            && Number of nodes in structure
   chrlen    = 18.7          && Characteristic length of structure    (m)
   slarea    = 295.          && Area                                  (m2)
   tunif     = 305.          && Initial uniform temperature           (K)
   compound  =  conc conc conc conc conc conc conc conc conc conc
   x         = 0. .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
   eoi
&&
   name      = Walls         && Name of structure
   type      = wall          && Type of structure
   shape     = slab          && Shape of structure
   nslab     = 10            && Number of nodes in structure
   chrlen    = 5.49          && Characteristic length of structure    (m)
   slarea    = 298.          && Area                                  (m2)
   tunif     = 305.          && Initial uniform temperature           (K)
   compound  =  conc conc conc conc conc conc conc conc conc conc
   x         = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
   eoi
&&
condense
ht-tran     on  on  on  on  on
overflow    1
&&
&& Lower cell input
&&
low-cell
   geometry= 295.       && Area of layers in lower cell               (m2)
      bc  = 305.        && Basemat boundary condition temperature     (K)
      concrete
         compos = 1       && Number of materials
                  conc    && Material
                  43200.  && Mass of material
         temp   = 305.    && Initial temperature
      eoi
      pool
         temp   = 305.    && Initial temperature
      eoi
eoi
&&
&& Engineered safety systems
&&
engineer    Spill  1  1  5  -.152
   overflow  1  5  1.74
eoi
```

```
&&
&& --------------------------- Cell 2, Room 113 ------------------------------
cell 2
control
   nhtm=2  mxslab=11  nsoatm=0  nspatm=0  naensy=1  jconc=5  jpool=1
eoi
title
       Cell 2, Room 113
&&
&&  Upper Cell Input
&&
geometry  3.794e2  6.10 && Cell volume and height                     (m3, m)
    atmos     = 3
               1.01e5  && Pressure                                    (Pa)
               305.    && Temperature                                 (K)
        o2    = 0.20
        n2    = 0.75
        h2ov  = 0.05
&&
struc
    name    = Ceiling        && Name of structure
    type    = roof           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 17.7           && Characteristic length of structure       (m)
    slarea  = 86.4           && Area                                     (m2)
    tunif   = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls          && Name of structure
    type    = wall           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 5.49           && Characteristic length of structure       (m)
    slarea  = 254.           && Area                                     (m2)
    tunif   = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
     x      = 0.  .040 .080 .120 .160 .200 .240 .280 .320 .360 .398 &&  (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
    geometry= 86.4       && Area of layers in lower cell                 (m2)
        bc  = 305.       && Basemat boundary condition temperature       (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     19000. && Mass of material                          (kg)
            temp   = 305.   && Initial temperature                       (K)
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  2  1  0.0
    overflow  2  1  3.05
eoi
&&
```

```
&& --------------------------- Cell 3, Room 115 ------------------------------
cell 3
control
   nhtm=2  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
       Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                    (m3, m)
   atmos    = 3
               1.01e5      && Pressure
               305.        && Temperature
       o2   = 0.20
       n2   = 0.75
       h2ov = 0.05
struc
    name    = Ceiling       && Name of structure
    type    = roof          && Type of structure
    shape   = slab          && Shape of structure
    nslab   = 10            && Number of nodes in structure
    chrlen  = 14.6          && Characteristic length of structure   (m)
    slarea  = 107.          && Area                                 (m2)
    tunif   = 305.          && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc c  c
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .2 , .305 && (m)
    eoi
 &&
    name    = Walls         && Name of structure
    type    = wall
    shape   = slab
    nslab   = 10
    chrlen  = 5.49
    slarea  = 241.
    tunif   = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
 &&
 condense
 ht-tran  on  on  on  on  on
 overflow  3
 &&
 &&  Lower cell inrut
 &&
 low-cell
    geometry= 107.      && Area of layers in lower cell                (m2)
       bc  = 305.       && Basemat boundary condition temperature      (K)
       concrete
          compos = 1      && Number of materials
                   conc   && Material
                   23500. && Mass of material
          temp   = 305.   && Initial temperature
       eoi
       pool
          temp   = 305.   && Initial temperature
       eoi
 eoi
 &&
 &&  Engineered safety systems
 &&
 engineer    Spill  1  3  2  0.
    overflow  3  2  3.05
 eoi
 &&
 && --------------------------- Cell 4, Room 236 ------------------------------
 cell 4
```

```
control
    nhtm=1  mxslab=11  nsoatm=2  nspatm=300 jconc=1  jpool=1  naensy=2
    nsoeng=1  nspeng=4
eoi
title
        Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                          (m3, m)
    atmos    = 3
              1.01e5        && Pressure
              305.          && Temperature
        o2   = 0.25
        n2   = 0.75
        h2ov = 0.05
source=2
&&
&&  Blowdown of saturated primary system water
&&
    h2ov  = 299
    iflag = 2
    t     =    0.0         1.0         2.0         3.0         4.0
               5.0         6.0         7.0         8.0         9.0
              10.0        11.0        12.0        13.0        14.0
              15.0        25.0        35.0        45.0        55.0
              65.0        75.0        85.0        95.0       105.0
             115.0       125.0       135.0       145.0       155.0
             165.0       175.0       185.0       195.0       205.0
             215.0       225.0       235.0       245.0       255.0
             265.0       275.0       285.0       295.0       305.0
             315.0       325.0       335.0       345.0       355.0
             365.0       375.0       385.0       395.0       405.0
             415.0       425.0       435.0       445.0       455.0
             465.0       475.0       485.0       495.0       505.0
             515.0       525.0       535.0       545.0       555.0
             565.0       575.0       585.0       595.0       605.0
             615.0       625.0       635.0       645.0       655.0
             665.0       675.0       685.0       695.0       705.0
             715.0       725.0       735.0       745.0       755.0
             765.0       775.0       785.0       795.0       805.0
             815.0       825.0       835.0       845.0       855.0
             865.0       875.0       885.0       895.0       905.0
             915.0       925.0       935.0       945.0       955.0
             965.0       975.0       985.0       995.0      1005.0
            1015.0      1025.0      1035.0      1045.0      1055.0
            1065.0      1075.0      1085.0      1095.0      1105.0
            1115.0      1125.0      1135.0      1145.0      1155.0
            1165.0      1175.0      1185.0      1195.0      1205.0
            1215.0      1225.0      1235.0      1245.0      1255.0
            1265.0      1275.0      1285.0      1295.0      1305.0
            1315.0      1325.0      1335.0      1345.0      1355.0
            1365.0      1375.0      1385.0      1395.0      1405.0
            1415.0      1425.0      1435.0      1445.0      1455.0
            1465.0      1475.0      1485.0      1495.0      1505.0
            1515.0      1525.0      1535.0      1545.0      1555.0
            1565.0      1575.0      1585.0      1595.0      1605.0
            1615.0      1625.0      1635.0      1645.0      1655.0
            1665.0      1675.0      1685.0      1695.0      1705.0
            1715.0      1725.0      1735.0      1745.0      1755.0
            1765.0      1775.0      1785.0      1795.0      1805.0
            1815.0      1825.0      1835.0      1845.0      1855.0
            1865.0      1875.0      1885.0      1895.0      1905.0
            1915.0      1925.0      1935.0      1945.0      1955.0
            1965.0      1975.0      1985.0      1995.0      2005.0
            2015.0      2025.0      2035.0      2045.0      2055.0
            2065.0      2075.0      2085.0      2095.0      2105.0
            2115.0      2125.0      2135.0      2145.0      2155.0
```

	2165.0	2175.0	2185.0	2195.0	2205.0
	2215.0	2225.0	2235.0	2245.0	2255.0
	2265.0	2275.0	2285.0	2295.0	2305.0
	2315.0	2325.0	2335.0	2345.0	2355.0
	2365.0	2375.0	2385.0	2395.0	2405.0
	2415.0	2425.0	2435.0	2445.0	2455.0
	2465.0	2475.0	2485.0	2495.0	2505.0
	2515.0	2525.0	2535.0	2545.0	2555.0
	2565.0	2575.0	2585.0	2595.0	2605.0
	2615.0	2625.0	2635.0	2645.0	2655.0
	2665.0	2675.0	2685.0	2695.0	2705.0
	2715.0	2725.0	2735.0	2745.0	2755.0
	2765.0	2775.0	2785.0	2795.0	2805.0
	2815.0	2825.0	2835.0	2845.0	
mass =	0.0	275.2	544.7	682.6	823.7
	985.0	1087.7	1243.0	1365.5	1394.1
	1398.5	1381.5	1357.9	1330.9	1302.9
	1279.5	1199.0	1109.8	1035.2	958.0
	752.3	572.9	469.3	354.0	241.6
	191.2	138.6	89.4	56.7	38.9
	28.3	21.3	16.4	13.3	11.1
	9.5	8.2	7.2	6.4	5.8
	5.4	4.9	4.6	4.3	4.0
	3.8	3.6	4.0	5.3	7.0
	51.9	60.0	75.5	73.3	64.6
	70.7	78.8	81.3	84.2	86.9
	87.7	87.5	90.5	96.0	96.6
	107.7	75.1	85.2	56.2	11.7
	31.0	41.8	152.8	260.0	302.2
	331.7	352.4	356.5	362.3	355.2
	326.6	339.3	481.2	614.7	639.0
	634.7	590.7	658.7	668.5	675.0
	681.5	677.4	681.7	682.4	685.7
	685.0	686.3	687.5	688.6	689.7
	690.8	691.9	692.8	693.8	694.7
	695.6	696.4	697.2	697.9	698.6
	699.3	700.0	700.6	701.1	701.7
	702.2	702.7	703.1	703.6	704.0
	704.4	704.7	705.1	705.4	705.7
	706.0	706.2	706.5	706.7	706.9
	707.1	707.3	707.5	707.7	707.8
	708.0	708.1	708.3	708.4	708.5
	708.6	708.7	708.8	708.9	709.0
	709.1	709.1	709.2	709.3	709.3
	709.4	709.4	709.5	709.5	709.6
	709.6	709.7	709.7	709.7	709.8
	709.8	709.8	709.9	709.9	709.9
	709.9	709.9	710.0	710.0	710.0
	710.0	710.0	710.1	710.1	710.1
	710.1	710.1	710.1	710.1	710.1
	710.2	710.2	710.2	710.2	710.2
	710.2	710.2	710.2	710.2	710.2
	710.2	710.2	710.2	710.2	710.2
	710.2	710.2	710.2	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3
	710.3	710.3	710.3	710.3	710.3

```
         710.3       710.3       710.3       710.4       710.4
         710.4       710.4       710.4       710.4       710.4
         710.4       710.4       710.4       710.4       710.4
         710.4       710.4       710.4       710.4       710.4
         710.4       710.4       710 4       710.4       710.4
         710.4       710.4       710.4       710.4       710.4
         710.4       710.4       710.4       710.4

enth  =  158000.0    885000.0   1020000.0   1060000.0   1100000.0
        1140000.0   1160000.0   1210000.0   1260000.0   1270000.0
        1270000.0   1270000.0   1260000.0   1260000.0   1260000.0
        1250000.0   1240000.0   1190000.0   1180000.0   1160000.0
        1110000.0   1170000.0   1070000.0   1040000.0    976000.0
         947000.0    917000.0    886000.0    857000.0    830000.0
         804000.0    781000.0    759000.0    739000.0    722000.0
         707000.0    693000.0    680000.0    669000.0    660000.0
         651000.0    642000.0    635000.0    629000.0    622000.0
         616000.0    610000.0    603000.0    597000.0    592000.0
         646000.0    653000.0    665000.0    661000.0    651000.0
         651000.0    653000.0    651000.0    650000.0    648000.0
         646000.0    642000.0    642000.0    661000.0    664000.0
         642000.0    614000.0    615000.0    602000.0    536000.0
         573000.0    595000.0    624000.0    618000.0    612000.0
         605000.0    597000.0    588000.0    580000.0    571000.
         562000.0    554000.0    543000.0    532000.0    523000.0
         513000.0    504000.0    493000.0    483000.0    473000.0
         463000.0    453000.0    443000.0    433000.0    423000.0
         413000.0    403000.0    394000.0    385000.0    376000.0
         367000.0    358000.0    350000.0    342000.0    334000.0
         326000.0    319000.0    312000.0    305000.0    298000.0
         292000.0    286000.0    280000.0    274000.0    269000.0
         263000.0    258000.0    254000.0    249000.0    244000.0
         240000.0    236000.0    232000.0    229000.0    225000.0
         222000.0    219000.0    216000.0    213000.0    210000.0
         207000.0    205000.0    202000.0    200000.0    198000.0
         196000.0    194000.0    192000.0    190000.0    189000.0
         187000.0    186000.0    184000.0    183000.0    182000.0
         180000.0    179000.0    178000.0    177000.0    176000.0
         175000.0    174000.0    173000.0    172000.0    172000.0
         171000.0    170000.0    169000.0    169000.0    168000.0
         168000.0    167000.0    167000.0    166000.0    166000.0
         165000.0    165000.0    164000.0    164000.0    163000.0
         163000.0    163000.0    162000.0    162000.0    162000.0
         161000.0    161000.0    161000.0    160000.0    160000.0
         160000.0    160000.0    159000.0    159000.0    159000.0
         159000.0    158000.0    158000.0    158000.0    158000.0
         158000.0    157000.0    157000.0    157000.0    157000.0
         157000.0    157000.0    156000.0    156000.0    156000.0
         156000.0    156000.0    156000.0    156000.0    155000.0
         155000.0    155000.0    155000.0    155000.0    155000.0
         155000.0    154000.0    154000.0    154000.0    154000.0
         154000.0    154000.0    154000.0    153000.0    153000.0
         153000.0    153000.0    153000.0    153000.0    153000.0
         153000.0    152000.0    152000.0    152000.0    152000.0
         152000.0    152000.0    152000.0    152000.0    152000.0
         151000.0    151000.0    151000.0    151000.0    151000.0
         151000.0    151000.0    151000.0    151000.0    151000.0
         150000.0    150000.0    150000.0    150000.0    150000.0
         150000.0    150000.0    150000.0    150000.0    150000.0
         149000.0    149000.0    149000.0    149000.0    149000.0
         149000.0    149000.0    149000.0    149000.0    149000.0
         149000.0    148000.0    148000.0    148000.0    148000.0
         148000.0    148000.0    148000.0    148000.0    148000.0
         148000.0    148000.0    147000.0    147000.0    147000.0
         147000.0    147000.0    147000.0    147000.0    147000.0
         147000.0    147000.0    147000.0    147000.0    146000.0
         146000.0    146000.0    146000.0    146000.0    146000.0
         146000.0    146000.0    146000.0    146000.0
```

```
    eoi
&&
&&  Blowdown of primary system steam
&&
    h2ov  = 299
    iflag = 2
    t     =     0.0         1.0         2.0         3.0         4.0
                5.0         6.0         7.0         8.0         9.0
               10.0        11.0        12.0        13.0        14.0
               15.0        25.0        35.0        45.0        55.0
               65.0        75.0        85.0        95.0       105.0
              115.0       125.0       135.0       145.0       155.0
              165.0       175.0       185.0       195.0       205.0
              215.0       225.0       235.0       245.0       255.0
              265.0       275.0       285.0       295.0       305.0
              315.0       325.0       335.0       345.0       355.0
              365.0       375.0       385.0       395.0       405.0
              415.0       425.0       435.0       445.0       455.0
              465.0       475.0       485.0       495.0       505.0
              515.0       525.0       535.0       545.0       555.0
              565.0       575.0       585.0       595.0       605.0
              615.0       625.0       635.0       645.0       655.0
              665.0       675.0       685.0       695.0       705.0
              715.0       725.0       735.0       745.0       755.0
              765.0       775.0       785.0       795.0       805.0
              815.0       825.0       835.0       845.0       855.0
              865.0       875.0       885.0       895.0       905.0
              915.0       925.0       935.0       945.0       955.0
              965.0       975.0       985.0       995.0      1005.0
             1015.0      1025.0      1035.0      1045.0      1055.0
             1065.0      1075.0      1085.0      1095.0      1105.0
             1115.0      1125.0      1135.0      1145.0      1155.0
             1165.0      1175.0      1185.0      1195.0      1205.0
             1215.0      1225.0      1235.0      1245.0      1255.0
             1265.0      1275.0      1285.0      1295.0      1305.0
             1315.0      1325.0      1335.0      1345.0      1355.0
             1365.0      1375.0      1385.0      1395.0      1405.0
             1415.0      1425.0      1435.0      1445.0      1455.0
             1465.0      1475.0      1485.0      1495.0      1505.0
             1515.0      1525.0      1535.0      1545.0      1555.0
             1565.0      1575.0      1585.0      1595.0      1605.0
             1615.0      1625.0      1635.0      1645.0      1655.0
             1665.0      1675.0      1685.0      1695.0      1705.0
             1715.0      1725.0      1735.0      1745.0      1755.0
             1765.0      1775.0      1785.0      1795.0      1805.0
             1815.0      1825.0      1835.0      1845.0      1855.0
             1865.0      1875.0      1885.0      1895.0      1905.0
             1915.0      1925.0      1935.0      1945.0      1955.0
             1965.0      1975.0      1985.0      1995.0      2005.0
             2015.0      2025.0      2035.0      2045.0      2055.0
             2065.0      2075.0      2085.0      2095.0      2105.0
             2115.0      2125.0      2135.0      2145.0      2155.0
             2165.0      2175.0      2185.0      2195.0      2205.0
             2215.0      2225.0      2235.0      2245.0      2255.0
             2265.0      2275.0      2285.0      2295.0      2305.0
             2315.0      2325.0      2335.0      2345.0      2355.0
             2365.0      2375.0      2385.0      2395.0      2405.0
             2415.0      2425.0      2435.0      2445.0      2455.0
             2465.0      2475.0      2485.0      2495.0      2505.0
             2515.0      2525.0      2535.0      2545.0      2555.0
             2565.0      2575.0      2585.0      2595.0      2605.0
             2615.0      2625.0      2635.0      2645.0      2655.0
             2665.0      2675.0      2685.0      2695.0      2705.0
             2715.0      2725.0      2735.0      2745.0      2755.0
             2765.0      2775.0      2785.0      2795.0      2805.0
             2815.0      2825.0      2835.0      2845.0

    mass  =         0.0       108.3       161.0       180.2       194.6
```

204.2	221.3	211.3	176.8	175.3
175.2	175.9	176.7	177.7	178.9
179.9	188.3	229.4	237.8	254.6
261.0	267.0	227.2	244.1	237.1
220.2	206.4	193.0	177.1	161.1
146.3	133.2	121.9	111.8	103.1
95.7	89.2	83.4	78.5	74.4
70.1	66.6	63.5	61.2	58.5
[illegible]	53.6	51.0	48.5	46.1
[illegible]	32.2	28.4	[illegible]	27.9
[illegible]	20.0	17.4	15.0	12.9
[illegible]	9.9	8.2	5.5	4.1
[illegible]	2.5	0.2	3.3	2.0
1.3	1.0	0.1	0.2	0.1
0.1	0.1	0.1	0.1	0.0
0.0	0.0	0.1	0.1	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	

enth =	2550000.0	2790000.0	2800000.0	2800000.0	2800000.0
	2800000.0	2760000.0	2790000.0	2780000.0	2770000.0
	2770000.0	2770000.0	2780000.0	2780000.0	2780000.0
	2780000.0	2780000.0	2790000.0	2790000.0	2790000.0
	2820000.0	2770000.0	2780000.0	2770000.0	[illegible]
	2800000.0	2800000.0	2790000.0	2790000.0	[illegible]
	2780000.0	2780000.0	2770000.0	2770000.0	2770000.0
	2760000.0	2760000.0	2760000.0	2750000.0	2750000.0

```
          2750000.0   2750000.0   2740000.0   2740000.0   2740000.0
          2740000.0   2740000.0   2740000.0   2730000.0   2730000.0
          2750000.0   2750000.0   2750000.0   2750000.0   2750000.0
          2750000.0   2750000.0   2750000.0   2750000.0   2750000.0
          2750000.0   2750000.0   2750000.0   2750000.0   2750000.0
          2740000.0   2740000.0   [illegible] 2730000.0   2720000.0
          2730000.0   2750000.0   2740000.0   2740000.0   2740000.0
          2740000.0   2740000.0   2730000.0   2730000.0   2730000.0
          2720000.0   2720000.0   2720000.0   2710000.0   2700000.0
          2710000.0   2710000.0   2700000.0   2700000.0   2700000.0
          2690000.0   2690000.0   2680000.0   2680000.0   2670000.0
          2680000.0   2680000.0   2680000.0   [illegible] 2680000.0
          2680000.0   2680000.0   2680000.0   [illegible] 2680000.0
          2680000.0   2680000.0   2680000.0   [illegible] 2680000.0
          2680000.0   2680000.0   2680000.0   [illegible] 2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0   2680000.0
          2680000.0   2680000.0   2680000.0   2680000.0
    eoi
&&
struc
    name    = Walls        && Name of structure
    type    = wall         && Type of structure
    shape   = slab         && Shape of structure
    nslab   = 10           && Number of nodes in structure
    chrlen  = 5.49         && Characteristic length of structure   (m)
    slarea  = 450.         && Area                                 (m2)
    tunif   = 305.         && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
    eoi
&&
condense
ht-tran   on  on  on  on  on
```

```
overflow  4
&&
&&  Lower cell input
&&
low-cell
   geometry= 91.9      && Area of layers in lower cell              (m2)
      bc  = 305.       && Basemat boundary condition temperature    (K)
      concrete
         compos = 1       && Number of materials
                  conc    && Material
                  6730.   && Mass of material
         temp   = 305.    && Initial temperature
      eoi
      pool
         temp   = 305.    && Initial temperature
      eoi
 i

 Engineered safety systems
 &
&&  Spillage from Room 236 to Room 115 via the connecting pipe chase
&&
engineer    Spill 1  4  3  5.79
   overflow  4  3  0.025
eoi
&&
&&  Fire water sprinkler system, activated on high temperature.
&&
engineer    Sprinklr  2  4  4  0.
   spray
     spdiam = .001   && Spray droplet diameter                     (m)
     sphite = 5.49   && Spray fall height                          (m)
     spsttm = 373.   && Temperature at which system activates      (K)
  eoi
   source = 1           &&  Sprays provide 336 gpm (21.1 kg/s) after
      h2ol  = 3         &&  activation
      iflag = 2
      t     = 0.0     100.    1.00e5
      mass  = 21.1    21.1    21.1
      temp  = 305.    305.    305.
   eoi
  eoi
&&
&& ------------------------- Cell 5, Balance of Plant -------------------------
cell 5
control
eoi
title
      Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
   o2 0.20
   n2 0.75
   h2ov 0.05
&&
&& -------------------------- Cell 6, Environment --------------- ------------
cell 6
control
eoi
title
      Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
   o2 0.20
   n2 0.75
   h2ov 0.05
eof
```

LISTING 7 - CONTAIN Input for BS-2

```
&& ========================== Model Description ==============================
&&
&& File:
&&
&&     cnt002.mdl
&&
&& Description:
&&
&&     BS-2.  This input deck describes a five volume model of the B&W Plant
&&     auxiliary building.  The rooms modeled are 105, 113, 115, and 236.
&&     The steam source is a 10 inch break in the decay heat removal
&&     system suction piping in room 113.  This model does not include
&&     water aerosols (the dropout option is used).
&&
&& Written by:
&&
&&     John Schroeder  6/91
&&
&& ========================== Machine Control Input ===========================
cray
eoi
&& ============================== Global Input ================================
&&
&& Section 3.2, p. 3-11
&&
&&     Atmospheric Gases
&&
&&     Material     Description
&&     --------     -----------
&&     o2           oxygen
&&     n2           nitrogen
&&     h2ov         steam
&&     h2ol         water
&&
control
    ncells    = 6       && Number of cells
    ntitl     = 2       && Number of title lines
    ntzone    = 5       && Number of time zones
    nac       = 0       && Number of aerosol groups
    nsectn    = 0       && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names ----------------
&&
&& Section 3.2.1, p. 3-12
&&
material
    compound
        n2 o2           && Air
        h2ov h2ol       && Steam and water
        conc            && Structural materials
&&
&& ----------------------------- Reactor Type ---------------------------------
&&
&& Section 3.2.2, p. 3-17
&&
thermal                 && Water-cooled reactor
&&
&& ----------------------------- Flow Options ---------------------------------
&&
&& Section 3.2.3, p. 3-17
&&
flows
&&
```

```
&&  Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&              1, 2, 3.
&&
    area(1,5) = 8.88    && Cross-sectional area of flow path         (m2)
    avl(1,5)  = 14.6    && Ratio of area to inertial length, A/L     (m)
    cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&&  Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
    area(1,2) = 12.6
    avl(1,2)  = 20.7
    cfc(1,2)  = 1.00
&&
&&  Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
    area(2,5) = 0.892
    avl(2,5)  = 1.46
    cfc(2,5)  = 1.0
&&
&&  Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
    area(2,3) = 1.95
    avl(2,3)  = 3.2
    cfc(2,3)  = 1.0
&&
&&  Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
    area(3,5) = 1.95
    avl(3,5)  = 3.2
    cfc(3,5)  = 1.00
&&
&&  Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
    area(3,4) = 2.97
    avl(3,4)  = 4.88
    cfc(3,4)  = 1.00
&&
&&  Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&              10, 11, 12, and 13.
&&
    area(4,5) = 29.1
    avl(4,5)  = 157.
    cfc(4,5)  = 1.00
&&
&&  Junction 8 - Balance of Plant to environment, includes only blowout
&&              paths.
&&
    area(5,6) = 46.5
    avl(5,6)  = 250.
    cfc(5,6)  = 1.00
&&
    implicit
    dropout
&&
&&  Compartment and junction elevation data
&&
&&  Compartments
&&
    elevcl(1)  = 169.   && Center of mass elevation for Rm 105          (m)
    elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
    elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
    elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
    elevcl(5)  = 185.   && Center of mass elevation for Rm BOP          (m)
    elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&&  Junctions
&&
    elevfp(1,5)= 167.
```

```
  elevfp(5,1)= 167.

  elevfp(1,2)= 170.
  elevfp(2,1)= 170.

  elevfp(2,5)= 172.
  elevfp(5,2)= 172.

  elevfp(2,3)= 170.
  elevfp(3,2)= 170.

  elevfp(3,5)= ;70.
  elevfp(5,3)= 170.

  elevfp(3,4)= 172.
  elevfp(4,3)= 172.

  elevfp(4,5)= 173.
  elevfp(5,4)= 173.

  elevfp(5,6)= 211.
  elevfp(6,5)= 211.
&&
&& ---- ----------------------- Aerosol Options ------------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& -------------------------------- Times ------------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
   1800.              && Maximum CPU time limit                   (s)
   0.                 && Problem start time                       (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  ------  ------  ------                                        (s)
      1.     10.     10.
      5.     50.    100.
     20.    200.    500.
     50.    100.   1000.
     50.    100.   3600.
&& -----------------------
eoi
&&
&& ---------  ----------------- Output Control ---- --------------------------
&&
&&  Section 3.2.7, p. 3-38
&&
shortedt      = 2       && System ts between short edits
longedt       = 1       && Ts edits between long edits
prflow                  && Print intercell flow data
praer                   &&       detailed aerosol inventories
prlow-cl                &&       low-r cell model
prheat                  &&       heat transfer structure model
prengsys                &&       engineered system model
title
           B&W Plant Auxilliary Building Steam Propagation Model
                    Five Compartme.. Model -- BS-2
&&
&&
&& ==================== Cell :.out and Cell Control ========== ==============
```

```
&&
&&  Section 3.3, p. 3-40
&&
&& --------------------------- Cell 1, Room 105 ------------------------------
cell 1
control
    nhtm=2  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 1, Room 105
&&
&&  Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                      (m3, m)
    atmos     = 3       && Number of materials
              1.01e5  && Pressure                                    (Pa)
              305.    && Temperature                                 (K)
        n2    = 0.75    && Initial nitrogen fraction
        o2    = 0.20    && Initial oxygen fraction
        h2ov  = 0.05    && Initial water vapor fraction
struc
    name      = Ceiling       && Name of structure
    type      = roof          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 18.7          && Characteristic length of structure     (m)
    slarea    = 295.          && Area                                   (m2)
    tunif     = 305.          && Initial uniform temperature            (K)
    compound  =   conc conc conc conc conc conc conc conc conc conc
    x         = 0. .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
    eoi
&&
    name      = Walls         && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure     (m)
    slarea    = 298.          && Area                                   (m2)
    tunif     = 305.          && Initial uniform temperature            (K)
    compound  =  conc conc conc conc conc conc conc conc conc conc
     x        = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
    eoi
&&
condense
ht-tran     on  on  on  on  on
overflow    1
&&
&&  Lower cell input
&&
low-cell
    geometry= 295.      && Area of layers in lower cell               (m2)
        bc  = 305.      && Basemat boundary condition temperature     (K)
        concrete
            compos = 1      && Number of materials
                    conc    && Material
                    43200.  && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  1  5  .152
    overflow  1  5  1.74
eoi
```

```
&&
&& --------------------------- Cell 2, Room 113 -----------------------------
cell 2
control
    nhtm=2  mxslab=11  nsoatm=4  nspatm=1000 naensy=1  jconc=5  jpool=1
eoi
title
        Cell 2, Room 113
&&
&&  Upper Cell Input
&&
geometry  3.794e2  6.10 && Cell volume and height                          (m3, m)
    atmos     = 3
                1.01e5  && Pressure                                        (Pa)
                305.    && Temperature                                     (K)
        o2    = 0.20
        n2    = 0.75
        h2ov  = 0.05
&&
source=4
&&
&&  Blowdown of saturated primary system water
&&
    h2ov  = 914
    iflag = 2
    t     =        0.0         0.5         1.5         2.5         3.5
                   4.5         5.5         6.5         7.5         8.5
                   9.5        10.5        11.5        12.5        13.5
                  14.5        15.5        16.5        17.5        18.5
                  19.5        20.5        21.5        22.5        23.5
                  24.5        25.5        26.5        27.5        28.5
                  29.5        30.5        31.5        32.5        33.5
                  34.5        35.5        36.5        37.5        38.5
                  39.5        40.5        41.5        42.5        43.5
                  44.5        45.5        46.5        47.5        48.5
                  49.5        50.5        51.5        52.5        53.5
                  54.5        55.5        56.5        57.5        58.5
                  59.5        60.5        61.5        62.5        63.5
                  64.5        65.5        66.5        67.5        68.5
                  69.5        70.5        71.5        72.5        73.5
                  74.5        75.5        76.5        77.5        78.5
                  79.5        80.5        81.5        82.5        83.5
                  84.5        85.5        86.5        87.5        88.5
                  89.5        90.5        91.5        92.5        93.5
                  94.5        95.5        96.5        97.5        98.5
                  99.5       100.0       110.0       120.0       130.0
                 140.0       150.0       160.0       170.0       180.0
                 190.0       200.0       204.8       214.8       224.8
                 234.8       244.8       254.8       264.8       274.8
                 284.8       294.8       304.8       314.8       324.8
                 334.8       344.8       354.8       364.8       374.8
                 384.8       394.8       404.8       414.8       424.8
                 434.8       444.8       454.8       464.8       474.8
                 484.8       494.8       504.8       514.8       524.8
                 534.8       544.8       554.8       564.8       574.8
                 584.8       594.8       604.8       614.8       624.8
                 634.8       644.8       654.8       664.8       674.8
                 684.8       694.8       704.8       714.8       724.8
                 734.8       744.8       754.8       764.8       774.8
                 784.8       794.8       804.8       814.8       824.8
                 834.8       844.8       854.8       864.8       874.8
                 884.8       894.8       904.8       914.8       924.8
                 934.8       944.8       954.8       964.8       974.8
                 984.8       994.8      1004.8      1014.8      1024.8
                1034.8      1044.8      1054.8      1064.8      1074.8
                1084.8      1094.8      1104.8      1114.8      1123.1
                1133.1      1143.1      1153.1      1163.1      1173.1
                1183.1      1193.1      1203.1      1213.1      1223.1
```

1233.1	1243.1	1251.9	1261.9	1271.9
1281.9	1291.9	1301.9	1311.9	1321.9
1331.9	1341.9	1351.9	1361.9	1371.9
1381.9	1391.9	1401.7	1402.7	1403.7
1404.7	1405.7	1406.7	1407.7	1408.7
1409.7	1410.7	1411.7	1412.7	1413.7
1414.7	1415.7	1416.7	1417.7	1418.7
1419.7	1420.7	1421.7	1422.7	1423.7
1424.7	1425.7	1426.7	1427.7	1428.7
1429.7	1430.7	1431.7	1432.7	1433.7
1434.7	1435.7	1436.7	1437.7	1438.7
1439.7	1440.7	1441.7	1442.7	1443.7
1444.7	1445.7	1446.7	1447.7	1448.7
1449.7	1450.7	1451.7	1452.7	1453.7
1454.7	1455.7	1456.7	1457.7	1458.7
1459.7	1460.7	1461.7	1462.7	1463.7
1464.7	1465.7	1466.7	1467.7	1468.7
1469.7	1470.7	1471.7	1472.7	1473.7
1474.7	1475.7	1476.7	1477.7	1478.7
1479.7	1480.7	1481.7	1482.7	1483.7
1484.7	1485.7	1486.7	1487.7	1488.7
1489.7	1490.7	1491.7	1492.7	1493.7
1494.7	1495.7	1496.7	1497.7	1498.7
1499.7	1500.7	1501.7	1502.7	1503.7
1504.7	1505.7	1506.7	1507.7	1508.7
1509.7	1510.7	1511.7	1512.7	1513.7
1514.7	1515.7	1516.7	1517.7	1518.7
1519.7	1520.7	1521.7	1522.7	1523.7
1524.7	1525.7	1526.7	1527.7	1528.7
1529.7	1530.7	1531.7	1532.	1533.7
1534.7	1535.7	1536.7	1537.7	1538.7
1539.7	1540.7	1541.7	1542.7	1543.7
1544.7	1545.7	1546.7	1547.7	1548.7
1549.7	1550.7	1551.7	1552.7	1553.7
1554.7	1555.7	1556.7	1557.7	1558.7
1559.7	1560.7	1561.7	1562.7	1563.7
1564.7	1565.7	1566.7	1567.7	1568.7
1569.7	1570.7	1571.7	1572.7	1573.7
1574.7	1575.7	1576.7	1577.7	1578.7
1579.7	1580.7	1581.7	1582.7	1583.7
1584.7	1585.7	1586.7	1587.7	1588.7
1589.7	1590.7	1591.7	1592.7	1593.7
1594.7	1595.7	1596.7	1597.7	1598.7
1599.7	1600.7	1601.7	1602.7	1603.7
1604.7	1605.7	1606.7	1607.7	1608.7
1609.7	1610.7	1611.7	1612.7	1613.7
1614.7	1615.7	1616.7	1617.7	1618.7
1619.7	1620.7	1621.7	1622.7	1623.7
1624.7	1625.7	1626.7	1627.7	1628.7
1629.7	1630.7	1631.7	1632.7	1633.7
1634.7	1635.7	1636.7	1637.7	1638.7
1639.7	1640.7	1641.7	1642.7	1643.7
1644.7	1645.7	1646.7	1647.7	1648.7
1649.7	1650.7	1651.7	1662.7	1653.7
1654.7	1655.7	1656.7	1657.7	1653.7
1659.7	1660.7	1661.7	1662.7	1663.7
1664.7	1665.7	1666.7	1667.7	1668.7
1669.7	1670.7	1671.7	1672.7	1673.7
1674.7	1675.7	1676.7	1677.7	1678.7
1679.7	1680.7	1681.7	1682.7	1683.7
1684.7	1685.7	1686.7	1687.7	1688.7
1689.7	1690.7	1691.7	1692.7	1693.7
1694.7	1695.7	1696.7	1697.7	1698.7
1699.7	1700.7	1701.7	1702.7	1703.7
1704.7	1705.7	1706.7	1707.7	1708.7
1709.7	1710.7	1711.7	1712.7	1713.7
1714.7	1715.7	1716.7	1717.7	1718.7
1719.7	1720.7	1721.7	1722.7	1723.7

1724.7	1725.7	1726.7	1727.7	1728.7
1729.7	1730.7	1731.7	1732.7	1733.7
1734.7	1735.7	1736.7	1737.7	1738.7
1739.7	1740.7	1741.7	1742.7	1743.7
1744.7	1745.7	1746.7	1747.7	1748.7
1749.7	1750.7	1751.7	1752.7	1753.7
1754.7	1755.7	1756.7	1757.7	1758.7
1759.7	1760.7	1761.7	1762.7	1763.7
1764.7	1765.7	1766.7	1767.7	1768.7
1769.7	1770.7	1771.7	1772.7	1773.7
1774.7	1775.7	1776.7	1777.7	1778.7
1779.7	1780.7	1781.7	1782.7	1783.7
1784.7	1785.7	1786.7	1787.7	1788.7
1789.7	1790.7	1791.7	1792.7	1793.7
1794.7	1795.7	1796.7	1797.7	1798.7
1799.7	1800.7	1801.7	1802.7	1803.7
1804.7	1805.7	1806.7	1807.7	1808.7
1809.7	1810.7	1811.7	1812.7	1813.7
1814.7	1815.7	1816.7	1817.7	1818.7
1819.7	1820.7	1821.7	1822.7	1823.7
1824.7	1825.7	1826.7	1827.7	1828.7
1829.7	1830.7	1831.7	1832.7	1833.7
1834.7	1835.7	1836.7	1837.7	1838.7
1839.7	1840.7	1841.7	1842.7	1843.7
1844.7	1845.7	1846.7	1847.7	1848.7
1849.7	1850.7	1851.7	1852.7	1853.7
1854.7	1855.7	1856.7	1857.7	1858.7
1859.7	1860.7	1861.7	1862.7	1863.7
1864.7	1865.7	1866.7	1867.7	1868.7
1869.7	1870.7	1871.7	1872.7	1873.7
1874.7	1875.7	1876.7	1877.7	1878.7
1879.7	1880.7	1881.7	1882.7	1883.7
1884.7	1885.7	1886.7	1887.7	1888.7
1889.7	1890.7	1891.7	1892.7	1893.7
1894.7	1895.7	1896.7	1897.7	1898.7
1899.7	1900.7	1901.7	1902.7	1903.7
1904.7	1905.7	1906.7	1907.7	1908.7
1909.7	1910.7	1911.7	1912.7	1913.7
1914.7	1915.7	1916.7	1917.7	1918.7
1919.7	1920.7	1921.7	1922.7	1923.7
1924.7	1925.7	1926.7	1927.7	1928.7
1929.7	1930.7	1931.7	1932.7	1933.7
1934.7	1935.7	1936.7	1937.7	1938.7
1939.7	1940.7	1941.7	1942.7	1943.7
1944.7	1945.7	1946.7	1947.7	1948.7
1949.7	1950.7	1951.7	1952.7	1953.7
1954.7	1955.7	1956.7	1957.7	1958.7
1959.7	1960.7	1961.7	1962.7	1963.7
1964.7	1965.7	1966.7	1967.7	1968.7
1969.7	1970.7	1971.7	1972.7	1973.7
1974.7	1975.7	1976.7	1977.7	1978.7
1979.7	1980.7	1981.7	1982.7	1983.7
1984.7	1985.7	1986.7	1987.7	1988.7
1989.7	1990.7	1991.7	1992.7	1993.7
1994.7	1995.7	1996.7	1997.7	1998.7
1999.7	2000.0	2010.0	2020.0	2030.0
2040.0	2050.0	2060.0	2070.0	2080.0
2090.0	2100.0	2110.0	2120.0	2130.0
2140.0	2150.0	2160.0	2170.0	2180.0
2190.0	2200.0	2210.0	2220.0	2230.0
2240.0	2250.0	2260.0	2270.0	2280.0
2290.0	2300.0	2310.0	2320.0	2330.0
2340.0	2350.0	2360.0	2370.0	2380.0
2390.0	2400.0	2410.0	2420.0	2430.0
2440.0	2450.0	2460.0	2470.0	2480.0
2490.0	2500.0	2510.0	2520.0	2521.7
2531.7	2541.7	2551.7	2561.7	2571.7
2581.7	2591.7	2601.7	2611.7	2621.7

2631.7	2641.7	2651.7	2661.7	2671.7
2681.7	2691.7	2701.7	2711.7	2721.7
2731.7	2741.7	2751.7	2761.7	2771.7
2781.7	2791.7	2801.7	2803.2	2813.1
2823.1	2833.1	2843.1	2853.1	2863.1
2873.1	2883.1	2893.1	2903.1	2913.1
2923.1	2933.1	2943.1	2953.1	2963.1
2973.1	2983.1	2993.1	3003.1	3013.1
3023.1	3033.1	3043.1	3053.1	3063.1
3073.1	3083.1	3093.1	3103.1	3113.1
3123.1	3133.1	3143.1	3153.1	3163.1
3173.1	3183.1	3193.1	3203.1	3213.1
3223.1	3233.1	3243.1	3253.1	3263.1
3273.1	3283.1	3293.1	3303.1	3313.1
3323.1	3333.1	3343.1	3353.1	3363.1
3373.1	3383.1	3393.1	3403.1	3413.1
3423.1	3433.1	3443.1	3453.1	3463.1
3473.1	3483.1	3493.1	3503.1	3513.1
3523.1	3533.1	3543.1	3553.1	3563.1
3573.1	3583.1	3593.1		

mass =	0.0	129.6	180.3	192.7	193.1
	316.4	1081.9	1858.9	138.5	87.6
	73.9	70.7	70.0	70.0	70.0
	70.0	70.5	71.8	73.1	74.3
	75.4	76.2	76.9	77.5	78.2
	78.8	79.4	79.9	80.5	81.0
	81.5	82.0	82.4	82.8	83.2
	83.6	84.0	84.3	84.6	84.9
	85.2	85.4	85.6	85.8	86.0
	86.2	86.4	86.5	86.6	86.7
	86.8	86.9	87.0	87.0	87.1
	87.1	87.1	87.1	87.0	87.0
	86.9	86.9	86.8	86.7	86.6
	86.4	86.3	86.1	86.0	85.8
	85.6	85.4	85.2	85.0	84.8
	84.5	84.3	84.0	83.7	83.4
	83.2	82.9	82.6	82.3	82.0
	81.7	81.3	81.0	80.6	80.2
	79.9	79.5	79.1	78.8	78.4
	78.0	77.5	77.0	76.5	76.0
	75.5	75.3	71.6	70.8	[illegible]
	69.4	68.5	67.2	65.9	64.4
	62.6	60.5	59.5	57.3	54.9
	52.3	49.7	47.1	55.6	54.2
	52.9	51.7	50.5	49.5	48.7
	48.1	47.6	47.2	46.8	46.2
	45.6	45.0	44.2	43.4	42.6
	41.7	40.8	39.9	38.9	37.8
	36.3	35.3	34.1	33.0	32.1
	31.6	30.7	30.5	29.7	28.9
	28.0	27.1	26.3	25.5	24.7
	24.0	23.4	22.8	22.2	21.7
	21.1	20.6	23.2	22.8	22.5
	22.1	21.7	21.3	20.9	21.9
	20.3	20.1	20.0	19.9	19.7
	19.6	19.5	19.4	19.3	19.1
	19.0	18.9	18.9	18.6	18.4
	18.2	18.0	17.8	17.6	17.4
	17.3	17.1	17.0	16.9	16.8
	16.7	16.6	16.5	16.4	16.4
	16.3	16.2	16.2	16.2	16.2
	16.1	16.0	15.9	15.8	15.7
	15.6	15.6	15.4	15.3	15.3
	15.2	15.3	15.3	15.1	15.4
	15.3	15.3	15.3	15.7	16.0
	16.7	15.8	13.9	15.6	16.0
	15.9	14.4	16.0	16.4	16.0

16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
16.2	16.2	16.2	16.2	16.2
1[illegible]	16.2	16.2	16.1	16.1
16.1	16.1	16.1	16.1	16.1
16.1	16.1	16.1	16.1	16.1
16.1	16.1	16.1	16.1	16.1
16.1	16.1	16.1	16.1	16.0
16.0	16.0	16.0	16.0	16.0
16.0	16.0	16.0	16.0	16.0
16.0	16.0	16.0	16.0	16.0
15.9	15.9	15.9	15.9	15.9
15.9	15.9	15.9	15.9	15.9
15.9	15.9	15.9	15.9	15.9
15.8	15.[illegible]	15.8	15.8	15.8
15.8	15.8	15.8	15.8	15.8
15.8	15.8	15.8	15.7	15.7
15.7	15.7	15.7	15.7	15.7
15.7	15.7	15.7	15.7	15.7
15.7	15.7	15.7	15.7	15.6
15.6	15.6	15.6	15.6	15.6
15.6	15.6	15.6	15.6	15.6
15.6	15.6	15.6	15.6	15.6
15.6	15.6	15.6	15.6	15.6
15.6	15.5	15.5	15.5	15.5
15.5	15.5	15.5	15.5	15.5
15.5	15.5	15.5	15.5	15.5
15.5	15.6	15.5	15.6	15.6
15.6	15.6	15.6	15.5	15.5
15.5	15.[illegible]	15.5	15.5	15.5
15.5	15.5	15.5	15.6	15.6
15.6	15.6	15.6	15.6	15.6
15.6	15.6	15.6	15.5	15.6
15.6	15.6	15.6	15.6	15.6
15.7	15.7	15.6	15.5	15.5
15.5	15.5	15.6	15.6	15.7
16.0	16.1	15.2	15.3	15.3
15.3	15.3	15.4	15.3	15.2
15.3	15.3	15.4	15.4	15.3
15.2	15.2	15.2	15.2	15.3
15.3	15.4	15.4	15.6	16.0
16.2	16.4	16.4	15.2	13.6
14.4	15.2	15.2	15.5	15.9
16.1	16.3	16.6	18.9	17.1
17.3	17.5	17.7	17.9	18.0
18.2	18.4	18.5	18.6	18.8
18.9	19.0	19.1	19.2	19.3
19.3	19.5	19.5	19.6	19.6
19.7	19.7	19.7	19.7	19.8
19.8	19.8	19.8	19.8	19.8
19.8	19.8	19.8	19.8	19.8
19.8	19.7	19.7	19.7	19.7
19.7	19.6	19.6	19.6	13.6
19.5	19.5	19.4	19.4	19.3
19.3	19.2	19.1	19.1	19.0
19.0	19.0	18.9	18.9	18.9
18.8	18.8	18.7	18.7	18.6

18.6	18.5	18.4	18.4	18.5
18.6	18.4	18.3	18.3	18.3
18.3	18.3	18.1	17.5	17.7
17.6	17.6	17.6	17.4	17.5
17.3	17.3	17.2	17.1	17.1
17.0	17.0	17.0	17.0	16.9
16.9	16.9	16.9	16.9	16.9
16.9	17.0	17.0	17.0	17.0
17.1	17.1	17.1	17.2	17.2
17.2	17.3	17.3	17.4	17.4
17.5	17.5	17.5	17.6	17.6
17.7	17.7	17.8	17.9	17.9
17.9	18.0	18.0	18.0	18.1
18.1	18.1	18.1	18.1	18.1
18.1	18.2	18.2	18.2	18.2
18.2	18.2	18.2	18.1	18.0
18.0	18.0	18.0	18.0	18.0
18.0	18.0	18.0	18.0	18.0
18.0	18.0	17.9	17.9	17.9
17.9	17.9	17.9	17.9	17.9
17.8	17.8	17.8	17.8	17.8
17.8	17.8	17.8	17.7	17.7
17.7	17.7	17.7	17.6	17.6
17.6	17.6	17.5	17.5	17.5
17.5	17.5	17.4	17.4	17.4
17.4	17.4	17.3	17.3	17.3
17.3	17.2	17.2	17.2	17.2
17.2	17.1	17.1	17.1	17.1
17.1	17.1	17.1	17.0	17.0
17.0	17.0	17.0	17.0	17.0
17.0	17.0	17.0	16.9	16.9
16.9	16.9	16.9	16.9	16.9
[illegible]	16.9	16.9	16.9	16.9
16.9	16.9	16.9	16.9	16.9
16.9	16.9	16.9	16.9	16.9
16.9	16.9	[illegible]	16.9	16.9
16.9	16.9	16.9	16.8	16.8
16.8	16.8	16.8	16.8	16.8
16.8	16.8	16.8	16.8	16.8
16.8	16.7	16.7	16.7	16.7
16.7	16.6	16.6	16.6	16.6
16.6	16.5	16.5	16.5	16.6
16.5	16.6	16.5	16.5	16.5
16.5	16.4	16.4	16.4	16.4
16.3	16.3	16.3	16.3	16.3
16.3	16.2	16.2	16.2	16.2
16.2	16.1	16.1	16.1	16.1
16.1	16.1	16.0	16.0	16.0
16.0	16.0	15.9	15.9	15.9
15.9	15.9	15.9	15.8	15.8
15.8	15.8	15.8	15.8	15.7
15.7	15.7	15.5	15.3	15.2
15.1	14.9	14.7	14.6	14.4
14.3	14.1	14.0	15.4	17.8
[illegible]	17.8	10.3	12.3	15.5
13.4	12.2	10.8	10.6	17.7
10.5	15.6	9.5	10.5	19.7
10.1	10.4	21.7	10.6	10.1
11.3	23.0	13.3	10.1	10.2
18.3	13.8	24.8	30.1	25.9
30.1	31.5	35.3	35.8	40.4
42.2	43.6	44.8	40.7	38.3
47.8	47.3	47.8	48.3	48.7
43.1	49.4	49.7	50.0	50.2
50.5	50.7	51.0	51.2	51.4
51.0	51.8	53.8	58.2	45.5
46.8	61.8	52.4	47.1	46.0
51.0	48.9	43.4	49.4	59.0

	53.9	56.7	43.3	48.5	48.2
	18.1	65.5	35.9	44.9	16.5
	39.5	193.3	56.4	33.5	44.2
	36.0	34.5	69.8	30.0	36.7
	40.6	167.6	29.4	30.3	17.0
	76.6	46.1	35.2	23.6	22.3
	24.9	20.1	33.4	39.7	12.9
	148.4	15.0	12.7	25.4	28.3
	11.0	21.6	75.8	9.0	[illegible].1
	38.7	4[illegible].6	18.3	37.9	14.2
	19.4	2[illegible].1	13.9	27.4	35.1
	46.0	59.9	343.8	20.4	22.1
	24.6	15.8	45.6	51.6	13.9
	36.5	36.0	22.5	46.4	40.5
	33.3	67.3	40.5	25.3	25.8
	10.2	21.4	38.6		
enth	158119.7	158227.3	158224.4	158225.9	158227.3
	158231.8	158290.1	200020.9	801773.9	739475.9
	717309.5	710926.9	709328.2	708997.9	708972.0
	709051.6	709962.1	712237.8	714723.1	716948.4
	719030.4	720731.1	722092.6	723370.2	724584.8
	725732.9	726830.3	727881.6	728883.3	729840.0
	730755.5	721626.6	732454.2	733232.6	733982.9
	734699.7	735379.2	735984.2	736521.3	737021.4
	737490.4	737931.1	738343.2	738727.2	739081.0
	739406.4	7397[illegible]1.6	739975.8	740219.4	740435.4
	74062[illegible].1	740785.1	740918.6	741025.1	741105.0
	74115[illegible].0	741187.4	741190.4	741188.6	741122.0
	741053.6	740961.8	740846.1	740707.2	740546.2
	740365.8	740159.9	739935.2	739690.4	739426.2
	739143.2	738841.9	738522.9	738185.7	737829.4
	737450.4	737038.1	736603.1	736156.5	735705.2
	735[illegible]50.3	734[illegible]92.2	734320.8	733828.8	733315.4
	732[illegible]81.4	732212.5	731618.5	731010.[illegible]	730393.1
	729[illegible]69.6	729142.3	728513.2	727884.8	727258.9
	726560.8	725671.6	724754.8	723847.2	722956.5
	722085.6	721659.0	715014.9	713975.0	713141.8
	712611.8	711530.6	709910.0	708015.9	705624.1
	702664.4	699061.7	697194.5	693005.6	688192.2
	682777.9	676902.8	670659.7	694372.2	692257.0
	690095.4	683054.6	686163.1	684603.9	683478.6
	682749.9	682227.4	681986.2	681537.4	680834.9
	679[illegible]6.2	678834.3	677556.9	675880.1	673988.2
	671933.6	669684.8	667475.7	664668.4	661817.4
	657578.0	654055.8	650935.4	647915.2	644864.2
	643106.8	639898.3	638623.4	635707.2	632431.1
	629020.4	625527.4	622024.9	618310.1	615047.8
	611596.8	[illegible]08399.0	[illegible]05316.4	602375.1	599389.2
	596320.0	5[illegible]3215.0	616752.3	614416.6	612202.2
	609997.1	60[illegible]606.5	605179.7	602860.1	603460.2
	597345.3	5[illegible]5503.9	593669.6	591843.9	590032.1
	588299.5	[illegible]86453.2	584804.4	583027.2	581271.2
	579531.1	577[illegible]94.5	576019.1	573958.9	571776.8
	569679.8	567515.6	565414.3	563159.6	561125.9
	559112.1	557095.1	555105.3	553148.6	551217.9
	549311.2	547424.7	545566.2	543758.9	541994.4
	540[illegible]6.2	538603.6	537009.8	535496.8	534296.5
	532671.4	530901.1	529160.1	527457.2	525799.1
	524603.6	523587.1	520874.9	519416.4	518017.0
	516685.0	516124.5	513376.3	512901.8	512945.8
	511716.2	510283.4	509077.4	507801.2	510549.6
	512647.0	507684.8	492006.9	503425.8	505358.6
	503450.1	492980.8	502774.3	504377.4	502896.8
	503098.3	503112.8	503109.9	503008.1	502[illegible]07.0
	502842.4	502780.0	502705.6	502618.7	502531.2
	502451.3	502371.4	502287.2	502201.0	502115.3
	502030.5	501945.4	501856.8	501775.7	501685.3

501599.9	501516.4	501426.1	501338.3	501251.2
501163.0	501075.0	500986.8	500899.3	500811.4
500722.4	500633.9	500545.9	500455.6	500362.3
500272.1	500185.2	500099.2	499992.4	499910.4
499820.7	499730.2	499640.6	499550.4	499460.1
499370.6	499298.7	499241.4	499151.8	499073.4
498993.8	498909.8	498803.6	498682.7	498594.9
498503.6	498412.0	493314.3	498216.3	498124.2
498031.7	497937.2	497839.9	497741.2	497644.0
497545.8	497445.5	497344.8	497242.9	497139.8
497036.5	496931.6	496824.6	496719.2	496613.4
496506.6	496400.4	496293.4	496185.1	496077.3
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490095.2	489976.7	409856.3	489736.2	489615.6
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488162.0	488033.8	487904.6	487785.2	487628.8
487503.8	487413.2	487305.3	487233.6	487132.5
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485738.7	485684.3	485617.9	485555.1	485492.9
485428.5	485366.0	485305.1	485242.7	485182.1
485123.0	485061.6	485003.9	484947.5	484888.0
484826.4	484761.9	484694.4	484632.8	484580.8
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483881.2	483833.6	483775.8	483715.9	483806.5
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484283.9	484217.7	483661.2	483412.4	483142.9
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502222.0	502211.1	502191.5	502171.2	502123.3
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501682.3	501573.1	501449.1	501341.9	501191.6
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498746.8	498589.8	498435.0	498342.0	498282.0
498140.3	497891.6	497652.3	497332.9	497096.8
496870.6	496551.5	496060.6	496262.5	496523.2
497200.3	496384.6	495783.5	495979.4	495983.6
495919.8	495702.1	495201.9	494372.8	493506.3
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493146.3	493376.8	493598.4	493829.0	494053.5
494226.2	494479.4	494669.3	495184.7	495363.0
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496194.5	496355.1	496417.6	496616.8	496643.9
496693.2	496725.4	496819.3	496915.2	496883.5
496908.6	496974.[illegible]	496981.4	496883.0	496530.7
496331.5	496333.7	496432.3	496436.7	496538.5
496539.7	496528.8	496486.8	496528.0	496559.4
496612.4	496597.6	496612.3	496595.8	496625.6
496616.3	496641.1	496619.7	496589.2	496604.2
496550.6	496595.7	496591.0	496636.2	496553.0
496619.4	496626.2	496562.3	496500.8	496519.6
[illegible]96494.7	496435.9	496430.2	496405.0	496357.4
496354.4	496322.7	496272.8	496276.1	496244.7
496194.8	496195.5	496168.1	496120.5	496125.4
4960[illegible]9.0	496039.4	496032.2	496009.4	495992.2
496030.2	496057.6	496061.2	496050.8	496097.9
496138.9	496164.5	496191.4	496224.6	496264.4
496307.2	496343.2	496387.2	496434.6	496477.7
496528.3	496584.4	496589.5	496647.7	496716.5
496921.0	496914.6	496911.1	496987.5	497050.8
497133.3	497316.2	497234.7	497385.7	497452.6
497470.9	497552.2	497727.9	497782.8	497839.7
497904.3	498015.5	498126.8	498176.3	498284.5
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498813.7	498955.1	499024.2	499094.3	499118.1
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499698.7	499725.7	499843.1	499991.8	499995.7
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500875.8	500967.2	501065.7	501243.8	501374.[illegible]
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505627.9	505776.6	505928.7	506081.8	506236.2
506391.8	506551.6	506709.8	506871.8	507035.3
507200.9	507255.7	508830.2	510269.1	512467.3
514797.2	517280.5	519964.8	522849.5	525973.6
529298.2	532546.1	536079.9	536775.9	529923.5
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[illegible]79.1	602255.6	602763.5	603216.8	603617.4
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620321.1	612820.9	[illegible]54136.8	591190.7	611101.1
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576664.2	573551.6	593672.5	565813.9	562640.9

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          575514.6    563308.6    587210.4    566057.7    581234.0
          574262.8    567689.1    577991.0    575992.9    564074.6
          562345.1    569967.5    570910.3
    eoi
&&
&&  Blowdown of primary system steam
&&
    n2ov  = 914
    iflag = 2
    t     =         0.0         0.5         1.5         2.5         3.5
                    4.5         5.5         6.5         7.5         8.5
                    9.5        10.5        11.5        12.5        13.5
                   14.5        15.5        16.5        17.5        18.5
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                   39.5        40.5        41.5        42.5        43.5
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                   59.5        60.5        61.5        62.5        63.5
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                   69.5        70.5        71.5        72.5        73.5
                   74.5        75.5        76.5        77.5        78.5
                   79.5        80.5        81.5        82.5        83.5
                   84.5        85.5        86.5        87.5        88.5
                   89.5        90.5        91.5        92.5        93.5
                   94.5        95.5        96.5        97.5        98.5
                   99.5       100.0       110.0       120.0       130.0
                  140.0       150.0       160.0       170.0       180.0
                  190.0       200.0       204.8       214.8       224.8
                  234.8       244.8       254.8       264.8       274.8
                  284.8       294.8       304.8       314.8       324.8
                  334.8       344.8       354.8       364.8       374.8
                  384.8       394.8       404.8       414.8       424.8
                  434.8       444.8       454.8       464.8       474.8
                  484.8       494.8       504.8       514.8       524.8
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                  584.8       594.8       604.8       614.8       624.8
                  634.8       644.8       654.8       664.8       674.8
                  684.8       694.8       704.8       714.8       724.8
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                  784.8       794.8       804.8       814.8       824.8
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                  884.8       894.8       904.8       914.8       924.8
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                  984.8       994.8      1004.8      1014.8      1024.8
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                 1404.7      1405.7      1406.7      1407.7      1408.7
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1984.7	1985.7	1986.7	1987.7	1988.7
1989.7	1990.7	1991.7	1992.7	1993.7
1994.7	1995.7	1996.7	1997.7	1998.7
1999.7	2000.0	2010.0	2020.0	2030.0
2040.0	2050.0	2060.0	2070.0	2080.0
2090.0	2100.0	2110.0	2120.0	2130.0
2140.0	2150.0	2160.0	2170.0	2180.0
2190.0	2200.0	2210.0	2220.0	2230.0
2240.0	2250.0	2260.0	2270.0	2280.0
2290.0	2300.0	2310.0	2320.0	2330.0
2340.0	2350.0	2360.0	2370.0	2380.0
2390.0	2400.0	2410.0	2420.0	2430.0
2440.0	2450.0	2460.0	2470.0	2480.0
2490.0	2500.0	2510.0	2520.0	2521.7
2531.7	2541.7	2551.7	2561.7	2571.7
2581.7	2591.7	2601.7	2611.7	2621.7
2631.7	2641.7	2651.7	2661.7	2671.7
2681.7	2691.7	2701.7	2711.7	2721.7
2731.7	2741.7	2751.7	2761.7	2771.7
2781.7	2791.7	2801.7	2803.2	2813.1
2823.1	2833.1	2843.1	2853.1	2863.1
2873.1	2883.1	2893.1	2903.1	2913.1
2923.1	2933.1	2943.1	2953.1	2963.1

	2973.1	2983.1	2993.1	3003.1	3013.1
	3023.1	3033.1	3043.1	3053.1	3063.1
	3073.1	3083.1	3093.1	3103.1	3113.1
	3123.1	3133.1	3143.1	3153.1	3163.1
	3173.1	3183.1	3193.1	3203.1	3213.1
	3223.1	3233.1	3243.1	3253.1	3263.1
	3273.1	3283.1	3293.1	3303.1	3313.1
	3323.1	3333.1	3343.1	3353.1	3363.1
	3373.1	3383.1	3393.1	3403.1	3413.1
	3423.1	3433.1	3443.1	3453.1	3463.1
	3473.1	3483.1	3493.1	3503.1	3513.1
	3523.1	3533.1	3543.1	3553.1	3563.1
	3573.1	3583.1	3593.1		
mass =	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	50.5	39.4
	35.2	33.8	33.4	33.3	33.3
	33.3	33.4	33.8	34.3	34.7
	35.2	35.6	35.9	36.1	36.4
	36.7	36.9	37.1	37.3	37.6
	37.8	38.0	38.1	38.3	38.5
	38.6	38.8	38.9	39.1	39.2
	39.3	39.4	39.5	39.6	39.7
	39.8	39.8	39.9	40.0	40.0
	40.1	40.1	40.1	40.2	40.2
	40.2	40.2	40.3	40.3	40.3
	40.2	40.2	40.2	40.2	40.2
	40.1	40.1	40.1	40.0	40.0
	39.9	39.9	39.8	39.7	39.7
	39.6	39.5	39.4	39.3	39.3
	39.2	39.1	39.0	38.9	38.8
	38.7	38.6	38.4	38.3	38.2
	38.1	38.0	37.8	37.7	37.6
	37.4	37.3	37.1	36.9	36.7
	36.6	36.5	35.2	35.1	35.1
	35.2	35.2	35.1	34.9	34.6
	34.2	33.7	33.4	32.8	32.0
	31.1	30.1	29.1	34.2	34.0
	33.8	33.5	33.4	33.2	33.2
	33.2	33.3	33.4	33.4	33.4
	33.4	33.3	33.1	33.0	32.8
	32.5	32.2	32.0	31.6	31.2
	30.7	30.2	29.9	29.6	29.3
	29.0	28.7	28.5	28.1	27.8
	27.4	27.0	26.7	26.3	25.9
	25.5	25.1	24.8	24.4	24.1
	23.7	23.3	23.4	27.0	26.7
	26.4	26.1	25.7	25.4	24.9
	24.5	24.2	23.9	23.5	23.2
	22.9	22.5	22.3	21.9	21.6
	21.3	21.0	20.7	20.4	20.1
	19.8	19.5	19.2	18.9	18.6
	18.3	18.0	17.7	17.4	17.1
	16.9	16.6	16.3	16.0	15.7
	15.5	15.2	15.0	14.7	14.5
	14.3	14.1	13.9	13.7	13.5
	13.3	13.2	12.9	12.7	12.5
	12.3	12.2	11.8	11.8	11.6
	11.5	11.3	11.1	10.9	10.8
	10.7	10.6	9.7	10.1	10.1
	9.8	9.5	9.7	9.6	9.7
	9.6	9.6	9.6	9.6	9.6
	9.6	9.6	9.6	9.5	9.5
	9.5	9.5	9.5	9.5	9.5
	9.5	9.4	9.4	9.4	9.4
	9.4	9.4	9.4	9.3	9.3
	9.3	9.3	9.3	9.3	9.3
	9.3	9.2	9.2	9.2	9.2

9.2	9.2	9.2	9.2	9.1
9.1	9.1	9.1	9.1	9.1
9.1	9.1	9.0	9.0	9.0
9.0	9.0	9.0	9.0	9.0
8.9	8.9	8.9	8.9	8.9
8.9	8.9	8.9	8.8	8.8
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8.6	8.6	8.6	8.5	8.5
8.5	8.5	8.5	8.5	8.5
8.5	8.4	8.4	8.4	8.4
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8.3	8.3	8.3	8.3	8.3
8.3	8.3	8.3	8.2	8.2
8.2	8.2	8.2	8.2	8.2
8.2	8.1	8.1	8.1	8.1
8.1	8.1	8.1	8.1	8.0
8.0	8.0	8.0	8.0	8.0
8.0	8.0	7.9	7.9	7.9
7.9	7.9	7.9	7.9	7.9
7.8	7.8	7.8	7.8	7.8
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7.7	7.7	7.7	7.6	7.6
7.6	7.6	7.6	7.6	7.6
7.6	7.6	7.6	7.5	7.5
7.5	7.5	7.5	7.5	7.5
7.5	7.5	7.4	7.4	7.4
7.4	7.4	7.4	7.4	7.4
7.4	7.4	7.4	7.4	7.4
7.3	7.3	7.3	7.3	7.3
7.3	7.3	7.3	7.2	7.2
7.2	7.2	7.2	7.2	7.2
7.2	7.2	7.1	7.1	7.1
7.1	7.1	7.1	7.1	7.1
7.1	7.1	7.1	7.1	7.1
7.1	7.0	7.0	7.0	7.0
7.0	7.0	7.0	7.0	7.0
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7.0	7.0	7.0	7.0	7.0
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6.9	6.9	6.9	6.8	6.8
6.8	6.8	6.7	6.8	6.7
6.7	6.7	6.6	6.2	6.0
5.7	5.8	5.9	5.9	5.9
6.0	6.0	6.0	6.1	6.1
6.1	6.1	6.2	6.2	6.2
6.2	6.2	6.2	6.3	6.3
6.3	6.3	6.3	6.3	6.3
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6.3	6.3	6.3	6.3	6.3
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6.3	6.3	6.3	6.3	6.3
6.3	6.2	6.2	6.2	6.2
6.2	6.2	6.2	6.2	6.2
6.2	6.1	6.1	6.1	6.1
6.1	6.0	6.0	6.0	6.0
6.0	6.0	6.0	5.9	5.9
5.9	5.9	5.9	5.9	5.9
5.8	5.8	5.8	5.8	5.8
5.8	5.8	5.8	5.8	5.8
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5.6	5.6	5.6	5.6	5.6
5.5	5.5	5.5	5.5	5.5
5.5	5.5	5.5	5.5	5.5
5.4	5.4	5.4	5.4	5.4

5.4	5.4	5.4	5.4	5.4
5.4	5.4	5.4	5.4	5.4
5.4	5.4	5.4	5.4	5.4
5.4	5.4	5.4	5.4	5.4
5.4	5.4	5.4	5.4	5.4
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5.1	5.1	5.1	5.1	5.0
5.0	5.0	5.0	5.0	5.0
5.0	5.0	5.0	5.0	4.9
4.9	4.9	4.9	4.9	4.9
4.9	4.9	4.9	4.9	4.9
4.9	4.8	4.8	4.8	4.8
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4.8	4.8	4.8	4.8	4.8
4.7	4.7	4.7	4.7	4.7
4.7	4.7	4.7	4.7	4.7
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4.7	4.7	4.6	4.6	4.6
4.6	4.6	4.6	4.6	4.6
4.6	4.6	4.6	4.6	4.6
4.6	4.6	4.6	4.5	4.5
4.5	4.5	4.5	4.5	4.5
4.5	4.5	4.5	4.5	4.5
4.5	4.5	4.4	4.4	4.4
4.4	4.4	4.4	4.4	4.4
4.4	4.4	4.4	4.4	4.4
4.4	4.4	4.3	4.3	4.3
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4.2	4.2	4.2	4.2	4.2
4.2	4.2	4.2	4.2	4.2
4.1	4.1	4.1	4.1	4.1
4.1	4.1	4.1	4.1	4.1
4.1	4.1	4.0	4.0	4.0
4.0	4.0	4.0	3.9	3.8
3.7	3.6	3.5	3.5	3.4
3.3	3.2	3.1	3.0	3.2
3.7	2.4	3.3	3.6	3.2
3.2	3.4	3.5	2.8	2.0
3.3	2.4	3.0	3.2	1.7
3.2	3.0	1.4	2.8	3.3
2.9	1.1	2.6	3.2	3.1
1.7	2.8	2.0	3.3	4.0
4.8	4.8	5.1	5.8	5.5
5.6	5.7	5.7	5.6	5.5
5.6	5.8	5.8	5.8	5.8
5.8	5.7	5.7	5.7	5.6
5.6	5.6	5.5	5.5	5.4
5.4	5.4	4.9	5.2	6.3
6.1	4.1	4.0	6.1	6.4
5.2	5.8	6.1	6.7	4.4
3.7	4.3	6.5	4.3	3.9
1.2	3.9	0.0	4.6	10.5
4.0	1.5	3.9	0.5	4.4
5.4	4.3	0.5	5.8	4.5
3.9	0.5	4.5	4.5	8.4
0.1	4.1	3.4	7.0	6.5
3.5	6.4	4.2	3.7	6.8

```
                0.1          0.6          8.8          2.7          3.1
                6.2          3.4          0.2          3.7          5.8
                3.9          2.6          3.6          2.7          1.9
                4.7          4.8          1.0          7.0          0.0
                0.1          0.2          0.2          0.0          0.5
                1.9          3.4          2.4          0.1          2.1
                0.5          0.1          0.9          0.0          0.9
                1.6          0.0          1.2          0.5          1.2
                1.5          0.6          1.3

enth  =   2547525.0    2678332.0    2676740.0    2676744.0    2676692.0
          2677138.0    2672659.0    2699500.0    2781961.0    2770659.0
          2766118.0    2764730.0    2764384.0    2764313.0    2764308.0
          2764327.0    2764541.0    2765058.0    2765616.0    2766113.0
          2766577.0    2766954.0    2767244.0    2767512.0    2767766.0
          2768007.0    2768236.0    2768456.0    2768664.0    2768864.0
          2769054.0    2769235.0    2769407.0    2769569.0    2769724.0
          2769873.0    2770014.0    2770138.0    2770250.0    2770353.0
          2770450.0    2770541.0    2770626.0    2770705.0    2770778.0
          2770846.0    2770907.0    2770963.0    2771013.0    2771057.0
          2771096.0    2771129.0    2771156.0    2771178.0    2771194.0
          2771205.0    2771211.0    2771211.0    2771206.0    2771196.0
          2771182.0    2771163.0    2771139.0    2771110.0    2771076.0
          2771038.0    2770996.0    2770949.0    2770898.0    2770844.0
          2770785.0    2770722.0    2770656.0    2770586.0    2770512.0
          2770433.0    2770347.0    2770257.0    2770164.0    2770070.0
          2769976.0    2769880.0    2769782.0    2769680.0    2769573.0
          2769462.0    2769343.0    2769219.0    2769092.0    2768963.0
          2768833.0    2768702.0    2768571.0    2768439.0    2768306.0
          2768161.0    2767974.0    2767782.0    2767592.0    2767404.0
          2767221.0    2767132.0    2765652.0    2765415.0    2765231.0
          2765109.0    2764862.0    2764493.0    2764063.0    2763518.0
          2762782.0    2761877.0    2761406.0    2760343.0    2759118.0
          2757737.0    2756237.0    2754642.0    2760676.0    2760135.0
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          2757703.0    2757568.0    2757504.0    2757388.0    2757206.0
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          2704110.0    2704081.0    2704045.0    2704003.0    2703973.0
```

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2703252.0	2703216.0	2703178.0	2703141.0	2703104.0
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2702080.0	2702040.0	2701998.0	2701956.0	2701916.0
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2701456.0	2701415.0	2701374.0	2701331.0	2701287.0
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[illegible]	2700790.0	2700691.0	2700521.0	2700548.0
2700537.0	2700523.0	2700488.0	2700462.0	2700418.0
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2700133.0	2700102.0	2700066.0	2700041.0	2700006.0
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2699804.0	2699771.0	2699740.0	2699704.0	[illegible]
2699640.0	2699617.0	2699592.0	2699564.0	2699547.0
2699524.0	2699505.0	2699482.0	2699460.0	2699439.0
2699416.0	2699395.0	2699374.0	2699352.0	2699332.0
2699312.0	2699290.0	2699270.0	2699252.0	2699231.0
2699210.0	2699188.0	2699165.0	2699143.0	2699126.0
2699185.0	2699271.0	2699185.0	2699200.0	2699229.0
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2698974.0	2698958.0	2698859.0	2698934.0	2698969.0
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2720432.0	2736754.0	2743232.0	2723444.0	2715190.0
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2722402.0	2726602.0	2750201.0	2714150.0	2743469.0

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            2744726.0   2731505.0   2819061.0   2737245.0   2753844.0
            2727543.0   2721452.0   2771315.0   2751222.0   2725396.0
            2736274.0   2725186.0   2735[illegible]94.0   2731813.0   2737567.0
            2728285.0   2745799.0   2722172.0   2731546.0   2725140.0
            2723374.0   2737963.0   2727181.0
    eoi
&&
&&  Blowdown of saturated primary system water
&&
    h2ov  = 914
    iflag = 2
    t     =        0.0         0.5         1.5         2.5         3.5
                   4.5         5.5         6.5         7.5         8.5
                   9.5        10.5        11.5        12.5        13.5
                  14.5        15.5        16.5        17.5        18.5
                  19.5        20.5        21.5        22.5        23.5
                  24.5        25.5        26.5        27.5        28.5
                  23.5        30.5        31.5        32.5        33.5
                  34.5        35.5        36.5        37.5        38.5
                  39.5        40.5        41.5        42.5        43.5
                  44.5        45.5        46.5        47.5        48.5
                  49.5        50.5        51.5        52.5        53.5
                  54.5        55.5        56.5        57.5        58.5
                  59.5        60.5        61.5        62.5        63.5
                  64.5        65.5        66.5        67.5        68.5
                  69.5        70.5        71.5        72.5        73.5
                  74.5        75.5        76.5        77.5        78.5
                  79.5        80.5        81.5        82.5        83.5
                  84.5        85.5        86.5        87.5        88.5
                  89.5        90.5        91.5        92.5        93.5
                  94.5        95.5        96.5        97.5        98.5
                  99.5       100.0       110.0       120.0       130.0
                 140.0       150.0       160.0       170.0       180.0
                 190.0       200.0       204.8       214.8       224.8
                 234.8       244.8       254.8       264.8       274.8
                 284.8       294.8       304.8       314.8       324.8
                 334.8       344.8       354.8       364.8       374.8
                 384.8       394.8       404.8       414.8       424.8
                 434.8       444.8       454.8       464.8       474.8
                 484.8       494.8       504.8       514.8       524.8
                 534.8       544.8       554.8       564.8       574.8
                 584.8       594.8       604.8       614.8       624.8
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                 684.8       694.8       704.8       714.8       724.8
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                 884.8       894.8       904.8       914.8       924.8
                 934.8       944.8       954.8       964.8       974.8
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                1084.8      1094.8      1104.8      1114.8      1123.1
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                1331.9      1341.9      1351.9      1361.9      1371.9
                1381.9      1391.9      1401.7      1402.7      1403.7
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                1414.7      1415.7      1416.7      1417.7      1418.7
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3273.1	3283.1	3293.1	3303.1	3313.1

	3323.1	3333.1	3343.1	3353.1	3363.1
	3373.1	3383.1	3393.1	3403.1	3413.1
	3423.1	3433.1	3443.1	3453.1	3463.1
	3473.1	3483.1	3493.1	3503.1	3513.1
	3523.1	3533.1	3543.1	3553.1	3563.1
	3573.1	3583.1	3593.1		
mass =	0.0	129.6	180.3	192.7	193.1
	318.4	1081.9	1858.9	138.5	87.6
	73.9	70.7	70.0	70.0	70.0
	70.0	70.5	71.8	73.1	74.3
	75.4	76.2	76.9	77.5	78.2
	78.8	79.4	79.9	80.5	81.0
	81.5	82.0	82.4	82.8	83.2
	83.6	84.0	84.3	84.6	84.9
	85.2	85.4	85.6	85.8	86.0
	86.2	86.4	86.5	86.6	86.7
	86.8	86.9	87.0	87.0	87.1
	87.1	87.1	87.1	87.0	87.0
	86.9	86.9	86.8	86.7	86.6
	86.4	86.3	86.1	86.0	85.8
	85.6	85.4	85.2	85.0	84.8
	84.5	84.3	84.0	83.7	83.4
	83.2	82.9	82.6	82.3	82.0
	81.7	81.3	81.0	80.6	80.2
	79.9	79.5	79.1	78.8	78.4
	78.0	77.5	77.0	76.5	76.0
	75.5	75.3	71.6	70.8	70.1
	69.4	68.5	67.2	65.9	64.4
	62.6	60.5	59.5	57.3	54.9
	52.3	49.7	47.1	55.6	54.2
	52.9	51.7	50.5	49.5	48.7
	48.1	47.6	47.2	46.8	46.2
	45.6	45.0	44.2	43.4	42.6
	41.7	40.8	39.9	38.9	37.8
	36.3	35.3	34.1	33.0	32.1
	31.6	30.7	30.5	29.7	28.9
	28.0	27.1	26.3	25.5	24.7
	24.0	23.4	22.8	22.2	21.7
	21.1	20.6	23.2	22.8	22.5
	22.1	21.7	21.3	20.9	21.9
	20.3	20.1	20.0	19.9	19.7
	19.6	19.5	19.4	19.3	19.1
	19.0	18.9	18.9	18.6	18.4
	18.2	18.0	17.8	17.6	17.4
	17.3	17.1	17.0	16.9	16.8
	16.7	16.6	16.5	16.4	16.4
	16.3	16.2	16.2	16.2	16.2
	16.1	16.0	15.9	15.8	15.7
	15.6	15.6	15.4	15.3	15.3
	15.2	15.3	15.3	15.1	15.4
	15.3	15.3	15.3	15.3	16.0
	16.7	15.8	13.9	15.6	16.0
	15.9	14.4	16.0	16.4	16.0
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	[illegible]	16.2	16.2	16.2
	16.2	[illegible]	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	16.2
	16.2	16.2	16.2	16.2	15.2
	16.2	16.2	16.2	16.2	16.2

16.2	16.2	16.2	16.1	16.1
16.1	16.1	16.1	16.1	16.1
16.1	16.1	16.1	16.1	16.1
16.1	16.1	16.1	16.1	16.1
16.1	16.1	16.1	16.1	16.0
16.0	16.0	16.0	16.0	16.0
16.0	16.0	16.0	16.0	16.0
16.0	16.0	16.0	16.0	16.0
15.9	15.9	15.9	15.9	15.9
15.9	15.9	15.9	15.9	15.9
15.9	15.9	15.9	15.9	15.9
15.8	15.8	15.8	15.8	15.8
15.8	15.8	15.8	15.8	15.8
15.8	15.8	15.8	15.7	15.7
15.7	15.7	15.7	15.7	15.7
15.7	15.7	15.7	15.7	15.7
15.7	15.7	15.7	15.7	13.6
15.6	15.6	15.6	15.6	15.6
15.6	15.6	15.6	15.6	15.6
15.6	15.6	15.6	15.6	15.6
15.6	15.6	15.6	15.6	15.6
15.6	15.5	15.5	15.5	15.5
15.5	15.5	15.5	15.5	15.5
15.5	15.5	15.5	15.5	15.5
15.5	15.6	15.5	15.6	15.6
15.6	15.6	15.6	15.5	15.5
15.5	15.5	15.5	15.5	15.5
15.5	15.5	15.5	15.6	15.6
15.6	15.6	[illegible]	15.6	15.6
15.6	15.6	[illegible]	15.5	15.6
15.6	[illegible]	[illegible]	15.6	15.6
15.7	[illegible]	[illegible]	15.5	15.5
15.5	[illegible]	15.6	15.6	15.7
16.0	[illegible]	15.2	15.3	15.3
15.3	15.3	15.4	15.3	15.2
15.3	15.3	15.4	15.4	15.3
15.2	15.2	15.2	15.2	15.3
15.3	15.4	15.4	15.6	16.0
16.2	16.4	16.4	15.2	13.6
14.4	15.2	15.2	15.5	15.9
16.1	16.3	16.6	16.9	17.1
17.3	17.5	17.7	17.9	18.0
18.2	18.4	18.5	18.6	18.8
18.9	19.0	19.1	19.2	19.3
19.3	19.5	19.5	15.6	19.6
19.7	19.7	19.7	19.7	19.8
19.8	19.8	19.8	19.8	19.8
19.8	19.8	19.8	19.8	19.8
19.8	19.7	19.7	19.7	19.7
19.7	19.6	19.6	19.6	19.6
19.5	19.5	19.4	19.4	19.3
19.3	19.2	19.1	19.1	19.0
19.0	19.0	18.9	18.9	18.9
18.8	18.8	18.7	18.7	18.6
18.6	18.5	18.4	18.4	18.5
18.6	18.4	18.3	18.3	18.3
18.3	18.3	18.1	17.9	17.7
17.6	17.6	17.6	17.4	17.3
17.3	17.3	17.2	17.1	17.1
17.0	17.0	17.0	17.0	16.9
16.9	16.9	16.9	16.9	16.9
16.9	17.0	17.0	17.0	17.0
17.1	17.1	17.1	17.2	17.2
17.2	17.3	17.3	17.4	17.4
17.5	17.5	17.5	17.6	17.6
17.7	17.7	17.8	17.9	17.9
17.9	18.0	18.0	18.0	18.1
18.1	18.1	18.1	18.1	18.1

18.1	18.2	18.2	18.2	18.2
18.2	18.2	18.2	18.1	18.0
18.0	18.0	18.0	18.0	18.0
18.0	18.0	18.0	18.0	18.0
18.0	18.0	17.9	17.9	17.9
17.9	17.9	17.9	17.9	17.9
17.8	17.8	17.8	17.8	17.8
17.8	17.8	17.8	17.7	17.7
17.7	17.7	17.7	17.6	17.6
17.6	17.6	17.5	17.5	17.5
17.5	17.5	17.4	17.4	17.4
17.4	17.4	17.3	17.3	17.3
17.3	17.2	17.2	17.2	17.2
17.2	17.1	17.1	17.1	17.1
17.1	17.1	17.1	17.0	17.0
17.0	17.0	17.0	17.0	17.0
17.0	17.0	17.0	16.9	16.9
16.9	16.9	16.9	16.9	16.9
16.9	16.9	16.9	16.9	16.9
16.3	16.9	16.9	16.9	16.9
16.9	16.9	16.9	16.9	16.9
16.9	16.9	16.9	16.9	16.9
16.9	16.9	16.9	16.8	16.8
16.8	16.8	16.8	16.8	16.8
16.8	16.8	16.8	16.8	16.8
16.8	16.7	16.7	16.7	16.7
16.7	16.6	16.6	16.6	16.6
16.6	16.5	16.5	16.5	16.6
16.5	16.6	16.5	16.5	16.5
16.5	16.4	16.4	16.4	16.4
16.3	16.3	16.3	16.3	16.3
16.3	16.2	16.2	16.2	16.2
16.2	16.1	16.1	16.1	16.1
16.1	16.1	16.0	16.0	16.0
16.0	16.0	15.9	15.9	15.9
15.9	15.9	15.9	15.8	15.8
15.8	15.8	15.8	15.8	15.7
15.7	15.7	15.5	15.3	15.2
15.1	14.9	14.7	14.6	14.4
14.3	14.1	14.0	15.4	17.8
12.3	17.8	10.3	12.3	15.5
13.4	12.2	10.8	10.6	17.7
10.5	15.6	9.5	10.5	19.7
10.1	10.4	21.7	10.6	10.1
11.3	23.0	13.3	10.1	10.2
11.3	13.8	24.8	30.1	25.9
30.1	31.5	35.3	35.8	40.4
42.2	43.6	44.8	40.7	38.3
47.8	47.3	47.8	48.3	48.7
49.1	49.4	49.7	50.0	50.2
50.5	50.7	51.0	51.2	51.4
51.6	51.8	53.8	58.2	45.5
46.8	61.8	52.4	47.1	46.0
51.0	48.9	43.4	49.4	59.0
53.9	56.7	43.3	48.5	48.2
18.1	65.5	35.0	44.9	16.5
39.5	193.3	56.4	33.5	44.2
36.0	34.5	69.8	30.0	36.7
40.6	167.6	29.4	30.3	17.0
76.6	46.1	35.2	23.6	22.3
24.9	20.1	33.4	39.7	12.9
148.4	15.0	12.7	25.4	28.3
11.0	21.6	75.8	9.0	21.1
38.7	47.6	18.3	37.9	14.2
19.4	28.1	12.9	27.4	35.1
46.0	59.9	343.8	20.4	[illegible]
24.6	15.8	45.6	51.6	13.9
36.5	36.0	22.5	46.4	40.5

	33.3	67.3	40.5	25.3	25.8
	10.2	21.4	38.6		
enth =	158119.7	158227.3	158224.4	158225.9	158227.3
	158231.8	158290.1	200020.9	801773.9	739475.9
	717309.5	710926.9	709328.2	708997.[illegible]	708972.0
	709051.6	709962.1	712237.8	714723.1	716948.4
	719030.4	720731.1	722092.6	723370.2	724584.8
	725732.9	726830.3	727881.6	728883.3	729840.0
	730753.5	731626.6	732454.2	733232.6	733982.[illegible]
	734699.7	735379.2	735984.2	736521.3	737021.4
	737490.4	737931.1	738343.2	738727.2	739081.0
	739406.4	739704.6	739975.8	740219.4	740435.4
	740624.1	740785.1	740918.6	741025.1	741105.0
	741159.0	741187.4	741190.4	741168.6	741122.0
	741053.6	740961.8	740846.1	740707.2	740546.2
	740363.8	740159.9	739935.2	739690.4	739426.2
	739143.2	738841.9	738522.9	738185.7	737829.4
	737450.4	737036.1	736603.1	736156.5	7357[illegible].2
	735250.3	734792.2	734320.8	733828.8	733315.4
	732781.4	732212.5	731618.5	731010.4	730393.1
	729769.6	729142.3	728513.2	727884.8	727258.9
	726560.8	725671.6	724754.8	723847.2	722956.5
	722085.6	721659.0	715014.9	713975.0	713141.8
	712611.8	711530.6	709910.0	708015.9	705624.1
	702664.4	699061.7	697194.5	693005.6	688192.2
	682777.9	676902.8	670659.7	694372.2	692257.0
	690095.4	688054.8	686163.1	684603.9	683478.6
	68[illegible]749.9	682227.4	681986.2	681537.4	680834.9
	67[illegible]16.2	678834.3	67[illegible]556.9	675880.1	673988.2
	671933.6	669684.8	667475.7	664668.4	661817.4
	65[illegible]	654055.8	650935.4	647915.2	644864.2
	643106.8	639898.3	638623.4	635707.2	632431.1
	629020.4	625527.4	622024.9	618310.1	615047.8
	611596.8	608399.0	605316.4	602375.1	599389.2
	596320.0	593215.0	616752.3	614416.6	612202.2
	609997.1	607606.5	605179.7	602860.1	603460.2
	597345.3	595503.9	593669.8	591843.9	590032.1
	588239.5	586453.2	584804.4	583027.2	581271.2
	579531.1	577794.5	576019.1	573958.9	571776.8
	569629.8	567515.6	565414.3	563159.6	561125.9
	559112.1	557095.1	555105.3	553148.6	551217.9
	549311.2	547424.7	545565.2	543758.9	541994.4
	540258.2	538603.6	537009.8	535496.8	534296.5
	532671.4	530901.1	529160.1	527457.2	525799.1
	524603.6	523587.1	520874.9	519416.4	518017.0
	516685.0	516124.5	513376.3	512901.8	512945.8
	511716.2	510283.4	509077.4	507801.2	510549.6
	512647.0	507684.8	492[illegible]06.9	503425.8	505358.6
	503450.1	492980.8	502774.3	504377.4	502896.8
	503098.3	503112.8	503109.9	503008.1	502907.0
	502842.4	502780.0	502705.6	502618.7	502531.2
	502451.3	502371.4	502287.2	502201.0	502115.3
	502030.5	501945.4	501856.8	501775.7	501685.3
	501599.9	501516.4	501426.1	501338.3	501251.2
	501163.6	501075.0	500986.8	500899.3	500811.4
	500722.4	500633.9	500545.9	500455.6	500362.3
	500272.1	500185.2	500099.2	499992.4	499910.4
	499820.7	499730.2	499640.6	499550.4	499460.1
	499370.6	499298.7	499241.4	499151.8	499073.4
	498993.8	498909.8	498803.6	498682.7	498594.9
	498503.6	498412.0	498314.3	498216.3	498124.2
	498031.7	497937.2	497839.9	497741.2	497644.0
	497545.8	497445.5	497344.8	497242.9	497139.8
	497036.5	496931.6	496824.6	496719.2	496613.4
	496506.6	496400.4	496293.4	496185.1	496077.3
	495968.8	495858.2	495750.0	495640.2	495529.2
	495418.6	495307.2	495194.8	495082.8	494970.3

494856.8	494744.2	494631.1	494516.7	494402.8
494288.7	494173.3	494058.7	493943.2	493826.2
493710.1	493593.7	493475.8	493358.4	493240.3
493121.0	493002.4	492883.5	492763.7	492644.8
492523.6	492403.7	492285.3	492167.2	492043.1
491923.4	491802.4	491680.3	491557.5	491436.0
491318.1	491200.4	491080.7	490958.8	490831.9
490693.2	490561.7	490446.4	490329.2	490210.9
490095.2	489976.7	489856.3	489736.2	489615.6
489493.7	489403.6	489118.8	488625.4	488695.8
488665.6	488621.4	488523.4	488448.1	488325.8
488182.0	488033.8	487904.6	487785.2	487628.8
487503.8	487413.2	487305.3	487233.6	487132.5
487026.6	486932.0	486839.6	486743.4	486647.6
486550.8	486454.2	486365.1	486265.2	486179.0
486077.0	486009.0	485938.0	485856.3	485807.5
485738.7	485684.3	485617.9	485555.1	485492.9
485428.5	485366.0	485305.1	485242.7	485182.1
485123.0	485061.6	485003.9	484947.5	484888.0
484826.4	484761.9	484694.4	484632.8	484580.8
484740.7	484984.9	484758.4	484785.6	484874.5
484862.9	484866.4	484628.3	484227.8	484035.3
483976.7	484049.7	484154.8	484109.4	484041.3
484038.5	484063.7	484094.8	484105.8	484072.1
484042.4	484035.3	484011.9	483977.5	483931.2
483881.2	483833.6	483775.8	483715.9	483808.5
484104.0	484102.3	483784.3	483999.7	484097.2
484283.9	484217.7	483661.2	483412.4	483142.9
483167.7	483321.6	483441.3	483550.2	483781.1
485663.1	486109.5	482082.7	481911.0	481994.3
481958.0	482195.5	482398.5	482023.8	481575.0
481915.9	482057.5	482242.2	482317.6	481837.1
481344.8	481243.8	481138.5	481129.9	481354.5
481736.1	481891.2	481780.8	482605.9	484616.5
485701.1	486569.8	486403.9	479936.3	471353.8
476089.3	480330.4	480356.5	481788.5	483664.2
484686.2	485813.9	487225.6	488244.0	489258.5
490229.2	491248.3	492209.3	493156.8	493976.9
494784.8	495519.2	496221.2	496876.2	497467.4
498014.8	498535.7	499009.5	499430.2	499722.4
500109.3	500612.6	501056.4	501165.0	501408.8
501654.8	501759.9	501864.0	501980.3	502044.3
502104.0	502151.2	502192.2	502208.6	502220.8
502222.0	502211.1	502191.5	502171.2	502123.3
502071.8	502022.2	501951.2	501872.1	501781.8
501682.3	501573.1	501449.1	501341.9	501191.6
501039.6	500879.3	500701.2	500497.9	500250.5
499914.3	499532.5	499202.6	499026.2	498848.2
498746.8	498589.8	498435.0	498342.0	498282.0
498140.3	497891.6	497652.3	497332.9	497096.8
496870.5	496551.5	496060.6	496262.5	496523.2
497200.3	496384.6	495783.5	495979.4	495983.6
495919.8	495702.1	495201.9	494372.8	493506.3
492932.0	492866.3	492920.5	492296.8	491639.2
491628.3	491630.1	491294.1	490949.2	490843.3
490721.5	490580.2	490554.4	490421.1	490311.6
490366.2	490356.9	490299.6	490411.7	490387.4
490473.5	490619.0	490728.8	490830.2	490899.1
491086.6	491285.1	491444.7	491620.2	491833.6
492043.6	492247.8	492469.4	492691.2	492912.8
493146.3	493376.8	493598.4	493829.0	494053.5
494226.2	494479.4	494669.3	495184.7	495363.0
495480.6	495686.9	495878.5	496005.3	496112.4
496194.5	496355.1	496417.6	496616.8	496643.9
496693.2	496725.4	496819.3	496915.2	496883.5
496908.6	496974.2	496981.4	496883.0	496530.7
496331.5	496333.7	496432.3	496436.7	496538.5
496539.7	496528.8	496486.8	496528.0	496559.4

496612.4	496597.6	496612.3	496595.8	496625.6
496616.3	496641.1	496619.7	496589.2	496604.2
496550.6	496595.7	496591.0	496636.2	496553.0
496619.4	496626.2	496562.3	496500.8	496519.6
496494.7	496435.9	496430.2	496405.0	496357.4
496354.4	496322.7	496272.8	496276.1	496244.7
496194.8	496195.5	496168.1	496120.5	496125.4
496099.0	496039.4	496032.3	496009.4	495992.2
496030.2	496057.8	496061.2	496050.8	496097.9
496138.9	496164.5	496191.4	496224.6	496264.4
496307.2	496343.2	496387.2	496434.6	496477.7
496528.3	496584.4	496589.5	496647.7	496716.5
496921.0	496914.6	496911.1	496987.5	497050.8
497133.3	497316.2	497234.7	497385.7	497452.6
497470.9	497552.2	4977[illegible]7.9	497782.3	497839.7
497904.3	498015.5	498126.8	498176.3	498284.5
498360.7	498437.2	498514.6	498621.3	498684.6
498813.7	4989[illegible]	499024.2	499094.3	499118.1
499294.7	49925[illegible]	499439.5	499555.1	499576.8
499698.7	499725.[illegible]	499843.1	499991.8	499995.7
500087.3	500217.1	500253.8	500465.8	500588.2
500616.2	500605.5	500697.4	500806.1	500867.[illegible]
500875.8	500967.2	501065.7	501243.8	501374.4
501358.4	501218.0	501476.2	501414.1	501833.2
502089.8	501984.8	501847.2	501905.6	502063.9
502186.2	502233.2	502247.1	502329.1	502443.2
502560.7	502653.4	502731.0	502824.6	502936.9
503055.0	503171.3	503286.6	503401.1	503520.1
503630.4	503745.3	503[illegible]61.3	503986.3	504112.2
504239.9	504368.7	504497.4	504631.8	504769.8
504907.4	505047.6	505189.8	505332.3	505478.[illegible]
505627.9	505776.6	505928.7	506081.8	506236.2
506391.8	506551.6	506709.8	506871.8	507035.3
507200.9	507255.7	508830.2	510269.1	512467.3
514797.2	517280.5	519964.8	522849.5	525973.6
529298.2	532546.1	536079.9	536775.9	529923.5
517303.6	516278.6	517827.9	508366.2	506544.3
507008.1	503415.7	502145.2	514348.3	507249.9
509043.2	504951.2	514045.5	498842.8	510093.9
508808.2	500493.4	507479.2	511664.1	499990.9
500488.6	507298.9	511570.2	506069.8	498170.8
503978.9	517406.3	52[illegible]997.4	554966.4	562750.3
553098.6	569402.8	575856.3	575055.0	580318.0
585552.4	589292.8	592230.4	582566.3	572876.5
596416.9	598138.9	599301.4	600233.[illegible]	601018.4
601679.1	602255.6	602763.5	603216.8	603617.4
603986.7	604320.1	604619.5	604897.0	605155.8
605375.0	605572.7	611807.5	6108[illegible]3.6	604977.0
598220.9	605815.1	620290.3	610643.5	597061.5
6040[illegible].9	596579.9	600616.5	606329.9	601491.9
620321.1	612820.9	554136.8	591190.7	611101.1
630472.3	599093.1	624696.5	602110.7	569970.2
609474.1	593093.4	576145.4	620694.4	591197.6
5766[illegible].2	573551.6	593672.5	565813.9	562640.9
601482.4	585834.5	572019.6	552365.[illegible]	565140.4
585228.1	557737.9	559249.9	527572.1	531403.7
564263.6	549020.9	549939.1	558838.2	580349.6
581261.8	605545.5	599064.2	603206.9	570482.6
560178.6	600449.8	572579.2	564005.6	536288.3
559654.4	550652.9	606809.3	567090.9	584522.1
558326.2	571625.2	574650.6	541837.4	563282.1
564436.1	584453.8	545579.2	553446.7	577896.8
[illegible]9475.7	551011.0	593928.9	591056.8	566946.3
575514.5	563808.6	587210.4	566057.7	581234.0
574262.8	567689.1	577991.0	575092.9	564074.6
562345.1	569967.5	570910.3		

eoi

&&

```
&& Blowdown of primary system steam
&&
   h2ov  = 914
   iflag = 2
   t     =       0.0      0.5      1.5      2.5      3.5
                 4.5      5.5      6.5      7.5      8.5
                 9.5     10.5     11.5     12.5     13.5
                14.5     15.5     16.5     17.5     18.5
                19.5     20.5     21.5     22.5     23.5
                24.5     25.5     26.5     27.5     28.5
                29.5     30.5     31.5     32.5     33.5
                34.5     35.5     36.5     37.5     38.5
                39.5     40.5     41.5     42.5     43.5
                44.5     45.5     46.5     47.5     48.5
                49.5     50.5     51.5     52.5     53.5
                54.5     55.5     56.5     57.5     58.5
                59.5     60.5     61.5     62.5     63.5
                64.5     65.5     66.5     67.5     68.5
                69.5     70.5     71.5     72.5     73.5
                74.5     75.5     76.5     77.5     78.5
                79.5     80.5     81.5     82.5     83.5
                84.5     85.5     86.5     87.5     88.5
                89.5     90.5     91.5     92.5     93.5
                94.5     95.5     96.5     97.5     98.5
                99.5    100.0    110.0    120.0    130.0
               140.0    150.0    160.0    170.0    180.0
               190.0    200.0    204.8    214.8    224.8
               234.8    244.8    254.8    264.8    274.8
               284.8    294.8    304.8    314.8    324.8
               334.8    344.8    354.8    364.8    374.8
               384.8    394.8    404.8    414.8    424.8
               434.8    444.8    454.8    464.8    474.8
               484.8    494.8    504.8    514.8    524.8
               534.8    544.8    554.8    564.8    574.8
               584.8    594.8    604.8    614.8    624.8
               634.8    644.8    654.8    664.8    674.8
               684.8    694.8    704.8    714.8    724.8
               734.8    744.8    754.8    764.8    774.8
               784.8    794.8    804.8    814.8    824.8
               834.8    844.8    854.8    864.8    874.8
               884.8    894.8    904.8    914.8    924.8
               934.8    944.8    954.8    964.8    974.8
               984.8    994.8   1004.8   1014.8   1024.8
              1034.8   1044.8   1054.8   1064.8   1074.8
              1084.8   1094.8   1104.8   1114.8   1123.1
              1133.1   1143.1   1153.1   1163.1   1173.1
              1183.1   1193.1   1203.1   1213.1   1223.1
              1233.1   1243.1   1251.9   1261.9   1271.9
              1281.9   1291.9   1301.9   1311.9   1321.9
              1331.9   1341.9   1351.9   1361.9   1371.9
              1381.9   1391.9   1401.7   1402.7   1403.7
              1404.7   1405.7   1406.7   1407.7   1408.7
              1409.7   1410.7   1411.7   1412.7   1413.7
              1414.7   1415.7   1416.7   1417.7   1418.7
              1419.7   1420.7   1421.7   1422.7   1423.7
              1424.7   1425.7   1426.7   1427.7   1428.7
              1429.7   1430.7   1431.7   1432.7   1433.7
              1434.7   1435.7   1436.7   1437.7   1438.7
              1439.7   1440.7   1441.7   1442.7   1443.7
              1444.7   1445.7   1446.7   1447.7   1448.7
              1449.7   1450.7   1451.7   1452.7   1453.7
              1454.7   1455.7   1456.7   1457.7   1458.7
              1459.7   1460.7   1461.7   1462.7   1463.7
              1464.7   1465.7   1466.7   1467.7   1468.7
              1469.7   1470.7   1471.7   1472.7   1473.7
              1474.7   1475.7   1476.7   1477.7   1478.7
              1479.7   1480.7   1481.7   1482.7   1483.7
              1484.7   1485.7   1486.7   1487.7   1488.7
```

1489.7	1490.7	1491.7	1492.7	1493.7
1494.7	1495.7	1496.7	1497.7	1498.7
1499.7	1500.7	1501.7	1502.7	1503.7
1504.7	1505.7	1506.7	1507.7	1508.7
1509.7	1510.7	1511.7	1512.7	1513.7
1514.7	1515.7	1516.7	1517.7	1518.7
1519.7	1520.7	1521.7	1522.7	1523.7
1524.7	1525.7	1526.7	1527.7	1528.7
1529.7	1530.7	1531.7	1532.7	1533.7
1534.7	1535.7	1536.7	1537.7	1538.7
1539.7	1540.7	1541.7	1542.7	1543.7
1544.7	1545.7	1546.7	1547.7	1548.7
1549.7	1550.7	1551.7	1552.7	1553.7
1554.7	1555.7	1556.7	1557.7	1558.7
1559.7	1560.7	1561.7	1562.7	1563.7
1564.7	1565.7	1566.7	1567.7	1568.7
1569.7	1570.7	1571.7	1572.7	1573.7
1574.7	1575.7	1576.7	1577.7	1578.7
1579.7	1580.7	1581.7	[illegible]	1583.7
1584.7	1585.7	1586.7	1587.7	1588.7
1589.7	1590.7	1591.7	1592.7	1593.7
1594.7	1595.7	1596.7	1597.7	1598.7
1599.7	1600.7	1601.7	1602.7	1603.7
1604.7	1605.7	1606.7	1607.7	1608.7
1609.7	1610.7	1611.7	1612.7	1613.7
1614.7	1615.7	1616.7	1617.7	1618.7
1619.7	1620.7	1621.7	1622.7	1623.7
1624.7	1625.7	1626.7	1627.7	1628.7
1629.7	1630.7	1631.7	1632.7	1633.7
1634.7	1635.7	1636.7	[illegible]	1638.7
1639.7	1640.7	1641.7	1642.7	1643.7
1644.7	1645.7	1646.7	1647.7	1648.7
1649.7	1650.7	1651.7	1652.7	1653.7
1654.7	1655.7	1656.7	1657.7	1658.7
1659.7	1660.7	1661.7	1662.7	1663.7
1664.7	1665.7	1666.7	1667.7	1668.7
1669.7	1670.7	1671.7	1672.7	1673.7
1674.7	1675.7	1676.7	1677.7	1678.7
1679.7	1680.7	1681.7	1682.7	1683.7
1684.7	1685.7	1686.7	1687.7	1688.7
1689.7	1690.7	1691.7	1692.7	1693.7
1694.7	1695.7	1696.7	1697.7	1698.7
1699.7	1700.7	1701.7	1702.7	1703.7
1704.7	1705.7	1706.7	1707.7	1708.7
1709.7	1710.7	1711.7	1712.7	1713.7
1714.7	1715.7	1716.7	1717.7	1718.7
1719.7	1720.7	1721.7	1722.7	1723.7
1724.7	1725.7	1726.7	1727.7	1728.7
1729.7	1730.7	1731.7	1732.7	1733.7
1734.7	1735.7	1736.7	1737.7	1738.7
1739.7	1740.7	1741.7	1742.7	1743.7
1744.7	1745.7	1746.7	1747.7	1748.7
1749.7	1750.7	1751.7	1752.7	1753.7
1754.7	1755.7	1756.7	1757.7	1758.7
1759.7	1760.7	1761.7	1762.7	1763.7
1764.7	1765.7	1766.7	1767.7	1768.7
1769.7	1770.7	1771.7	1772.7	1773.7
1774.7	1775.7	1776.7	1777.7	1778.7
1779.7	1780.7	1781.7	1782.7	1783.7
1784.7	1785.7	1786.7	1787.7	1788.7
1789.7	1790.7	1791.7	1792.7	1793.7
1794.7	1795.7	1796.7	1797.7	1798.7
1799.7	1800.7	1801.7	1802.7	1803.7
1804.7	1805.7	1806.7	1807.7	1808.7
1809.7	1810.7	1811.7	1812.7	1813.7
1814.7	1815.7	1816.7	1817.7	1818.7
1819.7	1820.7	1821.7	1822.7	1823.7
1824.7	1825.7	1826.7	1827.7	1828.7

1829.7	1830.7	1831.7	1832.7	1833.7
1834.7	1835.7	1836.7	1837.7	1838.7
1839.7	1840.7	1841.7	1842.7	1843.7
1844.7	1845.7	1846.7	1847.7	1848.7
1849.7	1850.7	1851.7	1852.7	1853.7
1854.7	1855.7	1856.7	1857.7	1858.7
1859.7	1860.7	1861.7	1862.7	1863.7
1864.7	1865.7	1866.7	1867.7	1868.7
1869.7	1870.7	1871.7	1872.7	1873.7
1874.7	1875.7	1876.7	1877.7	1878.7
1879.7	1880.7	1881.7	1882.7	1883.7
1884.7	1885.7	1886.7	1887.7	1888.7
1889.7	1890.7	1891.7	1892.7	1893.7
1894.7	1895.7	1896.7	1897.7	1898.7
1899.7	1900.7	1901.7	1902.7	1903.7
1904.7	1905.7	1906.7	1907.7	1908.7
1909.7	1910.7	1911.7	1912.7	1913.7
1914.7	1915.7	1916.7	1917.7	1918.7
1919.7	1920.7	1921.7	1922.7	1923.7
1924.7	1925.7	1926.7	1927.7	1928.7
1929.7	1930.7	1931.7	1932.7	1933.7
1934.7	1935.7	1936.7	1937.7	1938.7
1939.7	1940.7	1941.7	1942.7	1943.7
1944.7	1945.7	1946.7	1947.7	1948.7
1949.7	1950.7	1951.7	1952.7	1953.7
1954.7	1955.7	1956.7	1957.7	1958.7
1959.7	1960.7	1961.7	1962.7	1963.7
1964.7	1965.7	1966.7	1967.7	1968.7
1969.7	1970.7	1971.7	1972.7	1973.7
1974.7	1975.7	1976.7	1977.7	1978.7
1979.7	1980.7	1981.7	1982.7	1983.7
1984.7	1985.7	1986.7	1987.7	1988.7
1989.7	1990.7	1991.7	1992.7	1993.7
1994.7	1995.7	1996.7	1997.7	1998.7
1999.7	2000.0	2010.0	2020.0	2030.0
2040.0	2050.0	2060.0	2070.0	2080.0
2090.0	2100.0	2110.0	2120.0	2130.0
2140.0	2150.0	2160.0	2170.0	2180.0
2190.0	2200.0	2210.0	2220.0	2230.0
2240.0	2250.0	2260.0	2270.0	2280.0
2290.0	2300.0	2310.0	2320.0	2330.0
2340.0	2350.0	2360.0	2370.0	2380.0
2390.0	2400.0	2410.0	2420.0	2430.0
2440.0	2450.0	2460.0	2470.0	2480.0
2490.0	2500.0	2510.0	2520.0	2521.7
2531.7	2541.7	2551.7	2561.7	2571.7
2581.7	2591.7	2601.7	2611.7	2621.7
2631.7	2641.7	2651.7	2661.7	2671.7
2681.7	2691.7	2701.7	2711.7	2721.7
2731.7	2741.7	2751.7	2761.7	2771.7
2781.7	2791.7	2801.7	2803.2	2813.1
2823.1	2833.1	2843.1	2853.1	2863.1
2873.1	2883.1	2893.1	2903.1	2913.1
2923.1	2933.1	2943.1	2953.1	2963.1
2973.1	2983.1	2993.1	3003.1	3013.1
3023.1	3033.1	3043.1	3053.1	3063.1
3073.1	3083.1	3093.1	3103.1	3113.1
3123.1	3133.1	3143.1	3153.1	3163.1
3173.1	3183.1	3193.1	3203.1	3213.1
3223.1	3233.1	3243.1	3253.1	3263.1
3273.1	3283.1	3293.1	3303.1	3313.1
3323.1	3333.1	3343.1	3353.1	3363.1
3373.1	3383.1	3393.1	3403.1	3413.1
3423.1	3433.1	3443.1	3453.1	3463.1
3473.1	3483.1	3493.1	3503.1	3513.1
3523.1	3533.1	3543.1	3553.1	3563.1
3573.1	3583.1	3593.1		

mass =	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	50.5	39.4
	35.2	33.8	33.4	33.3	33.3
	33.3	33.4	33.8	34.7	34.7
	35.2	35.6	35.9	36.1	36.4
	36.7	36.9	37.1	37.3	37.6
	37.8	38.0	38.1	38.3	38.5
	38.6	38.8	38.9	39.1	39.2
	39.3	39.4	39.5	39.6	[illegible]
	39.8	39.8	39.9	40.0	40.0
	40.1	40.1	40.1	40.2	40.2
	40.2	40.2	40.3	40.3	40.3
	40.2	40.2	40.2	40.2	40.2
	40.1	40.1	40.1	40.0	40.0
	39.9	39.9	39.8	39.7	39.7
	39.6	39.5	39.4	39.3	39.3
	39.2	39.1	39.0	38.9	38.8
	38.7	38.6	38.4	38.3	38.2
	38.1	38.0	37.8	37.7	37.6
	37.4	37.3	37.1	36.9	36.7
	36.6	36.5	35.2	35.1	35.1
	35.2	35.2	35.1	34.0	34.6
	34.2	33.7	33.4	32.8	32.0
	31.1	30.1	29.1	34.2	34.0
	33.8	33.5	33.4	33.2	33.2
	33.2	33.3	33.4	33.4	33.4
	33.4	33.3	33.1	33.0	32.8
	32.5	32.2	32.0	31.6	31.2
	30.7	30.2	29.9	29.6	29.3
	29.0	28.7	28.5	28.1	27.8
	27.4	27.0	26.7	26.3	25.9
	25.5	25.1	24.8	24.4	24.1
	23.7	23.3	27.4	27.0	26.7
	26.4	26.1	25.7	25.4	24.9
	24.5	24.2	23.9	23.5	23.2
	22.9	22.5	22.3	21.9	21.6
	21.3	21.0	20.7	20.4	20.1
	19.8	19.5	19.2	18.9	18.6
	18.3	18.0	17.7	17.4	17.1
	16.9	16.6	16.3	16.0	15.7
	15.5	15.2	15.0	14.7	14.5
	14.3	14.1	13.9	13.7	13.5
	13.3	13.2	12.9	12.7	12.5
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2704791.0   2704786.0   2704820.0   2704856.0   2704878.0
2704882.0   2704914.0   2704950.0   2705012.0   2705055.0
2705049.0   2705001.0   2705093.0   2705071.0   2705224.0
2705300.0   2705269.0   2705219.0   2705242.0   2705299.0
2705340.0   2705355.0   2705361.0   2705390.0   2705430.0
2705471.0   2705503.0   2705530.0   2705563.0   2705603.0
2705643.0   2705684.0   2705724.0   2705764.0   2705806.0
2705844.0   2705883.0   2705924.0   2705968.0   2706011.0
2706056.0   2706100.0   2706144.0   2706192.0   2706239.0
2706284.0   2706332.0   2706380.0   2706426.0   2706476.0
2706526.0   2706574.0   2706626.0   2706677.0   2706728.0
2706780.0   2706834.0   2706886.0   2706940.0   2706995.0
2707050.0   2707068.0   2707558.0   2708070.0   2708805.0
2709576.0   2710400.0   2711289.0   2712244.0   2713287.0
2714376.0   2713441.0   2716575.0   2717479.0   2715764.0
2709244.0   2717533.0   2709940.0   2706765.0   2707916.0
2707356.0   2705743.0   2704562.0   2709009.0   2716900.0
2706804.0   2712316.0   2709003.0   2704124.0   2721174.0
2706813.0   2704932.0   2723279.0   2707968.0   2703828.0
2705493.0   2725673.0   2707572.0   2705907.0   2703822.0
2717379.0   2710476.0   2724490.0   2725371.0   2724520.0
2721841.0   2726314.0   2728248.0   2728045.0   2730173.0
2731730.0   2732871.0   2733769.0   2730711.0   2728088.0
2735208.0   2735571.0   2735926.0   2736210.0   2736449.0
2736650.0   2736825.0   2736980.0   2737116.0   2737239.0
2737352.0   2737452.0   2737543.0   2737625.0   2737700.0
2737763.0   2737820.0   2740064.0   2739390.0   2735644.0
2735412.0   2742554.0   2745561.0   2737230.0   2734979.0
2737278.0   2735304.0   2735570.0   2736636.0   2737875.0
2747108.0   2739805.0   2743914.0   2736192.0   2739179.0
2781715.0   2738770.0   2755562.0   2736250.0   2720564.0
2738154.0   2718860.0   2735820.0   2759214.0   2733628.0
2728685.0   2729542.0   2749347.0   2724204.0   2726526.0
2767421.0   2781681.0   2727220.0   2722144.0   2720087.0
2739568.0   2723116.0   2732810.0   2714422.0   2713701.0
2717686.0   2720572.0   2722932.0   2734807.0   2726082.0
2814093.0   2782506.0   2730763.0   2729831.0   2726293.0
2720432.0   2736754.0   2743232.0   2723444.0   2715190.0
2725543.0   2729064.0   2737420.0   2725943.0   2736436.0
2722402.0   2726602.0   2750201.0   2714150.0   2743469.0
2744726.0   2731505.0   2819061.0   2737245.0   2753844.0
2727543.0   2721452.0   2771315.0   2751222.0   2725396.0
2736274.0   2725186.0   2735294.0   2731813.0   2737567.0
2728285.0   2745799.0   2722172.0   2731540.0   2725140.0
2723374.0   2737963.0   2727181.0
    eoi
&&
struc
    name    = Ceiling     && Name of structure
    type    = roof        && Type of structure
    shape   = slab        && Shape of structure
    nslab   = 10          && Number of nodes in structure
    chrlen  = 17.7        && Characteristic length of structure      (m)
    slarea  = 86.4        && Area                                    (m2)
```

```
    tunif    = 305.          && Initial uniform temp  ature              (K)
    compound=   conc conc conc conc conc conc conc c  c conc conc
    x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name     = Walls         && Name of structure
    type     = wall          && Type of structure
    shape    = slab          && Shape of structure
    nslab    = 10            && Number of nodes in structure
    chrlen   = 5.49          && Characteristic length of structure       (m)
    slarea   = 254.          && Area                                     (m2)
    tunif    = 305.          && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
     x       = 0. .040 .080 .120 .160 .200 .240 .280 .320 .360 .3., &&   (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
    geometry= 86.4      && Area of layers in lower cell                  (m2)
        bc  = 305.      && Basemat boundary condition temperature        (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     19000. && Mass of material                          (kg)
            temp   = 305.   && Initial temperature                       (K)
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  2  3  0.0
    overflow  2  3  3.05
eoi
&&
&& --------------------------- Cell 3, Room 115 ------------------------------
cell 3
control
    nhtm=2  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                        (m3, m)
    atmos    = 3
               1.01e5       && Pressure
               305.         && Temperature
        o2   = 0.20
        n2   = 0.75
        h2ov = 0.05
struc
    name     = Ceiling       && Name of structure
    type     = roof          && Type of structure
    shape    = slab          && Shape of structure
    nslab    = 10            && Number of nodes in structure
    chrlen   = 14.6          && Characteristic length of structure   (m)
    slarea   = 107.          && Area                                 (m2)
    tunif    = 305.          && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
```

```
    x       = 0.   .031 .062 .093 .124  155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls          && Name of structure
    type    = wall
    shape   = slab
    nslab   = 10
    chrlen  = 5.49
    slarea  = 241.
    tunif   = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  3
&&
&&  Lower cell input
&&
low cell
    geometry= 107.      && Area of layers in lower cell                   (m2)
       bc  = 305.      && Basemat boundary condition temperature         (K)
       concrete
           compos = 1      && Number of materials
                    conc   && Material
                    23500. && Mass of material
           temp   = 305.   && Initial temperature
       eoi
       pool
           temp   = 305.   && Initial temperature
       eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
    overflow  3  2  3.05
eoi
&&
&& --------------------------- Cell 4, Room 236 -------------------------------
cell 4
control
    nhtm=1  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
    nsoeng=1  nspeng=4
eoi
title
        Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                        (m3, m)
    atmos    = 3
               1.01e5        && Pressure
               305.          && Temperature
        o2   = 0.25
        n2   = 0.75
        h2ov = 0.05
&&
struc
    name    = Walls          && Name of structure
    type    = wall           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 5.49           && Characteristic length of structure   (m)
    slarea  = 450.           && Area                                 (m2)
    tunif   = 305.           && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
```

```
   x        = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
   eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  4
&&
&&  Lower cell input
&&
low-cell
   geometry= 91.9      && Area of layers in lower cell             (m2)
      bc  = 305.       && Basemat boundary condition temperature    (K)
      concrete
         compos = 1       && Number of materials
                  conc    && Material
                  6730.   && Mass of material
         temp   = 305.    && Initial temperature
      eoi
      pool
         temp   = 305.    && Initial temperature
      eoi
eoi
&&
&&  Engineered safety systems
&&
&&  Spillage from Room 236 to Room 115 via the connecting pipe chase
&&
engineer    Spill 1  4  3  5.79
   overflow  4  3  0.025
eoi
&&
&&  Fire water sprinkler system, activated on high temperature.
&&
engineer    Sprinklr  2  4  4  0.
   spray
     spdiam = .001   && Spray droplet diameter                      (m)
     sphite = 5.49   && Spray fall height                           (m)
     spsttm = 373.   && Temperature at which system activates       (K)
   eoi
    source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
       h2ol  = 3        &&  activation
       iflag = 2
       t     = 0.0     100.    1.00e5
       mass  = 21.1    21.1    21.1
       temp  = 305.    305.    305.
    eoi
  eoi
&&
&& ------------------------ Cell 5, Balance of Plant ------------------------
cell 5
control
eoi
title
       Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
   o2 0.20
   n2 0.75
   h2ov 0.05
&&
&& ------------------------- Cell 6, Environment --------------------------
cell 6
control
eoi
title
       Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
```

```
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

LISTING 8 - CONTAIN Input for BS-3

```
&& ========================== Model Description ==============================
&&
&&  File:
&&
&&      cnt003.mdl
&&
&&  Description:
&&
&&      BS-3.  This input deck describes a five volume model of the B&W Plant
&&      auxilliary building.  The rooms modeled are 105, 113, 115, and 236.
&&      The steam source is a 18 inch break in the decay heat removal
&&      system suction piping in room 113.  This model does not include
&&      water aerosols (the dropout option is used).
&&
&&  Written by:
&&
&&      John Schroeder  6/91
&&
&& ========================== Machine Control Input ===========================
cray
eoi
&& ============== ============== Global Input ================================
&&
&&  Section 3.2, p. 3-11
&&
&&      Atmospheric Gases
&&
&&      Material     Description
&&      --------     -----------
&&      o2           oxygen
&&      n2           nitrogen
&&      h2ov         steam
&&      h2ol         water
&&
control
    ncells    = 6       && Number of cells
    ntitl     = 2       && Number of title lines
    ntzone    = 5       && Number of time zones
    nac       = 0       && Number of aerosol groups
    nsectn    = 0       && Number of aerosol sections
eoi
&&
&& -------------- Material, Fission Product, and Aerosol Names ----------------
&&
&&  Section 3.2.1, p. 3-13
&&
material
    compound
        n2 o2           && Air
        h2ov h2ol       && Steam and water
        conc            && Structural materials
&&
&& ---------------------------- Reactor Type ---------------------------------
&&
&&  Section 3.2.2, p. 3-17
&&
thermal                 && Water-cooled reactor
&&
&& ---------------------------- Flow Options --------------------------------
&&
&&  Section 3.2.3, p. 3-17
&&
flows
&&
```

```
&& Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&              1, 2, 3.
&&
   area(1,5) = 8.88    && Cross-sectional area of flow path          (m2)
   avl(1,5)  = 14.6    && Ratio of area to inertial length, A/L      (m)
   cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&& Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
   area(1,2) = 12.6
   avl(1,2)  = 20.7
   cfc(1,2)  = 1.00
&&
&& Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
   area(2,5) = 0.892
   avl(2,5)  = 1.46
   cfc(2,5)  = 1.0
&&
&& Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
   area(2,3) = 1.95
   avl(2,3)  = 3.2
   cfc(2,3)  = 1.0
&&
&& Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
   area(3,5) = 1.95
   avl(3,5)  = 3.2
   cfc(3,5)  = 1.00
&&
&& Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
   area(3,4) = 2.97
   avl(3,4)  = 4.88
   cfc(3,4)  = 1.00
&&
&& Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&              10, 11, 12, and 13.
&&
   area(4,5) = 29.1
   avl(4,5)  = 157.
   cfc(4,5)  = 1.00
&&
&& Junction 8 - Balance of Plant to environment, includes only blowout
&&              paths.
&&
   area(5,6) = 46.5
   avl(5,6)  = 250.
   cfc(5,6)  = 1.00
&&
   implicit
   dropout
&&
&& Compartment and junction elevation data
&&
&& Compartments
&&
   elevcl(1)  = 169.   && Center of mass elevation for Rm 105          (m)
   elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
   elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
   elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
   elevcl(5)  = 185.   && Center of mass elevation for Rm BOP          (m)
   elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&& Junctions
&&
   elevfp(1,5)= 167.
```

```
    elevfp(5,1)= 167.

    elevfp(1,2)= 170.
    elevfp(2,1)= 170.

    elevfp(2,5)= 172.
    elevfp(5,2)= 172.

    elevfp(2,3)= 170.
    elevfp(3,2)= 170.

    elevfp(3,5)= 170.
    elevfp(5,3)= 170.

    elevfp(3,4)= 172.
    elevfp(4,3)= 172.

    elevfp(4,5)= 173.
    elevfp(5,4)= 173.

    elevfp(5,6)= 211.
    elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ------------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& ---------------------------------- Times -----------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
    1800.              && Maximum CPU time limit                      (s)
    0.                 && Problem start time                          (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  ------  ------  ------                                            (s)
      1.     10.      10.
      5.     50.     100.
     20.    200.     500.
     50.    100.    1000.
     50.    100.    3600.
&& -----------------------
eoi
&&
&& ---------------------------- Output Control ------------------------------
&&
&&  Section 3.2.7, p. 3-38
&&
shortedt       = 2      && System ts between short edits
longedt        = 1      && Ts edits between long edits
prflow                  && Print intercell flow data
praer                   &&       detailed aerosol inventories
prlow-cl                &&       lower cell model
prheat                  &&       heat transfer structure model
prengsys                &&       engineered system model
title
          B&W Plant Auxiliary Building Steam Propagation Model
                    Five Compartment Model -- BS-3
&&
&&
&& ===================== Cell Input and Cell Control ========================
```

```
&&
&&  Section 3.3, p. 3-40
&&
&& -------------------------- Cell 1, Room 105 ------------------------------
cell 1
control
   nhtm=2  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
       Cell 1, Room 105
&&
&&  Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                      (m3, m)
    atmos      = 3        && Number of materials
                 1.01e5  && Pressure                                    (Pa)
                 305.    && Temperature                                 (K)
        n2     = 0.75    && Initial nitrogen fraction
        o2     = 0.20    && Initial oxygen fraction
        h2ov   = 0.05    && Initial water vapor fraction
struc
    name       = Ceiling        && Name of structure
    type       = roof           && Type of structure
    shape      = slab           && Shape of structure
    nslab      = 10             && Number of nodes in structure
    chrlen     = 18.7           && Characteristic length of structure     (m)
    slarea     = 295.           && Area                                   (m2)
    tunif      = 305.           && Initial uniform temperature            (K)
    compound   =   conc conc conc conc conc conc conc conc conc conc
    x          = 0.  .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
    eoi
&&
    name       = Walls          && Name of structure
    type       = wall           && Type of structure
    shape      = slab           && Shape of structure
    nslab      = 10             && Number of nodes in structure
    chrlen     = 5.49           && Characteristic length of structure     (m)
    slarea     = 298.           && Area                                   (m2)
    tunif      = 305.           && Initia' uniform temperature            (K)
    compound   =  conc conc conc conc conc conc conc conc conc conc
     x         = 0.  .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
    eoi
&&
condense
ht-tran      on  on  on  on  on
overflow     1
&&
&&  Lower cell input
&&
low-cell
    geometry= 295.      && Area of layers in lower cell                   (m2)
        bc  = 305.      && Basemat boundary condition temperature         (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     43200. && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 3C5.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  1  5  .152
    overflow  1  5  i.74
eoi
```

```
&&
&& ------------------     ----- Cell 2, Room 113 ------------------------------
cell 2
control
    nhtm=2  mxslab=11  nsoatm=4  nspatm=302  naensy=1  j^onc=5  jpool=1
eoi
title
       Cell 2, Room 113
&&
&&  Upper Cell Input
&&
geometry  3.794e2  6.10 && Cell volume and height                    (m3, m)
   atmos     = 3
              1.01e5  && Pressure                                   (Pa)
              305.    && Temperature                                (K)
      o2    = 0.20
      n2    = 0.75
      h2ov  = 0.05
&&
source=4
&&
&&  Blowdown of saturated primary system water
&&
    h2ov  = 301
    iflag = 2
    t     =         0.0       1.0       6.0      11.0      15.0
                   20.0      25.0      30.0      35.0      40.0
                   45.0      50.0      55.0      60.0      65.0
                   70.0      75.0      80.0      85.0      90.0
                   95.0     100.0     105.0     110.0     115.0
                  120.0     125.0     130.0     135.0     140.0
                  145.0     150.0     155.0     160.0     165.0
                  170.0     175.0     180.0     185.0     190.0
                  195.0     200.0     205.0     210.0     215.0
                  220.0     225.0     230.0     235.0     240.0
                  245.0     250.0     255.0     260.0     265.0
                  270.0     275.0     280.0     285.0     290.0
                  295.0     300.0     305.0     310.0     315.0
                  320.0     325.0     330.0     335.0     340.0
                  345.0     350.0     355.0     360.0     365.0
                  370.0     375.0     380.0     385.0     390.0
                  395.0     400.0     405.0     410.0     415.0
                  420.0     425.0     430.0     435.0     440.0
                  445.0     450.0     455.0     460.0     465.0
                  470.0     475.0     480.0     485.0     490.0
                  495.0     500.0     510.0     518.6     528.5
                  538.5     548.5     558.5     568.5     578.5
                  588.5     598.5     608.5     618.5     628.5
                  634.7     644.6     654.6     664.6     674.6
                  684.6     694.6     704.6     714.6     724.6
                  734.6     744.6     754.6     764.6     774.6
                  784.6     794.6     804.6     814.6     824.6
                  834.6     844.6     854.6     864.6     874.6
                  884.6     894.6     904.6     914.6     924.6
                  934.6     944.6     954.6     964.6     974.6
                  984.6     994.6    1004.6    1014.6    1024.6
                 1034.6    1044.6    1054.6    1064.6    1074.6
                 1084.6    1094.6    1104.6    1114.6    1124.6
                 1134.6    1144.6    1154.6    1164.6    1174.6
                 1184.6    1194.6    1204.6    1214.6    1224.6
                 1234.6    1244.6    1254.6    1264.6    1274.6
                 1284.6    1294.6    1304.6    1314.6    1324.6
                 1334.6    1344.6    1354.6    1364.6    1374.6
                 1384.6    1394.6    1404.6    1414.6    1424.6
                 1434.6    1444.6    1454.6    1464.6    1474.6
                 1484.6    1494.6    1504.6    1514.6    1524.6
                 1534.6    1544.6    1554.6    1564.6    1574.6
                 1584.6    1594.6    1604.6    1614.6    1624.6
```

1634.6	1644.6	1654.6	1664.6	1674.6
1684.6	1694.6	1704.6	1714.6	1724.6
1734.6	1744.6	1754.6	1764.6	1774.6
1784.6	1794.6	1804.6	1814.6	1824.6
1834.6	1844.6	1854.6	1864.6	1874.6
1884.6	1894.6	1904.6	1914.6	1924.6
1934.6	1944.6	1954.6	1964.6	1974.6
1984.6	1994.6	2004.6	2014.6	2024.6
2034.6	2044.6	2054.6	2064.6	2074.6
2084.6	2094.6	2104.6	2114.6	2124.6
2134.6	2144.6	2154.6	2164.6	2174.6
2184.6	2194.6	2204.6	2214.6	2224.6
2234.6	2244.6	2254.6	2264.6	2274.6
2284.6	2294.6	2304.6	2314.6	2324.6
2334.6	2344.6	2354.6	2364.6	2374.6
2384.6	2394.6	2404.6	2414.6	2424.6
2434.6	2444.6	2454.6	2464.6	2474.6
3600.0				

mass =	0.0	58.9	40.8	22.5	22.7
	24.5	25.5	26.3	26.9	27.3
	27.7	27.9	27.9	27.8	27.6
	27.4	27.0	26.5	26.0	25.5
	24.8	24.1	23.4	22.9	22.7
	22.6	22.5	22.4	22.3	22.2
	22.1	21.9	21.7	21.5	21.3
	21.1	20.8	20.6	20.3	20.0
	19.7	19.3	19.0	18.6	18.3
	17.9	17.5	17.1	16.7	16.3
	15.8	15.4	15.0	14.6	17.7
	17.5	17.3	17.1	16.9	16.7
	16.5	16.3	16.1	15.9	15.8
	15.7	15.5	15.4	15.4	15.3
	15.2	15.1	15.1	15.0	14.9
	14.8	14.7	14.6	14.5	14.4
	14.3	14.2	14.1	14.0	13.8
	13.7	13.6	13.4	13.3	13.1
	13.0	12.8	12.7	12.5	12.4
	12.2	12.0	11.7	11.5	11.3
	11.2	11.0	10.7	10.5	10.2
	10.0	9.7	9.7	9.4	9.1
	8.8	[illegible]	8.3	8.1	7.8
	7.7	7.5	7.3	7.1	6.9
	6.8	6.6	7.4	7.3	7.2
	7.1	6.9	6.8	6.7	6.8
	6.5	6.4	6.4	6.4	6.3
	6.3	6.3	6.2	[illegible]	6.2
	6.1	6.1	6.1	6.0	5.9
	5.9	5.8	5.8	5.7	5.6
	5.6	5.6	5.5	5.5	5.5
	5.4	5.4	5.4	5.4	5.4
	5.3	5.3	5.3	5.3	[illegible]
	5.3	5.3	5.2	5.2	[illegible]
	5.2	5.1	5.1	5.1	5.1
	5.1	5.2	5.1	5.2	5.2
	5.2	5.2	5.2	4.9	5.2
	5.4	5.1	5.3	5.2	5.5
	5.6	5.6	5.5	5.8	5.7
	5.5	5.8	5.6	6.0	5.7
	5.5	5.5	5.5	5.6	5.6
	5.6	5.6	5.5	5.5	5.5
	5.5	5.5	5.5	5.5	5.6
	5.6	5.5	5.5	5.6	5.7
	5.0	9.1	6.9	7.1	7.1
	7.1	7.0	6.9	6.4	6.5
	6.2	6.4	6.6	6.2	6.3
	6.4	6.5	6.5	6.4	6.4
	6.3	6.3	6.2	6.2	6.2

6.2	6.1	5.2	4.0	6.6
3.9	6.6	7.0	3.3	4.5
5.2	6.9	4.8	3.8	14.2
3.8	3.8	3.6	3.6	5.0
3.6	4.4	4.1	4.8	4.1
4.2	4.5	4.5	5.9	2.1
3.7	3.8	3.6	4.0	4.2
4.3	9.2	2.6	2.0	3.9
3.1	2.7	3.3	3.0	3.4
4.3	4.8	4.5	5.9	6.5
7.2	6.9	12.0	8.7	12.0
12.0				

enth =	158119.7	158275.8	031924.2	552703.6	554112.1
	565071.1	571186.1	575964.7	579662.9	581960.0
	583840.2	584837.9	585163.9	584867.1	583998.0
	582617.8	580745.3	578453.6	575779.3	572597.9
	568974.1	564997.6	560503.9	557778.9	556453.7
	556132.1	555960.3	555741.1	555405.8	554961.5
	554362.6	553595.6	552702.4	551679.0	550649.1
	549483.5	548178.4	546723.9	545119.1	543065.4
	541452.8	539373.3	537238.6	534994.9	532601.8
	530140.9	527780.6	525566.7	523233.3	520761.2
	518472.8	516241.9	513916.0	511628.2	533126.2
	531866.9	530638.9	529410.8	528375.0	527438.9
	526531.0	525663.8	524851.6	524110.5	523452.9
	522885.6	522412.7	522028.0	521693.8	521383.4
	521207.9	521073.5	520923.6	520733.2	520493.1
	520209.4	519885.5	519529.9	519147.8	518736.6
	518286.1	517795.1	517240.5	516636.8	516015.3
	515362.6	514696.9	513945.6	513195.6	512395.0
	511556.3	510707.3	509870.1	509073.2	508154.1
	507273.1	506341.1	504785.4	503715.9	502625.2
	501673.4	500777.2	498836.6	497328.0	495623.8
	494730.8	493091.5	492639.4	491024.7	489371.3
	487640.5	485944.4	484167.1	482523.8	480884.3
	479949.2	478484.0	477100.0	475784.2	474469.8
	473141.4	471855.1	482094.3	480988.4	479933.3
	478871.4	477748.9	476615.6	475540.5	475143.4
	473162.5	472400.3	471653.9	470938.3	470235.5
	469568.4	468921.4	468320.5	467722.7	467155.9
	466633.7	466126.2	465656.4	465016.2	464392.2
	463822.8	463309.4	462847.0	462333.4	461992.8
	461721.5	461519.3	461394.1	461355.3	461412.9
	461556.7	461802.9	462129.6	462587.9	463157.8
	463869.1	464706.2	465691.8	466817.7	468097.7
	469248.4	470525.7	471941.8	473513.4	475259.4
	477210.5	479372.9	481774.0	484140.9	487257.4
	490505.0	493674.8	496827.6	500665.9	504094.7
	508738.5	512925.1	516243.0	513436.2	522322.4
	528308.7	515683.1	532306.6	537456.0	541702.9
	546845.5	547418.8	550125.1	552940.2	554273.6
	554419.9	560000.8	559846.9	561385.0	564972.2
	564713.8	565021.6	566278.1	570270.9	571498.9
	572499.9	573364.4	574136.4	574978.4	575677.9
	576331.2	577193.9	577550.3	578569.5	579780.4
	580188.9	578541.1	578648.6	580825.4	582249.4
	576068.2	585166.3	596068.1	595850.2	595234.6
	595152.0	594386.5	593164.8	591549.9	589204.8
	582857.7	585656.1	586104.9	583876.5	588144.9
	588147.8	588551.2	588622.6	588492.5	587991.8
	587107.5	586073.9	585218.3	584714.4	584623.9
	584680.5	584515.1	534110.8	548280.6	518546.9
	539126.8	516692.0	537548.1	546426.5	537509.2
	518799.8	508717.7	527707.6	513545.1	516439.7
	522333.5	504681.8	526250.9	511345.6	503418.3
	519864.8	506309.6	494335.5	515835.8	504503.2
	521978.7	496007.1	488067.3	483293.8	501916.2

```
               495111.4    488512.5    482649.2    481143.2    477[illegible]44.5
               474706.4    481453.4    495235.0    484140.2    492[illegible]1.0
               504733.8    498843.1    487460.8    495541.4    489902.2
               491831.8    505150.6    505089.0    520139.4    537697.3
               550263.3    554174.9    575586.2    563304.8    546196.3
               589868.3    584141.0    577716.0    615913.7    609414.1
               609414.1
      eoi
&&
&&    Blowdown of primary system steam
&&
      h2ov  = 301
      iflag = 2
      t     =          0.0         1.0         6.0        11.0        15.0
                      20.0        25.0        30.0        35.0        40.0
                      45.0        50.0        55.0        60.0        65.0
                      70.0        75.0        80.0        85.0        90.0
                      95.0       100.0       105.0       110.0       115.0
                     120.0       125.0       130.0       135.0       140.0
                     145.0       150.0       155.0       160.0       165.0
                     170.0       175.0       180.0       185.0       190.0
                     195.0       200.0       205.0       210.0       215.0
                     220.0       225.0       230.0       235.0       240.0
                     245.0       250.0       255.0       260.0       265.0
                     270.0       275.0       280.0       285.0       290.0
                     295.0       300.0       305.0       310.0       315.0
                     320.0       325.0       330.0       33[illegible].0       340.0
                     345.0       350.0       355.0       360.0       365.0
                     370.0       375.0       380.0       385.0       390.0
                     395.0       400.0       405.0       410.0       415.0
                     420.0       425.0       430.0       435.0       440.0
                     445.0       450.0       455.0       460.0       465.0
                     470.0       475.0       480.0       485.0       490.0
                     495.0       500.0       510.0       518.6       528.5
                     538.5       548.5       558.5       568.5       570.5
                     588.5       598.5       608.5       618.5       628.5
                     634.7       644.6       654.6       664.6       674.6
                     684.6       694.6       704.6       714.6       724.6
                     734.6       744.6       754.6       764.6       774.6
                     784.6       794.6       804.6       814.6       824.6
                     834.6       844.6       854.6       864.6       874.6
                     884.6       894.6       904.6       914.6       924.6
                     934.6       944.6       954.6       964.6       974.6
                     984.6       994.6      1004.6      1014.6      1024.6
                    1034.6      1044.6      1054.6      1064.6      1074.6
                    1084.6      1094.6      1104.6      1114.6      1124.6
                    1134.6      1144.6      1154.6      1164.6      1174.6
                    1184.6      1194.6      1204.6      1214.6      1224.6
                    1234.6      1244.6      1254.6      1264.6      1274.6
                    1284.6      1294.6      1304.6      1314.6      1324.6
                    1334.6      1344.6      1354.6      1364.6      1374.6
                    1384.6      1394.6      1404.6      1414.6      1424.6
                    1434.6      1444.6      1454.6      1464.6      1474.6
                    1484.6      1494.6      1504.6      1514.6      1524.6
                    1534.6      1544.6      1554.6      1564.6      1574.6
                    1584.6      1594.6      1604.6      1614.6      1624.6
                    1634.6      1644.6      1654.6      1664.6      1674.6
                    1684.6      1694.6      1704.6      1714.6      1724.6
                    1734.6      1744.6      1754.6      1764.6      1774.6
                    1784.6      1794.6      1804.6      1814.6      1824.6
                    1834.6      1844.6      1854.6      1864.6      1874.6
                    1884.6      1894.6      1904.6      1914.6      1924.6
                    1934.6      1944.6      1954.6      1964.6      1974.6
                    1984.6      1994.6      2004.6      2014.6      2024.6
                    2034.6      2044.6      2054.6      2064.6      2074.6
                    2084.6      2094.6      2104.6      2114.6      2124.6
                    2134.6      2144.6      2154.6      21[illegible]4.6      2174.6
                    2184.6      2194.6      2204.6      2214.6      2224.6
```

	2234.6	2244.6	2254.6	2264.6	2274.6
	2284.6	2294.6	2304.6	2314.6	2324.6
	2334.6	2344.6	2354.6	2364.6	2374.6
	2384.6	2394.6	2404.6	2414.6	2424.6
	2434.6	2444.6	2454.6	2464.6	2474.6
	3600.0				
mass =	0.0	0.0	19.2	13.5	13.6
	14.5	15.0	15.5	15.8	16.0
	[illegible]	16.3	16.4	16.4	16.3
	16.2	16.1	15.9	15.6	15.4
	15.1	14.8	14.4	14.2	14.1
	14.1	14.1	14.1	14.1	14.1
	14.1	14.1	14.1	14.0	14.0
	13.9	13.9	13.8	13.7	13.6
	13.5	13.4	[illegible]	13.1	13.0
	12.8	12.6	12.4	12.2	12.0
	11.8	11.6	11.4	11.2	13.5
	13.4	13.4	13.3	13.2	13.2
	13.1	13.1	13.0	13.0	13.0
	12.9	12.9	12.9	12.9	12.9
	12.9	13.0	13.0	13.0	13.0
	13.0	13.0	12.9	12.9	12.9
	12.9	12.8	12.8	12.8	12.7
	12.7	12.6	12.6	12.5	12.4
	12.4	12.3	12.2	12.2	12.1
	12.0	11.9	11.8	11.7	11.6
	11.5	11.4	11.2	11.1	11.0
	10.9	10.8	10.7	10.5	10.4
	10.2	10.1	9.9	9.8	9.6
	9.5	9.4	9.2	9.1	9.0
	8.8	8.7	10.2	10.0	9.9
	9.8	9.7	9.5	9.4	9.3
	9.1	9.0	8.9	8.7	8.6
	8.5	8.4	8.3	8.1	8.0
	7.9	7.8	7.7	7.6	7.4
	7.3	7.2	7.1	7.0	6.9
	6.8	6.7	6.6	6.4	6.3
	6.2	6.1	6.0	5.9	5.8
	5.7	5.6	5.5	5.4	5.3
	5.3	5.2	5.1	5.0	4.9
	4.8	4.8	4.7	4.6	4.5
	4.4	4.4	4.3	4.2	4.1
	4.1	4.0	3.9	3.6	3.8
	3.7	3.1	3.6	3.5	3.6
	3.4	3.4	3.3	3.3	3.2
	3.0	3.1	3.1	3.1	3.0
	2.9	2.8	2.8	2.8	2.7
	2.7	2.6	2.6	2.5	2.5
	2.5	2.4	2.4	2.3	2.3
	2.3	2.3	2.2	2.2	2.1
	1.8	2.3	1.9	1.9	1.9
	1.9	1.8	1.8	1.7	1.7
	1.7	1.6	1.7	1.7	1.6
	1.6	1.6	1.6	1.5	1.5
	1.5	1.5	1.4	1.4	1.4
	1.4	1.4	1.5	1.2	1.5
	1.2	1.5	1.5	1.0	1.2
	[illegible]	1.4	1.2	1.1	1.9
	1.1	1.2	1.0	1.0	1.2
	0.9	1.1	1.1	1.1	1.0
	1.0	1.1	1.0	1.1	0.7
	0.9	1.0	1.0	0.9	1.0
	0.9	1.4	0.8	0.7	0.9
	0.8	0.7	0.9	0.7	0.9
	0.9	1.0	0.9	1.3	1.4
	1.4	1.6	[illegible]	1.7	1.9
	1.4				

```
enth  =   254752[illegible].0   2676888.0   2743692.0   2721457.[illegible]   2721903.0
          2725257.0   2727124.0   2728585.0   272971[illegible].[illegible]   2730415.0
          2730991.0   2731295.0   2731393.0   27315[illegible]0.0   2731032.0
          2730608.0   2730032.0   2729329.0   2728508.0   2727532.0
          27264[illegible]5.0   2725173.0   2723830.[illegible]   272299[illegible].0   2722596.0
          2722498.0   2722444.0   2722376.0   272227[illegible].0   2722136.0
          2721951.0   2721715.0   2721440.0   27211[illegible].0   2720809.0
          2720451.0   2720049.0   2719602.0   27191[illegible]8.0   2[illegible]1[illegible]568.0
          2717976.0   2717336.0   27165[illegible]6.0   271[illegible]80.0   2715232.0
          2714424.0   2713650.0   2712922.0   271[illegible]52.0   2711328.0
          2710574.0   2709844.0   2709082.0   270[illegible]36.0   2715391.0
          2714981.0   2714577.0   2714174.0   27[illegible]833.0   2713526.0
          2713227.0   2712942.0   2712674.0   27[illegible]2426.0   2712206.0
          2712017.0   2711858.0   271172[illegible].0   27[illegible]617.0   2711512.0
          2711454.0   271[illegible]410.0   2711[illegible]0.0   2711297.0   2711218.0
          2711124.0   2711017.0   2710900.0   27[illegible]0774.0   2710639.0
          2710491.0   2710330.0   2710148.0   [illegible]709949.0   2709745.0
          [illegible]709530.0   2709320.0   2709074.0   2708827.0   2708564.0
          2708288.0   2708009.0   2707734.0   2707472.0   2707169.0
          270[illegible]879.0   2706571.0   2706068.0   2705706.0   2705331.0
          2705002.0   2704693.0   2704008.0   2703482.0   2702766.0
          2702477.0   2701920.0   2701764.0   2701302.0   2700726.0
          2700129.0   2699540.0   2698324.0   2698352.0   2697784.0
          2697462.0   2696954.0   2696476.0   269[illegible]020.0   2695566.0
          2695106.0   2694663.0   2698178.[illegible]   2697796.0   2697431.0
          2[illegible]97064.0   2696676.0   2696284.[illegible]   2695914.0   2695760.0
          2695104.0   2694842.0   2694585.[illegible]   2694340.0   2694098.0
          2693870.0   2693647.0   2693442.0   2693237.0   2693034.0
          2692870.0   2692692.0   2692533.0   [illegible]692313.0   2692100.0
          2691905.0   2691730.0   2691572.0   2691397.0   2691282.0
          2691191.0   2691124.0   2691076.0   2691066.0   26911[illegible].0
          2691158.0   2691247.0   2691280.0   2691437.0   2691[illegible].0
          2691898.0   2692194.0   2692541.0   2692938.0   2693398.0
          2693789.0   2694269.0   2694767.0   2695322.0   2695928.0
          2696622.0   2697371.0   2698220.0   2699120.0   2700212.0
          2701344.0   [illegible]702611.0   2704848.0   [illegible]705405.0   2705859.0
          2708701.0   2710116.[illegible]   2708931.0   2710256.0   2713141.0
          2712044.0   [illegible]708803.0   2712948.0   2715801.0   2720412.0
          2720611.0   2722590.0   [illegible]720473.0   2722578.0   2722698.0
          27[illegible]3385.0   27[illegible]346[illegible].0   2[illegible]23872.0   2724362.0   2725252.0
          2726813.0   2726945.0   272[illegible]10.0   2726871.0   2727242.0
          2727539.0   2727832.0   [illegible]090.0   2728359.0   2728572.0
          2728786.0   2729054.0   2[illegible]182.0   2729510.0   272[illegible]854.0
          273104[illegible].0   2729509.0   27[illegible]559.0   2730212.0   2730834.0
          272[illegible]664.0   2727474.[illegible]   27[illegible]5914.[illegible]   2734277.0   2734103.0
          273407[illegible].0   27[illegible]836.0   2733468.[illegible]   2733969.0   2732331.0
          2731103.0   273277[illegible].0   2731[illegible]83.0   2[illegible]30996.0   2732334.0
          2732176.0   2732216.0   2732254.0   2732219.0   2732064.0
          27317[illegible]3.0   2731482.0   273123[illegible].0   2731101.0   2731095.0
          2731125.0   2[illegible]1087.0   [illegible]713090.0   2724582.0   2707130.0
          2720628.0   27[illegible]45[illegible].0   27[illegible]6646.0   2731465.0   2717582.0
          27[illegible]78[illegible].0   2708294.0   2715388.0   2712087.0   2708559.0
          2[illegible]1523[illegible].0   270[illegible]618.0   2717096.0   2710193.0   2705517.0
          2709296.0   2705628.0   2702882.0   2712806.0   2708881.0
          2712098.0   2704066.0   2[illegible]01[illegible]33.0   2696203.[illegible]   2706609.0
          2705730.0   2701440.0   2[illegible]01676.0   2698232.0   2696337.0
          2694984.0   2696794.0   270931[illegible].0   2707635.0   2704769.0
          2705347.0   2706318.0   2700150.0   2706632.0   2699273.0
          [illegible]7048[illegible]0.0   2706400.0   27096[illegible]1.0   2715150.0   2719166.0
          2724875.0   2725396.0   2729803.0   2725863.0   2724320.0
          27[illegible]4320.0
   eoi
&&
&& Blowdown of saturated primary system water - secon[illegible] break
&&
   h2ov  = 301
   iflag = 2
   t     =          0.0          1.0          6.0          11.0          15.0
```

	20.0	25.0	30.0	35.0	40.0
	45.0	50.0	55.0	60.0	65.0
	70.0	75.0	80.0	85.0	90.0
	95.0	100.0	105.0	110.0	115.0
	120.0	125.0	130.0	135.0	140.0
	145.0	150.0	155.0	160.0	165.0
	170.0	175.0	180.0	185.0	190.0
	195.0	2[illegible].0	205.0	210.0	215.0
	220.0	225.0	230.0	235.0	240.0
	245.0	250.0	255.0	260.0	265.0
	270.0	275.0	280.0	285.0	290.0
	295.0	300.0	[illegible]	310.0	315.0
	320.0	325.0	[illegible]	335.0	340.0
	345.0	350.0	[illegible]	360.0	365.0
	[illegible].0	375.0	[illegible]0.0	385.0	390.0
	39[illegible]	400.0	405.0	410.0	415.0
	420.0	425.0	430.0	435.0	440.0
	445.0	450.0	455.0	450.0	465.0
	470.0	475.0	480.0	485.0	490.0
	[illegible].0	500.0	510.0	51[illegible] 5	528.5
	538.5	548.5	558.5	[illegible] 5	578.5
	588.5	598.5	608.5	618.5	628.5
	634.7	644.6	654.6	664.6	674.6
	684.6	694.6	704.6	714.6	724.6
	734.6	744.6	754.6	764.6	774.6
	784.6	794.6	804.6	814.6	824.6
	834.6	844.6	854.6	864.6	874.6
	884.6	894.6	904.6	914.6	924.6
	934.6	944.6	954.6	964.6	974.6
	984.6	994.6	1004.6	1014.6	1024.6
	1034.6	1044.6	1054.6	1064.6	1074.6
	1084.6	1094.6	1104.6	1114.6	1124.6
	1134.6	1144.6	1154.6	1164.6	1174.6
	1184.6	1194.6	1204.6	1214.6	1224.6
	1234.6	1244.6	1254.6	1264.6	1274.6
	1284.6	1294.6	1304.6	1314.6	1324.6
	1334.6	1344.6	1354.6	1364.6	1374.6
	1384.6	1394.6	1404.6	1414.6	1424.6
	1434.6	1444.6	1454.6	1464.6	1474.6
	1484.6	1494.6	1504.6	1514.6	1524.6
	1534.6	1544.6	1554.6	1564.6	1574.6
	1584.6	1594.6	1604.6	1614.6	1624.6
	1634.6	1644.6	1654.6	1664.6	16[illegible]
	1684.6	1694.6	1704.6	1714.6	17[illegible]
	1734.6	1744.6	1754.6	1764.6	1774.6
	1784.6	1794.6	1804.6	1814.6	1824.6
	1834.6	1844.6	1854.6	1864.6	1874.6
	1884.6	1894.6	1904.6	1914.6	1924.6
	1934.6	1944.6	1954.6	1964.6	1974.6
	1984.6	1994.6	2004.6	20[illegible].6	2024.6
	2034.6	2044.6	2054.6	2064.6	2074.6
	2084.6	2094.6	2104.6	2114.6	2124.6
	2134.6	2144.6	2154.6	2164.6	2174.6
	2184.6	2194.6	2204.6	2214.6	2224.6
	2234.6	2244.6	2254.6	2264.6	2274.6
	2284.6	2294.6	2304.6	2314.6	2324.6
	2334.6	2344.6	2354.6	2364.6	2374.6
	2384.6	2394.6	2404.6	2414.6	2424.6
	2434.6	2444.6	2454.6	2464.6	2474.6
	3600.0				
mass =	0.0	58.9	40.8	22.5	22.7
	24.5	25.5	26.3	26.9	27.3
	27.7	27.9	27.9	27.8	27.6
	27.4	27.0	26.5	26.0	25.5
	24.8	24.1	23.4	22.9	22.7
	22.6	22.5	22.4	22.3	22.2
	22.1	21.9	21.7	21.[illegible]	21.3

	21.1	20.8	20.6	20.3	20.0
	19.7	19.3	19.0	18.6	18.3
	17.9	17.5	17.1	16.7	16.3
	15.8	15.4	15.0	14.6	17.7
	17.5	17.3	17.1	16.9	16.7
	16.5	16.3	16.1	15.9	15.8
	15.7	15.5	15.4	15.4	15.3
	15.2	15.1	15.1	15.0	14.9
	14.8	14.7	14.6	14.5	14.4
	14.3	14.2	14.1	14.0	13.8
	13.7	13.6	13.4	13.3	13.1
	13.0	12.8	12.7	12.5	12.4
	12.2	12.0	11.7	11.5	11.3
	11.2	11.0	10.7	10.5	10.2
	10.0	9.	9.7	9.4	9.1
	8.8	8.6	8.3	8.1	7.8
	7.7	7.5	7.3	7.1	6.9
	6.8	6.6	7.4	7.3	7.2
	7.1	6.9	6.8	6.7	6.8
	6.5	6.4	6.4	6.4	6.3
	6.3	6.3	6.2	6.2	6.2
	6.1	6.1	6.1	6.0	5.9
	5.9	5.8	5.8	5.7	5.6
	5.6	5.6	5.5	5.5	5.5
	5.4	5.4	5.4	5.4	5.4
	5.3	5.3	5.3	5.3	5.3
	5.3	5.3	5.2	5.2	5.2
	5.2	5.1	5.1	5.1	5.1
	5.1	5.2	5.1	5.2	5.2
	5.2	5.2	5.2	4.9	5.2
	5.4	5.1	5.3	5.2	5.5
	5.6	5.6	5.5	5.8	5.7
	5.5	5.8	5.6	6.0	5.7
	5.5	5.5	5.5	5.6	5.6
	5.6	5.6	5.5	5.5	5.5
	5.5	5.5	5.5	5.5	5.6
	5.6	5.5	5.5	5.6	5.7
	5.0	9.1	6.9	7.1	7.1
	7.1	7.0	6.9	6.4	6.5
	6.2	6.4	6.6	6.2	6.3
	6.4	6.5	6.5	6.4	6.4
	6.3	6.3	6.2	6.2	6.2
	6.2	6.1	5.2	4.0	6.6
	3.9	6.6	7.0	3.3	4.5
	5.2	6.9	4.8	3.8	14.2
	3.8	3.8	3.6	3.6	5.0
	3.6	4.4	4.1	4.8	4.1
	4.2	4.5	4.5	5.9	2.1
	3.7	3.8	3.6	4.0	4.2
	4.3	9.2	2.6	2.0	3.9
	3.1	2.7	3.3	3.0	3.4
	4.3	4.8	4.5	5.9	6.5
	7.2	6.9	12.0	8.7	12.0
	12.0				
enth =	158119.7	158275.8	631924.2	552702.6	554112.1
	565071.1	571186.1	575984.7	579662.9	581960.0
	583840.2	584837.9	585163.9	584867.1	583998.0
	582617.8	580745.3	578453.6	575779.3	572597.9
	568974.1	564997.6	560503.9	557778.9	556453.7
	556132.1	555960.3	555741.1	555405.8	554961.5
	554362.6	553595.6	552702.4	551679.0	550649.1
	549483.5	548178.4	546723.9	545119.1	543365.4
	541452.8	539373.3	537238.6	534994.9	532601.8
	530140.9	527780.6	525566.7	523233.3	520761.2
	518472.8	516241.9	513916.0	511628.2	533176.2
	531866.9	530638.9	529410.8	528375.0	527438.9
	526531.0	525663.8	524851.6	524110.5	523452.9

```
            522885.6    522412.7    522028.0    521693.8    521383.4
            521207.9    521073.5    520923.6    520733.2    520493.1
            520209.4    519885.5    519529.9    519147.8    518736.6
            518286.1    517795.1    517240.5    516636.8    516015.3
            515362.6    514696.9    513945.6    513195.6    512395.0
            511556.3    510707.3    509870.1    509073.2    508154.1
            507273.1    506341.1    504785.4    503715.9    502625.2
            501673.4    500777.2    498836.6    497328.0    495623.8
            494730.8    493091.5    492639.4    491024.7    489371.3
            487640.5    485944.4    484167.1    482523.8    480884.3
            479949.2    478484.0    477100.0    475784.2    474469.8
            473141.4    471855.1    482094.3    480988.4    479933.3
            478871.4    477748.9    476615.6    4/5540.5    475143.4
            473162.5    472400.3    471653.9    470938.3    470235.5
            469568.4    468921.4    468320.5    467722.7    467155.9
            466633.7    466126.2    465656.4    465016.2    464392.2
            463822.8    463309.4    462847.0    462333.4    461992.8
            461721.5    461519.3    461394.1    461355.3    461412.9
            461556.7    461802.9    462129.6    462587.9    463157.8
            463869.1    464706.2    465691.8    466817.7    468097.7
            469248.4    470525.7    471941.8    473513.4    475259.4
            477210.5    479372.9    481774.0    484140.9    487257.4
            490505.0    493674.8    496827.6    500665.9    504094.7
            508738.5    512925.1    516243.0    513436.2    522322.4
            528308.7    515683.1    532306.6    537458.0    541702.9
            546845.5    547418.8    550:25.1    552940.2    554273.6
            554419.9    560000.8    559846.9    56.385.0    564972.2
            564713.8    565021.6    566278.1    570270.9    571498.9
            572499.9    573364.4    574136.4    574978.4    575677.9
            576331.2    577193.9    577550.3    578569.5    579780.4
            580188.9    578541.1    578648.6    580825.4    582249.4
            576068.2     5166.5    596068.1    595850.2    595234.6
            595152.9    594386.5    593164.8    591549.9    589204.8
            582857.7    585656.1    586104.9    583876.5    588144.9
            588147.8    588551.2    588622.6    588492.5    587991.8
            587107.5    586073.9    585218.3    584714.4    584623.9
            584680.5    584515.1    534110.8    548280.6    518546.9
            539126.8    516692.0    537548.1    546426.5    537509.2
            518799.8    508717.7    527707.6    513545.1    516439.7
            522333.5    504681.8    526250.9    511345.6    503418.3
            519864.8    506309.6    494335.5    515835.8    504503.2
            521978.7    496007.1    488067.3    483293.8    501916.2
            495111.4    488512.5    482649.2    481143.2    477344.5
            474706.4    481453.4    495235.0    484140.2    492881.0
            504733.8    498843.1    487460.8    495541.4    489902.2
            491831.8    505150.6    505089.0    520139.4    537697.3
            550263.3    554174.9    575586.2    563304.8    546196.3
            589868.3    584141.0    577716.0    615913.7    609414.1
            609414.1
    eoi
&&
&&  Blowdown of primary system steam - second break
&&
    h2ov  = 301
    iflag = 2
    t     =        0.0         1.0         6.0        11.0        15.0
                  20.0        25.0        30.0        35.0        40.0
                  45.0        50.0        55.0        60.0        65.0
                  70.0        75.0        80.0        85.0        90.0
                  95.0       100.0       105.0       110.0       115.0
                 120.0       125.0       130.0       135.0       140.0
                 145.0       150.0       155.0       160.0       165.0
                 170.0       175.0       180.0       185.0       190.0
                 195.0       200.0       205.0       210.0       215.0
                 220.0       225.0       230.0       235.0       240.0
                 245.0       250.0       255.0       260.0       265.0
                 270.0       275.0       280.0       285.0       290.0
                 295.0       300.0       305.0       310.0       315.0
```

320.0	325.0	330.0	335.0	340.0
345.0	350.0	355.0	360.0	365.0
370.0	375.0	380.0	385.0	390.0
395.0	400.0	405.0	410.0	415.0
420.0	425.0	430.0	435.0	440.0
445.0	450.0	455.0	460.0	465.0
470.0	475.0	480.0	485.0	490.0
495.0	500.0	510.0	518.6	528.5
538.5	548.5	558.5	568.5	578.5
588.5	598.5	608.5	618.5	628.5
634.7	644.6	654.6	664.6	674.6
684.6	694.6	704.6	714.6	724.6
734.6	744.6	754.6	764.6	774.6
784.6	794.6	804.6	814.6	824.6
834.6	844.6	854.6	864.6	874.6
884.6	894.6	904.6	914.6	924.6
934.6	944.6	954.6	964.6	974.6
984.6	994.6	1004.6	1014.6	1024.6
1034.6	1044.6	1054.6	1064.6	1074.6
1084.6	1094.6	1104.6	1114.6	1124.6
1134.6	1144.6	1154.6	1164.6	1174.6
1184.6	1194.6	1204.6	1214.6	1224.6
1234.6	1244.6	1254.6	1264.6	1274.6
1284.6	1294.6	1304.6	1314.6	1324.6
1334.6	1344.6	1354.6	1364.6	1374.6
1384.6	1394.6	1404.6	1414.6	1424.6
1434.6	1444.6	1454.6	1464.6	1474.6
1484.6	1494.6	1504.6	1514.6	1524.6
1534.6	1544.6	1554.6	1564.6	1574.6
1584.6	1594.6	1604.6	1614.6	1624.6
1634.6	1644.6	1654.6	1664.6	1674.6
1684.6	1694.6	1704.6	1714.6	1724.6
1734.6	1744.6	1754.6	1764.6	1774.6
1784.6	1794.6	1804.6	1814.6	1824.6
1834.6	1844.6	1854.6	1864.6	1874.6
1884.6	1894.6	1904.6	1914.6	1924.6
1934.6	1944.6	1954.6	1964.6	1974.6
1984.6	1994.6	2004.6	2014.6	2024.6
2034.6	2044.6	2054.6	2064.6	2074.6
2084.6	2094.6	2104.6	2114.6	2124.6
2134.6	2144.6	2154.6	2164.6	2174.6
2184.6	2194.6	2204.6	2214.6	2224.6
2234.6	[illegible]	2254.6	2264.6	2274.6
2284.6	2294.6	2304.6	2314.6	2324.6
2334.6	2344.6	2354.6	2364.6	2374.6
2384.6	2394.6	2404.6	2414.6	2424.6
2434.6	2444.6	2454.6	2464.6	2474.6
3600.0				

mass =

0.0	0.0	19.2	13.5	13.6
14.5	15.0	15.5	15.8	16.0
16.2	16.3	16.4	16.4	16.3
16.2	16.1	15.9	15.6	15.4
15.1	14.8	14.4	14.2	14.1
14.1	14.1	14.1	14.1	14.1
14.1	14.1	14.1	14.0	14.0
13.9	13.9	13.8	13.7	13.6
13.5	13.4	13.2	13.1	13.0
12.8	[illegible]	12.4	12.2	12.0
11.8	11.6	11.4	11.2	13.5
13.4	13.4	13.3	13.2	13.2
13.1	13.1	13.0	13.0	13.0
12.9	12.9	12.9	12.9	12.9
12.9	13.0	13.0	[illegible]	13.0
13.0	13.0	12.9	12.9	12.9
12.9	12.8	12.8	12.8	12.7
12.7	12.6	12.6	12.5	12.4
12.4	12.3	12.2	12.2	12.1

	12.0	11.9	11.8	11.7	11.6
	11.5	11.4	11.2	11.1	11.0
	10.9	10.8	10.7	10.5	10.4
	10.2	10.1	9.9	9.8	9.6
	9.5	9.4	9.2	9.1	9.0
	8.8	8.7	10.2	10.0	9.9
	9.8	9.7	9.5	9.4	9.3
	9.1	9.0	8.9	8.7	8.6
	8.5	8.4	8.3	8.1	8.0
	7.9	7.8	7.7	7.6	7.4
	7.3	7.2	7.1	7.0	6.9
	6.8	6.7	6.6	6.4	6.3
	6.2	6.1	6.0	5.9	5.8
	5.7	5.6	5.5	5.4	5.3
	5.3	5.2	5.1	5.0	4.9
	4.8	4.8	4.7	4.6	4.5
	4.4	4.4	4.3	4.2	4.1
	4.1	4.0	3.9	3.6	3.8
	3.7	3.1	3.6	3.5	3.6
	3.4	3.4	3.3	3.3	3.2
	3.0	3.1	3.1	3.1	3.0
	2.9	2.8	2.8	2.8	2.7
	2.7	2.6	2.6	2.5	2.5
	2.5	2.4	2.4	2.3	2.3
	2.3	2.3	2.2	2.2	2.1
	1.8	2.3	1.9	1.9	1.9
	1.9	1.8	1.8	1.7	1.7
	1.7	1.6	1.7	1.7	1.6
	1.6	1.6	1.6	1.5	1.5
	1.5	1.5	1.4	1.4	1.4
	1.4	1.4	1.5	1.2	1.5
	1.2	1.5	1.5	1.0	1.2
	1.3	.4	1.2	1.1	1.9
	1.1	1.2	1.0	1.0	1.2
	0.9	1.1	1.1	1.1	1.0
	1.0	1.1	1.0	1.1	0.7
	0.9	1.0	1.0	0.9	1.0
	0.9	1.4	0.8	0.7	0.9
	0.8	0.7	0.9	0.7	0.9
	0.9	1.0	0.9	1.3	1.4
	1.4	1.6	1.7	1.7	1.9
	1.4				
enth =	2547525.0	2676858.0	2743692.0	2721457.0	2721903.0
	2725257.0	2727124.0	2728585.0	2729715.0	2730415.0
	2730991.0	2731295.0	2731393.0	2731300.0	2731032.0
	2730608.0	2730032.0	2729329.0	2728508.0	2727532.0
	2726418.0	2725173.0	2723830.0	2722999.0	2722596.0
	2722498.0	2722444.0	2722376.0	2722273.0	2722136.0
	2721951.0	2721715.0	2721440.0	2721126.0	2720809.0
	2720451.0	2720049.0	2719602.0	2719108.0	2718568.0
	2717978.0	2717336.0	2716676.0	2715980.0	2715232.0
	2714424.0	2713650.0	2712922.0	2712152.0	2711328.0
	2710574.0	2709844.0	2709082.0	2708336.0	2715391.0
	2714981.0	2714577.0	2714174.0	2713833.0	2713526.0
	2713227.0	2712942.0	2712674.0	2712426.0	2712206.0
	2712017.0	2711858.0	2711729.0	2711617.0	2711512.0
	2711454.0	2711410.0	2711360.0	2711297.0	2711218.0
	2711124.0	2711017.0	2710900.0	2710774.0	2710639.0
	2710451.0	2710330.0	2710148.0	2709949.0	2709746.0
	2709530.0	27093[illegible].0	2709074.0	2708827.0	2708564.0
	2708288.0	2708009.0	2707734.0	2707472.0	2707169.0
	2706879.0	2706571.0	2706068.0	2705706.0	2705331.0
	2705002.0	2704693.0	2704008.0	2703482.0	2702766.0
	2702477.0	2701920.0	2701764.0	2701302.0	2700726.0
	2700129.0	2699540.0	2698924.0	2698352.0	2697784.0
	2697462.0	2696954.0	2696476.0	2696020.0	2695566.0
	2695106.0	2694663.0	2698178.0	2697796.0	2697431.0

```
        2697064.0   2696676.0   2696284.0   2695914.0   2695760.0
        2695104.0   2694842.0   2694585.0   2694340.0   2694098.0
        2693870.0   2693547.0   2693442.0   2693237.0   2693034.0
        2692870.0   2692692.0   2692533.0   2692313.0   2692100.0
        2691905.0   2691730.0   2691572.0   2691397.0   2691282.0
        2691191.0   2691124.0   2691076.0   2691066.0   2691104.0
        2691158.0   2691247.0   2691280.0   2691437.0   2691640.0
        2691898.0   2692194.0   2692541.0   2692938.0   2693398.0
        2693789.0   2694262.0   2694767.0   2695322.0   2695928.0
        2696622.0   2697371.0   2698220.0   2699120.0   2700212.0
        2701344.0   2702611.0   2704848.0   2705405.0   2705859.0
        2708701.0   2710116.0   2708931.0   2710256.0   2713141.0
        2712044.0   2708803.0   2712948.0   2715801.0   2720412.0
        2720611.0   2722590.0   2720473.0   2722578.0   2722698.0
        2723385.0   2723462.0   2723872.0   2724362.0   2725252.0
        2726813.0   2726945.0   2726110.0   2726871.0   2727242.0
        2727539.0   2727832.0   2728090.0   2728359.0   2728572.0
        2728786.0   2729054.0   2729182.0   2729510.0   2729854.0
        2731041.0   2729509.0   27295[illegible].0   2730212.0   2730834.0
        2729684.0   2727474.0   2735914.0   2734277.0   2734103.0
        2734077.0   2733836.0   2733468.0   2733969.0   2732331.0
        2731103.0   2732778.0   2731183.0   2730996.0   2732334.0
        2732176.0   2732216.0   27[illegible]54.0   2732219.0   2732064.0
        2731793.0   2731482.0   2731233.0   2731101.0   2731095.0
        2731125.0   2731087.0   2713090.0   2724582.0   2707130.0
        2720626.0   2707452.0   2716646.0   2731465.0   271[illegible]582.0
        270[illegible]785.0   2708294.0   2715388.0   2[illegible]12087.0   2708559.0
        271[illegible]0.0   2704618.0   2717096.0   2710193.0   2705517.0
        2709296.0   2705628.0   2702882.0   2712806.0   2708881.0
        2712098.0   2704066.0   2701733.0   2696203.0   2706609.0
        2705730.0   2701440.0   2701676.0   2698232.0   2696337.0
        2694984.0   2696794.0   2709314.0   2707635.0   2704769.0
        2705347.0   2706318.0   2700150.0   2706632.0   2699273.0
        2704890.0   2706400.0   2709671.0   2715150.0   2719166.0
        2724875.0   2725396.0   2729803.0   2725863.0   2724320.0
        2724320.0
    eoi
&&
struc
    name    = Ceiling        && Name of structure
    type    = roof           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 17.7           && Characteristic length of structure       (m)
    slarea  = 86.4           && Area                                     (m2)
    tunif   = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls          && Name of structure
    type    = wall           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 5.49           && Characteristic length of structure       (m)
    slarea  = 254.           && Area                                     (m2)
    tunif   = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0. .040 .080 .120 .160 .200 .240 .280 .320 .360 .396 &&   (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
```

```
   geometry= 86.4      && Area of layers in lower cell              (m2)
      bc  = 305.       && Basemat boundary condition temperature    (K)
      concrete
         compos = 1       && Number of materials
                  conc   && Material
                  19000. && Mass of material                        (kg)
         temp   = 305.    && Initial tamperature                    (K)
      eoi
      pool
         temp   = 305.    && Initial temperature
      eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  2  3  0.0
   overflow  2  3  3.0
eoi
&&
&& -------------------------- Cell 3, Room 115 ------------------------------
cell 3
control
   nhtm=2  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
      Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                       (m3, m)
   atmos    = 3
              1.01e5      && Pressure
              305.        && Temperature
         o2   = 0.20
         n2   = 0.75
         h2ov = 0.05
struc
   name     = Ceiling       && Name of structure
   type     = roof          && Type of structure
   shape    = slab          && Shape of structure
   nslab    = 10            && Number of nodes in structure
   chrlen   = 14.6          && Characteristic length of structure   (m)
   slarea   = 107.          && Area                                 (m2)
   tunif    = 305.          && Initial uniform temperature          (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
   eoi
&&
   name     = Walls         && Name of structure
   type     = wall
   shape    = slab
   nslab    = 10
   chrlen   = 5.49
   slarea   = 241.
   tunif    = 305.
   compound=   conc conc conc conc conc conc conc conc conc conc
   x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
   eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  3
&&
&&  Lower cell input
&&
low-cell
   geometry= 107.      && Area of layers in lower cell              (m2)
      bc  = 305.       && Basemat boundary condition temperature    (K)
```

```
      concrete
         compos = 1      && Number of materials
                 conc    && Material
                 23500.  && Mass of material
         temp   = 305.   && Initial temperature
      eoi
      pool
         temp   = 305.   && Initial temperature
      eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
   overflow  3  2  3.05
eoi
&&
&& -------------- -------------- Cell 4, Room 236 ------------------------------
cell 4
control
   nhtm=1  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
   nsoeng=1  nspeng=4
eoi
title
      Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                       (m3, m)
   atmos    = 3
              1.01e5        && Pressure
              305.          && Temperature
      o2   = 0.25
      n2   = 0.75
      h2ov = 0.05
&&
struc
   name    = Walls          && Name of structure
   type    = wall           && Type of structure
   shape   = slab           && Shape of structure
   nslab   = 10             && Number of nodes in structure
   chrlen  = 5.49           && Characteristic length of structure   (m)
   slarea  = 450.           && Area                                 (m2)
   tunif   = 305.           && Initial uniform temperature          (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x       = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
   eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  4
&&
&&  Lower cell input
&&
low-cell
   geometry= 91.9      && Area of layers in lower cell                 (m2)
      bc  = 305.       && Basemat boundary condition temperature       (K)
      concrete
         compos = 1      && Number of materials
                 conc    && Material
                 6700.   && Mass of material
         temp   = 305.   && Initial temperature
      eoi
      pool
         temp   = 305.   && Initial temperature
      eoi
eoi
&&
```

```
&& Engineered safety systems
&&
&& Spillage from Room 236 to Room 115 via the connecting pipe chase
&&
engineer    Spill 1  4  3  5.79
    overflow  4  3  0.025
eoi
&&
&& Fire water sprinkler system, activated on high temperature.
&&
engineer    Sprinklr  2  4  4  0.
    spray
      spdiam = .001   && Spray droplet diameter                        (m)
      sphite = 5.49   && Spray fall height                             (m)
      spsttm = 373.   && Temperature at which system activates         (K)
   eoi
    source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
        h2ol  = 3       &&  activation
        iflag = 2
        t     = 0.0     100.    1.00e5
        mass  = 21.1    21.1    21.1
        temp  = 305.    305.    305.
    eoi
  eoi
&&
&& ------------------------- Cell 5, Balance of Plant -------------------------
cell 5
control
eoi
title
        Balance of Plant
geometry  1.87e5  38.0
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
&&
&& -------------------------- Cell 6, Environment ---------------------------
cell 6
control
eoi
title
        Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

LISTING 9 - CONTAIN Input for BS-4

```
&& ========================== Model Description ===============================
&&
&& File:
&&
&&     cnt004.mdl
&&
&& Description:
&&
&&     BS-4. This input deck describes a five volume model of the B&W Plant
&&     auxilliary building. The rooms modeled are 105, 113, 115, and 236.
&&     The steam source is a 10 inch break in the decay heat removal
&&     heat exchangers located in room 113. This model does not include
&&     water aerosols (the dropout option is used).
&&
&& Written by:
&&
&&     John Schroeder  6/91
&&
&& ========================= Machine Control Input ============================
cray
eoi
&& ============================== Global Input ================================
&&
&& Section 3.2, p. 3-11
&&
&&     Atmospheric Gases
&&
&&     Material    Description
&&     --------    -----------
&&     o2          oxygen
&&     n2          nitrogen
&&     h2ov        steam
&&     h2ol        water
&&
control
    ncells   = 6      && Number of cells
    ntitl    = 2      && Number of title lines
    ntzone   = 5      && Number of time zones
    nac      = 0      && Number of aerosol groups
    nsectn   = 0      && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names -----------------
&&
&& Section 3.2.1, p. 3-13
&&
material
    compound
        n2 o2          && Air
        h2ov h2ol      && Steam and water
        conc           && Structural materials
&&
&& ---------------------------- Reactor Type ----------------------------------
&&
&& Section 3.2.2, p. 3-17
&&
thermal                && Water-cooled reactor
&&
&& ---------------------------- Flow Options ----------------------------------
&&
&& Section 3.2.3, p. 3-17
&&
flows
&&
```

```
&&  Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&              1, 2, 3.
&&
    area(1,5) = 8.88    && Cross-sectional area of flow path         (m2)
    avl(1,5)  = 14.6    && Ratio of area to inertial length, A/L     (m)
    cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&&  Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
    area(1,2) = 12.6
    avl(1,2)  = 20.7
    cfc(1,2)  = 1.00
&&
&&  Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
    area(2,5) = 0.892
    avl(2,5)  = 1.46
    cfc(2,5)  = 1.0
&&
&&  Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
    area(2,3) = 1.95
    avl(2,3)  = 3.2
    cfc(2,3)  = 1.0
&&
&&  Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
    area(3,5) = 1.95
    avl(3,5)  = 3.2
    cfc(3,5)  = 1.00
&&
&&  Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
    area(3,4) = 2.97
    avl(3,4)  = 4.88
    cfc(3,4)  = 1.00
&&
&&  Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&               10, 11, 12, and 13.
&&
    area(4,5) = 2[illegible].1
    avl(4,5)  = 15[illegible].
    cfc(4,5)  = 1.00
&&
&&  Junction 8   Balance of Plant to environment, includes only blowout
&&               paths.
&&
    area(5,6) = 46.5
    avl(5,6)  = 250.
    cfc(5,6)  = 1.00
&&
    implicit
    dropout
&&
&&  Compartment and junction elevation data
&&
&&  Compartments
&&
    elevcl(1)  = 169.   && Center of mass elevation for Rm 105          (m)
    elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
    elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
    elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
    elevcl(5)  = 185.   && Center of mass elevation for Rm BOP          (m)
    elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&&  Junctions
&&
    elevfp(1,5)= 167.
```

```
   elevfp(5,1)= 167.

   elevfp(1,2)= 170.
   elevfp(2,1)= 170.

   elevfp(2,5)= 172.
   elevfp(5,2)= 172.

   elevfp(2,3)= 170.
   elevfp(3,2)= 170.

   elevfp(3,5)= 170.
   elevfp(5,3)= 170.

   elevfp(3,4)= 172
   elevfp(4,3)= 172.

   elevfp(4,5)= 173.
   elevfp(5,4)= 173.

   elevfp(5,6)= 211.
   elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ------------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& -------------------------------- Times -------------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
   30.                 && Maximum CPU time limit                         (s)
   0.                  && Problem start time                             (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  ------  ------  ------                                               (s)
       1.     10.     10.
       5.     50.    100.
      20.    200.    500.
      50.    100.   1000.
      50.    100.  13000.
&& -----------------------
eoi
&&
&& ------------------    ------ Output Control --------------------------------
&&
&&  Section 3.2.7, p. 3-38
&&
shortedt      = [illegible]   && System ts between short edits
longedt       = 1       && Ts edits between long edits
prflow                  && Print intercell flow data
praer                   &&       detailed aerosol inventories
prlow-cl                &&       lower cell model
prheat                  &&       heat transfer structure model
prengsys                &&       engineered system model
title
           B&W Plant Auxilliary Building Steam Propagation Model
                      Five Compartment Model -- BS-4
&&
&&
&& ===================== Cell Input and Cell Control =========================
```

```
&&
&&  Section 3.3, p. 3-40
&&
&& --------------------------- Cell 1, Room 105 ------------------------------
cell 1
control
    nhtm=2  mxslab=1  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 1, Room 105
&&
&&  Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                        (m3, m)
    atmor      = 3       && Number of materials
                 1.01e5  && Pressure                                      (Pa)
                 305.    && Temperature                                   (K)
        n2     = 0.75    && Initial nitrogen fraction
        o2     = 0.20    && Initial oxygen fraction
        h2ov   = 0.05    && Initial water vapor fraction
struc
    name       = Ceiling        && Name of structure
    type       = roof           && Type of structure
    shape      = slab           && Shape of structure
    nslab      = 10             && Number of nodes in structure
    chrlen     = 18.7           && Characteristic length of structure     (m)
    slarea     = 295.           && Area                                   (m2)
    tunif      = 305.           && Initial uniform temperature            (K)
    compound   =   conc conc conc conc conc conc conc conc conc conc
    x          = 0. .046 .092 138 .184 .230 .276 .322 .368 .414 .457 && (m)
    eoi
 &&
    name       = Walls          && Name of structure
    type       = wall           && Type of structure
    shape      = slab           && Shape of structure
    nslab      = 10             && Number of nodes in structure
    chrlen     = 5.49           && Characteristic leng'h of structure     (m)
    slarea     = 298.           && Area                                   (m2)
    tunif      = 305.           && Initial uniform temperature            (K)
    compound   =  conc conc conc conc conc conc conc conc conc conc
     x         = 0. .035 .070 .105 .140 .175 ?10 .245 .280 .315 .351 && (m)
    eoi
 &&
 condense
 ht-tran     on  on  on  on  on
 overflow    1
 &&
 &&  Lower cell input
 &&
 low-cell
     geometry= 295.      && Area of layers in lower cell                  (m2)
         bc  = 305.      && Basemat boundary condition temperature        (K)
         concrete
             compos = 1      && Number of materials
                      conc   && Material
                      43200. && Mass of material
             temp   = 305.   && Initial temperature
         eoi
         pool
             temp   = 305.   && Initial temperature
         eoi
 eoi
 &&
 &&  Engineered safety systems
 &&
 engineer    Spill  1  1  5  .152
     overflow  1  5  1.74
 eoi
```

```
&&
&& --------------------------- Cell 2, Room 113 ------------------------------
cell 2
control
   nhtm=2  mxslab=11  nsoatm=2  nspatm=365  naensy=1  jconc=5  jpool=1
eoi
title
      Cell 2, Room 113
&&
&& Upper Cell Input
&&
geometry  3.794e?  6.10 && Cell volume and height                    (m3, m)
   atmos     = 3
             1.01e5  && Pressure                                     (Pa)
             305.    && Temperature                                  (K)
      o2    = 0.20
      n2    = 0.75
      h2ov  = 0.05
&&
source=2
&&
&& Blowdown of saturated primary system water
&&
   h2ov  = 361
   iflag = 2
   t     =          0.0       1.0       2.0       3.0       4.0
                    5.0       6.0       7.0       8.0       9.0
                   10.0      11.0      12.0      13.0      14.0
                   15.0      25.0      35.0      45.0      55.0
                   65.0      75.0      85.0      95.0     105.0
                  115.0     125.0     135.0     145.0     155.0
                  165.0     175.0     185.0     195.0     205.0
                  215.0     225.0     235.0     245.0     255.0
                  265.0     275.0     285.0     295.0     305.0
                  315.0     325.0     335.0     345.0     355.0
                  365.0     375.0     382.8     392.8     402.8
                  412.8     422.8     432.8     442.8     452.8
                  462.8     472.8     482.8     492.8     497.7
                  507.7     517.7     527.7     537.7     547.7
                  557.7     567.7     577.7     587.7     597.7
                  607.7     617.7     627.7     637.7     647.7
                  657.7     667.7     677.7     687.7     697.7
                  707.7     717.7     727.7     737.7     747.7
                  757.7     767.7     777.7     787.7     797.7
                  807.7     817.7     827.7     837.7     847.7
                  857.7     867.7     877.7     887.7     897.7
                  907.7     917.7     927.7     937.7     947.7
                  957.7     967.7     977.7     987.7     993.5
                 1000.0    1010.0    1020.0    1030.0    1040.0
                 1050.0    1060.0    1070.0    1080.0    1090.0
                 1100.0    1110.0    1120.0    1130.0    1140.0
                 1150.0    1160.0    1170.0    1180.0    1190.0
                 1200.0    1210.0    1220.0    1230.0    1240.0
                 1250.0    1260.0    1270.0    1280.0    1290.0
                 1300.0    1310.0    1320.0    1330.0    1340.0
                 1350.0    1360.0    1370.0    1380.0    1390.0
                 1400.0    1410.0    1420.0    1430.0    1440.0
                 1450.0    1460.0    1470.0    1480.0    1490.0
                 1500.0    1510.0    1520.0    1530.0    1540.0
                 1550.0    1560.0    1570.0    1580.0    1590.0
                 1600.0    1610.0    1620.0    1630.0    1640.0
                 1650.0    1660.0    1670.0    1680.0    1690.0
                 1700.0    1710.0    1720.0    1730.0    1740.0
                 1750.0    1760.0    1770.0    1780.0    1790.0
                 1800.0    1810.0    1820.0    1830.0    1840.0
                 1850.0    1860.0    1870.0    1880.0    1890.0
                 1900.0    1910.0    1920.0    1930.0    1940.0
                 1950.0    1960.0    1970.0    1980.0    1990.0
```

	2000.0	2010.0	2020.0	2030.0	2040.0
	2050.0	2060.0	2070.0	2080.0	2090.0
	2100.0	2110.0	2120.0	2130.0	2140.0
	2150.0	2160.0	2170.0	2180.0	2190.0
	2200.0	2210.0	2220.0	2230.0	2240.0
	2250.0	2260.0	2270.0	2280.0	2290.0
	2300.0	2310.0	2320.0	2330.0	2340.0
	2350.0	2360.0	2370.0	2380.0	2390.0
	2400.0	2410.0	2420.0	2430.0	2440.0
	2450.0	2460.0	2470.0	2480.0	2490.0
	2500.0	2510.0	2520.0	2530.0	2540.0
	2550.0	2560.0	2570.0	2580.0	2590.0
	2600.0	2610.0	2620.0	2630.0	2640.0
	2650.0	2660.0	2670.0	2680.0	2690.0
	2700.0	2710.0	2720.0	2730.0	2740.0
	2750.0	2760.0	2770.0	2780.0	2790.0
	2800.0	2810.0	2820.0	2830.0	2840.0
	2850.0	2860.0	2870.0	2880.0	2890.0
	2900.0	2910.0	2920.0	2930.0	2940.0
	2950.0	2960.0	2970.0	2980.0	2990.0
	3000.0	3010.0	3020.0	3030.0	3040.0
	3050.0	3060.0	3070.0	3080.0	3090.0
	3100.0	3110.0	3120.0	3130.0	3140.0
	3150.0	3160.0	3170.0	3180.0	3190.0
	3200.0	3210.0	3220.0	3230.0	3240.0
	3250.0	3260.0	3270.0	3280.0	3290.0
	3300.0	3310.0	3320.0	3330.0	3340.0
	3350.0	3360.0	3370.0	3380.0	3390.0
	3400.0	3410.0	3420.0	3430.0	3440.0
	3444.0				
mass =	0.0	2400.9	1795.8	852.8	858.3
	867.9	878.3	887.5	894.6	899.2
	901.0	[illegible]00.1	896.8	891.6	884.5
	876.0	833.9	798.1	753.4	645.9
	586.4	631.6	508.1	378.6	337.1
	[illegible]28.8	316.4	258.1	207.6	161.9
	1[illegible]6.7	94.8	70.8	47.6	35.6
	27.7	22.2	18.3	15.4	13.3
	11.9	10.6	9.6	8.7	8.1
	7.5	7.1	6.7	6.5	6.3
	6.2	6.1	6.1	6.1	6.2
	6.3	6.4	6.6	6.8	7.1
	7.4	20.8	25.0	23.1	29.0
	29.1	33.8	31.4	36.5	37.3
	38.2	41.1	42.7	43.8	45.2
	47.1	48.8	50.5	52.3	53.8
	55.0	56.4	57.4	58.5	59.5
	60.3	61.1	61.9	62.3	61.7
	57.0	51.1	45.7	41.0	40.3
	44.1	48.1	49.9	49.9	52.2
	55.5	58.7	61.2	63.0	64.1
	64.5	64.6	6[illegible].2	69.0	73.2
	75.1	74.2	29.3	45.3	4[illegible].1
	223.7	23.1	290.3	10.5	25.7
	59.5	36.2	172.3	8.6	6.4
	28.3	78.8	189.7	80.3	150.0
	153.0	64.6	14.5	87.1	67.1
	141.1	72.1	126.9	386.7	276.3
	365.1	344.1	409.0	384.5	399.4
	404.7	404.3	416.8	402.1	403.1
	418.2	395.8	403.5	409.9	409.9
	407.9	407.3	412.9	402.8	412.1
	411.0	329.6	406.3	411.7	411.5
	413.6	413.5	411.6	413.6	412.4
	414.1	412.4	418.2	415.0	416.2
	418.8	413.3	420.8	414.3	412.1
	403.3	419.4	415.6	417.0	420.5

419.7	422.3	419.0	417.9	419.0
418.6	419.4	420.8	419.8	420.0
417.4	423.7	420.7	419.2	419.5
420.8	417.9	425.6	411.2	420.7
421.5	424.7	422.4	425.2	417.8
421.3	419.1	422.9	425.6	420.2
418.5	424.2	422.5	422.5	[illegible]
428.2	424.2	420.8	424.8	423.9
425.5	423.7	424.1	423.1	425.2
417.6	420.1	426.0	427.4	423.1
425.2	415.4	421.2	423.8	[illegible]
422.3	427.0	426.2	425.5	427.0
423.8	427.6	426.1	420.7	425.5
428.4	427.7	417.7	425.4	417.7
426.5	426.8	427.8	424.1	421.4
425.3	423.9	426.0	421.2	426.3
425.9	425.8	421.1	422.9	425.5
426.2	425.1	420.5	427.8	425.8
421.6	425.8	[illegible]	425.2	427.5
427.8	426.0	424.5	426.8	427.3
429.1	426.1	426.7	424.1	423.7
425.3	426.3	425.9	426.6	427.0
426.0	426.0	426.5	[illegible]	427.0
426.3	417.6	426.0	424.3	425.2
428.1	421.2	426.0	423.2	425.0
427.1	424.8	428.1	414.1	421.1
426.8	426.2	421.3	424.3	423.8
421.4	425.4	422.6	425.9	423.7
425.2	419.5	425.8	427.0	424.7
427.0	428.5	426.6	426.7	426.7
426.6	428.1	424.0	426.5	426.2
425.1	426.4	422.3	423.8	417.2
425.5	427.1	417.7	426.0	428.2
422.5	424.5	427.7	423.1	426.0
423.4	[illegible]	426.7	425.1	426.4
426.0				

enth =	158119.7	159940.5	1149073.0	1196146.0	1197744.0
	1200599.0	1203784.0	1206669.0	1208980.0	1210529.0
	1211204.0	1210940.0	1209931.0	1208330.0	1206208.0
	1203732.0	1193696.0	1187646.0	1179592.0	1118249.0
	1098122.0	1148469.0	1170119.0	1175558.0	[illegible]
	1042971.0	1061448.0	1038122.0	1013479.0	987731.6
	963405.7	941195.8	921489.1	903148.1	886067.9
	870344.2	855714.1	842109.6	829451.8	817508.1
	805975.7	795139.2	784777.9	774890.1	765441.1
	756320.7	747493.5	738975.9	730759.2	722844.2
	715226.9	707883.0	702302.2	695412.3	688891.4
	682787.6	677190.7	672051.5	667327.3	662980.5
	658950.4	649344.8	654414.2	650910.6	657595.5
	657522.9	662380.2	658880.6	664424.5	664785.4
	665867.8	668383.5	669768.4	670583.0	671659.8
	673122.8	[illegible]	675430.8	676722.2	[illegible]
	678514.2	679417.2	679999.6	680608.0	681130.4
	681435.1	681691.7	681651.9	681778.8	680592.1
	674782.5	666972.2	658911.1	649648.9	645002.0
	646580.4	648774.4	647686.9	644494.2	644701.8
	646726.4	648724.3	649993.4	650362.5	649831.0
	648366.6	646659.9	646774.2	648275.9	650953.1
	652826.6	655765.0	592682.9	598766.9	593585.8
	567223.9	570355.0	585558.2	614321.5	539718.6
	601192.6	597851.7	546948.5	572213.8	597235.9
	584162.2	598062.1	581966.1	596423.4	596189.9
	602085.1	598207.8	595952.1	596077.9	595189.5
	590186.2	588352.4	420003.8	570783.7	552039.4
	549792.3	545060.8	540088.3	535239.9	530094.5
	524456.9	518517.2	511716.6	508206.8	502604.6
	497048.0	491163.7	485556.3	479697.9	474216.6

```
                468319.9    462816.5    457035.6    451361.8    445875.5
                440640.6    433755.7    429288.6    423932.2    418533.1
                411147.2    407828.2    402980.9    397114.7    405840.7
                387761.3    387101.6    361200.9    373139.5    364667.3
                345090.7    372471.8    324835.5    350704.1    355836.8
                338760.2    340918.6    294192.8    335888.4    341130.2
                301957.3    239182.0    298674.4    320222.8    326511.4
                300836.9    285529.1    299765.4    293134.8    310318.4
                292353.2    286335.5    293988.8    266926.6    313583.2
                253159.5    288213.8    251325.9    245431.6    308942.8
                270734.7    256135.9    275098.3    250019.7    252025.9
                214782.7    318806.5    237763.5    239555.4    235444.8
                348079.6    226885.9    244002.6    264313.2    213269.9
                140767.7    204349.1    225517.4    254998.4    223122.1
                233729.8    229030.1    198064.7    235995.4    204547.2
                229626.8    269524.8    189354.1    164797.8    264127.9
                209705.8    307274.0    265882.8    241938.3    228125.8
                241499.0    174663.0    183645.6    207617.2    162024.7
                156858.6    210005.1    198855.7    251549.2    210441.9
                 71926.2    136117.0    323067.8    218240.2    272234.5
                179677.6    133219.7    130824.2    228835.7    266675.5
                178645.8    228047.0    184180.0    185855.0    144537.0
                184345.0    191200.1    238823.1    244096.8    202703.4
                171678.0    199983.3    203701.8    109655.6     75879.9
                213093.9    195335.6    173736.2    210305.3    148084.3
                132247.9    189820.3    183900.3    214575.9    155154.3
                177773.7    194552.1    166820.1    204808.9    206734.8
                168832.9    173595.3    191519.0    167682.0    155401.9
                190639.2    191949.5    172974.5    144767.7    158155.9
                183463.7    315483.8    184298.9    214395.1    153411.2
                121167.6    268270.8    188005.1    233527.8    212178.5
                156741.5    215305.7    128521.5    333436.1    267925.5
                137849.9    179222.9    266782.6    223382.1    213497.1
                219283.8    194644.6    241268.9    171866.1    190489.0
                203040.8    283064.4    108594.5    164981.6    210411.3
                160033.1     85402.5    172830.2    170064.0    171093.8
                156757.4    107313.2    225335.7    173815.0    183069.2
                203724.0    175712.8    211125.3    226096.8    313536.6
                195856.8     68646.1    250831.0    185159.2    102833.9
                195688.6    207347.4    138103.1    238664.8    186352.8
                205391.3    207035.7    171595.6    204985.7    174484.8
                173873.8
      eoi
&&
&&    Blowdown of primary system steam
&&
      h2ov  = 361
      iflag = 2
      t     =        0.0         1.0         2.0         3.0         4.0
                     5.0         6.0         7.0         8.0         9.0
                    10.0        11.0        12.0        13.0        14.0
                    15.0        25.0        35.0        45.0        55.0
                    65.0        75.0        85.0        95.0       105.0
                   115.0       125.0       135.0       145.0       155.0
                   165.0       175.0       185.0       195.0       205.0
                   215.0       225.0       235.0       245.0       255.0
                   265.0       275.0       285.0       295.0       305.0
                   315.0       325.0       335.0       345.0       355.0
                   365.0       375.0       382.8       392.8       402.8
                   412.8       422.8       432.8       442.8       452.8
                   462.8       472.8       482.8       492.8       497.7
                   507.7       517.7       527.7       537.7       547.7
                   557.7       567.7       577.7       587.7       597.7
                   607.7       617.7       627.7       637.7       647.7
                   657.7       667.7       677.7       687.7       697.7
                   707.7       717.7       727.7       737.7       747.7
                   757.7       767.7       777.7       787.7       797.7
                   807.7       817.7       827.7       837.7       847.7
```

857.7	867.7	877.7	887.7	897.7
907.7	917.7	927.7	937.7	947.7
957.7	967.7	977.7	987.7	993.5
1000.0	1010.0	1020.0	1030.0	1040.0
1050.0	1060.0	1070.0	1080.0	1090.0
1100.0	1110.0	1120.0	1130.0	1140.0
1150.0	1160.0	1170.0	1180.0	1190.0
1200.0	1210.0	1220.0	1230.0	1240.0
1250.0	1260.0	1270.0	1280.0	1290.0
1300.0	1310.0	1320.0	1330.0	1340.0
1350.0	1360.0	1370.0	1380.0	1390.0
1400.0	1410.0	1420.0	1430.0	1440.0
1450.0	1460.0	1470.0	1480.0	1490.0
1500.0	1510.0	1520.0	1530.0	1540.0
1550.0	1560.0	1570.0	1580.0	1590.0
1600.0	1610.0	1620.0	1630.0	1640.0
1650.0	1660.0	1670.0	1680.0	1690.0
1700.0	1710.0	1720.0	1730.0	1740.0
1750.0	1760.0	1770.0	1780.0	1790.0
1800.0	1810.0	1820.0	1830.0	1840.0
1850.0	1860.0	1870.0	1880.0	1890.0
1900.0	1910.0	1920.0	1930.0	1940.0
1950.0	1960.0	1970.0	1980.0	1990.0
2000.0	2010.0	2020.0	2030.0	2040.0
2050.0	2060.0	2070.0	2080.0	2090.0
2100.0	2110.0	2120.0	2130.0	2140.0
2150.0	2160.0	2170.0	2180.0	2190.0
2200.0	2210.0	2220.0	2230.0	2240.0
2250.0	2260.0	2270.0	2280.0	2290.0
2300.0	2310.0	2320.0	2330.0	2340.0
2350.0	2360.0	2370.0	2380.0	2390.0
2400.0	2410.0	2420.0	2430.0	2440.0
2450.0	2460.0	2470.0	2480.0	2490.0
2500.0	2510.0	2520.0	2530.0	2540.0
2550.0	2560.0	2570.0	2580.0	2590.0
2600.0	2610.0	2620.0	2630.0	2640.0
2650.0	2660.0	2670.0	2680.0	2690.0
2700.0	2710.0	2720.0	2730.0	2740.0
2750.0	2760.0	2770.0	2780.0	2790.0
2800.0	2810.0	2820.0	2830.0	2840.0
2850.0	2860.0	2870.0	2880.0	2890.0
2900.0	2910.0	2920.0	2930.0	2940.0
2950.0	2960.0	2970.0	2980.0	2990.0
3000.0	3010.0	3020.0	3030.0	3040.0
3050.0	3060.0	3070.0	3080.0	3090.0
3100.0	3110.0	3120.0	3130.0	3140.0
3150.0	3160.0	3170.0	3180.0	3190.0
3200.0	3210.0	3220.0	3230.0	3240.0
3250.0	3260.0	3270.0	3280.0	3290.0
3300.0	3310.0	3320.0	3330.0	3340.0
3350.0	3360.0	3370.0	3380.0	3390.0
3400.0	3410.0	3420.0	3430.0	3440.0
3444.0				

mass =	0.0	0.0	20.7	151.3	151.1
	151.2	151.3	151.3	151.3	151.3
	151.3	151.4	151.6	151.9	152.1
	152.3	154.8	159.5	165.0	157.8
	164.4	183.1	166.8	189.5	202.0
	188.6	185.5	183.4	178.9	172.4
	159.8	150.8	142.4	134.1	126.6
	119.3	112.2	105.6	99.3	93.7
	88.5	83.8	79.5	75.6	72.0
	68.7	65.7	62.9	60.4	58.0
	55.8	53.7	52.2	50.4	48.7
	47.1	45.8	44.5	43.4	42.3
	41.4	37.2	36.0	36.1	34.6
	34.5	33.3	33.6	32.4	32.0

31.8	30.9	30.5	30.1	29.7
29.2	28.7	28.2	27.8	27.3
27.0	26.6	26.2	25.9	25.5
25.2	24.8	24.5	24.2	24.0
24.3	24.6	24.7	24.6	23.5
21.5	19.4	17.9	16.7	15.3
13.8	12.5	11.3	10.3	9.4
8.7	8.0	7.2	6.3	5.4
4.6	3.8	7.5	3.4	3.4
1.5	4.2	0.6	2.1	4.7
1.6	1.5	1.4	1.1	0.2
0.4	0.1	0.6	0.7	0.3
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.5
0.1	0.1	0.1	0.0	0.0
0.1	0.2	0.4	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.2	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0				

enth =	2547525.0	2664386.0	2802502.0	2787865.0	2787532.0
	2787026.0	2786432.0	2785866.0	2785396.0	2785072.0
	2784927.0	2784981.0	2785193.0	2785521.0	2785945.0
	2786426.0	2788246.0	2789243.0	2790551.0	2786608.0
	2783113.0	2757058.0	2743625.0	2785683.0	2755245.0
	2760535.0	2801202.0	2802431.0	2802310.0	2799790.0
	2799174.0	2797705.0	2795834.0	2792481.0	2790172.0
	2787836.0	2785469.0	2783265.0	2781132.0	2778713.0

2776362.0	2773889.0	2771476.0	2769245.0	2767068.0
2764930.0	2762840.0	2760824.0	2758956.0	2757234.0
2755628.0	2754063.0	2752994.0	2751653.0	2750380.0
2749182.0	2748085.0	2747075.0	2746148.0	2745296.0
274440[illegible]	2748807.0	2750224.0	2749335.0	2751086.0
2751070.0	2752346.0	2751433.0	2752895.0	2753005.0
2753290.0	2753947.0	[illegible]4319.0	2754542.0	2754823.0
2755204.0	2755510.0	2755820.0	2756163.0	2756446.0
2756628.0	2756879.0	2757037.0	2757196.0	2757338.0
2757446.0	2757479.0	2757548.0	2757533.0	2757218.0
2755716.0	2753698.0	2751616.0	2749228.0	2748062.0
2748516.0	2749121.0	2748866.0	2748067.0	2748153.0
2748705.0	2749242.0	2749586.0	2749696.0	2749571.0
2749204.0	2748777.0	2748823.0	2749232.0	2749942.0
2750416.0	2751354.0	2732419.0	2727607.0	2734098.0
2763592.0	2691029.0	2742713.0	2737747.0	2717149.0
2725838.0	2734611.0	2714874.0	2757554.0	2749563.0
2764313.0	2742226.0	2746332.0	2737528.0	2734979.0
2733536.0	2741034.0	2782116.0	2774922.0	2730948.0
2711929.0	2729599.0	2755906.0	2728360.0	2696576.0
2717914.0	2720170.0	271[illegible]190.0	2716209.0	2705809.0
2750050.0	2711621.0	2708299.0	2711853.0	2699404.0
2706848.0	2701470.0	2699525.0	2698382.0	2695769.0
2693572.0	2691375.0	2722910.0	2686803.0	2685663.0
2684226.0	2654062.0	2676506.0	2677629.0	2676575.0
2676550.0	2669325.0	2677034.0	2681659.0	2675723.0
2673638.0	2656123.0	2679910.0	2691487.0	2660805.0
2676506.0	2676656.0	2637265.0	2665955.0	2674022.0
2730987.0	2717096.0	2701628.0	2676592.0	2669910.0
2677334.0	2676578.0	2676594.0	2667681.0	2676549.0
2675879.0	2676659.0	265571[illegible].0	2675664.0	2676602.0
2724[illegible].0	2707120.0	2660317.0	2676666.0	2659621.0
2719[illegible].0	2725855.0	2631458.0	26779[illegible]5.0	2673642.0
2676597.0	2637036.0	2676633.0	2669027.0	2693838.0
2676775.0	2676587.0	2676527.0	2638242.0	2672320.0
2669761.0	2673232.0	2674432.0	2676578.0	2685808.0
2676528.0	2665899.0	2724844.0	2671973.0	2688657.0
2665858.0	2676381.0	2675882.0	2732469.0	2679661.0
2676786.0	2671435.0	2675984.0	2643804.0	2676592.0
2674307.0	2676700.0	2668176.0	2688464.0	2679[illegible]65.0
2709532.0	2648346.0	2379904.0	2676596.0	2676420.0
2676410.0	2671401.0	2676428.0	2676197.0	2670914.0
2676456.0	2676530.0	2676580.0	2676516.0	2696390.0
2676578.0	2676436.0	2676497.0	2676176.0	2673885.0
2684538.0	2677129.0	2675134.0	2676887.0	2677626.0
2678262.0	2673512.0	2676342.0	2676532.0	2676571.0
2671593.0	2669536.0	2720130.0	2676500.0	2676404.0
2675912.0	2664673.0	2673150.0	2676544.0	2676447.0
2676520.0	2676112.0	2675633.0	2672073.0	2676503.0
2667949.0	2676379.0	2676556.0	2676515.0	2676321.0
2683896.0	2676309.0	2676352.0	2676511.0	2676507.0
2676336.0	2676445.0	2676391.0	2676434.0	2676042.0
2676276.0	2676515.0	2676518.0	2676546.0	2675674.0
2676503.0	2676520.0	2676504.0	2676437.0	2676547.0
2676174.0	2676533.0	2675436.0	2676347.0	2676431.0
2676442.0	2676509.0	2675513.0	2676547.0	2675865.0
2675894.0	2676519.0	2676470.0	2686776.0	2676240.0
2676365.0	2676364.0	2673355.0	2676354.0	2677744.0
2676408.0	2676473.0	2676073.0	2676446.0	2676384.0
2676428.0	2676480.0	2676504.0	2676428.0	2677458.0
2677393.0	2676562.0	2675955.0	2676356.0	2676487.0
2676282.0	2676364.0	2675357.0	2675978.0	2676481.0
2675048.0	2676187.0	2676395.0	2677881.0	2676548.0
2675836.0	[illegible]02.0	2676484.0	2677189.0	2676518.0
2676104.0				

eoi
&&
struc

```
   name    = Ceiling       && Name of structure
   type    = roof          && Type of structure
   shape   = slab          && Shape of structure
   nslab   = 10            && Number of nodes in structure
   chrlen  = 17.7          && Characteristic length of structure       (m)
   slarea  = 86.4          && Area                                     (m2)
   tunif   = 305.          && Initial uniform temperature              (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
   eoi
&&
   name    = Walls         && Name of structure
   type    = wall          && Type of structure
   shape   = slab          && Shape of structure
   nslab   = 10            && Number of nodes in structure
   chrlen  = 5.49          && Characteristic length of structure       (m)
   slarea  = 254.          && Area                                     (m2)
   tunif   = 305.          && Initial uniform temperature              (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
    x      = 0.  .040 .080 .120 .160 .200 .240 .280 .320 .360 .396 &&   (m)
   eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
    geometry= 86.4      && Area of layers in lower cell                (m2)
        bc  = 305.      && Basemat boundary condition temperature      (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     19000. && Mass of material                        (kg)
            temp   = 305.   && Initial temperature                     (K)
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  2  3  0.0
    overflow  2  3  3.05
eoi
&&
&& -------------------------- Cell 3, Room 115 ------------------------------
cell 3
control
    nhtm=2  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
       Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                      (m3, m)
    atmos    = 3
               1.01e5      && Pressure
               305.        && Temperature
         o2   = 0.20
         n2   = 0.75
         h2ov = 0.05
struc
    name    = Ceiling       && Name of structure
    type    = roof          && Type of structure
```

```
   hape   = slab          && Shape of structure
   nslab  = 10            && Number of nodes in structure
   chrlen = 14.6          && Characteristic length of structure   (m)
   slarea = 107.          && Area                                 (m2)
   tunif  = 305.          && Initial uniform temperature          (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
   eoi
&&
   name   = Walls         && Name of structure
   type   = wall
   shape  = slab
   nslab  = 10
   chrlen = 5.49
   slarea = 241.
   tunif  = 305.
   compound=   conc conc conc conc conc conc conc conc conc conc
   x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
   eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  3
&&
&&  Lower cell input
&&
low-cell
   geometry= 107.      && Area of layers in lower cell                 (m2)
       bc  = 305.      && Basemat boundary condition temperature       (K)
       concrete
           compos = 1      && Number of materials
                    conc   && Material
                    23500. && Mass of material
           temp   = 305.   && Initial temperature
       eoi
       pool
           temp   = 305.   && Initial temperature
       eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
   overflow  3  2  3.05
eoi
&&
&& --------------------------- Cell 4, Room 236 ------------------------------
cell 4
control
   nhtm=1  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
   nsoeng=1  nspeng=4
eoi
title
        Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                         (m3, m)
    atmos    = 3
               1.01e5        && Pressure
               305.          && Temperature
        o2   = 0.25
        n2   = 0.75
        h2ov = 0.05
&&
struc
    name    = Walls          && Name of structure
    type    = wall           && Type of structure
```

```
   shape   = slab          && Shape of structure
   nslab   = 10            && Number of nodes in structure
   chrlen  = 5.49          && Characteristic length of structure   (m)
   slarea  = 450.          && Area                                 (m2)
   tunif   = 305.          && Initial uniform temperature          (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x       = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
   eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  4
&&
&&  Lower cell input
&&
low-cell
   geometry= 91.9      && Area of layers in lower cell                (m2)
      bc  = 305.      && Basemat boundary condition temperature       (K)
      concrete
         compos = 1      && Number of materials
                  conc   && Material
                  6730.  && Mass of material
         temp   = 305.   && Initial temperature
      eoi
      pool
         temp   = 305.   && Initial temperature
      eoi
eoi
&&
&&  Engineered safety systems
&&
&&  Spillage from Room 236 to Room 115 via the connecting pipe chase
&&
engineer    Spill 1  4  3  5.79
   overflow  4  3  0.025
eoi
&&
&&  Fire water sprinkler system, activated on high temperature.
&&
engineer    Sprinklr  2  4  4  0.
    spray
      spdiam = .001   && Spray droplet diameter                      (m)
      sphite = 5.49   && Spray fall height                           (m)
      spsttm = 373.   && Temperature at which system activates       (K)
   eoi
    source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
       h2ol  = 3       &&  activation
       iflag = 2
       t     = 0.0     100.    1.00e5
       mass  = 21.1    21.1    21.1
       temp  = 305.    305.    305.
    eoi
  eoi
&&
&& ------------------------ Cell 5, Balance of Plant ------------------------
cell 5
control
eoi
title
       Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
&&
&& -------------------------- Cell 6, Environment ---------------------------
cell 6
```

```
control
eoi
title
       Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

LISTING 10 - CONTAIN Input for BS-5

```
&& ========================== Model Description ==============================
&&
&& File:
&&
&&     cnt005.mdl
&&
&& Description:
&&
&&     BS-5.  This input deck describes a five volume model of the B&W Plant
&&     auxiliary building.  The rooms modeled are 105, 113, 115, and 236.
&&     The steam source is a 6 inch break in the HPI pump suction piping in
&&     room 115.  Break flow is limited by the 2.5 inch HPI injection piping.
&&     This model does not include water aerosols (the dropout option is used).
&&
&& Written by:
&&
&&     John Schroeder  7/91
&&
&& ========================= Machine Control Input =======          ============
cray
eoi
&& ============================== Global Input ===============================
&&
&& Section 3.2, p. 3-11
&&
&&     Atmospheric Gases
&&
&&     Material     Description
&&     --------     -----------
&&     o2           oxygen
&&     n2           nitrogen
&&     h2ov         steam
&&     h2ol         water
&&
control
    ncells    = 6       && Number of cells
    ntitl     = 2       && Number of title lines
    ntzone    = 5       && Number of time zones
    nac       = 0       && Number of aerosol groups
    nsectn    = 0       && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names ----------------
&&
&& Section 3.2.1, p. 3-13
&&
material
    compound
        n2 o2           && Air
        h2ov h2ol       && Steam and water
        conc            && Structural materials
&&
&& ---------------------------- Reactor Type --------------------------------
&&
&& Section 3.2.2, p. 3-17
&&
thermal                 && Water-cooled reactor
&&
&& ---------------------------- Flow Options --------------------------------
&&
&& Section 3.2.3, p. 3-17
&&
flows
&&
```

```
&&  Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&              1, 2, 3.
&&
    area(1,5) = 8.88     & Cross-sectional a -, of flow path          (m2)
    avl(1,5)  = 14.6     && Ratio of area to inertial length, A/L      (m)
    cfc(1,5)  = 1.00     && Flow loss corfficient
&&
&&  Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
    area(1,2) = 12.6
    avl(1,2)  = 20.7
    cfc(1,2)  = 1.00
&&
&&  Junction 3 - Room 113 to Balance of Plant, includes on'y flow path 5.
&&
    area(2,5) = 0.892
    avl(2,5)  = 1.46
    cfc(2,5)  = 1.0
&&
&&  Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
    area(2,3) = 1.⁰⁵
    avl(2,3)  = 3.2
    cfc(2,3)  = 1.0
&&
&&  Junction 5 - Room 1.5 to Balance of F.ant, includes only flow path 7.
&&
    area(3,5) = 1.95
    avl(3,5)  = 3.2
    cfc(3,5)  = 1.00
&&
&&  Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
    area(3,4) = 2.97
    avl(3,4)  = 4.88
    cfc(3,4)  = 1.00
&&
&&  Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&              10, 11, 12, and 13.
&&
    area(4,5) = 29.1
    avl(4,5)  = 157.
    cfc(4,5)  = 1.00
&&
&&  Junction 8 - Balance of Plant to environment, includes only blowout
&&              paths.
&&
    area(5,6) = 46.5
    avl(5,6)  = 250.
    cfc(5,6)  = 1.00
&&
    implicit
    dropout
&&
&&  Compartment and junction elevation data
&&
&&  Compartments
&&
    elevcl(1)  = 169.   && Center of mass elevation for Rm 105         (m)
    elevcl(2)  = 169.   && Center of mass elevation for Rm 113         (m)
    elevcl(3)  = 169.   && Center of mass elevation for Rm 115         (m)
    elevcl(4)  = 175.   && Center of mass elevation for Rm 236         (m)
    elevcl(5)  = 185.   && Center of mass elevation for Rm BOP         (m)
    elevcl(6)  = 185.   && Center of mass elevation for Environment    (m)
&&
&&  Junctions
&&
    elevfp(1,5   167.
```

```
   elevfp(5,1)= 167.

   elevfp(1,2)= 170.
   elevfp(2,1)= 170.

   elevfp(2,5)= 172.
   elevfp(5,2)= 172.

   elevfp(2,3)= 170.
   elevfp(3,2)= 170.

   elevfp(3,5)= 170.
   elevfp(5,3)= 170.

   ele,fp(3,4)= 172.
   elevfp(4,3)= 172.

   elevfp(4,5)= 173.
   elevfp(5,4)= 173.

   elevfp(5,6)= 211.
   elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ------------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& -------------------------------- Times ------------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
   1800.              && Maximum CPU time limit                     (s)
   0.                 && Problem start time                         (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  ------  ------  ------                                          (s)
       1.     10.     10.
       5.     50.    100.
      20.    200.    500.
      50.    100.   1000.
      50.    100.   7200.
&& -----------------------
eoi
&&
&& ---------------------------- Output Control ------------------------------
&&
&&  Section 3.2.7, p. 3-38
&&
shortedt      = 2      && System ts between short edits
longedt       = 1      && Ts edits between long edits
prflow                 && Print intercell flow data
praer                  &&       detailed aerosol inventories
prlow-cl               &&       lower cell model
prheat                 &&       heat transfer structure model
prengsys               &&       engineered system model
title
          B&W Plant Auxilliary Building Steam Propagation Model
                    Five Compartment Model -- BS-5
&&
&&
&& ==================== Cell Input and Cell Control ====================
```

```
&&
&& Section 3.3, p. 3-40
&&
&& ------------------------- Cell 1, Room 105 -----------------------------
cell 1
control
   nhtm=2  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
      Cell 1, Room 105
&&
&& Upper Cell Input
&&
geometry  1.134e3  6.43 && Cell volume and height                    (m3, m)
   atmos     = 3        && Number of materials
               1.01e5  && Pressure                                    (Pa)
               305.    && Temperature                                 (K)
      n2    = 0.75     && Initial nitrogen fraction
      o2    = 0.20     && Initial oxygen fraction
      h2ov  = 0.05     && Initial water vapor fraction
struc
   name      = Ceiling        && Name of structure
   type      = roof           && Type of structure
   shape     = slab           && Shape of structure
   nslab     = 10             && Number of nodes in structure
   chrlen    = 18.7           && Characteristic length of structure     (m)
   slarea    = 295.           && Area                                   (m2)
   tunif     = 305.           && Initial uniform temperature            (K)
   compound  =  conc conc conc conc conc conc conc conc conc conc
   x         = 0. .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
   eoi
&&
   name      = Walls          && Name of structure
   type      = wall           && Type of structure
   shape     = slab           && Shape of structure
   nslab     = 10             && Number of nodes in structure
   chrlen    = 5.49           && Characteristic length of structure     (m)
   slarea    = 208.           && Area                                   (m2)
   tunif     = 305.           && Initial uniform temperature            (K)
   compound  =  conc conc conc conc conc conc conc conc conc conc
    x        = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
   eoi
&&
condense
ht-tran     on  on  on  on  on
overflow    1
&&
&& Lower cell input
&&
low-cell
   geometry= 295.      && Area of layers in lower cell                (m2)
      tb   = 305.      && Basemat boundary condition temperature      (K)
      concrete
         compos = 1      && Number of materials
                  conc   && Material
                  43200. && Mass of material
         temp   = 305.   && Initial temperature
      eoi
      pool
         temp   = 305.   && Initial temperature
      eoi
eoi
&&
&& Engineered safety systems
&&
engineer    Spill  1  1  5  .152
   overflow  1  ? 1.74
eoi
```

```
&&
&& --------------------------- Cell 2, Room 113 -------------------------------
cell 2
control
   nntw=2  mxslab=11  nspatm=0  nspsum=0  naensy=.  jconc=5  jpool=1
eoi
title
      Cell 2, Room 113
&&
&&  Upper Cell Input
&&
geometry  3.794e2  0.10 && Cell volume and height                  (m3, m)
   atmos    = 3
              1.01e5  && Pressure                                     (Pa)
              305.    && Temperature                                  (K)
      o2    = 0.20
      n2    = 0.75
      h2ov  = 0.05
&&
struc
   name    = Ceiling       && Name of structure
   type    = roof          && Type of structure
   shape   = slab          && Shape of structure
   nslab   = 10            && Number of nodes in structure
   chrlen  = 17.7          && Characteristic length of structure      (m)
   slarea  = 86.4          && Area                                    (m2)
   tunif   = 305.          && Initial uniform temperature             (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
   eoi
&&
   name    = Walls         && Name of structure
   type    = wall          && Type of structure
   shape   = slab          && Shape of structure
   nslab   = 10            && Number of nodes in structure
   chrlen  = 5.49          && Characteristic length of structure      (m)
   slarea  = 254.          && Area                                    (m2)
   tunif   = 305.          && Initial uniform temperature             (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
    x      = 0. .040 .080 .120 .160 .200 .240 .280 .320 .360 .396 &&  (m)
   eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
   geometry= 86.4      && Area of layers in lower cell                (m2)
      bc  = 305.       && Basemat boundary condition temperature      (K)
      concrete
         compos = 1       && Number of materials
                  conc    && Material
                  10000.  && Mass of material                         (kg)
         temp   = 305.    && Initial temperature                      (K)
      eoi
      pool
         temp   = 305.   && Initial temperature
      eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  2  1  0.0
   overflow  2  1  3.05
eoi
&&
```

```
&& --------------------------- Cell 3, Room 115 -----------------------------
cell 3
control
    nhtm=2  mxslab=11  nsoatm=2  nspatm=736  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                    (m3, m)
    atmos    = 3
               1.01e5       && Pressure
               305.         && Temperature
        o2   = 0.20
        n2   = 0.75
        h2ov = 0.05
source=2
&&
&&  Blowdown of saturated primary system water
&&
    h2ov  = 736
    iflag = 2
    t     =         0.0         1.0         2.0         3.0         4.0
                    5.0         6.0         7.0         8.0         9.0
                   10.0        11.0        12.0        13.0        14.0
                   15.0        25.0        35.0        45.0        55.0
                   65.0        75.0        85.0        95.0       105.0
                  115.0       125.0       135.0       145.0       155.0
                  165.0       175.0       185.0       195.0       205.0
                  215.0       225.0       235.0       245.0       255.0
                  265.0       275.0       285.0       295.0       305.0
                  315.0       325.0       335.0       345.0       355.0
                  365.0       375.0       385.0       395.0       405.0
                  415.0       425.0       435.0       445.0       455.0
                  465.0       475.0       485.0       495.0       505.0
                  515.0       525.0       535.0       545.0       555.0
                  565.0       575.0       585.0       595.0       605.0
                  615.0       625.0       635.0       645.0       655.0
                  665.0       675.0       685.0       695.0       705.0
                  715.0       725.0       735.0       745.0       755.0
                  765.0       775.0       785.0       795.0       805.0
                  815.0       825.0       835.0       845.0       855.0
                  865.0       875.0       885.0       888.6       898.6
                  908.6       918.6       928.6       938.6       948.6
                  958.6       968.6       978.6       988.6       998.6
                 1000.0      1010.0      1020.0      1030.0      1040.0
                 1050.0      1060.0      1070.0      1080.0      1090.0
                 1100.0      1110.0      1120.0      1130.0      1140.0
                 1150.0      1160.0      1170.0      1180.0      1190.0
                 1200.0      1210.0      1220.0      1230.0      1240.0
                 1250.0      1260.0      1270.0      1280.0      1290.0
                 1300.0      1310.0      1320.0      1330.0      1340.0
                 1350.0      1360.0      1370.0      1380.0      1390.0
                 1400.0      1410.0      1420.0      1430.0      1440.0
                 1450.0      1460.0      1470.0      1480.0      1490.0
                 1500.0      1510.0      1520.0      1530.0      1540.0
                 1550.0      1560.0      1570.0      1580.0      1590.0
                 1600.0      1610.0      1620.0      1630.0      1640.0
                 1650.0      1660.0      1670.0      1680.0      1690.0
                 1700.0      1710.0      1720.0      1730.0      1740.0
                 1750.0      1760.0      1770.0      1780.0      1790.0
                 1800.0      1810.0      1820.0      1830.0      1840.0
                 1850.0      1860.0      1870.0      1880.0      1890.0
                 1900.0      1910.0      1920.0      1930.0      1940.0
                 1950.0      1960.0      1970.0      1980.0      1990.0
                 2000.0      2010.0      2020.0      2030.0      2040.0
                 2050.0      2060.0      2070.0      2080.0      2090.0
```

2100.0	2110.0	2120.0	[illegible]	2140.0
2150.0	2160.0	2170.0	2180.0	2190.0
2200.0	2210.0	2220.0	2230.0	2240.0
2250.0	2260.0	2270.0	2280.0	2290.0
2300.0	2310.0	2320.0	2330.0	2340.0
2350.0	2360.0	2370.0	2380.0	2390.0
2400.0	2410.0	2420.0	2430.0	2440.0
2450.0	2460.0	2470.0	2480.0	2490.0
2500.0	2510.0	2520.0	2530.0	2540.0
2550.0	2560.0	2570.0	2580.0	2590.0
2600.0	2610.0	2620.0	2630.0	2640.0
2650.0	2660.0	2670.0	2680.0	2690.0
2700.0	2710.0	2720.0	2730.0	2740.0
2750.0	2760.0	2770.0	2780.0	2790.0
2800.0	2810.0	2820.0	2830.0	2840.0
2850.0	2860.0	2870.0	2880.0	2890.0
2900.0	2910.0	2920.0	2930.0	2940.0
2950.0	2960.0	2970.0	2980.0	2990.0
3000.0	3010.0	3020.0	3030.0	3040.0
3050.0	3060.0	3070.0	3080.0	3090.0
3100.0	3110.0	3120.0	3130.0	3140.0
3150.0	3160.0	3170.0	3180.0	3190.0
3200.0	3210.0	3220.0	3230.0	3240.0
3250.0	3260.0	3270.0	3280.0	3290.0
3300.0	3310.0	2320.0	3330.0	3340.0
3350.0	3360.0	3370.0	3380.0	3390.0
3400.0	3410.0	3420.0	3430.0	3440.0
3450.0	3460.0	3470.0	3480.0	3490.0
3500.0	3510.0	3520.0	3530.0	3540.0
3550.0	3560.0	3570.0	3580.0	3590.0
3600.0	3610.0	3620.0	3630.0	3640.0
3650.0	3660.0	3670.0	3680.0	3690.0
3700.0	3710.0	3720.0	3730.0	3740.0
3750.0	3760.0	3770.0	3780.0	3790.0
3800.0	3810.0	3820.0	3830.0	3840.0
3850.0	3860.0	3870.0	3880.0	[illegible]
3900.0	3910.0	3020.0	3930.0	3940.0
3950.0	3960.0	3970.0	3980.0	3990.0
4000.0	4010.0	4020.0	4030.0	4040.0
4050.0	4060.0	4070.0	4080.0	4090.0
4100.0	4110.0	4120.0	4130.0	4140.0
4150.0	4160.0	4170.0	4180.0	4190.0
4200.0	4210.0	4220.0	4230.0	4240.0
4250.0	4260.0	4270.0	4280.0	4290.0
4300.0	4310.0	4320.0	4330.0	4340.0
4350.0	4360.0	4370.0	4380.0	4390.0
4400.0	4410.0	4420.0	4430.0	4440.0
4450.0	4460.0	4470.0	4480.0	4490.0
4500.0	4510.0	4520.0	4530.0	4540.0
4550.0	4560.0	4570.0	4580.0	4590.0
4600.0	4610.0	4620.0	4630.0	4640.0
4650.0	4660.0	4670.0	4680.0	4690.0
4700.0	4710.0	4720.0	4730.0	4740.0
4750.0	4760.0	4770.0	4780.0	4790.0
4800.0	4810.0	4820.0	4830.0	4840.0
4850.0	4860.0	4870.0	4880.0	4890.0
4900.0	4910.0	4920.0	4930.0	4940.0
4950.0	4960.0	4970.0	4980.0	4990.0
5000.0	5010.0	5020.0	5030.0	5040.0
5050.0	5060.0	5070.0	5080.0	5090.0
5100.0	5110.0	5120.0	5130.0	5140.0
5150.0	5160.0	5170.0	5180.0	5190.0
5200.0	5210.0	5220.0	5230.0	5240.0
5250.0	5260.0	5270.0	5280.0	5290.0
5300.0	5310.0	5320.0	5330.0	5340.0
5350.0	5360.0	5370.0	5380.0	5390.0
5400.0	5410.0	5420.0	5430.0	5440.0
5450.0	5460.0	5470.0	5480.0	5490.0

5500.0	5510.0	5520.0	5530.0	5540.0
5550.0	5560.0	5570.0	5580.0	5590.0
5600.0	5610.0	5620.0	5630.0	5640.0
5650.0	5660.0	5670.0	5680.0	5690.0
5700.0	5710.0	5720.0	5730.0	5740.0
5750.0	5760.0	5770.0	5780.0	5790.0
5800.0	5810.0	5820.0	5830.0	5840.0
5850.0	5860.0	5870.0	5880.0	5890.0
5900.0	5910.0	5920.0	5930.0	5940.0
5950.0	5960.0	5970.0	5980.0	5990.0
6000.0	6010.0	6020.0	6030.0	6040.0
6050.0	6060.0	6070.0	6080.0	6090.0
6100.0	6110.0	6120.0	6130.0	6140.0
6150.0	6160.0	6170.0	6180.0	6190.0
6200.0	6210.0	6220.0	6230.0	6240.0
6250.0	6260.0	6270.0	6280.0	6290.0
6300.0	6310.0	6320.0	6330.0	6340.0
6350.0	6360.0	6370.0	6380.0	6390.0
6400.0	6410.0	6420.0	6430.0	6440.0
6450.0	6460.0	6470.0	6480.0	6490.0
6500.0	6510.0	6520.0	6530.0	6540.0
6550.0	6560.0	6570.0	6580.0	6590.0
6600.0	6610.0	6620.0	6630.0	6640.0
6650.0	6660.0	6670.0	6680.0	6690.0
6700.0	6710.0	6720.0	6730.0	6740.0
6750.0	6760.0	6770.0	6780.0	6790.0
6800.0	6810.0	6820.0	6830.0	6840.0
6850.0	6860.0	6870.0	6880.0	6890.0
6900.0	6910.0	6920.0	6930.0	6940.0
6950.0	6960.0	6970.0	6980.0	6990.0
7000.0	7010.0	7020.0	7030.0	7040.0
7050.0	7060.0	7070.0	7080.0	7090.0
7100.0	7110.0	7120.0	7130.0	7140.0
7150.0	7160.0	7170.0	7180.0	7190.0
7200.0				

mass =	0.0	53.8	54.7	55.6	56.5
	57.4	58.4	59.3	59.5	59.5
	59.5	59.5	59.5	59.5	59.5
	59.5	55.8	56.4	55.8	55.2
	55.0	54.9	69.6	69.7	69.8
	69.9	70.0	70.2	70.5	70.9
	71.1	70.5	56.0	54.3	46.8
	47.3	47.1	46.6	52.9	50.3
	49.2	47.8	45.7	44.4	43.2
	41.6	[illegible]	39.0	37.7	37.6
	36.4	38.3	39.2	37.7	31.9
	30.8	29.8	29.5	28.7	31.2
	28.9	28.1	27.3	26.1	24.2
	22.5	21.3	20.5	19.5	18.6
	17.7	16.8	19.0	18.8	18.5
	18.3	17.9	17.5	18.1	18.5
	18.0	17.8	17.4	17.0	16.6
	16.3	15.7	15.3	15.0	14.8
	14.5	14.2	13.9	13.6	13.4
	13.1	12.8	12.5	12.2	11.9
	11.6	11.4	11.1	11.0	10.8
	10.6	10.4	10.2	10.1	9.9
	9.8	9.7	9.5	9.4	9.2
	9.2	9.6	9.5	9.4	9.4
	9.3	9.2	9.2	9.1	9.1
	9.0	9.0	9.0	8.9	8.9
	8.9	8.9	8.9	9.0	9.0
	9.0	9.0	9.1	9.1	9.2
	9.2	9.3	9.3	9.4	9.5
	9.6	9.6	9.7	9.8	9.9
	10.0	10.1	10.2	10.2	10.3
	10.4	10.5	10.0	10.1	10.2

10.3	10.4	10.5	10.7	10.8
10.9	11.0	11.1	11.2	11.4
11.5	11.6	11.7	11.9	12.0
12.1	12.2	12.4	12.5	12.6
12.8	12.9	13.0	13.2	13.3
13.5	13.6	13.8	13.9	14.1
14.2	14.4	14.5	14.7	14.8
14.9	15.1	15.2	15.3	15.4
15.6	13.0	13.1	13.1	13.6
13.9	14.2	14.3	14.4	14.5
14.6	14.9	14.6	14.7	14.8
14.7	14.9	6.8	15.7	15.8
7.8	17.2	20.1	16.7	12.4
12.6	12.7	12.9	13.1	13.4
13.6	14.2	14.2	14.0	13.8
13.4	13.1	13.1	12.4	11.4
10.7	10.8	11.1	11.4	11.7
12.0	12.[illegible]	12.6	12.9	13.2
13.5	14.0	14.2	14.5	14.7
15.0	15.2	15.3	15.4	15.5
15.7	15.8	15.9	16.1	16.2
16.4	18.8	14.9	24.4	15.0
25.5	11.8	19.8	24.4	9.8
29.8	24.4	17.2	27.6	13.8
14.5	19.9	20.0	20.1	20.2
20.3	20.4	20.5	20.6	20.2
20.3	20.5	20.6	20.8	20.9
21.0	21.1	21.2	21.3	21.5
21.6	23.1	22.8	22.7	22.7
22.6	22.6	22.8	23.2	23.3
23.3	23.4	23.4	22.7	22.8
22.9	23.0	22.9	23.0	21.6
21.8	22.1	22.4	22.7	27.2
28.8	20.4	32.1	18.9	35.8
29.9	29.8	29.5	29.2	28.8
28.4	28.1	28.1	28.2	28.4
28.6	28.9	29.0	29.0	29.0
28.9	28.7	28.5	28.3	28.1
28.0	28.0	28.0	28.1	28.1
28.2	28.1	28.1	28.0	27.9
27.9	27.8	27.7	27.6	27.5
27.4	27.3	27.2	27.1	27.0
26.9	20.8	26.7	26.6	26.5
26.3	26.2	26.1	26.0	25.9
25.8	25.7	25.6	25.5	25.4
25.2	25.1	25.0	24.9	24.8
24.7	24.6	24.5	24.4	24.3
24.2	24.1	24.0	23.9	23.8
23.7	23.6	23.5	23.4	23.3
23.2	23.1	23.0	22.9	22.8
22.7	22.6	22.6	22.5	22.4
18.5	24.0	14.5	19.9	23.2
22.7	21.6	24.0	19.4	13.8
18.8	21.0	21.4	20.7	22.2
22.8	18.0	20.7	27.3	32.2
26.9	21.4	22.5	22.2	35.2
76.8	18.1	24.6	52.1	34.8
22.6	35.0	21.7	24.6	27.4
43.1	39.8	38.5	45.4	46.6
47.3	48.4	50.5	50.7	54.3
54.5	56.0	53.2	53.7	54.2
54.7	55.1	55.4	55.7	55.9
56.1	56.3	56.5	56.7	56.8
57.0	57.1	57.[illegible]	57.4	57.5
57.6	59.9	59.4	59.5	59.5
59.5	59.5	59.5	59.5	59.5
59.4	59.2	58.6	56.2	55.3
57.8	58.3	59.2	59.9	60.4

60.7	60.9	61.1	61.2	61.3
61.4	61.5	61.6	61.7	61.7
61.8	61.9	61.9	62.0	62.0
62.1	62.2	62.2	62.3	62.4
62.4	62.5	62.5	62.6	62.7
62.7	62.8	62.9	62.9	63.0
63.0	63.1	63.2	63.2	63.3
63.3	63.4	63.5	63.5	63.6
63.6	63.7	63.7	63.8	63.9
63.9	64.0	64.0	64.1	64.1
64.2	64.3	64.3	64.4	64.4
64.5	64.5	64.6	64.6	64.7
64.8	64.8	64.9	64.9	65.0
65.0	65.1	65.1	65.2	65.2
65.3	65.3	65.4	65.4	65.5
65.5	65.6	65.6	65.7	65.7
65.8	65.8	65.9	65.9	66.0
66.0	66.1	66.1	66.2	66.2
66.3	66.3	66.3	66.4	66.4
66.5	66.5	66.6	66.6	66.7
66.7	66.7	66.8	66.8	66.9
66.9	67.0	67.0	67.1	67.1
67.1	67.2	67.2	67.2	67.3
67.3	67.3	67.4	67.4	67.5
67.5	67.5	67.6	67.6	67.6
67.7	67.7	67.7	67.8	67.8
67.8	67.9	67.9	68.0	68.0
68.0	68.1	68.1	68.1	68.2
68.2	68.2	68.2	68.3	68.3
68.3	68.4	68.4	68.4	68.5
68.5	68.5	68.6	68.6	68.6
68.7	68.7	68.7	68.7	68.8
68.8	68.8	68.9	68.9	68.9
68.9	69.0	69.0	69.0	69.1
69.1	69.1	69.1	69.2	69.2
69.2	69.3	69.3	69.3	69.3
69.4	69.4	69.4	69.4	69.5
69.5	69.5	69.5	69.6	69.6
69.6	69.6	69.7	69.7	69.7
69.7	69.8	69.8	69.8	69.8
69.8	69.9	69.9	69.9	69.9
70.0	70.0	70.0	70.0	70.0
70.1	70.1	70.1	70.1	70.2
70.2	70.2	70.2	70.2	70.3
70.3	70.3	70.3	70.3	70.4
70.4	70.4	70.4	70.4	70.5
70.5	70.5	70.5	70.5	70.5
70.6				

enth =	158119.7	1315678.0	1319274.0	1322915.0	1326278.0
	1329812.0	1332963.0	1335866.0	1336738.0	1336759.0
	1336788.0	1336787.0	1336776.0	1336762.0	1336784.0
	1336780.0	1316393.0	1320209.0	1316496.0	1313436.0
	1313009.0	1313194.0	1383841.0	1384522.0	1385224.0
	1386094.0	1387132.0	1388411.0	1390058.0	1391758.0
	1394223.0	1400809.0	1353282.0	1355197.0	1358870.0
	1359778.0	1360359.0	1361359.0	1359062.0	1360367.0
	1361290.0	1362105.0	[illegible]	1363782.0	1364715.0
	1365603.0	1366227.0	[illegible]	1367763.0	1367192.0
	1366610.0	1296113.0	1381702.0	1383374.0	[illegible]
	1260773.0	1255993.0	[illegible]	1254592.0	[illegible]
	1393473.0	1396441.0	[illegible]	1404121.0	1404725.0
	1413837.0	1420611.0	[illegible]	1433573.0	1441272.0
	1448001.0	1454929.0	[illegible]	1440578.0	1442571.0
	1443546.0	1447336.0	[illegible]	1445196.0	1443583.0
	1447129.0	1446696.0	1450414.0	1453375.0	1456304.0
	1459198.0	1250546.0	1250004.0	1249401.0	[illegible]
	1248382.0	1247885.0	1247879.0	1247224.0	[illegible]

1246445.0	1245819.0	1245162.0	1244534.0	1243917.0
1243304.0	1242736.0	1242222.0	1242031.0	1241570.0
1241193.0	1241320.0	1240968.0	1240639.0	1240353.0
1240580.0	1240408.0	1240151.0	1239974.0	1240579.0
1240556.0	1243775.0	1243652.0	1243555.0	1243526.0
1243458.0	1243352.0	1243377.0	1243306.0	1243284.0
1243220.0	1243185.0	1243182.0	1243151.0	1243130.0
1243136.0	1243146.0	1243110.0	1243027.0	1242910.0
1242768.0	1242591.0	1242388.0	1242166.0	1241915.0
1241651.0	1241390.0	1241114.0	1240827.0	1240536.0
1240220.0	1239890.0	1239556.0	1239197.0	1238826.0
1238450.0	1238700.0	1238274.0	1237848.0	1237400.0
1236938.0	1236481.0	1237911.0	1237397.0	1236881.0
12363[illegible]0.0	1235806.0	1235260.0	1234704.0	1234137.0
1233564.0	1233015.0	1232426.0	1231833.0	1231234.0
1230633.0	1230032.0	1229425.0	1228775.0	1228116.0
1227455.0	1226834.0	1226171.0	1225508.0	1224848.0
1224196.0	1223540.0	1222880.0	1222229.0	1221571.0
1220917.0	1220288.0	1219626.0	1218965.0	1218308.0
1217629.0	1216505.0	1215849.0	1215138.0	1214404.0
1213625.0	1212840.0	1212032.0	1211201.0	1210358.0
1209488.0	1208815.0	1208165.0	1207398.0	1176431.0
1183866.0	1186729.0	1[illegible]6528.0	1186336.0	1186151.0
1185986.0	1203584.0	1211424.0	1210512.0	1209606.0
1198625.0	1197997.0	707168.1	1185762.0	1185172.0
1401812.0	1181058.0	1321526.0	1175293.0	1092225.0
1094787.0	1096254.0	1095278.0	1102466.0	1104973.0
1112808.0	1116084.0	1115524.0	1112528.0	1108807.0
1103768.0	1098388.0	1097267.0	1087206.0	1067120.0
1050411.0	1052252.0	1059202.0	1065370.0	1071079.0
1076267.0	1080965.0	1085216.0	1089044.0	1092434.0
1095424.0	1100388.0	1102478.0	1104317.0	1105938.0
1107356.0	1108576.0	1108647.0	1108762.0	1108863.0
1108944.0	1109019.0	1109462.0	1109556.0	1109612.0
1109638.0	1178335.0	1159067.0	1156515.0	1155660.0
1169435.0	1221813.0	1192361.0	1151086.0	1035327.0
1221144.0	1150401.0	1113750.0	1198399.0	1209159.0
1208177.0	1129992.0	1128767.0	1126926.0	1125951.0
1124835.0	1123585.0	1122503.0	1121390.0	1119113.0
1118028.0	1116918.0	1114238.0	1113145.0	1112033.0
1110821.0	1109790.0	1108112.0	1106969.0	1105848.0
1104719.0	1107350.0	1106544.0	1104990.0	1102301.0
1100738.0	1099440.0	1099718.0	1100544.0	1099346.0
1098334.0	1097386.0	1096142.0	1093381.0	109290[illegible].0
1092113.0	1091404.0	1088315.0	1087667.0	1109844.0
1107967.0	1107138.0	1106558.0	1105756.0	1150509.0
1149120.0	1081033.0	1078712.0	1140491.0	1121396.0
1103086.0	1101705.0	1099359.0	1097778.0	1095173.0
1092491.0	1090138.0	1089335.0	1088871.0	1088953.0
1089231.0	1089270.0	1088951.0	1088232.0	1086989.0
1085380.0	1083678.0	1081806.0	1080012.0	1078420.0
1077034.0	1076020.0	1075296.0	1074620.0	1073901.0
1073011.0	1071966.0	1070802.0	1069553.0	1068253.0
1066925.0	1065584.0	1064231.0	1062863.0	1061484.0
1060092.0	1058683.0	1057261.0	1055826.0	1054379.0
1052925.0	1051463.0	1049996.0	1048524.0	1047026.0
1045522.0	1044013.0	1042497.0	1040589.0	1039483.0
1037972.0	1036457.0	1034943.0	1033419.0	1031903.0
1030389.0	1028875.0	1027361.0	1025849.0	1024338.0
1022828.0	1021318.0	1019810.0	1018313.0	1016814.0
1015293.0	1013[illegible]5.0	1012259.0	1010743.0	1009229.0
1007711.0	1006179.0	1004657.0	1003138.0	1001620.0
1000104.0	998591.6	997080.4	995573.2	994070.2
992592.1	991148.7	989722.0	988317.4	986930.9
1017446.0	1011037.0	1005642.0	1006755.0	1000073.0
1016224.0	1007882.0	986841.4	1003749.0	981246.5
1002118.0	1001727.0	1032144.0	1000070.0	977819.4
996948.8	988294.4	992275.9	994635.8	995009.3

```
            1009643.0   1030662.0   1030099.0   1042376.0   1047106.0
            1033281.0   1031242.0   1023219.0   1048438.0   1046795.0
            1028726.0   1045297.0   1000508.0   1019591.0   1035438.0
            1062547.0   1078606.0   1080365.0   1075304.0   1078629.0
            1078427.0   1079007.0   1077010.0   1078099.0   1077353.0
            1075502.0   1075311.0   1074424.0   1073383.0   1072280.0
            1071060.0   1069894.0   1068690.0   1067462.0   1066214.0
            1064944.0   1063655.0   1062346.0   1061070.0   1059677.0
            1058325.0   1056959.0   1055579.0   1054183.0   1052774.0
            1051349.0   1050377.0   1047926.0   1046465.0   1044996.0
            1043516.0   1042026.0   1040524.0   1039010.0   1037479.0
            1035927.0   1034339.0   1032656.0   1030674.0   1028763.0
            1027458.0   1026228.0   1024895.0   1023493.0   1022034.0
            1020533.0   1019002.0   1017450.0   1015885.0   1014308.0
            1012722.0   1011128.0   1009528.0   1007921.0   1006310.0
            1004693.0   1003073.0   1001448.0    999818.8    998187.1
             996552.6    994915.7    993276.3    991634.4    989990.1
             988343.6    986694.9    985044.2    983391.8    981737.4
             980081.6    978424.3    976765.8    975106.0    973445.2
             971783.4    970120.9    968457.7    966793.9    965129.7
             963465.2    961800.5    960135.7    958470.9    956806.1
             955141.4    953477.1    951813.1    950149.6    948486.6
             946824.3    945162.8    943502.1    941842.2    940183.4
             938525.7    936869.1    935213.8    933559.7    931907.1
             930255.9    928606.2    926958.2    925311.8    923667.2
             922024.4    920383.4    918744.3    917107.3    915472.2
             913839.4    912208.6    910580.1    908953.9    907330.0
             905708.5    904089.4    902472.8    900858.6    899247.0
             897638.1    896031.8    894428.2    892827.4    891229.3
             889634.1    888041.8    886452.4    884865.9    883282.5
             881702.1    880124.8    878550.6    876979.6    875411.8
             873847.2    872286.0    870728.1    869173.4    867622.2
             866074.4    864530.1    862989.2    861451.9    859918.1
             858387.8    856861.2    85[illegible]38.2    853818.9    852303.2
             850791.2    849282.9    84[illegible]79.4    846277.2    844779.0
             843284.8    841786.6    840291.9    838801.2    837314.6
             835831.8    834352.9    832878.0    831406.9    829939.7
             828476.4    827016.9    825561.4    824109.8    822662.1
             821218.3    819778.4    818342.5    816910.5    815482.4
             814058.4    812638.2    811222.1    809809.9    808401.8
             806997.6    805597.4    804201.[illegible]    802809.1    801421.0
             800036.9    798656.8    797280.[illegible]    795908.8    794540.8
             793176.8    791816.9    790461.0    789109.2    787761.4
             786417.7    785078.1    783742.6    782411.1    781083.7
             779760.4    778441.2    777126.1    775815.0    774508.1
             773205.2    771906.4    770611.8    769321.1    768034.6
             766752.2    765473.9    764199.6    762929.5    761663.4
             760401.4    759143.5    757889.7    756639.9    755394.2
             754152.6    752915.1    751681.7    750452.2    749226.9
             748005.7    746788.5    745575.3    744366.2    743161.2
             741960.2    740763.2    739570.3    738381.4    737196.5
             736015.6    734838.8    733665.9    732497.1    731332.3
             730171.5    729014.7    727861.9    726713.0    725568.2
             724427.2    723290.4    722157.4    721028.4    719903.3
             718782.2    717665.1    716551.8    715442.5    714337.1
             713235.6    712138.0    711044.4    709954.6    708868.6
             707786.6    706708.4    7056[illegible]4.1    704563.7    703497.1
             702434.3    701375.4    700320.3    69[illegible]69.0    698221.5
             697177.9    696137.9    695101.9    69[illegible]69.6    693041.0
             692016.2    6[illegible]0995.2    689977.9    688964.4    687954.5
             686948.4
     eoi
&&
&&  Blowdown of primary system steam
&&
     h2ov  = 736
     iflag = 2
     t     =        0.0         1.0         2.0         3.0         4.0
```

5.0	6.0	7.0	8.0	9.0
10.0	11.0	12.0	13.0	14.0
15.0	25.0	35.0	45.0	55.0
65.0	75.0	85.0	95.0	105.0
115.0	125.0	135.0	145.0	155.0
165.0	175.0	185.0	195.0	205.0
215.0	225.0	235.0	245.0	255.0
265.0	275.0	285.0	295.0	305.0
315.0	325.0	335.0	345.0	355.0
365.0	375.0	385.0	395.0	405.0
415.0	425.0	435.0	445.0	455.0
465.0	475.0	485.0	495.0	505.0
515.0	525.0	535.0	545.0	555.0
565.0	575.0	585.0	595.0	605.0
615.0	625.0	635.0	645.0	655.0
665.0	675.0	685.0	695.0	705.0
715.0	725.0	735.0	745.0	755.0
765.0	775.0	785.0	795.0	805.0
815.0	825.0	835.0	845.0	855.0
865.0	875.0	885.0	888.6	898.6
908.6	918.6	928.6	938.6	948.6
958.6	968.6	978.6	988.6	998.6
1000.0	1010.0	1020.0	1030.0	1040.0
1050.0	1060.0	1070.0	1080.0	1090.0
1100.0	1110.0	1120.0	1130.0	1140.0
1150.0	1160.0	1170.0	1180.0	1190.0
1200.0	1210.0	1220.0	1230.0	1240.0
1250.0	1260.0	1270.0	1280.0	1290.0
1300.0	1310.0	1320.0	1330.0	1340.0
1350.0	1360.0	1370.0	1380.0	1390.0
1400.0	1410.0	1420.0	1430.0	1440.0
1450.0	1460.0	1470.0	1480.0	1490.0
1500.0	1510.0	1520.0	1530.0	1540.0
1550.0	1560.0	1570.0	1580.0	1590.0
1600.0	1610.0	1620.0	1630.0	1640.0
1650.0	1660.0	1670.0	1680.0	1690.0
1700.0	1710.0	1720.0	1730.0	1740.0
1750.0	1760.0	1770.0	1780.0	1790.0
1800.0	1810.0	1820.0	1830.0	1840.0
1850.0	1860.0	1870.0	1880.0	1890.0
1900.0	1910.0	1920.0	1930.0	1940.0
1950.0	1960.0	1970.0	1980.0	1990.0
2000.0	2010.0	2020.0	2030.0	2040.0
2050.0	2060.0	2070.0	2080.0	2090.0
2100.0	2110.0	2120.0	2130.0	2140.0
2150.0	2160.0	2170.0	2180.0	2190.0
2200.0	2210.0	2220.0	2230.0	2240.0
2250.0	2260.0	2270.0	2280.0	2290.0
2300.0	2310.0	2320.0	2330.0	2340.0
2350.0	2360.0	2370.0	2380.0	2390.0
2400.0	2410.0	2420.0	2430.0	2440.0
2450.0	2460.0	2470.0	2480.0	2490.0
2500.0	2510.0	2520.0	2530.0	2540.0
2550.0	2560.0	2570.0	2580.0	2590.0
2600.0	2610.0	2620.0	2630.0	2640.0
2650.0	2660.0	2670.0	2680.0	2690.0
2700.0	2710.0	2720.0	2730.0	2740.0
2750.0	2760.0	2770.0	2780.0	2790.0
2800.0	2810.0	2820.0	2830.0	2840.0
2850.0	2860.0	2870.0	2880.0	2890.0
2900.0	2910.0	2920.0	2930.0	2940.0
2950.0	2960.0	2970.0	2980.0	2990.0
3000.0	3010.0	3020.0	3030.0	3040.0
3050.0	3060.0	3070.0	3080.0	3090.0
3100.0	3110.0	3120.0	3130.0	3140.0
3150.0	3160.0	3170.0	3180.0	3190.0
3200.0	3210.0	3220.0	3230.0	3240.0
3250.0	3260.0	3270.0	3280.0	3290.0

3300.0	3310.0	3320.0	3330.0	3340.0
3350.0	3360.0	3370.0	3380.0	3390.0
3400.0	3410.0	3420.0	3430.0	3440.0
3450.0	3460.0	3470.0	3480.0	3490.0
3500.0	3510.0	3520.0	3530.0	3540.0
3550.0	3560.0	3570.0	3580.0	3590.0
3600.0	3610.0	3620.0	3630.0	3640.0
3650.0	3660.0	3670.0	3680.0	3690.0
3700.0	3710.0	3720.0	3730.0	3740.0
3750.0	3760.0	3770.0	3780.0	3790.0
3800.0	3810.0	3820.0	3830.0	3840.0
3850.0	3860.0	3870.0	3880.0	3890.0
3900.0	3910.0	3920.0	3930.0	3940.0
3950.0	3960.0	3970.0	3980.0	3990.0
4000.0	4010.0	4020.0	4030.0	4040.0
4050.0	4060.0	4070.0	4080.0	4090.0
4100.0	4110.0	4120.0	4130.0	4140.0
4150.0	4160.0	4170.0	4180.0	4190.0
4200.0	4210.0	4220.0	4230.0	4240.0
4250.0	4260.0	4270.0	4280.0	4290.0
4300.0	4310.0	4320.0	4330.0	4340.0
4350.0	4360.0	4370.0	4380.0	4390.0
4400.0	4410.0	4420.0	4430.0	4440.0
4450.0	4460.0	4470.0	4480.0	4490.0
4500.0	4510.0	4520.0	4530.0	4540.0
4550.0	4560.0	4570.0	4580.0	4590.0
4600.0	4610.0	4620.0	4630.0	4640.0
4650.0	4660.0	4670.0	4680.0	4690.0
4700.0	4710.0	4720.0	4730.0	4740.0
4750.0	4760.0	4770.0	4780.0	4790.0
4800.0	4810.0	4820.0	4830.0	4840.0
4850.0	4860.0	4870.0	4880.0	4890.0
4900.0	4910.0	4920.0	4930.0	4940.0
4950.0	4960.0	4970.0	4980.0	4990.0
5000.0	5010.0	5020.0	5030.0	5040.0
5050.0	5060.0	5070.0	5080.0	5090.0
5100.0	[illegible]	5120.0	5130.0	5140.0
5150.0	5160.0	5170.0	5180.0	5190.0
5200.0	5210.0	5220.0	5230.0	5240.0
5250.0	5260.0	5270.0	5280.0	5290.0
5300.0	5310.0	5320.0	5330.0	5340.0
5350.0	5360.0	5370.0	5380.0	5390.0
5400.0	5410.0	5420.0	5430.0	5440.0
5450.0	5460.0	5470.0	5480.0	5490.0
5500.0	5510.0	5520.0	5530.0	5540.0
5550.0	5560.0	5570.0	5580.0	5590.0
5600.0	5610.0	5620.0	5630.0	5640.0
5650.0	5660.0	5670.0	5680.0	5690.0
5700.0	5710.0	5720.0	5730.0	5740.0
5750.0	[illegible]	5770.0	5780.0	5790.0
5800.0	5810.0	5820.0	5830.0	5840.0
5850.0	5860.0	5870.0	5880.0	5890.0
5900.0	5910.0	5920.0	5930.0	5940.0
5950.0	5960.0	5970.0	5980.0	5990.0
6000.0	6010.0	6020.0	6030.0	[illegible]
6050.0	6060.0	6070.0	6080.0	[illegible]
6100.0	6110.0	6120.0	6130.0	6140.0
6150.0	6160.0	6170.0	6180.0	6190.0
6200.0	6210.0	6220.0	6230.0	6240.0
6250.0	6260.0	6270.0	6280.0	6290.0
6300.0	6310.0	6320.0	6330.0	6340.0
6350.0	6360.0	6370.0	6380.0	6390.0
6400.0	6410.0	6420.0	6430.0	6440.0
6450.0	6460.0	6470.0	6480.0	6490.0
6500.0	6510.0	6520.0	6530.0	6540.0
6550.0	6560.0	6570.0	6580.0	6590.0
6600.0	6610.0	6620.0	6630.0	6640.0
6650.0	6660.0	6670.0	6680.0	6690.0

6700.0	6710.0	6720.0	6730.0	6740.0
6750.0	6760.0	6770.0	6780.0	6790.0
6800.0	6810.0	6820.0	6830.0	6840.0
6850.0	6860.0	6870.0	6880.0	6890.0
6900.0	6910.0	6920.0	6930.0	6940.0
6950.0	6960.0	6970.0	6980.0	6990.0
7000.0	7010.0	7020.0	7030.0	7040.0
7050.0	7060.0	7070.0	7080.0	7090.0
7100.0	7110.0	7120.0	7130.0	7140.0
7150.0	7160.0	7170.0	7180.0	7190.0
7200.0				

mass =	0.0	5.6	5.6	5.5	5.5
	5.4	5.4	5.4	5.4	5.4
	5.4	5.4	5.4	5.4	5.4
	5.4	5.4	5.4	5.5	5.7
	5.8	5.8	4.0	4.1	4.2
	4.2	4.3	4.4	4.6	4.7
	5.0	5.3	7.3	7.6	8.2
	8.4	8.7	8.9	8.8	9.1
	9.4	9.7	10.0	10.2	10.5
	10.7	10.9	11.2	11.4	11.5
	11.7	12.2	13.1	12.4	14.0
	14.3	14.5	14.8	15.0	16.4
	16.3	16.6	17.0	17.5	18.3
	18.9	19.3	20.1	20.8	21.5
	22.1	22.8	21.2	21.4	21.6
	21.7	22.0	22.3	21.8	21.6
	22.0	22.1	22.3	22.6	22.9
	23.2	18.8	18.9	19.0	19.1
	19.1	19.2	19.3	19.4	19.5
	19.7	19.8	19.9	20.1	20.2
	20.4	20.5	20.7	20.7	20.8
	20.9	21.1	21.1	21.2	21.3
	21.4	21.4	21.5	21.5	21.7
	21.7	21.8	21.8	21.8	21.9
	21.9	21.9	21.9	22.0	22.0
	22.0	22.0	22.0	22.0	22.0
	22.0	22.0	22.0	22.0	22.0
	22.0	21.9	21.9	21.9	21.8
	21.8	21.7	21.7	21.7	21.6
	21.6	21.5	21.4	21.4	21.3
	21.3	21.2	21.2	21.1	21.0
	21.0	20.9	21.4	21.3	21.2
	21.1	21.0	20.9	20.8	20.7
	20.7	20.6	20.5	20.4	20.3
	20.2	20.1	20.0	19.8	19.7
	19.6	19.5	19.4	19.3	19.2
	19.0	18.9	18.8	18.6	18.5
	18.4	18.2	18.1	17.9	17.8
	17.6	17.5	17.4	17.2	17.1
	17.0	16.8	16.7	16.6	16.4
	16.3	17.3	17.2	17.4	16.2
	15.7	15.7	15.6	15.5	15.4
	15.3	15.6	15.8	15.7	15.6
	15.4	15.3	14.3	14.6	14.5
	21.5	14.0	16.8	13.9	13.4
	13.3	13.3	13.2	13.0	13.1
	13.0	13.0	13.0	13.0	13.0
	12.9	13.0	12.9	12.9	[illegible]
	12.3	12.3	12.3	12.3	[illegible]
	[illegible]	12.2	12.1	[illegible]	11.9
	11.8	11.8	11.7	11.6	11.5
	11.4	11.4	11.3	11.2	11.2
	11.1	11.1	11.0	10.9	10.8
	10.7	10.0	11.1	9.7	11.0
	9.3	12.2	11.3	9.9	10.8
	9.9	9.9	9.8	9.7	11.2

12.0	10.3	10.2	10.0	9.6
9.8	9.7	9.6	9.5	9.5
9.4	9.3	9.0	8.9	8.9
8.9	8.7	8.6	8.5	8.4
8.3	8.2	8.2	8.1	8.0
7.5	7.9	7.8	7.6	7.5
7.5	7.4	7.3	7.2	7.1
7.0	6.9	6.8	6.7	7.0
6.9	6.8	6.6	6.5	5.0
4.7	4.7	5.7	4.4	4.3
4.6	4.6	4.6	4.6	4.6
4.6	4.6	4.6	4.5	4.5
4.4	4.3	4.2	4.2	4.2
4.1	4.1	4.1	4.1	4.0
4.0	4.0	3.9	3.9	3.8
3.7	3.7	3.6	3.6	3.6
3.5	3.5	3.5	3.4	3.4
3.3	3.3	3.3	3.2	3.2
3.2	3.1	3.1	3.1	3.1
3.0	3.0	3.0	2.9	2.9
2.9	2.8	2.8	2.8	2.8
2.7	2.7	2.7	2.6	2.6
2.6	2.5	2.5	2.5	2.5
2.4	2.4	2.4	2.3	2.3
2.3	2.3	2.2	2.2	2.2
2.2	[illegible]	2.1	2.1	2.1
2.0	[illegible]	2.0	2.0	1.9
1.5	1.5	1.6	1.4	1.5
1.9	1.3	1.8	1.3	1.6
1.3	1.3	1.9	1.4	1.7
1.3	1.4	1.3	1.1	1.3
1.2	0.9	0.8	0.9	0.8
0.9	1.2	1.1	0.0	1.1
0.7	1.0	1.2	1.1	0.9
0.7	0.2	0.2	0.2	0.1
0.1	0.1	0.1	0.1	0.0
0.1	0.0	0.1	0.1	0.1
0.1	0.1	0.1	0.1	0.1
0.1	0.1	0.1	0.1	0.1
0.1	0.1	0.1	0.1	0.1
0.1	0.0	0.1	0.1	0.1
0.1	0.1	0.1	0.0	0.0
0.0	0.0	0.0	0.1	0.1
0.0	0.1	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0

```
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0         0.0         0.0         0.0         0.0
                0.0

enth =    2547525.0   2759832.0   2758862.0   2757853.0   2756862.0
          2755800.0   2754871.0   2754031.0   2753743.0   2753732.0
          2753734.0   2753727.0   2753738.0   2753735.0   2753736.0
          2753727.0   2753751.0   2752420.0   2749247.0   2748497.0
          2750342.0   2751066.0   2767814.0   2767910.0   2768040.0
          2768193.0   2768372.0   2768536.0   2768708.0   2764154.0
          2765547.0   2764656.0   2748828.0   2747390.0   2742711.0
          2742970.0   2742955.0   2742635.0   2749928.0   2748032.0
          2747594.0   2746875.0   2745236.0   2744714.0   2743939.0
          2742891.0   2742442.0   2741249.0   2740590.0   2741814.0
          2741700.0   2725052.0   2728691.0   2751053.0   2733594.0
          2733262.0   2732814.0   2724582.0   2722536.0   2689994.0
          2723622.0   2723008.0   2720710.0   2719314.0   2713258.0
          2707079.0   2707048.0   2690470.0   2679806.0   2669252.0
          2658055.0   2646119.0   2674027.0   2671568.0   2668459.0
          2666231.0   2661040.0   2655831.0   2664082.0   2667578.0
          2661729.0   2658780.0   2655382.0   2650174.0   2644538.0
          2639388.0   2781869.0   2782268.0   2782150.0   2782565.0
          2782248.0   2781533.0   2779512.0   2776981.0   2773957.0
          2769900.0   2765480.0   2760058.0   2753971.0   2747447.0
          2740929.0   2734877.0   2729560.0   2727772.0   2723456.0
          2719768.0   2716176.0   2713680.0   2711632.0   2709939.0
          2708116.0   2706763.0   2705884.0   2705188.0   2703300.0
          2703368.0   2704012.0   2703966.0   2703987.0   2704110.0
          2704076.0   2704114.0   2704207.0   2704184.0   2704231.0
          2704276.0   2704252.0   2704262.0   2704320.0   2704280.0
          2704291.0   2704319.0   2704292.0   2704342.0   2704432.0
          2704454.0   2704551.0   2704684.0   2704744.0   2704879.0
          2705044.0   2705123.0   2705271.0   2705450.0   2705540.0
          2705716.0   2705922.0   2706035.0   2706236.0   2706477.0
          2706616.0   2706141.0   2706429.0   2706604.0   2706876.0
          2707195.0   2707381.0   2669170.0   2669911.0   2670633.0
          2671434.0   2672230.0   2673012.0   2673867.0   2674726.0
          2675604.0   2676105.0   2677060.0   [illegible]044.0   2679060.0
          2680132.0   2681229.0   2682386.0   2683663.0   2685040.0
          2686527.0   2687564.0   2689372.0   2691261.0   2693391.0
          2695768.0   2698464.0   2701159.0   2704086.0   2707308.0
          2710716.0   2714680.0   2718534.0   2722518.0   2726658.0
          2730938.0   2734412.0   2738240.0   2741630.0   2744932.0
          2747982.0   2750966.0   2753881.0   2756475.0   2759084.0
          2762387.0   2709871.0   2710604.0   2688938.0   2700607.0
          2748155.0   2748506.0   2748464.0   2748403.0   2748334.0
          2748154.0   2728173.0   2751908.0   2752553.0   2753212.0
```

2744673.0	2745257.0	2718558.0	2753736.0	2754596.0
2615714.0	2750942.0	2744078.0	2768560.0	2807262.0
2812034.0	2808992.0	2807841.0	2810174.0	2807472.0
2798563.0	2792507.0	2787254.0	2786860.0	2786910.0
2789831.0	2785432.0	2784016.0	2787781.0	2821215.0
28353[illegible]7.0	2831448.0	2821558.0	2813961.0	2808057.0
2803404.0	2800273.0	2798738.0	2799783.0	2800961.0
2801406.0	2799009.0	2799633.0	2799985.0	28001[illegible]4.0
2799462.0	2798621.0	2797864.0	2797594.0	2794422.0
2794259.0	2794[illegible]92.0	2794223.0	2794809.0	2795518.0
2796297.0	2745054.0	2741040.0	2842940.0	2743822.0
2893040.0	2716236.0	2752486.0	2804690.0	2728378.0
2758283.0	2809124.0	2766088.0	278446[illegible]	2768140.0
2706151.0	2763938.0	2766588.0	2779654.0	2781125.0
2782989.0	2784596.0	2785927.0	2787145.0	2786800.0
2788206.0	2789502.0	2804140.0	2803844.0	2803660.0
2803509.0	2803394.0	2803336.0	2803188.0	2803076.0
2803046.0	2809124.0	2797172.0	2795136.0	2794424.0
2792411.0	2791213.0	2790264.0	2787880.0	2787707.0
2787672.0	2787824.0	2788229.0	2793350.0	2794939.0
2796602.0	2798248.0	2800451.0	2801946.0	2772915.0
2775292.0	27[illegible]134.0	2778989.0	2780524.0	2821942.0
2819989.0	2855368.0	2780719.0	2774354.0	2782410.0
2770324.0	2770164.0	2770258.0	2770478.0	2770944.0
2771234.0	2771313.0	2771111.0	2770640.0	2770063.0
2769770.0	2769881.0	2770228.0	2770625.0	2770964.0
2771203.0	2771348.0	2771414.0	2771462.0	2771572.0
27718[illegible].0	2772248.0	2772889.0	2777714.0	2780693.0
2783465.0	2785872.0	2787941.0	2789737.0	2791336.0
2792796.0	2794151.0	2795404.0	2796547.0	2797588.0
2798532.0	2799379.0	2800137.0	2800814.0	2801418.0
2801954.0	2802430.0	2802833.0	2803194.0	2803508.0
2803788.0	2804037.0	2804236.0	2804402.0	2804539.0
2804524.0	2804124.0	2803933.0	2803869.0	2803888.0
2803958.0	2804053.0	2804156.0	2804253.0	2804334.0
2804395.0	2804410.0	2804419.0	2804382.0	2804328.0
2804268.0	2804202.0	2804133.0	2804058.0	2803976.0
28038[illegible].0	2803786.0	2803662.0	2803543.0	2803427.0
2803315.0	2803206.0	2803100.0	2802998.0	2802899.0
2802804.0	2802712.0	2802623.0	2802538.0	2802456.0
2797644.0	2802294.0	2790236.0	2793144.0	2808463.0
2815043.0	2801995.0	2762822.0	2803948.0	2789982.0
[illegible]	2801662.0	2781376.0	2800536.0	2801023.0
2802288.0	2797031.0	2800884.0	2804190.0	2805882.0
2803132.0	2802120.0	2804420.0	2795206.0	2793611.0
2802386.0	2797258.0	2825878.0	2803542.0	2790794.0
2863319.0	2790778.0	2797307.0	2796198.0	2795194.0
2774604.0	28008[illegible].0	2800743.0	2800152.0	2800949.0
2800454.0	2800733.0	2800380.0	2800706.0	2800959.0
2800783.0	2800901.0	2801162.0	2801211.0	2801264.0
2801307.0	2801356.0	2801399.0	2801467.0	2801512.0
2801558.0	2801604.0	2801650.0	2801698.0	2801745.0
2801788.0	2801830.0	2801874.0	2801917.0	2801960.0
2802004.0	2802086.0	2802033.0	2802054.0	2802076.0
2802096.0	2802117.0	2802137.0	2802156.0	2802175.0
2802193.0	2802209.0	2802222.0	2802226.0	2802268.0
2802252.0	2802306.0	2802320.0	2802335.0	2802338.0
2802334.0	2802330.0	2802324.0	2802319.0	2802313.0
2802307.0	2802300.0	2802291.0	2802272.0	2802238.0
2802205.0	2802170.0	2802136.0	2802100.0	2802064.0
2802028.0	2801990.0	2801952.0	2801914.0	2801875.0
2801836.0	2801795.0	2801754.0	2801712.0	2801670.0
2801627.0	2801583.0	2801538.0	2801483.0	2801414.0
2801344.0	2801274.0	2801204.0	2801132.0	2801060.0
2800988.0	2800906.0	2800798.0	2800690.0	2800581.0
2800472.0	2800362.0	2800252.0	2800142.0	2800031.0
2799920.0	2799808.0	2799695.0	2799582.0	2799469.0
2799356.0	2799242.0	2799127.0	2799012.0	2798897.0

```
            2798781.0   2798665.0   2798548.0   2798431.0   2798313.0
            2798195.0   2798076.0   2797958.0   2797838.0   2797718.0
            2797598.0   2797476.0   2797355.0   2797233.0   2797078.0
            2796918.0   2796759.0   2796600.0   2796440.0   2796280.0
            279[illegible]20.0   2795960.0   2795800.0   2795640.0   2795479.0
            279[illegible]18.0   2795156.0   2794994.0   2794832.0   2794664.0
            2794473.0   2794282.0   2794092.0   2793901.0   2793710.0
            2793519.0   2793328.0   2793138.0   2792947.0   2792[illegible]57.0
            2792566.0   2792376.0   2[illegible]92185.0   2791994.0   2791804.0
            2791613.0   2791423.0   2791232.0   2791042.0   2790851.0
            2790660.0   2790470.0   2790279.0   2790087.0   2789893.0
            2789656.0   278[illegible]465.0   278[illegible]282.0   [illegible]789100.0   2788919.0
            2788738.0   2788557.0   2[illegible]8377.0   [illegible]788198.0   2788019.0
            2787840.0   2787662.0   2787485.0   2787308.0   2787131.0
            2786955.0   2786779.0   2786604.0   2786430.0   2786256.0
            2786082.0   2785908.0   2785736.0   2785564.0   2785[illegible].0
            2785221.0   2785050.0   2784880.0   2784710.0   2784541.0
            2784372.0   2784204.0   2784036.0   2783869.0   2783702.0
            2783535.0   2783367.0   2783199.0   2783032.0   2782865.0
            2782698.0   2782532.0   2782367.0   2782202.0   [illegible]782038.0
            2781873.0   2781693.0   2781511.0   2781330.0   2781150.0
            2780970.0   2780790.0   2780612.0   2780434.0   2780257.0
            2780080.0   2779904.0   2779729.0   2779555.0   2779381.0
            2779208.0   2779035.0   2778863.0   2778692.0   2778521.0
            2778351.0   2778181.0   2778012.0   2777844.0   2777676.0
            2777510.0   2777343.0   2777177.0   2777012.0   2776847.0
            2776683.0   2776520.0   2776356.0   2776194.0   2776022.0
            2775847.0   2775672.0   2775498.0   2775324.0   2775152.0
            2774980.0   2774808.0   2774638.0   2774468.0   2774299.0
            [illegible]4131.0   2773963.0   2773796.0   2773630.0   2773465.0
            2773300.0   2773136.0   2772973.0   2772811.0   2772649.0
            2772488.0   2772328.0   2772168.0   2772010.0   2771852.0
            2771694.0   2771537.0   2771382.0   2771225.0   2771069.0
            2770913.0   2770758.0   2770604.0   2770451.0   2770298.0
            2770146.0   2769995.0   2769844.0   2769694.0   2769545.0
            2769397.0   27692[illegible].0   2769102.0   2768955.0   2768810.0
            2768664.0
    eoi
&&
struc
    name    = Ceiling       && Name of structure
    type    = roof          && Type of structure
    shape   = slab          && Shape of structure
    nslab   = 10            && Number of nodes in structure
    chrlen  = 14.6          && Characteristic length of structure   (m)
    slarea  = 157.          && Area                                 (m2)
    tunif   = 305.          && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.    .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls         && Name of structure
    type    = wall
    shape   = slab
    nslab   = 10
    chrlen  = 5.49
    slarea  = 241.
    tunif   = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.    .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  3
&&
&&  Lower cell input
&&
```

```
low-cell
   geometry= 107.      && Area of layers in lower cell                  (m2)
      bc  = 305        && Basemat boundary condition temperature        (K)
      concrete
         compos = 1       && Number of materials
                  conc    && Material
                  23500.  && Mass of material
         temp   = 305.    && Initial temperature
      eoi
      pool
         temp   = 305.    && Initial temperature
      eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
   overflow  3  2  3.05
eoi
&&
&& -------------------------- Cell 4, Room 236 ---------------------------------
cell 4
control
   nhtm=1  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
   nsoeng=1   speng=4
eoi
title
       Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                          (m3, m)
   atmos    = 3
              1.01e5        && Pressure
              305.          && Temperature
       o2   = 0.25
       n2   = 0.75
       h2ov = 0.05
&&
struc
    name    = Walls          && Name of structure
    type    = wall           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 5.49           && Characteristic length of structure   (m)
    slarea  = 450.           && Area                                 (m2)
    tunif   = 305.           && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  4
&&
&&  Lower cell input
&&
low-cell
   geometry= 91.9      && Area of layers in lower cell                  (m2)
      bc  = 305.       && Basemat boundary condition temperature        (K)
      concrete
         compos = 1       && Number of materials
                  conc    && Material
                  6730.   && Mass of material
         temp   = 305.    && Initial temperature
      eoi
      pool
         temp   = 305.    && Initial temperature
```

```
        eoi
eoi
&&
&& Engineered safety systems
&&
&& Spillage from Room 236 to Room 115 via the connecting pipe chase
&&
engineer    Spill 1  4  3  5.79
    overflow  4  5  0.025
eoi
&&
&& Fire water sprinkler system, activated on high temperature.
&&
engineer    Sprinklr  2  4  4  0.
    spray
      spdiam = .001   && Spray droplet diameter                    (m)
      sphite = 5.49   && Spray fall height                         (m)
      spsttm = 373.   && Temperature at which system act   es      (K)
    eoi
    source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
        h2ol  = 3       &&  activation
        iflag = 2
        t     = 0.0     100.    1.00e5
        mass  = 21.1    21.1    21.1
        temp  = 305.    305.    305.
    eoi
  eoi
&&
&& ------------------------ Cell 5, Balance of Plant ------------------------
cell 5
control
eoi
title
        Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
&&
&& -------------------------- Cell 6, Environment --------------------------
cell 6
control
eoi
title
        Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

LISTING 11 - CONTAIN Input for BS-5a

```
&& ========================== Model Description ===============================
&&
&& File:
&&
&&     cnt005a.mdl
&&
&& Description:
&&
&&     BS-5. This input deck describes a five volume model of the B&W Plant
&&     auxiliary building. The rooms modeled are 105, 113, 115, and 236.
&&     The steam source is a 6 inch break in the HPI pump suction piping in
&&     room 115. Break flow is limited by the 2.5 inch HPI injection piping.
&&     This model does not include water aerosols (the dropout option is used).
&&
&&      a. this modification uses an Oconee blowdown from the B&W CSAU study
&&
&& Written by:
&&
&&     John Schroeder  7/91
&&
&& ======================== Machine Control Input ============================
cray
eoi
&& ============================= Global Input ================================
&&
&& Section 3.2, p. 3-11
&&
&&     Atmospheric Gases
&&
&&     Material     Description
&&     --------     -----------
&&     o2           oxygen
&&     n2           nitrogen
&&     h2ov         steam
&&     h2ol         water
&&
control
    ncells    = 6       && Number of cells
    ntitl     = 2       && Number of title lines
    ntzone    = 5       && Number of time zones
    nac       = 0       && Number of aerosol groups
    nsectn    = 0       && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names --  -------------
&&
&& Section 3.2.1, p. 3-13
&&
material
    compound
        n2 o2           && Air
        h2ov h2ol       && Steam and water
        conc            && Structural materials
&&
&& ----------------------------- Reactor Type --------------------------------
&&
&& Section 3.2.2, p. 3-17
&&
thermal                 && Water-cooled reactor
&&
&& ----------------------------- Flow Options --------------------------------
&&
&& Section 3.2.3, p. 3-17
&&
```

```
flows
&&
&&  Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&               1, 2, 3.
&&
    area(1,5) = 8.88    && Cross-sectional area of flow path           (m2)
    avl(1,5)  = 14.6    && Ratio of area to inertial length, A/L       (m)
    cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&&  Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
    area(1,2) = 12.6
    avl(1,2)  = 20.7
    cfc(1,2)  = 1.00
&&
&&  Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
    area(2,5) = 0.892
    avl(2,5)  = 1.46
    cfc(2,5)  = 1.0
&&
&&  Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
    area(2,3) = 1.95
    avl(2,3)  = 3.2
    cfc(2,3)  = 1.0
&&
&&  Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
    area(3,5) = 1.95
    avl(3,5)  = 3.2
    cfc(3,5)  = 1.00
&&
&&  Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
    area(3,4) = 2.97
    avl(3,4)  = 4.88
    cfc(3,4)  = 1.00
&&
&&  Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&               10, 11, 12, and 13.
&&
    area(4,5) = 29.1
    avl(4,5)  = 157.
    cfc(4,5)  = 1.00
&&
&&  Junction 8 - Balance of Plant to environment, includes only blowout
&&               paths.
&&
    area(5,6) = 46.5
    avl(5,6)  = 250.
    cfc(5,6)  = 1.00
&&
    implicit
    dropout
&&
&&  Compartment and junction elevation data
&&
&&  Compartments
&&
    elevcl(1)  = 169.   && Center of mass elevation for Rm 105          (m)
    elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
    elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
    elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
    elevcl(5)  = 185.   && Center of mass elevation for Rm BOP          (m)
    elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&&  Junctions
```

```
&&
    elevfp(1,5)= 167.
    elevfp(5,1)= 167.

    elevfp(1,2)= 170.
    elevfp(2,1)= 170.

    elevfp(2,5)= 172.
    elevfp(5,2)= 172.

    elevfp(2,3)= 170.
    elevfp(3,2)= 170.

    elevfp(3,5)= 170.
    elevfp(5,3)= 170.

    elevfp(3,4)= 172.
    elevfp(4,3)= 172.

    elevfp(4,5)= 173.
    elevfp(5,4)= 173.

    elevfp(5,6)= 211.
    elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ----------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      n2ov 1.0e-8 0.693
&&
&& -------------------------------- Times ------------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
    1800.             && Maximum CPU time limit                    (s)
    0.                && Problem start time                        (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  ------  ------  ------                                         (s)
       1.     10.      10.
       5.     50.     100.
      20.    200.     500.
      50.    100.    1000.
      50.    100.    7200.
&& -----------------------
eoi
&&
&& ------ -------------------- Output Control ------------------------------
&&
&&  Section 3.2.7, p. 3-38
&&
shortedt      = 2      && System ts between short edits
longedt       = 1      && Ts edits between long edits
prflow                 && Print intercell flow data
praer                  &&       detailed aerosol inventories
prlow-cl               &&       lower cell model
prheat                 &&       heat transfer structure model
prengsys               &&       engineered system model
title
         B&W Plant Auxiliary Building Steam Propagation Model
                   Five Compartment Model -- BS-5
&&
```

```
&&
&& ==================== Cell Input and Cell Control ========================
&&
&& Section 3.3, p. 3-40
&&
&& --------------------------- Cell 1, Room 105 ------------------------------
cell 1
control
    nhtm=2  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 1, Ronm 105
&&
&& Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                    (m3, m)
    atmos     = 3       && Number of materials
                1.01e5  && Pressure                                  (Pa)
                305.    && Temperature                               (K)
        n2    = 0.75    && Initial nitrogen fraction
        o2    = 0.20    && Initial oxygen fraction
        h2ov  = 0.05    && Initial water vapor fraction
struc
    name      = Ceiling      && Name of structure
    type      = roof         && Type of structure
    shape     = slab         && Shape of structure
    nslab     = 10           && Number of nodes in structure
    chrlen    = 18.7         && Characteristic length of structure     (m)
    slarea    = 295.         && Area                                   (m2)
    tunif     = 305.         && Initial uniform temperature            (K)
    compound  =   conc conc conc conc conc conc conc conc conc conc
    x         = 0. .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
    eoi
&&
    name      = Walls        && Name of structure
    type      = wall         && Type of structure
    shape     = slab         && Shape of structure
    nslab     = 10           && Number of nodes in structure
    chrlen    = 5.49         && Characteristic length of structure     (m)
    slarea    = 298.         && Area                                   (m2)
    tunif     = 305.         && Initial uniform temperature            (K)
    compound  =  conc conc conc conc conc conc conc conc conc conc
     x        = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
    eoi
&&
condense
ht-tran     on  on  on  on  on
overflow    1
&&
&& Lower cell input
&&
low-cell
    geometry= 295.      && Area of layers in lower cell                (m2)
        bc  = 305.      && Basemat boundary condition temperature      (K)
        concrete
            compos = 1      && Number of materials
                    conc   && Material
                    43200. && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 305    && Initial temperature
        eoi
eoi
&&
&& Engineered safety systems
&&
engineer    Spill  1  1  5  .152
```

```
   overflow  1  5  1.74
eoi
&&
&& --------------------------- Cell 2, Room 113 ------------------------------
cell 2
control
   nhtm=2  mxslab=11  nsoatm=0  nspatm=0  naensy=1  jconc=5  jpool=1
eoi
title
      Cell 2, Room 113
&&
&&  Upper Cell Input
&&
geometry  3.794e2  6.10 && Cell volume and height                        (m3, m)
    atmos     = 3
                1.01e5  && Pressure                                      (Pa)
                305.    && Temperature                                   (K)
        o2    = 0.20
        n2    = 0.75
        h2ov  = 0.05
&&
struc
    name    = Ceiling        && Name of structure
    type    = roof           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 17.7           && Characteristic length of structure      (m)
    slarea  = 86.4           && Area                                    (m2)
    tunif   = 305.           && Initial uniform temperature             (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls          && Name of structure
    type    = wall           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 5.49           && Characteristic length of structure      (m)
    slarea  = 254.           && Area                                    (m2)
    tunif   = 305.           && Initial uniform temperature             (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
     x      = 0. .040 .080 .120 .160 .200 .240 .280 .320 .360 .396 &&   (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
    geometry= 86.4      && Area of layers in lower cell                 (m2)
        bc  = 305.      && Basemat boundary condition temperature       (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     19000. && Mass of material                         (kg)
            temp   = 305.   && Initial temperature                      (K)
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  2  1  0.0
    overflow  2  1  3.05
```

```
eoi
&&
&& -------------------------- Cell 3, Room 115 ------------------------------
cell 3
control
    nhtm=2  mxslab=11  nsoatm=1  nspatm=10  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                        (m3, m)
    atmos    = 3
              1.01e5      && Pressure
              305.        && Temperature
        o2   = 0.20
        n2   = 0.75
        h2ov = 0.05
source=1
&&
&&  Blowdown of RCS - Oconee blowdown
&&
    h2ov  = 6
    iflag = 2
    t     =          0.        500.        501.       2000.       2001.
               4000.

    mass  =       190.5       190.5        36.3        36.3        36.3
                36.3

    enth  =    1250000.    1250000.    1900000.    2300000.    2000000.
              1500000.

    eoi
&&
struc
    name    = Ceiling        && Name of structure
    type    = roof           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 14.6           && Characteristic length of structure   (m)
    slarea  = 107            && Area                                 (m2)
    tunif   = 305.           && initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls          && Name of structure
    type    = wall
    shape   = slab
    nslab   = 10
    chrlen  = 5.49
    slarea  = 241.
    tunif   = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  3
&&
&&  Lower cell input
&&
low-cell
    geometry= 107.      && Area of layers in lower cell                     (m2)
        bc  = 305.      && Basemat boundary condition temperature           (K)
```

```
      concrete
         compos = 1      && Number of materials
                  conc   && Material
                  23500. && Mass of material
         temp   = 305.   && Initial temperature
      eoi
      pool
         temp   = 305.   && Initial temperature
      eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
   overflow  3  2  3.05
eoi
&&
&& -------------------------- Cell 4, Room 236 ------------------------------
cell 4
control
   nhtm=1  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
   nsoeng=1  nspeng=4
eoi
title
      Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                    (m3, m)
   atmos    = 3
              1.01e5        && Pressure
              305.          && Temperature
      o2    = 0.25
      n2    = 0.75
      h2ov  = 0.05
&&
struc
   name     = Walls         && Name of structure
   type     = wall          && Type of structure
   shape    = slab          && Shape of structure
   nslab    = 10            && Number of nodes in structure
   chrlen   = 5.49          && Characteristic length of structure   (m)
   slarea   = 450.          && Area                                 (m2)
   tunif    = 305.          && Initial uniform temperature          (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x        = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
   eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  4
&&
&&  Lower cell input
&&
low-cell
   geometry= 91.9      && Area of layers in lower cell               (m2)
      bc   = 305.      && Basemat boundary condition temperature     (K)
      concrete
         compos = 1      && Number of materials
                  conc   && Material
                  6730.  && Mass of material
         temp   = 305.   && Initial temperature
      eoi
      pool
         temp   = 305.   && Initial temperature
      eoi
eoi
&&
```

```
&& Engineered safety system
&&
&& Spillage from Room 236 to Room 1?? via the connecting pipe chase
&&
engineer   Spill 1  4  3  5.7?
   overflow  4  3  0.025
eoi
&&
&& Fire water sprinkler system, activated on high temperature.
&&
engineer   Sprinklr  ?  4  4  0.
   spray
      spdiam = .001   && Spray droplet diameter                        (m)
      sphite = 5.49   && Spray fall height                             (m)
      spsttm = 373.   && Temperature at which system activates        (K)
   eoi
   source = 1         &&  Sprays provide 336 gpm (21.1 kg/s) after
      h2ol  = ?       &&  activation
      iflag = 2
      t     = 0.0     100.    1.00e5
      mass  = 21.1    21.1    21.1
      temp  = 305.    305.    305.
   eoi
  eoi
&&
&& ------------------------ Cell 5, Balance of Plant ------------------------
cell 5
control
eoi
title
       Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
&&
&& -------------------------- Cell 6, Environment ---------------------------
cell 6
control
eoi
title
       Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

LISTING 12 - CONTAIN Input for BS-5b

```
&& ==================================== Model Description ================================
&&
&& File:
&&
&&     cn.005b.mdl
&&
&& Description:
&&
&&     BS-5. This input deck describes a five volume model of the B&W Plant
&&     auxiliary building. The rooms modeled are 105, 113, 115, and 236.
&&     The steam source is a 6 inch break in the HPI pump suction piping in
&&     room 115. Break flow is limited by the 2.5 inch HPI injection piping.
&&     This model does not include water aerosols (the dropout option is used).
&&
&&      a. this modification uses an Oconee blowdown from the B&W CSAU study
&&
&&      b. this modification uses an Oconee blowdown from the B&W CSAU study
&&         modified so the break enthalpy corresponds to fluid with a void
&&         fraction of 0. before 500 seconds, and 1. after 500 seconds.
&&
&& Written by:
&&
&&     John Schroeder  7/91
&&
&& ========================= Machine Control Input ============================
cray
eoi
&& ============================ Global Input ==================================
&&
&& Section 3.2, p. 3-11
&&
&&     Atmospheric Gases
&&
&&     Material     Description
&&     --------     -----------
&&     o2           oxygen
&&     n2           nitrogen
&&     h2ov         steam
&&     h2ol         water
&&
control
    ncells    = 6       && Number of cells
    ntitl     = 2       && Number of title lines
    ntzone    = 5       && Number of time zones
    nac       = 0       && Number of aerosol groups
    nsectn    = 0       && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names ----------------
&&
&& Section 3.2.1, p. 3-13
&&
material
    compound
        n2 o2          && Air
        h2ov h2ol      && Steam and water
        conc           && Structural materials
&&
&& ---------------------------- Reactor Type -------------------------------
&&
&& Section 3.2.2, p. 3-17
&&
thermal                && Water-cooled reactor
&&
```

```
&& ---------------------------- Flow Options --------------------------------
&&
&&  Section 3.2.3, p. 3-17
&&
flows
&&
&&  Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&              1, 2, 3.
&&
    area(1,5) = 8.88    && Cross-sectional area of flow path           (m2)
    avl(1,5)  = 14.6    && Ratio of area to inertial length, A/L       (m)
    cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&&  Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
    area(1,2) = 12.6
    avl(1,2)  = 20.7
    cfc(1,2)  = 1.01

    Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
    area(2,5) = 0.892
    avl(2,5)  = 1.46
    cfc(2,5)  = 1.0
&&
&&  Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
    area(2,3) = 1.95
    avl(2,3)  = 3.2
    cfc(2,3)  = 1.0
&&
&&  Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
    area(3,5) = 1.95
    avl(3,5)  = 3.2
    cfc(3,5)  = 1.00
&&
&&  Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
    area(3,4) = 2.97
    avl(3,4)  = 4.88
    cfc(3,4)  = 1.00
&&
&&  Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&              10, 11, 12, and 13.
&&
    area(4,5) = 29.1
    avl(4,5)  = 157.
    cfc(4,5)  = 1.00
&&
&&  Junction 8 - Balance of Plant to environment, includes only blowout
&&              paths.
&&
    area(5,6) = 46.5
    avl(5,6)  = 250.
    cfc(5,6)  = 1.00
&&
    implicit
    dropout
&&
&&  Compartment and junction elevation data
&&
&&  Compartments
&&
    elevcl(1)  = 169.   && Center of mass elevation for Rm 105          (m)
    elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
    elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
    elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
```

```
    elevcl(5)  = 185.   && Center of mass elevation for Rm BOP          (m)
    elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&&  Junctions
&&
    elevfp(1,5)= 167.
    elevfp(5,1)= 167.

    elevfp(1,2)= 170.
    elevfp(2,1)= 170.

    elevfp(2,5)= 172.
    elevfp(5,2)= 172.

    elevfp(2,3)= 170.
    elevfp(3,2)= 170.

    elevfp(3,5)= 170.
    elevfp(5,3)= 170.

    elevfp([illegible])= 172.
    elevfp([illegible])= 172.

    elevfp(4,5)= 173.
    elevfp(5,4)= 173.

    elevfp(5,6)= 211.
    elevfp(6,5)= 211.
&&
&&  [illegible] ---------------- Aerosol Options ------------------------------
&&
&&  Section [illegible].2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&&  ------------------------ ------ Times --------------------------- --------
&&
&&  Section 3.2.6, p. 3-36
&&
times
    1800.               && Maximum CPU time limit                       (s)
    0.                  && Problem start time                           (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  ------  -----  -------                                              (s)
        1.     10.      10.
        5.     [illegible]0.     100.
        [illegible]    200.     500.
        [illegible]    100.    1000.
       50.    100.    7200.
&& -------------------------
eoi
&&
&& --------------------------- Output Control ------------------------------
&&
&&  Section 3.2.7, p. 3-[illegible]8
&&
shortedt       = [illegible]      && System ts between short edits
longedt        = 1      && Ts edits between long edits
prflow                  && Print intercell flow data
praer                   &&       detailed aerosol inventories
prlow-cl                &&       lower cell model
prheat                  &&       heat transfer structure model
prengsys                &&       engineered system model
```

```
title
          B&W Plant Auxiliary Building Steam Propagation Model
                    Five Compartment Model -- B5-5
&&
&&
&& ====================== Cell Input and Cell Control ==========================
&&
&& Section 3.3, p. 3-40
&&
&& ---------------------------- Cell 1, Room 105 --------------------------------
cell 1
control
    nhtm=2  mxslab=11  nsoatm=0  n[illegible]  naensy=1  jconc=1  jpool=1
eoi
title
       Cell 1, Room 105
&&
&& Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                      (m3  m)
    atmos     = 3        && Number of materials
                1.01e5  && Pressure                                     (Pa)
                305.    && Temperature                                  (K)
        n2    = 0.75    && Initial nitrogen fraction
        o2    = 0.20    && Initial oxygen fraction
        h2ov  = 0.05    && Initial water vapor fraction
struc
    name      = Ceiling       && Name of structure
    type      = roof          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 18.7          && Characteristic length of structure     (m)
    slarea    = 295.          && Area                                   (m2)
    tunif     = 305.          && Initial uniform temperature            (K)
    compound  =  conc conc conc conc conc conc conc conc conc conc
    x         = 0. .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
    eoi
&&
    name      = Walls         && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure     (m)
    slarea    = 298.          && Area                                   (m2)
    tunif     = 305.          && Initial uniform temperatura            (K)
    compound  =  conc conc conc conc conc conc conc conc conc conc
     x        = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
     eoi
&&
condense
ht-tran     on  on  on  on  on
overflow    1
&&
&& Lower cell input
&&
low-cell
    geometry= 295.      && Area of layers in lower cell                 (m2)
        bc  = 305.      && Basemat boundary condition temperature       (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     43200. && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
```

```
&&
&& Engineered safety systems
&&
engineer   Spill  1  1  5  .152
   overflow  1  5  1.74
eoi
&&
&& -------------------------- Cell 2, Room 113 -------------        --------------
cell 2
control
   nhtm=2  mxslab=11  nsoatm=0  nspatm=0  naensy=1  jconc=5  jpool=1
eoi
title
      Cell 2, Room 113
&&
&& Upper Cell Input
&&
geometry  3.794e2  6.10 && Cell volume and height                         (m3, m)
   atmos      = 3
                1.01e5  && Pressure                                        (Pa)
                305.    && Temperature                                     (K)
       o2     = 0.20
       n2     = 0.75
       h2ov   = 0.05
&&
struc
    name     = Ceiling        && Name of structure
    type     = roof           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 17.7           && Characteristic length of structure       (m)
    slarea   = 86.4           && Area                                     (m2)
    tunif    = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name     = Walls          && Name of structure
    type     = wall           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 5.49           && Characteristic length of structure       (m)
    slarea   = 254.           && Area                                     (m2)
    tunif    = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
     x       = 0. .040 .080 .120 .160 .200 .240 .280 .320 .360 .395 &&    (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&& Lower cell input
&&
low-cell
    geometry= 86.4      && Area of layers in lower cell                    (m2)
       bc  = 305.       && Basemat boundary condition temperature          (K)
       concrete
          compos = 1      && Number of materials
                  conc    && Material
                  19000.  && Mass of material                              (kg)
          temp   = 305.   && Initial temperature                           (K)
       eoi
       pool
          temp   = 305.   && Initial temperature
       eoi
eoi
&&
```

```
&& Engineered safety systems
&&
engineer    Spill  1  2  1  0.0
    overflow  2  1  3.05
eoi
&&
&& -------------------------- Cell 3, Room 115 -----------------------------
cell 3
control
    nhtm=2  mxslab=11  nsoatm=1  nspatm=10  naensy=1  jconc=1  jpool=1
eoi
title
       Cell 3, Room 115
&&
&& Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                    (m3, m)
    atmos    = 3
              1.01e5      && Pressure
              305.        && Temperature
        o2   = 0.20
        n2   = 0.75
        h2ov = 0.05
source=1
&&
&& Blowdown of RCS - Oconee blowdown, void fraction 1. after 500 seconds
&&
    h2ov  = 4
    iflag = 2
    t     =        0.        500.        501.       4000.

    mass  =      190.5      190.5       36.3        36.3

    enth  =    1356000.    1356000.    2747000.    2747000.

    eoi
&&
struc
    name    = Ceiling       && Name of structure
    type    = roof          && Type of structure
    shape   = slab          && Shape of structure
    nslab   = 10            && Number of nodes in structure
    chrlen  = 14.6          && Characteristic length of structure   (m)
    slarea  = 107.          && Area                                 (m2)
    tunif   = 305.          && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls         && Name of structure
    type    = wall
    shape   = slab
    nslab   = 10
    chrlen  = 5.49
    slarea  = 241.
    tunif   = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  3
&&
&& Lower cell input
&&
low-cell
    geometry= 107.      && Area of layers in lower cell                (m2)
```

```
        bc  = 305.      && Basemat boundary condition temperature       (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     23500. && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
    overflow  3  2  3.05
eoi
&&
&&
&& --------------------------- Cell 4, Room 236 ------------------------------
cell 4
control
    nhtm=1  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
    nsoeng=1  nspeng=0
eoi
title
        Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                       (m3, m)
    atmos    = 3
                1.01e5        && Pressure
                305.          && Temperature
        o2   = 0.25
        n2   = 0.75
        h2ov = 0.05
&&
struc
    name     = Walls          && Name of structure
    type     = wall           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 5.49           && Characteristic length of structure    (m)
    slarea   = 450.           && Area                                  (m2)
    tunif    = 305.           && Initial uniform temperature           (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x        = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  4
&&
&&  Lower cell input
&&
low-cell
    geometry= 91.9      && Area of layers in lower cell                 (m2)
        bc  = 305.      && Basemat boundary condition temperature       (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     6730.  && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
```

```
&&
&&  Engineered safety systems
&&
&&  Spillage from Room 236 to Room 115 via the connecting pipe chase
&&
engineer    Spill 1  4  3  5.79
   overflow  4  3  0.025
eoi
&&
&&  Fire water sprinkler system, activated on high temperature.
&&
engineer    Sprinklr  2  4  4  0.
   spray
     spdiam = .001   && Spray droplet diameter                        (m)
     sphite = 5.49   && Spray fall height                             (m)
     spsttm = 373.   && Temperature at which system activates         (K)
  eoi
   source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
       h2ol  = 3       &&  activation
       iflag = 2
       t     = 0.0     100.    1.00e5
       mass  = 21.1    21.1    21.1
       temp  = 305.    305.    305.
   eoi
  eoi
&&
&& ------------------------ Cell 5, Balance of Plant ------------------------
cell 5
control
eoi
title
       Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
   o2 0.20
   n2 0.75
   h2ov 0.05
&&
&& --------------------------- Cell 6, Environment ---------------------------
cell 6
control
eoi
title
       Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
   o2 0.20
   n2 0.75
   h2ov 0.05
eof
```

LISTING 13 - CONTAIN Input for BS-5c

```
&& ========================== Model Description ========================= ====
&&
&&  File:
&&
&&      cnt005c.mdl
&&
&&  Descrip`ion:
&&
&&      BS-5.  This input deck describes a five volume model of the B&W Plant
&&      auxiliary building.  The rooms modeled are 105, 113, 115, and 236.
&&      The steam source is a 6 inch break in the HPI pump suction piping in
&&      room 115.  Break flow is limited by the 2.5 inch HPI injection piping.
&&      This model does not include water aerosols (the dropout option is used).
&&
&&       a.  this modification uses an Oconee blowdown from the B&W CSAU study
&&
&&       b   this modificat'.n uses an Oconee blowdown from the B&W CSAU study
&&           modified so the break enthalpy corresponds to flu'd with a void
&&           fraction of 0. before 500 seconds, and 1. after 500 seconds.
&&
&&       c.  this modification adds 1000 lb of metal mass to each compartment.
&&
&&
&&  Written by:
&&
&&      John Schroeder  7/91
&&
&& ========================= Machine Control Input ===========================
cray
eoi
&& ============================== Global Input ===============================
&&
&&  Section 3.2, p. 3-11
&&
&&      Atmospheric Gases
&&
&&      Material     Description
&&      --------     -----------
&&      o2           oxygen
&&      n2           nitrogen
&&      h2ov         steam
&&      h2ol         water
&&
control
    ncells    = 6        && Number of cells
    ntitl     = 2        && Number of title lines
    ntzone    = 5        && Number of time zones
    nac       = 0        && Number of aerosol groups
    nsectn    = 0        && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names ----------------
&&
&&  Section 3.2.1, p. 3-13
&&
material
    compound
        n2 o2          && Air
        h2ov h2ol      && Steam and water
        conc ss        && Structural materials
&&
&& ---------------------------- Reactor Type ---------------------------------
&&
&&  Section 3.2.2, p. 3-17
```

```
&&
thermal                  && Water-cooled reactor
&&
&& ---------------------------- Flow Options --------------------------------
&&
&&  Section 3.2.3, p. 3-17
&&
flows
&&
&&  Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&              1, 2, 3.
&&
    area(1,5) = 8.88    && Cross-sectional area of flow path          (m2)
    avl(1,5)  = 14.6    && Ratio of area to inertia length, A/L       (m)
    cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&&  Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
    area(1,2) = 12.6
    avl(1,2)  = 20.7
    cfc(1,2)  = 1.00
&&
&&  Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
    area(2,5) = 0.892
    avl(2,5)  = 1.46
    cfc(2,5)  = 1.0
&&
&&  Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
    area(2,3) = 1.95
    avl(2,3)  = 3.2
    cfc(2,3)  = 1.0
&&
&&  Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
    area(3,5) = 1.95
    avl(3,5)  = 3.2
    cfc(3,5)  = 1.00
&&
&&  Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
    area(3,4) = 2.97
    avl(3,4)  = 4.88
    cfc(3,4)  = 1.00
&&
&&  Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&              10, 11, 12, and 13.
&&
    area(4,5) = 29.1
    avl(4,5)  = 157.
    cfc(4,5)  = 1.00
&&
&&  Junction 8 - Balance of Plant to environment, includes only blowout
&&              paths.
&&
    area(5,6) = 46.5
    avl(5,6)  = 250.
    cfc(5,6)  = 1.00
&&
    implicit
    dropout
&&
&&  Compartment and junction elevation data
&&
&&  Compartments
&&
    elevel(1)  = 169.   && Center of mass elevation for Rm 105         (m)
```

```
   elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
   elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
   elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
   elevcl(5)  = 183.   && Center of mass elevation for Rm BOP          (m)
   elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&&  Junctions
&&
   elevfp(1,5)= 167.
   elevfp(5,1)= 167.

   elevfp(1,2)= 170.
   elevfp(2,1)= 170.

   elevfp(2,5)= 172.
   elevfp(5,2)= 172.

   elevfp(2,3)= 170.
   elevfp(3,2)= 170.

   elevfp(3,5)= 170.
   elevfp(5,3)= 170.

   elevfp(3,4)= 172.
   elevfp(4 3)= 172.

   elevfp(4,5)= 173.
   elevfp(5,4)= 173.

   elevfp(5,6)= 211.
   elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ----------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& ------------------------------- Times -------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
    1800.              && Maximum CPU time limit                        (s)
    0.                 && Problem start time                            (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  -------  ------  ------                                             (s)
      1.     10.      10.
      5.     50.     100.
     10.    200.     500.
     50.    100.    1000.
     50.    100.    7200.
 && ----------------------
 eoi
 &&
 && --------------------------- Output Control ----------------------------
 &&
 &&  Section 3.2.7, p. 3-38
 &&
 shortedt     = 2       && System ts between short edits
 longedt      = 1       && Ts edits between long edits
 prflow                 && Print intercell flow data
 praer                  &&       detailed aerosol inventories
```

```
prlow-cl              &&      lower cell model
prheat                &&      heat transfer structure model
prengsys              &&      engineered system model
title
        B&W Plant Auxiliary Building Steam Propagation Model
                  Five Compartment Model -- BS-5
&&
&&
&& ===================== Cell Input and Cell Control ==========================
&&
&&  Section 3.3, p. 3-40
&&
&& --------------------------- Cell 1, Room 105 ------------------------------
cell 1
control
   nhtm=3  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
       Cell 1, Room 105
&&
&&  Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                    (m3, m)
    atmos     = 3       && Number of materials
                1.01e5  && Pressure                                  (Pa)
                305.    && Temperature                               (K)
       n2     = 0.75    && Initial nitrogen fraction
       o2     = 0.20    && Initial oxygen fraction
       h2ov   = 0.05    && Initial water vapor fraction
struc
    name      = Ceiling        && Name of structure
    type      = roof           && Type of structure
    shape     = slab           && Shape of structure
    nslab     = 10             && Number of nodes in structure
    chrlen    = 18.7           && Characteristic length of structure     (m)
    slarea    = 295.           && Area                                   (m2)
    tunif     = 305.           && Initial uniform temperature            (K)
    compound  =   conc conc conc conc conc conc conc conc conc conc
    x         = 0. .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
    eoi
&&
    name      = Walls          && Name of structure
    type      = wall           && Type of structure
    shape     = slab           && Shape of structure
    nslab     = 10             && Number of nodes in structure
    chrlen    = 5.49           && Characteristic length of structure     (m)
    slarea    = 298.           && Area                                   (m2)
    tunif     = 305            && Initial uniform temperature            (K)
    compound  =  conc conc conc conc conc conc conc conc conc conc
    x         = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
    eoi
&&
    name      = Metals         && Name of structure
    type      = wall           && Type of structure
    shape     = slab           && Shape of structure
    nslab     = 10             && Number of nodes in structure
    chrlen    = 5.49           && Characteristic length of structure     (m)
    slarea    = 4.6            && Area                                   (m2)
    tunif     = 305.           && Initial uniform temperature            (K)
    compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran    on  on  on  on  on
overflow    1
&&
&&  Lower cell input
```

```
&&
low-cell
   geometry = 295.       && Area of layers in lower cell                (m2)
      bc  = 305.         && Basemat boundary condition temperature      (K)
      concrete
         compos = 1      && Number of materials
                  conc   && Material
                  43200. && Mass of material
         temp   = 305.   && Initial temperature
      eoi
      pool
         temp   = 305.   && Initial temperature
      eoi
eoi
&&
&& Engineered safety systems
&&
engineer    Spill  1  1  5  .152
   overflow  1  5  1.74
eoi
&&
&& ------------------------- Cell 2, Room 113 ---------------------------
cell 2
control
   nhtm=3  mxslab=11  nsoatm=0  nspatm=0  naensy=1  jconc=5  jpool=1
eoi
title
      Cell 2, Room 113
&&
&& Upper Cell Input
&&
geometry  3.794e2  6.10 && Cell volume and height                       (m3, m)
   atmos    = 3
               1.01e5  && Pressure                                      (Pa)
               305.    && Temperature                                   (K)
      o2    = 0.20
      n2    = 0.75
      h2ov  = 0.05
&&
struc
   name     = Ceiling        && Name of structure
   type     = roof           && Type of structure
   shape    = slab           && Shape of structure
   nslab    = 10             && Number of nodes in structure
   chrlen   = 17.7           && Characteristic length of structure     (m)
   slarea   = 85.4           && Area                                   (m2)
   tunif    = 305.           && Initial uniform temperature            (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
   eoi
&&
   name     = Walls          && Name of structure
   type     = wall           && Type of structure
   shape    = slab           && Shape of structure
   nslab    = 10             && Number of nodes in structure
   chrlen   = 5.49           && Characteristic length of structure     (m)
   slarea   = 254.           && Area                                   (m2)
   tunif    = 305.           && Initial uniform temperature            (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.  .040 .080 .120 .160 .200 .240 .280 .320 .360 .396 &&  (m)
   eoi
&&
   name       = Metals         && Name of structure
   type       = wall           && Type of structure
   shape      = slab           && Shape of structure
   nslab      = 10             && Number of nodes in structure
   chrlen     = 5.49           && Characteristic length of structure   (m)
   slarea     = 4.6            && Area                                 (m2)
```

```
    tunif     = 305.          && Initial uniform temperature                (K)
    compound  =  ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
    geometry= 86.4       && Area of layers in lower cell                  (m2)
       bc  = 305.        && Basemat boundary condition temperature        (K)
       concrete
          compos = 1        && Number of materials
                 conc    && Material
                 19000.  && Mass of material                               (kg)
          temp   = 305    && Initial temperature                           (K)
       eoi
       pool
          temp   = 305.   && Initial temperature
       eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  2  1  0.0
    overflow  2  1  3.00
eoi
&&
&& ---------------------------- Cell 3, Room 115 ---------------------------------
cell 3
control
    nhtm=3  mxslab=11  nsoatm=1  nspatm=10  naensy=1  jconc=1  jpool=1
eoi
title
       Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                          (m3, m)
    atmos     = 3
                1.01e5      && Pressure
                305.        && Temperature
       o2   = 0.20
       n2   = 0.75
       h2ov = 0.05
source=1
&&
&&  Blowdown of RCS - Oconee blowdown, void fraction 1. after 500 seconds
&&
    h2ov  = 4
    iflag = 2
    t     =          0.        500.        501.       4000.

    mass  =       190.5       190.5        36.3        36.3

    enth  =    1356000.     1356000.   2747000.    2747000.

    eoi
&&
struc
    name     = Ceiling        && Name of structure
    type     = roof           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 14.6           && Characteristic length of structure   (m)
```

```
    slarea  = 107.          && Area                                  (m2)
    tunif   = 305.          && Initial uniform temperature           (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls         && Name of structure
    type    = wall
    shape   = slab
    nslab   = 10
    chrlen  = 5.49
    slarea  = 241.
    tunif   = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name      = Metals        && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure     (m)
    slarea    = 4.6           && Area                                   (m2)
    tunif     = 305.          && Initial uniform temperature            (K)
    compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  3
&&
&& Lower cell input
&&
low-cell
    geometry= 107.      && Area of layers in lower cell                (m2)
        bc  = 305.      && Basemat boundary condition temperature      (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     23500. && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&& Engineered safety systems
&&
engineer    Spill  1  3  2  0.
    overflow  3  2  3.05
eoi
&&
&& ------------------------ Cell 4, Room 236 ---- -------------------------
cell 4
control
    nhtm=2  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
    nsoeng=1  nspeng=4
eoi
title
        Cell 4, Room 236
&&
&& Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                      (m3, m)
    atmos    = 3
             1.01e5       && Pressure
```

```
            305.          && Temperature
        o2   = 0.25
        n2   = 0.75
        h2ov = 0.05
&&
struc
    name    = Walls         && Name of structure
    type    = wall          && Type of structure
    shape   = slab          && Shape of structure
    nslab   = 10            && Number of nodes in structure
    chrlen  = 5.49          && Characteristic length of structure   (m)
    slarea  = 450.          && Area                                  (m2)
    tunif   = 305.          && Initial uniform temperature           (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
    eoi
&&
    name      = Metals        && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure     (m)
    slarea    = 4.6           && Area                                    (m2)
    tunif     = 305.          && Initial uniform temperature             (K)
    compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0.  .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  4
&&
&&  Lower cell input
&&
low-cell
    geometry= 91.3      && Area of layer  in lower cell                  (m2)
        bc  = 305.      && Basemat boundary condition temperature         (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     6730.  && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = [illegible].   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
&&  Spillage from Room 236 to Room 115 via the connecting pipe chase
&&
engineer    Spill 1  4  3  5.79
    overflow  4  3  0.025
eoi
&&
&&  Fire water sprinkler system, activated on high temperature.
&&
engineer    Sprinklr  2  4  4  0.
    spray
      spdiam = .001   && Spray droplet diameter                      (m)
      sphite = 5.49   && Spray fall height                           (m)
      spsttm = 373.   && Temperature at which system activates       (K)
    eoi
     source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
        h2ol  = 3        &&  activation
        iflag = 2
        t     = 0.0     100.    1.00e5
```

```
        mass  = 21.1    21.1    21.1
        temp  = 305.    305.    305.
     eoi
   eoi
&&
&& ------------------------ Cell 5, Balance of Plant ------------------------
cell 5
control
eoi
title
        Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
&&
&& - ------------------------ Cell 6, Environment ---------------------------
cell 6
control
eoi
title
        Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

LISTING .4 - CONTAIN Input for BS-5d

```
&& ========================= Model Description ===============================
&&
&& File:
&&
&&     cnt005d.mdl
&&
&& Description:
&&
&&     BS-5. This input deck describes a five volume model of the B&W Plant
&&     auxiliary building. The rooms modeled are 105, 113, 115, and 236.
&&     The steam source is a 6 inch break in the HPI pump suction piping in
&&     room 115. Break flow is limited by the 2.5 inch HPI injection piping.
&&     This model does not include water aerosols (the dropout option is used).
&&
&&      a. this modification uses an Oconee blowdown from the B&W CSAU study
&&
&&      b. this modification uses an Oconee blowdown from the B&W CSAU study
&&         modified so the break enthalpy corresponds to fluid with a void
&&         fraction of 0. before .00 seconds, and 1. after 500 seconds.
&&
&&      c. this modification adds 1000 lb of metal mass to each compartment.
&&
&&      d. this modification changes the 1000 lb of metal mass to 10,000 lb.
&&
&&
&& Written by:
&&
&&     John Schroeder 7/91
&&
&& ======================== Machine Control Input =========================
cray
eoi
&& ============================ Global Input ================================
&&
&& Section 3.2, p. 3-11
&&
&&     Atmospheric Gases
&&
&&     Material     Description
&&     --------     -----------
&&     o2           oxygen
&&     n2           nitrogen
&&     h2ov         steam
&&     h2ol         water
&&
control
    ncells    = 6       && Number of cells
    ntitl     = 2       && Number of title lines
    ntzone    = 5       && Number of time zones
    nac       = 0       && Number of aerosol groups
    nsectn    = 0       && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names ----------------
&&
&& Section 3.2.1, p. 3-13
&&
material
    compound
        n2 o2           && Air
        h2ov h2ol       && Steam and water
        conc ss         && Structural materials
&&
&& ---------------------------- Reactor Type -------------------------------
```

```
&&
&&  Section 3.2.2, p. 3-17
&&
thermal                   && Water-cooled reactor
&&
&& ---------------------------- Flow Options --------------------------------
&&
&&  Section 3.2.3, p. 3-17
&&
flows
&&
&&  Junction 1 - Room 105 to Balance of Plant, in    s flow paths
&&               1, 2, 3.
&&
    area(1,5) = 8.88     && Cross-sectional area of flow path           (m2)
    avl(1,5)  = 14.6     && Ratio of area to inertial length, A/L       (m)
    cfc(1,5)  = 1.00     && Flow loss coefficient
&&
&&  Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
    area(1,2) = 12.6
    avl(1,2)  = 20.7
    cfc(1,2)  = 1.00
&&
&&  Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
    area(2,5) = 0.892
    avl(2,5)  = 1.46
    cfc(2,5)  = 1.0
&&
&&  Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
    area(2,3) = 1.95
    avl(2,3)  = 3.2
    cfc(2,3)  = 1.0
&&
&&  Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
    area(3,5) = 1.95
    avl(3,5)  = 3.2
    cfc(3,5)  = 1.00
&&
&&  Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
    area(3,4) = 2.97
    avl(3,4)  = 4.88
    cfc(3,4)  = 1.00
&&
&&  Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&               10, 11, 12, and 13.
&&
    area(4,5) = 29.1
    avl(4,5)  = 157.
    cfc(4,5)  = 1.00
&&
&&  Junction 8 - Balance of Plant to environment, includes only blowout
&&               paths.
&&
    area(5,6) = 46.5
    avl(5,6)  = 250.
    cfc(5,6)  = 1.00
&&
    implicit
    dropout
&&
&&  Compartment and junction elevation data
&&
&&  Compartments
```

```
&&
    elevcl(1)  = 169.   && Center of mass elevation for Rm 105          (m)
    elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
    elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
    elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
    elevcl(5)  = 185.   && Center of mass elevation for Rm BOP          (m)
    elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&&  Junctions
&&
    elevfp(1,5)= 167.
    elevfp(5,1)= 167.

    elevfp(1,2)= 170.
    elevfp(2,1)= 170

    elevfp(2,5)= 172.
    elevfp(5,2)= 172.

    elevfp(2,3)= 170.
    elevfp(3,2)= 170.

    elevfp(3,5)= 170.
    elevfp(5,3)= 170.

    elevfp(3,4)= 172.
    elevfp(4,3)= 172.

    elevfp(4,5)= 173.
    elevfp(5,4)= 173.

    elevfp(5,6)= 211.
    elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ------------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& -------------------------------- Times ------------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
    1800.               && Maximum CPU time limit                       (s)
    0.                  && Problem start time                           (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     zone
&&  ------  ------  ------                                              (s)
       1.     10.     10.
       5.     50.    100.
      20.    200.    500.
      50.    100.   1000.
      50.    100.   7200.
&& ----------------------
eoi
&&
&& ---------------------------- Output Control -------------------------------
&&
&&  Section 3.2.7, p. 3-38
&&
shortedt      = 2       && System ts between short edits
longedt       = 1       && Ts edits between long edits
```

```
prflow                 && Print intercell flow data
praer                  &&       detailed aerosol inventories
prlow-cl               &&       lower cell model
prheat                 &&       heat transfer structure model
prengsys               &&       engineered system model
title
          B&W Plant Auxiliary Building Steam Propagation Model
                    Five Compartment Model -- BS-5
&&
&&
&& ==================== Cell Input and Cell Control ========================
&&
&&  Section 3.3, p. 3-40
&&
&& -------------------------- Cell 1, Room 105 ------------------------------
cell 1
control
   nhtm=3  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 1, Room 105
&&
&&  Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                    (m3, m)
    atmos     = 3       && Number of materials
              1.01e5  && Pressure                                   (Pa)
              305.    && Temperature                                (K)
        n2    = 0.75    && Initial nitrogen fraction
        o2    = 0.20    && Initial oxygen fraction
        h2ov  = 0.05    && Initial water vapor fraction
struc
    name      = Ceiling        && Name of structure
    type      = roof           && Type of structure
    shape     = slab           && Shape of structure
    nslab     = 10             && Number of nodes in structure
    chrlen    = 18.7           && Characteristic length of structure     (m)
    slarea    = 295.           && Area                                   (m2)
    tunif     = 305.           && Initial uniform temperature            (K)
    compound  =   conc conc conc conc conc conc conc conc conc conc
    x         = 0. .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
    eoi
&&
    name      = Walls          && Name of structure
    type      = wall           && Type of structure
    shape     = slab           && Shape of structure
    nslab     = 10             && Number of nodes in structure
    chrlen    = 5.49           && Characteristic length of structure     (m)
    slarea    = 298.           && Area                                   (m2)
    tunif     = 305.           && Initial uniform temperature            (K)
    compound  =  conc conc conc conc conc conc conc conc conc conc
    x         = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
    eoi
&&
    name      = Metals         && Name of structure
    type      = wall           && Type of structure
    shape     = slab           && Shape of structure
    nslab     = 10             && Number of nodes in structure
    chrlen    = 5.49           && Characteristic length of structure     (m)
    slarea    = 46.            && Area                                   (m2)
    tunif     = 305.           && Initial uniform temperature            (K)
    compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran     on  on  on  on  on
overflow    1
```

```
&&
&&  Lower cell input
&&
low-cell
    geometry= 295.       && Area of layers in lower cell                  (m2)
       bc  = 305.        && Basemat boundary condition temperature        (K)
       concrete
           compos = 1      && Number of materials
                   conc   && Material
                   43200. && Mass of material
           temp   = 305.   && Initial temperature
       eoi
       pool
           temp   = 305.   && Initial temperature
       eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  1  5  .152
   overflow  1  5  1.74
eoi
&&
&& ---------------------------- Cell 2, Room 113 -------------------------------
cell 2
control
   nhtm=3  mxslab=11  nsoatm=0  nspatm=0  naensy=1  jconc=5  jpool=1
eoi
title
       Cell 2, Room 113
&&
&&  Upper Cell Input
&&
geometry  3.794e2  6.10 && Cell volume and height                          (m3, m)
    atmos     = 3
                1.01e5  && Pressure                                        (Pa)
                305.    && Temperature                                     (K)
       o2    = 0.20
       n2    = 0.75
       h2ov  = 0.05
&&
struc
    name     = Ceiling        && Name of structure
    type     = roof           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 17.7           && Characteristic length of structure       (m)
    slarea   = 86.4           && Area                                     (m2)
    tunif    = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
 &&
    name     = Walls          && Name of structure
    type     = wall           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 5.49           && Characteristic length of structure       (m)
    slarea   = 254.           && Area                                     (m2)
    tunif    = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
     x       = 0. .040 .080 .120 .160 .200 .240 .280 .320 .360 .396 &&   (m)
     eoi
 &&
    name      = Metals        && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
```

```
    chrlen    = 5.49          && Characteristic length of structure      (m)
    slarea    = 46.           && Area                                    (m2)
    tunif     = 305.          && Initial uniform temperature             (K)
    compound  =  ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
    geometry= 86.4      && Area of layers in lower cell              (m2)
        bc  = 305.      && Basemat boundary condition temperature    (K)
        concrete
            compos = 1      && Number of materials
                   conc   && Material
                   19000. && Mass of material                        (kg)
            temp   = 305.   && Initial temperature                   (K)
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
enginee     Spill  1  2  1  0.0
    overflow  2  1  3.05
eoi
&&
&& -------------------------- Cell 3, Room 115 -------------------- ---------
cell 3
control
    nhtm=3  mxslab=11  nsoatm=1  nspatm=10  naensy=1  jcrnc=1  jpool=1
eoi
title
        Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                   (m3, m)
    atmos     = 3
              1.01e5      && Pressure
              305.        && Temperature
        o2   = 0.20
        n2   = 0.75
        h2ov = 0.05
source=1
&&
&&  Blowdown of RCS - Oconee blowdown, void fraction 1. after 500 seconds
&&
    h2ov  = 4
    iflag = 2
    t     =          0.        500.        501.       4000.

    mass  =       190.5       190.5        36.3        36.3

    enth  =    1356000.    1356000.    2747000.    2747000.

    eoi
&&
struc
    name    = Ceiling       && Name of structure
    type    = roof          && Type of structure
    shape   = slab          && Shape of structure
```

```
    nslab   = 10            && Number of nodes in structure
    chrlen  = 14.6          && Characteristic length of structure   (m)
    slarea  = 107.          && Area                                 (m2)
    tunif   = 305.          && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls         && Name of structure
    type    = wall
    shape   = slab
    nslab   = 10
    chrlen  = 5.49
    slarea  = 241.
    tunif   = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name      = Metals        && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure     (m)
    slarea    = 46.           && Area                                   (m2)
    tunif     = 305.          && Initial uniform temperature            (K)
    compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  3
&&
&&  Lower cell input
&&
low-cell
    geometry= 107.      && Area of layers in lower cell                (m2)
        bc  = 305.      && Basemat boundary condition temperature      (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     23500. && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
    overflow  3  2  3.05
eoi
&&
&& --------------------------- Cell 4, Room 236 -------------------------------
cell 4
control
    nhtm=2  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
    nsoeng=1  nspeng=4
eoi
title
        Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                      (m3, m)
```

```
   atmos    = 3
              1.01e5        && Pressure
              305.          && Temperature
        o2   = 0.25
        n2   = 0.75
        h2ov = 0.05
&&
struc
   name     = Walls         && Name of structure
   type     = wall          && Type of structure
   shape    = slab          && Shape of structure
   nslab    = 10            && Number of nodes in structure
   chrlen   = 5.49          && Characteristic length of structure   (m)
   slarea   = 450.          && Area                                 (m2)
   tunif    = 305.          && Initial uniform temperature          (K)
   compound=   conc conc conc conc conc conc conc conc conc conc
   x        = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
   eoi
&&
   name      = Metals        && Name of structure
   type      = wall          && Type of structure
   shape     = slab          && Shape of structure
   nslab     = 10            && Number of nodes in structure
   chrlen    = 5.49          && Characteristic length of structure     (m)
   slarea    = 46.           && Area                                   (m2)
   tunif     = 305.          && Initial uniform temperature            (K)
   compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
   x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
   eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  4
&&
&&  Lower cell input
&&
low-cell
   geometry= 21.9       && Area of layers in lower cell                    (m2)
       bc  = 305.       && Basemat boundary condition temperature          (K)
       concrete
           compos = 1      && Number of materials
                    conc   && Material
                    6730.  && Mass of material
           temp   = 305.   && Initial temperature
       eoi
       pool
           temp   = 305.   && Initial temperature
       eoi
eoi
&&
&&  Engineered safety systems
&&
&&  Spillage from Room 236 to Room 115 via the connecting pipe chase
&&
engineer    Spill 1  4  3  5.79
   overflow  4  3  0.025
eoi
&&
&&  Fire water sprinkler system, activated on high temperature.
&&
engineer    Sprinklr  2  4  4  0.
    spray
      spdiam = .001   && Spray droplet diameter                      (m)
      sphite = 5.49   && Spray fall height                           (m)
      spsttm = 373.   && Temperature at which system activates       (K)
   eoi
    source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
       h2ol  = 3        &&  activation
```

```
        iflag = 2
        t     = 0.0     100.    1.00e5
        mass  = 21.1    21.1    21.1
        temp  = 305.    305.    305.
    eoi
  eoi
&&
&& ------------------------ Cell 5, Balance of Plant ------------------------
cell 5
control
eoi
title
        Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
&&
&& -------------------------- Cell 6, Environment ---------------------------
cell 6
control
eoi
title
        Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

LISTING 15 - CONTAIN Input for BS-5e

```
&& ============================= Model Description ================================
&&
&& File:
&&
&&     cnt005e mdl
&&
&& Description:
&&
&&     BS-5. This input deck describes a five volume model of the B&W Plant
&&     auxiliary building. The rooms modeled are 105, 113, 115, and 236.
&&     The steam source is a 6 inch break in the HPI pump suction piping in
&&     room 115. Break flow is limited by the 2.5 inch HPI injection piping.
&&     This model does not include water aerosols (the dropout option is used).
&&
&&       a. this modification uses an Oconee blowdown from the B&W CSAU study
&&
&&       b. this modification uses an Oconee blowdown from the B&W CSAU study
&&          modified so the break enthalpy corresponds to fluid with a void
&&          fraction of 0. before 500 seconds, and 1. after 500 seconds.
&&
&&       c. this modification adds 1000 lb of metal mass to each compartment.
&&
&&       d. this modification changes the 1000 lb of metal mass to 10,000 lb.
&&
&&       e. this modification changes the 10,000 lb of metal mass to
&&          100,000 lb.
&&
&& Written by:
&&
&&     John Schroeder  7/91
&&
&& ========================= Machine Control Input ============================
cray
eoi
&& ============================ Global Input ==================================
&&
&& Section 3.2, p. 3-11
&&
&&     Atmospheric Gases
&&
&&     Material     Description
&&     --------     -----------
&&     o2           oxygen
&&     n2           nitrogen
&&     h2ov         steam
&&     h2ol         water
&&
control
   ncells    = 6       && Number of cells
   ntitl     = 2       && Number of title lines
   ntzone    = 5       && Number of time zones
   nac       = 0       && Number of aerosol groups
   nsectn    = 0       && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names ----------------
&&
&& Section 3.2.1, p. 3-13
&&
material
   compound
      n2 o2            && Air
      h2ov h2ol        && Steam and water
      conc ss          && Structural materials
```

```
&&
&& ---------------------------- Reactor Type --------------------------------
&&
&& Section 3.2.2, p. 3-17
&&
thermal                  && Water-cooled rractor
&&
&& ---------------------------- Flow Options --------------------------------
&&
&& Section 3.2.3, p. 3-17
&&
flows
&&
&& Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&              1, 2, 3.
&&
   area(1,5) = 8.88    && Cross-sectional area of flow path          (m2)
   avl(1,5)  = 14.6    && Ratio of area to inertial length, A/L      (m)
   cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&& Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
   area(1,2) = 12.6
   avl(1,2)  = 20.7
   cfc(1,2)  = 1.00
&&
&& Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
   area(2,5) = 0.892
   avl(2,5)  = 1.46
   cfc(2,5)  = 1.0
&&
&& Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
   area(2,3) = 1.95
   avl(2,3)  = 3.2
   cfc(2,3)  = 1.0
&&
&& Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
   area(3,5) = 1.95
   avl(3,5)  = 3.2
   cfc(3,5)  = 1.00
&&
&& Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
   area(3,4) = 2.97
   avl(3,4)  = 4.88
   cfc(3,4)  = 1.00
&&
&& Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&              10, 11, 12, and 13.
&&
   area(4,5) = 29.1
   avl(4,5)  = 157.
   cfc(4,5)  = 1.00
&&
&& Junction 8 - Balance of Plant to environment, includes only blowout
&&              paths.
&&
   area(5,6) = 46.5
   avl(5,6)  = 250.
   cfc(5,6)  = 1.00
&&
   implicit
   dropout
&&
&& Compartment and junction elevation data
```

```
&&
&&  Compartments
&&
    elevcl(1)  = 169.   && Center of mass elevation for Rm 105          (m)
    elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
    elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
    elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
    elevcl(5)  = 185.   && Center of mass elevation for Rm BOP          (m)
    elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&&  Junctions
&&
    elevfp(1,5)= 167.
    elevfp(5,1)= 167.

    elevfp(1,2)= 170.
    elevfp(2,1)= 170.

    elevfp(2,5)= 172.
    elevfp(5,2)= 172.

    elevfp(2,3)= 170.
    elevfp(3,2)= 170.

    elevfp(3,5)= 170.
    elevfp(5,3)= 170.

    elevfp(3,4)= 172.
    elevfp(4,3)= 172.

    elevfp(4,5)= 173.
    elevfp(5,4)= 173.

    elevfp(5,6)= 211.
    elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ------------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& -------------------------------- Times ------------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
    1800.               && Maximum CPU time limit                       (s)
    0.                  && Problem start time                           (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  ------  ------  ------                                              (s)
       1.     10.     10.
       5.     50.    100.
      20.    200.    500.
      50.    100.   1000.
      50.    100.   7200.
&& ----------------------
eoi
&&
&& ---------------------------- Output Control -----------------------------
&&
&&  Section 3.2.7, p. 3-38
&&
```

```
shortedt      = 2       && System ts between short edits
longedt       = 1       && Ts edits between long edits
prflow                  && Print intercell flow data
praer                   &&      detailed aerosol inventories
prlow-cl                &&      lower cell model
prheat                  &&      heat transfer structure model
prengsys                &&      engineered system model
title
          B&W Plant Auxiliary Building Steam Propagation Model
                    Five Compartment Model -- BS-5
&&
&&
&& ==================== Cell Input and Cell Control ========================
&&
&&  Section 3.3, p. 3-40
&&
&& ---------------------- --- Cell 1, Room 105 ----------------------------
cell 1
control
   nhtm=3  mxslab=11  nsoatm=0  nsnatm=7  naensy=1  jconc=1  jpool=1
eoi
title
      Cell 1, Room 105
&&
&&  Upper Cell Input
&&
geometry  1.134e3  5.49 && Cell volume and height                    (m3, m)
   atmos     = 3        && Number of materials
               1.01e5   && Pressure                                  (Pa)
               305.     && Temperature                               (K)
       n2    = 0.75     && Initial nitrogen fraction
       o2    = 0.20     && Initial oxygen fraction
       h2ov  = 0.05     && Initial water vapor fraction
struc
   name      = Ceiling        && Name of structure
   type      = roof           && Type of structure
   shape     = slab           && Shape of structure
   nslab     = 10             && Number of nodes in structure
   chrlen    = 18.7           && Characteristic length of structure     (m)
   slarea    = 295.           && Area                                   (m2)
   tunif     = 305.           && Initial uniform temperature            (K)
   compound  =  conc conc conc conc conc conc conc conc conc conc
   x         = 0. .046 .092 .138 .184 .230 .276 .322 .365 .414 .457 && (m)
   eoi
&&
   name      = Walls          && Name of structure
   type      = wall           && Type of structure
   shape     = slab           && Shape of structure
   nslab     = 10             && Number of nodes in structure
   chrlen    = 5.49           && Characteristic length of structure     (m)
   slarea    = 298.           && Area                                   (m2)
   tunif     = 305.           && Initial uniform temperature            (K)
   compound  = conc conc conc conc conc conc conc conc conc conc
   x         = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
   eoi
&&
   name      = Metals         && Name of structure
   type      = wall           && Type of structure
   shape     = slab           && Shape of structure
   nslab     = 10             && Number of nodes in structure
   chrlen    = 5.49           && Characteristic length of structure     (m)
   slarea    = 460.           && Area                                   (m2)
   tunif     = 305.           && Initial uniform temperature            (K)
   compound  =  ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
   x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
   eoi
&&
condense
```

```
ht-tran     on  on  on  on  on
overflow    1
&&
&&  Lower cell input
&&
low-cell
    geometry= 295.      && Area of layers in lower cell                 (m2)
        bc  = 305.      && Basemat boundary condition temperature       (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     43200. && Mass of material
            temp   = 305.   && Initial temperature
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  1  5  .152
    overflow  1  5  1.74
eoi
&&
&& --------------------------- Cell 2, Room 113 -------------------------------
cell 2
control
    nhtm=3  mxslab=11  nsoatm=0  nspatm=0  naensy=1  jconc=5  jpool=1
eoi
title
        Cell 2, Room 113
&&
&&  Upper Cell Input
&&
geometry  3.794e2  6.10 && Cell volume and height                        (m3, m)
    atmos     = 3
                1.01e5  && Pressure                                      (Pa)
                305.    && Temperature                                   (K)
        o2    = 0.20
        n2    = 0.75
        h2ov  = 0.05
&&
struc
    name     = Ceiling        && Name of structure
    type     = roof           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 17.7           && Characteristic length of structure       (m)
    slarea   = 86.4           && Area                                     (m2)
    tunif    = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name     = Walls          && Name of structure
    type     = wall           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 5.49           && Characteristic length of structure       (m)
    slarea   = 254.           && Area                                     (m2)
    tunif    = 305.           && Initial uniform temperature              (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
     x       = 0. .040 .080 .120 .160 .200 .240 .280 .320 .360 .396 &&   (m)
    eoi
&&
    name      = Metals        && Name of structure
    type      = wall          && Type of structure
```

```
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure     (m)
    slarea    = 460.          && Area                                   (m2)
    tunif     = 305.          && Initial uniform temperature            (K)
    compound  =  ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&&  Lower cell input
&&
low-cell
    geometry= 86.4      && Area of layers in lower cell                 (m2)
        bc  = 305.      && Basemat boundary condition temperature       (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     19000. && Mass of material                         (kg)
            temp   = 305.   && Initial temperature                      (K)
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  2  1  0.0
    overflow  2  1  3.05
eoi
&&
&& -------------------------- Cell 3, Room 115 ------------------------------
cell 3
control
    nhtm=3  mxslab=11  nsoatm=1  nspatm=10  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 3, Room 115
&&
&&  Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                       (m3, m)
    atmos     = 3
                1.01e5      && Pressure
                305.        && Temperature
        o2   = 0.20
        n2   = 0.75
        h2ov = 0.05
source=1
&&
&&  Blowdown of RCS - Oconee blowdown, void fraction 1. after 500 seconds
&&
    h2ov  = 4
    iflag = 2
    t     =          0.         500.         501.        4000.

    mass  =       190.5        190.5         36.3         36.3

    enth  =    1356000.     1356000.     2747000.     2747000.

    eoi
&&
struc
    name    = Ceiling       && Name of structure
```

```
    type     = roof          && Type of structure
    shape    = slab          && Shape of structure
    nslab    = 10            && Number of nodes in structure
    chrlen   = 14.6          && Characteristic length of structure   (m)
    slarea   = 107.          && Area                                 (m2)
    tunif    = 305.          && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name     = Walls         && Name of structure
    type     = wall
    shape    = slab
    nslab    = 10
    chrlen   = 5.49
    slarea   = 241.
    tunif    = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x        = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name       = Metals        && Name of structure
    type       = wall          && Type of structure
    shape      = slab          && Shape of structure
    nslab      = 10            && Number of nodes in structure
    chrlen     = 5.49          && Characteristic length of structure     (m)
    slarea     = 460.          && Area                                   (m2)
    tunif      = 305.          && Initial uniform temperature            (K)
    compound   =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x          = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  3
&&
&&  Lower cell input
&&
low-cell
   geometry= 107.      && Area of layers in lower cell                    (m2)
       bc  = 305.      && Basemat boundary condition temperature          (K)
       concrete
           compos = 1      && Number of materials
                    conc   && Material
                    23500. && Mass of material
           temp   = 305.   && Initial temperature
       eoi
       pool
           temp   = 305.   && Initial temperature
       eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
   overflow  3  2  3.05
eoi
&&
&& ---------------------------- Cell 4, Room 236 --------------------------------
cell 4
control
   nhtm=2  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
   nsoeng=1  nspeng=4
eoi
title
      Cell 4, Room 236
&&
&&  Upper Cell Input
```

```
&&
geometry  2.520e2  5.49 && Cell volume and height                        (m3, m)
   atmos    = 3
              1.01e5        && Pressure
              305.          && Temperature
       o2   = 0.25
       n2   = 0.75
       h2ov = 0.05
&&
struc
    name     = Walls        && Name of structure
    type     = wall         && Type of structure
    shape    = slab         && Shape of structure
    nslab    = 10           && Number of nodes in structure
    chrlen   = 5.49         && Characteristic length of structure   (m)
    slarea   = 450.         && Area                                  (m2)
    tunif    = 305.         && Initial uniform temperature           (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x        = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
    eoi
 &&
    name      = Metals        && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.4[illegible]          && Characteristic length of structure     (m)
    slarea    = [illegible]           && Area                                     (m2)
    tunif     = 305.          && Initial uniform temperature              (K)
    compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
 &&
 condense
 ht-tran   on  on  on  on  on
 overflow  4
 &&
 &&  Lower cell input
 &&
 low-cell
     geometry= 91.9      && Area of layers in lower cell               (m2)
         bc  = 305.      && Basemat boundary condition temperature      (K)
         concrete
             compos = 1      && Number of materials
                      conc   && Material
                      6730.  && Mass of material
             temp   = 305.   && Initial temperature
         eoi
         pool
             temp   = 305.   && Initial temperature
         eoi
  eoi
  &&
  &&  Engineered safety systems
  &&
  &&  Spillage from Room 236 to Room 115 via the connecting pipe chase
  &&
  engineer    Spill 1  4  3  5.79
     overflow  4  3  0.025
  eoi
  &&
  &&  Fire water sprinkler system, activated on high temperature.
  &&
  engineer    Sprinklr  2  4  4  0.
     spray
       spdiam = .001   && Spray droplet diameter                        (m)
       sphite = 5.49   && Spray fall height                             (m)
       spsttm = 373.   && Temperature at which system activates         (K)
     eoi
```

```
    source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
        h2ol  = 3       &&  activation
        iflag = 2
        t     = 0.0     100.    1.00e5
        mass  = 21.1    21.1    21.1
        temp  = 305.    305.    305.
    eoi
  eoi
&&
&& ------------------------ Cell 5, Balance of Plant ------------------------
cell 5
control
eoi
title
        Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
&&
&& -------------------------- Cell 6, Environment ---------------------------
cell 6
control
eoi
title
        Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

LISTING 16 - CONTAIN Input for BS-5f

```
&& ========================== Model Description ==============================
&&
&& File:
&&
&&      cnt005f.mdl
&&
&& Description:
&&
&&      BS-5.  This input deck describes a five volume model of the B&W Plant
&&      auxiliary building.  The rooms modeled are 105, 113, 115, and 236.
&&      The steam source is a 6 inch break in the HPI pump suction piping in
&&      room 115.  Break flow is limited by the 2.5 inch HPI injection piping.
&&      This model does not include water aerosols (the dropout option is used).
&&
&&       a.  this modification uses an Oconee blowdown from the B&W CSAU study
&&
&&       b.  this modification uses an Oconee blowdown from the B&W CSAU study
&&           modified so the break enthalpy corresponds to fluid with a void
&&           fraction of 0. before 500 seconds, and 1. after 500 seconds.
&&
&&       c.  this modification adds 1000 lb of metal mass to each compartment.
&&
&&       d.  this modification changes the 1000 lb of metal mass to 10,000 lb.
&&
&&       e.  this modification changes the 10,000 lb of metal mass to
&&           100,000 lb.
&&
&&       f.  this modification changes the 100,000 lb of metal mass to
&&           1,000,000 lb.
&&
&& Written by:
&&
&&      John Schroeder  7/91
&&
&& ======================== Machine Control Input ============================
cray
eoi
&& ============================= Global Input =================================
&&
&& Section 3.2, p. 3-11
&&
&&      Atmospheric Gases
&&
&&      Material     Description
&&      --------     -----------
&&      o2           oxygen
&&      n2           nitrogen
&&      h2ov         steam
&&      h2ol         water
&&
control
    ncells    = 6       && Number of cells
    ntitl     = 2       && Number of title lines
    ntzone    = 5       && Number of time zones
    nac       = 0       && Number of aerosol groups
    nsectn    = 0       && Number of aerosol sections
eoi
&&
&& ------------- Material, Fission Product, and Aerosol Names ----------------
&&
&& Section 3.2.1, p. 3-13
&&
material
    compound
```

```
        n2 o2            && Air
        h2ov h2ol        && Steam and water
        conc ss          && Structural materials
&&
&& ---------------------------- Reactor Type ------------------------------
&&
&&  Section 3.2.2, p. 3-17
&&
thermal                  && Water-cooled reactor
&&
&& ---------------------------- Flow Options ------------------------------
&&
&&  Section 3.2.3, p. 3-17
&&
flows
&&
&&  Junction 1 - Room 105 to Balance of Plant, includes flow paths
&&               1, 2, 3.
&&
    area(1,5) = 8.88    && Cross-sectional area of flow path          (m2)
    avl(1,5)  = 14.6    && Ratio of area to inertial length, A/L      (m)
    cfc(1,5)  = 1.00    && Flow loss coefficient
&&
&&  Junction 2 - Room 105 to Room 113, includes only flow path 4.
&&
    area(1,2) = 12.6
    avl(1,2)  = 20.7
    cfc(1,2)  = 1.00
&&
&&  Junction 3 - Room 113 to Balance of Plant, includes only flow path 5.
&&
    area(2,5) = 0.892
    avl(2,5)  = 1.46
    cfc(2,5)  = 1.0
&&
&&  Junction 4 - Room 113 to Room 115, includes only flow path 6.
&&
    area(2,3) = 1.95
    avl(2,3)  = 3.2
    cfc(2,3)  = 1.0
&&
&&  Junction 5 - Room 115 to Balance of Plant, includes only flow path 7.
&&
    area(3,5) = 1.95
    avl(3,5)  = 3.2
    cfc(3,5)  = 1.00
&&
&&  Junction 6 - Room 115 to Room 236, includes only flow path 8.
&&
    area(3,4) = 2.97
    avl(3,4)  = 4.88
    cfc(3,4)  = 1.00
&&
&&  Junction 7 - Room 236 to Balance of Plant, includes flow paths 9,
&&               10, 11, 12, and 13.
&&
    area(4,5) = 29.1
    avl(4,5)  = 157.
    cfc(4,5)  = 1.00
&&
&&  Junction 8 - Balance of Plant to environment, includes only blowout
&&               paths.
&&
    area(5,6) = 46.5
    avl(5,6)  = 250.
    cfc(5,6)  = 1.00
&&
    implicit
```

```
    dropout
&&
&&  Compartment and junction elevation data
&&
&&  Compartments
&&
    elevcl(1)  = 169.   && Center of mass elevation for Rm 105          (m)
    elevcl(2)  = 169.   && Center of mass elevation for Rm 113          (m)
    elevcl(3)  = 169.   && Center of mass elevation for Rm 115          (m)
    elevcl(4)  = 175.   && Center of mass elevation for Rm 236          (m)
    elevcl(5)  = 185.   && Center of mass elevation for Rm BOP          (m)
    elevcl(6)  = 185.   && Center of mass elevation for Environment     (m)
&&
&&  Junctions
&&
    elevfp(1,5)= 167.
    elevfp(5,1)= 167.

    elevfp(1,2)= 170.
    elevfp(2,1)= 170.

    elevfp(2,5)= 172.
    elevfp(5,2)= 172.

    elevfp(2,3)= 170.
    elevfp(3,2)= 170.

    elevfp(3,5)= 170.
    elevfp(5,3)= 170.

    elevfp(3,4)= 172.
    elevfp(4,3)= 172.

    elevfp(4,5)= 173.
    elevfp(5,4)= 173.

    elevfp(5,6)= 211.
    elevfp(6,5)= 211.
&&
&& ---------------------------- Aerosol Options ------------------------------
&&
&&  Section 3.2.4, p. 3-29
&&
&&  aerosol
&&      h2ov 1.0e-8 0.693
&&
&& -------------------------------- Times -------------------------------------
&&
&&  Section 3.2.6, p. 3-36
&&
times
    1800.              && Maximum CPU time limit                      (s)
    0.                 && Problem start time                          (s)
&&
&&  Time zone data
&&
&&  System   Edit   End of
&&    Ts      Ts     Zone
&&  ------  ------  ------                                            (s)
       1.     10.     10.
       5.     50.    100.
      20.    200.    500.
      50.    100.   1000.
      50.    100.   7200.
&& ----------------------
eoi
&&
&& ---------------------------- Output Control ------------------------------
```

```
&&
&&  Section 3.2.7, p. 3-38
&&
shortedt      = 2       && System ts between short edits
longedit      = 1       && Ts edits between long edits
prflow                  && Print intercell flow data
praer                   &&       detailed aerosol inventories
prlow-1                 &&       lower cell model
prheat                  &&       heat transfer structure model
prengsys                &&       engineered system model
title
          B&W Plant Auxiliary Building Steam Propagation Model
                   Five Compartment Model -- BS-5
&&
&&
&& ======================== Cell Input and Cell Control ==========================
&&
&&  Section 3.3, p. 3-40
&&
&& -------------------------- Cell 1, Room 105 ------------------------------
cell 1
control
    nhtm=3  mxslab=11  nsoatm=0  nspatm=7  naensy=1  jconc=1  jpool=1
eoi
title
       Cell 1, Room 105
&&
&&  Upper Cell Input
&&
geometry  1.174e3  5.49 && Cell volume and height                        (m3  m)
    atmos     = 3        && Number of materials
               1.01e5  && Pressure                                        (Pa)
               305.    && Temperature                                     (K)
        n2    = 0.75    && Initial nitrogen fraction
        o2    = 0.20    && Initial oxygen fraction
        h2ov  = 0.05    && Initial water vapor fraction
struc
    name      = Ceiling       && Name of structure
    type      = roof          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 18.7          && Characteristic length of structure      (m)
    slarea    = 295.          && Area                                    (m2)
    tunif     = 305.          && Initial uniform temperature             (K)
    compound  =   conc conc conc conc conc conc conc conc conc conc
    x         = 0. .046 .092 .138 .184 .230 .276 .322 .368 .414 .457 && (m)
    eoi
&&
    name      = Walls         && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure      (m)
    slarea    = 295           && Area                                    (m2)
    tunif     = 305.          && Initial uniform temperature             (K)
    compound  =  conc conc conc conc conc conc conc conc conc conc
    x         = 0. .035 .070 .105 .140 .175 .210 .245 .280 .315 .351 && (m)
    eoi
&&
    name      = Metals        && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure      (m)
    slarea    = 4600.         && Area                                    (m2)
    tunif     = 305.          && Initial uniform temperature             (K)
    compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
```

```
    eoi
&&
condense
ht-tran     on  on  on  on  on
overflow    1
&&
&&  Lower cell input
&&
low-cell
    geometry= 295.        && Area of layers in lower cell                  (m2)
        bc  = 305.        && Basemat boundary condition temperature        (K)
        concrete
            compos = 1       && Number of materials
                     conc    && Material
                     43200.  && Mass of material
            temp   = 305.    && Initial temperature
        eoi
        pool
            temp   = 305.    && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  1  5  .152
    overflow  1  5  1.74
eoi
&&
&& ------------------------- Cell 2, Room 113 ------------------------------
cell 2
control
    nhtm=3  mxslab=11  nsoatm=0  nspatm=0  naensy=1  jconc=5  jpool=1
eoi
title
        Cell 2, Room 113
&&
&&  Upper Cell Input
&&
geometry  3.794e2  5.10 && Cell volume and height                          (m3, m)
    atmos     = 3
                1.01e5  && Pressure                                        (Pa)
                305.    && Temperature                                     (K)
        o2    = 0.20
        n2    = 0.75
        h2ov  = 0.05
&&
struc
    name    = Ceiling         && Name of structure
    type    = roof            && Type of structure
    shape   = slab            && Shape of structure
    nslab   = 10              && Number of nodes in structure
    chrlen  = 17.7            && Characteristic length of structure      (m)
    slarea  = 86.4            && Area                                    (m2)
    tunif   = 305.            && Initial uniform temperature             (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls           && Name of structure
    type    = wall            && Type of structure
    shape   = slab            && Shape of structure
    nslab   = 10              && Number of nodes in structure
    chrlen  = 5.49            && Characteristic length of structure      (m)
    slarea  = 254.            && Area                                    (m2)
    tunif   = 305.            && Initial uniform temperature             (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
     x      = 0. .040 .080 .120 .160 .200 .240 .280 .320 .360 .396 &&    (m)
    eoi
```

```
&&
    name      = Metals        && Name of structure
    type      = wall          && Type of structure
    shape     = slab          && Shape of structure
    nslab     = 10            && Number of nodes in structure
    chrlen    = 5.49          && Characteristic length of structure     (m)
    s'area    = 4600.         && Area                                   (m2)
    tunif     = 305.          && Initial uniform temperature            (K)
    compound  =  ss  ss  ss  ss  ss  ss  ss  ss  ss  ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran  on  on  on  on  on
overflow  2
&&
&& Lower cell input
&&
low-cell
    geometry= 86.4      && Area of layers in lower cell               (m2)
        bc  = 305.      && Basemat boundary condition temperature     (K)
        concrete
            compos = 1      && Number of materials
                     conc   && Material
                     19000. && Mass of material                       (kg)
            temp   = 305.   && Initial temperature                    (K)
        eoi
        pool
            temp   = 305.   && Initial temperature
        eoi
eoi
&&
&& Engineered safety systems
&&
engineer    Spill  1  2  1  0.0
    overflow  2  1  3.05
eoi
&&
&& ---------------------- --- Cell 3, Room 115 ------------------------------
cell 3
control
    nhtm=3  maxslab=11  nsoatm=1  nspatm=10  naensy=1  jconc=1  jpool=1
eoi
title
        Cell 3, Room 115
&&
&& Upper Cell Input
&&
geometry  5.267e2  5.49 && Cell volume and height                     (m3, m)
    atmos    = 3
               1.01e5      && Pressure
               305.        && Temperature
        o2   = 0.20
        n2   = 0.75
        h2ov = 0.05
source=1
&&
&& Blowdown of RCS - Oconee blowdown, void fraction 1. after 500 seconds
&&
    h2ov  = 4
    iflag = 2
    t     =        0.        500.        501.       4000.

    mass  =      190.5      190.5        36.3        36.3

    enth  =   1356000.   1356000.    2747000.    2747000.

    eoi
```

```
&&
struc
    name    = Ceiling        && Name of structure
    type    = roof           && Type of structure
    shape   = slab           && Shape of structure
    nslab   = 10             && Number of nodes in structure
    chrlen  = 14.6           && Characteristic length of structure   (m)
    slarea  = 107.           && Area                                 (m2)
    tunif   = 305.           && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name    = Walls          && Name of structure
    type    = wall
    shape   = slab
    nslab   = 10
    chrlen  = 5.49
    slarea  = 241.
    tunif   = 305.
    compound=   conc conc conc conc conc conc conc conc conc conc
    x       = 0.   .031 .062 .093 .124 .155 .186 .221 .252 .283 .305 && (m)
    eoi
&&
    name      = Metals         && Name of structure
    type      = wall           && Type of structure
    shape     = slab           && Shape of structure
    nslab     = 10             && Number of nodes in structure
    chrlen    = 5.49           && Characteristic length of structure     (m)
    slarea    = 4600.          && Area                                   (m2)
    tunif     = 305.           && Initial uniform temperature            (K)
    compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
    x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
    eoi
&&
condense
ht-tran   on  on  on  on  on
overflow  3
&&
&&  Lower cell input
&&
low-cell
    geometry= 107.      && Area of layers in lower cell                (m2)
        bc  = 305.      && Basemat boundary condition temperature      (K)
        concrete
            compos = 1       && Number of materials
                     conc    && Material
                     23500.  && Mass of material
            temp   = 305.    && Initial temperature
        eoi
        pool
            temp   = 305.    && Initial temperature
        eoi
eoi
&&
&&  Engineered safety systems
&&
engineer    Spill  1  3  2  0.
    overflow  3  2  3.05
eoi
&&
&& ------------------------ --- Cell 4, Room 236 ---------------------------------
cell 4
control
    nhtm=2  mxslab=11  nsoatm=2  nspatm=000 jconc=1  jpool=1  naensy=2
    nsoeng=1  nspeng=4
eoi
title
```

```
      Cell 4, Room 236
&&
&&  Upper Cell Input
&&
geometry  2.520e2  5.49 && Cell volume and height                          (m3, m)
    atmos     = 3
                1.01e5          && Pressure
                305.            && Temperature
        o2    = 0.25
        n2    = 0.75
        h2ov  = 0.05
&&
struc
    name     = Walls          && Name of structure
    type     = wall           && Type of structure
    shape    = slab           && Shape of structure
    nslab    = 10             && Number of nodes in structure
    chrlen   = 5.49           && Characteristic length of structure   (m)
    slarea   = 450.           && Area                                 (m2)
    tunif    = 305.           && Initial uniform temperature          (K)
    compound=   conc conc conc conc conc conc conc conc conc conc conc
    x        = 0.   .015 .030 .045 .060 .075 .090 .105 .120 .135 .152
    eoi
 &&
     name      = Metals          && Name of structure
     type      = wall            && Type of structure
     shape     = slab            && Shape of structure
     nslab     = 10              && Number of nodes in structure
     chrlen    = 5.49            && Characteristic length of structure     (m)
     slarea    = 4600.           && Area                                   (m2)
     tunif     = 305.            && Initial uniform temperature            (K)
     compound  =   ss   ss   ss   ss   ss   ss   ss   ss   ss   ss
     x         = 0. .001 .002 .003 .004 .005 .006 .007 .008 .009 .013 && (m)
     eoi
  &&
  condense
  ht-tran   on  on  on  on  on
  overflow  4
  &&
  &&  Lower cell input
  &&
  low-cell
      geometry= 91.9       && Area of layers in lower cell                   (m2)
          bc  = 305.       && Basemat boundary condition temperature         (K)
          concrete
              compos = 1      && Number of materials
                      conc   && Material
                      6730.  && Mass of material
              temp   = 305.  && Initial temperature
          eoi
          pool
              temp   = 305.   && Initial temperature
          eoi
   eoi
   &&
   &&  Engineered safety systems
   &&
   &&  Spillage from Room 236 to Room 115 via the connecting pipe chase
   &&
   engineer    Spill 1  4  3  5.79
      overflow  4  3  0.025
   eoi
   &&
   &&  Fire water sprinkler system, activated on high temperature.
   &&
   engineer    Sprinklr  2  4  4  0.
       spray
         spdiam = .001   && Spray droplet diameter                        (m)
```

```
      sphite = 5.49   && Spray fall height                                (m)
      spsttm = 373.   && Temperature at which system activates            (K)
   eoi
    source = 1          &&  Sprays provide 336 gpm (21.1 kg/s) after
        h2ol  = 3       &&  activation
        iflag = 2
        t     = 0.0     100.    1.00e5
        mass  = 21.1    21.1    21.1
        temp  = 305     305.    305.
    eoi
  eoi
&&
&& ------------------------- Cell 5, Balance of Plant -------------------------
cell 5
control
eoi
title
       Balance of Plant
geometry  1.87e5  38.8
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
&&
&& -------------------------- Cell 6, Environment ---------------------------
cell 6
control
eoi
title
       Environment Cell
geometry  1.e10  1.e30
atmos=3  1.01e5  305.
    o2 0.20
    n2 0.75
    h2ov 0.05
eof
```

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11. ABSTRACT (200 words or less)

This document presents information essential to understanding the risk associated with inter-system loss-of-coolant accidents (ISLOCAs). The methodology developed and presented in this document provides a state-of-the-art method for identifying and evaluating plant-specific hardware designs, human performance issues, and accident consequence factors relevant to the prediction of the ISLOCA risk. This ISLOCA methodology was developed and then applied to a Babcock and Wilcox (B&W) nuclear power plant. The results from this application are described in detail. For this particular B&W reference plant, the assessment indicated that the probability of a severe ISLOCA is approximately 2.2E − 06/reactor-year.

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