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Severe Accident Source Term Characteristics for Selected Peach Bottom Sequences Predicted by the MELCOR Code

Prepared by
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Prepared for
U.S. Nuclear Regulatory Commission

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Abstract

The purpose of this study is to compare in-containment source terms developed for NUREG-1150, which used the Source Term Code Package (STCP), with those generated by MELCOR to identify significant differences. For this comparison, two short-term depressurized station blackout sequences (with a dry cavity and with a flooded cavity) and a loss-of-coolant accident (LOCA) concurrent with complete loss of the emergency core cooling system (ECCS) were analyzed for the Peach Bottom Atomic Power Station (a BWR-4 with a Mark I containment).

The results indicate that for the sequences analyzed, the two codes predict similar total in-containment release fractions for each of the element groups. However, the MELCOR/CORBH Package predicts significantly longer times for vessel failure and reduced energy of the released material for the station blackout sequences (when compared to the STCP results). MELCOR also calculated smaller releases into the environment than the STCP for the station blackout sequences.

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Acronyms

AC	Alternating Current
ADS	Automatic Depressurization System (includes 5 SRVs)
ACH	Active Core Height (150 in or 3.81 m for Peach Bottom)
BAF	Bottom Active Fuel
BNL	Brookhaven National Laboratory
BWR	Boiling Water Reactor
BWROG	BWR Owner's Group
CRDHS	Control Rod Drive Hydraulic System
DC	Direct Current
ECCS	Emergency Core Cooling System
EPGs	Emergency Procedures Guidelines
FSAR	Final Safety Analysis Report
HPCI	High Pressure Coolant Injection
LOCA	Loss-of-Coolant Accident
LWR	Light Water Reactor
MSIV	Main Steam Isolation Valves
NRC	Nuclear Regulatory Commission
ORNL	Oak Ridge National Laboratory
PP&L	Pennsylvania Power and Light
PRA	Probabilistic Risk Assessment
PWR	Pressurized Water Reactor
RB	Reactor Building
RCIC	Reactor Core Isolation Cooling
RCS	Reactor Coolant System
RPV	Reactor Pressure Vessel
SBO	Station Blackout
SNL	Sandia National Laboratories
SRV	Safety Relief Valve
STCP	Source Term Code Package
TB	Turbine Building
USNRC	United States Nuclear Regulatory Commission

Executive Summary

Introduction

The purpose of this work is to calculate best-estimate source terms with the MELCOR code for three severe accident sequences at the Peach Bottom Atomic Power Station, and to compare these source terms with NUREG-1150 results calculated by the Source Term Code Package (STCP) for similar sequences.

The three severe accident sequences analyzed are two low-pressure, short-term station blackouts (one with a dry cavity, the other with a flooded cavity), and a design basis loss-of-coolant accident (LOCA) concurrent *with complete failure of the emergency core cooling system (ECCS).* The station blackout sequences assume that all AC and DC power is lost except for the DC power needed to actuate the automatic depressurization system (ADS) and the safety relief valves (SRVs). The ADS is used to depressurize the reactor in conformance with Rev. 3 of the BWR Owner's Group Emergency Procedures Guidelines (EPGs) for steam cooling that calls for ADS actuation when the water in the core is about 1/3 of the active core height.

The plant analyzed, the Peach Bottom Atomic Power Station Unit 2, is a BWR-4 with a Mark I containment.

The MELCOR severe accident code, version 1.8.1, and the MELCOR/CORBH Package were used for these calculations.

Containment Failure Modes

Mark-I containments have three basic failure modes. These failure modes are: (1) by high pressure-induced failure of the wetwell torus, (2) by high temperature degradation of the head flange seals combined by a moderate pressure in the drywell, and (3) by liner melt-through or creep rupture when hot debris in the cavity contacts the drywell liner. It is believed the first failure mode (high pressure-induced torus failure) would occur at the Peach Bottom Mark-I containment at about 159 psig (1.2 MPa) with an assumed breach area of 1 ft^2 (0.1 m^2). Available analyses indicate that the second failure mode (high temperature degradation of the head flange seals combined with moderate pressure in the drywell) would occur when the head flange seals are subjected to temperatures above 700°F (644 K) and to a pressure differential across the seals of at least 82 psid (0.565 MPa). The resulting leakage area after failure is pressure dependent, ranging from 0 ft^2 (0 m^2) at 82 psid (0.565 MPa) to 0.43 ft^2 (0.04 m^2) at 200 psid (1.378 MPa). This failure mode generally results in small leakage areas as the pressure in the containment is held around 85-90 psid (0.687-0.719 MPa) once leakage starts. Finally, the third failure mode would require a temperature at the liner of 2800°F (1810 K) for liner melt-through, and somewhat lower temperatures for creep rupture of the liner.

Because of limitations of the MELCOR code (the CORCON-MOD2 subroutine that handles the cavity), the third containment failure mode could not be modeled.

MELCOR Computer Models

A multi-node drywell model with two cavities was used with MELCOR to provide the *best-estimate source term results.*

A single-node drywell, single cavity model was used with the MELCOR/CORBH Package to calculate the *best-estimate vessel failure time.*

Timing of Events

The best-estimate times for the important events in the three severe accidents analyzed are presented in Table ES.1. For the station blackouts, ADS actuation was predicted to occur at about 66 min, the "gap" release phase was predicted to be initiated at about 93 min and ended at 122 min, and vessel failure was predicted by the MELCOR/CORBH Package to occur at about 286 min after accident initiation. For the station blackout with a dry cavity, the containment was predicted to fail by high temperature at the drywell head flange seals (containment failure mode 2), 548 min after transient initiation. Only the first two containment failures modes (high pressure in the wetwell and high-temperature at the head flange seals) were implemented into the MELCOR model. However, containment failure mode 3, by liner melt-through, is believed to be very probable for the station blackout with a dry cavity. For the station blackout with a flooded cavity, the containment was predicted to fail due to high pressure in the wetwell (containment failure mode 1), 617 min after transient initiation. The flooded cavity kept the drywell atmospheric temperatures below the head flange seals failure temperature of 700°F (644 K). The maximum atmospheric temperature of any drywell volume in the flooded cavity station blackout was 460°F (510 K). The atmospheric temperatures of the drywell in the dry cavity station blackout reached values up to 1520°F (1100 K). *Thus, one potential major impact of drywell flooding is to change the location of primary containment failure from the drywell to the wetwell.*

The LOCA sequence does not require ADS actuation since the primary coolant system is depressurized during the blowdown. The gap release was predicted to be initiated at about 10 min and to be ended at 30 min. Vessel failure was predicted at 57 min, and containment failure at 264 min. The containment was predicted to fail by high temperature at the head flange seals as in the station blackout with a dry cavity.

Table ES.1. Best-estimate times (min) for the important events of the three sequences analyzed

Event	Station blackout Dry cavity	Station blackout Flooded cavity	LOCA	Comments
ADS actuation	66	66		LOCA depressurized without ADS
Gap release initiated	93	92	10	Shorter time for LOCA
Gap release ended	122	122	30	Shorter time for LOCA
Gap release duration	29	30	20	Shorter time for LOCA
Vessel failure time	286	286	57	Shorter time for LOCA
In-vessel release duration	164	164	27	Shorter time for LOCA
Containment failure time	548	617	264	Shorter time for LOCA
Containment failure mode	2. Drywell head flange seals	1. Wetwell air space	2. Drywell head flange seals	

In-containment Source Terms

In-containment source terms by class and release phase are given in Tables ES.2, ES.3, and ES.4 for the three sequences analyzed. The total in-containment source terms for the three sequences and those reported in draft NUREG-1465 are given in Table ES.5 and Fig. ES.1. The in-containment source term for noble gases is 100% of the total inventory for all the three sequences analyzed in agreement with draft NUREG-1465. *Source terms calculated by MELCOR for I, Cs, Sr, and Ba exceed the values reported in draft NUREG-1465.* MELCOR calculates smaller source terms for Te, Ru, and Ce. MELCOR also calculates smaller amounts of non-radioactive aerosols than the draft NUREG-1465 values.

Of the three sequences, the LOCA has the largest in-containment source terms for I (as CsI) and Cs, because the LOCA has the lowest retention of these fission products in the reactor coolant system (about 21%). The station blackout with a dry cavity has the lowest releases of I (as CsI) and Cs of the three sequences and also the largest retention of these fission products in the reactor coolant system (about 40%). For the remaining fission products, the station blackout with a dry cavity has the largest source terms, the station blackout with a flooded cavity the smallest source terms for Te, La, and Ce, and the LOCA the smallest source terms for Ba, Sr, and Ru.

Source Terms Released into the Environment

The best-estimate source terms released into the environment at the end of the calculations (13 h after transient initiation) for the three sequences analyzed are given in Table ES.6. The largest release of noble gases into the environment (89%) was predicted for the station blackout with a flooded cavity. In this sequence, the wetwell (torus air space) failed by high pressure and all the noble gases accumulated in the wetwell escaped.

The LOCA has the largest releases of Cs and CsI into the environment. The LOCA also has the largest in-containment source terms for Cs and I(as CsI) in Table ES.5.

The station blackout with the flooded cavity has the lowest releases for all the classes (except for the noble gases). The scrubbing effect of the water in the flooded cavity and in the wetwell retained most of the fission products.

It should be noted that the MELCOR model of the station blackout with a dry cavity did not have containment failure mode 3 (liner melt-through) incorporated because of MELCOR limitations. According to some previous studies, the probability of liner melt-through is very high for this sequence. If liner melt-through occurs in the station blackout with the dry cavity, the source terms released into the environment could be significantly different than the values reported in Table ES.6 for this sequence.

The environmental source terms calculated by MELCOR for the station blackout sequences were also compared to STCP results obtained for the NUREG-1150 calculation. MELCOR calculated smaller releases than the STCP calculations.

Table ES.2. Best-estimate source terms released into containment for the station blackout with a dry cavity

		PHASE	GAP RELEASE	EARLY IN-VESSEL	EX-VESSEL	LATE IN-VESSEL	TOTAL
	Duration,	min	29	164	495	495	688
		h	0.5	2.72	8.25	8.25	11.5
Class	Elements	Inventory (kg)	Fraction	Fraction	Fraction	Fraction	Fraction
1	Noble gases	463.70	0.0216	0.9480	0.0291	0	0.9987
2	Cs	246.30	0.0276	0.4336	0.0281	0.1136	0.6029
3	Ba, Sr	207.52	0	0.0334	0.3518	0.0026	0.3878
4	I	20.93	-	-	-	-	-
5	Te	40.78	0	0.1000	0.2540	0.0023	0.3563
6	Ru	306.99	0	0.0015	0	0.0011	0.0026
7	Mo	350.64	0.0003	0.0400	0.0106	0	0.0509
8	Ce	593.65	0	0	0.0010	0	0.0010
9	La	571.03	0	0	0.0590	0	0.0590
10	U	132,390.00	0	0	0.0009	0	0.0009
11	Cd	1.41	0.0005	0.1514	0.0425	0	0.1944
12	Sn	8.59	0.0005	0.1555	0.0662	0	0.2222
13	B	-	-	-		-	-
14	H_2O	-	-	-		-	-
15	Concrete[a]	-	-	-	[a]	-	-
16	CsI	42.06	0.0123	0.4494	0.0114	0.1196	0.5927

[a]A total of 933 kg of non-radioactive compounds are released from core-concrete interaction during the ex-vessel release phase.

Table ES.3. Best-estimate in-containment source terms by release phase for the station blackout with a flooded cavity

		PHASE	GAP RELEASE	EARLY IN-VESSEL	EX-VESSEL	LATE IN-VESSEL	TOTAL
	Duration,	min	30	164	495	495	688
		h	0.5	2.7	8.25	8.25	11.5
Class	Elements	Inventory (kg)	Fraction	Fraction	Fraction	Fraction	Fraction
1	Noble gases	463.70	0.0322	0.9353	0.0321	0	0.9996
2	Cs	246.40	0.0381	0.4479	0.0536	0.1000	0.6396
3	Ba, Sr	207.52	0.0005	0.0335	0.2530	0.0100	0.2970
4	I	20.93	-	-	-	-	-
5	Te	40.78	0	0.1000	0.1235	0.0015	0.2250
6	Ru	306.99	0	0.0015	0	0.0006	0.0021
7	Mo	350.64	0.0002	0.0400	0.0016	0	0.0418
8	Ce	593.65	0	0	0	0	0
9	La	571.03	0	0	0.0129	0	0.0129
10	U	132,390.00	0	0	0	0	0
11	Cd	1.41	0.0011	0.1514	0	0	0.1525
12	Sn	8.59	0.0011	0.1554	0	0	0.1565
13	B	-	-	-	-	-	-
14	H_2O	-	-	-	-	-	-
15	Concrete[a]	-	-	-	[a]	-	-
16	CsI	42.85	0.0197	0.4420	0.0836	0.1000	0.6453

[a]A total of 1,127 kg of non-radioactive compounds are released from core-concrete interactions during the ex-vessel release phase.

Table ES.4. Best-estimate in-containment source terms by release phase for the design LOCA without ECCS

		PHASE	GAP RELEASE	EARLY IN-VESSEL	EX-VESSEL	LATE IN-VESSEL	TOTAL
	Duration,	min	20	27	723	723	770
		h	0.33	0.46	12	12	12.8
Class	Elements	Inventory (kg)	Fraction	Fraction	Fraction	Fraction	Fraction
1	Noble gases	463.70	0.0500	0.7323	0.1190	0.0946	0.9959
2	Cs	246.30	0.0561	0.2143	0.1100	0.4045	0.7849
3	Ba, Sr	207.52	0.0002	0.0351	0.1921	0.0060	0.2334
4	I	20.93	-	-	-	-	-
5	Te	40.78	0	0.0050	0.2509	0.0072	0.2631
6	Ru	306.99	0	0.0011	0	0.0003	0.0014
7	Mo	350.64	0.0002	0.0201	0.0114	0.0073	0.0390
8	Ce	593.65	0	0	0.0002	0	0.0002
9	La	571.03	0	0	0.0530	0	0.0530
10	U	132,390.00	0	0	0.0021	0	0.0021
11	Cd	1.41	0.0009	0.1071	0.0435	0	0.1515
12	Sn	8.59	0.0009	0.1071	0.0725	0	0.1805
13	B	-	-	-	-	-	-
14	H_2O	-	-	-	-	-	-
15	Concrete[a]	-	-	-	[a]	-	-
16	CsI	42.75	0.0328	0.2183	0.1170	0.4226	0.7907

[a]A total of 971 kg of non-radioactive compounds are released from core-concrete interactions during the ex-vessel release phase.

Table ES.5. Comparison of the total in-containment source terms of Draft NUREG-1465 with the three sequences analyzed

Fission product	Draft NUREG 1465	SBO Dry cavity	SBO Flooded	LOCA	Comments
Noble gases	1.0	1.0	1.0	1.0	Good agreement
I	0.71	0.6	0.64	**0.79**	LOCA highest
Cs	0.68	0.6	0.65	**0.78**	LOCA highest
Te	**0.50**	0.36	0.23	0.26	Draft NUREG-1465 highest
Sr	0.27	**0.39**	0.3	0.23	SBO/Dry highest
Ba	0.24	**0.39**	0.3	0.23	SBO/Dry highest
Ru	**0.011**	0.0026	0.0021	0.0014	Draft NUREG-1465 highest
La	0.019	**0.06**	0.0129	0.053	SBO/Dry highest
Ce	**0.012**	0.0010	0	0.0002	Draft NUREG-1465 highest
Non-radioactive (kg)	6,380	933	971	1,127	Draft NUREG-1465 highest

Note: The largest value for each fission product is shown in **bold**.

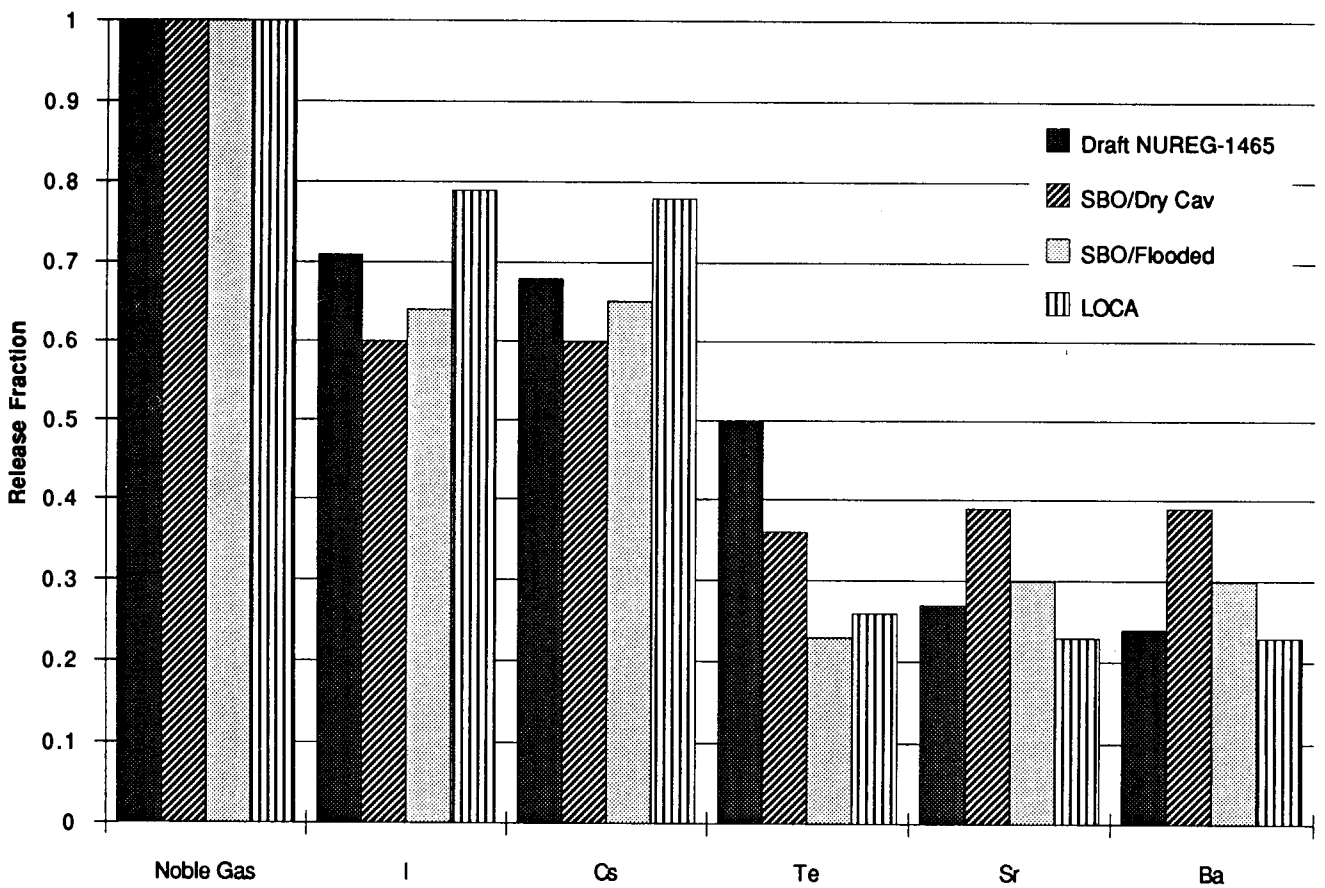

Figure ES.1 **Comparison of the total in-containment release fractions of Draft NUREG-1465 with MELCOR results for the three sequences analyzed**

Table ES.6. Source terms released into the environment for the three sequences analyzed at the end of the calculations (13 h)

Class	Element	Station Blackout dry cavity	Station Blackout flooded cavity	LOCA
1	Noble gases	0.06	0.889	0.033
2	Cs	0.0097	0.0013	0.0165
3	Ba, Sr	0.0005	2×10^{-6}	0.0002
4	I	-	-	-
5	Te	0.0066	0.0004	0.005
6	Ru	3×10^{-8}	6×10^{-7}	2×10^{-8}
7	Mo	0.0003	2×10^{-6}	0.0002
8	Ce	10^{-7}	2×10^{-9}	7×10^{-8}
9	La	4×10^{-7}	5×10^{-9}	2×10^{-7}
10	U	10^{-7}	3×10^{-9}	4×10^{-6}
11	Cd	2×10^{-5}	10^{-6}	7×10^{-5}
12	Sn	7×10^{-5}	10^{-6}	0.0005
16	CsI	0.0075	0.0013	0.017
Containment failure location and time (min)		Head flange seals 548	Wetwell air space 617	Head flange seals 264

1 Introduction and Background

The United States Nuclear Regulatory Commission (USNRC) is currently pursuing several activities involving regulatory implementation of updated source term information. These activities are intended to produce a more realistic severe accident source term for licensing nuclear power plants than the current source term based on the 1962 report TID-14844 (Ref. 1) and current licensing assumptions which are contained in NRC's Regulatory Guides 1.3 and 1.4 (Refs. 2 and 3). New source term information has been reported in Ref. 4 and has been used by the NRC as the basis for revised source terms.[5] The work in Ref. 4 is based largely upon calculations using the Source Term Code Package (STCP),[6] supplemented by some MELCOR[7] calculations as well as NUREG-1150 (Ref. 8) expert elicitations.

However, the STCP[6] as a package is ten years old. The state-of-the art technology for integrated severe accident calculations is the MELCOR program,[7] which has been the "flagship" code of the NRC for the last four years. The amount of information provided by MELCOR calculations to date has been very limited compared to the amount of information available from STCP calculations.[4]

This document presents a comparison of the results of BWR severe accident timing and source term calculations performed with the MELCOR code and similar STCP analyses from NUREG-1150. The results of this effort will provide additional insight for revision of NRC source terms.

2 Objective and Approach

2.1 Objective and Scope

The objective of this work is to calculate and compare MELCOR's best-estimate source terms for three severe accident sequences at the Peach Bottom Atomic Power Station, with NUREG-1150 results for similar sequences. The source terms include fission products and other materials such as those generated by core-concrete interactions. In addition to calculating the source terms which enter the containment and which are released to the environment, the timing of the events in the severe accident sequences were also calculated.

The three severe accident sequences analyzed are two low-pressure, short-term station blackouts (one with a dry cavity, the other with a flooded cavity) and a beyond design basis loss-of-coolant accident (LOCA) in which the emergency core cooling system (ECCS) does not function. The station blackout sequences assume that all AC and DC power is lost except for the DC power needed to actuate the automatic depressurization system (ADS) and the safety relief valves (SRVs). None of the emergency cooling systems are operational. Manual operation of the ADS is used to depressurize the reactor in conformance with Rev. 3 of the BWR Owner's Group Emergency Procedures Guidelines (EPGs)[9] for steam cooling. Revision 3 of the EPGs states that ADS actuation should be initiated when the water level in the core is about 1/3 of the active core height. Peach Bottom currently uses procedures based on EPGs Rev. 4.

The LOCA severe accident sequence assumes a double-ended guillotine break of one of the recirculation pump lines concurrent with complete failure of all the ECCS. Since the reactor vessel is not reflooded, core melting and vessel failure occur.

2.2 Approach

The MELCOR severe accident code, version 1.8.1 (Ref. 7), was used to perform these source term calculations. The MELCOR code is being developed and enhanced by Sandia National Laboratories (SNL) for the USNRC. Three versions of MELCOR 1.8.1 were used in the calculations of this report: HN, IR, and KH.

MELCOR is a fully integrated computer code that models the progression of severe accidents in nuclear power plants using Light Water Reactors (LWRs). MELCOR has been developed as a second generation PRA tool and is the successor to the STCP.[6] The entire spectrum of severe accident phenomena, including vessel and containment thermal-hydraulic response, core heatup, degradation, and relocation, and radionuclide release and transport, is treated in MELCOR in a unified code framework for both BWRs and PWRs. The development emphasis for MELCOR has been focused on building a reasonably fast-running code capable of being used in parametric studies with detailed mechanistic modeling where possible.

Release of fission products from the fuel is determined by application of CORSOR or CORSOR-M models as specified by the user. A dynamic surface-to-volume ratio can also be applied to either model to account for changes in the core geometry. Released fission products may exist as vapors, aerosols, or both, depending on the material's vapor pressure. If the vapor mass is greater than the saturation value for the fission product vapor, the excess vapor mass is converted to aerosol mass.

MELCOR contains a number of physics packages or modules which model essential phenomena and plant features. Key packages include those modeling control volume thermodynamics and hydrodynamics, heat sink structure thermal response, core heatup and degradation, reactor cavity interactions (i.e., core-concrete interaction using CORCON-MOD2), and radionuclide behavior.

Thermal-hydraulic behavior is modeled in MELCOR in terms of control volumes and flowpaths in the Control Volume Hydrodynamics (CVH) and the Flow Path (FL) Packages. No formal distinction is made between the Reactor Coolant System (RCS) and the containment volumes; the same models and solution algorithms are used for both and the resulting equations are solved simultaneously.

The Core Package calculates the thermal response of structures in the core and lower plenum. This package treats all important models of heat transfer within the core, as well as oxidation, debris formation, and relocation of core and structural materials during melting, candling, and slumping. Lower head heatup, failure, and debris ejection are also modeled. For the debris in the lower plenum, once the core plate fails and debris relocates to the lower plenum, failure of the vessel penetration occurs almost immediately as the debris transfers all its decay heat to the penetration and to the lower head. Debris heat transfer to other structures in the lower plenum or debris quenching by the water in the lower plenum is not considered. Consequently, vessel failure is predicted by MELCOR almost immediately after core plate failure occurs. The Core Package represents a significant improvement in modeling capabilities over the models in the STCP, especially in the area of core relocation. However, the MELCOR Core model still has deficiencies, specifically in treating debris relocation in the lower plenum. For this reason, an enhanced model for debris interactions in the lower reactor vessel plenum (termed the "CORBH Package)"[10-12] has been developed by Oak Ridge National Laboratory (ORNL) for the USNRC, and has been interfaced with the MELCOR code to form the MELCOR/ CORBH Package. This Package has a more realistic model of the molten core/debris behavior in the lower plenum than the MELCOR Core model and is believed to provide more realistic estimates

for the timing of reactor vessel failure. The MELCOR/CORBH Package was used to calculate best-estimates times for the events in the severe accident sequence analyzed.

The aerosol dynamics portion of MELCOR is based on the MAEROS computer code. MELCOR does not calculate resuspension of deposited aerosol mass. Vapor condensation and evaporation on heat structures and aerosol surfaces are evaluated by the same models as in TRAP-MELT3.

For ex-vessel release of radionuclides, the VANESA model has been implemented in MELCOR and has been coupled to CORCON-MOD2 for each time step.

2.3 Previous Work

Source term calculations have been performed in the past for the Peach Bottom Plant.[13-16] However, all the calculations have been performed with the Source Term Code Package (STCP)[6] or its components (stand-alone) codes. One previously analyzed station blackout is similar in that it is a short-term station blackout with a depressurized reactor vessel due to a stuck open safety relief valve.[13,14]

One calculation for the same low-pressure short-term station blackout sequence of the Peach Bottom Plant was completed in the past[17] using the BWRSAR[18,19] and the CONTAIN[20] codes. These codes did not calculate source terms, but only the timing of significant events (vessel failure, containment failure, etc.). A comparison of the MELCOR and BWRSAR/CONTAIN calculations is presented in Chap. 5 and in Appendix A (Sect. A.3 and Table A.3).

3 Description of Peach Bottom Atomic Power Station

3.1 General Plant Description

The Peach Bottom Atomic Power Station, Unit 2, is a BWR-4 with a Mark I containment design, referred to as an inverted light bulb (drywell) and torus (wetwell) as illustrated in Fig. 3.1. The drywell and wetwell or torus are made of steel, with an internal design pressure of 56 psig (0.485 MPa). The estimated failure pressure is 159 psig (1.2 MPa), significantly higher than the design pressure (Sect. 3.3). Containment failure criteria and containment failure modes will be discussed more fully in Sect. 3.3. The reactor coolant system design is the BWR-4. The thermal power is 3,293 MW(t) and the net electrical output is 1,065 MW(e) with a power density of 50.7 kW/L. The core contains 764 fuel bundles and 185 control rods. The free volumes in the drywell and wetwell are 169,500 ft^3 (4,777 m^3) and 112,000 ft^3 (3,170 m^3), respectively. The total volume of the wetwell (torus) is 252,000 ft^3 (7,132 m^3). About half of this volume is occupied by water.

The primary containment structure in the Peach Bottom plant is enclosed by a reactor building. Leakage from the primary containment may be filtered by the Standby Gas Treatment System (SGTS) in the reactor building before being released to the environment. In the accident sequences studied in this report, it is assumed that the Standby Gas Treatment System is not operational.

The secondary containment (reactor building) has five different floors (Fig. 3.1). The lowest floor is the building basement where the torus room is located. The highest floor, at elevation 234 ft, is the refueling bay. The secondary containment affects the source terms released into the environment as the leakage from the primary containment passes through the secondary containment before entering the environment.

The Safety Relief Valves (SRVs) and the Automatic Depressurization System (ADS) play an important role in the sequence of events of the station blackout. The SRVs vent steam from the reactor vessel into the wetwell. Each SRV is located on a steam header attached to the main steam lines leaving the reactor vessel. The Peach Bottom Plant has a total of eleven SRVs and two spring safety valves. Data for the SRVs are shown in Table 3.1. The eleven SRVs have different opening and closing pressures; they open automatically when the opening pressure is reached. They also close automatically when the closing pressure in the vessel is reached. SRV No. 1 opens at the lowest pressure (1,115 psia or 7.687 MPa); SRV No. 11 opens at the highest pressure [1,141 psia (7.867 MPa)]. The eleven SRVs are distributed into three banks of four, four, and three SRVs each, respectively. The two remaining spring safety valves have an automatic opening pressure of 1,245 psia (8.555 MPa). Consequently, the spring safety valves will only open at high pressures after all the SRVs are already open. The spring safety valves close at a low pressure of 1,053 psia (7.260 MPa).

The SRVs can also be opened manually at a pressure below the automatic set point. The ADS is fully described in Sect. 3.2. ADS actuation automatically opens five SRVs (Nos. 1, 2, 3, 5, and 6 of Table 3.1) that discharge symmetrically into and around the torus below the suppression pool water level.

The model of Peach Bottom used by the MELCOR Code is described in Chap. 4.

3.2 The Automatic Depressurization System (ADS)

The purpose of the ADS is described in this section. After the station blackout is initiated, the reactor is shutdown, the recirculation and feed pumps stop, and the main steam line valves close. The decay heat of the fuel will increase the pressure inside the vessel until the opening pressure of the first SRV is reached. The first SRV opens at 1,115 psia (7.687 MPa) and closes when the pressure drops to 1,052 psia (7.253 MPa) (Table 3.1). If the steam flow through this SRV, about 865,000 lb/h (109 kg/s), is sufficient to stop the reactor vessel pressure increase, a second SRV will not be needed. If this automatic procedure is left undisturbed, the same SRV will continuously cycle with the disadvantage of releasing all the steam to the same point in the wetwell and unequal heating of the wetwell water will occur. In addition, the risk of that SRV sticking open is increased. In order to avoid these problems, *manual operation* of the SRVs is mandated in the Peach Bottom plant-specific operating procedures. These procedures were obtained for the Peach Bottom Unit 2 from Philadelphia Electric Company. The procedures keep the vessel pressure between 945 and 1,045 psia (6.49 and 7.18 MPa) by opening a *different* SRV each time. By doing this, a more even wetwell water temperature distribution is obtained. In this procedure, the SRV is manually opened at a pressure of 945 psia, a value well below the automatic opening point of the first SRV (1,115 psia). Therefore, manual operation of the SRVs will prevent pressure-initiated operation of the SRVs.

SRV actuation releases the steam produced in the vessel by the decay heat of the fuel. Since water is being vaporized in this process, the water level in the vessel drops. Eventually, the water level in the vessel will drop below the top of the core. Once the core is uncovered, core heatup and core damage will occur.

The purpose of vessel depressurization is to delay fuel heat-up by "steam cooling" uncovered portions of the core. The steam is produced by vaporization/flashing of some of the water when it is depressurized. The timing of the initiation of this depressurization for "steam cooling" is very important in the accident progression. If the

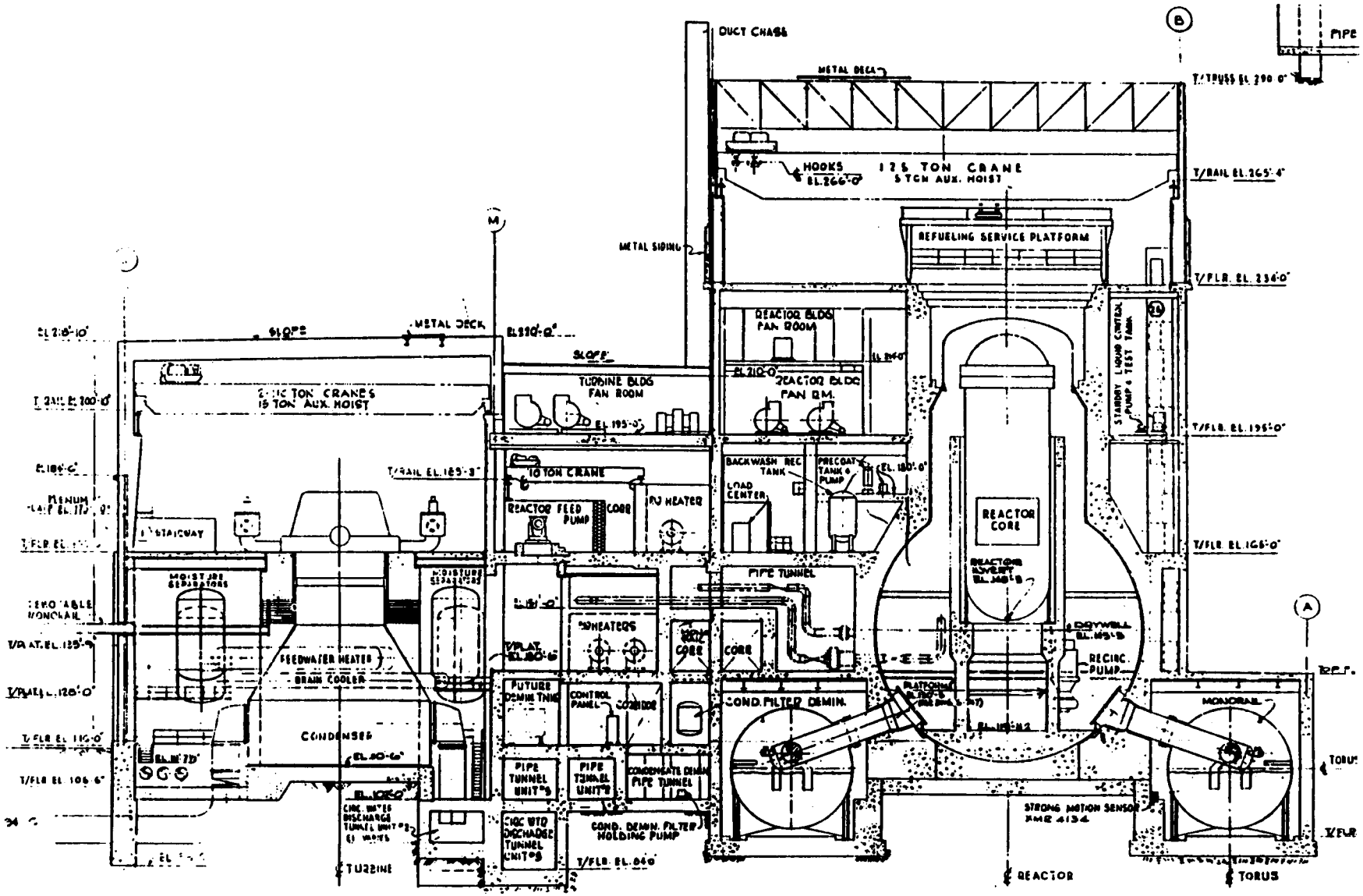

Figure 3.1 Sectional view of the Peach Bottom Atomic Power Station

Table 3.1. The Peach Bottom Safety Relief Valve characteristics

Valve No.	Bank No.	Opening press. [psia	(MPa)]	Closing press. [psia	(MPa)]	Rated flow [lb/h	(kg/s)]	Rated press. [psia	(MPa)]	Rated density [lb/cu. ft	(kg/m³)]	ADS
1	1	1,115.0	(7.687)	1,052.0	(7.253)	865,000.0	(109)	1,120.0	7.722	2.5469	(40.8)	yes
2	1	1,118.0	(7.708)	1,030.0	(7.101)	865,000.0	(109)	1,120.0	7.722	2.5469	(40.8)	yes
3	1	1,120.0	(7.722)	1,042.0	(7.184)	865,000.0	(109)	1,120.0	7.722	2.5469	(40.8)	yes
4	1	1,125.0	(7.756)	1,014.0	(6.991)	865,000.0	(109)	1,120.0	7.722	2.5469	(40.8)	no
5	2	1,126.0	(7.763)	1,023.0	(7.053)	873,000.0	(110)	1,130.0	7.791	2.5729	(41.2)	yes
6	2	1,130.0	(7.791)	1,062.0	(7.322)	873,000.0	(110)	1,130.0	7.791	2.5729	(41.2)	yes
7	2	1,131.0	(7.797)	1,042.0	(7.184)	873,000.0	(110)	1,130.0	7.791	2.5729	(41.2)	no
8	2	1,135.0	(7.825)	1,051.0	(7.246)	873,000.0	(110)	1,130.0	7.791	2.5729	(41.2)	no
9	3	1,138.0	(7.846)	1,072.0	(7.391)	880,000.0	(111)	1,140.0	7.860	2.5996	(41.6)	no
10	3	1,140.0	(7.860)	1,032.0	(7.115)	880,000.0	(111)	1,140.0	7.860	2.5996	(41.6)	no
11	3	1,141.0	(7.867)	1,060.0	(7.308)	880,000.0	(111)	1,140.0	7.860	2.5996	(41.6)	no

depressurization is initiated when the core is still covered with water, or when the uncovered portion of the core is not very hot, vaporization of the coolant will not provide effective cooling. In this case, some of the water inventory will be lost during the depressurization without benefit. On the other hand, if depressurization is initiated later in the transient when the core is uncovered and very hot, the flow of steam from depressurization may increase Zircaloy oxidation (with the "run-away" Zircaloy-steam reaction) increasing the fuel and cladding temperature instead of providing cooling.

During a short-term station blackout, all coolant injection systems and all AC power are lost. Emergency Procedure Guidelines (EPGs) outline the sequence of operations to be performed during an emergency situation. The last revision of these EPGs, Rev. 4 (Ref. 21), specifies steam cooling of the core to be initiated via ADS actuation when the core water level is about 2/3 of the active core height. A previous revision of the EPGs, Rev. 3 (Ref. 9), indicated that during the same emergency situation, steam cooling of the core should be initiated when the core water level is about 1/3 of the active core height. Revision 3 of the EPGs has a two-step maneuver for ADS actuation. First, when the reactor vessel water level has fallen to 1/3 of the active core height, one SRV is manually open. As a result of this open SRV, the vessel pressure decreases. When the vessel pressure reaches 715 psia (4.9 MPa) the ADS is actuated and the reactor vessel is depressurized resulting in steam cooling. The time difference between these two steps (one SRV open and ADS actuation) is very small, typically only a few minutes. It was concluded in a previous study (Ref. 22, pp. 29-30 and Ref. 23, pp. 19-21 and 226) using the BWRSAR code[18,19] that ADS actuation at the time indicated by Rev. 3 of the EPGs delays the accident progression relative to the earlier ADS actuation indicated by Rev. 4 of the EPGs. The benefits of the later ADS actuation were identified as: (a) later initiation of core relocation, (b) less in-vessel hydrogen production, and (c) longer time to vessel failure. On February 14, 1990, ORNL presented these results to the NRC and the BWR Owner's Group (BWROG). The BWROG is currently considering incorporation of these findings in future EPGs revisions.[24]

Revision 5 of the EPGs is anticipated to be similar to the previous Rev. 3 of the EPGs but with only one step for ADS actuation (the SRV actuation will be eliminated) when the core water level is at 1/3 of the active core height. This one-step ADS actuation is used in the MELCOR model in this study in anticipation of the future release of Rev. 5 of the EPGs. Furthermore, this single-step ADS actuation is also a good approximation of Rev. 3 of the EPGs.

The effect of the ADS actuation timing on the accident progression has also been studied with the MELCOR code and the result of this study are presented in Appendix A.

3.3 Containment Failure Modes

There are basically three different failure modes of the Peach Bottom Mark I containment. These failure modes are: (1) by high pressure-induced primary containment liner failure, (2) by high temperature degradation of the drywell head flange seals, and (3) by liner melt-through (or creep rupture) when hot debris in the cavity contacts the drywell liner.

The first failure mode (high pressure inside the primary containment) has been considered historically to be the dominant primary containment failure mode. There have

been, however, different opinions on the pressure and location of this failure. The Reactor Safety Study,[25] indicated that the most likely location of primary containment over-pressurization failure would be in the torus air space (wetwell) region of the containment at a pressure of 160 psig (1.2 MPa). After containment failure, a path from the wetwell to the torus room (Fig. 3.2) in the basement of the reactor building would be established. The torus room would then leak into the reactor building and from there into the environment.

An analysis[23] of the Browns Ferry containment indicated that the failure of the primary containment by overpressure is in the drywell rather than in the wetwell. According to this analysis, the failure pressure is 117 psig (0.8 MPa) and the failure location is the intersection of the spherical and cylindrical portions of the primary containment (Fig. 3.2). After drywell failure, a path connecting the drywell with the reactor building (Fig. 3.2) is established. Thereafter, leakage from the primary containment must flow through the reactor building before reaching the outside environment.

This primary containment pressure and location failure has been used in past studies of the Peach Bottom Atomic Power Station (Refs. 15 and 16). Although the Browns Ferry Plant also has a Mark-I containment very similar to Peach Bottom, there are significant differences between both containments. For instance, the wetwell torus walls at Browns Ferry are thicker than those at Peach Bottom. Consequently, this Browns Ferry analysis[26] is not applicable to Peach Bottom. Containment failure location and pressure are, therefore, plant-dependent.

A more recent structural analysis by the Chicago Bridge and Iron Company[27] performed for the specific geometry of the Peach Bottom Mark-I containment, indicated that the primary containment will fail by high pressure in the upper region of the wetwell at a high pressure of 159 psig (1.2 MPa). This recent result agrees well with the previous result of the Reactor Safety Study.[25] This failure pressure and location has been used for the "containment failure mode 1" of this study. The resulting breach opening area has been assumed to be 1 ft^2 (0.1 m^2).

The second mode of primary containment failure in Mark-I containments is by failure of the drywell head flange seals as confirmed by analyses performed by Chicago Bridge and Iron Company[27] for the Peach Bottom Mark-I containment. The containment fails in this mode by a combination of high temperature and moderate pressure. The high temperature degrades the seals first, then the pressure lifts the head from the drywell and leakage can occur. The Idaho National Laboratory and Sandia National Laboratories have conducted thermal performance tests of different seals

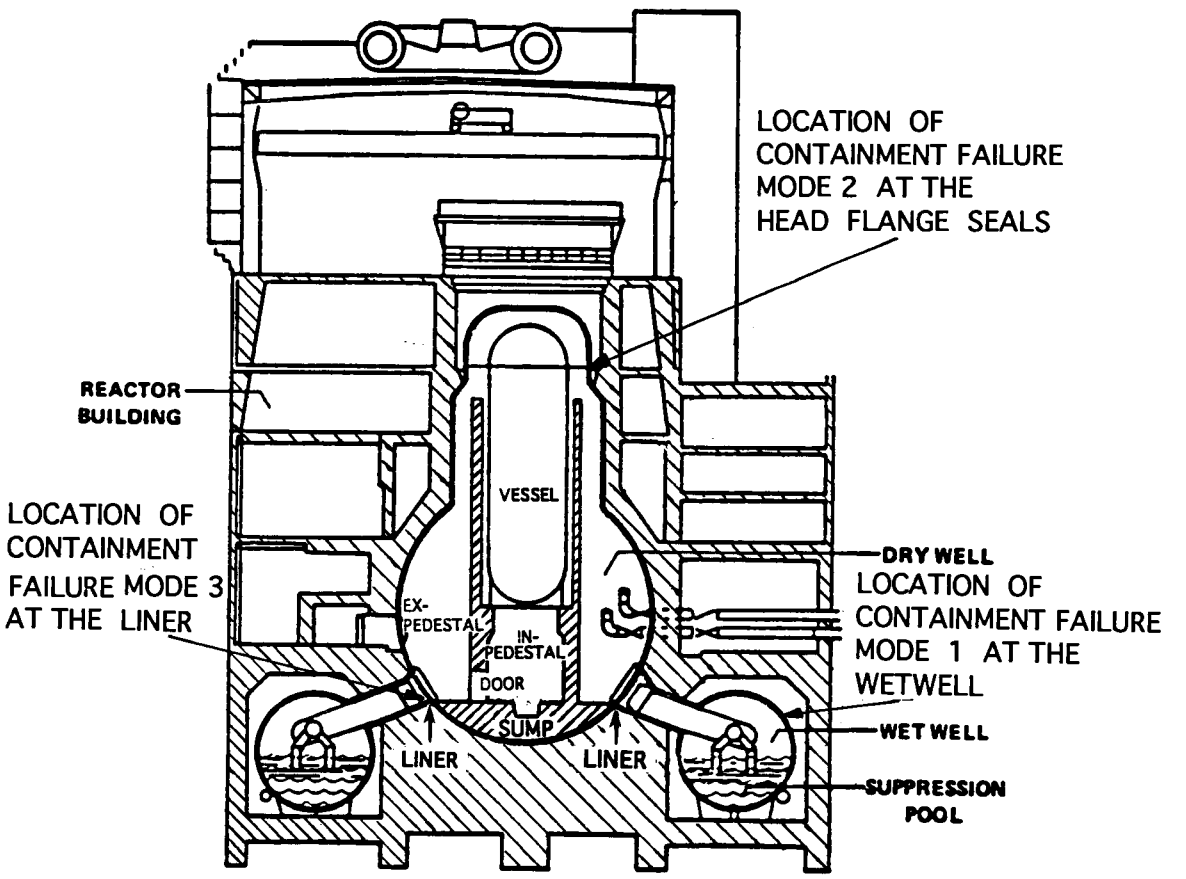

Figure 3.2 **Peach Bottom containment failure modes and cavity view**

used in BWRs.[28,29] The experiments indicated that these seals sustain a permanent loss of their elasticity and structural integrity when subjected to temperatures above 700°F (371°C or 644 K). According to Ref. 27, once the seals lose their structural integrity, leakage will start when the pressure differential across the seals reaches 82 psid (0.565 MPa). These analyses were performed for the actual geometry at Peach Bottom. The actual flow area available for leakage through this path is a function of the drywell pressure. It is assumed that the open flow area increases linearly from 0 ft^2 (0 m^2) at 82 psid (0.565 MPa) to 0.43 ft^2 (0.04 m^2) at 200 psid (1.378 MPa). As already explained, once the seals are degraded by high temperature, leakage will occur if the drywell pressure is above 82 psid (0.565 MPa), even if the temperature of the seals drops below the degrading temperature of 700°F (644 K).

The leakage path for the head flange seal failure mode connects the drywell with the refueling bay above the drywell (Fig. 3.2). At Peach Bottom, the refueling bay will leak directly into the environment. Although this leakage path is a more direct route into the environment than the path for failure by high pressure in the wetwell (failure mode 1), the leakage area is small and a function of both the pressure differential across the seals and the leakage area around the drywell shield plugs. Leakage will start above 82 psid (0.565 MPa) with a very small leakage area. The higher the pressure differential, the larger the leakage area. However, as leakage starts, the drywell pressure will stabilize at a value not much higher than 82 psid (0.565 MPa differential) or 97 psia (0.666 MPa, absolute). This normally results in small leakage areas, as the flow area is a function of the pressure over 82 psid (0.565 MPa). For instance, for a drywell pressure of 105 psid (0.721 MPa), the leakage area is only 15 in^2 or 0.107 ft^2 (0.01 m^2). Consequently, the source term released into the environment is expected to be smaller for this failure mode than for the high pressure-induced wetwell (torus air space) failure (failure mode 1) that has a larger leaking area. Furthermore, it is anticipated that significant amount of particulate removal will occur as the material flows through the cracks between the drywell shield plugs prior to the reaching the refueling bay floor level.

Finally, the third failure mode of the primary containment is by drywell liner failure due to contact with the molten debris in the cavity. The liner may fail by either melt-through or creep-rupture. The melting temperature of the carbon steel liner is about 2,800°F (1,810°K). A lower temperature can produce liner creep-rupture.

There are many studies on Mark-I containment liner melt-through. A number of these studies have been reviewed (Refs. 30-35). Reference 30 states that when the cavity is dry, the probability of liner melt-through after vessel failure is between 0.63 and 1.0. The same reference states that if the cavity is flooded after vessel failure, the probability of liner melt-through is less than 10^{-4}. Nevertheless, there are many variables with high uncertainties that influence the outcome of this event. The occurrence of liner melt-through results from very complex phenomena that are difficult to quantify. This containment failure mode has not been implemented in the MELCOR model of Peach Bottom because of all the associated uncertainties. One of the important reasons for not implementing this failure mode is because MELCOR cannot model the movement of the debris across the cavity floor and cannot predict the debris/liner contact time. (Further details are given in Sect. 4.3.)

3.4 Cavity Description

The Peach Bottom cavity has three well-defined regions: the sump, the in-pedestal and the ex-pedestal regions (Figs. 3.2 and 3.3). The sump region has an horizontal area of about 159 ft^2 (14.6 m^2) and a depth of about 1.3 ft (0.4 m) with a total volume of 206 ft^3 (5.83 m^3). This region is located immediately under the vessel (Fig. 3.3) and it normally will be the first region to be filled with molten debris after vessel failure.

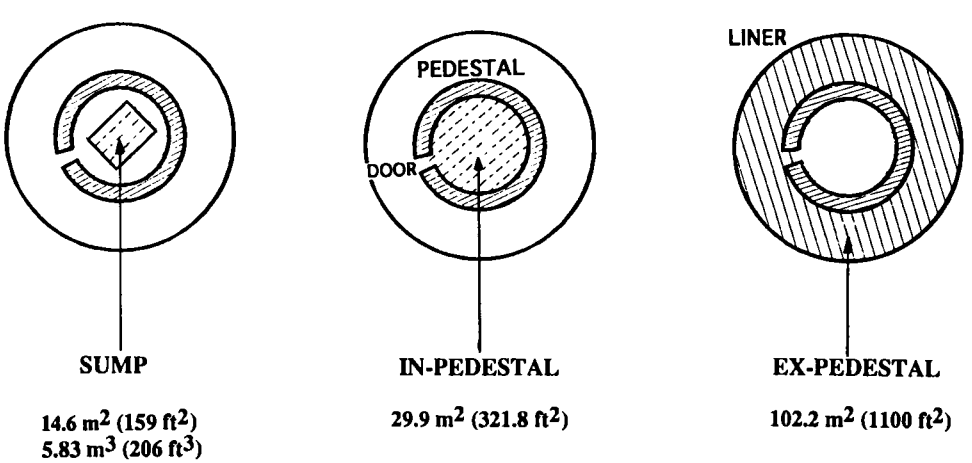

Figure 3.3 Horizontal view of the different regions of the Peach Bottom cavity

Description

The in-pedestal region is the circle inside the pedestal with a horizontal area of 321.8 ft^2 (29.9 m^2) (Fig. 3.3). Once the sump is filled with molten debris, the debris will spread and fill this region. Finally the ex-pedestal region is a circular ring located outside the pedestal with a horizontal area of 1,100 ft^2 (102.2 m^2). The total horizontal area of the in-pedestal and the ex-pedestal regions is 1,421.8 ft^2 (132.1 m^2). The in-pedestal and the ex-pedestal region are connected through an opening with a steel door. When the in-pedestal region is filled with molten debris, the debris will leave through the door (ablated by the debris) into the ex-pedestal region. The drywell liner is located on the periphery of the ex-pedestal region. Once the molten debris spreads out to the periphery of the ex-pedestal region, molten debris will contact the drywell liner. All the cavity floor is horizontal, with the exception of the sump region. The time needed for the molten debris to reach the drywell liner is a function of the debris release rate from the vessel and the debris viscosity. The higher the viscosity of the debris, the longer the time to travel to the liner.

4 Problem Definition and Nodalization

The reactor and containment nodalizations used with the MELCOR code[7] and with the MELCOR/CORBH Package[10-12] are described in this chapter. The initial conditions used with each transient are covered in the chapter which describes each transient. Two different nodalizations were used. One nodalization used a multi-node representation for the drywell and two cavities. The other nodalization was for the MELCOR/CORBH Package with a single-node drywell and one cavity. The multi-node representation of the drywell is described in Sect. 4.1. The nodalization used with the MELCOR/CORBH Package is described in Sect. 4.2. The different cavity nodalizations are described in Sect. 4.3. Finally, fission product modeling is described in Sect. 4.4.

The MELCOR input was created from an input deck received from Brookhaven National Laboratory (BNL). The deck received from BNL was for MELCOR Ver. 1.8.0. The version of MELCOR employed for most of the calculations described here is MELCOR 1.8.1 KH. Consequently, the input deck received from BNL was modified to make it compatible with MELCOR 1.8.1. Other modifications were also required because the original input deck was prepared for a different transient: a long-term station blackout without depressurization. Several initialization parameters (such as the starting time of the calculation, initial containment temperatures, and pressures) had to be modified for each of the severe accident sequences. Models for the ADS and for the SRV manual operation, as well as LOCA flows as required, were added. Additional changes reconciled differences between values in the deck and actual plant values. For instance, the amount of steel in the lower plenum was lower than in the actual plant, the structure surface areas in the lower plenum were larger than actual values at Peach Bottom, and the pressure-induced containment failure (containment failure mode 1 of Sect. 3.3) was changed from the drywell to the wetwell and a failure pressure of 159 psig (1.2 MPa) was used.

4.1 Multi-Node Drywell Representation

This representation uses a total of 22 volumes, six of which correspond to the reactor vessel, 15 correspond to the primary and secondary containment and one volume models the outside environment. The six volumes of the reactor vessel are described in Table 4.1. All the transients analyzed used the same control volumes; the differences between the station blackouts and the LOCA sequences are in the flowpaths of the reactor vessel volumes. Figures 4.1 and 4.2 show the volumes and the flowpaths connecting the volumes in the reactor vessel for the station blackouts and for the LOCA, respectively. Figure 4.1 shows three different flow paths connecting the steam dome of the reactor vessel (Vol. 360) with the wetwell (Vol. 200). These three flowpaths correspond to different modes of operation of the Safety Relief Valves (SRVs). Flowpath 362 models the automatic operation of the SRVs. Flowpath 363 models the ADS, opening five SRVs simultaneously when the water level in the core is at 1/3 of the active core height. Finally, flowpath 364 models the manual operation of one SRV to avoid cycling of the same SRV during automatic operation.

Table 4.1. Reactor vessel volumes

Volume No.	Volume name	Volume [ft^3 (m^3)]
310	Downcomer (Annulus)	6,491 (183.8)
320	Lower plenum	3,655 (103.5)
330	By-pass	911 (25.8)
340	Channel	1,176 (33.3)
350	Shroud dome	1,586 (44.9)
360	Steam dome	7,720 (218.6)

Operation of these three flowpaths is normally exclusive. The automatic operation of the SRVs (flowpath 362) occurs at higher pressures (above 1,115 psia) than the manual operation of the SRVs (flowpath 364) that occurs between 945 psia and 1,045 psia (Sects. 3.1 and 3.2). Manual operation of one SRV is initiated 200 s after the calculation started (as described in Sect. 5.1.1). ADS actuation (flowpath 363) is initiated by core water level (Sect. 3.2). There is a chance that two modes of operation of the SRVs may overlap for a short period of time. However, this overlap did not occur in the station blackouts analyzed here.

Figure 4.1 also shows two different leakage flowpaths: flowpath 370 that corresponds to the recirculation pumps leakage and flowpath 371 that corresponds to the control rod drives leakage. The recirculation pumps leakage (flowpath 370) goes to control volume 100 (the in-pedestal region of the drywell). Since these pumps are located in the ex-pedestal region of the drywell (Vol. 101), it would have been more accurate to discharge this flowpath 370 into Vol. 101. However, since the leakage of these pumps is very small, the effect of this inaccuracy is deemed to be very small also.

Figure 4.2, that applies to the LOCA sequence, does not have flowpaths 363 and 364 because during the LOCA there is no need to depressurize the vessel with the ADS or to manually open one SRV, as the LOCA transient itself depressurizes the reactor vessel. Figure 4.2 also does not have the flowpath 370, leakage from the recirculation pumps. Instead, it has two new flowpaths: 370A and 372 that correspond to the two sides of the double-ended guillotine LOCA. There is an additional flowpath, 311, that models the intact recirculation pump during the coastdown after reactor scram (first 15 s of the transient).

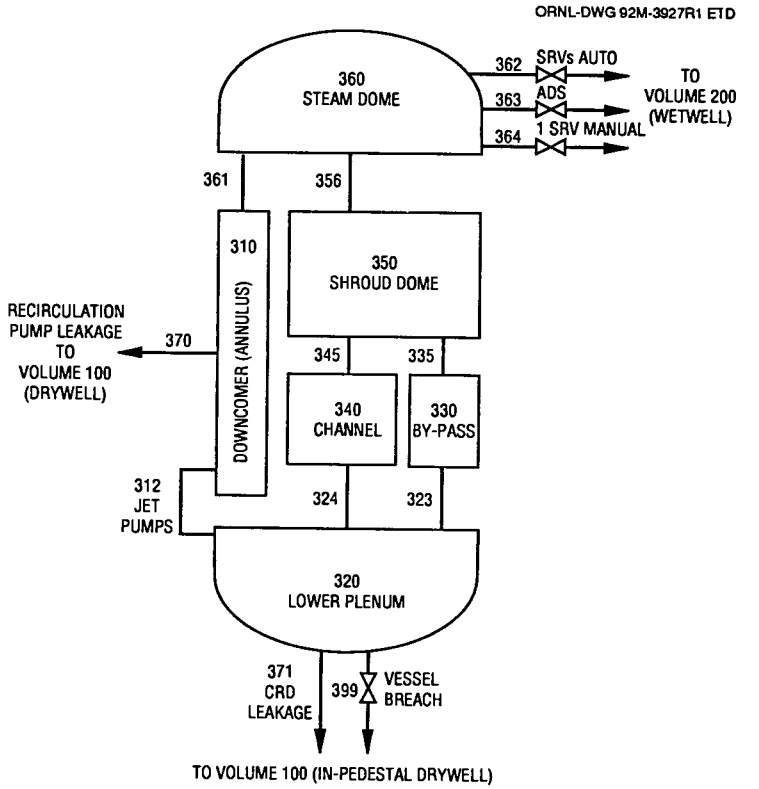

Figure 4.1 **Volumes and flowpaths in the reactor vessel for the station blackout sequences**

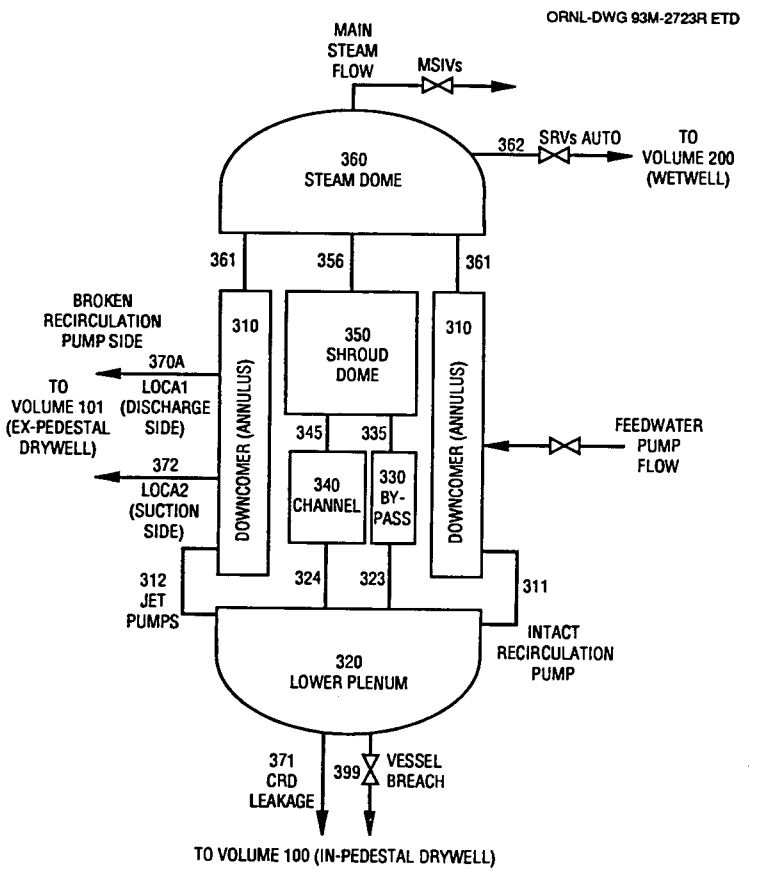

Figure 4.2 **Volumes and flowpaths in the reactor vessel for the LOCA sequence**

Flowpath 312 models the jet pumps of the broken recirculation pump loop. Finally, the steam leaving the dome and the feedwater flow entering the downcomer during the first moments of the transient are modeled using tables of flow versus time in control volumes 360 and 310, respectively.

The 16 volumes of the primary and secondary containment and the environment are described in Table 4.2 and shown in Fig. 4.3. The primary containment is modeled using six volumes: four for the drywell, one for the wetwell and one for the vent legs connecting the drywell and the wetwell. Volume 100 is the drywell volume inside the pedestal. Volume 101 is the drywell volume outside the pedestal but excluding the top part of the drywell. Volume 102 is the top of the drywell where the head flange seals are located. Volume 103 is a long annulus surrounding the reactor vessel. Five flowpaths (numbers 10, 11, 13, 14, and 15) connect these volumes (Fig. 4.3). Flowpaths 398 and 400 model two containment failure modes. Flowpath 398 models the head flange seals failure and connects (after containment failure) Vol. 102 with Vol. 408, the refueling bay. Flowpath 400, containment failure by high pressure at the wetwell (torus air space), connects (after containment failure), Vol. 200 with Vol. 401, the torus room. All the flowpaths are listed in Table 4.3.

In the station blackout with a flooded cavity, one Control Rod Drive Hydraulic System (CRDHS) pump is assumed to start operation *after* vessel failure. The pump injects water into the in-pedestal cavity region. The flow of this pump for pressures under 159 psig is between 170 and 180 gpm (10.7 and 11.3 L/s). This pump is modeled using a table of flow and temperature versus time. The water flow of the pump is added to the existing water pool of Vol. 100 (the in-pedestal drywell region).

The secondary containment uses nine volumes (Fig. 4.3) at five different floors (Fig. 3.1). One volume represents the torus room at the lowest elevation (first floor). The second floor has two volumes (south and north at elevation 135 ft). The next floor is at elevation 165 ft and has two volumes. The turbine building is also at this elevation and has one volume. The next floor is at elevation 195 ft and is also modeled with two volumes. The top floor is the refueling bay at the highest elevation (234 ft) and has one volume.

A total of 40 flowpaths are used; three of them differ depending on the transient, and ten of them have variable flow area (valves) modified by control functions. A list of all the flowpaths used is given in Table 4.3. A total of 34 control functions, 30 tabular functions and 73 heat slabs are used in this model.

The core and lower plenum are nodalized with three radial rings and 11 axial levels (with a total of 33 nodes) as shown in Fig. 4.4. Five axial levels are in the lower plenum, one is the core plate region and the remaining five levels are the active core region. Total masses used are: fuel, 371,435 lbs (168,480 kg), Zircaloy 136,043 lb (61,708 kg), steel (that can melt and relocate) 267,202 lb (121,180 kg), and poison (boron carbide) 3,935 lb (1,785 kg). Three penetrations through the lower head are used, with a total steel mass of 4,656 lb (2,112 kg). The total mass of steel includes the mass of the penetrations, the mass of the structures and control rod guide tubes in the lower plenum, the core plate mass and the steel in the control rods. Other steel present in the vessel that does not melt and relocate (like the vessel itself, the shroud and the steam separators) are considered as heat slabs. The shroud is modeled with eleven heat slabs, one for each axial node of the core and lower plenum and one for the core plate (Fig. 4.4).

The decay heat of the fuel is modeled by a table of decay heat versus time after shutdown. This table predicts accurately the decay heat of the Peach Bottom core. The initial radioactive inventories used are the BWR default values of MELCOR for the first 15 classes. An additional class is used to model the formation of CsI (cesium iodide). (Details about fission products modeling are given in Sect. 4.4.)

Two cavities were used with this model. One cavity, in the in-pedestal region, is in contact with drywell Vol. 100. The second cavity, in the ex-pedestal region, is in contact with drywell Vol. 101. This two-cavity model is further described in Sect. 4.3. The complete MELCOR input for the station blackout sequence with a dry cavity is given in Appendix B and the input for the station blackout with a flooded cavity is presented in Appendix C. There are two files in each Appendix. The first file, a large file that contains all the plant data, is the input file for the MELGEN part of MELCOR. The second file, a very short file that contains mainly run time input data, is the input file for MELCOR. The complete MELCOR input for the LOCA sequence is given in Appendix D. MELGEN and MELCOR files are also provided.

4.2 MELCOR/CORBH Package Nodalization

The MELCOR/CORBH Package[10-12] models the molten debris in the lower plenum in a different way than the MELCOR 1.8.1 code[7] does. The MELCOR/CORBH Package models debris quenching with the water present in the lower plenum. The water in the lower plenum is boiled off by the debris before the debris starts heating and failing the penetrations. The penetrations can be instrument tubes or control rod guide tubes. The time predicted by the MELCOR/CORBH Package for vessel failure is *longer* than the conservative time calculated by the unmodified MELCOR code. MELCOR predicts almost immediate failure of the penetrations once the core debris fails the core plate and reaches the lower plenum.

The additional input required for the MELCOR/CORBH Package[11] was prepared and used with a single-node drywell model of MELCOR and a single cavity. This CORBH input is enclosed in Appendix E. The card COR00009 prevents failure of the penetrations by

Table 4.2. Volumes used in the primary and secondary containment

Volume No.	Volume name	Volume [ft^3 (m^3)]	Volume gas [ft^3 (m^3)]	Volume liquid [ft^3 (m^3)]	Temperature [°F (K)]	Pressure [psia (MPa)]
100	Drywell-In-pedestal	8,546 (242)	8,493 (240.5)	53[a] (1.5)	145 (336)	15.7 (0.108)
101	Drywell-Ex-pedestal	101,618 (2,878)	Full	0[b]	145 (336)	15.7 (0.108)
102	Drywell-Top	36,605 (1,037)	Full	0	145 (336)	15.7 (0.108)
103	Drywell-Annulus	2,788 (79)	Full	0	261 (400)	15.7 (0.108)
150	Vent pipes	19,953 (565)	19,183 (543)	770 (22)	145 (336)	15.7 (0.108)
200	Wetwell	251,880 (7,133)	112,018 (3,172)	139,881 (3,961)	90 (306)	14.4 (0.099)
401	Torus room	191,612 (5,426)	Full	0	90 (306)	14.2 (0.097)
402	South 135 level	182,011 (5,154)	Full	0	82 (301)	14.7 (0.101)
403	North 135 level	182,011 (5,154)	Full	0	82 (301)	14.7 (0.101)
404	South 165 level	83,201 (2,356)	Full	0	80 (300)	14.7 (0.101)
405	Remain 165 level	249,532 (7,066)	Full	0	80 (300)	14.7 (0.101)
406	South 195 level	86,591 (2,452)	Full	0	80 (300)	14.7 (0.101)
407	Remain 195 level	171,840 (4,866)	Full	0	80 (300)	14.7 (0.101)
408	Refueling Bay	1,096,444 (31,048)	Full	0	80 (300)	14.7 (0.101)
409	Turbine Bldg.	5,255,677 (148,825)	Full	0	80 (300)	14.7 (0.101)
410	Environment	3.5×10^{11} (10^{10})	Full	0	80 (300)	14.7 (0.101)

[a]This value is for a dry cavity. For a flooded cavity this liquid volume is 1032.6 ft^3 (29.24 m^3).
[b]This value is for a dry cavity. For a flooded cavity this liquid volume is 2826 ft^3 (80.0 m^3).

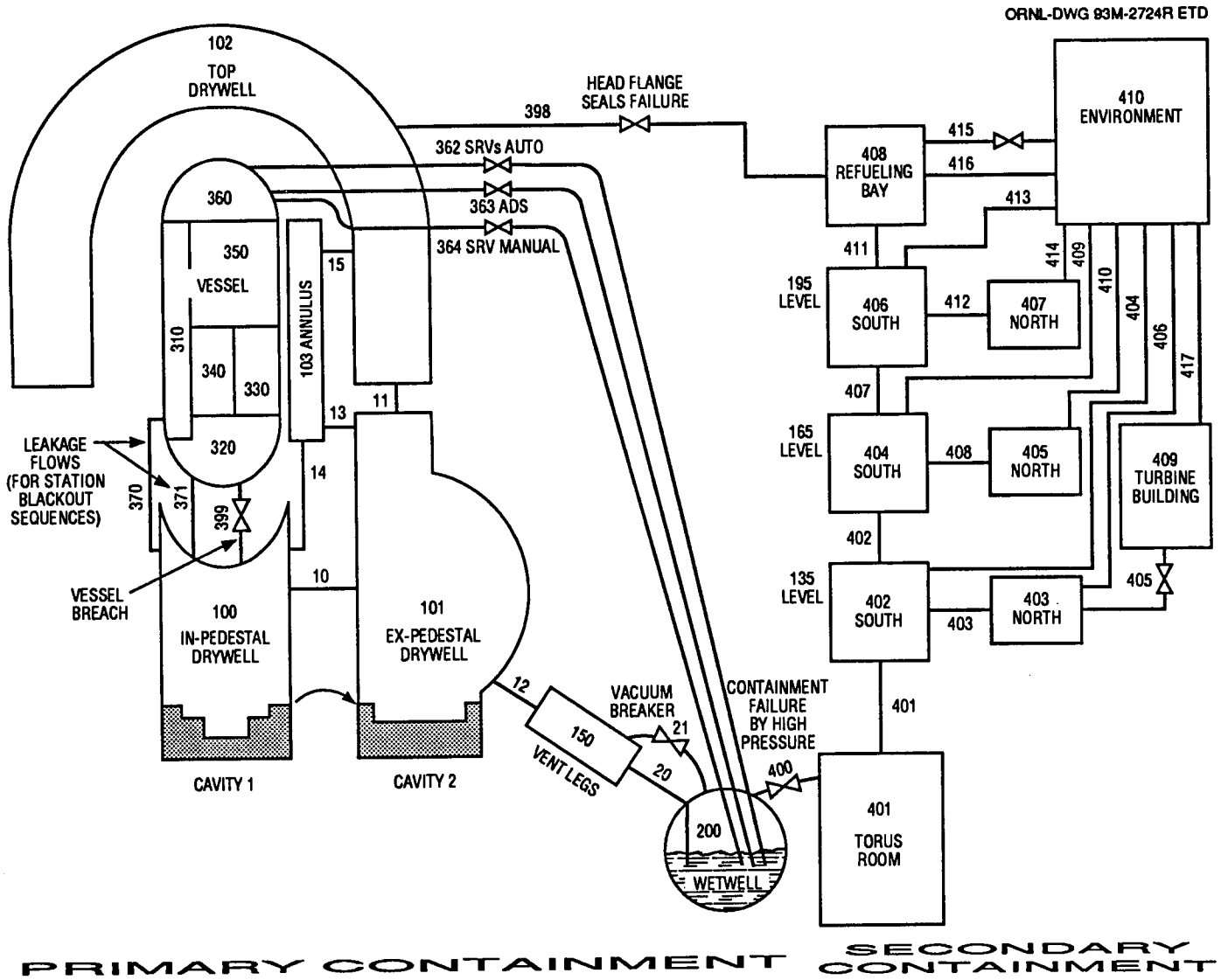

Figure 4.3 Volumes and flowpaths in the primary and secondary containment at Peach Bottom

Table 4.3. Flowpaths used in the MELCOR model of Peach Bottom

Flowpath No.	From volume	To volume	Flowpath name	Area (ft^2)	Fraction open initially	Control function
10	100	101	In-Pedestal to Ex-Pedestal	92.6	1.0	
11	101	102	Ex-Pedestal to Top-Drywell	673.7	1.0	
12	101	150	Vent Opening to Legs	288.5	1.0	
13	101	103	Ex-Pedestal to Annulus	2.3	1.0	
14	100	103	In-Pedestal to Annulus	34.4	1.0	
15	102	103	Top-Drywell to Annulus	56.9	1.0	
20	150	200	Legs Exit	286.3	1.0	
21	200	150	Vacuum Breaker	20.0	0.0	Yes
311[a]	310	320	Intact Recirculation Pump	3.7	1.0	
312	310	320	Internal Jet Pumps	7.3	1.0	
323	320	330	Lower Plenum to Bypass	66.2	0.0129	
324	320	340	Lower Plenum to Channel	85.5	0.6174	Yes
335	330	350	Bypass to Steam Separators	66.2	1.0	
345	340	350	Channel to Steam Separators	85.5	0.6756	
356	350	360	Steam Separators to Dome	51.3	1.0	
361	360	310	Dome to Downcomer	281.0	1.0	
362	360	200	Automatic SRVs	1.3	0.0	Yes
363[b]	360	200	Manual ADS (5 SRVs)	0.5	0.0	Yes
364[b]	360	200	Manual 1 SRV	0.1	0.0	Yes
370[b]	310	100	Leakage of Recirculation Pumps	2.9×10^{-5}	0.5	
370A[a]	310	101	LOCA 1	3.92	1.0	
371	320	100	Leakage of Control Rod Pumps	3.6×10^{-5}	0.5	
372[a]	310	101	LOCA 2	3.92	1.0	
398	100	408	Drywell Head Seals Failure	0.4	0.0	Yes
399	320	100	Vessel Breach	0.1	0.0	Yes
400	200	401	Wetwell Cont. Failure	7.0	0.0	Yes
401	401	402	Torus to Level-135	92.6	1.0	
402	402	404	Level-135 to Level-165	357.4	1.0	
403	402	403	Level-135 South to North	269.0	1.0	
404	402	410	Leak to Environment of Level-135-South	0.3	1.0	

Table 4.3. Flowpaths used in the MELCOR model of Peach Bottom (cont.)

Flowpath No.	From volume	To volume	Flowpath name	Area (ft^2)	Fraction open initially	Control function
405	403	409	Level-135 South to Turbine Bldg.	30.1	0.0	Yes
406	403	410	Leak to Environment of Level-135-North	0.3	1.0	
407	404	406	Level-165 to Level-195-Shaft	357.4	1.0	
408	404	405	Level-165-South to North	471.5	1.0	
409	404	410	Leak to Environment of Level-165-South	0.3	1.0	
410	405	410	Leak to Environment of Level-165-North	0.3	1.0	
411	406	408	Level-195 to Refueling Bay	357.4	1.0	
412	406	407	Level-195-South to North	803.0	1.0	
413	406	410	Leak to Environment of Level-195-South	0.3	1.0	
414	407	410	Leak to Environment of Level-195-North	0.3	1.0	
415	408	410	Blowout Panels of Refueling Bay	240.0	0.0	Yes
416	408	410	Leak to Environment of Refueling Bay	1.2	1.0	
417	409	410	Leak to Environment of Turbine Bldg.	3.1	1.0	

[a]This flowpath is only used in the LOCA sequence.
[b]This flowpath is only used in the station blackout sequences.

reducing the heat transfer between the debris and the penetrations to a very small number, 10^{-4} Btu/h ft^2°F (10^{-3} W/m^2 K) and by increasing the failure temperature of the penetrations to a high value [17,540°F (10,000 K)]. By doing this, the CORBH Package boils the water in the lower plenum before the penetrations fail.

The rest of the input consists of tables of constituents of the debris, eutectic mixtures, free volume versus height, structural volume (steel) versus height, and other variables as required and described in the CORBH user's manual.[11]

4.3 Cavity Model and Nodalization

MELCOR employs the CORCON-MOD2 module to simulate the interaction between core debris and the concrete floor of the primary containment.

The current version of CORCON-MOD2 does not simulate debris spreading through the cavity. Rather, debris ejected from the reactor vessel will spread instantaneously over all the horizontal floor of the cavity, including the in- and ex-pedestal regions (Sect. 3.4). This is not realistic, since some time will be required for the molten debris to reach the periphery of the in-pedestal region, and more time is required to reach the periphery of the ex-pedestal region of the cavity where the liner is located.

This time delay can be crudely represented by using several cavities. In a two-cavity approach, the first cavity represents the sump and the in-pedestal region (Fig. 4.5) and the second cavity represents the ex-pedestal region. Once this first cavity is filled with debris, the debris will start overflowing into the second cavity. Once the second cavity is full, molten debris reaches the top of the cavity wall, and debris contacts the drywell liner (Fig. 4.5). The temperature of the molten debris in the second cavity will determine if liner melt-through or creep failure will occur. Implementation of this model requires the specification of the heights of the cavity walls, h_1 and h_2 (Fig. 4.5). The first height, h_1, controls the time required to fill the first cavity and to start debris pouring into the second cavity (the in-pedestal region of the cavity is full). The second height, h_2, controls the time required for the debris to travel from the door connecting the in-pedestal and ex-pedestal regions of the cavity to the periphery of the

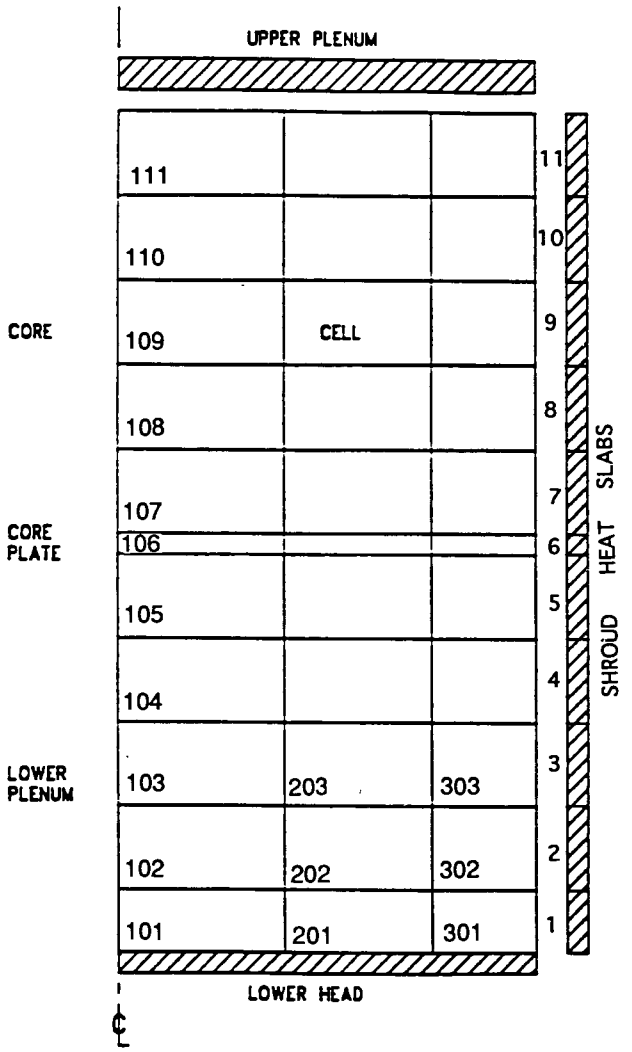

Figure 4.4 Core and lower plenum nodalization

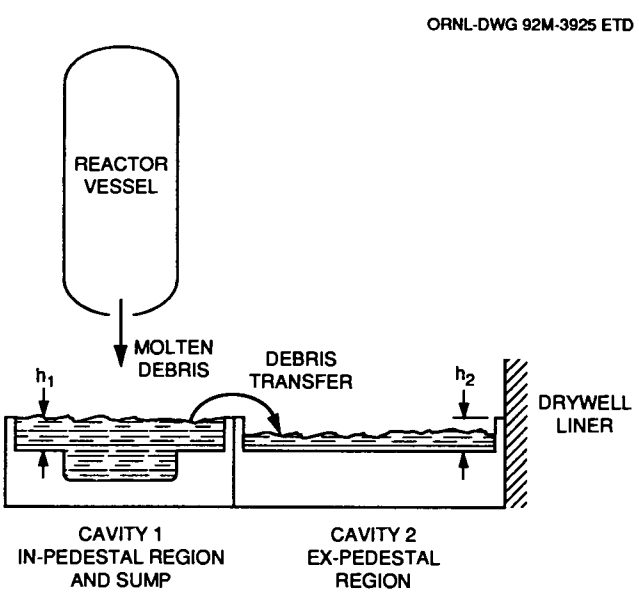

Figure 4.5 Dual-cavity drywell model

ex-pedestal region (where the liner is). This is equivalent to having artificial barriers between both cavities and between the second cavity and the liner. The heights of these barriers are not representative of the actual floor geometry of a horizontal floor at Peach Bottom.

The timing of the contact between the debris and liner depends on the heights of the cavity's walls-parameters which have no physical significance in the Peach Bottom drywell design. This approach does not predict accurately the debris/liner contact time.

Another method of spreading debris across the cavity floor is to employ a sloping floor. Figure 4.6 shows this cavity or drywell floor using cylindrical geometry (the only geometry available in MELCOR/CORCON). First, the sump is modeled with a cylinder 13.5 ft (4.12 m) in diameter and 1.5 ft (0.457 m) deep with a volume of 206 ft^3 (5.8 m^3), the volume of the sump. Outside the sump, the cavity floor slopes slightly. The total cavity horizontal area, a circle of 42.52 ft (12.96 m) in diameter, is 1,421 ft^2 (132 m^2) which is the actual area of the Peach Bottom cavity. The slope taken for the cavity floor is arbitrary, the bigger this slope, the longer the time required for the debris to reach the cavity periphery. The time for the debris to contact the liner predicted by this model is not accurate either as it strongly depends on the cavity floor slope used.

The basic problem is that the current version of CORCON in MELCOR does not have the capability to spread debris across a surface based on viscosity and, therefore, cannot be used to predict drywell liner failure due to debris-liner interaction.

In consideration of these limitations and other uncertainties involved in modeling liner melt-through, this containment failure mode (containment failure mode 3) was not implemented in the MELCOR model of Peach Bottom.

The multi-node drywell model of MELCOR (Sect. 4.1) used a two-cavity model as shown in Fig. 4.5. The two-cavity model, although inaccurate to predict debris/liner contact time, is accurate to predict drywell atmospheric temperatures used in conjunction with a multi-node drywell model. Accurate drywell atmospheric temperatures will result in accurate predictions of drywell head flange seals failure time (containment failure mode 2 of Sect. 3.3). The first cavity of this model, has a radius of 10.12 ft (3.085 m) with a horizontal area of 321.8 ft^2 (29.9 m^2). This first cavity models the in-pedestal region of the drywell floor, including the sump. This first cavity is in contact with the in-pedestal drywell control Vol. 100 (Fig. 4.3). The second cavity models the ex-pedestal region of the drywell floor. The second cavity has a radius of 18.71 ft (5.703 m) and a horizontal area of 1,100 ft^2 (102.2 m^2). The second cavity is in contact with the ex-pedestal region of the drywell, control Vol. 101 of Fig. 4.3. Molten debris from the reactor vessel is ejected into the first cavity. Transfer of molten material from cavity 1 to cavity 2 is initiated by radial rupture of the

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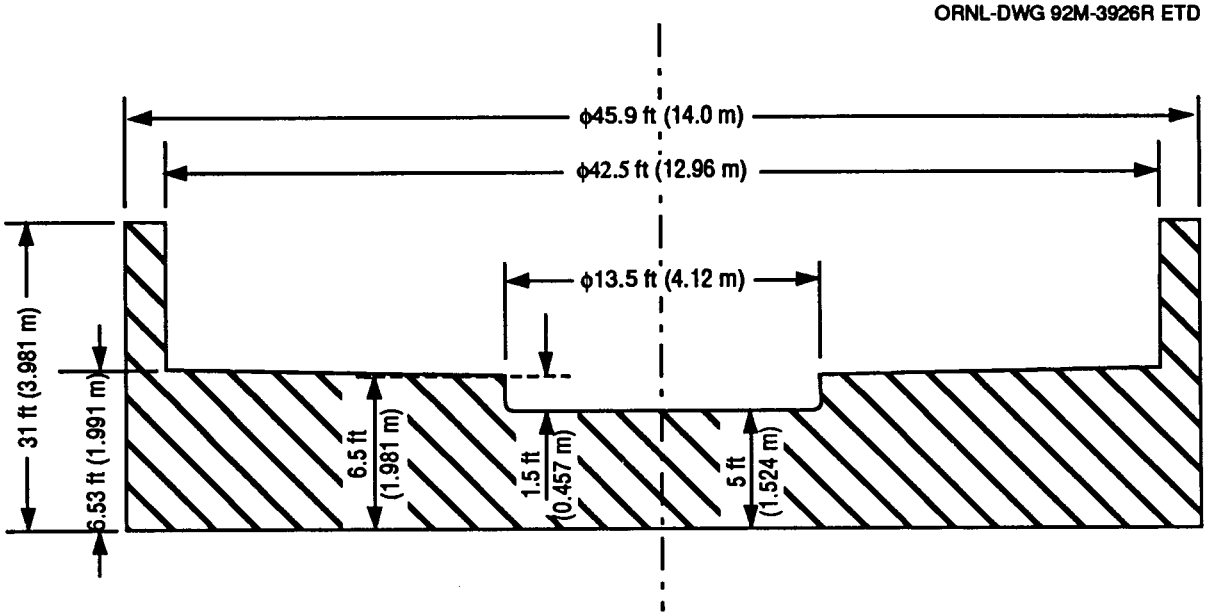

Figure 4.6 Single-cavity model

wall of the first cavity. Transfer of material could be initiated by any other mechanism, such as the in-pedestal debris height exceeding a user-defined value. However, the use of the radial rupture mechanism provides a versatile means of controlling the timing of debris transfer. The thinner the radial wall of cavity 1, the sooner cavity 1 ruptures and transfers debris to cavity 2. By selecting the appropriate thickness of the radial wall of cavity 1, the transfer of debris could be initiated at a predetermined debris height in the first cavity or at a predetermined time.

Tables 4.4 and 4.5 summarizes the material data employed as input to the model.

A single-cavity model, as shown in Fig. 4.6, was used for the single-node drywell model employed with the MELCOR/CORBH Package. In this model, the in-pedestal and the ex-pedestal regions of the drywell are lumped into a single control volume so only a single-cavity is required to model energy exchange between the debris and the drywell atmosphere.

4.4 MELCOR Fission Product Modeling

MELCOR uses a total of 16 different groups or classes of fission products. The first 15 classes are standard in MELCOR and are shown in Table 4.6. The last three classes of this table, classes 13, 14, and 15 are not radioactive materials. Class 16 is a user-defined class to model formation of CsI (cesium iodide). Cesium iodide is formed by the combination of cesium from class 2 and iodine from class 4. All the iodine released from class 4 is assumed to be combined with cesium and to form CsI. In fact, all the material released from class 4 which includes iodine, bromine, and other halogens is assumed to form CsI. No free iodine (or any free halogen) exists in

Table 4.4. Composition of the limestone/sand concrete of the Peach Bottom cavity (Ref. 17)

Constituent	Weight fraction
Al_2O_3	0.009
CaO	0.338
CO_2	0.206
SiO_2	0.358
Free H_2O	0.045
Bound H_2O	0.027
Other	0.017
Total	1.000

NOTE: Rebar in concrete not included in this table. It is about 13.5% of the total weight.

Table 4.5. Other variables used in the Peach Bottom cavity model (Refs. 17 and 36)

Variable	Value	
Ablation temperature, °F (K)	2,240	(1,500)
Initial temperature, °F (K)	81	(300)
Solidus temperature, °F (K)	2,096	(1,420)
Liquidus temperature, °F (K)	2,546	(1,670)
Density of concrete, lb/ft^3 (kg/m^3)	146	(2,340)

Table 4.6. MELCOR fission product material classes

Class No. and name	Representative element	Other member elements
1. Noble gases	**Xe**	**Kr**, Rn, He, Ne, Ar, H, N
2. Alkali Metals	**Cs**	**Rb**, Li, Na, K, Fr, Cu
3. Alkaline Earths	**Ba**	**Sr**, Be, Mg, Ca, Ra, Es, Fm
4. Halogens	**I**	**Br**, F, Cl, At
5. Chalcogens	**Te**	**Se**, S, O, Po
6. Platinoids	**Ru**	**Pd**, **Rh**, Ni, Re, Os, Ir, Pt, Au
7. Transition metals	**Mo**	**Tc**, **Nb**, Fe, Cr, Mn, B, Co, Ta, W
8. Tetravalents	**Ce**	**Zr**, Th, **Np**, Ti, Hf, Pa, Pu, C
9. Trivalents	**La**	**Pm**, Sm, **Y**, **Pr**, **Nd**, Al, Sc, Ac, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Am, Cm, Bk, Cf
10. Uranium	**U**	**U**
11. More volatile main group metals	Cd	Hg, Pb, Zn, **As**, **Sb**, Tl, Bi
12. Less volatile main group metals	**Sn**	**Ag**, In, Ga, Ge
13. Boron	B	Si, P
14. Water	H_2O	
15. Concrete		

NOTE: The 29 ORIGEN elements used in MELCOR decay heat tabulations are shown in **boldface**.

the released fission products since there is always an excess of cesium that combines with any free iodine released.

This modeling agrees with the findings of recent studies on the chemical form of iodine released into containments.[37] Reference 37 indicates that more than 95% of the iodine released into containment is in the form of CsI.

The initial inventories used for these 16 classes are given in Table 4.7. The amounts for the first 13 classes are the MELCOR default values for a BWR reactor of 3,578 MWth. The Peach Bottom reactor has a nominal power of 3,293 MWth, about 9% less than the default value in MELCOR. The default initial inventories of fission products in MELCOR are also larger (between 10 and 15%) than inventories reported for the Peach Bottom plant elsewhere (Refs. 15 and 16). An attempt to correct these inventories was made. This task appeared to be very difficult, subject to error and uncertainties. Therefore, the unchanged inventories of the MELCOR deck as received were used. However, since the source terms will be reported as *fractions of the fission product inventories*, the fact that the initial inventories are slightly larger does not affect the results as *fractions*.

The initial inventory of class 16 (CsI) employed in the model is zero as it is assumed that there is no CsI at the beginning of the problem. The maximum final inventory of CsI that can be produced is 42.85 kg. This amount results from converting all the material of class 4 into CsI. The molecular weight of CsI is 259.8, the atomic weight of iodine is 126.9. Consequently, 20.93 kg of class 4 inventory (Table 4.7) will be converted into $20.93 \times (259.8/126.9) = 42.85$ kg of CsI. MELCOR calculated final inventories of CsI are close to this maximum theoretical amount.

Likewise, to produce 42.85 kg of CsI with 20.93 kg of I, $42.85 - 20.93 = 21.92$ kg of Cs need to react with the 20.93 kg of I. Therefore, the amount of class 2 material available for release at the end of the transient will be $268.35 - 21.92 = 246.43$ kg.

The MELCOR code calculates the release fractions for each class as a fraction of the *actual* inventory of that class. The initial and the actual inventory of fission products for all classes are the same because the fission product inventory does not change (or decay) during the calculation with the exception of classes 2 and 16. The class 2 inventory (Cs) decreases over time from 268.35

Table 4.7. Initial inventory of fission products in the Peach Bottom MELCOR calculations

Class No.	Name	Element	Amount (kg)	Class total (kg)
1	Noble gases	Xe	429.36	463.7
		Kr	34.34	
2	Alkali metals	Cs	236.15	268.35
		Rb	32.20	
3	Alkaline earths	Ba	121.65	207.52
		Sr	85.87	
4	Halogens	I	18.96	20.93
		Br	1.97	
5	Chalcogens	Te	35.78	40.78
		Se	5.00	
6	Platinoids	Ru	182.48	
		Rh	35.06	306.99
		Pd	89.45	
7	Early transition	Mo	275.51	
		Tc	71.15	350.64
		Nb	3.58	
8	Tetravalents	Ce	243.30	
		Zr	311.0	593.65
		Np	39.35	
9	Trivalents	La	107.34	
		Pr	93.02	
		Nd	314.86	571.03
		Pm	12.88	
		Y	42.93	
10	Uranium	U	132,390	132,390
11	More volatile main group	Sb	1.40	1.41
		As	0.01	
12	Less volatile main group	Sn	3.94	8.59
		Ag	4.65	
13	Boron	B	0	0
14	Water	H_2O	0	0
15	Concrete		0	0
16	New class, cesium iodide	CsI	0	0

to 246.43 kg as part of the Cs is converted into CsI. Class 16 inventory increases over time from the zero (10^{-6} kg) initial inventory to a maximum final inventory of about 42.85 kg. Therefore, the release fractions of class 16 early in the calculation when the inventory of CsI is small are relative to a different inventory than the fractions late in the calculation with a large inventory of CsI. A similar problem occurs with class 2. To avoid this problem, the fractions of both classes 2 and 16 have been converted from fractions of the *actual* inventory (a variable amount) to fractions of the *final* inventory (a fixed amount). These inventories are around 246.43 kg for class 2 and 42.85 kg for class 16 (MELCOR calculates slightly different amounts).

In order to obtain the *total fraction* of Cs released, including the amounts in class 2 and class 16 (as CsI), the fraction from classes 2 and 16 need to be combined using the following expression:

$$f_{CS,TOTAL} = \frac{246.43\, f_2 + 42.85 \left(\frac{21.92}{42.85}\right) f_{16}}{268.35} =$$

$$0.918\, f_2 + 0.082\, f_{16}\,.$$

This expression indicates that the *total fraction* of Cs is in between the fractions of classes 2 and 16, and very close to the fraction of class 2.

Similarly, the fraction of total I (in CsI) is equal to the fraction of CsI (class 16) as all the I released is converted into CsI, therefore:

$$f_{I,TOTAL} = f_{16}\,.$$

The 15 default classes of fission products in MELCOR are different than the nine groups used in the STCP[6] and given in Table 4.8. These nine groups are an expansion of the original WASH-1400 (Ref. 25) and BMI-2104 (Ref. 15) groups. Two additional groups have been added in some STCP calculations:[16] group 10, in-vessel aerosols, and group 11, ex-vessel aerosols.

Table 4.9 compares Tables 4.6, the MELCOR classes, with Table 4.8, the STCP groups of fission products. With the exception of the first four classes of MELCOR, the remaining MELCOR classes do not have direct correspondence with the groups of the STCP. This fact complicates comparisons of MELCOR and STCP source term results. Comparison between the STCP groups (with some groups split in subgroups by elements) and the MELCOR classes is easier as all the STCP groups are represented in MELCOR. This comparison is given in Table 4.10.

Table 4.8. STCP radionuclide groups

Group	Elements
1	Xe, Kr
2	I, Br
3	Cs, Rb
4	Te, Sb, Se
5	Sr
6	Ru, Rh, Pd, Mo, Tc
7	La, Zr, Nd, Eu, Nb, Pm, Pr, Sm, Y
8	Ce, Pu, Np
9	Ba

Table 4.9. Comparison between MELCOR classes and STCP groups of fission products

MELCOR class	STCP group
1	1
2	3
3	5 + 9
4	2
5	4 (part)
6	6 (part)
7	6 (part) + 7 (part)
8	8 + 7 (part)
9	7 (part)
10	None
11	4 (part)
12	None
13	New Group 10, in-vessel aerosols
14	None
15	New Group 11, ex-vessel aerosols
16	None

Table 4.10. Comparison between STCP groups and MELCOR classes of fission products

STCP group	Elements	MELCOR class
1	Noble gases	1
2	I, Br	4 or 16 if CsI present
3	Cs, Rb	2 or 2 and 16 combined
4	Te, Se (no Sb)	5
4	Sb (no Te or Se)	11
5	Sr	3
6	Ru, Rh, Pd	6
6	Mo, Tc	7
7	La	9
7	Zr	8
8	Ce	8
9	Ba	3

5 Station Blackout Characterization

This chapter describes the results of the two station blackout sequences. Section 5.1 covers the station blackout with a dry cavity and Sect. 5.2 the station blackout with a flooded cavity. Section 5.3 compares the results of both station blackout sequences.

5.1 Station Blackout with Dry Cavity

The initial conditions for this sequence are first described in Sect. 5.1.1. The MELCOR model was described in Chap. 4, Sect. 4.1. The thermal-hydraulic results of this transient are given in Sect. 5.1.2. The timing of the important events is given in Sect. 5.1.3. The best-estimate in-containment and environmental source terms are given in Sects. 5.1.4 and 5.1.5, respectively.

5.1.1 Initial Conditions

At the time of the initiating event, many systems and components respond in a short time frame. The reactor scrams and its power goes from 100% to decay heat levels. The main steam isolation valves (MSIVs) close over a period of several seconds. All the recirculation pumps of the reactor and the main feedwater pump trip and coast down for over one minute. If the simulation with MELCOR is started at time zero, all these pumps and flows need to be modeled, a very difficult task that requires tables of flow-versus-time for all the pump coast downs and for the steam leaving the reactor.

There is information available for the conditions in the plant after a reactor scram from a test performed by Pennsylvania Power and Light (PP&L)[38] at the Susquehanna Plant, a sister plant (reactor) to Peach Bottom Unit 2. The Susquehanna plant has two BWR-4 reactors, each with a thermal power of 3,293 MWt. The test performed consisted of closing the MSIVs with the reactor at full power. The data recorded included reactor vessel pressure, vessel water level and feedwater flow as a function of time. The data showed that at about 36 s after transient initiation, the feedwater and steam flows were zero. At this time, all the pumps were almost stopped with the exception of the emergency core cooling system (ECCS). The high pressure coolant injection (HPCI) and the reactor core isolation cooling (RCIC) systems started after shutdown and were injecting water into the reactor. (During a station blackout with loss of all AC and DC power, the ECCS is not operational). The flows through the HPCI and the RCIC were also recorded as a function of time in this test and could be subtracted from the flow entering the vessel. Consequently, the conditions inside the reactor vessel 36 s after station blackout initiation could be calculated from the recorded data obtained in this test. These conditions are: time, 36 s after reactor scram (or after station blackout initiation); steam flow leaving the main steam lines, zero; feedwater flow entering the reactor vessel, zero; water level in the core, 556.1 in. (14.125 m) measured from reactor vessel bottom; and vessel pressure 1,034.7 psia (7.134 MPa). For comparison, the normal water level in the reactor under normal operating conditions is 561 in. above the reactor vessel bottom, which is 23 in. above the instrument zero level (538 in.).

Consequently, there is a 36 s difference between calculation time and transient time. Time zero of the calculations corresponds to 36 s after the station blackout was initiated.

Initial conditions for the volumes of the reactor vessel are given in Table 5.1. The initial conditions in the containment are normal operating values of the plant (Sect. 4.1).

A total of 3,183 lb (1,447 kg) of water is in the sump of the in-pedestal drywell region. This water is leakage from the control rod hydraulic drive and recirculation pumps. This is a small amount of water occupying about 53 ft^3 (1.5 m^3) of the total volume of the sump (206 ft^3). There is no water in the ex-pedestal region of the drywell. Manual operation of the SRVs (as described in Sect. 3.2)

Table 5.1. Reactor vessel volumes and initial conditions for the station blackout

Volume No.	Volume name	Volume [ft^3 (m^3)]	Water Level [in. (m)]	Temperature [°F (K)]	Pressure [psia (Mpa)]
310	Downcomer (Annulus)	6,491 (183.8)	556.1 (14.13)	549 (560)	1,034.7 (7.134)
320	Lower plenum	3,655 (103.5)	Full	549 (560)	1,034.7 (7.134)
330	By-pass	911 (25.8)	Full	549 (560)	1,034.7 (7.134)
340	Channel	1,176 (33.3)	Full	549 (560)	1,034.7 (7.134)
350	Shroud dome	1,586 (44.9)	556.1 (14.13)	549 (560)	1,034.7 (7.134)
360	Steam dome	7,720 (218.6)	Empty	549 (560)	1,034.7 (7.134)

is started after 200 s of calculations. Therefore, during the first 200 s of the calculations, the SRVs are opening and closing automatically (in fact, one SRV, the one that opens at the lowest pressure is the one cycling). This time lapse between blackout initiation and manual actuation of the SRVs is arbitrary, but it is reasonable as the operators will not start the operation of the SRVs immediately after blackout initiation.

5.1.2 Thermal-Hydraulic Results

The best-estimate run for source terms and containment failure time was calculated with MELCOR (version 1.8.1) using the model described in Sect. 4.1. The MELCOR 1.8.1 input is in Appendix B. This model used a multi-node drywell representation with a dual cavity and two containment failure modes (by high pressure-induced liner failure and by high temperature, coupled with moderate pressure at the drywell head flange seals). This best-estimate run predicted containment failure at the head flange seals 262.5 min after vessel failure. An additional run was performed with the MELCOR/CORBH Package (model described in Sect. 4.2) to calculate the best-estimate time for vessel failure of 285 min. The MELCOR code has a very conservative model for vessel failure and predicted vessel failure at about 163 min. Calculations performed in the past with the BWRSAR[18,19] and CONTAIN[20] codes for the same severe accident sequence at Peach Bottom predicted vessel failure at 255 min and containment failure 338 min after vessel failure. The vessel failure time of the MELCOR/CORBH Package (285 min) agrees well with the vessel failure time of the BWRSAR/CONTAIN code (255 min). The time difference between containment failure and vessel failure calculated by MELCOR (262.5 min) is shorter than the value calculated by the BWRSAR/CONTAIN codes (338 min). The MELCOR/CORBH Package run aborted before containment failure. Since the version of MELCOR/CORBH used in these calculations was not interfaced with the fuel fission product release algorithms, best-estimate source terms were calculated with MELCOR from the best-estimate run described above.

Additional sensitivity studies for this accident sequence have been completed and the results are presented in Appendix A. In particular, a comparison of different MELCOR runs with MELCOR/CORBH Package runs and BWRSAR/CONTAIN results is given in Table A.3 and described in Sect. A.3 and A.5.

Some graphical results are presented now. Results from the sequence of events up to vessel failure are presented first.

Figure 5.1 shows the pressure inside the vessel during the first 4,500 s of calculations. One SRV cycles five times before manual operation of the SRV takes place at 200 s of calculation time. Plant procedures described in Sect. 3.2 call for manual operation of one SRV between the pressures of 945 psia (6.49 MPa) for closing and 1,045 psia (7.18 MPa) for SRV opening. In order to obtain equal heating of the wetwell water, a *different* SRV

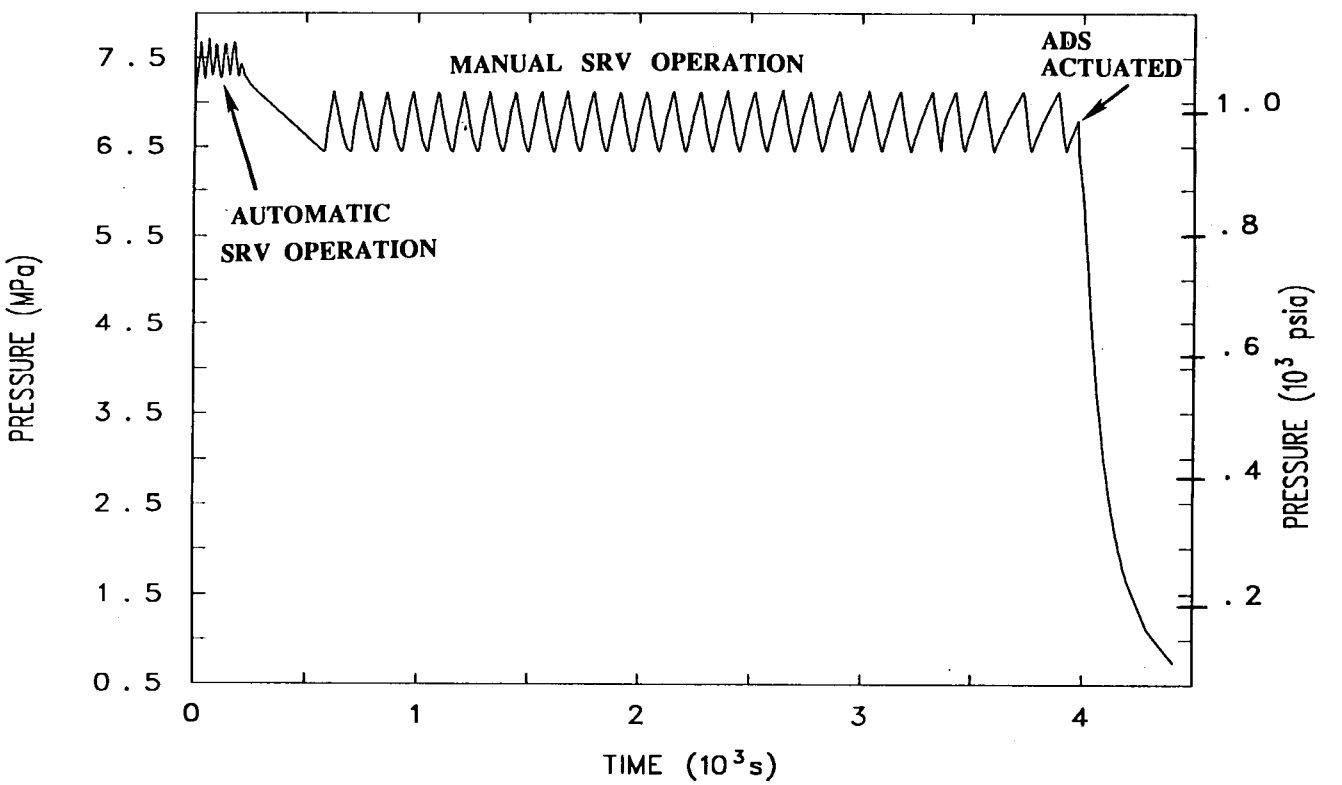

Figure 5.1 Vessel pressure during the first 4500 s of the station blackout sequence

is manually actuated each time. In Fig. 5.1, one SRV is open and closed manually 28 times before the ADS is actuated at 3,947 s calculation time (or 3,983 s transient time since the calculation is initiated 36 s after transient initiation).

Figure 5.2 shows the collapsed water levels inside the vessel from the MELCOR/CORBH run. Water levels, are shown in the downcomer, steam separators, core, and lower plenum volumes. The effect of the SRV operation can be observed in the core and steam separator levels. When the ADS is actuated at 3,947 s calculation time, the collapsed water level in the core is at 1/3 of the active core height. The water level first increased (due to the ADS depressurization) and decreased afterwards due to coolant vaporization. The water in the lower plenum completely vaporized at about 12,700 s. Then, the debris in the lower plenum heated up and a penetration failed at 17,092 s calculation time, or 17,128 s (285.5 min) transient time.

Figure 5.3 shows the temperature of the three rings of the core plate. Temperature decreases after 3,947 s (66 min) are due to the lower saturation temperature that results after the vessel is depressurized by ADS actuation. After 6,000 s (100 min), the first ring of the core relocates onto the core plate and the first ring of the core plate starts heating up. At about 7,000 s (117 min), it heats up very rapidly due to contact with fuel debris relocated from above. After the core plate fails at a temperature of 1,832°F (1,273 K), it continues heating up until melting begins at 2,600°F (1,700 K). Once a core plate node melts and relocates, the material in the node is converted into particulate debris and does not exist anymore as a core plate node. Core plate rings 1 and 2 melt and the core plate and all material on top of it relocates to the bottom head. The core plate of ring 3 failed but did not melt or relocate.

Figure 5.4 shows the accumulated amount of in-vessel hydrogen produced in the MELCOR and MELCOR/CORBH runs. Most of the hydrogen is produced in both runs shortly after core plate failure. This hydrogen is produced from the Zr in the fuel standing in the core. Additional hydrogen is produced in the lower plenum debris after penetration failure in the MELCOR/CORBH run. Very small amounts of hydrogen are produced in the MELCOR run after containment failure. At the end of the calculation, the total amount of in-vessel hydrogen produced is 1,100 lb (500 kg) in the MELCOR run and 1,320 lb (600 kg) in the MELCOR/CORBH run, about 220 lb (100 kg) more than in the MELCOR run.

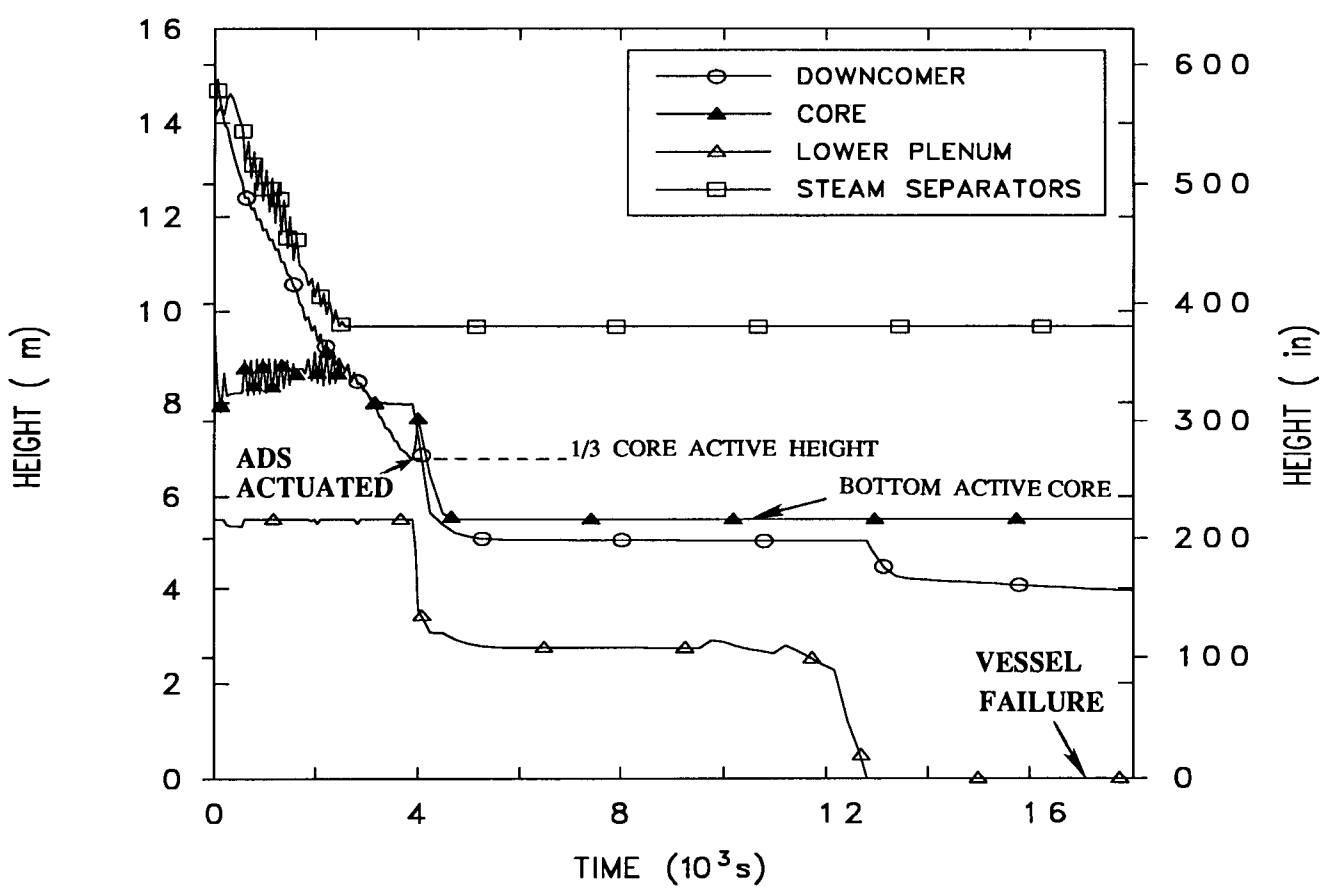

Figure 5.2 **Collapsed water levels in the vessel from the MELCOR/CORBH run**

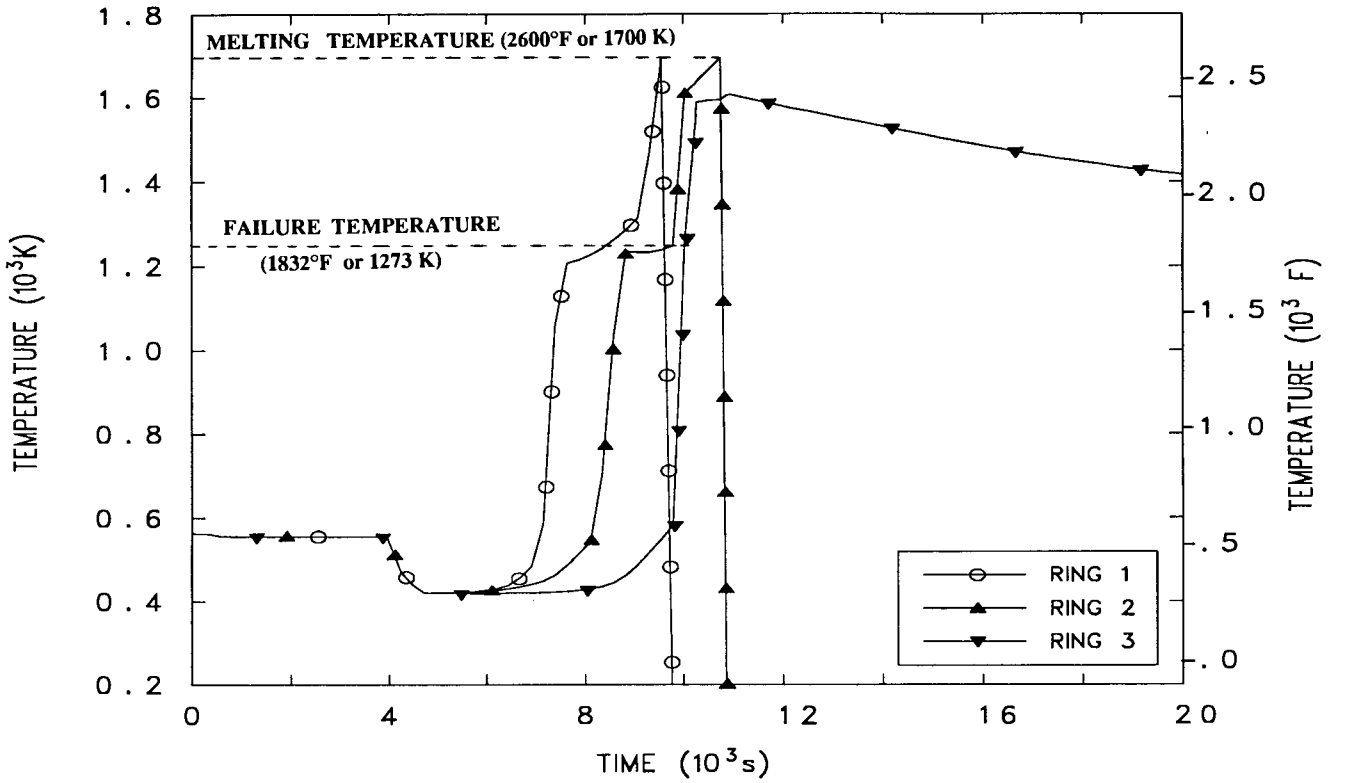

Figure 5.3 Core plate temperatures for the station blackout with a dry cavity

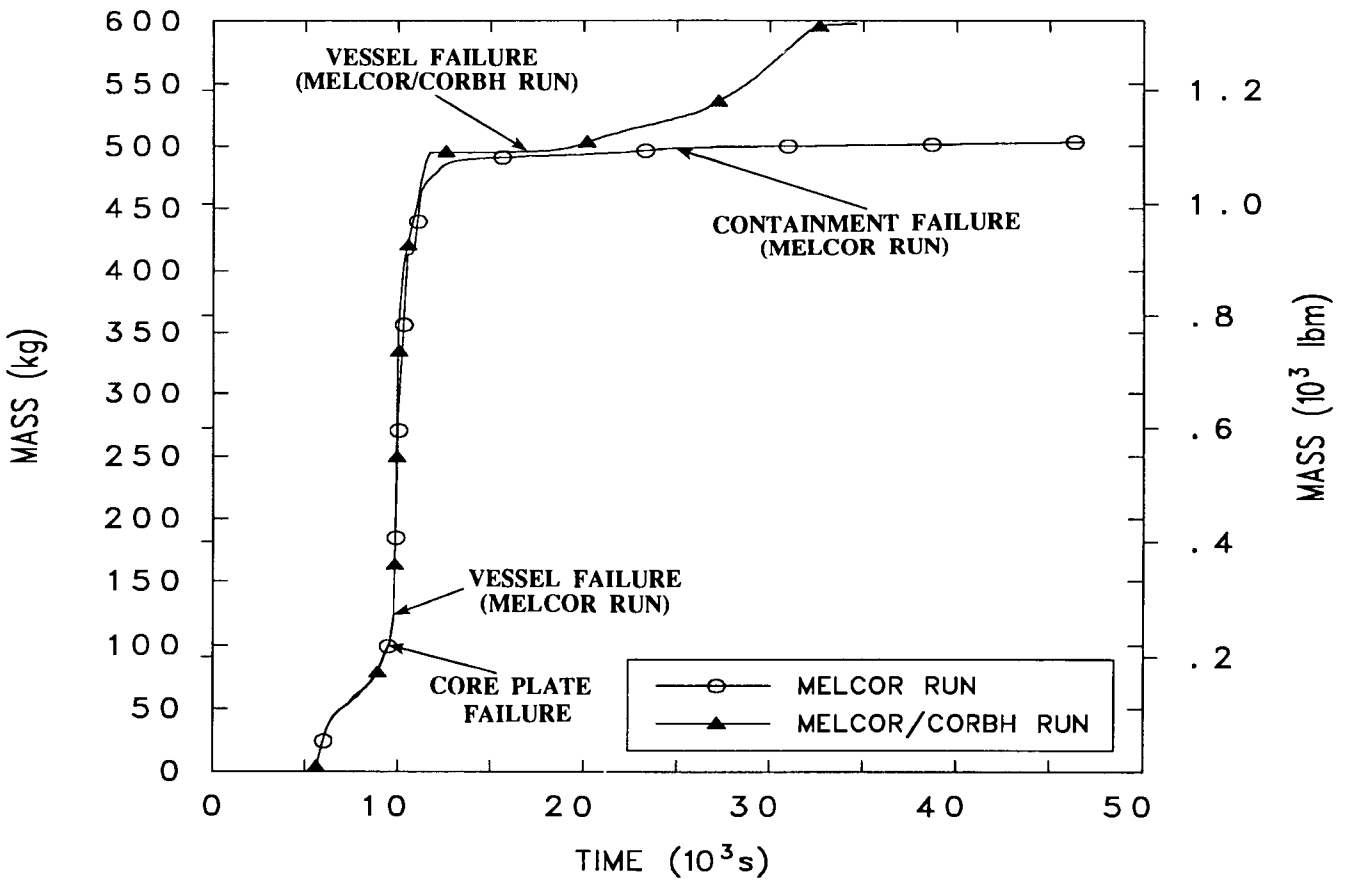

Figure 5.4 In-vessel hydrogen produced in the station blackout with a dry cavity

Figure 5.5 shows the containment pressure as a function of time from the MELCOR and MELCOR/CORBH run. There is an increase in the pressure after vessel failure in both runs. There is a pressure increase in the MELCOR/CORBH run after core plate failure (about 9,700 s) when the debris reaches the lower plenum and significant boiling results. The resulting steam is discharged into containment via the ADS SRVs. The containment failed at 25,515 s (425 min) calculation time, by high temperature at the head flange seals in the MELCOR run. The pressure at that time was 107 psia (840 kPa), well above the value of 82 psid (565 kPa) needed to start leakage through the head flange seals. Consequently, the pressure decreased rapidly after containment failure. The pressure remained at a value around 85 psid (687 kPa) afterwards. The MELCOR/CORBH run aborted before containment failure.

Figure 5.6 shows the temperatures of the atmosphere of the four volumes of the drywell calculated by MELCOR in the best-estimate run. The head flange seals are located in Vol. 102. After vessel failure, Vol. 102 is generally the coolest region of the drywell. However, its temperature goes above the failure temperature of the head flange seals (700°F or 644 K) after 20,000 s (340 min). The head flange seals failed at 25,515 s (425 min) in this MELCOR run. Before vessel failure, the coldest region of the containment is the in-pedestal drywell (volume 100). After vessel failure, this region is the hottest for most of the time as core debris is discharged into this volume. Conversely, the top of the drywell (volume 102) is one of the hottest regions of the containment before vessel failure and the coldest region after vessel failure (for most of the time).

Figure 5.7 shows the atmospheric temperature of the single-node drywell from the MELCOR/CORBH run. Figure 5.7 also shows the maximum and minimum drywell temperatures of the best-estimate MELCOR run (in-pedestal and top drywell volumes) also shown in Fig. 5.6. During the first 10,000 of the transient, the temperature of the single node drywell from the MELCOR/CORBH run is in between the maximum and minimum temperatures of the MELCOR run. After 10,000 s, the MELCOR/ CORBH single node drywell temperature is lower than any drywell temperature calculated by MELCOR. There are two reasons for these differences. First, vessel failure was predicted in the MELCOR/CORBH run at about 17,100 s, later than the vessel failure time predicted by MELCOR at 9,760 s. Second, the amount of core debris ejected from the vessel in the MELCOR/CORBH run is generally less than in the MELCOR run. At about 28,000 s, the lower head fails in the MELCOR/CORBH run and a significant amount of core debris is ejected into the drywell with a corresponding temperature increase in the drywell.

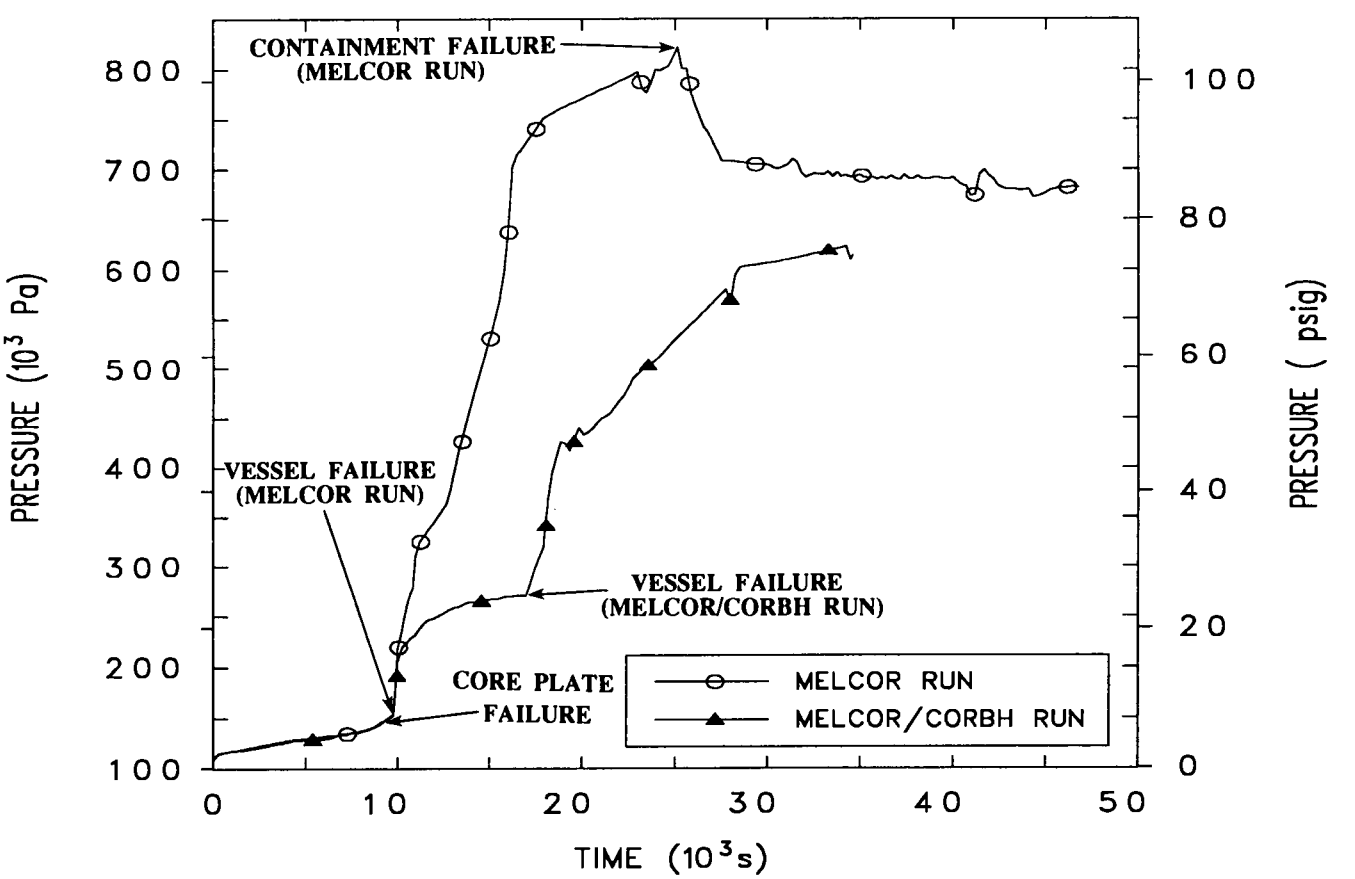

Figure 5.5 **Containment pressure for the station blackout with a dry cavity**

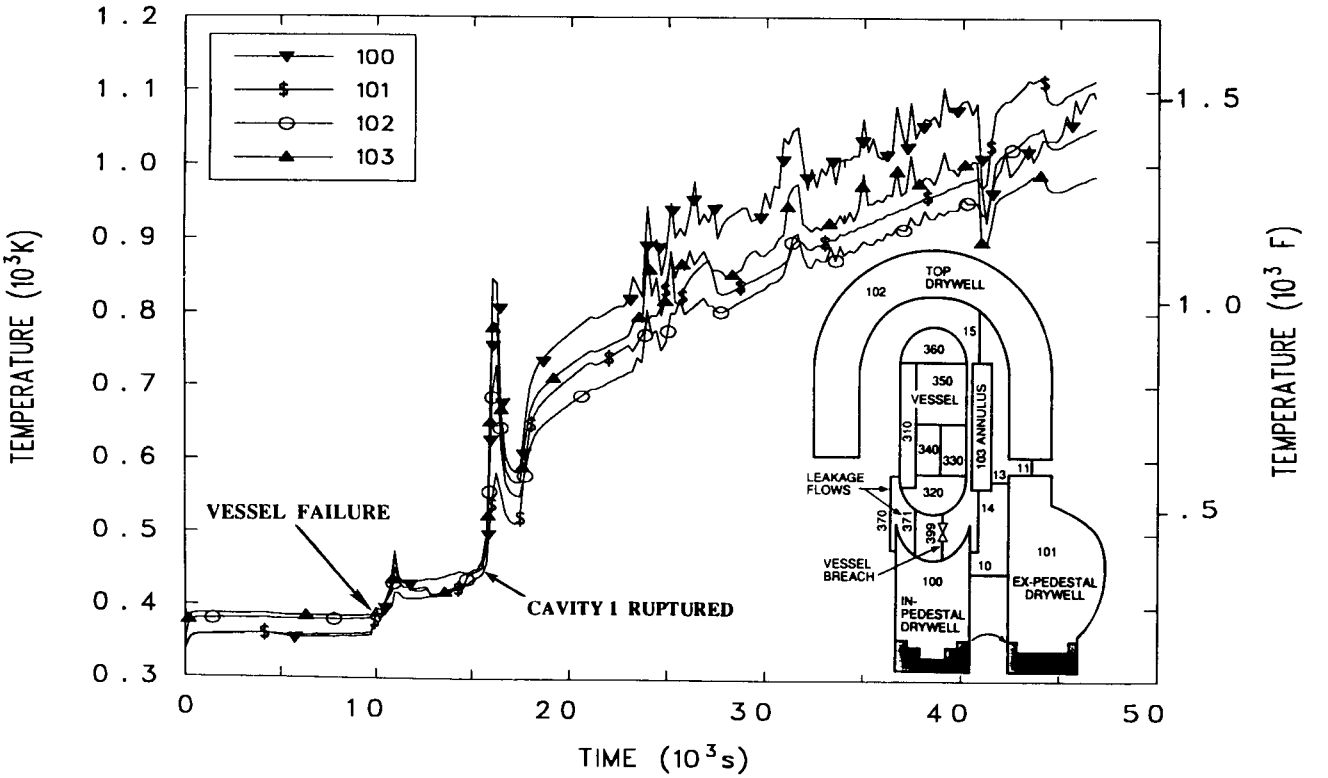

Figure 5.6 Temperatures of the drywell atmosphere for the station blackout with a dry cavity calculated by MELCOR

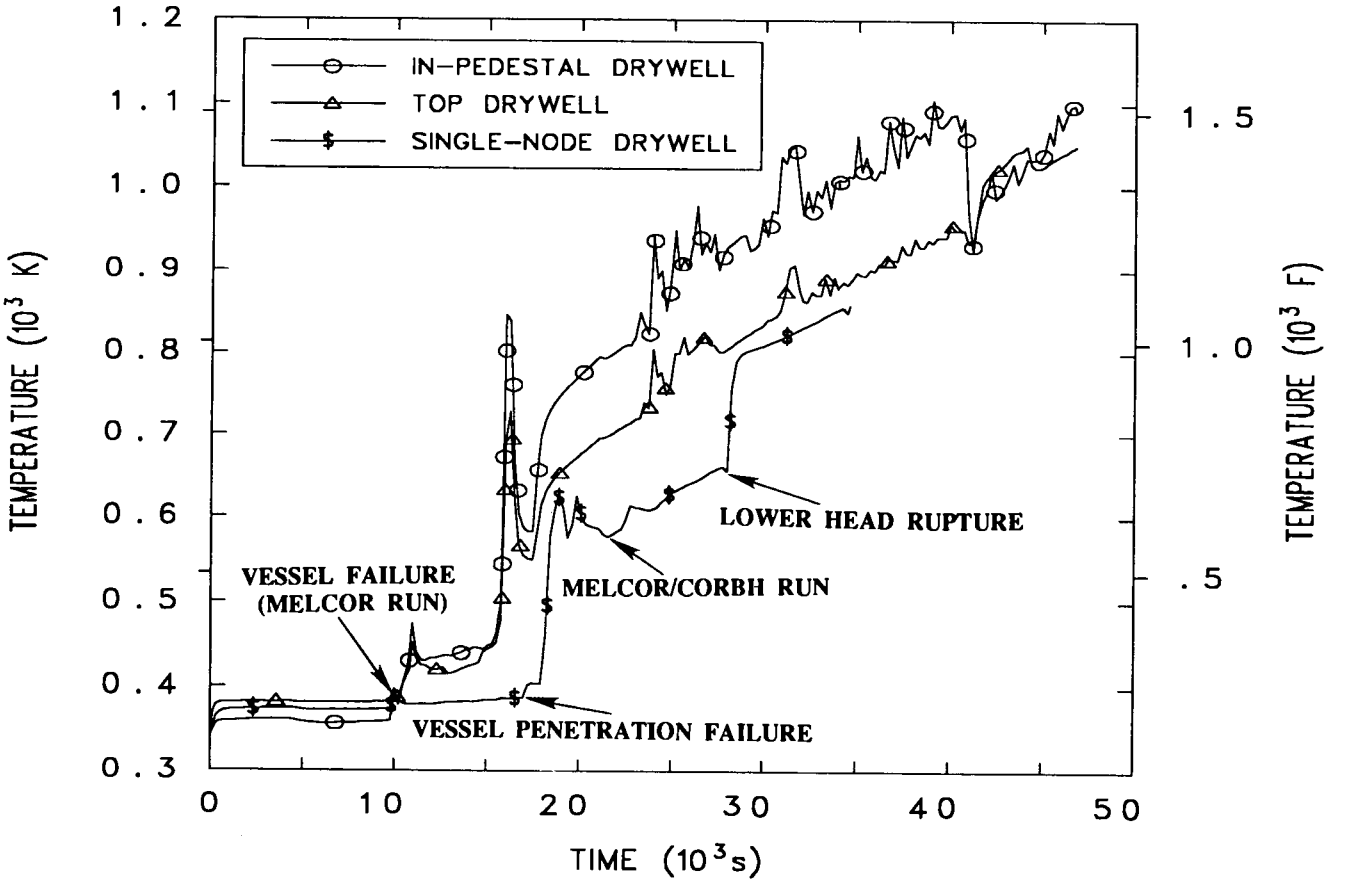

Figure 5.7 Temperature of the single-node drywell atmosphere calculated by MELCOR/CORBH and two drywell temperatures calculated by MELCOR

Figure 5.8 shows the total debris mass in each cavity from the MELCOR run. This mass includes core debris plus materials ablated from core-concrete interaction. The near vertical increases (for ex-pedestal) and decreases (for in-pedestal) correspond to molten debris into the ex-pedestal cavity and out of the in-pedestal cavity. Slow material increases are due to the addition of concrete decomposition products to the debris.

Figure 5.9 shows the total debris mass in the single cavity of the MELCOR/CORBH run. Instrument tube failure was predicted at 17,092 s (calculation time) and lower head creep rupture at about 28,000 s. Of the total 616,342 lb (279,520 kg) of corium released into containment, about 220,000 lb (100,000 kg) were released between instrument tube failure and lower head creep rupture times.

5.1.3 Timing of Important Events

The best-estimate times for the important events in this sequence are summarized in Table 5.2. There is a 36 s time difference between *actual transient times* and *calculation times* as the initial conditions for the calculations were taken at 36 s after transient initiation. The times of Table 5.2 have these 36 s added. ADS actuation is predicted at 3,983 s transient time (3,947 s calculation time). The "gap release phase" starts when the cladding in the first ring fails at 92.9 min and ends when the cladding in the last ring (ring 3) fails at 122.2 min. The "in-vessel release phase" starts when the gap release ends and ends when the vessel fails. The best-estimate vessel failure time [285.5 min (4.75 h)], has been taken from the MELCOR/CORBH Package analysis. Both the "ex-vessel" and the "late in-vessel" release phases extend from the time the vessel fails until the end of the calculations (about 13 h).

The best-estimate *time difference* between containment failure and vessel failure calculated by MELCOR is 262.5 min. This time has been added to the best-estimate vessel failure time (from MELCOR/CORBH) of 285.5 min, resulting in a containment failure time of 548 min.

The last column of Table 5.2 provides cumulative times from transient initiation. It shows that the ADS is actuated at about 1.1 h (66 min) after station blackout initiation. The release of fission products in the gap is initiated at about 1.54 h (93 min) and is ended at 2 h (122 min) after transient initiation. Vessel failure is predicted to occur at 4.75 h (285 min) after transient initiation, and containment failure at the head flange seals is predicted to occur at about 9.14 h.

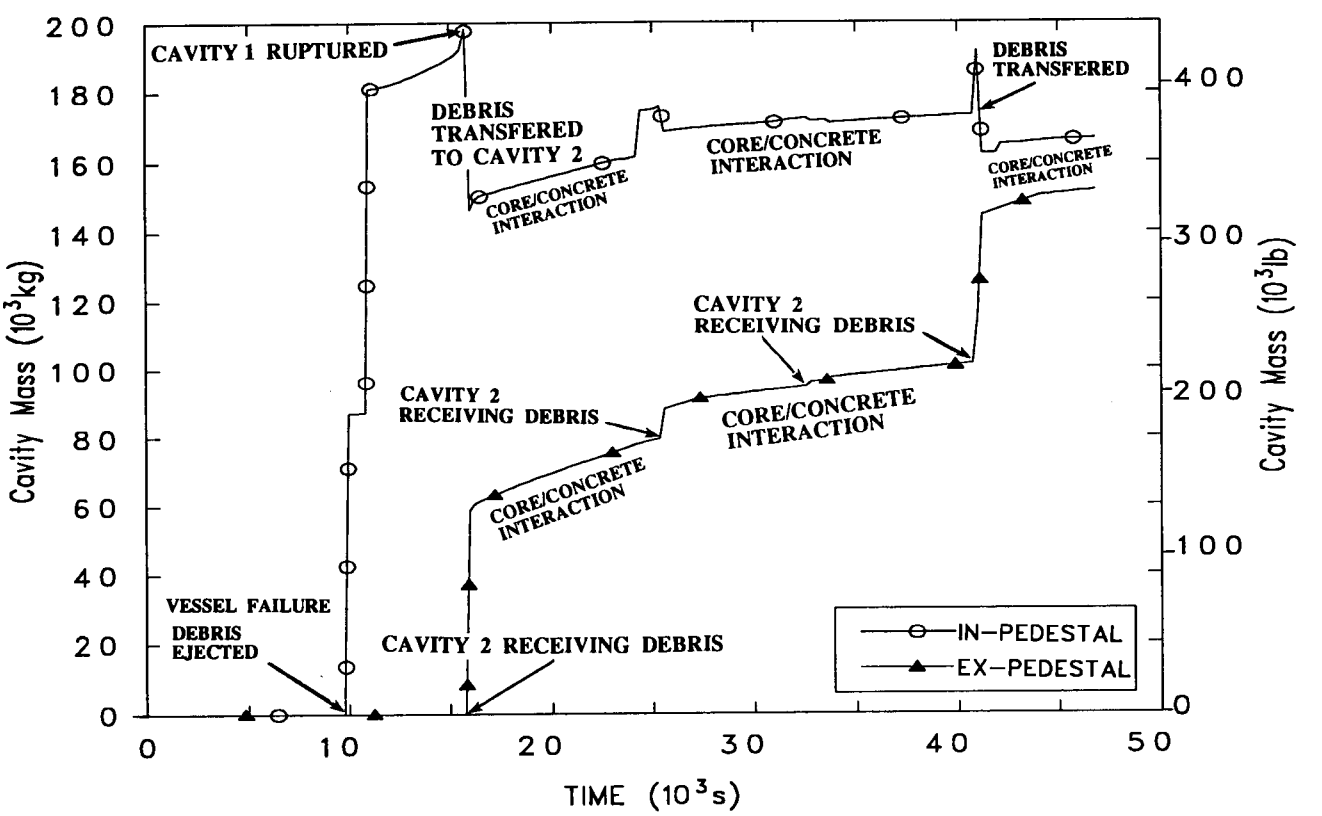

Figure 5.8 **Molten debris mass on the dual-cavity for the station blackout with a dry cavity (MELCOR run)**

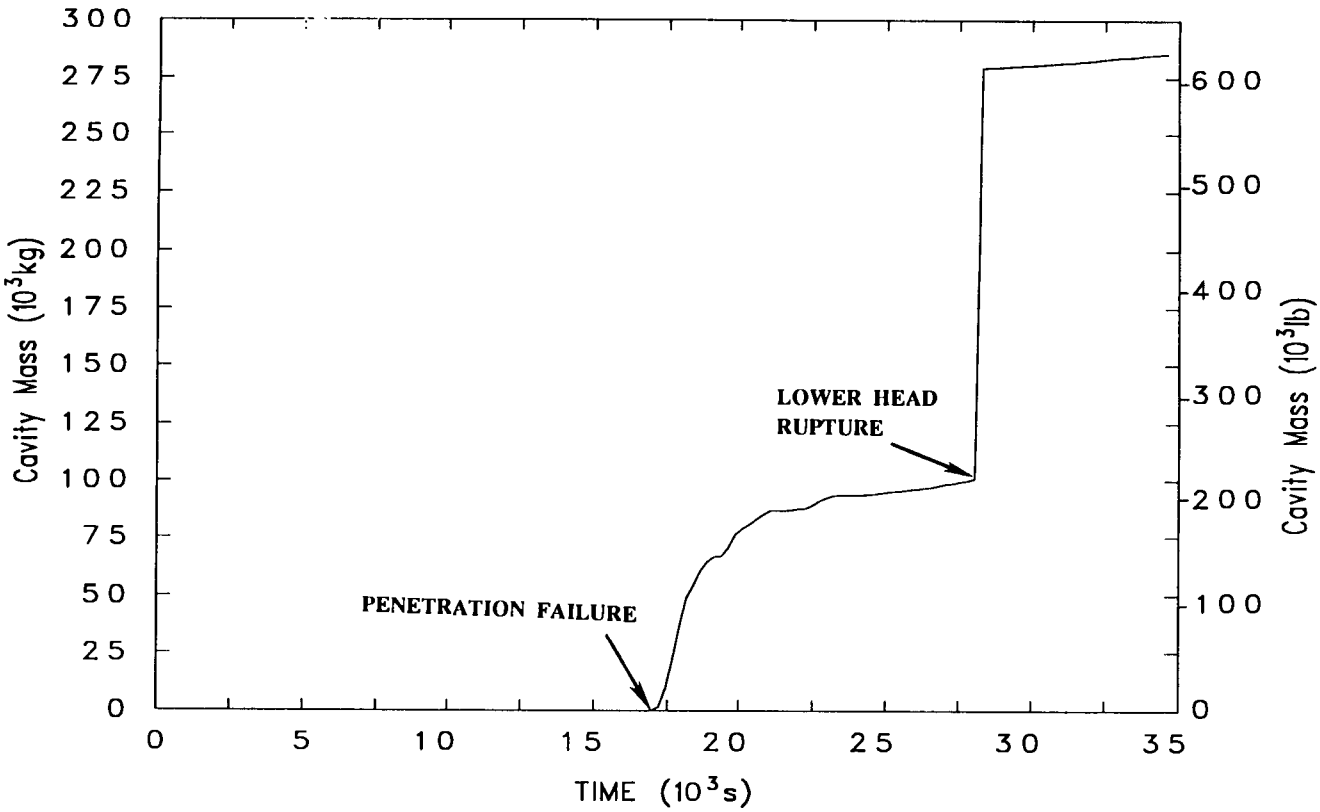

Figure 5.9 **Molten debris mass in the single cavity for the MELCOR/CORBH run**

Table 5.2. Best-estimate times for the events in the station blackout with a dry cavity

Event	Seconds	Minutes	Hours	Time from transient initiation (h)
Station blackout initiation	0	0	0	0
MELCOR calculation started	36	0.5	0	0
ADS actuated	3,983	66.4	1.1	1.1
Gap release initiated	5,577	92.9	1.54	1.54
Gap release ended	7,333	122.2	2	2
Gap release phase duration	1,756	29.3	0.5	
Vessel failure time[a]	17,128	285.5	4.75	4.75
In-vessel release phase duration	9,795	163.3	2.72	
Containment failure at Head Flange Seals		548	9.14	9.14

[a]MELCOR/CORBH Package calculation.

5.1.4 Best-Estimate In-Containment Source Term

Table 5.3 shows the fractional distribution of the final inventories of fission products by class among nine different locations after 13 h. These nine locations are: core, debris in cavity, reactor coolant system (RCS), drywell, wetwell, reactor building (RB), turbine building (TB), refueling bay and environment. The reactor building includes volumes 401, 402, 403, 404, 405, 406, and 407 (Fig. 4.3). These volumes comprise all the secondary containment. The turbine building, the

Table 5.3. Fractional distribution of the final inventories of fission products by class and location for the station blackout with a dry cavity 13 h after accident initiation

Class	Element	Core	Cavity debris	RCS	Drywell	Wetwell	RB	TB	Ref-Bay	Environ
1	Noble gases	0.288×10^{-3}	0	0.103×10^{-2}	0.747×10^{-1}	0.842	0.126×10^{-3}	0.855×10^{-6}	0.217×10^{-1}	0.604×10^{-1}
2	Cs	0.307×10^{-3}	0.300×10^{-5}	0.397	0.261	0.325	0.349×10^{-3}	0.409×10^{-6}	0.680×10^{-2}	0.966×10^{-2}
3	Ba, Sr	0.142×10^{-1}	0.554	0.440×10^{-1}	0.246	0.141	0.323×10^{-4}	0.424×10^{-7}	0.277×10^{-3}	0.556×10^{-3}
4	I	1.0	0	0	0	0	0	0	0	0
5	Te	0.157×10^{-1}	0.621	0.701×10^{-2}	0.266	0.798×10^{-1}	0.133×10^{-3}	0.126×10^{-6}	0.419×10^{-2}	0.666×10^{-2}
6	Ru	0.159×10^{-1}	0.980	0.147×10^{-2}	0.360×10^{-3}	0.180×10^{-2}	0.105×10^{-8}	0.897×10^{-12}	0.149×10^{-7}	0.326×10^{-7}
7	Mo	0.148×10^{-1}	0.905	0.293×10^{-1}	0.174×10^{-1}	0.333×10^{-1}	0.902×10^{-5}	0.940×10^{-8}	0.161×10^{-3}	0.287×10^{-3}
8	Ce	0.159×10^{-1}	0.984	0.386×10^{-4}	0.196×10^{-4}	0.478×10^{-4}	0.305×10^{-8}	0.294×10^{-11}	0.651×10^{-7}	0.115×10^{-6}
9	La	0.159×10^{-1}	0.925	0.895×10^{-4}	0.450×10^{-1}	0.138×10^{-1}	0.170×10^{-7}	0.194×10^{-10}	0.174×10^{-6}	0.371×10^{-6}
10	U	0.159×10^{-1}	0.984	0.555×10^{-4}	0.144×10^{-3}	0.102×10^{-3}	0.661×10^{-8}	0.875×10^{-11}	0.682×10^{-7}	0.136×10^{-6}
11	Cd	0.108×10^{-1}	0.665	0.130	0.373×10^{-1}	0.157	0.128×10^{-5}	0.178×10^{-8}	0.112×10^{-4}	0.224×10^{-4}
12	Sn	0.108×10^{-1}	0.637	0.130	0.589×10^{-1}	0.163	0.296×10^{-5}	0.413×10^{-8}	0.402×10^{-4}	0.684×10^{-4}
13	B	0	0	0	0	0	0	0	0	0
14	H_2O	0	0	0	0	0	0	0	0	0
15	Concrete	0	0	0	0	0	0	0	0	0
16	CsI	0.372×10^{-9}	0.181×10^{-1}	0.400	0.256	0.312	0.192×10^{-3}	0.203×10^{-6}	0.578×10^{-2}	0.755×10^{-2}

refueling bay, and the environment are outside of the secondary containment. The fractions of radioactive radionuclides that are in the first two columns (the core and the cavity debris) are *not released yet* because they are still *inside the fuel*. The fractions in the remaining seven columns added for each class are the released fractions. The released fraction minus the fraction in the reactor coolant system (RCS, Col. 3) is the fraction released *into the containment*. A fraction of the source term has been released into the environment since the containment has already failed. The largest fraction released into the environment is for the noble gases (class 1) with a value of 6% followed by classes 2, 5, and 16, with <1%. Source term releases into the environment are covered in Sect. 5.1.5.

This Table 5.3 shows that the largest fraction of the noble gases (class 1) is in the wetwell (84.2%); the largest fraction of Cs (class 2) inventory (39.7%) is in the reactor coolant system and 32.5% is in the wetwell. The largest fraction of class 3 (Ba, Sr) is in the fuel debris in the cavity (55.4%) (not released) and 24.6% is in the drywell. Elemental iodine (class 4) is only in the core fuel (100%), that is, iodine only exists as a *non-released* element in the fuel left inside the vessel. The actual amount of elemental iodine left in the fuel at the end of the calculation is very small since most of the iodine has been released before and has been combined with the released cesium. Class 5 (Te) has 62.1 % in the cavity (non released) and the largest released fraction of this class is in the drywell with 26.6%. The majority of classes 6 through 12 inventories are in the cavity (non-released). Thirteen percent of classes 11 and 12 have been released into the reactor coolant system and about 16% has been released into the wetwell. Finally, the majority of the class 16 (CsI) inventory (40%) is in the reactor coolant system followed by 31% in the wetwell and 26% in the drywell.

The cumulative source terms fractions released into containment as a function of transient time are given in Table 5.4 for this best-estimate run. All these fractions are from the *initial* inventories of fission products, except for classes 2 and 16. For these two classes, the fractions are of the *final* fission product inventory released. Fission products release begins at 93 min (5,577 s), when the first ring of the core model starts releasing gap fission products into the reactor vessel. The fission products are transported from the reactor vessel to the wetwell via the ADS and from the wetwell to the drywell via the vacuum breakers. The cumulative fractions released into containment are increasing as a function of time.

Source terms for each of the four release phases are shown in Table 5.5. The total source term for each class is the sum of the four release phases:

$$S_{TOTAL} = S_{GAP} + S_{IN\text{-}V} + S_{EX\text{-}V} + S_{LAT\text{-}IN\text{-}V}$$

where the subscripts of the right hand side mean "gap," "in-vessel," "ex-vessel" and "late in-vessel". These four release phases are the same phases described in Refs. 4 and 5. The first release phase, the "gap" release phase, starts when the fuel cladding fails, releasing the fission products from the gap between the fuel pellets and the cladding. This phase ends when the last fuel cladding fails. The MELCOR model of the core of the reactor has three radial rings. The cladding of the first ring failed at 92.9 min (5,577 s); the cladding of radial ring 3, the last to fail, failed at 122.2 min (7,333 s). Therefore, the "gap" release phase starts at 92.9 min and ends at 122.2 min, with a duration of 29.3 min.

The second phase, the "in-vessel release" phase, starts when the "gap" release phase ends at 122 min (7,333 s) and ends when the vessel fails at 285.5 min according to MELCOR/CORBH Package calculation.

The last two release phases, the "ex-vessel" (core-concrete interaction phase) and the "late in-vessel" (by revaporization of fission products from the reactor coolant system) start when the vessel fails and they end at the end of the calculations with a duration of over 8 h.

The sum of the source term contributions from the four release phases is the "*total source term*" which is the source term released into containment at the end of the calculations (last column of Tables 5.4 and 5.5).

The best-estimate vessel failure time is 285.5 min calculated by the MELCOR/CORBH Package. The release phase durations of Table 5.5 are consistent with the best-estimate release phase durations of Table 5.2. The "early in-vessel" release phase has been extended to account for the differences between the MELCOR and the MELCOR/CORBH calculations. The adjustment of the "early in-vessel" release phase *duration* necessitates a consistent adjustment of the "early in-vessel" *release fractions*.

A crude methodology for adjusting these release fractions can be synthesized from the lower head debris/coolant/structure interaction scenario modeled by MELCOR/CORBH. The MELCOR/CORBH Package assumes that debris entering the lower plenum is initially cooled and quenched by the water present in the lower head. Following this quenching, the debris bed slowly heats up after the water is boiled off. The debris eventually reheats to temperatures similar to those present at the time the debris initially entered the lower plenum. At some point while the debris bed is still heating, the lower head penetrations are predicted to fail (this is usually predicted to occur prior to the time the fuel debris becomes molten.) Following penetration failure, debris exits the reactor vessel as it becomes molten. Thus, the debris spends *longer times* at elevated temperatures in the reactor vessel under the MELCOR/CORBH scenario than under the MELCOR scenario. It is, therefore, clear that the "in-vessel" releases would be higher than those predicted by the MELCOR calculation. There is some question, however, regarding how to apportion this additional release between the "early in-vessel" (prior to reactor

Table 5.4. Best-estimate cumulative fractions of the initial fission product inventory released into containment as a function of time for the station blackout with a dry cavity

		Transient time, min								
Class	Element	122	163	181	250	285	333	500	667	780
1	Noble gases	0.0216	0.6513	0.9276	0.9691	0.9696	0.9703	0.9910	0.9920	0.9987
2[a]	Cs	0.0276	0.2317	0.3833	0.4555	0.4612	0.4767	0.5648	0.5847	0.6029
3	Ba, Sr	0	0.0334	0.0651	0.1775	0.3420	0.3790	0.3852	0.3862	0.3878
4	I	-	-	-	-	-	-	-	-	-
5	Te	0	0.0011	0.0163	0.1406	0.3058	0.3151	0.3320	0.3456	0.3563
6	Ru	0	0.0014	0.0014	0.0025	0.0025	0.0025	0.0026	0.0026	0.0026
7	Mo	0.0003	0.0232	0.0374	0.0397	0.0417	0.0427	0.0466	0.0496	0.0509
8	Ce	0	0	0	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
9	La	0	0	0	0.0279	0.0579	0.0589	0.0589	0.0589	0.0590
10	U	0	0	0	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009
11	Cd	0.0005	0.1020	0.1780	0.1870	0.1890	0.1900	0.1942	0.1944	0.1944
12	Sn	0.0005	0.1020	0.1780	0.1990	0.2150	0.2170	0.2214	0.2220	0.2222
13	B	-	-		-	-				-
14	H_2O	-	-		-	-				-
15	Concrete		-		-	-				-
16[b]	CsI	0.0123	0.2127	0.3773	0.4503	0.4617	0.4900	0.5623	0.5806	0.5927
Event		Gap release ended				CORBH Vessel failure	Containment failure			End Calculation

[a]These fractions are of the total final inventory of Cs (246.30 kg).
[b]These fractions are of the total final inventory of CsI (42.06 kg).

vessel failure) and "late in-vessel" (after penetration failure) phases of the accident.

The approach that is employed here is to simply assume that all of the noble gases, cesium, and cesium iodide releases predicted to have occurred in the MELCOR calculation at 285 min into the accident actually occurred "in-vessel" prior to vessel failure. This is assumed even though some of the releases in the MELCOR run originated from the core-concrete interaction after the debris left the vessel. It is also believed that some additional tellurium release would occur in-vessel prior to vessel failure. For tellurium, the cumulative source term fraction of 0.1 is a value between the fractions at 285 min (0.3151), vessel failure time predicted by MELCOR/CORBH, and at 163 min (0.0011), vessel failure time predicted by MELCOR. This is because tellurium releases are dependent on the amount of unoxidized Zircaloy still present inside the vessel. Tellurium combines with the unoxidized Zircaloy and it is not released until the Zircaloy cladding is oxidized above a cut-off value. For classes 7 (Mo), 11 (Cd), and 12 (Sn) some additional "in-vessel" releases are also assumed before vessel failure. Classes 1, 2, 5, 7, 11, 12, and 16 were adjusted. These classes are the *noble gases*, the *volatiles* Cs, Te, Cd, and CsI, and the *less volatiles* Mo and Sn. The source terms for the remaining classes are unchanged. It is assumed that the remaining classes do not have any additional "in-vessel" releases during the additional time that the fuel remains inside the vessel.

These adjustments shift a portion of the "ex-vessel" releases into "early in-vessel" releases for the adjusted classes. This approach of redistributing source terms among the "in-vessel," the "ex-vessel" and the "late in-vessel" release phases is approximate. The adjusted source terms are the *best-estimate* in-containment source terms by release phase for the Peach Bottom low pressure, short-term station blackout with a dry cavity.

Table 5.5 shows that only five classes (classes 2, 3, 5, 6, and 16) have "late in-vessel" source term contributions. These contributions are partly from revaporization in the reactor coolant system and partly from continuing release from the fuel still inside the vessel. The most significant "late in-vessel" release contributions are from class 2 (cesium) and class 16 (cesium iodide).

Table 5.5. Best-estimate source terms released into containment for the station blackout with a dry cavity

		PHASE	GAP RELEASE	EARLY IN-VESSEL	EX-VESSEL	LATE IN-VESSEL	TOTAL
	Duration	min	29	164	495	495	688
		h	0.5	2.72	8.25	8.25	11.5
Class	Elements	Inventory (kg)	Fraction	Fraction	Fraction	Fraction	Fraction
1	Noble gases	463.70	0.0216	0.9480	0.0291	0	0.9987
2	Cs	246.30	0.0276	0.4336	0.0281	0.1136	0.6029
3	Ba, Sr	207.52	0	0.0334	0.3518	0.0026	0.3878
4	I	20.93	-	-	-	-	-
5	Te	40.78	0	0.1000	0.2540	0.0023	0.3563
6	Ru	306.99	0	0.0015	0	0.0011	0.0026
7	Mo	350.64	0.0003	0.0400	0.0106	0	0.0509
8	Ce	593.65	0	0	0.0010	0	0.0010
9	La	571.03	0	0	0.0590	0	0.0590
10	U	132,390.00	0	0	0.0009	0	0.0009
11	Cd	1.41	0.0005	0.1514	0.0425	0	0.1944
12	Sn	8.59	0.0005	0.1555	0.0662	0	0.2222
13	B	-	-	-		-	-
14	H_2O	-	-	-		-	-
15	Concrete[a]	-	-	-	[a]	-	-
16	CsI	42.06	0.0123	0.4494	0.0114	0.1196	0.5927

[a]A total of 933 kg of non-radioactive compounds are released from core-concrete interaction during the ex-vessel release phase.

In addition to the radioactive source terms released, a total of 933 kg of non-radioactive compounds are released from the core-concrete interaction in the cavity (ex-vessel release phase). No releases were calculated from the control rod materials (B_4C) because this model is currently disabled in MELCOR as recommended by SNL.

A comparison of these in-containment source terms with the values reported in draft NUREG-1465, Table 3.11 (Ref. 5) is given in Table 5.6. This comparison shows fairly good agreement with only small differences. In particular, the "gap release" source terms calculated by MELCOR are smaller than the ones reported in Ref. 5. MELCOR calculates a duration of 0.5 h for this "gap release" phase; a value of 1 h is reported in Ref. 5. The "early in-vessel" source terms for I and Cs calculated by MELCOR are larger than the values reported in Ref. 5; the noble gases, Sr and Ba are equal; and the source terms for Ru, La, and Ce are smaller. MELCOR did not calculate any "early in-vessel" releases for La and Ce. The duration of this "early in-vessel" release phase calculated by the MELCOR/CORBH Package is 2.72 h, longer than the value reported in Ref. 5 (only 1.5 h). This longer duration explains the larger source terms. If an earlier vessel failure time is predicted, smaller source terms will result in closer agreement with the values of Ref. 5. The "ex-vessel" source terms calculated by MELCOR are in general smaller than the values reported in Ref. 5 (with the exception of the noble gases, Sr, Ba, and La that are larger). MELCOR predicts no releases during the "ex-vessel" phase for Ru, probably due to the excess of unoxidized Zr present in the cavity debris. The unoxidized Zr prevents the Ru from being oxidized and released. All Ru releases (from both MELCOR and Ref. 5) are very small (less than 1%). The duration of this "ex-vessel" phase was extended in the MELCOR calculation to 8.25 h, longer than the 3 h reported in Ref. 5. Despite this longer duration, the source terms calculated by MELCOR are smaller than in Ref. 5. The "late in-vessel" source terms calculated by MELCOR are larger (except for Te) than the values reported in Ref. 5. Draft NUREG-1465 does not report "late in-vessel" releases for Sr, Ba, and Ru whereas MELCOR predicts releases. The duration of this phase was taken as 8.25 h in the MELCOR calculation versus 10 h in Ref. 5. Overall, the "total" source terms are very similar, with slightly smaller values (with the exception of Sr, Ba, and La) in the MELCOR calculations than the values reported in Ref. 5. For non-radioactive aerosols, MELCOR did not calculate aerosols inside the vessel and the amount predicted by MELCOR in the cavity ("ex-vessel") is one sixth of the value reported in Ref. 5.

Table 5.6. Comparison between in-containment source terms calculated by MELCOR for the station blackout with a dry cavity and the source terms reported in Draft NUREG-1465 (Ref. 5)

Release Phase:	Gap		Early In-Vessel		Ex-Vessel		Late In-Vessel		Total	
Source	NUREG 1465[a]	MELCOR	NUREG 1465[a]	MELCOR	NUREG 1465[a]	MELCOR	NUREG 1465[a]	MELCOR	NUREG 1465[a]	MELCOR
Duration (hr)	1	0.5	1.5	2.72	3	8.25	10	8.25	12.5	11.5
Element	Fraction		Fraction		Fraction		Fraction		Fraction	
Noble gases	0.05	0.02	0.95	0.95	0	0.03	0	0	1.0	1.0
I	0.05	0.01	0.22	0.45	0.37	0.01	0.07	0.12	0.71	0.6
Cs	0.05	0.03	0.15	0.43	0.45	0.03	0.03	0.11	0.68	0.6
Te	0	0	0.11	0.10	0.38	0.25	0.01	0.002	0.50	0.36
Sr	0	0	0.03	0.03	0.24	0.35	0	0.003	0.27	0.39
Ba	0	0	0.03	0.03	0.21	0.35	0	0.003	0.24	0.39
Ru	0	0	0.007	0.001	0.004	0	0	0.001	0.011	0.002
La	0	0	0.002	0	0.01	0.06	0	0	0.012	0.06
Ce	0	0	0.009	0	0.01	0.001	0	0	0.019	0.001
Non Radioactive (kg)	0	0	780	0	5,600	933	0	0	6,380	933

[a] Draft NUREG-1465 published for public comment in June 1992.

5.1.5 Best-Estimate Source Term Releases into the Environment

Table 5.7 shows the best-estimate cumulative source terms released into the environment as a function of time. All the class fractions are from the initial inventories, except for classes 2 and 16, that are from the final inventories. The containment failed at 548 min (32,880 s) by high temperature at the head flange seals. Table 5.7 shows times after containment failure (differential times). The largest release of Table 5.7 is for the noble gases (class 1) with 6% at the end of the calculation. The remaining classes do not reach the 1% release fraction even 355 min after the containment failed.

These small releases into the environment are a consequence of the containment failure mode at the head flange seals. The leakage flow through the failed head flange seals is small, with the containment remaining pressurized at about 100 psia or 85 psid (687 kPa) as shown in Sect. 5.1.2 and Fig. 5.5.

Releases into the environment could be larger if the containment fails by liner melt-through because the leakage flow could be larger.

The source term releases into the environment calculated by MELCOR for this transient were compared to the environmental source term releases calculated in Ref. 14 for a similar transient at the Peach Bottom Plant. The transient analyzed in Ref. 14 is also a short-term station blackout with a dry cavity and depressurization due to a stuck open safety relief valve. The transient also ended in containment failure by leakage at the drywell head. A total of eight different observations were found for the source terms of this transient in Ref. 14. The average source term for the eight observations, together with the maximum and the minimum source terms are shown in Table 5.8. Also shown in this table are MELCOR results. The MELCOR calculated environmental source terms are *smaller* than the average values of Ref. 14. A significant discrepancy was found for the noble gases releases, that is predicted to be 100% of the initial inventory in Ref. 14 while MELCOR only predicts a release of 6%.

Table 5.7. Best-estimate cumulative source terms released into the environment for the station blackout with a dry cavity

Time after containment failure	min	0	75	242	355
	h	0	1.25	4	6
Classes	**Element**				
1	Noble Gases	0	0.0015	0.0417	0.0604
2	Cs	0	0.0008	0.0064	0.0097
3	Ba, Sr	0	0.0001	0.0005	0.0005
4	I	0	-	-	-
5	Te	0	0.0002	0.0044	0.0066
6	Ru	0	2×10^{-9}	2×10^{-8}	3×10^{-8}
7	Mo	0	10^{-5}	0.0002	0.0003
8	Ce	0	5×10^{-9}	8×10^{-8}	10^{-7}
9	La	0	3×10^{-8}	3×10^{-7}	4×10^{-7}
10	U	0	10^{-8}	10^{-7}	10^{-7}
11	Cd	0	3×10^{-6}	2×10^{-5}	2×10^{-5}
12	Sn	0	6×10^{-6}	5×10^{-5}	7×10^{-5}
13	B	0	-	-	-
14	H_2O	0	-	-	-
15	Concrete	0	-	-	-
16	CsI	0	0.0004	0.0042	0.0075

NOTE: The fractions are from the initial inventories except for classes 2 and 16 that are from the final inventories.

Table 5.8. Comparison of MELCOR and NUREG/CR-4551 environmental source terms for the station blackout with a dry cavity

		Results from NUREG/CR-4551 (Ref. 14)		
Element	MELCOR	Average	Maximum	Minimum
Noble gases	0.06	1.0	1.0	1.0
I	0.0075	0.0278	0.0774	6×10^{-4}
Cs	0.0097	0.0390	0.1230	3.1×10^{-4}
Te	0.0066	0.0591	0.22448	1.9×10^{-4}
Sr	0.0005	0.0580	0.2310	1.12×10^{-6}
Ba	0.0005	0.0344	0.1350	8.96×10^{-7}
Ru	3×10^{-8}	7.2×10^{-7}	3×10^{-6}	2.6×10^{-11}
La	4×10^{-7}	0.0013	0.0049	8.6×10^{-8}
Ce	10^{-7}	0.0025	0.0097	1.2×10^{-7}

5.2 Station Blackout with Flooded Cavity

The initial conditions for this sequence are described in Sect. 5.2.1. The MELCOR model employed was described in Chap. 4, Sect. 4.1. Some results are given in Sect. 5.2.2. The timing of the important events is given in Sect. 5.2.3. The best-estimate in-containment and environment source terms are given in Sects. 5.2.4 and 5.2.5, respectively.

5.2.1 Initial Conditions

The station blackout with a flooded cavity has the same initial conditions as the station blackout with a dry cavity, with the exception of the amount of water on the cavity floor. Both the in-pedestal and the ex-pedestal regions of the cavity are filled with water up to the lower lip of the vent openings that connect the ex-pedestal cavity with the vent legs to the wetwell. This lower lip opening is 2.57 ft (0.78 m) above the cavity floor. The amounts of water in each region of the cavity at time zero are: 63,407 lb (28,782 kg) in the in-pedestal region and 173,529 lb (78,769 kg) in the ex-pedestal region. These masses correspond to volumes of 1,033 ft^3 (29 m^3) and 2,826 ft^3 (80 m^3) in the in-pedestal and in the ex-pedestal region, respectively. The in-pedestal region has the sump filled with water, plus water 2.57 ft (0.78 m) above the floor level. The temperature of this water is 135°F (330 K) at the start of the calculations, a value slightly below the drywell in-pedestal atmospheric temperature of 145°F (Table 4.2).

After vessel failure (at about 163 min), one Control Rod Drive Hydraulic System (CRDHS) pump is assumed to start operation. This hypothetical CRDHS pump operation was assumed in order to investigate the effect of the flooded cavity on the station blackout transient. This pump injects water into the in-pedestal cavity region. The flow of this pump for the actual pressures in the reactor system (under 159 psig) is between 170 and 180 gpm (10.7 and 11.3 L/s). This pump is modeled using a table of flow and temperature versus time. The water flow of the pump is added to the existing water pool of Vol. 100 (the in-pedestal drywell region).

As previously indicated, the remaining initial conditions for this sequence are identical to the station blackout with a dry cavity described in Sect. 5.1. These initial conditions at time zero of the calculations are: time, 36 s after blackout initiation; steam flow leaving the main steam lines, zero; feedwater flow entering the reactor vessel, zero; water level in the core 556.1 in. (14.125 m) measured from reactor vessel bottom; and vessel pressure 1034.7 psia (7.134 MPa). The initial pressure and temperature in the primary and secondary containment are the normal operating values of the plant (described in Sect. 4.1). The initial conditions inside the vessel volumes were given in Table 5.1.

5.2.2 Thermal-hydraulic Results

The best-estimate run used the MELCOR model described in Sect. 4.1. The input deck for this transient is in Appendix C. This model uses a multi-node representation of the drywell, a dual cavity, and two containment failure modes (by high pressure in the wetwell and by high temperature, moderate-pressure at the head flange seals). Containment failure mode 3 (by drywell liner melt-through) was not implemented. This containment failure mode is believed to be very unlikely for this station blackout with a flooded cavity (as per Ref. 30). MELCOR predicted containment failure by

high pressure in the wetwell 331.5 min after vessel failure. If the vessel failure time calculated by the MELCOR/CORBH Package is used (285.5 min), the containment failure time is 331.5 + 285.5 = 617 min after transient initiation. Comparing the results of this sequence with the results of a station blackout with a dry cavity (Sect. 5.1), this sequence resulted in the same vessel failure time, but a longer time to containment failure and a different containment failure mode. The water present in the cavity in this sequence reduced the atmospheric temperature of the drywell, thus, avoiding the failure of the head flange seals. The containment failed by high pressure in the wetwell.

Figure 5.10 shows the pressure in the primary containment (drywell and wetwell) calculated by MELCOR as a function of time. There is a pressure increase with change in the slope when the vessel failed. There is a second pressure increase when debris enters the ex-pedestal region and vaporization of the water in this region starts. After containment failure, the pressure drops rapidly from 159 psig (1.2 MPa) to around atmospheric. The pressure in the drywell is a little higher than the pressure in the wetwell. Flow goes from the drywell into the wetwell and from the wetwell, after containment failure, into the secondary containment. From the secondary containment leakage flow goes into the environment.

Figure 5.11 shows the atmospheric temperature of the drywell volumes. The temperatures increased at vessel failure and decreased when the containment failed due to the sudden depressurization of the containment. The temperature of Vol. 101, the ex-pedestal region, increases considerably when debris enters this region. All the volume temperatures remain well below 700°F (644 K), the failure temperature of the head flange seals. Figure 5.12 shows the total debris masses in the in-pedestal and the ex-pedestal regions of the cavity. Molten debris enters the in-pedestal region after vessel failure. Debris enters the ex-pedestal region when the in-pedestal cavity "ruptures".

Figure 5.13 shows the total in-vessel hydrogen calculated by MELCOR. At the end of the transient, a total of 1,676 lb (760 kg) of hydrogen has been produced.

5.2.3 Timing of Important Events

Table 5.9 shows the best-estimate times for the important events in the station blackout with a flooded cavity. These times are about the same as the station blackout with a dry cavity (Table 5.2) with the exception of the containment failure time that is now at 617 min (versus 548 min for the station blackout with a dry cavity). The times of Table 5.9 have the 36 s, initial time for the start of the calculations, added. The time for vessel failure,

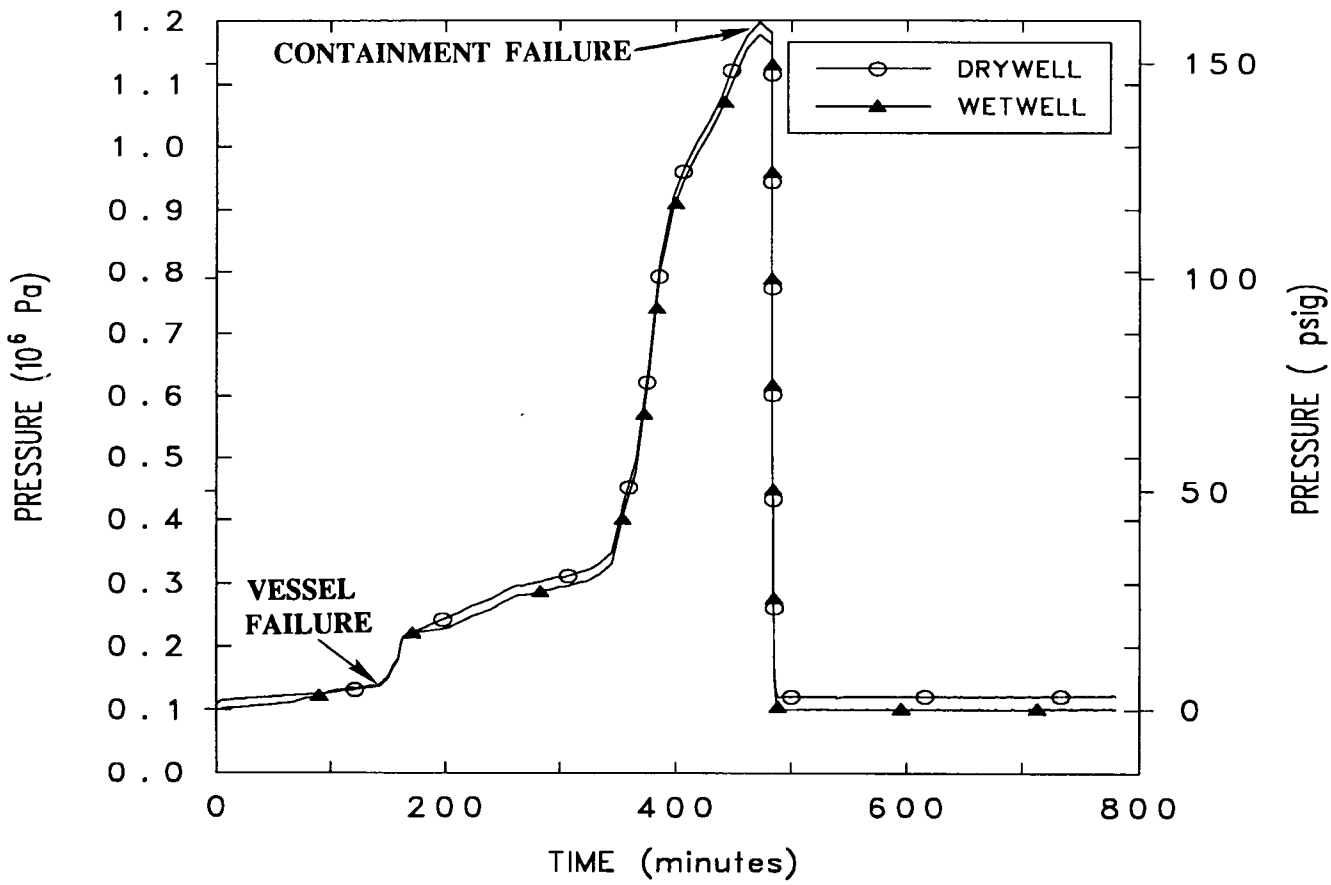

Figure 5.10 Containment pressure for the station blackout with a flooded cavity

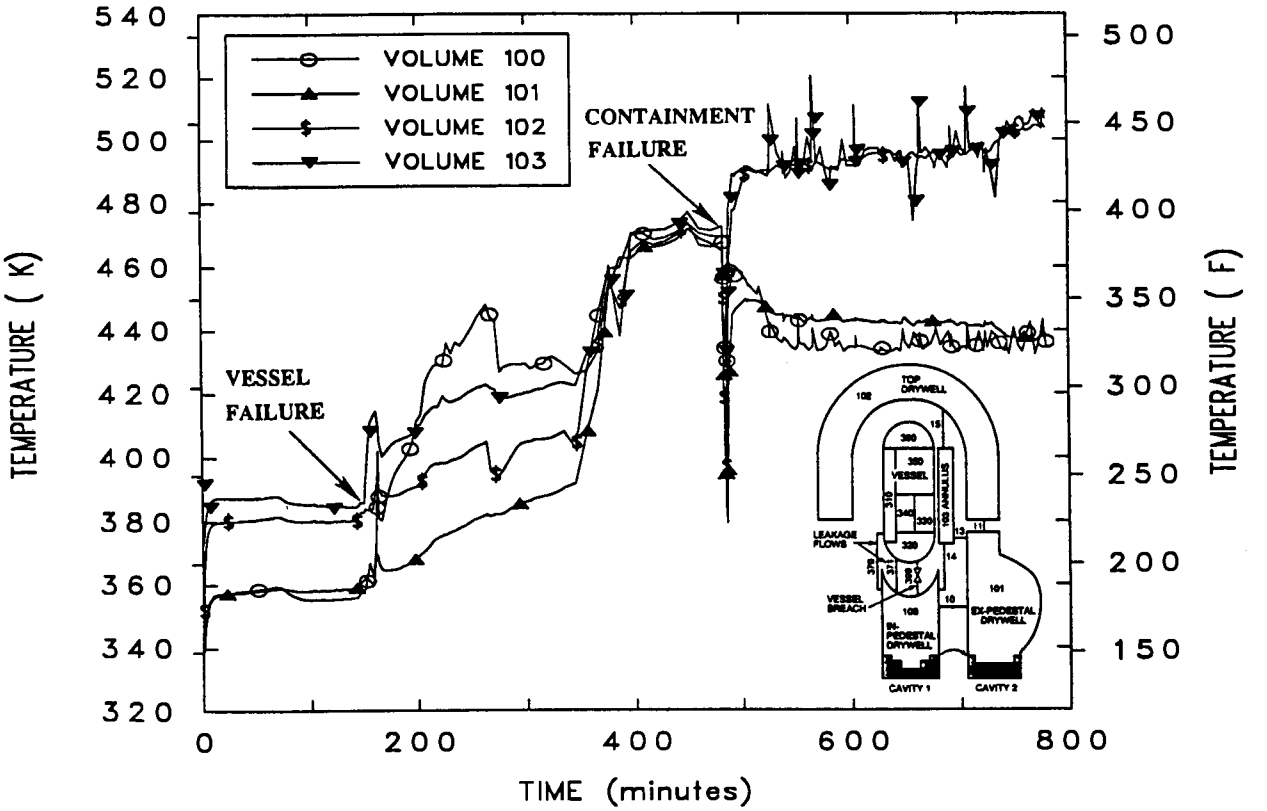

Figure 5.11 Temperatures of the drywell atmosphere for the station blackout with a flooded cavity

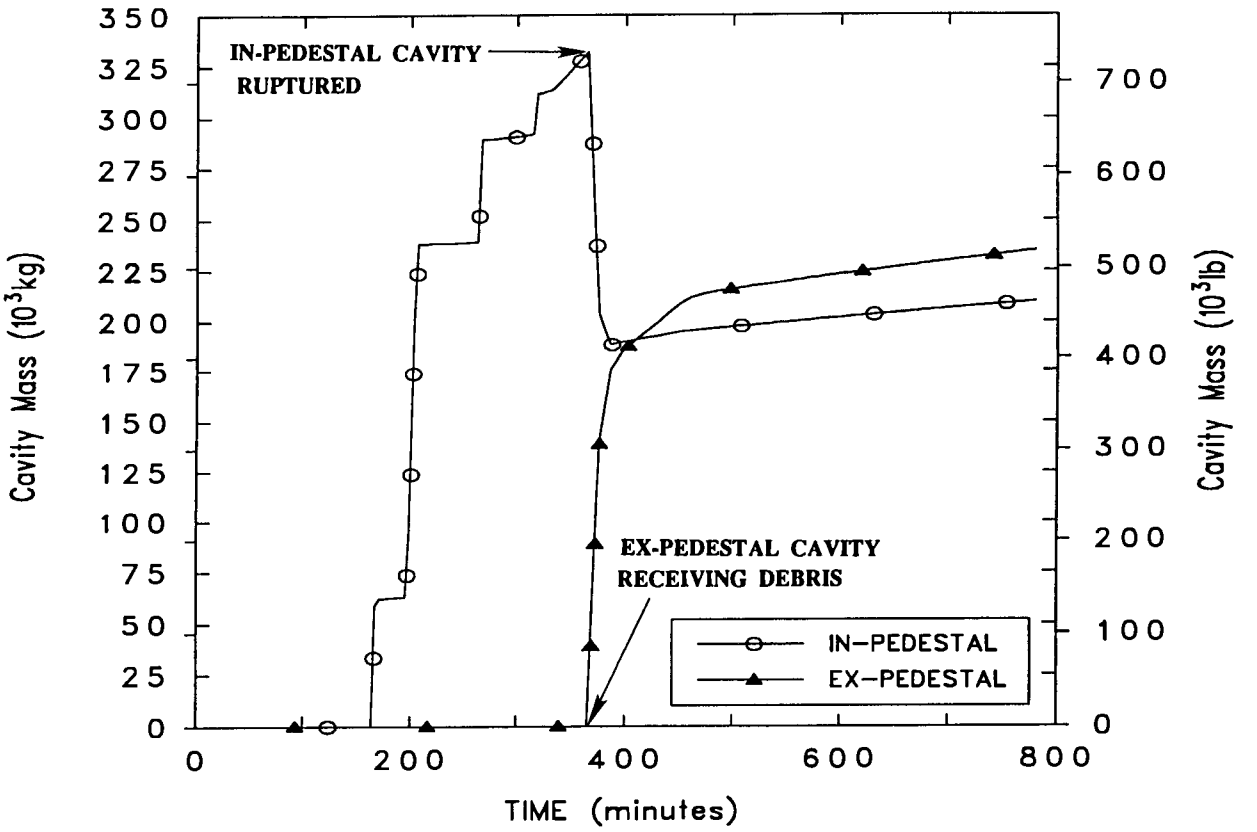

Figure 5.12 Molten debris masses on the drywell floor for the station blackout with a flooded cavity

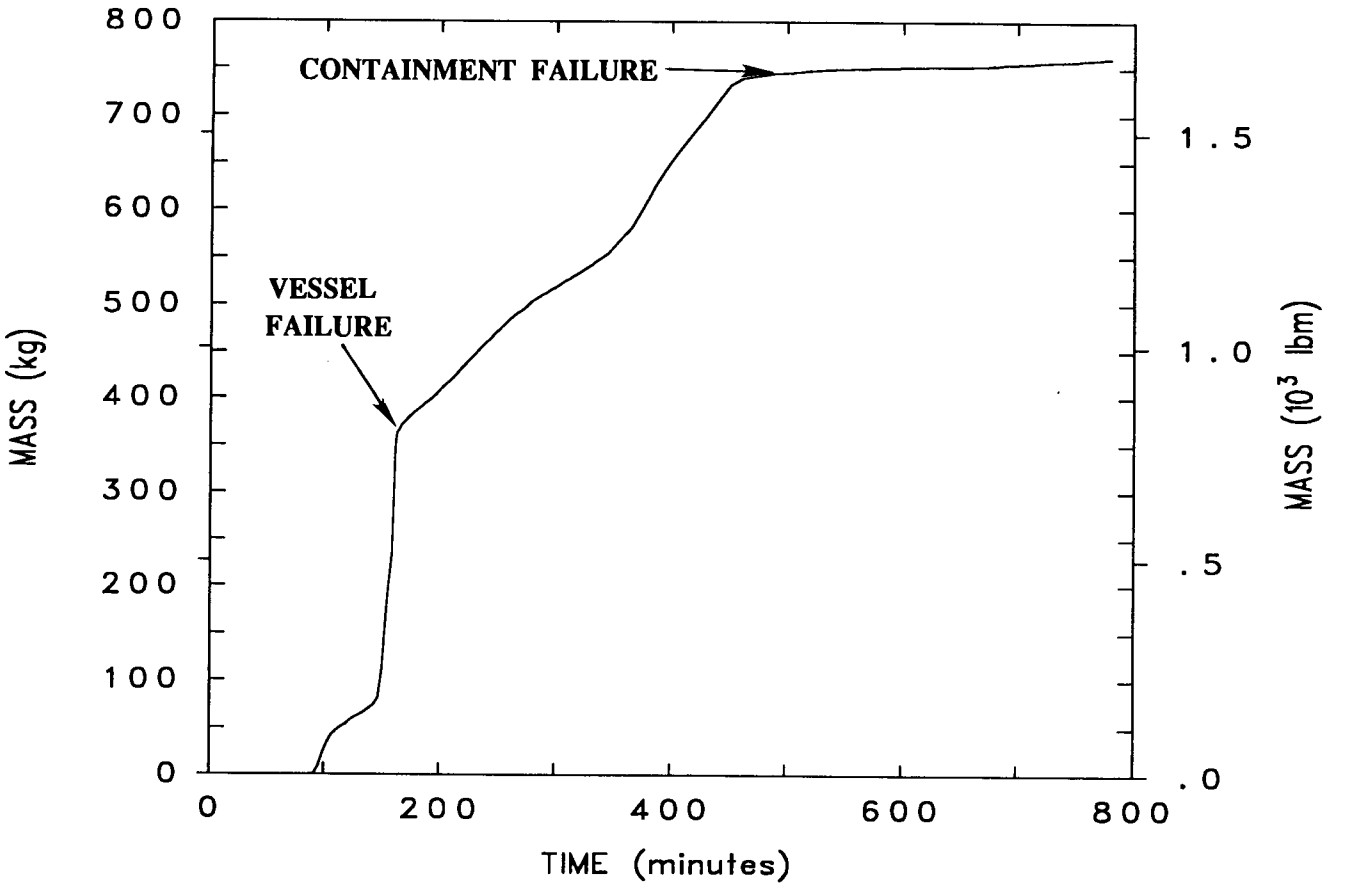

Figure 5.13 **In-vessel hydrogen produced in the station blackout with a flooded cavity**

Table 5.9. Best-estimate times for the events in the station blackout with a flooded cavity

Event	Seconds	Min	Hours	Time from transient initiation
Station blackout initiation	0	0	0	0
MELCOR calculation started	36	0.5	0	0
ADS actuated	3,983	66.4	1.1	1.1
Gap release initiated	5,553	92.6	1.54	1.54
Gap release ended	7,333	122.2	2	2
Gap release phase duration	1,780	29.7	0.5	
Vessel failure time[a]	17,128	285.5	4.75	4.75
In-vessel release phase duration	9,795	163.3	2.72	
Containment failure by high pressure in the wetwell		617	10.28	10.28

[a]MELCOR/CORBH Package calculations.

285.5 min, has been calculated by the MELCOR/CORBH Package. The last column of Table 5.9 provides event times from transient initiation. The ADS is actuated at 1.1 h after transient initiation. The release of fission products in the gap is initiated at 1.54 h and is ended at 2 h after transient initiation. Vessel failure occurs at 4.75 h and containment failure at 10.28 h after transient initiation.

5.2.4 Best-Estimate In-Containment Source Terms

The best-estimate cumulative source terms released into containment as a function of time are given in Table 5.10.

All fractions are from the *initial* inventories of fission products, except for class 2 (Cs) and 16 (CsI). For these two classes, the fractions are of the *final* fission product inventories. Table 5.11 shows the fractional distribution of the final inventories of fission products by class among nine different locations at the end of the calculations (13 h). These nine locations are: core, debris in cavity, reactor coolant system (RCS), drywell, wetwell, reactor building (RB), turbine building (TB), refueling bay, and environment. The reactor building includes all the secondary containment. The turbine building, the refueling bay, and the environment are outside of secondary containment. The in-containment source term is the summation of all the fractions in the last six columns of Table 5.11, that is, the fraction out of the core, cavity debris and reactor coolant system.

Table 5.11 shows that the largest fraction of the noble gases (class 1) is in the environment with a value of about 89%. The largest fractions of Cs (class 2) and CsI (class 16) are in the wetwell with 57% followed by 36% inside the reactor coolant system. For the remaining classes, the largest fractions are in the cavity debris with values between 63% for class 3 (Ba, Sr) to 95% for class 6 (Ru), class 8 (Ce) and class 10 (U). Elemental iodine (Class 4) is only inside the fuel in the core as a non-released element. Most of the iodine has been released previously and combined with Cs to form class 16 (Cs I).

Best-estimate in-containment source terms for each of the four release phases are given in Table 5.12. This table has the "early in-vessel" release phase adjusted for the vessel

Table 5.10. Cumulative fractions of the initial fission product inventory released into containment for the station blackout with a flooded cavity

		Transient Time (min)							
Class	Element	123	150	163	285	333	500	667	780
1	Noble gases	0.0322	0.5914	0.7812	0.9675	0.9864	0.9994	0.9996	0.9996
2	Cs[a]	0.0381	0.3052	0.4387	0.5187	0.6099	0.6342	0.6384	0.6396
3	Ba, Sr	0.0005	0.0224	0.0361	0.0598	0.1065	0.2954	0.2965	0.2970
4	I	0	0	0	0	0	0	0	0
5	Te	0	0.0009	0.0032	0.1140	0.1584	0.1850	0.2160	0.2250
6	Ru	0	0.0005	0.0012	0.0015	0.0020	0.0021	0.0021	0.0021
7	Mo	0.0002	0.0186	0.0252	0.0336	0.0344	0.0392	0.0403	0.0418
8	Ce	0	0	0	0	0	0	0	0
9	La	0	0	0	0.0004	0.0080	0.0119	0.0119	0.0129
10	U	0	0	0	0	0	0	0	0
11	Cd	0.0011	0.0709	0.1123	0.1471	0.1484	0.1517	0.1525	0.1525
12	Sn	0.0011	0.0709	0.1123	0.1471	0.1504	0.1557	0.1565	0.1565
13	B	-	-	-	-	-			
14	H_2O	-	-	-	-	-			
15	Concrete	-	-	-	-	-			
16	CsI[b]	0.0197	0.2880	0.3952	0.5281	0.6112	0.6427	0.6446	0.6453
	Event	Gap release ended			Vessel failure	Containment failure			End calculation

[a]Fractions of the final inventory of 246.40 kg.
[b]Fractions of the final inventory of 42.85 kg.

Table 5.11. Fractional distribution of the final inventories of fission products by class and location for the station blackout with a flooded cavity 13 h after transient initiation

Class	Element	Core	Cavity Debris	RCS	Drywell	Wetwell	RB	TB	Ref-Bay	Environ
1	Noble gases	0.243×10^{-9}	0	0.156×10^{-3}	0.246×10^{-4}	0.481×10^{-4}	0.546×10^{-1}	0.303×10^{-1}	0.259×10^{-1}	0.889
2	Cs	0.257×10^{-9}	0.124×10^{-15}	0.360	0.633×10^{-1}	0.574	0.103×10^{-2}	0.565×10^{-4}	0.984×10^{-4}	0.125×10^{-2}
3	Ba, Sr	0.235×10^{-1}	0.629	0.505×10^{-1}	0.119	0.177	0.810×10^{-5}	0.731×10^{-7}	0.301×10^{-6}	0.171×10^{-5}
4	I	1.0	0	0	0	0	0	0	0	0
5	Te	0.228×10^{-1}	0.721	0.312×10^{-1}	0.754×10^{-1}	0.148	0.327×10^{-3}	0.182×10^{-4}	0.303×10^{-4}	0.411×10^{-3}
6	Ru	0.452×10^{-1}	0.951	0.169×10^{-2}	0.524×10^{-4}	0.160×10^{-2}	0.315×10^{-6}	0.248×10^{-8}	0.111×10^{-7}	0.575×10^{-7}
7	Mo	0.258×10^{-1}	0.893	0.394×10^{-1}	0.400×10^{-2}	0.375×10^{-1}	0.141×10^{-4}	0.677×10^{-7}	0.508×10^{-6}	0.177×10^{-5}
8	Ce	0.460×10^{-1}	0.954	0.494×10^{-4}	0.377×10^{-5}	0.460×10^{-4}	0.163×10^{-7}	0.890×10^{-10}	0.583×10^{-9}	0.222×10^{-8}
9	La	0.460×10^{-1}	0.941	0.664×10^{-4}	0.429×10^{-2}	0.818×10^{-2}	0.160×10^{-7}	0.198×10^{-9}	0.652×10^{-9}	0.478×10^{-8}
10	U	0.460×10^{-1}	0.954	0.626×10^{-4}	0.186×10^{-4}	0.859×10^{-4}	0.164×10^{-7}	0.104×10^{-9}	0.576×10^{-9}	0.256×10^{-8}
11	Cd	0.679×10^{-2}	0.712	0.129	0.483×10^{-2}	0.147	0.667×10^{-5}	0.650×10^{-7}	0.242×10^{-6}	0.151×10^{-5}
12	Sn	0.679×10^{-2}	0.708	0.129	0.704×10^{-2}	0.150	0.773×10^{-5}	0.677×10^{-7}	0.281×10^{-6}	0.160×10^{-5}
13	B	0	0	0	0	0	0	0	0	0
14	H_2O	0	0	0	0	0	0	0	0	0
15	Concrete	0	0	0	0	0	0	0	0	0
16	CsI	0.107×10^{-8}	0.263×10^{-11}	0.355	0.701×10^{-1}	0.573	0.101×10^{-2}	0.570×10^{-4}	0.962×10^{-4}	0.127×10^{-2}

Table 5.12. Best-estimate in-containment source terms by release phase for the station blackout with a flooded cavity

		PHASE	GAP RELEASE	EARLY IN-VESSEL	EX-VESSEL	LATE IN-VESSEL	TOTAL
	Duration,	min	29.7	163	495	495	688
		h	0.5	2.7	8.25	8.25	11.5
Class	Elements	Inventory (kg)	Fraction	Fraction	Fraction	Fraction	Fraction
1	Noble gases	463.70	0.0322	0.9353	0.0321	0	0.9996
2	Cs	246.40	0.0381	0.4479	0.0536	0.1000	0.6396
3	Ba, Sr	207.52	0.0005	0.0335	0.2530	0.0100	0.2970
4	I	20.93	-	-	-	-	-
5	Te	40.78	0	0.1000	0.1235	0.0015	0.2250
6	Ru	306.99	0	0.0015	0	0.0006	0.0021
7	Mo	350.64	0.0002	0.0400	0.0016	0	0.0418
8	Ce	593.65	0	0	0	0	0
9	La	571.03	0	0	0.0129	0	0.0129
10	U	132,390.00	0	0	0	0	0
11	Cd	1.41	0.0011	0.1514	0	0	0.1525
12	Sn	8.59	0.0011	0.1554	0	0	0.1565
13	B	-	-	-	-	-	-
14	H_2O	-	-	-	-	-	-
15	Concrete[a]	-	-	-	[a]	-	-
16	CsI	42.85	0.0197	0.4420	0.0836	0.1000	0.6453

[a]A total of 1,127 kg of non-radioactive compounds are released from core-concrete interactions during the ex-vessel release phase.

failure time of 285 min calculated by the MELCOR/CORBH Package. The "early in-vessel" source terms for classes 1 (noble gasses), 2 (Cs), 5 (Te), 7 (Mo), 11 (Cd), 12 (Sn), and 16 (CsI) have been increased to account for the longer time to vessel failure calculated by the MELCOR/CORBH Package. This "adjustment" is consistent with the "adjustment" performed for the station blackout with a dry cavity sequence in Sect. 5.1.4. Both the "gap" and the "early in-vessel" release phases of both station blackouts (with dry and flooded cavities) are very similar, as these two release phases should not be affected by the dry or flooded cavity. The other two release phases are different for each station blackout sequence.

5.2.5 Best-Estimate Source Term Releases Into the Environment

Table 5.13 shows the best-estimate cumulative source terms released into the environment by class and as a function of time. All the fractions are from the initial inventories, except for class 2 (Cs) and 16 (CsI) that are from the final inventories. The containment failed at 617 min by high pressure (159 psig) in the wetwell. The times in Table 5.12 are times after containment failure (differential times).

The largest release of Table 5.13 is for the noble gases with 67% released 18 min after containment failure and 89%, 298 min (5 h) after containment failure. The release for Cs and CsI are about 0.1%. The remaining classes have smaller releases (0.04% and less) even 5 h after containment failure. These small releases are a consequence of the containment failing at the wetwell, with all the fission products being scrubbed through the wetwell water before being released into the secondary containment and into the environment.

Comparison of these source term releases into the environment with the values calculated in NUREG-4551 (Ref. 14) for a similar sequence (short-term station blackout with a relief valve stuck open and a flooded cavity) is shown in Table 5.14. A total of three different observations were found for this sequence in Ref. 14. The average values, together with the maximum and the minimum values of the source terms for the three observations, are shown in Table 5.14. The MELCOR calculated source terms are *smaller* than the average source terms of Ref. 14, with the exception of the Cs source term. The MELCOR Cs source term is smaller than the maximum value of the source term of Ref. 14 for this fission product. The releases of noble gases are in fairly good agreement, with MELCOR predicting 89% of the initial

Table 5.13. Best-estimate cumulative source term released into the environment for the station blackout with a flooded cavity

	Time after containent failure, min	0	18	185	298
	h	0	0.3	3	5
Class	Elements				
1	Noble gases	0	0.6690	0.8190	0.8890
2	Cs	0	0.0010	0.0012	0.0013
3	Ba, Sr	0	0.91×10^{-6}	0.14×10^{-5}	0.17×10^{-5}
4	I	0	-	-	-
5	Te	0	0.0003	0.0004	0.0004
6	Ru	0	0.28×10^{-7}	0.48×10^{-7}	0.57×10^{-7}
7	Mo	0	0.63×10^{-6}	0.12×10^{-5}	0.18×10^{-5}
8	Ce	0	0.88×10^{-9}	0.16×10^{-8}	0.22×10^{-8}
9	La	0	0.30×10^{-8}	0.42×10^{-8}	0.48×10^{-8}
10	U	0	0.11×10^{-8}	0.19×10^{-8}	0.26×10^{-8}
11	Cd	0	0.78×10^{-6}	0.13×10^{-5}	0.15×10^{-5}
12	Sn	0	0.80×10^{-6}	0.13×10^{-5}	0.16×10^{-5}
16	CsI	0	0.0010	0.0012	0.0013

Note: The fractions are from the initial inventories except for classes 2 and 16 that are from the final inventories

Table 5.14. Comparison of MELCOR and NUREG-4551 environmental source terms for the station blackout with a flooded cavity

		Results from NUREG/CR-4551 (Ref. 14)		
Element	MELCOR	Average	Maximum	Minimum
Noble gases	0.89	1.0	1.0	1.0
I	0.0013	0.107	0.313	1.4×10^{-3}
Cs	0.0013	7×10^{-4}	0.002	0
Te	0.0004	6.32×10^{-4}	0.002	3.7×10^{-7}
Sr	2×10^{-6}	4.1×10^{-4}	0.001	1.5×10^{-9}
Ba	2×10^{-6}	0.0004	0.0013	1.4×10^{-8}
Ru	6×10^{-7}	2.6×10^{-6}	7.7×10^{-6}	8×10^{-15}
La	5×10^{-9}	3.7×10^{-5}	1.11×10^{-4}	1.35×10^{-11}
Ce	2×10^{-9}	8.4×10^{-5}	2.5×10^{-4}	2.6×10^{-11}

inventory released and Ref. 14 predicting 100% released. The sequence of Ref. 14 also ended in containment failure at the wetwell.

5.3 Comparison of Station Blackout Sequences

MELCOR predicted different containment failure modes and times for each station blackout. For the station blackout with a dry cavity, the containment was predicted to fail by high temperature at the head flange seals 262 min after vessel failure. On the other hand, for the station blackout with a flooded cavity, the containment was predicted to fail by high pressure in the wetwell 332 min after vessel failure, which is 70 min later than in the previous sequence. The flooded cavity kept the atmospheric temperatures of the drywell cooler than the dry cavity sequence. The drywell atmosphere temperatures went up to 1,520°F (1,100 K) in the station blackout with the dry cavity (Fig. 5.6). In the station blackout with the flooded cavity, these temperatures did not exceed 460°F (510 K) as shown in Fig. 5.11. The flooded cavity resulted also in slightly lower temperatures for debris in both the in-pedestal and ex-pedestal cavities (Figs. 5.14 and 5.15).

Containment pressures for both sequences are shown in Fig. 5.16. Before vessel failure, the pressures are about the same for both sequences. After vessel failure, the sequence with a flooded cavity has a lower containment pressure than the sequence with a dry cavity, with the exception of a period of about 95 min. During these 95 min, the containment pressure is higher in the sequence with a flooded cavity due to water vaporization from the ex-pedestal cavity. A comparison of the vessel pressures for both sequences (Fig. 5.17) indicates that the pressures are the same before vessel failure. After vessel failure, the pressures in the vessel and containment equalize for each sequence. Consequently, the station blackout with a flooded cavity has a lower vessel pressure for more time than the station blackout with a dry cavity. Lower pressures inside the vessel normally result in higher vessel temperatures because lower pressure gases have lower densities and reduced heat capacities resulting in less heat removal. Figures 5.18 and 5.19 show the atmospheric temperatures of the vessel volumes for the station blackout with a dry cavity and with a flooded cavity. The

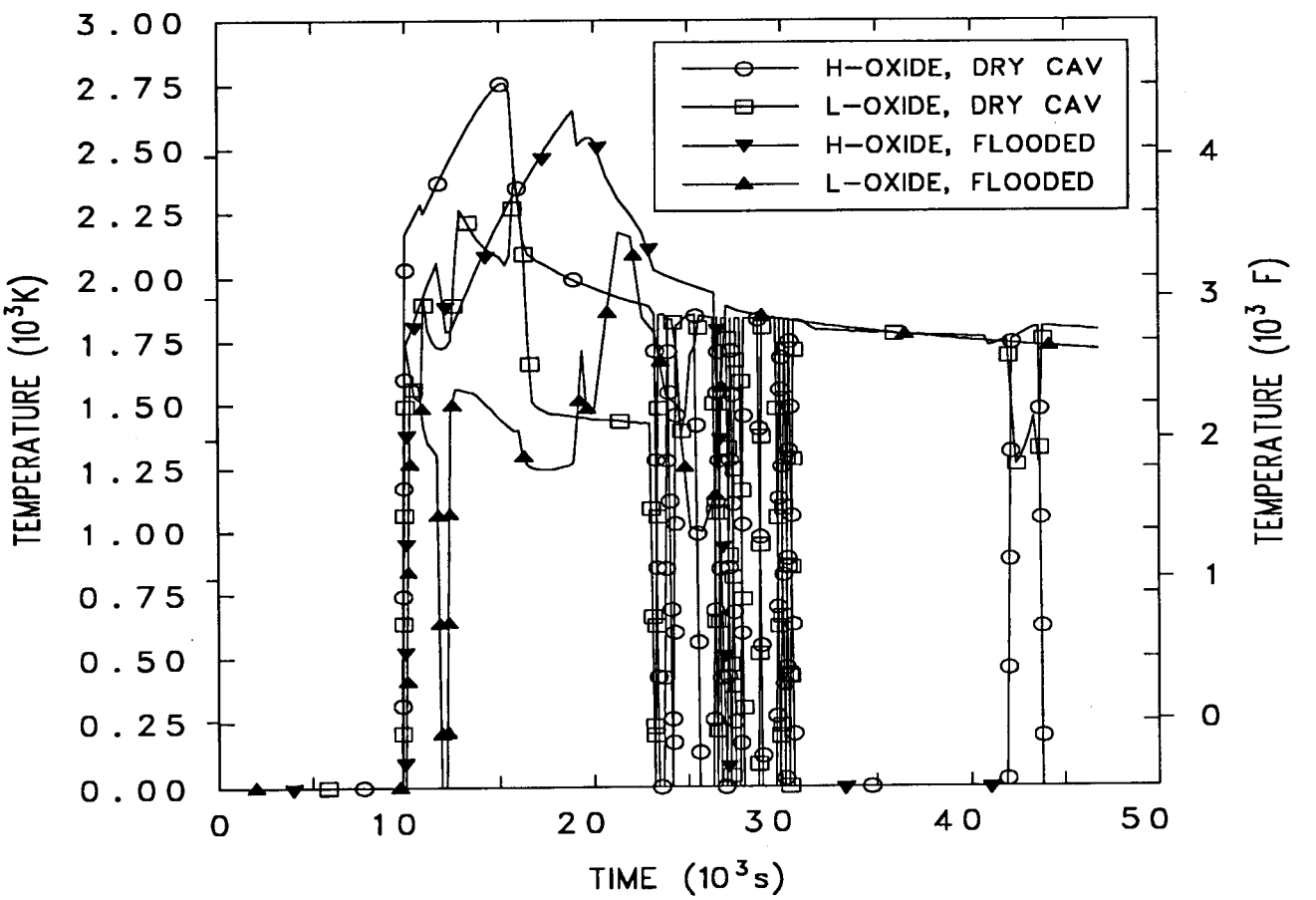

Figure 5.14 **Comparison of the temperatures of two layers of the in-pedestal cavity for both station blackout sequences. Multiple layer flips occurred after 23,000 s for the dry cavity sequence**

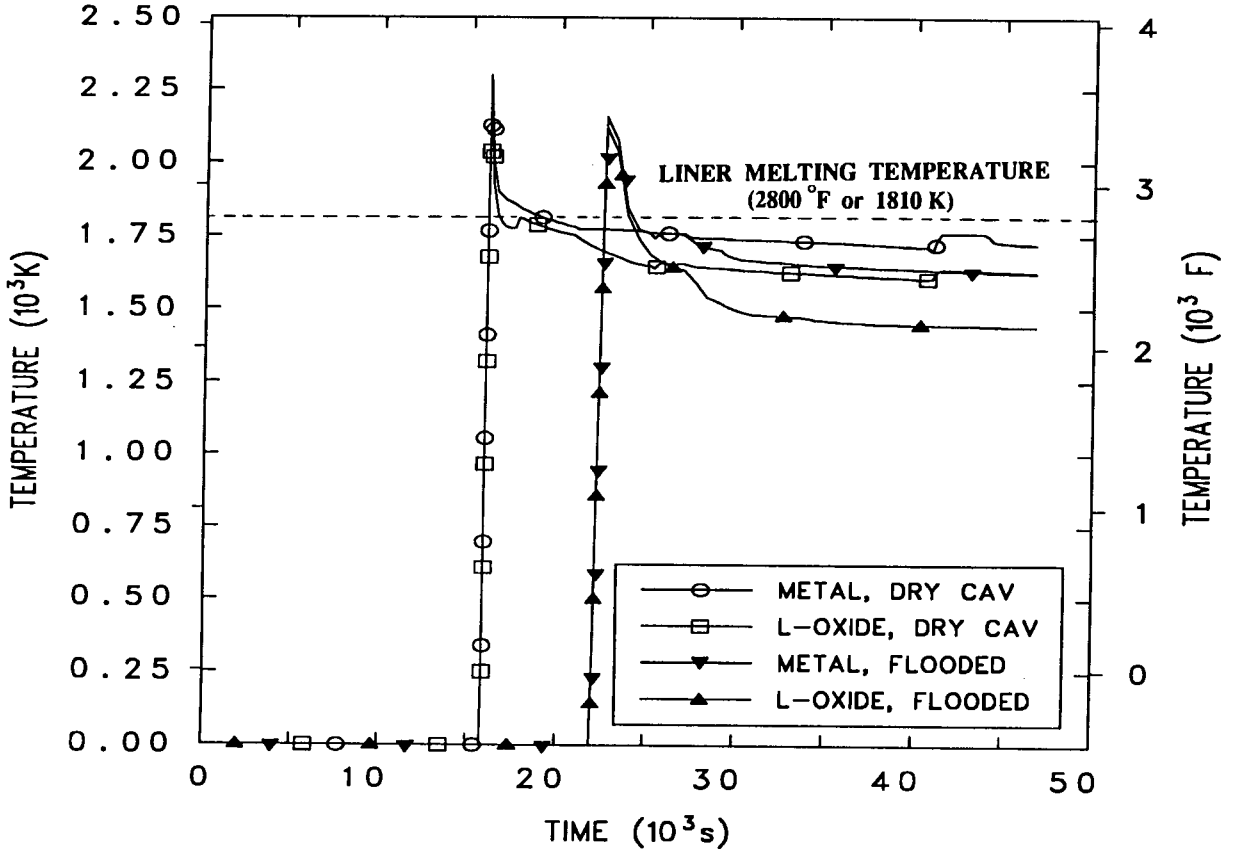

Figure 5.15 Comparison of the temperatures of two layers of the ex-pedestal cavity for both station blackout sequences

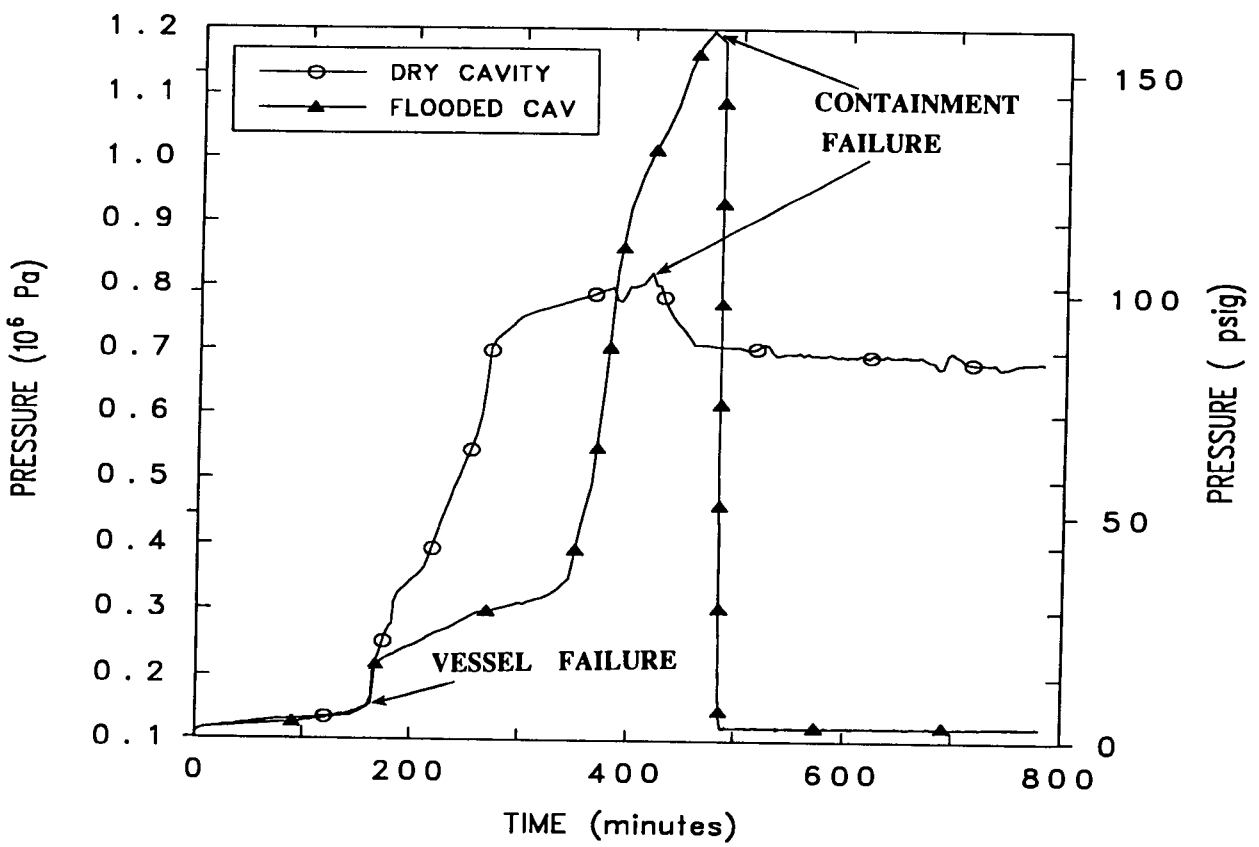

Figure 5.16 Comparison of the containment pressure for both station blackout sequences

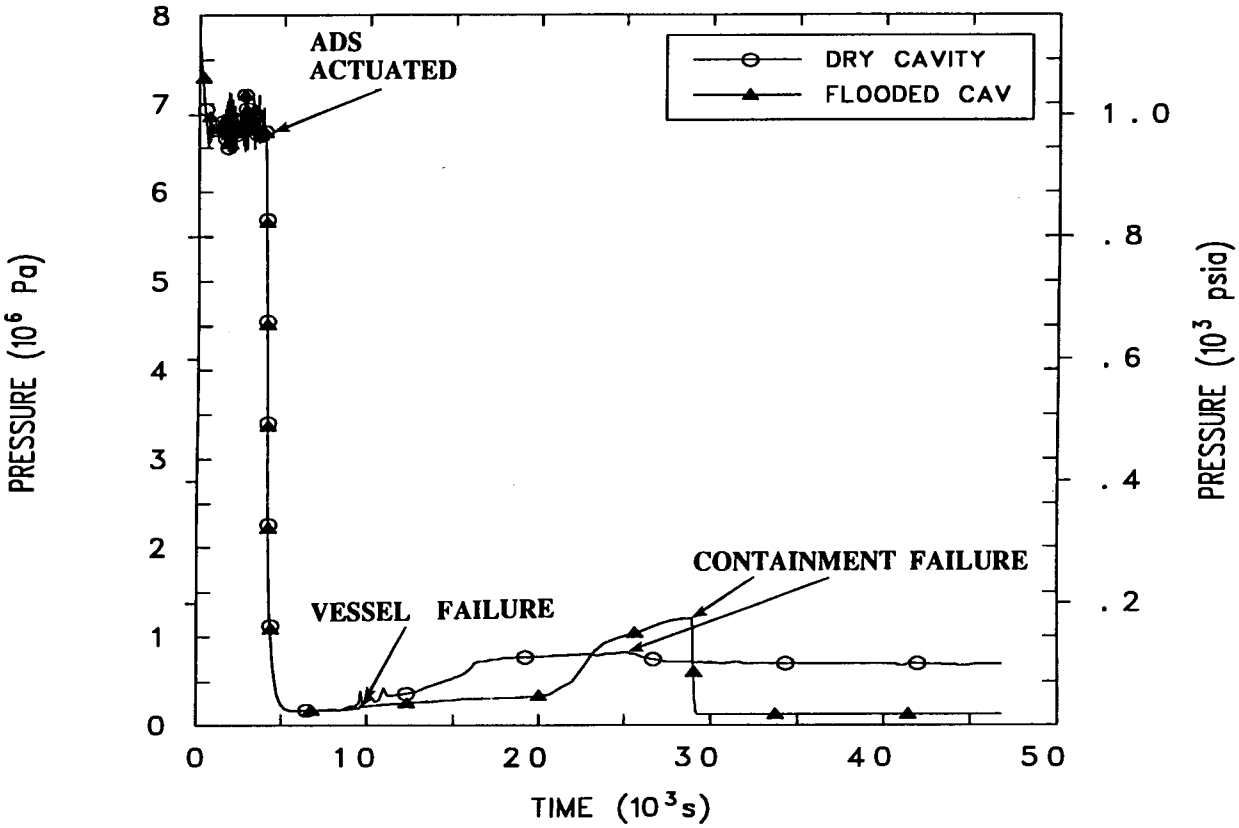

Figure 5.17 Comparison of the vessel pressure for both station blackout sequences

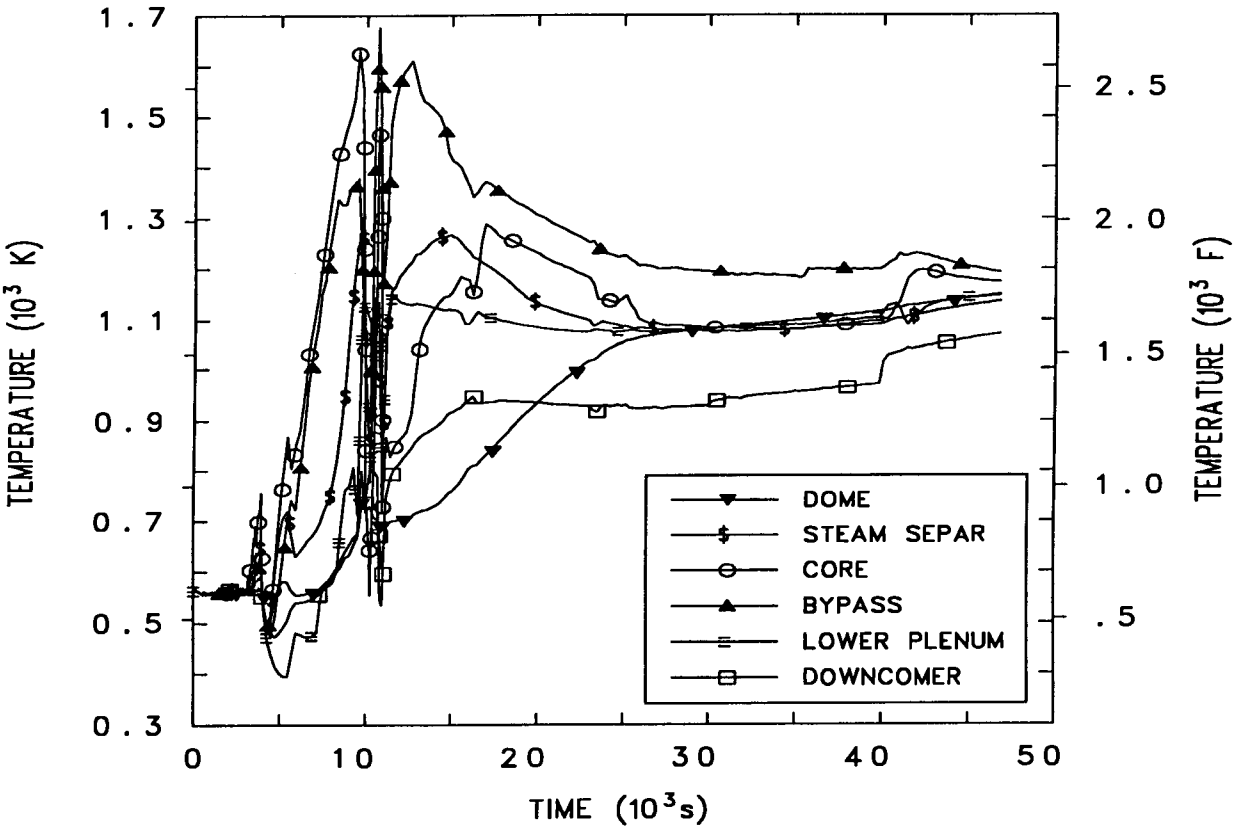

Figure 5.18 Atmospheric temperatures inside the vessel for the station blackout with a dry cavity

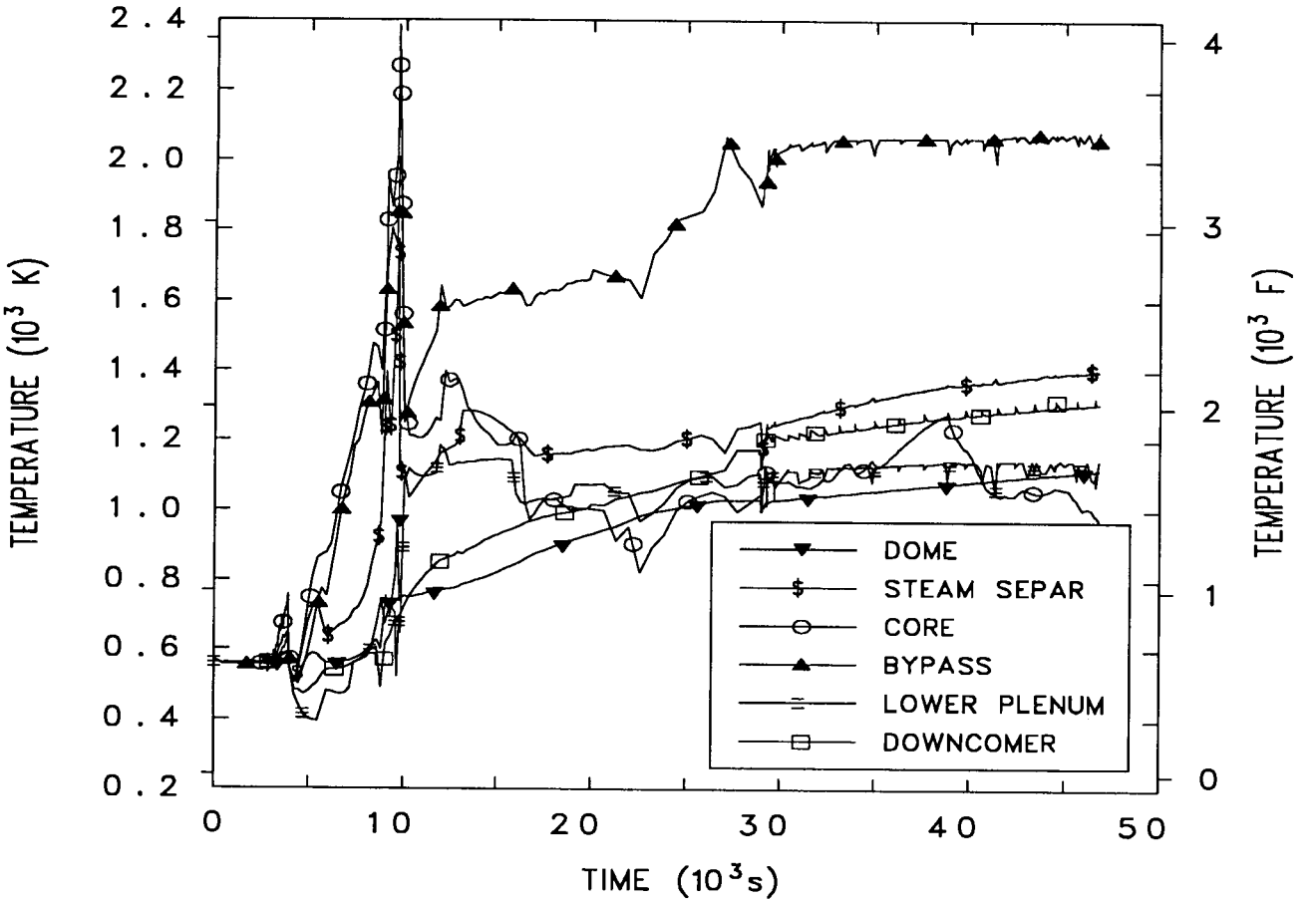

Figure 5.19 **Atmospheric temperatures inside the vessel for the station blackout with a flooded cavity**

lower pressure sequence, the station blackout with the flooded cavity, has higher temperatures inside the vessel.

There are also some differences in the in-containment source terms for both sequences (Tables 5.5 and 5.12). The "gap release" and "early in-vessel" in-containment source terms are very similar for both sequences since the differences in accident behavior start after vessel failure. The "total" and the "ex-vessel" in-containment source terms are smaller for the station blackout with a flooded cavity with the exception of Cs and CsI, that are larger. The hotter temperatures inside the vessel for the station blackout with a flooded cavity resulted in less deposition of Cs and CsI on the vessel walls and, therefore, less revaporization and larger "ex-vessel" contributions. Tables 5.3 and 5.11 show the fractional distribution of fission products by class and location at the end of the calculation (13 h) for both station blackout sequences. The station blackout with the dry cavity has most of the noble gases (84.2%) in the wetwell air space followed by 7.5% in the drywell and 6% into the environment. The station blackout with the flooded cavity resulted in containment failure at the wetwell with almost no noble gases inside the primary containment. The majority of the noble gases (89%) escaped to the environment, 5.5% are in the reactor building, 3% in the turbine building, and 2.6% in the refueling bay. For class 2 (Cs), the dry cavity sequence has almost 40% in the reactor coolant system (RCS), 32.5% in the wetwell water, and 26% in the drywell. The flooded cavity sequence has only 36% in the RCS, 4% less than the dry cavity sequence because the hotter temperatures of the RCS resulted in less deposition on the hotter walls. The flooded cavity sequence has a total in-containment Cs source term fraction of 64% (Table 5.12), 4% larger than the dry cavity sequence with only 60% (Table 5.5), because the 4% difference in the Cs retention in the RCS. On the other hand, the amount of Cs retained in the wetwell water for the flooded cavity is 57.4% versus only 32.5% in the dry cavity sequence. The amount of Cs left in the drywell is only 6.3% in the flooded cavity versus 26% in the dry cavity case. The behavior of class 16 (CsI) is very similar to class 2. The flooded cavity sequence retained 35.5% in the RCS and the dry cavity sequence 40%, a 4.5% difference. Similarly, the total in-containment source term for the flooded cavity case is 64.5%, 5.2% larger than the source term for the dry cavity case with only 59.3%. Retention of CsI in the wetwell water for the sequence with the flooded cavity was much larger (57.3%) than in the sequence with the dry cavity (only 31.2%). The fraction on CsI in the drywell is only 7% for the flooded cavity sequence and 25.6% for the dry cavity sequence.

For the remaining fission product classes, the total in-containment source terms are smaller for the flooded cavity sequence (Tables 5.5 and 5.12) due to reduced core-concrete interaction.

The source terms released into the environment at the end of the calculation (13 h) for both sequences are compared in Table 5.15. The station blackout with a flooded cavity has a larger release of noble gases (89%) than the station blackout with a dry cavity (only 6%), because the station blackout with the flooded cavity resulted in containment failure at the wetwell with a larger flow area than the containment failure at the head flange seals for the station blackout with a dry cavity. The containment depressurized after failure in the station blackout with the flooded cavity (Fig. 5.16) compared with the station blackout with a dry cavity that remained pressurized after containment failure.

For the remaining classes, the scrubbing effect of the wetwell (all the fission products have to pass through the wetwell water before leaking out of the primary containment) for the station blackout with the flooded cavity resulted in smaller releases into the environment than in the station blackout with a dry cavity.

Table 5.15. Source terms released into the environment for both station blackouts at the end of the calculations (13 h)

Class	Element	Station Blackout dry cavity	Station Blackout flooded cavity
1	Noble gases	0.06	0.889
2	Cs	0.0097	0.0013
3	Ba, Sr	0.0005	2×10^{-6}
4	I	-	-
5	Te	0.0066	0.0004
6	Ru	3×10^{-8}	6×10^{-7}
7	Mo	0.0003	2×10^{-6}
8	Ce	10^{-7}	2×10^{-9}
9	La	4×10^{-7}	5×10^{-9}
10	U	10^{-7}	3×10^{-9}
11	Cd	2×10^{-5}	10^{-6}
12	Sn	7×10^{-5}	10^{-6}
16	CsI	0.0075	0.0013

6 LOCA Characterization

This chapter describes the MELCOR results for the unmitigated design basis LOCA accident concurrent with loss of all ECCS. Since the ECCS is assumed not to be available after the LOCA, the uncovered core heats up, melts, and vessel failure eventually occurs as it occurred in the station blackout accidents. This accident is also a low pressure sequence, since the LOCA depressurizes the reactor vessel.

The initial conditions used are described in Sect. 6.1. The MELCOR model was described in Chap. 4, Sect. 4.1, and the MELCOR input employed is in Appendix D. Thermal-hydraulic results are presented in Sect. 6.2. The timing of the important events is given in Sect. 6.3. Best-estimate source terms are described in Sects. 6.4 and 6.5.

6.1 Initial Conditions

Initial conditions in the Peach Bottom reactor system for a LOCA without ECCS after the blowdown is completed and the feedwater and recirculation pumps are stopped were not found in the available literature. The Peach Bottom Final Safety Analysis Report (FSAR)[39] does not provide these conditions because the FSAR assumes the ECCS is operational after the LOCA.

The LOCA calculation was initiated at time zero of the transient with the following initial conditions and calculational assumptions:

a) The reactor is at full power (3,293 MWt) and is scrammed from full power at time zero.
b) The initial conditions in the reactor vessel and in the containment are normal plant operating values. For the reactor vessel these conditions are: water level 561 in. (14.25 m) above bottom of the reactor vessel; pressure 1,025 psia (7.042 MPa); and, water temperature 547°F (559 K). The initial conditions in the reactor vessel volumes are given in Table 6.1. The initial conditions in the containment volumes, are identical to those given in Table 4.2.
c) The main steam isolation valves (MSIVs) are fully-open at time zero, releasing 13,385,581 lb/h (1,685.9 kg/s) of steam. This steam flow continues for the first second of the transient. Afterwards, the steam flow is linearly ramped down to zero flow in the next three seconds. Therefore, four seconds after the transient is initiated, the MSIVs are completely closed. This is consistent with the Technical Specification requirement for MSIVs to fully close within three to five seconds.
d) The full feedwater flow of 13,463,881 lb/h (1,696.4 kg/s) is maintained during the first six seconds of the transient. Afterwards, this flow is linearly ramped down to zero in 30 s. Therefore, 36 s after transient initiation, the feedwater flow ceases. These conditions have been taken from the turbine test performed by Pennsylvania Power and Light at the Susquehanna Plant (Ref. 38), another BWR-4 reactor with the same thermal power as Peach Bottom.
e) The intact recirculation pump is at full flow at time zero, pumping about 22,590,960 lb/h of drive water through the jet pump for a total flow rate of ~50,000,000 lb/h. The pump is assumed to trip at time zero, and to start a linear coastdown from full flow to zero flow in 15 s. If the suction side of the pump becomes uncovered, the pump flow will go to zero even if it occurs before the end of the coastdown. This model accounts for the inertia of the pump.
f) The break is assumed to be *downstream* of the recirculation pump. Therefore, no flow from the broken pipe is pumped into the core. The only flows in this leg are the critical flows from the downcomer through the broken piping into the ex-pedestal drywell region.
g) Both LOCA flowpaths are open at time zero. Critical flow out of both flowpaths is established almost immediately. A discharge coefficient of 0.68 is used in MELCOR to account for the critical flow vena contracta.

Table 6.1. Reactor vessel volumes and initial conditions for the LOCA sequence

Volume No.	Volume name	Volume [ft³ (m³)]	Water Level [in. (m)]	Temperature [°F (K)]	Pressure [psia (Mpa)]
310	Downcomer (Annulus)	6,491 (183.8)	561 (14.25)	547 (559)	1,025 (7.042)
320	Lower plenum	3,655 (103.5)	Full	547 (559)	1,025 (7.042)
330	By-pass	911 (25.8)	Full	547 (559)	1,025 (7.042)
340	Channel	1,176 (33.3)	Full	547 (559)	1,025 (7.042)
350	Shroud dome	1,586 (44.9)	561 (14.25)	547 (559)	1,025 (7.042)
360	Steam dome	7,720 (218.6)	Empty	547 (559)	1,025 (7.042)

h) The drywell is assumed to be basically "dry" with the exception of the in-pedestal sump which is assumed to hold 3,183 lb (1,447 kg) of water. No water is present in the ex-pedestal region of the cavity. These conditions in the drywell are identical to the ones assumed for the station blackout with a dry cavity.

6.2 Thermal-Hydraulic Results

After the LOCA is initiated, the pressure inside the vessel decreases (Fig. 6.1) and the pressure inside the primary containment increases. At about 100 s, both pressures equalize (Fig. 6.1). The vessel pressure decreases very rapidly during the first 3 s of the transient. Pressures in the drywell (Vol. 101) and in the wetwell (Vol. 200) during the first 40 s of calculations, are shown in Fig. 6.2. There is a peak pressure of 43 psig (395 kPa) in the drywell at about 8 s. This pressure decreases to about 24 psig (265 kPa) at about 12 s and slowly increases afterwards. The peak pressure calculated by MELCOR agrees well with the peak pressure of 44.1 psig at 10 s after LOCA initiation reported in the Peach Bottom FSAR.[39] Figure 6.3 shows the atmospheric temperature of the in-pedestal (Vol. 100) and the ex-pedestal (Vol. 101) drywell volumes and the temperature of the water in the wetwell. The atmospheric temperature of Vol. 100 peaks also at 8 s like the drywell pressure of Fig. 6.2.

Figure 6.4 shows the critical flows of water out of the discharge and suction sides of the break, the water flows through the intact recirculation pump and through the jet pumps in the broken side of the loop. The critical flows are established very quickly at a value about 20,000 lb/s (9,500 kg/s). The discharge side of the recirculation pump is uncovered before the suction side (the discharge side is located at a higher elevation in the downcomer) and its flow drops to zero before the suction side does. The intact recirculation pump follows a trip coastdown to zero flow in 15 s. However, at about 11 s its suction side is uncovered (as the suction side in the broken recirculation loop was) and its flow goes to zero very rapidly. The jet pumps in the LOCA side have negative flow, that is, the water flows from the lower plenum into the downcomer.

Figure 6.5 shows the collapsed water levels inside the vessel for the first 160 s of the calculation. The core is completely uncovered at about 100 s. The water level in the lower plenum is at the 100 in. (2.5 m) level, measured from the bottom of the vessel, at about 160 s.

Figure 6.6 shows the pressure in the containment during the entire calculation (780 min). After the first peak (at about 8 s in Fig. 6.2) the pressure decreases and then increases until containment failure at 264 min. The containment failed by high temperature/moderate pressure at

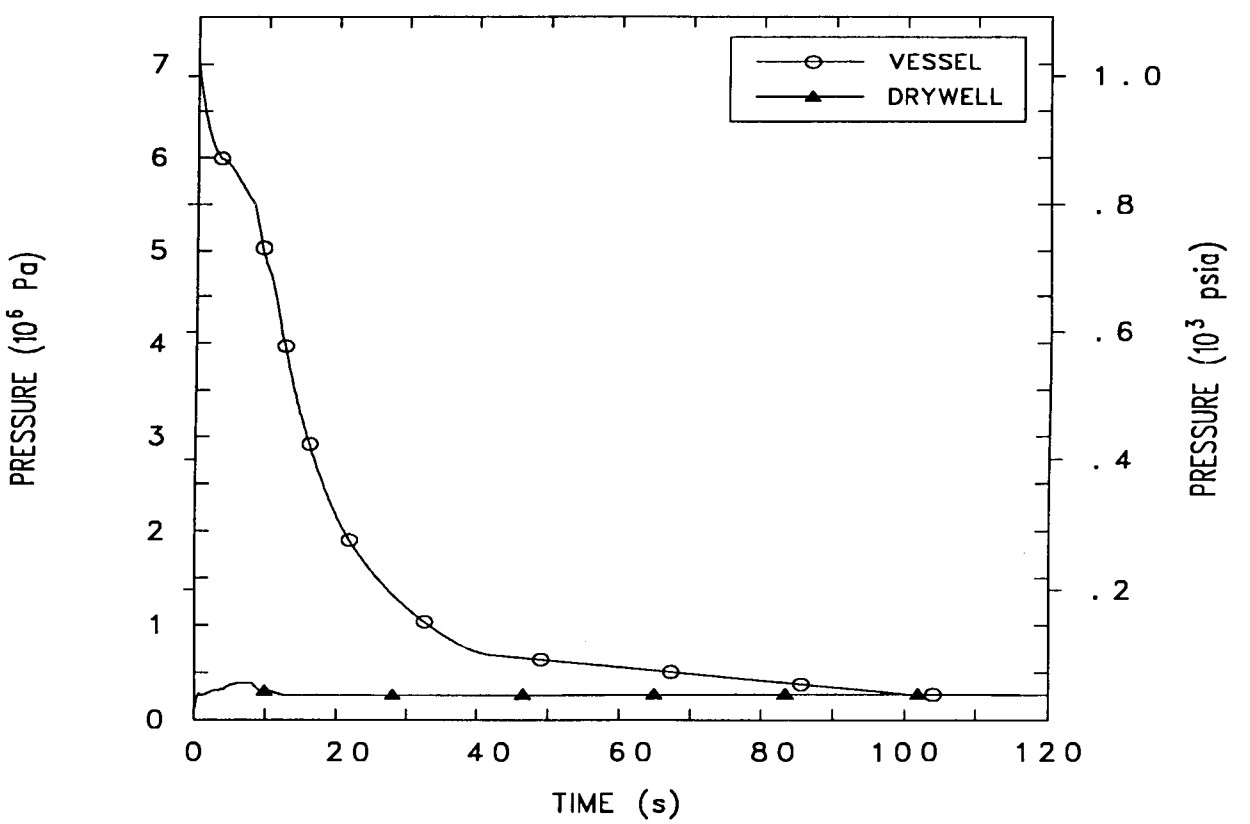

Figure 6.1 **Pressures inside the vessel and in the drywell during the first 120 s of the LOCA sequence**

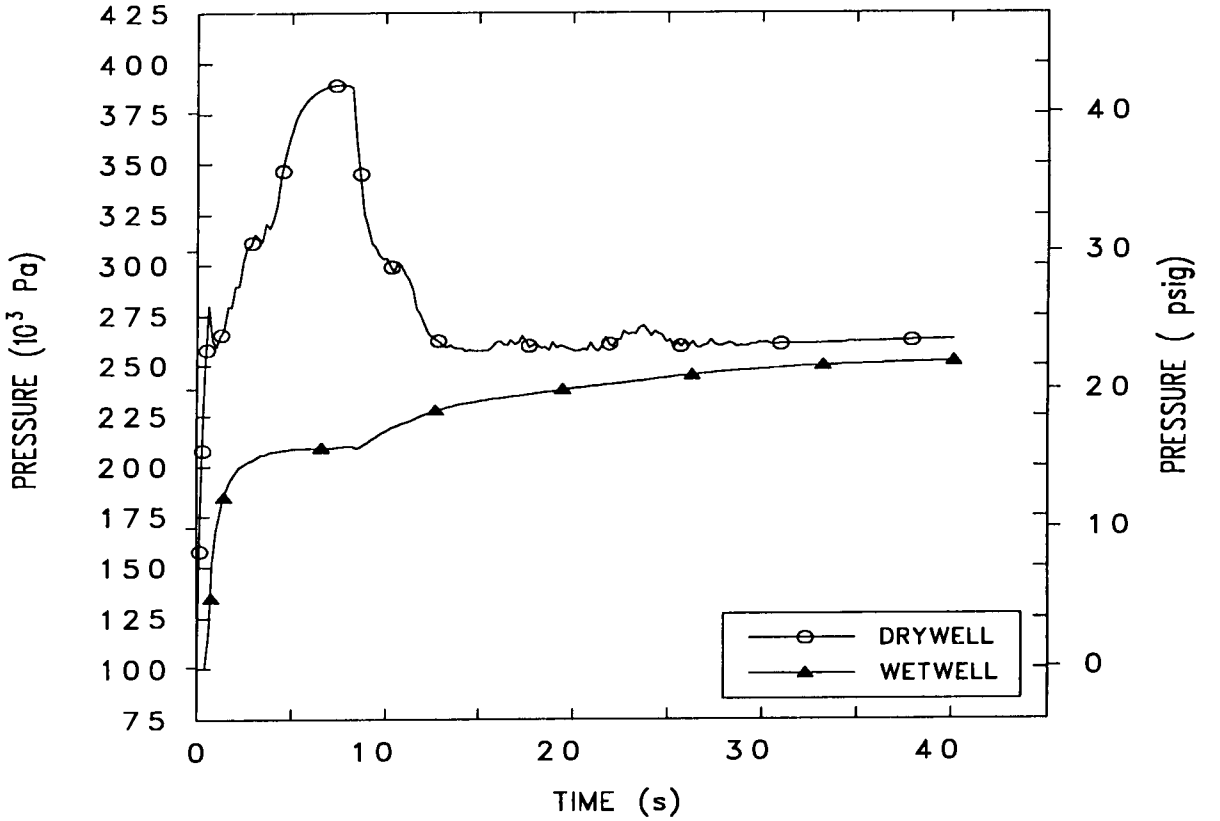

Figure 6.2 **Pressure in the drywell and wetwell during the first 40 s of the LOCA sequence**

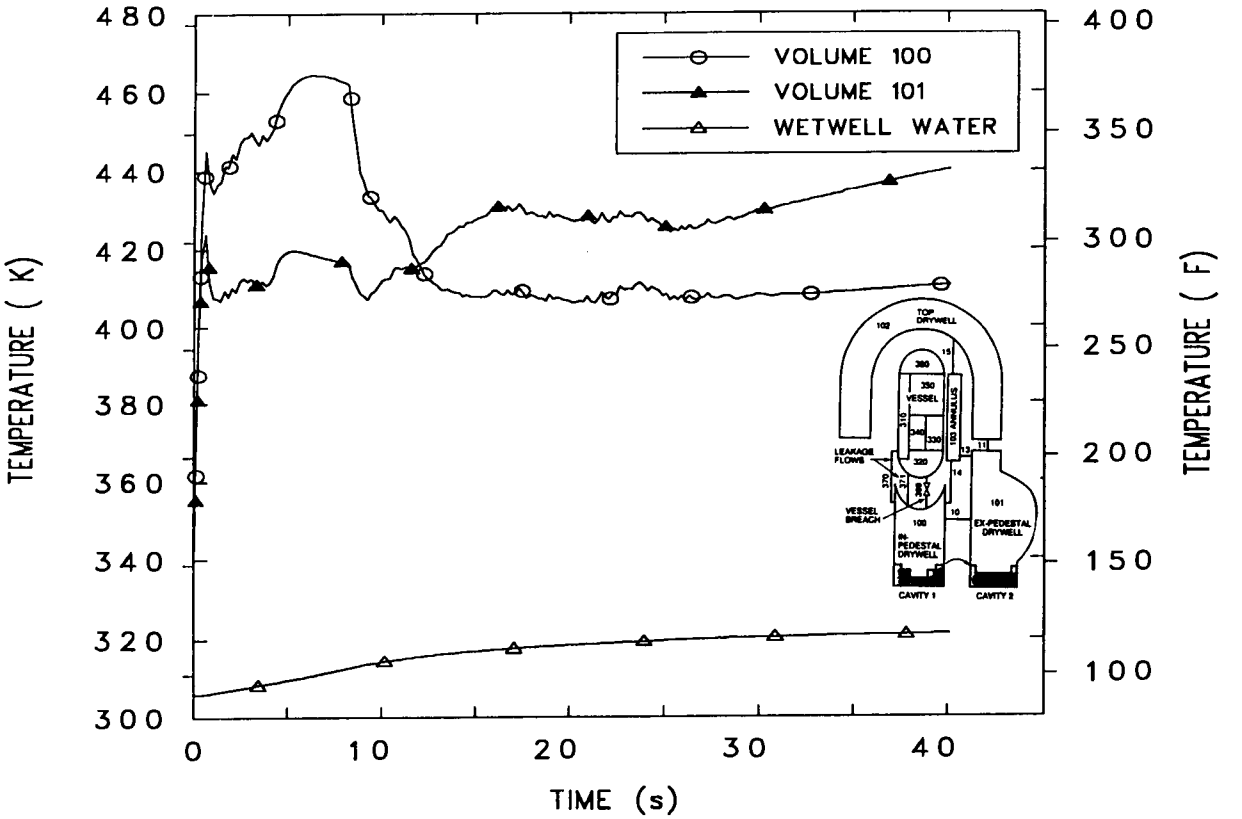

Figure 6.3 **Temperatures of the drywell atmosphere and wetwell water during the first 40 s of the LOCA sequence**

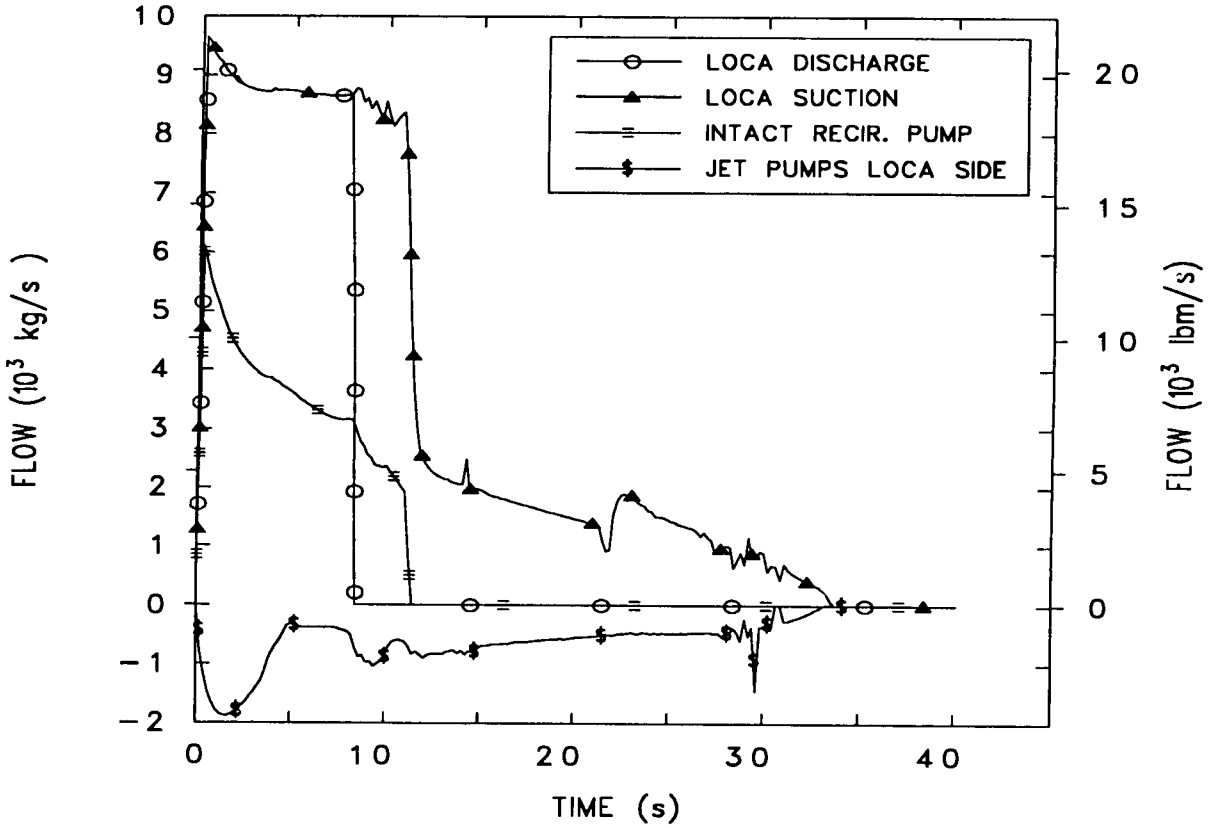

Figure 6.4 Water flows in the vessel during the first 40 s of the LOCA sequence

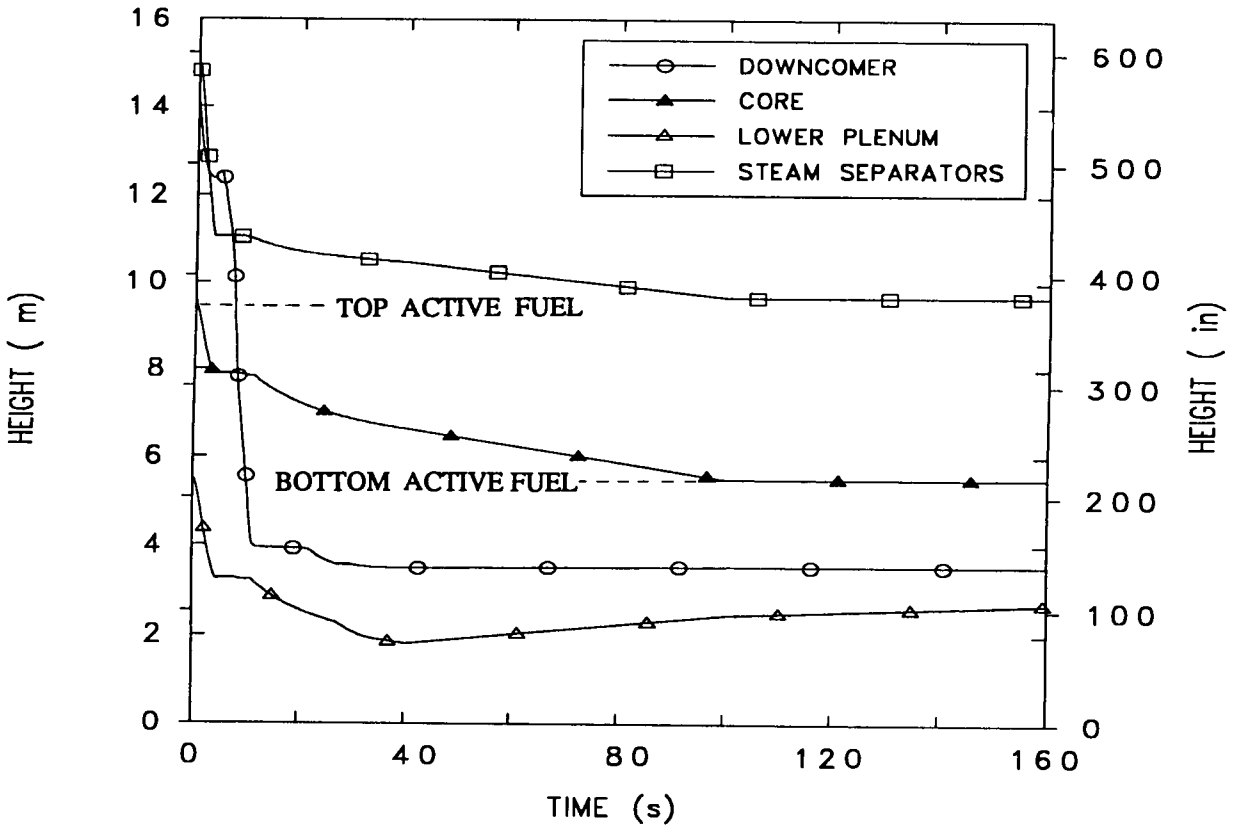

Figure 6.5 Collapsed water levels in the vessel during the first 160 s of the LOCA sequence

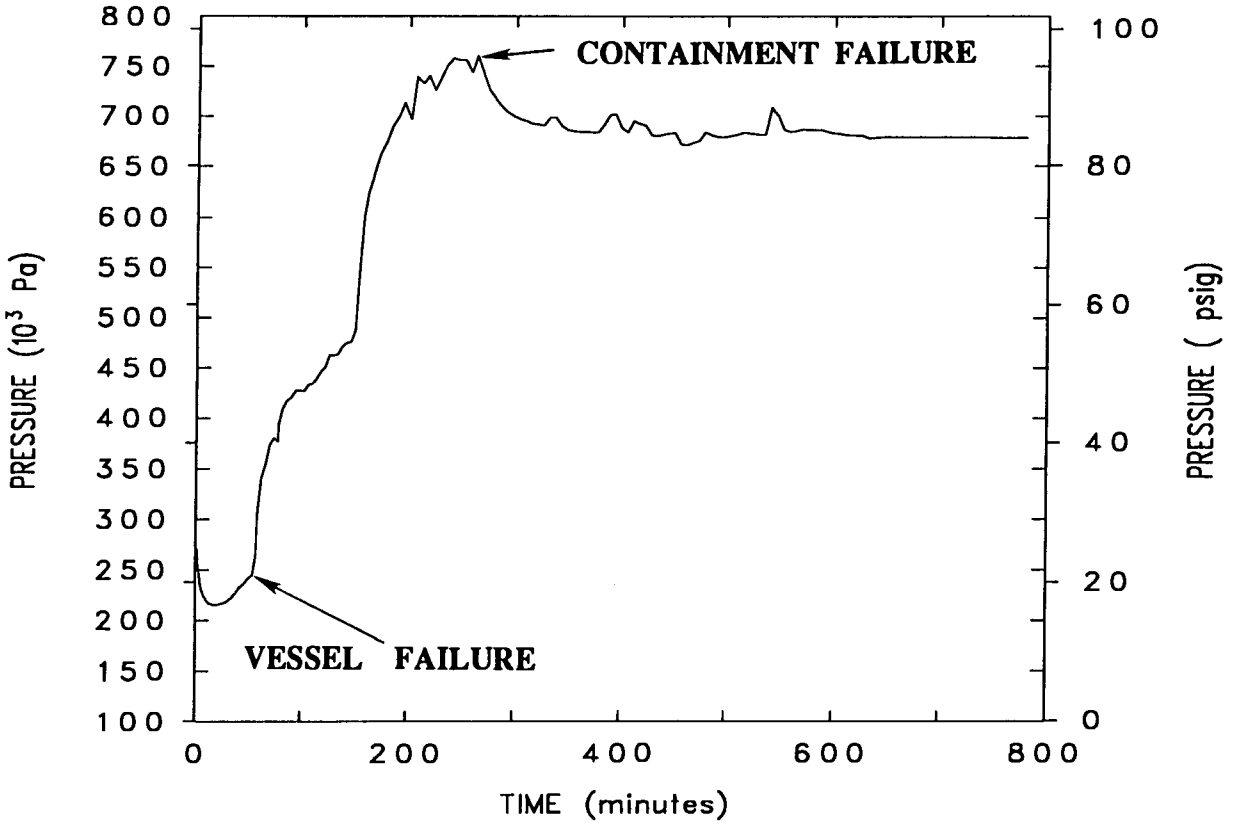

Figure 6.6 Containment pressure for the LOCA sequence

the head flange seals. The containment pressure never drops below 83 psig (675 kPa) after containment failure.

Figure 6.7 shows the atmospheric temperature of the drywell volumes. After 200 min, the temperatures of all the volumes are over 700°F (644 K), the failure temperature of the head flange seals.

Figure 6.8 shows the debris mass in the in-pedestal and ex-pedestal cavity. The in-pedestal region starts receiving debris shortly after vessel failure (at 57 min) and the ex-pedestal region starts receiving debris at about 148 min, after the in-pedestal "cavity" ruptures.

Finally, Fig. 6.9 shows the amount of hydrogen produced in-vessel. At the end of the transient, about 960 lb (435 kg) of hydrogen was produced.

6.3 Timing of Important Events

The best-estimate times for the important events in this sequence are given in Table 6.2. The gap release is initiated at 9.5 min and ended at 29.6 min with a duration of 20 min. Vessel failure occurs at 57.1 min and containment failure at 264 min (4.4 h) after transient initiation. All these calculations were performed with the MELCOR code. No calculations were performed with the MELCOR/CORBH Package for this sequence.

6.4 Best-Estimate In-Containment Source Terms

The best-estimate cumulative in-containment source terms as a function of time are given in Table 6.3. The fractions of Table 6.3 are from the *initial inventories* of fission products except for classes 2 and 16 that are from the *final inventories*.

Table 6.4 shows the fractional distribution of the final inventories of fission products by class among nine different locations at the end of the calculation (13 h). The largest fraction of noble gases (almost 90%) is in the wetwell. The largest fractions of Cs and CsI (about 45%) are in the drywell. The largest fraction released into the environment is for the noble gases (with 3%) and for Cs and CsI with less than 2% released. The largest fractions of the remaining classes are in the cavity with values ranging between 63% for class 12 and 98.5% for class 8. All elemental iodine is inside the fuel in the core (100%), but it is only a very small amount (0.04 kg). All the iodine previously released has been combined with cesium to form Cs I (class 16).

The best-estimate in-containment source terms for each of the four release phases are given in Table 6.5. The MELCOR calculation was terminated 13 h after transient

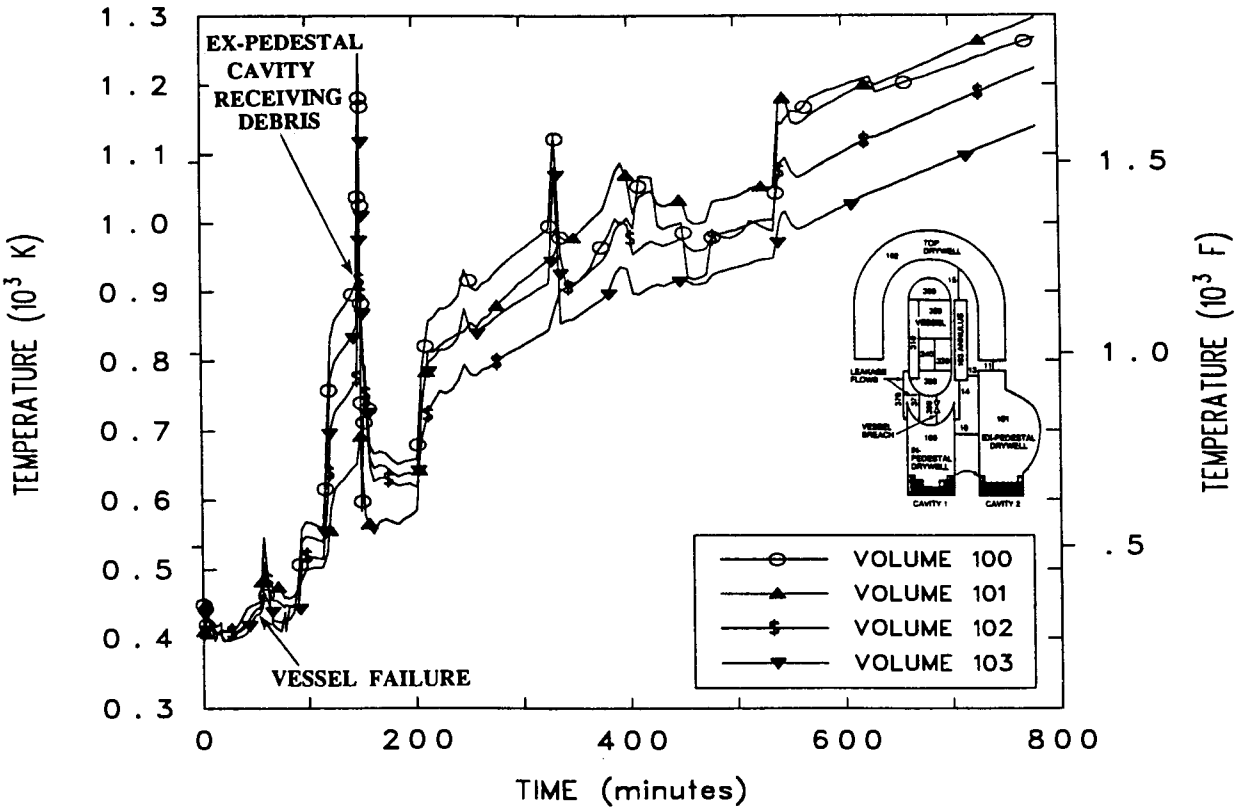

Figure 6.7 Temperatures of the drywell atmosphere for the LOCA sequence

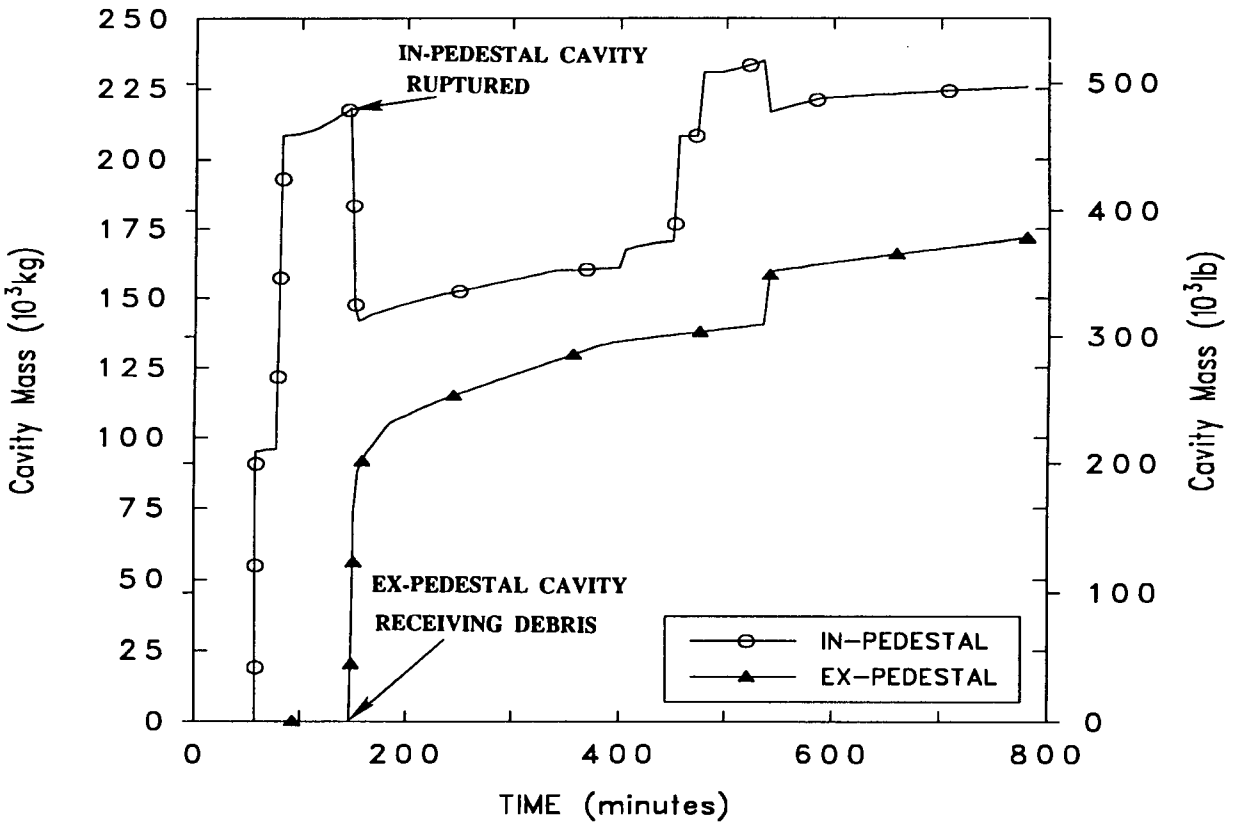

Figure 6.8 Cavity masses on the drywell floor for the LOCA sequence

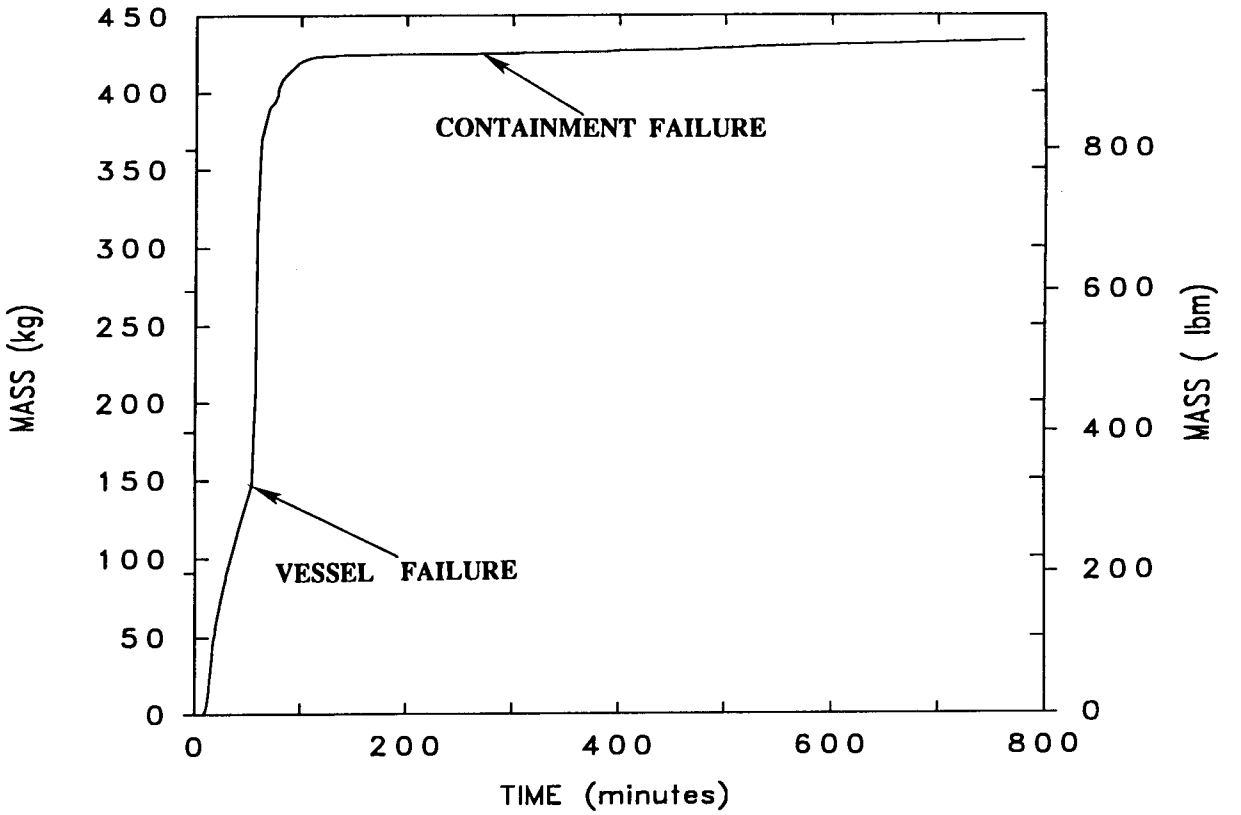

Figure 6.9 In-vessel hydrogen produced in the LOCA sequence

Table 6.2. Best-estimate times for the events in the LOCA sequence without ECCS

Event	Seconds	Min	Hours	Time from transient initiation (h)
LOCA initiation	0	0	0	0
Gap release initiated (Ring 1)	572	9.5	0.16	0.16
Gap release ended (Ring 3)	1,778	29.6	0.5	0.5
Gap release phase duration	1,206	20.1	0.33	
Vessel failure time	3,426	57.1	0.95	0.95
In-vessel release phase duration	1,648	27.5	0.46	
Containment failure at the head flange seals		264	4.4	4.4

initiation. Vessel failure occurred about 1 h after transient initiation. The "ex-vessel" and "late in-vessel" release phases have been taken up to the end of the calculation, with a duration of over 12 h. The largest release for noble gases and classes 6 (Ru), 7 (Mo), 11 (Cd), and Sn (12) is during the "early in-vessel" phase.

The largest release for Cs and CsI is during the "late in-vessel" release phase (by revaporization). The remaining classes have the largest release during the "ex-vessel" phase.

6.5 Best-Estimate Source Term Releases Into the Environment

Table 6.6 shows the best-estimate source term releases into the environment for each of the classes of fission products. Two sets of time references are given: actual transient times and time differential after containment failure that occurred at 264 min. The containment failed at the head flange seals, resulting in relatively small fractions of fission products being released to the

Table 6.3. Cumulative fractions of the fission product inventory released into containment for the LOCA sequence without ECCS

		Transient Time, min								
Class	Element	30	57	77	167	280	333	500	683	780
1	Noble gases	0.0500	0.7823	0.9335	0.9636	0.9675	0.9676	0.9953	0.9954	0.9959
2[a]	Cs	0.0561	0.2704	0.3707	0.6055	0.7093	0.7144	0.7373	0.7644	0.7849
3	Ba, Sr	0.0002	0.0353	0.0605	0.2249	0.2280	0.2285	0.2314	0.2324	0.2334
4	I	-	-	-	-	-	-	-	-	-
5	Te	0	0.0050	0.0225	0.1856	0.2053	0.2084	0.2497	0.2585	0.2631
6	Ru	0	0.0011	0.0012	0.0012	0.0012	0.0012	0.0013	0.0013	0.0014
7	Mo	0.0002	0.0203	0.0279	0.0307	0.0328	0.0337	0.0360	0.0380	0.0390
8	Ce	0	0	0	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002
9	La	0	0	0.0009	0.0410	0.0530	0.0530	0.0530	0.0530	0.0530
10	U	0	0	0.0009	0.0020	0.0021	0.0021	0.0021	0.0021	0.0021
11	Cd	0.0009	0.1080	0.1460	0.1480	0.1485	0.1486	0.1514	0.1515	0.1515
12	Sn	0.0009	0.1080	0.1460	0.1613	0.1626	0.1626	0.1804	0.1805	0.1805
13	B	-	-	-	-	-	-	-	-	-
14	H_2O	-	-	-	-	-	-	-	-	-
15	Concrete	-	-	-	-	-	-	-	-	-
16[b]	CsI	0.0328	0.2511	0.3767	0.6690	0.7009	0.7048	0.7200	0.7497	0.7907
Event		Gap released ended	Vessel failure		Containment failure					End calculation

[a]Fraction of the final inventory of 246.3 kg.
[b]Fraction of the final inventory of 42.75 kg.

Table 6.4. Fractional distribution of the final inventories of fission products by class and location for the LOCA sequence 13 h after accident initiation

Class	Element	Core	Cavity Debris	RCS	Drywell	Wetwell	RB	TB	Ref-Bay	Environ
1	Noble gases	0.382×10^{-3}	0	0.368×10^{-2}	0.566×10^{-1}	0.896	0.206×10^{-4}	0.298×10^{-6}	0.990×10^{-2}	0.334×10^{-1}
2	Cs	0.408×10^{-3}	0.608×10^{-14}	0.215	0.458	0.300	0.132×10^{-3}	0.126×10^{-6}	0.120×10^{-1}	0.165×10^{-1}
3	Ba, Sr	0.133×10^{-1}	0.692	0.613×10^{-1}	0.159	0.739×10^{-1}	0.347×10^{-5}	0.369×10^{-8}	0.795×10^{-4}	0.192×10^{-3}
4	I	1.0	0	0	0	0	0	0	0	0
5	Te	0.146×10^{-1}	0.708	0.143×10^{-1}	0.194	0.598×10^{-1}	0.314×10^{-4}	0.313×10^{-7}	0.292×10^{-2}	0.555×10^{-2}
6	Ru	0.148×10^{-1}	0.982	0.202×10^{-2}	0.838×10^{-3}	0.859×10^{-3}	0.638×10^{-9}	0.798×10^{-12}	0.953×10^{-8}	0.213×10^{-7}
7	Mo	0.135×10^{-1}	0.914	0.335×10^{-1}	0.242×10^{-1}	0.143×10^{-1}	0.264×10^{-5}	0.281×10^{-8}	0.870×10^{-4}	0.158×10^{-3}
8	Ce	0.148×10^{-1}	0.985	0.498×10^{-4}	0.280×10^{-4}	0.226×10^{-4}	0.928×10^{-9}	0.100×10^{-11}	0.396×10^{-7}	0.712×10^{-7}
9	La	0.148×10^{-1}	0.931	0.124×10^{-2}	0.352×10^{-1}	0.181×10^{-1}	0.784×10^{-8}	0.962×10^{-11}	0.114×10^{-6}	0.244×10^{-6}
10	U	0.148×10^{-1}	0.983	0.145×10^{-3}	0.124×10^{-2}	0.127×10^{-2}	0.183×10^{-6}	0.241×10^{-9}	0.184×10^{-5}	0.364×10^{-5}
11	Cd	0.105×10^{-1}	0.662	0.176	0.783×10^{-1}	0.729×10^{-1}	0.764×10^{-6}	0.683×10^{-9}	0.230×10^{-4}	0.691×10^{-4}
12	Sn	0.105×10^{-1}	0.632	0.177	0.103	0.769×10^{-1}	0.556×10^{-5}	0.474×10^{-8}	0.173×10^{-3}	0.514×10^{-3}
13	B	0	0	0	0	0	0	0	0	0
14	H_2O	0	0	0	0	0	0	0	0	0
15	Concrete	0	0	0	0	0	0	0	0	0
16	CsI	0.345×10^{-9}	0.185×10^{-2}	0.210	0.445	0.312	0.158×10^{-3}	0.141×10^{-6}	0.140×10^{-1}	0.172×10^{-1}

Table 6.5. Best-estimate in-containment source terms by release phase for the design basis LOCA without ECCS

		PHASE	GAP RELEASE	EARLY IN-VESSEL	EX-VESSEL	LATE IN-VESSEL	TOTAL
		Duration, min	20	27	723	723	770
		h	0.33	0.46	12	12	12.8
Class	Elements	Inventory (kg)	Fraction	Fraction	Fraction	Fraction	Fraction
1	Noble gases	463.70	0.0500	0.7323	0.1190	0.0946	0.9959
2	Cs	246.30	0.0561	0.2143	0.1100	0.4045	0.7849
3	Ba, Sr	207.52	0.0002	0.0351	0.1921	0.0060	0.2334
4	I	20.93	-	-	-	-	-
5	Te	40.78	0	0.0050	0.2509	0.0072	0.2631
6	Ru	306.99	0	0.0011	0	0.0003	0.0014
7	Mo	350.64	0.0002	0.0201	0.0114	0.0073	0.0390
8	Ce	593.65	0	0	0.0002	0	0.0002
9	La	571.03	0	0	0.0530	0	0.0530
10	U	132,390.00	0	0	0.0021	0	0.0021
11	Cd	1.41	0.0009	0.1071	0.0435	0	0.1515
12	Sn	8.59	0.0009	0.1071	0.0725	0	0.1805
13	B	-	-	-	-	-	-
14	H_2O	-	-	-	-	-	-
15	Concrete[a]	-	-	-	[a]	-	-
16	CsI	42.75	0.0328	0.2183	0.1170	0.4226	0.7907

[a]A total of 971 kg of non-radioactive compounds are released from core-concrete interactions during the ex-vessel release phase.

Table 6.6. Best-estimate source term releases into the environment for the LOCA sequence

	Transient Time, min	280	333	367	500	550	683	780
	Time differential min	16	69	103	236	286	419	516
	h	0.3	1.2	1.7	3.9	4.8	7.0	8.6
Class	Element							
1	Noble gases	0.26×10^{-4}	0.15×10^{-3}	0.27×10^{-3}	0.002	0.0134	0.0260	0.0334
2[a]	Cs	0.64×10^{-5}	0.52×10^{-4}	0.1×10^{-3}	0.001	0.0080	0.0126	0.0165
3	Ba, Sr	0.85×10^{-6}	0.41×10^{-5}	0.61×10^{-5}	0.26×10^{-4}	0.0001	0.0002	0.0002
4	I	-	-	-	-	-	-	-
5	Te	0.34×10^{-5}	0.16×10^{-4}	0.26×10^{-4}	0.0003	0.0015	0.0041	0.0055
6	Ru	0.25×10^{-9}	0.11×10^{-8}	0.17×10^{-8}	0.42×10^{-8}	0.14×10^{-7}	0.19×10^{-7}	0.21×10^{-7}
7	Mo	0.57×10^{-6}	0.29×10^{-5}	0.48×10^{-5}	0.2×10^{-4}	0.8×10^{-4}	0.0001	0.0002
8	Ce	0.2×10^{-9}	0.10×10^{-8}	0.16×10^{-8}	0.7×10^{-8}	0.3×10^{-7}	0.6×10^{-7}	0.7×10^{-7}
9	La	0.3×10^{-8}	0.13×10^{-7}	0.2×10^{-7}	0.6×10^{-7}	0.2×10^{-6}	0.22×10^{-6}	0.24×10^{-6}
10	U	0.87×10^{-7}	0.37×10^{-6}	0.54×10^{-6}	0.11×10^{-5}	0.3×10^{-5}	0.35×10^{-5}	0.36×10^{-5}
11	Cd	0.42×10^{-7}	0.19×10^{-6}	0.28×10^{-6}	0.63×10^{-5}	0.5×10^{-4}	0.6×10^{-14}	0.7×10^{-4}
12	Sn	0.13×10^{-6}	0.65×10^{-6}	0.1×10^{-5}	0.47×10^{-4}	0.0004	0.0005	0.0005
16[b]	CsI	0.73×10^{-5}	0.63×10^{-4}	0.12×10^{-3}	0.0013	0.0083	0.0125	0.0172

environment. The largest fractions released at the end of the calculations (780 min or 13 h), which is 516 min or 8.6 h after containment failure, are 3.3% for the noble gases, 1.65% for Cs and 1.72% for CsI.

Comparison of these source term releases into the environment with the values calculated in NUREG-4551 (Ref. 14) for a similar LOCA sequence was not possible because a LOCA sequence with a dry cavity ending in containment failure at the head flange seals (as predicted by MELCOR) was not found in Ref. 14.

7 Uncertainties in the Calculations

The uncertainties in these calculations are in five different areas: (a) containment failure mode and timing, (b) vessel failure timing, (c) source terms, (d) plant input data, and (e) MELCOR input parameters. The largest uncertainties are in the containment failure *mode* and *timing*.

7.1 Containment Failure Mode and Timing

The greatest uncertainty in all these calculations is in the containment failure mode and timing for the station blackout with a dry cavity. The CORCON-MOD2 package of MELCOR cannot model molten debris *movement* across the cavity floors. Consequently, containment failure by liner melt-through or creep rupture due to hot debris contact could not be modeled in this calculation due to this limitation of MELCOR and to other uncertainties in modeling this containment failure mode. MELCOR results indicated that there is a period of time when the debris is hot enough to fail the liner. However, the timing of this contact could not be calculated. Therefore, only two containment failure modes (by high wetwell pressure and by high temperature at the head flange seals, Sect. 3.3) were modeled. If the containment actually fails at the liner by hot debris contact before it fails at the head flange seals or in the wetwell, the resulting environmental source terms will be different.

The containment failure time was also found to be dependent on the modeling and nodalization of the drywell cavities, in particular, on the timing for debris transfer initiation from the in-pedestal to the ex-pedestal cavity. This debris transfer could not be initiated shortly after the in-pedestal cavity received debris from the core because of MELCOR execution problems. Consequently, the time calculated by MELCOR for containment failure has uncertainties relating to the timing of debris transfer initiation (or "cavity rupture" time). Furthermore, the flow rate and timing of the core debris ejected into the first cavity also influence the final results. The MELCOR/CORBH Package[10-12] predicts later vessel failure and different debris flow rates into the cavity than the values calculated by MELCOR for the best-estimate run. Finally, there is one more factor: the chemistry option of CORCON. In the best-estimate run for the station blackout with a dry cavity, the "original" CORCON-MOD2 chemistry was used instead of the "new" chemistry because of MELCOR execution problems with the "new" chemistry. The "new" chemistry of CORCON includes oxides and gases as reactants in the cavity. The "old" chemistry ("original" CORCON model) excludes the oxides and only consider the gases as reactants. The effect on the results of using either chemistry is not expected to be significant. All these factors (containment failure mode, flow and timing of debris ejected into the first cavity, cavity modeling, timing of initiation of debris transfer to the ex-pedestal cavity, and CORCON chemistry option) introduced uncertainties in the containment failure time results. These uncertainties have not been quantified.

7.2 Vessel Failure Timing

The best-estimate vessel failure timing predicted by the MELCOR/CORBH Package[10-12] was 285 min and the time predicted by the BWRSAR code was 255 min. The best-estimate time selected was 285 min, the time calculated by the MELCOR/CORBH Package. This time was selected because the model of the MELCOR/CORBH Package is deemed to be more realistic than the single node MELCOR containment model discussed in Appendix A. However, there are uncertainties in the MELCOR/CORBH Package model resulting in uncertainties in the predicted vessel failure time. The actual vessel failure time could be earlier or later than the one predicted by this package. The vessel failure time affects the "in-vessel" release phase duration and the corresponding source terms. The vessel failure time of the LOCA sequence was calculated by MELCOR. MELCOR generally, calculates <u>shorter</u> vessel failure times than the MELCOR/CORBH Package. The best-estimate vessel failure time predicted by MELCOR for the LOCA sequence is expected to be shorter than the actual time.

7.3 Source Term Uncertainties

The main uncertainties in the source term are from two different sources: MELCOR inherent uncertainties and source terms adjustments. MELCOR fission products release and transport models are by, necessity, approximate. MELCOR calculates source terms that have errors and uncertainties. In some cases, unexpected source term results can be tracked to assumptions in MELCOR models.

The second group of uncertainties are due to post-processing the calculated source terms.

The best-estimate in-containment source terms for the station blackout sequences are source terms from the MELCOR best-estimate run adjusted for the best-estimate vessel failure time of 285 min from the MELCOR/-CORBH Package.[10-12] This was done because the MELCOR/CORBH Package did not calculate source terms.

This adjustment increases the "in-vessel" source term by reducing the "ex-vessel" and the "late in-vessel" source term contributions. This uncertainty will be eliminated when the MELCOR/CORBH Package is interfaced with the radionuclide release models. The source terms can then be calculated directly by the MELCOR/CORBH Package without corrections.

Additional uncertainties are in the allocation of the source terms for the "ex-vessel" and "late in-vessel" phases. If

the fission products released are coming from the fuel inside the vessel or from revaporization of fission products previously deposited on the vessel or reactor coolant system walls, the source term is the "late in-vessel" phase. If the fission products are released from the fuel in the cavity, the source term is the "ex-vessel" phase. This is complicated by the fact that the amount of fuel inside the vessel changes with time as fuel is being ejected into the cavity during the accident progression. Since MELCOR does not calculate these contributions directly, they have to be estimated resulting in uncertainties from allocating the fission products released after vessel failure into the "ex-vessel" and the "late in-vessel" phases.

7.4 Plant Input Data Uncertainties

The MELCOR input deck for Peach Bottom severe accidents studied in this report was created from a deck received from BNL. Some of the plant-specific input data did not reflect the actual Peach Bottom values and had to be modified. For instance, the amount of steel in the lower plenum had to be increased, the structure surface areas in the lower plenum had to be reduced, and the containment failure location and pressure has to be modified to reflect actual plant values. Also, one heat slab had to be split into three heat slabs because of problems with the dT/dz model of MELCOR.

Due to resource constraints, many values of the input deck had not been checked in detail (including most of the heat slabs) and input errors may still be present. The fact that the input may still have errors introduces uncertainties in the results.

7.5 MELCOR Input Parameters Uncertainties

The MELCOR code is very sensitive to input parameters that are not part of the plant data or specific problem input. Such parameters are, for example, the maximum and the minimum calculational time step. Different results were obtained when the maximum or minimum calculational time step was changed. The results are also dependent on the version of the code used (the versions available were 1.8.1 HN, IR, and KH) and in the compiler option used with the subroutines of the code. The effect of all these factors can be significant at the end of a calculation. The maximum time step used can influence the timing of SRV and ADS actuation by seconds, the timing of vessel failure by minutes and the timing of containment failure by tens of minutes.

Other input parameters also affecting the results are: porosities of the intact components, porosity of the debris, core and lower plenum support flags and penetration failure parameters. The effect of these input parameters, as described in Appendix A, can significantly alter the results. In particular, the debris porosity had a significant effect on the results. The value chosen for the debris porosity in the best-estimate run was 0.9. This large debris porosity results in large debris volumes that may not be totally realistic. However, this large debris volume promotes heat transfer between the debris and the structures in the lower plenum, a more realistic situation than when a low debris porosity is used resulting in no heat transfer between debris and structures in the lower plenum. Nevertheless, the results have uncertainties, since the debris porosity input value is also uncertain. Different values of this porosity can be justified (using different criteria) resulting in different results.

There are many other input parameters and models that have not been studied. For instance, different release models for the core can be used in the Radionuclide Package. The large number of parameters and options in MELCOR that can be changed by the user without changing the general input of the problem, can yield vastly different results. This is a strength of the MELCOR code, allowing the user to perform sensitivity studies to quantify the effect on the results of the value of a parameter that cannot be easily calculated (i.e., porosities of the core and debris, mass of the penetrations, etc.). However, each parameter introduces uncertainties in the results.

8 Technical Findings

8.1 Introduction

Three low-pressure severe accident sequences have been analyzed for the Peach Bottom Atomic Power Station using the MELCOR code version 1.8.1 (Ref. 7). This plant has a BWR-4 reactor with a Mark-I containment. The three sequences analyzed are two low-pressure, short-term station blackouts (with a dry cavity and with a flooded cavity) and a design basis LOCA *without* ECCS. The ADS was used to depressurize the reactor vessel in the station blackouts in conformance with Ref. 3 of the BWROG EPGs[9] for steam cooling. Revision 3 of the EPGs states that ADS actuation should be initiated when the water level in the core is about 1/3 of the active core height. The LOCA sequence assumes a double-ended guillotine break of one of the recirculation pump lines concurrent with complete failure of all the ECCS.

MELCOR results include best-estimate times of the important events and best-estimate source terms released into the containment and into the environment. Calculation of the best-estimate vessel failure time for the station blackouts was performed using the MELCOR/CORBH Package.[10-12]

8.2 Timing of Events

Table 8.1 shows the best-estimate times for the important events in the three severe accident sequences analyzed. The best-estimate vessel failure time calculated by the MELCOR/CORBH Package for the station blackout accidents is about 286 min after accident initiation. For both station blackouts, the "gap" release phase duration is about 29 min (0.5 h) and the "in-vessel" release phase duration 164 min. The containment was predicted to fail at 548 min after transient initiation in the station blackout with the dry cavity. The containment failure mode predicted in this sequence was head flange seal failure (containment failure mode 2) by high temperature with moderate pressure.

For the station blackout with a flooded cavity. MELCOR predicted high pressure-induced containment failure in the wetwell, 617 min after transient initiation (70 min later than the time predicted for the station blackout with a dry cavity). The flooded cavity kept the drywell volumes cooler than in the sequence with a dry cavity and the head flange seals never reached the failure temperature of 700°F (644 K). In fact, the drywell atmospheric temperatures did not exceed 460°F (510 K) during all the station blackout with a flooded cavity. In contrast, the drywell atmospheric temperatures reached values up to 1,520°F (1,100 K) in the station blackout with the dry cavity. *Thus, one potential major impact of drywell flooding is to change the location of primary containment failure from the drywell to the wetwell.*

In the LOCA sequence, the events occurred faster than in the station blackouts because a large amount of coolant was lost during the initial blowdown. The "gap" release in the first ring of the core was initiated about 10 min after the LOCA started. The "gap" release duration was 20 min in the LOCA versus 29 min in the station blackouts. Vessel failure was predicted to occur 57 min after transient initiation and containment failure by high temperature at the drywell head flange seals was predicted 264 min after transient initiation.

8.3 Pressures and Temperatures

Containment pressures for the three sequences analyzed are shown in Fig. 8.1. The containment remains pressurized after failure when it failed at the head flange seals in the station blackout with a dry cavity and in the LOCA.

Table 8.1. Best-estimate times (min) for the important events of the three sequences analyzed

Event	Station blackout Dry cavity	Station blackout Flooded cavity	LOCA	Comments
ADS actuation	66	66	-	LOCA depressurized without ADS
Gap release initiated	93	92	10	Shorter time for LOCA
Gap release ended	122	122	30	Shorter time for LOCA
Gap release duration	29	30	20	Shorter time for LOCA
Vessel failure time	286	286	57	Shorter time for LOCA
In-vessel release duration	164	164	27	Shorter time for LOCA
Containment failure time	548	617	264	Shorter time for LOCA
Containment failure mode (Sect. 3.3)	2. Drywell head flange seals	1. Wetwell air space	2. Drywell head flange seals	

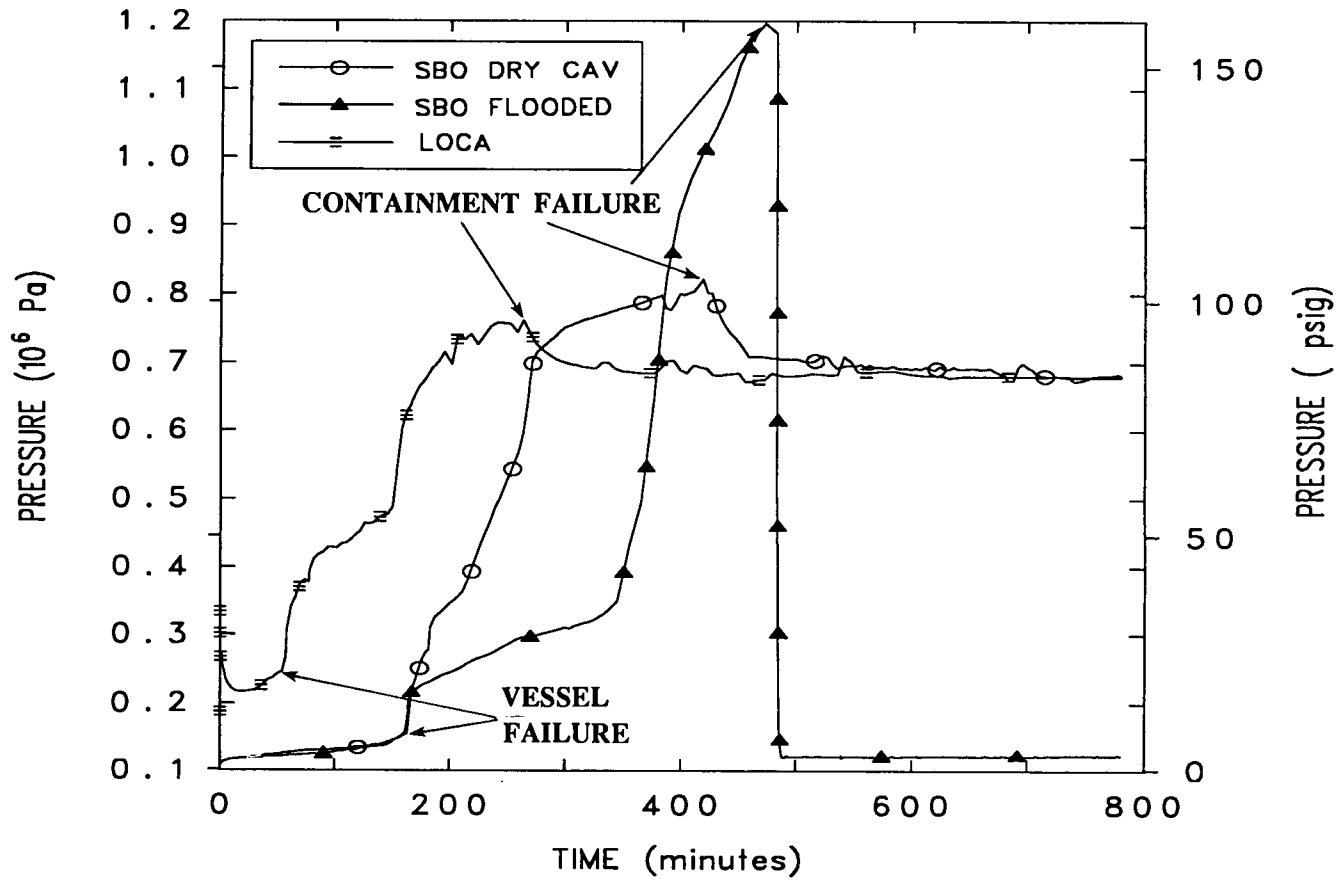

Figure 8.1 Containment pressure for the three transients analyzed

This is because the flow area through the failed head flange seals is very small. However, when the containment fails at the wetwell by high pressure as it occurred in the station blackout with a flooded cavity, containment depressurization occurred. The containment pressure remains lower most of the time in the station blackout with the flooded cavity sequence than in the other two sequences.

The pressure inside the vessel equalizes with the containment pressure shortly after vessel failure, or, in the case of the LOCA, shortly after the blowdown is finished. Vessel pressures for the three sequences analyzed are shown in Fig. 8.2.

Lower pressures inside the vessel generally result in higher atmospheric temperatures because the reduced heat removal capacity of lower density gases at lower pressures. The LOCA sequence has the lowest vessel pressure of the three sequences for the first 70 min of the transient. Afterwards, the station blackout with the flooded cavity has the lowest pressure of the three sequences. These two sequences resulted in hotter temperatures inside the reactor vessel.

8.4 In-Containment Source Terms

The "total" in-containment source terms calculated by MELCOR for the three sequences at the end of the calculations (13 h after transient initiation) are shown in Table 8.2 together with the "total" in-containment source terms reported in draft NUREG-1465 (Ref. 5) for BWR releases. The release fractions of the noble gases, I, Cs, Te, Sr, and Ba are also compared in Fig. 8.3. The source term for the noble gases is about 100% for all three sequences and also in Ref. 5. *The source terms calculated by MELCOR for I, Cs, Sr, and Ba exceed the values reported in Ref. 5. The source terms for Te, Ru, and Ce are smaller than the reported values of Ref. 5.* The largest discrepancy is for Ce. MELCOR calculated released fractions between 0 and 9% of the value reported in draft NUREG-1465 for this fission product. Nevertheless, the released fraction reported in draft NUREG-1465 for Ce is small (only 0.012).

MELCOR calculates lower amounts of non-radioactive aerosols than the draft NUREG-1465 values.

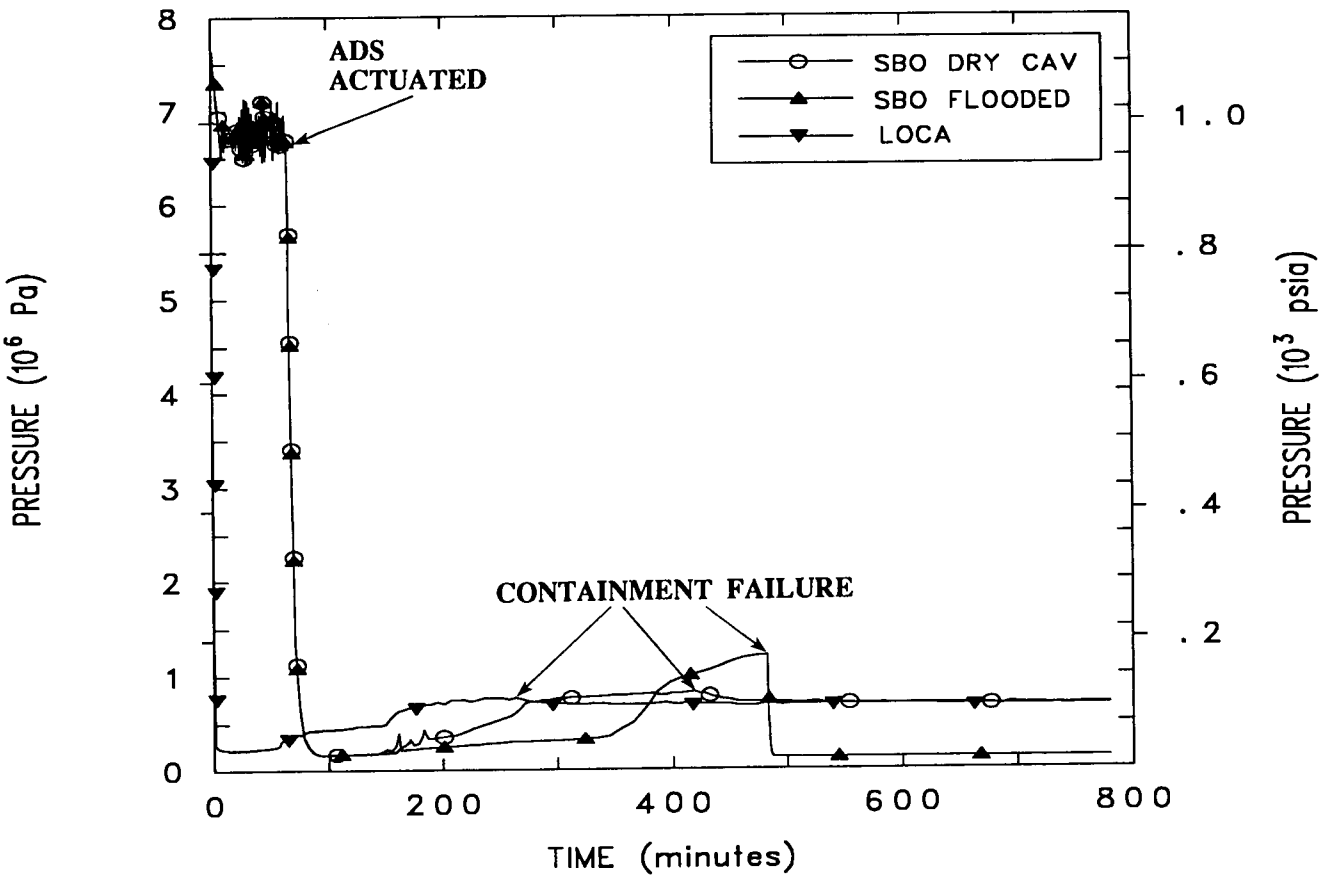

Figure 8.2 **Vessel pressure for the three transients analyzed**

Table 8.2. Comparison of the total in-containment source terms of Draft NUREG-1465 (Ref. 5) with the three sequences analyzed

Fission product	Draft NUREG 1465	SBO Dry cavity	SBO Flooded	LOCA	Comments
Noble gases	1.0	1.0	1.0	1.0	Good agreement
I	0.71	0.6	0.64	**0.79**	LOCA highest
Cs	0.68	0.6	0.65	**0.78**	LOCA highest
Te	**0.50**	0.36	0.23	0.26	Draft NUREG-1465 highest
Sr	0.27	**0.39**	0.3	0.23	SBO/Dry highest
Ba	0.24	**0.39**	0.3	0.23	SBO/Dry highest
Ru	**0.011**	0.0026	0.0021	0.0014	Draft NUREG-1465 highest
La	0.019	**0.06**	0.0129	0.053	SBO/Dry highest
Ce	**0.012**	0.0010	0	0.0002	Draft NUREG-1465 highest
Non-radioactive (kg)	6,380	933	971	1,127	Draft NUREG-1465 highest

Note: The largest value for each fission product is shown in **bold**.

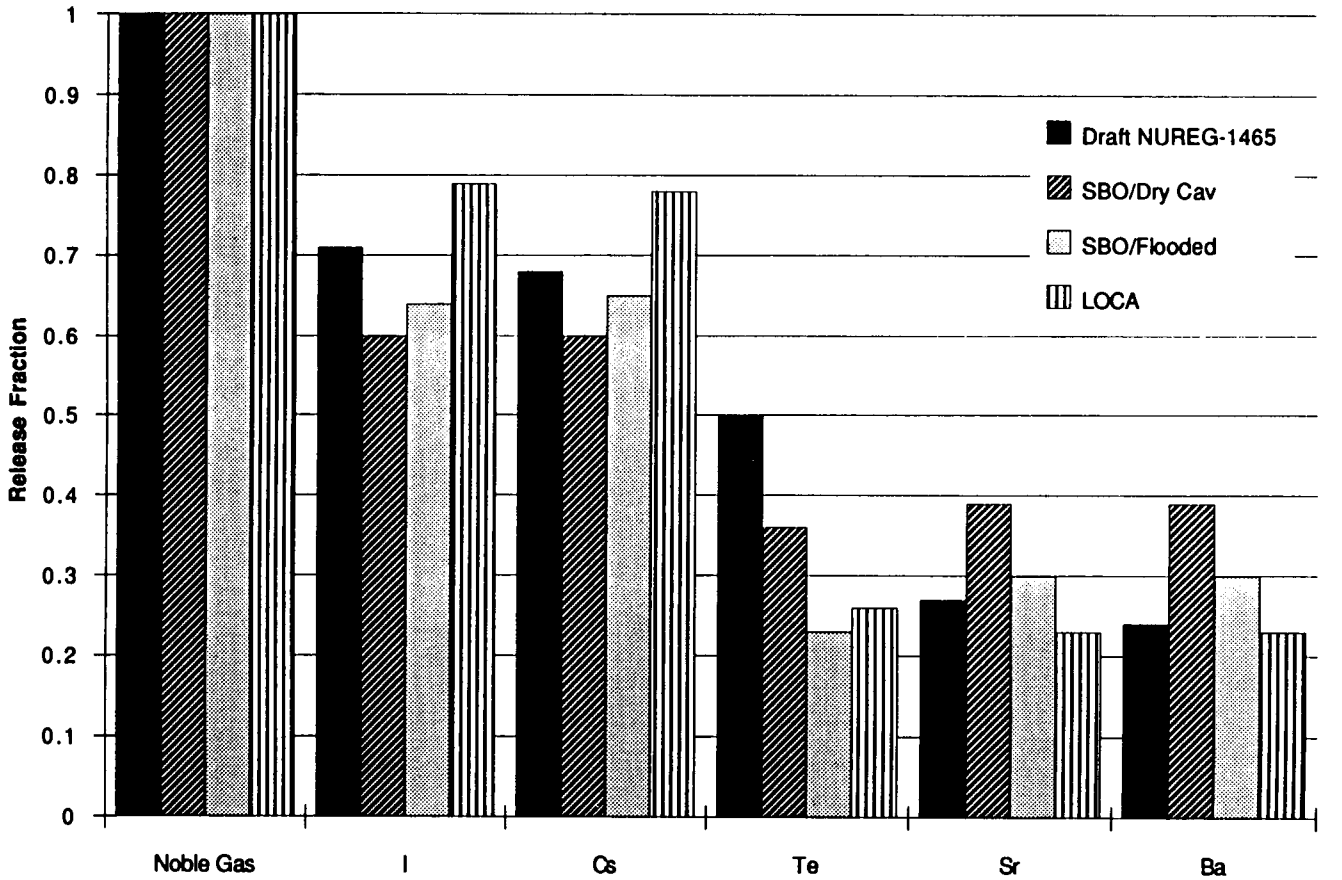

Figure 8.3 **Comparison of the total in-containment release fractions of Draft NUREG-1465 with MELCOR results for the three sequences analyzed**

Out of the three sequences, the LOCA has the largest in-containment source terms for I (as CsI) and Cs with fractions released of 0.79 and 0.78 respectively. The LOCA sequence has the lowest retention of both Cs and CsI in the reactor coolant system (about 21%) of the three sequences. The station blackout with a dry cavity has the lowest releases of I (as CsI) and Cs of the three sequences and also the largest retention of Cs and CsI in the reactor coolant system (about 40%). For the remaining fission products, the station blackout with a dry cavity has the largest source terms; the station blackout with a flooded cavity has the smallest source terms for Te, La, and Ce; and the LOCA the smallest source terms for Ba, Sr, and Ru.

The in-containment source terms are now compared by release phase. The "gap" release phase source terms are compared in Table 8.3. There is good agreement among the four columns of Table 8.3 except for the phase duration, with the draft NUREG-1465 (Ref. 5) duration (1 h) twice or more the durations calculated by MELCOR. The released fractions listed in Ref. 5 are, generally, the largest ones. All the values are small, (0.05 or less).

The "early in-vessel" release phase source terms are compared in Table 8.4. The duration of this phase reported in Ref. 5 is 1.5 h. The MELCOR/CORBH Package[10-12] calculated for the station blackouts an "early in-vessel" phase duration of 2.72 h (almost twice the value of Ref. 5) and for the LOCA a duration of 0.46 h (less than half the value of Ref. 5). The LOCA releases are the smallest for the noble gases, Te and Ru (it is also the shortest phase). MELCOR calculates larger I and Cs releases for the station blackouts than draft NUREG-1465. The values reported in draft NUREG-1465 for I and Cs agree well with the releases calculated by MELCOR for the LOCA sequence (the LOCA has the shortest phase duration). In contrast to draft NUREG-1465, MELCOR predicts no releases of La or Ce for the "early in-vessel" release phase. Finally, MELCOR did not calculate releases of non-radioactive aerosols from the control rods because this model was disabled due to problems with the model.

The "ex-vessel" release phase source terms are compared in Table 8.5. The largest releases are generally for the LOCA sequence (which has the longest "ex-vessel" release phase duration since the vessel failure occurred earlier than in the station blackouts) with the exception of Sr, Ba, La, and Ce. For these four fission products, the largest "ex-vessel" releases are for the station blackout with the dry cavity. The "ex-vessel" releases reported in Ref. 5 for I and Cs are significantly larger than the values calculated by MELCOR. As it will be seen later, opposite trends resulted for the "late in-vessel" releases (Table 8.6). Thus, although the releases from MELCOR

Table 8.3. Comparison of the "gap" release phase of Draft NUREG-1465 with MELCOR best-estimate values for the three sequences analyzed

Fission product	Draft NUREG 1465	SBO Dry cavity	SBO Flooded	LOCA
Duration (h)	**1**	**0.5**	**0.5**	**0.33**
Noble gases	0.05	0.02	0.03	0.05
I	0.05	0.01	0.02	0.03
Cs	0.05	0.03	0.04	0.05
Te	0	0	0	0
Sr	0	0	0.0005	0.0002
Ba	0	0	0.0005	0.0002
Ru	0	0	0	0
La	0	0	0	0
Ce	0	0	0	0

Table 8.4. Comparison of the "early in-vessel" release phase of Draft NUREG-1465 with MELCOR best-estimate values for the three sequences analyzed

Fission product	Draft NUREG 1465	SBO Dry cavity	SBO Flooded	LOCA	Comments
Duration (h)	**1.5**	**2.72**	**2.72**	**0.46**	
Noble gases	0.95	0.95	0.96	0.73	Smallest for the LOCA
I	0.22	0.45	0.44	0.22	
Cs	0.15	0.43	0.45	0.21	
Te	0.11	0.10	0.10	0.005	Smallest for the LOCA
Sr	0.03	0.03	0.03	0.04	
Ba	0.03	0.03	0.03	0.04	
Ru	0.007	0.0015	0.0015	0.0011	Smallest for the LOCA
La	0.002	0	0	0	No releases in MELCOR
Ce	0.009	0	0	0	No releases in MELCOR
Non-radioactive (kg)	780	0	0	0	MELCOR model disabled

Table 8.5. Comparison of the "ex-vessel" release phase of Draft NUREG-1465 with MELCOR best-estimate values for the three sequences analyzed

Fission product	Draft NUREG 1465	SBO Dry cavity	SBO Flooded	LOCA	Comments
Duration (h)	3	8.25	8.25	12	
Noble gases	0	0.03	0.03	0.12	
I	0.37	0.01	0.08	0.12	
Cs	0.45	0.03	0.05	0.11	
Te	0.38	0.25	0.12	0.25	
Sr	0.24	0.35	0.25	0.20	
Ba	0.21	0.35	0.25	0.20	
Ru	0.004	0	0	0	No releases in MELCOR
La	0.01	0.06	0.01	0.05	
Ce	0.01	0.001	0	0.0002	
Non-radioactive (kg)	5,600	933	971	1,127	MELCOR lowest values

Table 8.6. Comparison of the "late in-vessel" release phase of Draft NUREG-1465 with MELCOR best-estimate values for the three sequences analyzed

Fission product	Draft NUREG 1465	SBO Dry cavity	SBO Flooded	LOCA	Comments
Duration (h)	10	8.25	8.25	12	
Noble gases	0	0	0	0.09	
I	0.07	0.12	0.1	0.42	Largest for the LOCA
Cs	0.03	0.11	0.1	0.40	Largest for the LOCA
Te	0.01	0.0023	0.0015	0.0072	
Sr	0	0.0026	0.01	0.006	No releases in Draft NUREG-1465
Ba	0	0.0026	0.01	0.006	No releases in Draft NUREG-1465
Ru	0	0.0011	0.0006	0.0003	No releases in Draft NUREG-1465
La	0	0	0	0	
Ce	0	0	0	0	

and Ref. 5 for the "ex-vessel" and the "late in-vessel" phases for Cs and I do not agree well, they compensate and the "total" in-containment source terms from MELCOR and Ref. 5 for Cs and I agree well (Table 8.2).

Another discrepancy between Ref. 5 and MELCOR calculated source terms is in Ru releases. MELCOR predicts no "ex-vessel" releases for this fission product, in disagreement with draft NUREG-1465.

Finally, the "late in-vessel" releases are compared in Table 8.6. Except for Te, the releases for this phase calculated by MELCOR are larger than the values reported in draft NUREG-1465. No "late in-vessel" releases are reported in Ref. 5 for Sr, Ba, and Ru in disagreement with MELCOR that predicts releases for these fission products. MELCOR's calculated releases for Cs and I are larger than the values reported in draft NUREG-1465 (the opposite occurred for the "ex-vessel" releases).

The largest release of I and Cs for the "late in-vessel" phase were calculated by MELCOR in the LOCA sequence.

8.5 Source Terms Released Into the Environment

MELCOR's calculated best-estimate source terms released into the environment at the end of the calculations (13 h after transient initiation) are shown in Table 8.7 for the three sequences analyzed. According to these results, the LOCA sequence has the lowest release of noble gases into the environment (3.3%) followed by the station blackout with a dry cavity (6%). The station blackout with the flooded cavity has the largest release of noble gases (almost 89%). The LOCA sequence has the majority of the noble gases (about 90%) retained inside the wetwell air space. The station blackout with the dry cavity has about 84% of the noble gases retained in the wetwell. These two sequences resulted in containment failure at the head flange seals of the drywell with the wetwell intact. By contrast, the station blackout with the flooded cavity resulted in wetwell failure and all the noble gases accumulated in the air space of the wetwell leaked into the secondary containment and into the environment after containment failure.

The LOCA sequence resulted in the largest release of Cs and CsI of the three sequences. This sequence has the lowest retention of these fission products inside the reactor vessel. The LOCA sequence also has the largest releases (but very small fractions) into the environment of Classes 10 (U), 11 (Cd), and 12 (Sn).

On the other hand, the station blackout with a flooded cavity has the lowest releases for all the classes with the exception of the noble gases. The scrubbing effect of the wetwell water and the water in the flooded cavity removed most of the fission products. The fission products remain in the wetwell water.

As previously explained, the station blackout with a dry cavity did not have the containment failure mode 3 (liner melt-through) incorporated into its MELCOR model. If the containment fails by this mode early in the transient, different source term releases into the environment than the values reported in Table 8.7 could occur for the station blackout with a dry cavity.

Table 8.7. Source terms released into the environment for the three sequences analyzed at the end of the calculations (13 h)

Class	Element	Station Blackout dry cavity	Station Blackout flooded cavity	LOCA
1	Noble gases	0.06	0.889	0.033
2	Cs	0.0097	0.0013	0.0165
3	Ba, Sr	0.0005	2×10^{-6}	0.0002
4	I	-	-	-
5	Te	0.0066	0.0004	0.005
6	Ru	3×10^{-8}	6×10^{-7}	2×10^{-8}
7	Mo	0.0003	2×10^{-6}	0.0002
8	Ce	10^{-7}	2×10^{-9}	7×10^{-8}
9	La	4×10^{-7}	5×10^{-9}	2×10^{-7}
10	U	10^{-7}	3×10^{-9}	4×10^{-6}
11	Cd	2×10^{-5}	10^{-6}	7×10^{-5}
12	Sn	7×10^{-5}	10^{-6}	0.0005
16	CsI	0.0075	0.0013	0.017
Containment failure location and time (min)		Head flange seals 548	Wetwell air space 617	Head flange seals 264

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Appendix A

Sensitivity Studies for the Station Blackout with Dry Cavity

This Appendix presents sensitivity studies and results obtained for the station blackout sequence with a dry cavity. These studies employed a single-node drywell model. Since most of the results presented (except containment failure timing) are for accident behavior before or at vessel failure, the drywell model should not affect the sensitivity effects significantly. The drywell model will significantly affect containment failure time. Seven sensitivity studies were conducted to assess the impact of several input parameters on the accident results. These sensitivity studies and results of this Appendix are: the effect of ADS actuation timing on accident progression (Sect. A.1); the effect of fuel and cladding porosities on vessel failure and on containment failure (Sect. A.2); the effect of several miscellaneous parameters on the amount of in-vessel steel ejected into cavity after vessel failure (Sect. A.3); a sensitivity study on the variables that affect penetration failure timing (Sect. A.4), reactor vessel failure timing (Sect. A.5), and lower plenum and core shroud temperatures (Sect. A.6); and effect of debris pour composition on source terms (Sect. A.7).

A.1 ADS Action Timing

As described in Sect. 3.2, the timing of the ADS actuation to depressurize the vessel and to provide "steam cooling" to the hot core is very important in the station blackout accident progression. Revisions 3 and 4 of the Emergency Procedures Guidelines (EPGs)[1,2] mandate ADS actuation at different core water levels.

A sensitivity study of the effect of ADS actuation timing on the accident progression was completed. The results were obtained with MELCOR 1.8.1 Version HN using a single node drywell model. (The drywell model does not affect the accident progression up to vessel failure.)

During the first 200 s of the MELCOR calculation, one SRV opens and closes automatically. After 200 s, manual operation of the SRVs is started (as described in Sect. 3.2). Once the water level in the core reaches the predetermined level, the ADS is manually actuated and the vessel is depressurized.

This study includes a base calculation with no depressurization, Case 1, and four calculations with ADS actuated at four different times. The actuation times for each of these four calculations are:

Case 2, when the collapsed water level is 50 in. (1.3 m) below the bottom of the active fuel (BAF) (the core is uncovered and the water level is in the lower plenum);

Case 3, when the core is completely uncovered (collapsed water level at exactly BAF);

Case 4, when the collapsed water level is 50 in. (1.3 m) above the BAF or 1/3 of the active core height (in accordance with EPGs Rev. 3); and

Case 5, when the collapsed water level in the core is 100 in. (2.5 m) above the BAF, equivalent to 2/3 of the active core height (as in EPGs Rev. 4).

The results are presented in Table A.1. The results are evaluated based on: (a) time when core oxidation starts, (b) amount of hydrogen produced in-vessel, (c) time when core relocation starts, and (d) vessel failure time.

The results of Table A.1 indicate that Case 4, with depressurization when the collapsed water level in the core is 50 in. (1.3 m) above BAF (about 1/3 of the active core height), is the MELCOR case that yields the *longest time* to initiation of core oxidation and relocation, and containment failure. The amount of in-vessel hydrogen produced at vessel failure is also the *smallest* for Case 4. This case provides the *optimum steam cooling* of the core of all the cases analyzed here. The results obtained in this study provide additional support for previous sensitivity studies.[3,4]

The longest time to vessel failure of the five MELCOR cases was calculated for Case 2, the case with late depressurization at about 162 min. It appears that the later the depressurization is initiated, the later the vessel fails (with the exception of the case with no depressurization, Case 1, which yields a time slightly shorter than the time with late depressurization, Case 2).

Case 4 also yields the longest time to containment failure but there is a high uncertainty due to the containment model used. Similar results have been reported earlier using different computer codes (last case of Table A.1). The times calculated by MELCOR in Case 4 for both vessel failure and containment failure are shorter than the ones calculated in Ref. 5 for a similar short-term station blackout for the same plant using the CONTAIN[7] and BWRSAR[8,9] codes. MELCOR 1.8.1 does not consider debris quenching as it falls in the lower plenum. Therefore, MELCOR's vessel failure time is shorter than calculated by BWRSAR. The results of Table A.1 indicate that early vessel depressurization results in a slower containment pressure increase *after* vessel failure than does late vessel depressurization.

These results confirm previous results indicating that vessel depressurization during a short-term station blackout in a BWR-4 should be initiated when the water level in the core is about 1/3 of the active core height in order to optimize steam cooling of the core. This depressurization timing (as per EPGs Rev. 3) yields the longest times to core oxidation initiation, core relocation and

Table A.1. MELCOR results for different ADS actuation times on short-term station blackout sequences

Case No.	ADS Actuated: At time (min.)	ADS Actuated: Core level [in (m)] BAF[a]	ADS Actuated: Fraction ACH[b]	Vessel failure (min.)	Time between ADS actuation and vessel failure (min.)	Core starts uncovering (min.)	Complete core uncovery (min.)	Core oxidation starts (min.)	Core relocation starts (min.)	In-vessel H_2 produced at: Vessel failure [lb (kg)]	In-vessel H_2 produced at: Containment failure [lb (kg)]	Containment failure (h:min.)
1	-	-	-	204	-	37	96	77	92	2,337 (1,060)	2,535 (1,150)	4:14
2	162	-50 (-1.3)		221	59	37	96	77	94	2,337 (1,060)	2,535 (1,150)	5:11
3	96	0	0	199	103	37	96	77	95	1,279 (580)	2,094 (950)	6:06
4	67	50 (1.3)	1/3	165	98	37	86	89	117	220 (100)	717 (325)	8:16
5	54	100 (2.5)	2/3	151	97	37	74	79	109	606 (275)	717 (325)	6:02
BWRSAR/ CONTAIN[c]	80	50 (1.3)	1/3	255	175	40	81		132		1,637 (737)	9:53

NOTE: Times after blackout initiation (calculation times plus 36 s as per initial conditions, Sect. 5.1.1).

[a]BAF, Bottom Active Fuel. Level zero is the BAF.
[b]ACH, Active Core Height.
[c]Results from Refs. 5 and 6.

containment failure and significantly longer time to vessel failure than using Rev. 4 of the EPGs.

Some graphical results of these calculations are presented in Figs. A.1-A.4. Figure A.1 shows the pressure inside the reactor vessel (specifically in Vol. 360, the reactor dome) for Case 4. The initial vessel pressure of 1,034.7 psig (7.134 MPa) at time 0 increases until it reaches the automatic opening set point of the first SRV at about 1,115 psia (7.7 MPa). The SRV closes when the pressure decreases to 1,052 psia (7.25 MPa). After five complete SRV cycles (open and close) of automatic operation of the SRV, one SRV is open manually at 200 s. Manual operation of the SRVs keeps the pressure in the reactor vessel between 930 and 1,030 psig (6.43 and 7.13 MPa). There are 28 cycles (open and close) of this manual operation of the SRVs before ADS is actuated. At 3,973 s (66.2 min of calculations), the level in the core reaches 1/3 of the active core height and the ADS is actuated, resulting in a pressure reduction. Figure A.2 depicts the pressure inside the vessel during the complete calculation of Case 4. Figure A.3 shows the collapsed water levels for three volumes inside the reactor vessel: downcomer (Vol. 310), core channel (Vol. 340), and lower plenum (Vol. 320). After the ADS is actuated, the water level in the core decreases to the bottom of the active fuel due to coolant vaporization. Vessel failure occurs at 9,871 s (165 min); the water level in the lower head drops gradually to zero after vessel failure as the lower plenum contents are emptied. For comparison, Fig. A.4 shows the same water levels in the core for Case 5 (with depressurization when the water level is at 2/3 of the active core height). Vessel failure was also calculated to occur earlier, at 9,014 s (150 min) for Case 5.

The conclusion that using EPG Rev. 3 produced longer times until core relocation and vessel failure (due to enhanced steam cooling) and less hydrogen generation in-vessel than using Rev. 4 was identified by Dr. S. A. Hodge in 1989 using the BWRSAR. This finding was presented to the BWR Owners Group (BWROG) on February 14, 1990. The BWROG reconsidered EPG Rev. 4, Contingency #3, "steam cooling." Subsequently, the BWROG has proposed a revision to Contingency #3 which reverts to the timing of Rev. 3 for most of the fuel cycle. It is expected that this revision will be in Rev. 5 of the EPGs.

A.2 Fuel and Cladding Porosities

MELCOR has a user-defined input called "porosity" to define the "effective" or "packed" volume of a component (V_{pack}). The "porosity," p, is employed to calculate the "packed" volume from the component "original" volume, V_o, by the following formula:

$$V_{pack} = \frac{V_o}{1-p} .$$

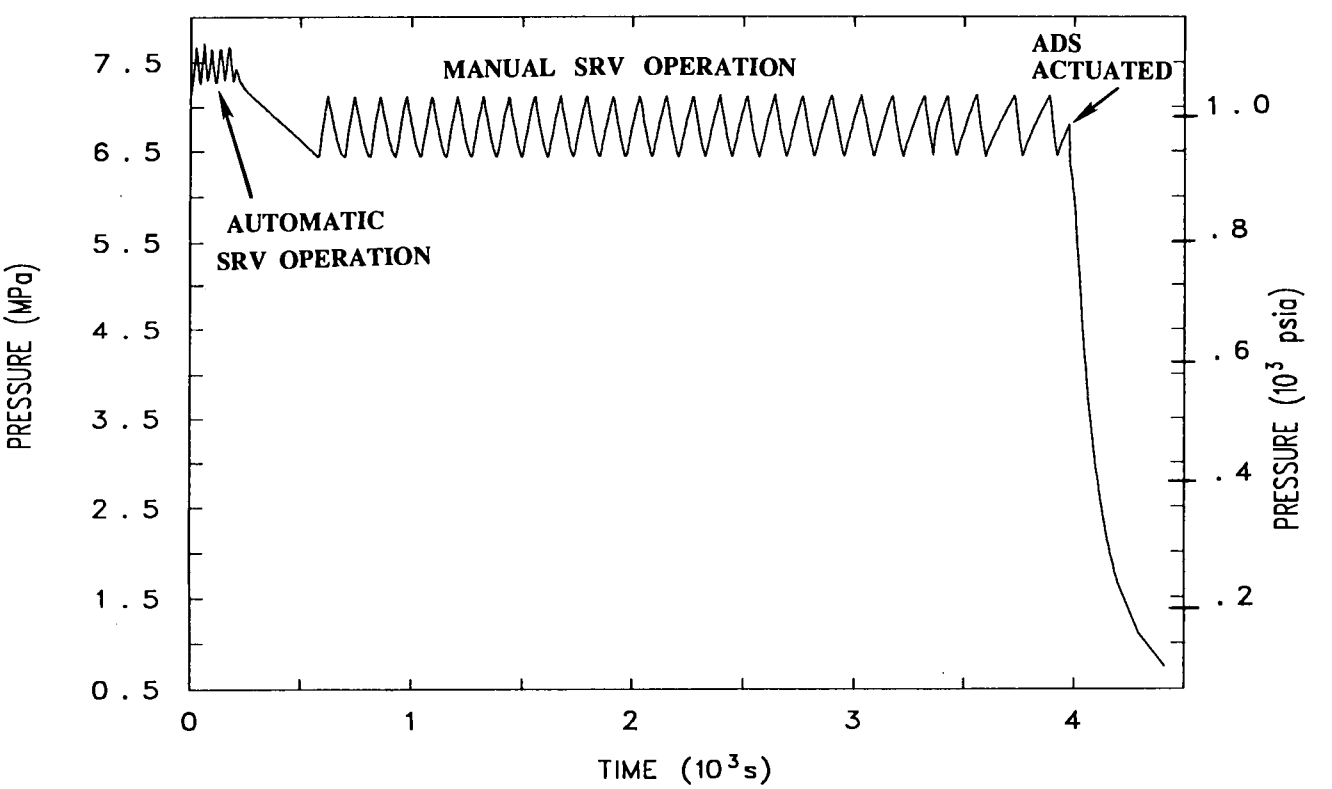

Figure A.1 Vessel pressure during the first 4500 s of calculations for Case 4 of Table A.1

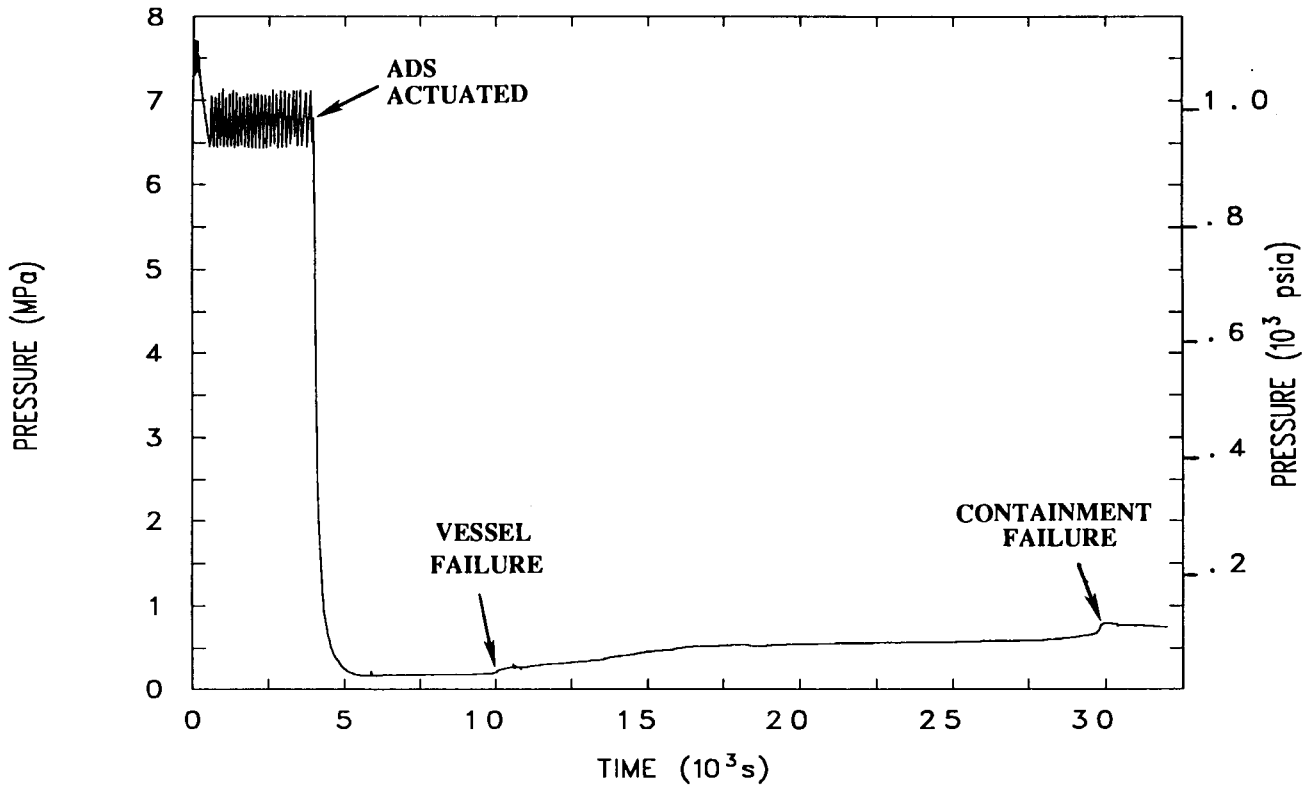

Figure A.2 **Reactor vessel pressure for Case 4 of Table A.1**

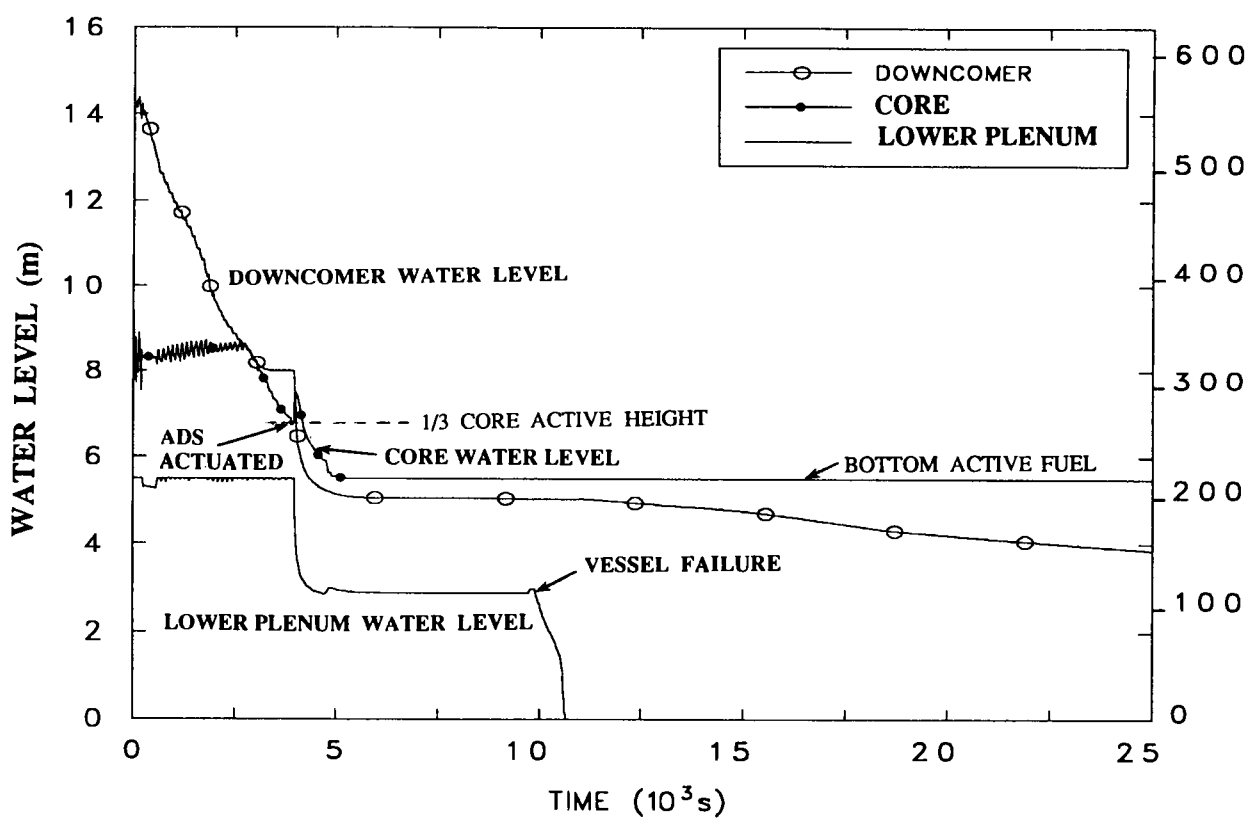

Figure A.3 **Collapsed water levels inside the vessel for Case 4 of Table A.1**

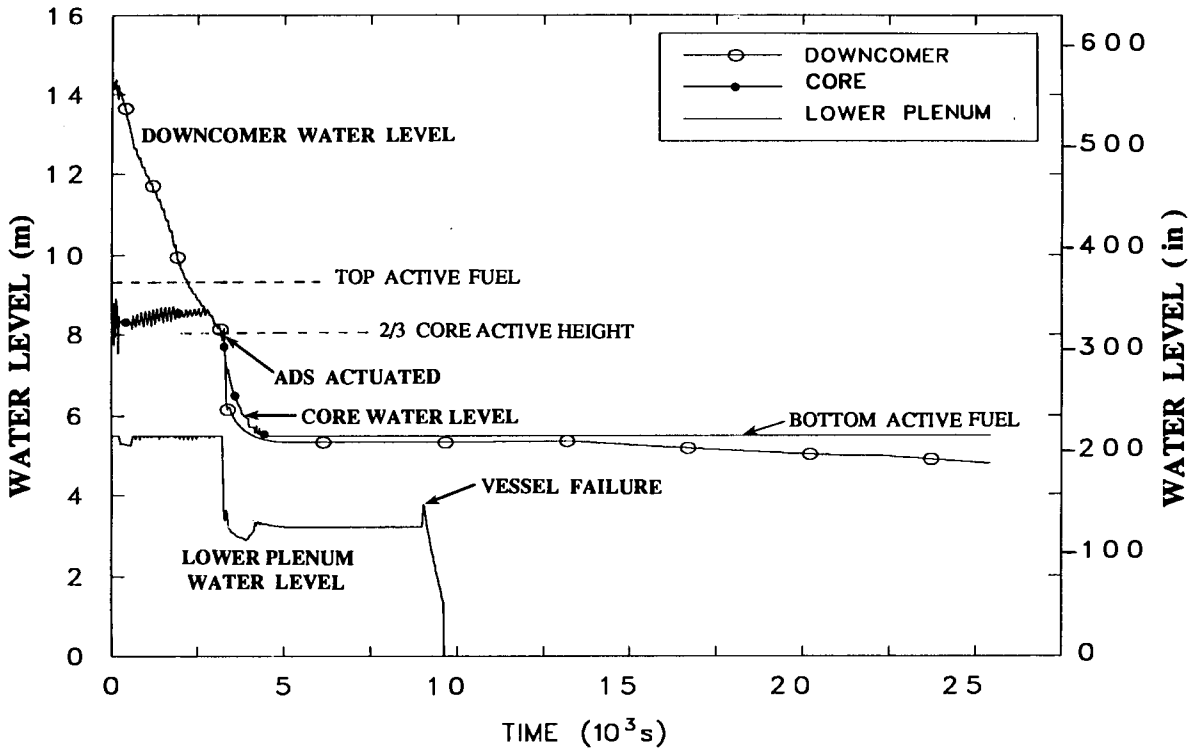

Figure A.4 Collapsed water levels inside the vessel for Case 5 of Table A.1

The porosity can vary between 0 and 0.99. A zero value of the porosity does not modify the original volume of a component: $V_{pack} = V_o$. A large value of the porosity (p = 0.99) produces a large "packed" volume of a component, 100 times the original volume V_o:

$$V_{pack} = \frac{V_o}{1-0.99} = 100\,V_o\ .$$

The porosity can be used with intact components (fuel and cladding) and with debris. When a large value of the porosity is used with the intact components of the core (fuel and cladding) the resulting large "packed" volume will occupy all the "free" volume of the core and no relocation of debris from above is possible. Therefore, the core will support debris regardless of the intact component mass. The large "packed" volume of the intact components only affects relocation of debris from above; the original free volume between components is still open for flow calculations. Similarly, when a large porosity is used with the debris, large effective "packed" volume of debris results that will occupy or spread out over large "free" volumes in the core or lower plenum.

The values of the porosities in the original MELCOR deck were 0.99 for the intact components (fuel and cladding) in the core, and 0.0 for the intact components in the lower plenum. The porosity of the particulate debris was 0.3 in the core and lower plenum. The porosities of the intact components do not apply to the lower plenum since there is neither fuel nor cladding present in the lower plenum.

The use of a porosity value of 0.99 for the core intact components is adequate to prevent debris relocation but is not realistic. Based on the "original" volumes of the intact components and on the "free" volumes between components of the Peach Bottom core it was calculated that a realistic value for the core intact component porosity is 0.53. This porosity value allows free space for relocation of debris into the space between fuel assemblies. Relocation into the region between fuel pins is not allowed because the grid spacers are assumed to block the debris. If relocation inside the fuel pins is desired (assuming that the grid spacers have failed) a intact component porosity value lower than 0.53 should be used. A porosity value around 0.40 is adequate for this purpose.

Table A.2 shows the results of two runs performed for the station blackout with a dry cavity with MELCOR 1.8.1 Version IR using two different core intact component porosities: 0.99 and 0.53. The differences between the two runs are not significant. Run 2, with the lowest core porosity (0.53) yielded vessel failure 1 min earlier and containment failure 16 min later. Therefore, *the core intact component's porosities do not significantly affect the vessel and containment failure times significantly.*

The core intact component porosity of 0.53 was chosen for use in all the calculations of this report because it is a

Table A.2. Core intact component porosity results for the station blackout sequence

Case No.	Core porosities	ADS actuated at time (min.)	Vessel failure (min.)	Time between ADS actuation and vessel failure (min.)	Core complete uncovery (min.)	Core oxidation starts (min.)	Core relocation starts (min.)	In-vessel H_2 produced at: Vessel failure lbs (kg)	In-vessel H_2 produced at: Containment failure lbs (kg)	Containment failure (min.)
1	0.99	66	161	95	86	88	117	231 (105)	893 (405)	431
2	0.53	66	160	94	86	88	117	220 (100)	937 (425)	447

more realistic value than 0.99. (The effect of the debris porosity is covered in Appendix A.3).

A.3 Parameters that Affect the Amount of In-Vessel Steel Ejected into the Cavity after Vessel Failure

This section describes the results of several studies conducted to investigate the effect of certain parameters on the amount of in-vessel steel ejected after vessel failure. The parameters investigated are: mass of steel in the lower plenum, debris porosity, support flags in the lower plenum, lower plenum structural failure temperature, open flow area through the core plate, open flow areas through the lower plenum, and lower plenum surface areas. Finally, calculations using lower plenum debris bed models, the MELCOR/CORBH Package[10-12] and the BWRSAR[8,9] codes, are also presented and compared to the MELCOR 1.8.1 results.

A.3.1 Lower Plenum Steel Mass

The original MELCOR input deck of Peach Bottom specified that an amount of 153,962 lbs (69,824 kg) of steel is present inside the reactor vessel. The actual amount of steel in the lower plenum, core plate and core (steel that can be melted and ejected after core meltdown) is 267,202 lbs (121,180 kg). The cause of this difference was traced to the masses of the control rod guide tubes and in the structural material in the lower plenum. The model was modified to reflect the actual amount of steel in the lower plenum and an investigation of the effect of the amount of steel input on the calculated results was completed. The results of this study are summarized in Table A.3. All these calculations were performed for the station blackout with a dry cavity and with ADS actuated at 1/3 of the active core height. The first ten runs of this table were performed with MELCOR 1.8.1 Version KH. Run 11 used the MELCOR/CORBH Package[10-12] and the last run (Run 12), is the combined result from the BWRSAR[8,9] and CONTAIN[7] codes taken from Refs. 5 and 6.

Run 1, with the low inventory of steel inside the vessel, predicted that 62% of the initial steel inventory (95,127 lbs) were ejected to the cavity. Run 2, with the large inventory of steel in the lower plenum, predicted only 9.9% (26,416 lbs) of the initial steel inventory ejected to the cavity.

The additional steel in the lower plenum acts as a heat sink to the molten steel from the core above. If more steel is present in the lower plenum, more molten steel from the core refreezes on the lower plenum structures and, therefore, less steel leaves the vessel as debris.

The MELCOR code models the core heat up, melting and relocation process in a different way for the uranium dioxide fuel and for the steel inside the vessel. After the core dries out, heat is transferred from the fuel rods to the steel in the control rods primarily by radiation. When the steel melts, it candles down into the steel nodes below. This process continues until the molten steel reaches the core plate, where the steel piles up on the core plate itself. The molten steel does not refreeze in the core region above the core plate when the fuel heat source is present.

After the core plate fails or melts, the molten steel candles down into the node below with the control rod guide tubes. Some of the solid steel in the node below the core plate may be melted by the molten steel coming from the core region, or, some of the molten steel may refreeze on this steel node depending on the temperatures and masses of the molten and solid steel . The molten steel will candle down into the node below. This candling process continues until the molten steel reaches the bottom of the lower plenum where it can be ejected as debris through failed penetrations. The decay heat of the fuel <u>does not</u> heat the steel in the lower plenum in MELCOR 1.8.1. The fuel debris falls down from the core plate or the core region (after core plate failure or meltdown) *directly to the bottom of the vessel.* At the bottom of the vessel, the fuel debris heats up the penetrations which fail in a very short time after they contact the fuel debris. No energy is transferred from the fuel debris to the lower plenum structures or molten steel when there is water present in the lower plenum. The molten steel from the core region can only reach the bottom of the vessel by candling down.

If the initial amount of steel in the lower plenum is not very large (compared to the molten steel from the core region), the lower plenum steel may be melted by the molten steel coming from above and both the core steel and the lower plenum steel will be melted and available to be ejected from the vessel. On the other hand, if the inventory of steel in the lower plenum is large, the molten steel from above may be insufficient to melt it. In fact, some of this molten steel may refreeze on the steel nodes in the lower plenum. Consequently, if a large inventory of steel is present in the lower plenum, the lower plenum steel may not be melted by the molten steel from above and less molten steel may reach the bottom of the vessel where it can be released as debris. This situation will be different if the additional steel is added to the *core region*, above the core plate. This additional steel will be melted by the fuel decay heat and, in this case, more molten steel will be available for melting the steel in the lower plenum and for ejection after vessel failure.

For the Peach Bottom sequence analyzed here, a larger inventory of steel in the lower plenum resulted in less molten steel ejected from the vessel.

These results demonstrate the MELCOR 1.8.1 code's inability to transfer decay heat from the fuel debris to the structures in the lower plenum when the lower plenum contains water (as is the case in these calculations). The MELCOR Core Package only allows energy to be transferred from the debris to the structures in the lower plenum by radiation when there is no water present.

Table A.3. Steel inside the vessel and ejected in the station blackout sequence

Run No.	Steel inside the vessel [lbs (kg)]	Debris porosity	Support flags in lower plenum	Failure temperature for supports [°F (K)]	Vessel failure (min.)	Containment failure (min.)	Time difference, containment vessel failure (min.)	H_2 produced [lb (kg)]	UO_2 ejected [lb (kg)]	% initial inventory	Stainless steel ejected [lbs (kg)]	% initial inventory	Total debris ejected [lbs (kg)]
1	153,962 (69,824)	0.3	01,00	1,832 (1,273)	165	498	333	716 (325)	359,512 (163,072)	97	95,127 (43,149)	62	577,435 (261,920)
2	267,202 (121,190)	0.3	01,00	1,832 (1,273)	163	415	252	992 (450)	337,308 (152,974)	91	26,416 (11,980)	9.9	440,581 (199,810)
3	267,202 (121,190)	0.9	01,00	1,832 (1,273)	163	366	203	1,561 (708)	319,149 (144,739)	86	140,809 (63,859)	54	553,962 (251,230)
4	267,202 (121,190)	0.3	11	1,832 (1,273)	193	414	221	1,387 (629)	314,241 (142,513)	85	14,553 (6,600)	5.5	343,149 (156,530)
5	267,202 (121,190)	0.3	11	2,600 (1,700)	329	656	327	1,497 (679)	318,025 (144,229)	86	232,321 (105,361)	87	642,757 (291,500)
6	267,202 (121,190)	0.3	00	1,832 (1,273)	153	412	259	2,496 (1,132)	371,101 (168,300)	99.9	265,702 (120,500)	99.9	796,755 (361,340)
7	262,545 (119,068)	0.9	00	1,832 (1,273)	163	374	211	1,202 (545)	319,093 (144,738)	86	135,979 (61,679)	52	549,171 (249,100)
8[a]	262,545 (119,068)	0.9	00	1,832 (1,273)	191	394	203	1,162 (527)	318,860 (144,608)	86	55,251 (25,057)	21	481,991 (218,590)
9[b]	262,545 (119,068)	0.9	00	1,832 (1,273)	163	361	198	1,252 (568)	364,638 (165,369)	98	54,591 (24,758)	21	504,791 (228,930)
10[c]	262,545 (119,068)	0.9	00	1,832 (1,273)	163	376	213	1,376 (624)	328,618 (149,033)	88	139,382 (63,212)	53	563,179 (255,410)
11[d]	262,545 (119,068)	0.9	00	1,832 (1,273)	285	~600[e]	~315[e]	1,323 (600)	255,048 (115,668)	67	264,600 (120,000)	100	616,342 (279,520)
12[f]	267,202 (121,190)	--	--	--	255	593	338	1,632 (737)	347,400 (157,550)	98	352,657 (159,935)	132	848,642 (384,871)

[a]Run 8 has reduced flow areas and reduced lower plenum surface areas.
[b]Run 9 has only reduced lower plenum surface areas (most realistic values). This run has the most credible input.
[c]Run 10 has reduced lower plenum surface areas for rings 1 and 3 only (large values for ring 2).
[d]Run 11 used the MELCOR/CORBH package with the same input values of Run 9.
[e]Estimated values.
[f]Results from Ref. 5 and 6 using the codes BWRSAR and CONTAIN. This run had a larger amount of steel ejected than the MELCOR runs because it also included part of the vessel bottom head that had melted.

In a more realistic scenario, some decay heat should be transferred from the fuel debris to the structures in the lower plenum, even if water is present. Several attempts to model this more realistic scenario were pursued by varying some MELCOR input parameters. Basically, all of these runs focused on an attempt to force the fuel debris and the lower plenum structures into contact so that energy would be transferred into these structures. It is precisely this issue that has led to the development of the MELCOR/CORBH version of MELCOR.

A.3.2 Debris Porosity

The porosity of the debris was increased to 0.9 in the MELCOR input. This large debris porosity results in a very large "packed" volume of fuel debris. Fuel debris will occupy all the open space at all the levels of structures in the lower plenum instead of falling directly to the bottom head or lower levels. Energy will be transferred from the fuel debris to the lower plenum structures not covered with water and more steel should melt and reach the bottom of the vessel for release. This approach affected the results *significantly* as shown in Run 3 of Table A.3. At the end of the calculations (500 min), 54% of the initial steel inventory in the vessel (core and lower plenum) was released into the cavity versus only 9.9% for Run 2. *Larger debris porosities resulted in significantly larger amounts of steel ejected into the cavity.*

A.3.3 Lower Plenum Support Flags and Structural Failure Temperature

A new approach assumed that each level of the lower plenum supports debris (as the core plate does) until the failure temperature of 1,832°F (1,273 K, or the default value) is reached. The melting temperature of stainless steel is 2,600°F (1,700 K). This was accomplished by setting the input for the logical support flag at all levels of the lower plenum to "11." Normally, the support flag is set to "11" only at the support core plate. The support flags at the other levels of the core and lower plenum are set to 00 with the exception of the second axial node of the lower plenum that is set to 01. The second axial node of the lower plenum needs the support flag of 01 for the structures of this level to stay in place without structures below. The first axial node of the lower plenum of the original MELCOR deck does not have any structures. The results of this run (Run 4) did not show any increase in the amount of steel melted and ejected from the vessel when compared to Run 2. In fact, Run 4 released less steel than Run 2. This was because the structures in the lower plenum failed at 1,832°F — long before any melting occurred at 2,600°F. Once the structure at a level fails, the fuel debris is released and no further heating of that structure takes place. However, Run 4 calculated a longer time to vessel failure since the debris took a longer time to fail the five levels of structures in the lower plenum before reaching the penetrations at the bottom of the lower plenum. This run was repeated with the failure temperature increased to the melting temperature of steel (2,600°F) in Run 5. The results of Run 5 predict that as much as 87% of the initial inventory of steel is released to the cavity. Also, this run predicted vessel failure at 329 min (19,762 s), much later than any other previous run. The fuel debris required a much longer time to fall through the five different levels of structures in the lower plenum and reach the lower head penetrations. In addition to melting and releasing significant amounts of steel, at the time of vessel failure (329 min), all the water in the lower plenum was boiled off by the decay heat of the fuel. Previous runs predicted vessel failure much earlier, when there is still a significant mass of water in the lower plenum [about 8.85 ft (2.7 m) above the bottom of the vessel].

In Run 6 the steel structure in the lower plenum was collapsed onto the vessel bottom before the fuel debris reached the lower head. (This approach forced the hot fuel debris to heat the steel in the lower plenum at the same time that the penetrations were heated.) This was accomplished by changing the support flag in the second axial node of the lower plenum from 01 to 00. (The structures need a support flag set to 01 to stay in place without structures below.) This run (Run 6) predicted that, at the end of the calculation, almost all the contents of the vessel including steel, control rods and fuel were released to the cavity. However, vessel failure was predicted to occur earlier than in any other run. Core plate failure and melting occurred earlier than in previous runs because there was no structure under the core plate to act as a heat sink for the core debris. After core plate failure, the debris heated the penetrations and the steel in the lower plenum bottom simultaneously.

Therefore, *the lower plenum support flags and structural failure temperatures have a very significant effect on the amount of steel ejected and vessel failure and containment failure times.*

Run 7 has a slightly smaller amount of steel inside the vessel than previous Runs 2-6. The total amount of steel inside the core and lower plenum, 267,202 lbs (121,190 kg) was split into 4,657 lbs (2,112 kg) for the vessel penetrations, and the remaining 262,545 lbs (119,068 kg) are input as structural steel inside the vessel available for melting and debris ejection. This was done because the mass of the penetrations is not available for expulsion from the reactor vessel after vessel failure. The only way to eject the penetrations' mass is by adding it to the first axial node of the lower plenum. This results in a duplication of the penetration mass. Since this is undesirable, the mass used for the penetrations should be a small mass and it should be subtracted from the mass of steel in the axial node 1 of the lower plenum.

In Run 7, the lower plenum steel mass was distributed among all the five nodes of the lower plenum, including the first axial node. The support flag for *all* the axial nodes of the lower plenum was "00", as there are intact structures below each axial level to support the structures above.

This Run 7 is very similar to Run 3. The differences between both runs are in the total amount of steel in the lower plenum and the way this steel is distributed. As expected, the results from Run 3 and 7 are very similar. *Thus, the mass distribution of steel in the lower plenum has a minor effect on the results.*

A.3.4 Core Plate and Lower Plenum Flow and Surface Areas

Some of the structure surface areas and open flow areas in the lower plenum and core plate were larger in the original MELCOR input deck than the actual values. Specifically, the open flow area through the core plate in the original deck was 111.73 ft^2 (10.38 m^2). The open flow area through the core plate is actually about 22 ft^2 (2 m^2). The open flow areas and surface areas in the lower plenum were also larger in the original deck than the actual plant values. The correct values were input in Run 8. Run 8 is similar to Run 7 but used reduced values for the open flow areas in the core plate and lower plenum and reduced values for the surface areas of the structures in the lower plenum. The results of this run indicate that vessel and containment failure times occur later, and a smaller amount of steel is ejected to the cavity (only 21% in Run 8 vs. 54% in Run 7). The smaller open flow area at the core plate reduced the amount of debris that could relocate onto the core plate and its failure occurred later. The core plate axial node of the MELCOR input is 0.9 ft (0.277 m) in height, and it includes the core plate and some structures on top of the core plate (below the active fuel). Consequently, the open flow area through the core plate is not the appropriate value to be used since this axial node extends from the bottom of the core plate to the bottom of the active fuel region. This "open flow area" is actually the area that, multiplied by the height of the axial node, will result in the "open free volume" for this axial node. The open flow area that should be used is an average value for this axial node that will give the correct available free volume for debris relocation. The value of this flow area in the original deck yields a total free volume for relocation of 111.73 $ft^2 \times 0.9$ ft = 100.6 ft^3, close to the actual value. Consequently, the value of this open flow area was changed back to the original value in the original deck as received.

Run 9 used the correct structure surface areas, and the original flow areas of the original input deck. Vessel and containment failure times for Run 9 were very similar to the ones calculated in Run 7. However, the amount of steel ejected was still similar to the amount calculated in Run 8, much lower than the value of Run 7. The surface areas in the lower plenum were affecting these results. The smaller surface areas provide less surface for heat transfer from the debris or from molten steel coming from the core region. Consequently, less steel in the lower plenum was melted and less molten steel was ejected. In particular, both Runs 8 and 9 predicted that almost no steel is melted and ejected from radial ring number 2. On the contrary, Run 7 predicted that all the steel in the lower plenum for this radial ring 2 is completely molten and ejected. Run 9 was repeated, with the surface areas of the structures in the lower plenum of ring number 2 increased to the original values of the input deck. This new run, Run 10, predicted 53% of the steel inventory in the core is ejected because all the steel in ring number 2 of the lower plenum is melted and ejected. This result is comparable to the value calculated in Run 7.

Therefore, smaller core plate open flow areas result in less debris relocated into the core plate and longer times to core plate failure and vessel failure. Smaller lower plenum structures' surface areas result in less heat transferred to the lower plenum structures and less steel melted and ejected from the vessel.

While there is justification to have the large open flow areas in the core plate axial node of the MELCOR input deck, there are no valid reasons to keep the large surface areas of the lower plenum structures that were in the input deck as received. Consequently, it is deemed that Run 9 has the most realistic input values and therefore, Run 9 is more credible. It should also be noted, that Run 9 ejected a lot of fuel debris into the cavity (about 98% of the total initial inventory). Larger ejected fuel masses generally result in larger source terms.

A.3.5 Lower Plenum Debris Bed Models

Run 9 was repeated using the MELCOR/CORBH Package.[10-12] The results of this run (Run 11 of Table A.3) predicted instrument tube failure at 285 min (17,092 s) and lower head creep rupture at 467 min (28,040 s). Of the total 616,342 lbs (279,520 kg) of corium released into containment in this run, about 220,000 lbs (100,000 kg) were released between the times of instrument tube failure and lower head creep rupture. The remaining mass was released at 467 min, when the lower head ruptured. Figure A.5 shows the mass in the cavity for this run. This run aborted at about 577 min, before containment failure. It was estimated from the calculated containment temperature curve that the containment would fail at about 600 min. The problems with the MELCOR/CORBH Package that prevented execution after 577 min of transient time have not been resolved. Furthermore, the current version of the CORBH Package has not been interfaced with the fuel fission product release algorithms and is not yet useful for source term quantification. Consequently, no further attempts to run the MELCOR/CORBH Package have been pursued.

Finally, Run 12 shows the results obtained using the codes BWRSAR[8,9] and CONTAIN.[7] These results are taken from Refs. 5 and 6. These results indicate that about 98% of the total core inventory is released together with a portion of the vessel bottom head. The results from Runs 11 and 12 using the lower plenum debris bed model are in good agreement for vessel and containment failure times and for the amount of steel ejected. Both vessel and containment failure times from these two runs are the longest

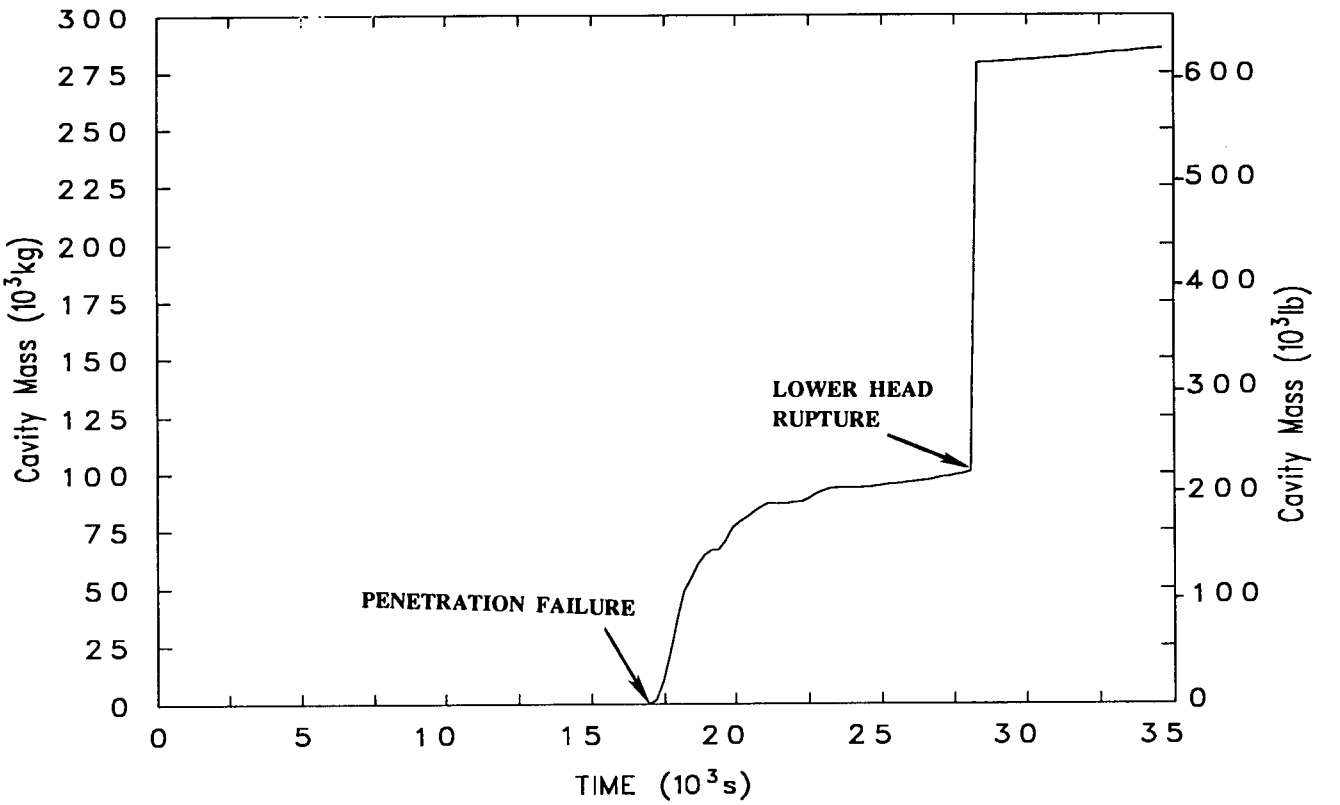

Figure A.5 Molten debris mass in the cavity for Run 11 of Table A.3

times of Table A.3 with the exception of MELCOR Run 5.

The CORBH and BWRSAR lower plenum debris bed models result in longer (and probably more realistic) vessel failure times than MELCOR 1.8.1.

A.3.6 Summary

The MELCOR results presented in Table A.3 demonstrate a wide range of behavior. In particular, the amount of steel ejected varies between 5.5% for Run 4 and almost 100% for Runs 6 and 11. The amount of fuel ejected varies between 67% (Run 11) and 99.9% (Run 6). Vessel failure times vary between 153 and 329 min. Containment failure times vary between 361 and 600 min. *These vastly different results were obtained by varying MELCOR input parameters within reasonable values.*

A.4 Penetration Failure Timing

There are several input parameters that control the timing of the failure of the penetrations in the MELCOR code. These parameters are:

a) penetration failure temperature, (card COR00009 of MELCOR input),
b) heat transfer coefficient between the debris and the penetration, (card COR00009 of MELCOR input), and
c) penetration mass (cards CORPENnn).

There are uncertainties in the values of these parameters. The effects on reactor vessel failure timing of varying these parameters are presented in Table A.4. All these calculations were performed for the station blackout. The base case in these calculations used a penetration mass of 4,657 lb (2,112 kg), a penetration heat transfer coefficient of 88 Btu/ft^2 h°F (500 W/m^2 K), and a penetration failure temperature of 1,832°F (1,273 K). This base case is Run 1 of Table A.4. In Run 2 of Table A.4 the value used for the penetration failure temperature was increased to 2,600°F (1,700 K), the melting temperature of steel. This is the maximum reasonable value that could be used for this parameter. MELCOR estimated that vessel failure would occur 26 s later for this case (Run 2 of Table A.4) than the base case (Run 1).

The value of the heat transfer coefficient between the debris and the penetrations in the MELCOR deck as received from BNL was 88 Btu/h ft^2 °F (500 W/m^2 K). In order to delay vessel failure, MELCOR runs were performed with values 1/10 and 1/100 of this value of the heat transfer coefficient. The run with 1/10 the original value (Run 3), predicted vessel failure about 4 min (242 s) later. The run with 1/100 the original value, predicted vessel failure 6 min (369 s) later. Both time differences are not very significant.

Finally, the mass of the penetrations was increased to six times the original value. In order to avoid duplication of mass, this additional mass of the penetrations was removed from the structural steel mass of axial node 1 in

Table A.4. Vessel failure times calculated by MELCOR by varying penetration input parameters in the station blackout sequence

Run No.	Penetration failure temperature [°F (K)]	Penetration h [Btu/ft²h °F (W/m² K)]	Penetration mass [lb (kg)]	Vessel failure [min. (s)]	Difference [min. (s)]
1[a]	1,832 (1,273)	88 (500)	4,657 (2,112)	163 (9,793)	Base
2	2,600 (1,700)	88 (500)	4,657 (2,112)	164 (9,819)	0.5 (26)
3	1,832 (1,273)	8.8 (50)	4,657 (2,112)	167 (10,035)	4 (242)
4	1,832 (1,273)	0.8 (5)	4,657 (2,112)	169 (10,162)	6 (369)
5	1,832 (1,273)	88 (500)	27,942 (12,672)	165 (9,896)	2 (103)

[a]This run is Run 3 of Table A.3.

the lower plenum (Sect. A.3). The results of this Run 5, predicted vessel failure about 2 min (103 s) later than the base case.

The timing of vessel failure varied between 163 (Run 1) and 169 min (Run 4). Even if a combination of these parameters is used (large penetration mass together with high failure temperature and low heat transfer coefficient) the delay in vessel failure timing would probably be only a few minutes. *The results of this study (Table A.4) indicate that MELCOR's estimated time of vessel failure is not very sensitive to the input values of the penetration parameters.*

A.5 Timing of Vessel Failure

The results from Sect. A.4 indicated that vessel failure time predicted by MELCOR for the station blackout is not very sensitive to the input values of the penetration parameters. Once the core plate fails (or melts), the hot debris falls to the bottom of the lower plenum and contacts the penetrations, which fail shortly thereafter. *The only way to delay vessel failure in MELCOR is by delaying the time at which debris reaches the penetrations.*

This delay was accomplished in Runs 4 and 5 of Table A.3 where debris was supported at each level of the lower plenum until that level structure failed or melted. Run 5 predicted the longest time to vessel failure, 329 min - more than twice the time calculated by Run 6 (153 min). Some results from Run 5 are similar to the results from Run 11 using the ORNL Lower Plenum Debris Bed Package[10-12] (CORBH) added to MELCOR. The MELCOR 1.8.1/CORBH Package starts calculations after the lower plenum is dry (all the water in the lower plenum has been boiled off). Heat transfer between the debris and the water in the lower plenum has been artificially increased in the MELCOR1.8.1/CORBH Package to represent boiling of water during the simulated debris quenching. Also, the penetrations of the lower head were prevented from failing in MELCOR prior to the activation of the CORBH package. This was done by artificially increasing the penetration failure temperature to a very high value [i.e., 17,500°F (10,000 K)] and by eliminating heat transfer between the debris and the penetrations. Once the lower plenum is dry, the CORBH package is activated.

Comparison of the vessel failure time of Run 11 with the other times of Table A.3 shows the following:

a) the time predicted by the MELCOR 1.8.1/CORBH Package (Run 11) is in good agreement with the time predicted by the codes BWRSAR/CONTAIN (Run 12).
b) the time calculated by the MELCOR 1.8.1/CORBH Package for vessel failure (285 min) is in-between the shortest time calculated by MELCOR (153 min for Run 6) and the longest time (329 min for Run 5) and is closer to the longest time.

The run with the most credible input of Table A.3 is Run 11. The MELCOR 1.8.1/CORBH Package has an improved lower plenum molten debris thermal-hydraulic model. The time calculated by the MELCOR 1.8.1/CORBH Package in Run 11 (Table A.3) is 285 min (17,092 s). This is the best-estimate time for vessel failure for the low pressure, short-term, station blackout analyzed.

A.6 Lower Plenum and Core Shroud Temperatures

The shroud is a cylindrical stainless steel assembly that separates the downcomer from the core and lower plenum. The lower plenum shroud is located below the

core plate and separates the lower plenum from the downcomer. The core shroud is above the core plate and surrounds the core. The shrouds are modeled in MELCOR as heat slabs, one for each axial level of the core (Sect. 4.1). Consequently, there are 11 shroud heat slabs, five in the lower plenum, one at the core plate level, and five more in the core region (Fig. A.6). Each heat slab has five radial nodes. Node 5 is the outside node, next to the downcomer. Node 1 is the inside node, next to the core or lower plenum structures. Heat slabs cannot melt and relocate in MELCOR.

Figure A.7 shows the temperature of the inside radial node (node 1) of the shroud heat slabs in the first six axial levels (includes the five levels of the lower plenum plus the core plate level), for Run 9 of Table A.3. The temperatures at all six levels are well below the melting temperature of steel [2,600°F (1,700 K)]. Therefore, the shroud at the core plate level and in the lower plenum does not melt.

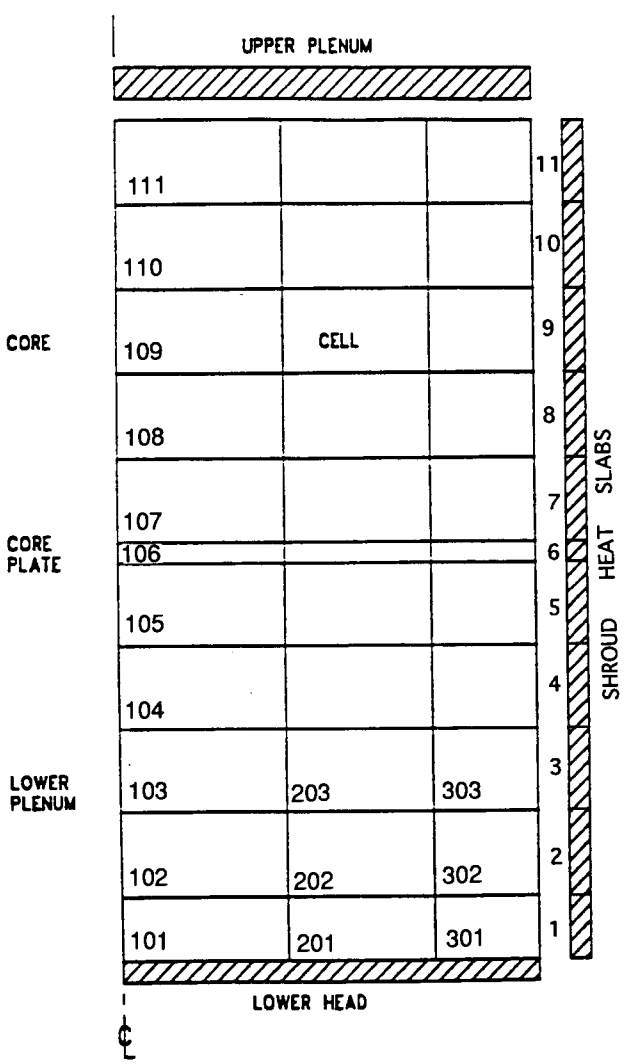

Figure A.6 **Location of the eleven axial shroud heat slabs**

Figure A.8 shows the temperature of the inside radial node (node 1) of the shroud in the five axial levels of the core (level 7 through 11) for the same Run 9 of Table A.3. Figure A.9 shows the temperature of the outside radial node (node 5) of the same five axial levels of Fig. A.8. These figures show that the shroud temperature at these five axial levels goes above the steel melting temperature for a significant amount of time (about 1,800 s or 30 min). Consequently, according to these results, *melting and relocation of these structures would occur.* It is anticipated, however, that the molten steel will probably refreeze on colder shroud structures below (lower plenum) and will not be available for ejection into the cavity. Nevertheless, it is important to know that the shroud structure located at the core levels will probably melt during this transient. *A new flowpath between the core and the downcomer would be established if the shroud were to melt.*

Shroud melting occurs in Run 9 after vessel failure. However, in the MELCOR 1.8.1/CORBH analysis (Run 11 of Table A.3) melting of the shroud starts at about the same time (10,000 s or 167 min) but vessel failure occurred later (at 285 min or 17,092 s). This might possibly provide a more direct flow path via the ADS for the fission products to enter the wetwell because some of the flow through the debris would probably bypass the steam dryers. Consequently, higher releases of fission products into the containment may result due to the possible bypass of the steam dryers. After vessel failure, this new flowpath is not important.

A.7 Effect of Debris Pour Composition on the Source Terms

The large number of MELCOR runs completed in this sensitivity analysis (Sect. A.1 through A.6) were used to investigate the effect of some variables on the source terms releases. However, all these runs were not obtained for the purpose of analyzing source term *trends*. Therefore, many of these runs could not be used for this investigation. The runs used are shown in Table A.5. This table shows the source terms released into containment at 533 min. All the runs are very similar. The independent variables analyzed in these runs are the amounts of steel and fuel ejected into the cavity.

It appears from these runs, that the in-containment releases from classes 3, 5, 6, and 7 *decrease* when the amount of steel ejected into the cavity *increases*. The last run of Table A.5, the run with the highest amount of steel ejected (53%) has the lowest source terms for these four classes. Another trend was discovered for the runs with the largest fractions of UO_2 ejected into the cavity. These runs resulted in the largest source terms for classes 2 and 16. Therefore, it appears that in-containment releases of classes 2 and 16 *increase* when the amount of UO_2 ejected into the cavity *increases*. No other trends could be observed in the runs of Table A.5 or in other MELCOR runs completed in the previous sensitivity studies.

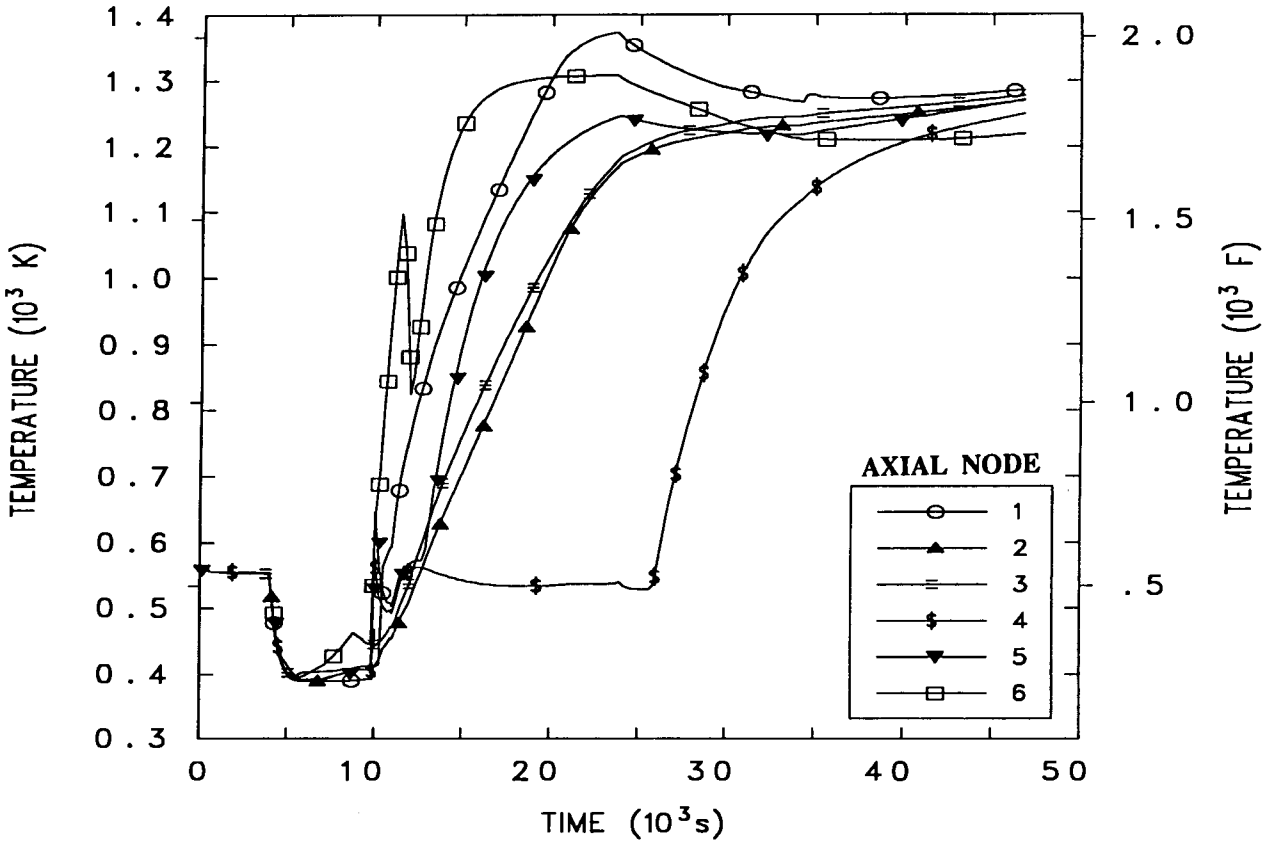

Figure A.7 **Inside temperatures of the lower plenum shroud and core plate shroud**

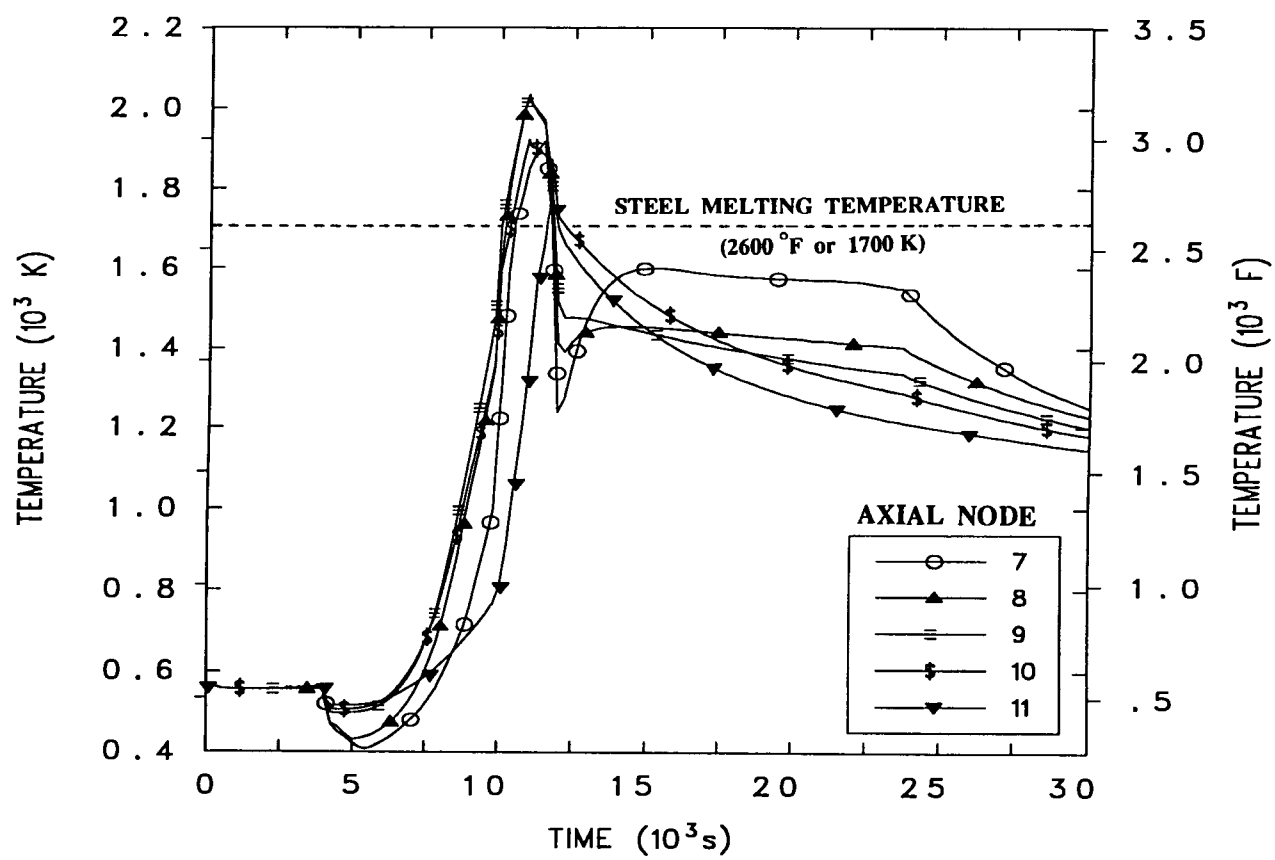

Figure A.8 **Inside temperatures of the five axial levels of the core shroud**

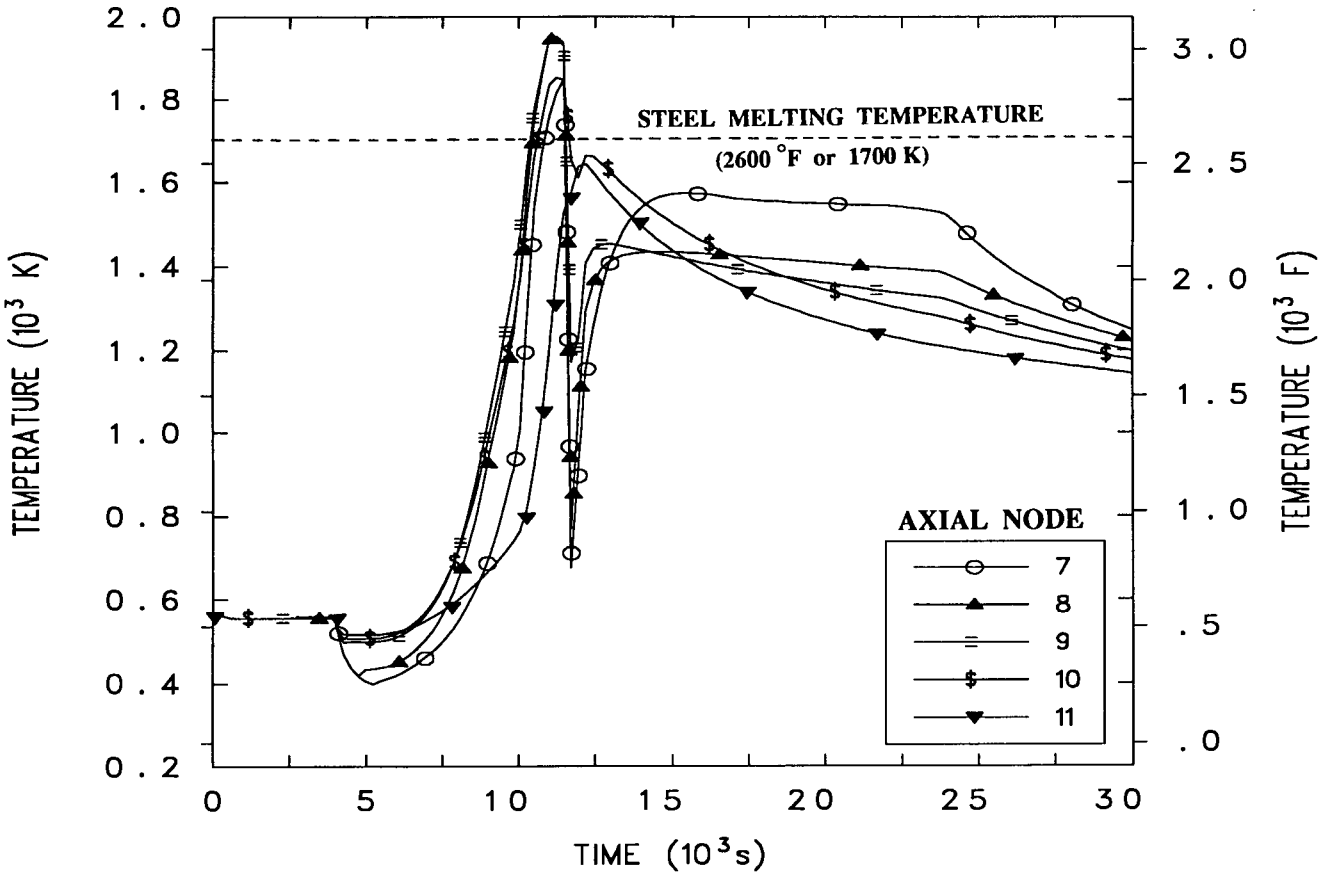

Figure A.9 Outside temperatures of the five axial levels of the core shroud

A.8 References

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Table A.5. Source term released into containment at 533 min for different amounts of steel and fuel ejected

Containment failure (min)		**415**	**431**	**395**	**361**	**376**
% steel ejected from RPV		**8.4**	**9.9**	**21**	**21**	**53**
% UO_2 ejected from RPV		**99.5**	**91**	**86**	**98**	**88**
Class	**Elements**	**Fraction released**	**Fraction released**	**Fraction released**	**Fraction released**	**Fraction released**
1	Noble Gases	0.9999	0.9988	0.9981	0.9994	0.9980
2	Cs	0.5820	0.4959	0.5438	0.5824	0.5472
3	Ba, Sr	0.4474	0.4259	0.4164	0.3145	0.2326
4	I					
5	Te	0.5528	0.5443	0.3644	0.3356	0.1711
6	Ru	0.0045	0.0027	0.0036	0.0017	0.0017
7	Mo	0.0819	0.0458	0.0780	0.0489	0.0403
8	Ce	0.0004	0.0005	0.0002	0.0004	0.0004
9	La	0.0026	0.0024	0.0031	0.0003	0.0004
10	U	0.0006	0.0004	0.0031	0.0003	0.0004
11	Cd	0.2288	0.1700	0.2690	0.1656	0.1638
12	Sn	0.2288	0.1900	0.2770	0.1656	0.1638
13	B					
14	H_2O					
15	Concrete					
16	CsI	0.6050	0.5110	0.5268	0.5850	0.5590

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Appendix B

MELCOR Input for the Station Blackout with Dry Cavity and Multi-Node Drywell Representation

The model for this input is described in Sect. 4.1. This model used a dual-cavity and a multi-node representation of the drywell. This appendix has two files. The first file is the input file for MELGEN and contains the plant and transient data. The second file is the input file for MELCOR. Selected output for this run is enclosed in Appendix F.

```
*******************************************************************************
*******************************************************************************
***     FILE NAME:      pb.gen.2     SEP 1992
***     Reactor:        Peach Bottom BWR 4/MK 1
***     Sequence:       Short Term Station Blackout with ADS Depressurization
***     Compartments:   RPV(6), DW(1), WW(1), SC(9), ENV(1)
*******************************************************************************
*******************************************************************************
*       PRELIMINARY DECK FROM SNL, MODIFIED AND TESTED AT BNL
*
* APR/92 - MODIFIED AND CHECKED BY J. J. CARBAJO, ORNL(SRVS, ADS, HF-SEALS
*          FOR MELCOR 1.8.1 AND SHORT-TERM STATION BLACKOUT WITH ADS)
* JUN/92 - STAINLESS STEEL ADDED IN LOWER PLENUM
*          POROSITIES OF CORE INTACT COMPONENTS=0.53
* JUL/92 - POROSITIES OF DEBRIS= 0.9
*
* JUL/92 - TWO HEAT SLABS ADDED TO THE LOWER PLENUM - HS32002 & HS32003
* AUG/92 - SURFACE AREAS IN LOWER PLENUM REDUCED
* SEP/92 - MULTI-NODE DRYWELL MODEL
*          TWO-CAVITY MODEL
*
*******************************************************************************
*
TITLE      STSB-W-ADS
JOBID      ST2
CRTOUT
OUTPUTF    ST2.OUT
RESTARTF   ST2.RST
DIAGF      ST2.DIA
DTTIME     1.
*******************************************************************************
*******************************************************************************
*** NON-CONDENSIBLE GASES PACKAGE
*******************************************************************************
***        GAS   MATERIAL NUMBER
NCG000      O2        4
NCG001      N2        5
NCG002      H2        6
NCG003      CO        7
NCG004      CO2       8
NCG005      CH4       9
*******************************************************************************
*******************************************************************************
*** CONTROL VOLUME HYDRODYNAMICS PACKAGE
*******************************************************************************
***        CV 100 is the Drywell-in Pedestal region
***
CV10000    DRYWELL-IN   2   2   2
CV100A0    3
CV100A1    PVOL    1.08E5   RHUM    0.20
CV100A2    TATM    335.92   TPOL    330.93  * 145 F
CV100A3    MASS.1 1446.7   MASS.2  0.0
CV100A4    MLFR.5  1.00
***
***        ALTITUDE   VOLUME
CV100B1     -9.093       0.
CV100B2     -8.636       6.106
CV100B3     -8.331      46.376
CV100B4     -6.397      80.0
CV100B5     -3.7       161.34
CV100B6      3.26      242.016
***
*******************************************************************************
***         CV  101 is the Drywell-ex Pedestal region
```

```
***
CV10100   DRYWELL-EX   2  2  2
CV101A0   3
CV101A1   PVOL   1.08E5   RHUM  0.20
CV101A2   TATM   335.92   TPOL  330.93
CV101A3   MASS.1  0.0  MASS.2  0.0
CV101A4   MLFR.5  1.0
***
CV101B1   -8.636     0.0
CV101B2   -6.397    80.0
CV101B3   -3.701   713.0
CV101B4    0.0    1710.0
CV101B5    6.47   2877.5
***
*******************************************************************************
***        CV  102 is the Drywell-Top region
***
CV10200   DRYWELL-TOP  2  2  2
CV102A0   3
CV102A1   PVOL  1.08E5    RHUM  0.20
CV102A2   TATM  335.92    TPOL  330.93
CV102A3   MASS.1  0.0   MASS.2  0.0   MLFR.5  1.0
***
CV102B1    6.47    0.0
CV102B2   23.495  1036.5
***
*******************************************************************************
***        CV   103 is the Drywell-Annulus region
***
CV10300    DRYWELL-ANN  2  2  2
CV103A0    3
CV103A1    PVOL  1.08E5    RHUM  0.2
CV103A2    TATM  400.0   TPOL  400.0
CV103A3    MASS.1  0.0  MASS.2  0.0  MLFR.5  1.0
***
CV103B1     3.086   0.0
CV103B2     9.2585 39.971
CV103B3    15.431  78.942
*******************************************************************************
***       CV 150 is the Downcomer Volume
***
CV15000   VENT/DOWNCOMER   2   2   2
CV150A0   3
CV150A1   PVOL    1.08E5        RHUM  0.20
CV150A2   TATM    335.92        TPOL  305.93  *  145 F, POOL 90 F
CV150A3   ZPOL    -12.205        VFOG    0.0
CV150A4   MLFR.5  1.0
***
***       ALTITUDE   VOLUME
CV150B1    -12.81       0.0
CV150B2    -10.53      82.0
CV150B3     -9.07     257.0
CV150B4     -5.59     565.0
*******************************************************************************
***       CV 200 is the Wetwell
***
CV20000   WETWELL   2   2   3
CV20003   47.33  *  CV area for velocity calculation
CV200A0   3
CV200A1   PVOL    .99974E5  PH2O    -1.0
CV200A2   TATM    305.85    TPOL    305.87  *  90 F
CV200A3   ZPOL   -11.435    VFOG    0.0
CV200A4   MLFR.5  1.00
***
```

```
***        ALTITUDE   VOLUME
CV200B1     -16.38       0.0
CV200B2     -15.16     572.7
CV200B3     -13.33    2114.3
CV200B4     -12.81    2629.6
CV200B5     -12.11    3298.1
CV200B6     -11.76    3647.5
CV200B7     -11.50    3898.0
CV200B8     -10.53    4837.2
CV200B9     -10.28    5058.3
CV200BA      -9.07    6035.7
CV200BB      -8.46    6547.6
CV200BC      -6.93    7132.5
***
*****************************************************************************
***        SIX-VOLUME PRIMARY SYSTEM FROM MARCON VOLUME/ALTITUDE TABLES
*****************************************************************************
***        CV 310 is the Reactor Pressure Vessel Annulus
***
CV31000    ANNULUS  2  2  1     *  NON-EQ TH, VERT FLOW, PRI CV
CV310A0    3                    *
CV310A1    PVOL      7.1340E6   *  1034.7 PSI * INITIAL CONDITION * JJC April 92
CV310A2    PH2O     -1.0        *  PH20 = PVOL
CV310A3    TATM     -1.0        *  TATM = T(SAT) AT PH20
CV310A4    TPOL    560.00       *  DEG K,
CV310A5    ZPOL  14.1249    *  JJC, Initial level 556.1 in (14.1249 m)
***
***        ALTITUDE   VOLUME
CV310BA      3.086    0.0000 * BOTTOM OF SHROUD BAFFLE
CV310BM      8.080   41.0323 * JET PUMP THROAT
CV310BP      9.152   51.5666
CV310BV     10.460   61.1004 * BOTTOM OF SHROUD DOME
CV310B0     11.242   74.3757 * TOP OF SHROUD DOME
CV310B9     15.431  183.7962 * TOP OF SEPARATORS
*****************************************************************************
***        CV 320 is the Reactor Pressure Vessel Lower Plenum
***        including the internal volume of the jet pumps
***
CV32000    LOWER-PLENUM  2 2 1 *  NON-EQ TH, VERT FLOW, PRI CV
CV320A0    2                    *  P/T/X DATA
CV320A1    PVOL      7.1340E6   *  1034.7 PSI
CV320A2    PH2O     -1.0        *  PH20 = PVOL
CV320A3    TATM     -1.0        *  TATM = T(SAT) AT PH20
CV320A4    TPOL    560.00       *  DEG K,
CV320A5    MFRC.1    1.000      *  MFRC POOL, 166093.9 LBS H2O
CV320A6    MFRC.2    0.0        *  MFRC FOG
CV320A7    MFRC.3    0.0        *  MFRC STEAM
***
***        ALTITUDE   VOLUME
CV320B1      0.000     0.0000  * BOTTOM OF RPV
CV320B2      1.2954   22.4064  * increased from 11.4064 *JULY 92****************
CV320B3      2.2757   34.7348
CV320B4      3.2560   61.3489
CV320B5      4.2363   81.8691
CV320B6      5.2166   99.2356
CV320B7      5.4943  103.4594  * BOTTOM OF ACTIVE FUEL
*****************************************************************************
***        CV 330 is the Reactor Pressure Vessel By-Pass
***
CV33000    BY-PASS  2  2  1     *  NON-EQ TH, VERT FLOW, PRI CV
CV330A0    2                    *  P/T/X DATA
CV330A1    PVOL      7.1340E6   *  1034.7 PSI
CV330A2    PH2O     -1.0        *  PH20 = PVOL
CV330A3    TATM     -1.0        *  TATM = T(SAT) AT PH20
```

```
CV330A4   TPOL   560.00        *  DEG K,
CV330A5   MFRC.1   1.000       *  MFRC POOL, FULL H2O
CV330A6   MFRC.2   0.0         *  MFRC FOG
CV330A7   MFRC.3   0.0000      *  MFRC STEAM,
***
***       ALTITUDE   VOLUME
CV330B7     5.4943    0.0000  * BOTTOM OF ACTIVE FUEL
CV330B8     6.2563    4.7889
CV330B9     7.0183    9.5779
CV330BA     7.7803   14.3668
CV330BB     8.5423   18.9546
CV330BC     9.3043   23.4455
CV330BD     9.667    25.7814  * TOP OF CORE TOP GUIDE
*****************************************************************************
***       CV 340 is the Reactor Pressure Vessel Channel
***
CV34000   CHANNEL  2  2  1     *  NON-EQ TH, VERT FLOW, PRI CV
CV340A0   2                    *  P/T/X DATA
CV340A1   PVOL     7.1340E6    *  1034.7 PSI
CV340A2   PH2O    -1.0         *  PH20 = PVOL
CV340A3   TATM    -1.0         *  TATM = T(SAT) AT PH20
CV340A4   TPOL   560.00        *  DEG K,
CV340A5   MFRC.1   1.0000      *  MFRC POOL, FULL H2O
CV340A6   MFRC.2   0.0         *  MFRC FOG
CV340A7   MFRC.3   0.0000      *  MFRC STEAM
***
***       ALTITUDE   VOLUME
CV340B7     5.4943    0.0000  * BOTTOM OF ACTIVE FUEL
CV340B8     6.2563    6.1869
CV340B9     7.0183   12.3739
CV340BA     7.7803   18.5608
CV340BB     8.5423   24.4793
CV340BC     9.3043   30.2791
CV340BD     9.667    33.2959  * TOP OF CORE TOP GUIDE
*****************************************************************************
***       CV 350 is the Reactor Pressure Vessel
***       Shroud Dome, Pipes, and Separators
***
CV35000   SHROUD-DOME  2 2 1   *  NON-EQ TH, VERT FLOW, PRI CV
CV350A0   3                    *
CV350A1   PVOL     7.1340E6    *  1034.7 PSI
CV350A2   PH2O    -1.0         *  PH20 = PVOL
CV350A3   TATM    -1.0         *  TATM = T(SAT) AT PH20
CV350A4   TPOL   560.00        *  DEG K,
CV350A5   ZPOL   14.1249        *  POOL level 556.1 in (14.1249 m)
***
***       ALTITUDE   VOLUME
CV350BA     9.667    0.0000 * TOP OF CORE TOP GUIDE
CV350BD    10.460   17.9923 * BOTTOM OF SHROUD DOME
CV350BH    11.082   27.2877 * TOP OF SHROUD DOME
CV350BR    15.431   44.9011 * TOP OF SEPARATORS
*****************************************************************************
***       CV 360 is the Reactor Pressure Vessel
***       Dryer Region and Steam Dome
***
CV36000   STEAM-DOME   2 2 1   *  NON-EQ TH, VERT FLOW, PRI CV
CV360A0   2                    *  P/T/X DATA
CV360A1   PVOL     7.1340E6    *  1034.7 PSI
CV360A2   PH2O    -1.0         *  PH20 = PVOL
CV360A3   TATM    -1.0         *  TATM = T(SAT) AT PH20
CV360A4   TPOL   560.00        *  DEG K,
CV360A5   MFRC.1   0.0         *  MFRC POOL
CV360A6   MFRC.2   0.0         *  MFRC FOG
CV360A7   MFRC.3   1.000       *  MFRC STEAM, 18796.2 LBS H2O
```

```
***
***        ALTITUDE   VOLUME
CV360BA     15.431    0.0000 * TOP OF SEPARATORS
CV360BC     16.439   30.5896 * BOTTOM OF MAIN STEAM LINE
CV360BE     17.018   89.1637 * TOP OF MAIN STEAM LINE
CV360BR     22.243  218.5968 * TOP OF RPV
*****************************************************************************
***        CV 401 is the Torus Room
***
CV40100 'TORUS ROOM'      2  2  4        *  NON-EQ TH, VERT FLOW, CONT CV
CV401A0 2                                *  P/T/X DATA
CV401A1 PVOL 101210.      PH2O  9118.
CV401A2 TATM 305.8        TPOL 305.8  *  90 F
CV401A3 MFRC.1 0.         MFRC.3 1.
CV401A4 MFRC.5 .7671      MFRC.4 .2329
***        ELEV      VOL
CV401B1  -17.2        0.
CV401B2   -4.1     5426.
*****************************************************************************
***        CV 402 is the Southern half of the 135 Level
***
CV40200 LEV-135-SOUTH     2  2  4
CV402A0 2
CV402A1 PVOL  101180.     PH2O 3500.
CV402A2 TATM  301.        TPOL 301.
CV402A3 MFRC.1 0.         MFRC.3 1.
CV402A4 MFRC.5 .7671      MFRC.4 .2329
***        ELEV    VOL
CV402B1   -4.1       0.
CV402B2    5.1    5154.
*****************************************************************************
***        CV 403 is the Northern half of the 135 Level
***
CV40300 LEV-135-NORTH     2  2  4
CV403A0 2
CV403A1 PVOL  101180.     PH2O 3500.
CV403A2 TATM  301.        TPOL 301.
CV403A3 MFRC.1 0.         MFRC.3 1.
CV403A4 MFRC.5 .7671      MFRC.4 .2329
***        ELEV    VOL
CV403B1   -4.1       0.
CV403B2    4.5    5154.
*****************************************************************************
***        CV 404 is the Southeast quadrant of the 165 Level
***
CV40400 LEVEL-165-SE    2  2  4
CV404A0 2
CV404A1 PVOL  101080.     PH2O 3480.
CV404A2 TATM  299.8       TPOL 299.8
CV404A3 MFRC.1 0.         MFRC.3 1.
CV404A4 MFRC.5 .7671      MFRC.4 .2329
***        ELEV     VOL
CV404B1    5.1       0.
CV404B2   14.2    2356.
*****************************************************************************
***        CV 405 is the remainder of the 165 Level
***
CV40500 LEVEL-165-MAIN  2  2  4
CV405A0 2
CV405A1 PVOL  101080.     PH2O 3480.
CV405A2 TATM  299.8       TPOL 299.8
CV405A3 MFRC.1 0.         MFRC.3 1.
CV405A4 MFRC.5 .7671      MFRC.4 .2329
***        ELEV     VOL
```

```
CV405B1    5.1       0.
CV405B2   13.6    7066.
*****************************************************************************
***       CV 406 is the Southeast quadrant of the 195 Level
***
CV40600 LEVEL-195-SE    2  2  4
CV406A0 2
CV406A1 PVOL  100980.     PH2O 3480.
CV406A2 TATM  299.8       TPOL 299.8
CV406A3 MFRC.1 0.         MFRC.3 1.
CV406A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV406B1   14.2       0.
CV406B2   26.1    2452.
*****************************************************************************
***       CV 407 is the remainder of the 195 Level
***
CV40700 LEVEL-195-MAIN  2  2  4
CV407A0 2
CV407A1 PVOL  100980.     PH2O 3480.
CV407A2 TATM  299.8       TPOL 299.8
CV407A3 MFRC.1 0.         MFRC.3 1.
CV407A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV407B1   14.2       0.
CV407B2   25.5    4866.
*****************************************************************************
***       CV 408 is the Refueling Bay
***
CV40800 REFUELING-BAY   2  2  7
CV408A0 2
CV408A1 PVOL  100840.     PH2O 3480.
CV408A2 TATM  299.8       TPOL 299.8
CV408A3 MFRC.1 0.         MFRC.3 1.
CV408A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV408B1   26.1       0.
CV408B2   45.0   31048.
*****************************************************************************
***       CV 409 is the Turbine Building
***
CV40900 TURBINE-BUILDING  2  2  5
CV409A0 2
CV409A1 PVOL  101080.     PH2O 3480.
CV409A2 TATM  299.8       TPOL 299.8
CV409A3 MFRC.1 0.         MFRC.3 1.
CV409A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV409B1     5.1         0.
CV409B2    21.9    148825.
*****************************************************************************
***       CV 410 is the Environment
***
CV41000 ENVIRONMENT   2  2  6
CV410A0 2
CV410A1 PVOL  101326.     PH2O 3480.
CV410A2 TATM  299.8       TPOL 299.8
CV410A3 MFRC.1 0.         MFRC.3 1.
CV410A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV  VOL
CV410B1  -17.2     0.
CV410B2    45.     1.E10
*****************************************************************************
*****************************************************************************
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```
*** FLOW PATH PACKAGE INPUT
*****************************************************************************
*****     MSL/SRV Flow Path
*****     From RPV MSL outlet to T-Quencher in Wetwell
*****     Modified by J. J. Carbajo, ORNL
*****
FL36200  STEAM-LINE-SRV  360  200  16.73  -15.01
FL36201  0.1201   47.15   0.0   0.1955   0.2794 *modified by JJC
FL36202  0  0  0  1  *  VERT, ACTIVE, NO BUBBLES, BUBBLES
FL36203  4.0  5.0   * modified by JJC
FL362V0  -1  105  105
FL362S1  0.1201   47.15   0.39104  5.E-6 * modified by JJC
***
***
***        CF105 GIVES FRACTION OPEN OF THE MSL/SRV FLOW PATH (FL362)
***        IT IS THE SUM OF 4 CONTROL FUNCTIONS, EACH GIVING THE NUMBER
***        OF VALVES OPEN IN ONE SUBSET WITH MONOTONE OPEN/CLOSE
***        CHARACTERISTICS
***
CF10500   SRV   ADD     4    0.07692  0.0  *SF = 1./13  *  modified by JJC
CF10511    1.    0.   CFVALU.101          *NUMBER OPEN IN GROUP 1
CF10512    1.    0.   CFVALU.102          *NUMBER OPEN IN GROUP 2
CF10513    1.    0.   CFVALU.103          *NUMBER OPEN IN GROUP 3
CF10514    1.    0.   CFVALU.104          *NUMBER OPEN IN GROUP 4
***
CF10100   SRV-1  HYST   1    1.0     0.0  *GROUP 1, SRVS 1,6,9
CF10101   0.0                             *INITIAL VALUE
CF10103   -11   -21                       *LOAD/UNLOAD TF NUMBERS
CF10110   1.0   0.0     CFVALU.99
***
***        TF011 GIVES THE NUMBER OF VALVES IN GROUP 1
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01100  SRV-LOAD-1     6    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF01110  7.68759E6  0.0
TF01111  7.68760E6  1.0   *SRV 1 (1115 PSI)
TF01160  7.79101E6  1.0
TF01161  7.79102E6  2.0   *SRV 6 (1130 PSI)
TF01190  7.84617E6  2.0
TF01191  7.84618E6  3.0   *SRV 9 (1138 PSI)
***
***        TF021 GIVES THE NUMBER OF VALVES IN GROUP 1
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02100  SRV-UNLOAD-1   6    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF02110  7.25322E6  0.0
TF02111  7.25323E6  1.0   *SRV 1 (1052 PSI)
TF02160  7.32217E6  1.0
TF02161  7.32218E6  2.0   *SRV 6 (1062 PSI)
TF02190  7.39112E6  2.0
TF02191  7.39113E6  3.0   *SRV 9 (1072 PSI)
***
CF10200   SRV-2  HYST   1    1.0     0.0  *GROUP 2, SRVS 2,3,7,8,12
CF10201   0.0                             *INITIAL VALUE
CF10203   -12   -22                       *LOAD/UNLOAD TF NUMBERS
CF10210   1.0   0.0     CFVALU.99
***
***        TF012 GIVES THE NUMBER OF VALVES IN GROUP 2
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
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TF01200  SRV-LOAD-2    10    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF01220  7.70827E6  0.0
TF01221  7.70828E6  1.0   *SRV 2 (1118 PSI)
TF01230  7.72206E6  1.0
TF01231  7.72207E6  2.0   *SRV 3 (1120 PSI)
TF01270  7.79791E6  2.0
TF01271  7.79792E6  3.0   *SRV 7 (1131 PSI)
TF01280  7.82548E6  3.0
TF01281  7.82549E6  4.0   *SRV 8 (1135 PSI)
TF012C0  1.03420E7  4.0  *  modified by JJC
TF012C1  1.03421E7  5.0  ****SRV 12 (1500 PSI) SPRING VALVE ***** mod. JJC
***
***        TF022 GIVES THE NUMBER OF VALVES IN GROUP 2
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02200  SRV-UNLOAD-2   8    1.0     0.0
***
***      PRESSURE  FRACTION OPEN
TF02220  7.10154E6  0.0
TF02221  7.10155E6  1.0   *SRV 2 (1030 PSI)
TF02230  7.18428E6  1.0
TF02271  7.18429E6  3.0   *SRVS 3+7 (1042 PSI)
TF02280  7.24633E6  3.0
TF02281  7.24634E6  4.0   *SRV 8 (1051 PSI)
TF022C0  7.26012E6  4.0
TF022C1  7.26013E6  5.0   *SRV 12 (1053 PSI)
***
CF10300   SRV-3  HYST   1    1.0     0.0  *GROUP 3, SRVS 4,5,10,11
CF10301   0.0                             *INITIAL VALUE
CF10303   -13   -23                       *LOAD/UNLOAD TF NUMBERS
CF10310   1.0   0.0     CFVALU.99
***
***        TF013 GIVES THE NUMBER OF VALVES IN GROUP 3
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01300  SRV-LOAD-3     8    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF01340  7.75654E6  0.0
TF01341  7.75655E6  1.0   *SRV 4 (1125 PSI)
TF01350  7.76343E6  1.0
TF01351  7.76344E6  2.0   *SRV 5 (1126 PSI)
TF013A0  7.85996E6  2.0
TF013A1  7.85997E6  3.0   *SRV 10 (1140 PSI)
TF013B0  7.86685E6  3.0
TF013B1  7.86686E6  4.0   *SRV 11 (1141 PSI)
***
***        TF023 GIVES THE NUMBER OF VALVES IN GROUP 3
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02300  SRV-UNLOAD-3   8    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF02340  6.99123E6  0.0
TF02341  6.99124E6  1.0   *SRV 4 (1014 PSI)
TF02350  7.05328E6  1.0
TF02351  7.05329E6  2.0   *SRV 5 (1023 PSI)
TF023A0  7.11533E6  2.0
TF023A1  7.11534E6  3.0   *SRV 10 (1032 PSI)
TF023B0  7.30838E6  3.0
TF023B1  7.30839E6  4.0   *SRV 11 (1060 PSI)
***
```

```
CF10400   SRV-4  HYST   1    1.0     0.0  *GROUP 4, SRV  13
CF10401   0.0                             *INITIAL VALUE
CF10403   -14   -24                       *LOAD/UNLOAD TF NUMBERS
CF10410   1.0   0.0     CFVALU.99
***
***        TF014 GIVES THE NUMBER OF VALVES IN GROUP 4
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01400  SRV-LOAD-4     2    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF014D0  1.03420E7  0.0  *  modified by JJC
TF014D1  1.03421E7  1.0   *****SRV 13 (1500 PSI) SPRING VALVE ***** Mod. JJC
***
***        TF024 GIVES THE NUMBER OF VALVES IN GROUP 4
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02400  SRV-UNLOAD-4   2    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF024D0  6.99812E6  0.0
TF024D1  6.99813E6  1.0   *SRV 13 (1015 PSI)
***
***       CF99  gives the pressure difference between the primary system
***       and the drywell
***
CF09900  PDIF  ADD  2  1. 0.
CF09910  1.0  1.08E5  CVH-P.360  *  PRESSURE IN STEAM DOME * modif. JJC
CF09911 -1.0  0.0  CVH-P.101  *  PRESSURE IN DRYWELL
*************************************************************************
***       ADS SYSTEM - 5 SRV VALVES  *   by JJC  April 1992  *
***
FL36300   ADS-5-SRVS 360  200  16.73  -15.01
FL36301   0.046195  47.15  0.0 0.0542 0.2794
FL36302   0 0 0 1
FL36303   4.0 5.0
FL363V0   -1  106 106
FL363S1   0.046195 47.15 0.242523 5.0E-6
***
CF10600   'OPEN ADS'  L-A-IFTE  3  1.0  0.0
CF10601   0.0   *  INITIAL  VALUE
CF10605   'NORMAL'
CF10610   1.0  0.0  CFVALU.107
CF10611   0.0  0.0  TIME
CF10612   0.0  1.0  TIME
***
CF10700   'LEVEL-IN-VESSEL'  L-GT  2  1.0  0.0
CF10701   .TRUE.
CF10705   'LATCH'
CF10706   2 'WATER LEVEL AT 1/3 OF ACTIVE CORE'
CF10710   1.0   0.0   CVH-CLIQLEV.340  *  Colapsed liq.level in core
CF10711   0.0   6.7643  TIME  *  Liquid level 50 inches above BAF ** 1/3 CORE *
***
***
*************************************************************************
***       Manual Depressurization
***       JJC    April 1992
***
FL36400   MANUAL-DEPRES   360  200  16.73  -15.01
FL36401   0.009239  47.15   0.0  0.04542  0.2794
FL36402   0 0 0 1
FL36403   4.0  4.0
FL364V0   -1  108  108
FL364S1   0.009239  47.15  0.1085  5.0E-6
```

```
***
CF10800   SRV-MANUAL L-A-IFTE  3  1.0 0.0
CF10801   0.0
CF10810   1.0  0.0  CFVALU.200
CF10811   1.0  0.0  CFVALU.201
CF10812   0.0  0.0  TIME
***
CF20000   TIME-CRITER   L-GT  2  1.0 0.0
CF20001   .FALSE.
CF20010   1.0  0.0  TIME
CF20011   0.0  200.0  TIME
***
CF20100   VALVE-OPEN  HYST  1  1.0  0.0
CF20101   0.0
CF20103   -202  -203
CF20110   1.0  0.0  CFVALU.99
***
TF20200   SRV-OPEN  3  1.0  0.0
TF20210   7.101581E6 0.0
TF20211   7.101599E6 1.0 *open at 1030 psig as per PECO
TF20212   8.0E6      1.0
***
TF20300   SRV-CLOSE  3  1.0  0.0
TF20310   6.429361E6  0.0  * close at 930 psig as per PECO fax
TF20311   6.429371E6  1.0
TF20312   8.0E6       1.0
***
*************************************************************************
***       Drywell head flange seals failure
****      JJC  April 1992
***
FL39800   DW-HD-FAILURE   102  408   18.42   26.1
FL39801   0.04  0.1016   0.0  *  normally closed
FL39802   0  0  0  0
FL39803   10.0  10.0
FL398S0   0.04   0.1016   0.0043  1.0E-4
FL398V0   -1   151  151
****
CF15100   DW-HD-FAILFRAC   L-A-IFTE   3   1.0  0.0
CF15101   0.0    *  initial value
CF15111   1.0  0.0  CFVALU.152
CF15112   1.0  0.0  CFVALU.160
CF15113   0.0  0.0  TIME
***
CF15200   DW-HD-FAIL    L-AND 2  1.0  0.0
CF15201   .FALSE.
CF15211   1.0  0.0   CFVALU.153     *   Temp. criterion
CF15212   1.0  0.0   CFVALU.154     *    DP   criterion
***
CF15300   TEMP-CRIT.    L-GT   2   1.0  0.0
CF15301   .FALSE.
CF15305   'LATCH'
CF15306   2 'DRYWELL HEAD FLANGE SEALS FAILURE TEMP. EXCEEDED'
CF15311   1.0  0.0   HS-TEMP.1000203    *  Node  3  of Drywell liner in Volume 102
CF15312   0.0  644.3  TIME  *   700 F  Temperature
****
CF15400    DP-CRITE   L-GT   2   1.0   0.0
CF15401   .FALSE.
CF15406   2 'CONTAINMENT PRES. FOR HEAD FLANGE SEALS EXCEEDED'
CF15411   1.0  0.0   CFVALU.155
CF15412   0.0   565370.0   TIME   *  82  psig   DP
***
CF15500    DIFF-PRES    ADD    2   1.0  0.0
CF15511    1.0  0.0   CVH-P.102
```

```
CF15512   -1.0  0.0   CVH-P.408
***
CF16000    FRAC-OPEN   TAB-FUN    1   1.0  0.0
CF16003   161
CF16010    1.0 0.0  CFVALU.155
****
TF16100    AREA-VS-DP     4    1.0  0.0
TF16111     -1.0E9     0.0
TF16112     565370.0   0.0
TF16113    1378951.4   1.0
TF16114      1.0E9     1.0
***
*************************************************************************
***       Wetwell/Drywell vacuum breaker Flow Path
***
***       From the Wetwell through the vacuum breakers
***         to the Vent Lines (effectively to the Drywell)* CORRECTED **
***
FL02100  WET-DRY-VACRV   200   150   -10.13   -9.61 * modified JJC
FL02101  1.86   0.5   0.0   0.445   2.06
FL02102  3  0  0  0  *  HORIZ, ACTIVE, ATMOS/ATMOS, ATMOS/ATMOS
FL02103  1.0  1.0
FL021V0  -1    2    2
FL021S1  1.86   0.5   0.445   5.E-6
***
***     CF001, CF002, and TF030 open and close the
***       vacuum relief valves at 0.5 psi (3447 Pa)
***       differential pressure between the wetwell
***       and the drywell
***
***         CF002 = SF*TF030 where SF = 1.0
***         TF030 = function (CF001)
***         CF001 = P.CV200 - P.CV100
***
CF00200  VAC-RV   TAB-FUN   1   1.00   0.00
CF00203  30
CF00210  1.00    0.00   CFVALU.001
***
***       CF200 = wetwell pressure - drywell pressure
***
CF00100  VAC-RV-DP    ADD   2   1.00   0.00
CF00110   1.00  0.00  CVH-P.200
CF00111  -1.00  0.00  CVH-P.150
***
TF03000  VAC-RV-AREA   4   1.00   0.00
***
***      FRACTION OPEN   PRESSURE
TF03010  0.00            0.00
TF03011  3.444E+03       0.00
TF03012  3.447E+03       1.00
TF03013  2.000E+04       1.00
*************************************************************************
***       Vent Lines/Vent Header/Downcomers
***       From the Drywell to the Wetwell
***
FL01200  VENT-OPENING  101  150  -6.7   -6.7
FL01201  26.6   13.1   1.0   0.73   0.73
FL01202  0  0  0  0
FL01203  6.7  6.7
FL012S1  26.6   13.1   1.31   5.E-6
*************************************************************************
FL02000  DOWNCOMEREX   150   200    -12.81     -12.81
FL02001  26.6   3.9   1.0   0.001    0.001
FL02002  0   0   0   1
```

```
FL02003  1.0   1.0
FL020S1  26.6    3.9   1.31   5.0E-6
*****************************************************************************
*****    NEW FLOWS FOR MULTI-CELL DRYWELL
*****
FL01000  DW-LOW-H   100  101  -4.5  -4.5
FL01001  8.6  1.0  1.0
FL01002  3  0  0  0
FL01003  1.0  1.0
FL010S1  8.6  1.0  1.5  5.0E-6
*****
FL01100  DW-EX-V    101  102   6.47  6.47
FL01101  62.592  0.5  1.0
FL01102  0  0  0  0
FL01103  1.0  1.0
FL011S1  62.592  0.5  6.0  5.0E-6
*****
FL01300  DW-MED-H  101  103   5.0  5.0
FL01301   0.21361   1.0  1.0
FL01302  3  0  0  0
FL01303  1.0  1.0
FL013S1  0.21361  1.0  1.0  5.0E-6
*****
FL01400  DW-IN-V  100   103   2.0   3.086
FL01401  3.2  1.1  1.0
FL01402  0  0  0  0
FL01403  1.5  1.5
FL014S1  3.2  1.1  0.5  5.0E-6
*****
FL01500  DW-TOP   102  103   15.431  15.431
FL01501  5.292  0.5  1.0
FL01502  0  0  0  0
FL01503  1.0  1.0
F1015S1  5.292  0.5  1.0  5.0E-6
*****************************************************************************
*****    Pump Seal Leakage Taken From Downcomer Vol 310 (45%)
*****
FL37000  LEAKAGE-DOWN   310  100  6.838   -6.0
FL37001  2.783E-6   0.15   1.0
FL37002  3  0  0  0
FL37003  1.0  1.0
FL370S1  2.783E-6   0.15   0.001631
*****************************************************************************
*****    CRD Seal Leakage Taken From Lower Plenum (55%)
*****
FL37100  LEAKAGE-LP   320  100    0.1     -6.0
FL37101  3.399E-6   0.15   1.0
FL37102  0  0  0  0
FL37103  1.0  1.0
FL371S1  3.399E-6   0.15   0.001804
*****************************************************************************
***      RPV FLOW PATHS
***
***  FLOW PATH ZFM AND ZTO CONSISTENT WITH HEIGHTS AND BOTTOM OF CONTROL VOLUMES
***  HYDRAULIC DIAMETERS AND FRICTION FACTORS CONSISTENT WITH LASALLE DECK
***  JMM  01/16/86
*****************************************************************************
***PATH  FLNAME  KCVFM  KCVTO   ZFM      ZTO
FL31200  AN-LP    310    320    8.080    3.086 * 8.080 M = JET PUMP THROAT
FL32300  LP-BP    320    330    5.4943   5.4943
FL32400  LP-CH    320    340    5.4943   5.4943
FL34500  CH-SH    340    350    9.667    9.667
FL33500  BP-SH    330    350    9.667    9.667
FL35600  SH-SD    350    360   15.431   15.431
```

```
FL36100  SD-AN    360    310   15.431   15.431
***
***PATH  FLARA   FLLEN   FLOPO   FLHGTF   FLHGTT     FLNAME
FL31201  0.6782  4.9936   1.0    0.1524   0.1524  *  AN-LP
FL32301  6.1502  1.9050   .01289 0.1524   0.0254  *  LP-BP
FL32401  7.9428  1.9050   .61748 0.1524   0.1016  *  LP-CH
FL33501  6.1502  1.9050   1.0    0.0254   0.0254  *  BP-SH
FL34501  7.9428  1.9050   .67561 0.1325   0.1325  *  CH-SH
FL35601  4.7763  4.1885   1.0    0.1676   0.1676  *  SH-SD
FL36101 26.1069  5.3492   1.0    0.6484   0.6484  *  SD-AN
***
***PATH  SAREA   SLEN    SHYD    SRGH     SLAM     FLNAME
FL312S1  0.0339  4.9936  .27783  5.0E-06  16.0  *  AN-LP
FL323S1  6.1502  1.9050  .05841  5.0E-06  16.0  *  LP-BP
FL324S1  7.9428  1.9050  .01359  5.0E-06  16.0  *  LP-CH
FL335S1  6.1502  1.9050  .05841  5.0E-06  16.0  *  BP-SH
FL345S1  7.9428  1.9050  .01359  5.0E-06  16.0  *  CH-SH
FL356S1  4.7763  4.1885  .00878  5.0E-06  16.0  *  SH-SD
FL361S1 26.1069  5.3492  .73944  5.0E-06  16.0  *  SD-AN
***
***PATH  FRICFO   FRICRO     FLNAME   DF      DT
FL31203  0.0785   17.0    *  AN-LP    0.2078  5.3066
FL32303  0.5188   4.97    *  LP-BP    5.0201  2.7983
FL32403  10.216   13.267  *  LP-CH    5.0201  3.1801
FL33503  50.0     0.5     *  BP-SH    2.7983  4.3326
FL34503  5.6885   5.6885  *  CH-SH    3.1801  4.3326
FL35603  12.585   5.0475  *  SH-SD    2.4660  6.3557
FL36103  0.11     0.11    *  SD-AN    6.3557  5.7654
***
***PATH  KFLGFL  KACTFL   IBUBF   IBUBT   FLNAME
FL31202    0       0       0       0  *  AN-LP
FL32302    0       0       0       0  *  LP-BP
FL32402    0       0       0       0  *  LP-CH
FL33502    0       0       0       0  *  BP-SH
FL34502    0       0       0       0  *  CH-SH
FL35602    0       0       0       0  *  SH-SD
FL36102    0       0       0       0  *  SD-AN
*****************************************************************************
***      SECONDARY CONTAINMENT FLOW PATHS
*****************************************************************************
FL40000   'CONT FAIL'   101  401  -5.0    -5.0
FL40001   .650  0.001 0.0          * INITIALLY CLOSED
FL40002   3 * HORIZONTAL FLOW PATH
FL40003   0.593   0.593
FL400S0   .102  0.001  1.0
FL400V0   150  145  145
***
***       CF150 opens the flow path from the drywell to the reactor
***       building at containment failure, CF145 sets the fraction open
***       CF149 writes the time of occurrence
CF14500   CONT-BRK  EQUALS  1  0.0  1.0
CF14510   1.0  0.0  TIME
***
CF15000   'FAIL THRESH' T-O-F  1  1. 0.
CF15003    -1.E9  9.1E5
CF15010    1. 0. CVH-P.101
***
CF14900   'CONT-FAIL MES'  L-GT  2  1.0  0.0
CF14901   .FALSE.
CF14905   'LATCH'
CF14906   2  'CONTAINMENT FAILURE BY HIGH DRYWELL PRESSURE'
CF14911   1.0  0.0  CVH-P.101
CF14912   0.0  9.1E5  TIME
***
```

```
***
***      NAME              FROM     TO     ZFROM       ZTO
FL40100 TORUS-135           401     402     -4.7       -4.1
FL40200 135-165-SHAFT       402     404      4.5        5.1
FL40300 135-SO-NO           402     403       .2         .2
FL40400 LEAK-135-SO         402     410       .2         .2
FL40500 BO-135-TURB         403     409       .2        6.2
FL40600 LEAK-135-NO         403     410       .2         .2
FL40700 165-195-SHAFT       404     406     13.6       14.2
FL40800 165-SE-MAIN         404     405      9.35       9.35
FL40900 LEAK-165-SE         404     410      9.35       9.35
FL41000 LEAK-165-MAIN       405     410      9.35       9.35
FL41100 195-SE-REFUEL       406     408     25.5       26.1
FL41200 195-SE-MAIN         406     407     19.85      19.85
FL41300 LEAK-195-SE         406     410     19.85      19.85
FL41400 LEAK-195-MAIN       407     410     19.85      19.85
FL41500 BO-REFUEL-ENV       408     410     34.9       34.9
FL41600 LEAK-REFUEL         408     410     35.55      35.55
FL41700 LEAK-TURB           409     410     13.5       13.5
***
***      AREA      LENGTH    FLOPO    HGTF    HGTTO
FL40101   8.6        .86      1.      .3       .3
FL40201  33.2       3.32      1.      .3       .3
FL40301  25.        2.5       1.      .3       .3
FL40401   0.025      .0025    1.      .1       .1
FL40501   2.8        .28      0.      .3       .3
FL40601   0.025      .0025    1.      .1       .1
FL40701  33.2       3.32      1.      .3       .3
FL40801  43.8       4.38      1.      .3       .3
FL40901   0.025      .0025    1.      .1       .1
FL41001   0.025      .0025    1.      .1       .1
FL41101  33.2       3.32      1.      .3       .3
FL41201  74.6       7.46      1.      .3       .3
FL41301   0.025      .0025    1.      .1       .1
FL41401   0.025      .0025    1.      .1       .1
FL41501  22.3       2.23      0.      .3       .3
FL41601   0.109      0.0109   1.      .1       .1
FL41701   0.29       0.0109   1.      .1       .1
***
***      TYPE   ACTIVE   IBUBF   IBUBTO
FL40102    1       0       0       0
FL40202    1       0       0       0
FL40302    4       0       0       0
FL40402    4       0       0       0
FL40502    1       0       0       0
FL40602    4       0       0       0
FL40702    1       0       0       0
FL40802    4       0       0       0
FL40902    4       0       0       0
FL41002    4       0       0       0
FL41102    1       0       0       0
FL41202    4       0       0       0
FL41302    4       0       0       0
FL41402    4       0       0       0
FL41502    4       0       0       0
FL41602    4       0       0       0
FL41702    4       0       0       0
***
***       FRICFO     FRICREV
FL40103     .5         .5
FL40203     .5         .5
FL40303     .5         .5
FL40403    1.         1.
FL40503     .5         .5
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FL40603     .5          .5
FL40703     .5          .5
FL40803     .5          .5
FL40903    1.          1.
FL41003    1.          1.
FL41103     .5          .5
FL41203     .5          .5
FL41303    1.          1.
FL41403    1.          1.
FL41503     .5          .5
FL41603    1.          1.
FL41703    1.          1.
***
***        SAREA      SLEN    SHYD     SRGH    SLAM
FL401S1    8.6        .01      1.
FL402S1   33.2        .01      1.
FL403S1   25.         .01      1.
FL404S1    0.025      .01      1.
FL405S1    2.8        .01      1.
FL406S1    0.025      .01      1.
FL407S1   33.2        .01      1.
FL408S1   43.8        .01      1.
FL409S1     .025      .01      1.
FL410S1     .025      .01      1.
FL411S1   33.2        .01      1.
FL412S1   74.6        .01      1.
FL413S1    0.025      .01      1.
FL414S1    0.025      .01      1.
FL415S1   22.3        .01      1.
FL416S1     .109      .01      1.
FL417S1     .29       .01      1.
***
***                 ---   VALVES  ---
***        TRIP NO.   CF-ON-FORWARD  CF-ON-REVERSE
FL405V1      110          111           111
FL415V1      140          141           141
***
***        TABULAR AND CONTROL FUNCTIONS FOR VALVE INPUT
***
CF10900  405-DP    ADD    4  1.  0.
CF10910   1.    0.  CVH-P.403
CF10911  -1.    0.  CVH-P.409
CF10912 -42.18  0.  CVH-RHOA.403
CF10913  10.79  0.  CVH-RHOA.409
***
CF11000  405-TRIP  T-O-F  1  1.  0.
CF11003  -1.E6  1551.3
CF11010  1.  0.  CFVALU.109
***
CF11100  405-FRAC  HYST    1   1.  0.
CF11103  -410   -400
CF11110  1.  0.  CFVALU.109
***
TF40000  405-UNLOAD  1  1.  0.
TF40010  0.     1.
***
TF41000  405-A-DP  5 1. 0.
TF41010  1551.3  0.1
TF41011  1637.5  0.1857
TF41012  1723.7  0.7429
TF41013  1809.9  0.8357
TF41014  1898.0  1.
***
CF13900  415-DP    ADD    4  1.  0.
```

```
CF13910   1.     0.  CVH-P.408
CF13911  -1.     0.  CVH-P.410
CF13912 -86.33   0.  CVH-RHOA.408
CF13913 511.1    0.  CVH-RHOA.410
***
CF14000  415-TRIP  T-O-F  1  1.  0.
CF14003  -1.E6  2154.6
CF14010  1.  0.  CFVALU.139
***
CF14100  415-FRAC  HYST    1   1.  0.
CF14103  -440   -400
CF14110  1.  0.  CFVALU.139
***
TF44000  415-A-DP  5 1. 0.
TF44010  2154.6  0.1
TF44011  2274.3  0.2
TF44012  2394.0  0.8
TF44013  2513.7  0.9
TF44014  2633.4  1.
*****************************************************************************
*****************************************************************************
*** HEAT SLAB PACKAGE INPUT
*****************************************************************************
***   HS NAMES
***
***SLAB        NAME
HS10001001  DW-LINER-101
HS10002001  DW-LINER-102
HS10010001  DW-FLOOR-100
HS10011001  DW-FLOOR-101
HS10003001  REAC-PED-103-101
HS10013001  REAC-PED-103-102
HS10004001  LO-REAC-PED
HS10005001  DW-STEEL-101
HS10006001  DW-STEEL-102
HS10009001  STEEL-100
HS20001001  WETWELL-LINER
HS20002001  WETWELL-STEEL
HS31001001  RPV-CYLINDER
HS32001001  LOWER-HEAD
HS35003001  SEPARATORS
HS36001001  DRYERS
HS36002001  UPPER-HEAD
*************************************************************************
***   HS MATERIALS
***
***SLAB        MATERIAL       INT     NAME
HS10001201    'CARBON STEEL'   4  *  DRYWELL-LINER-101
HS10002201    'CARBON STEEL'   4  *  DRYWELL-LINER-102
HS10010201     CONCRETE       10  *  DRYWELL-FLOOR-100
HS10011201     CONCRETE       10  *  DRYWELL-FLOOR-101
HS10003201     CONCRETE        7  *  REAC-PED-103-101
HS10013201     CONCRETE        7  *  REAC-PED-103-102
HS10004201     CONCRETE        7  *  LO-REAC-PED
HS10005201    'CARBON STEEL'   3  *  DRYWELL-STEEL-101
HS10006201    'CARBON STEEL'   3  *  DRYWELL-STEEL-102
HS10009201    'CARBON STEEL'   3  *  STEEL-100
HS20001201    'CARBON STEEL'   4  *  WETWELL-LINER
HS20002201    'CARBON STEEL'   3  *  WETWELL-STEEL
HS31001201    'CARBON STEEL'   6  *  RPV-CYLINDER
HS32001201    'CARBON STEEL'   5  *  LOWER-HEAD
HS35003201   'STAINLESS STEEL' 4  *  SEPARATORS
HS36001201   'STAINLESS STEEL' 1  *  DRYERS
HS36002201    'CARBON STEEL'   5  *  UPPER-HEAD
```

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*************************************************************************
***   HS GEOMETRIES
***
***SLAB     NO. T  GEOMETRY        INITIAL     NAME
***         NODES  SL CY SP HB HT  N  Y  I
HS10001000    5     1              0        *  DRYWELL-LINER-101
HS10002000    5     1              0        *  DRYWELL-LINER-102
HS10010000   11     1              0        *  DRYWELL-FLOOR-100
HS10011000   11     1              0        *  DRYWELL-FLOOR-101
HS10003000    8     1              0        *  REAC-PED-103-101
HS10013000    8     1              0        *  REAC-PED-103-102
HS10004000    8     1              0        *  LO-REAC-PED
HS10005000    4     1              0        *  DRYWELL-STEEL-101
HS10006000    4     1              0        *  DRYWELL-STEEL-102
HS10009000    4     1              0        *  STEEL-100
HS20001000    5     1              0        *  WETWELL-LINER
HS20002000    4     1              0        *  WETWELL-STEEL
HS31001000    7        2           0        *  RPV-CYLINDER
HS32001000    6        2           0        *  LOWER-HEAD, MODELLED AS CYLINDER
HS35003000    5     1              0        *  SEPARATORS
HS36001000    2     1              0        *  DRYERS
HS36002000    6                 5  0        *  UPPER-HEAD
*************************************************************************
***   HS ELEVATIONS/ORIENTATIONS
***
***SLAB     ELEVATION  ORIENTATION         NAME
***                    VT  HZ  OT
HS10001002     -8.635  1.0              *  DRYWELL-LINER-101
HS10002002      6.470  1.0              *  DRYWELL-LINER-102
HS10010002     -8.635  0.0              *  DRYWELL-FLOOR-100
HS10011002     -8.635  0.0              *  DRYWELL-FLOOR-101
HS10003002      3.086  1.0              *  REAC-PED-103-101
HS10013002      6.47   1.0              *  REAC-PED-103-102
HS10004002     -8.635  1.0              *  LO-REAC-PED
HS10005002     -8.635  1.0              *  DRYWELL-STEEL-101
HS10006002      6.470  1.0              *  DRYWELL-STEEL-102
HS10009002     -3.0    1.0              *  STEEL-100
HS20001002    -11.660  1.0              *  WETWELL-LINER
HS20002002    -13.18   1.0              *  WETWELL-STEEL
HS31001002      3.1856 1.0              *  RPV-CYLINDER
HS32001002      0.7550                  *  LOWER-HEAD (TOP OF STUB TUBES) *modified
HS35003002     10.92   1.0              *  SEPARATORS
HS36001002     16.18   1.0              *  DRYERS
HS36002002     19.0343 1.0              *  UPPER-HEAD
*************************************************************************
***   HS D/T FORMATS
***
***SLAB     LOC T   FORMAT   LOCATION        NAME
***         DATA    D/T N-M  L/I BOUNDRY
HS10001100     -1    1            0.0     *  DRYWELL-LINER-101
HS10002100     -1    1            0.0     *  DRYWELL-LINER-102
HS10010100     -1    1            0.0     *  DRYWELL-FLOOR-100
HS10011100     -1    1            0.0     *  DRYWELL-FLOOR-101
HS10003100     -1    1            0.0     *  REAC-PED-103-101
HS10013100     -1    1            0.0     *  REAC-PED-103-102
HS10004100     -1    1            0.0     *  LO-REAC-PED
HS10005100     -1    1            0.0     *  DRYWELL-STEEL-101
HS10006100     -1    1            0.0     *  DRYWELL-STEEL-102
HS10009100     -1    1            0.0     *  STEEL-100
HS20001100     -1    1            0.0     *  WETWELL-LINER
HS20002100     -1    1            0.0     *  WETWELL-STEEL
HS31001100     -1    1            3.1856  *  RPV-CYLINDER
HS32001100     -1    1            2.5797  *  LOWER-HEAD (RAD OF SHROUD)
HS35003100     -1    1            0.0     *  SEPARATORS
```

```
HS36001100     -1    1            0.0     *  DRYERS
HS36002100     -1    1            3.1856  *  UPPER-HEAD
*************************************************************************
***   HS D/T DATA
*************************************************************************
***   DRYWELL-LINER- 101 and  102
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10001102      0.00305    2
HS10001103      0.00914    3
HS10001104      0.01524    4
HS10001105      0.02858    5
***
HS10002102      0.00305    2
HS10002103      0.00914    3
HS10002104      0.01524    4
HS10002105      0.02858    5
***
*************************************************************************
***   DRYWELL-FLOOR- 100 and 101
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10010102      0.00305    2
HS10010103      0.00914    3
HS10010104      0.02134    4
HS10010105      0.04572    5
HS10010106      0.09144    6
HS10010107      0.18288    7
HS10010108      0.36576    8
HS10010109      0.67056    9
HS10010110      1.00584   10
HS10010111      1.44250   11
***
***
HS10011102    0.00305       2
HS10011103    0.00914       3
HS10011104    0.02134       4
HS10011105    0.04572       5
HS10011106    0.09144       6
HS10011107    0.18288       7
HS10011108    0.36576       8
HS10011109    0.67056       9
HS10011110    1.00584      10
HS10011111    1.44250      11
*************************************************************************
***   REAC-PED
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10003102      0.00305    2
HS10003103      0.00914    3
HS10003104      0.02134    4
HS10003105      0.04572    5
HS10003106      0.09144    6
HS10003107      0.18288    7
HS10003108      0.34930    8
***
***
HS10013102    0.00305       2
HS10013103    0.00914       3
HS10013104    0.02134       4
HS10013105    0.04572       5
```

```
HS10013106    0.09144       6
HS10013107    0.18288       7
HS10013108    0.34930       8
*************************************************************************
***   LO-REAC-PED
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10004102      0.00305    2
HS10004103      0.00914    3
HS10004104      0.02134    4
HS10004105      0.04572    5
HS10004106      0.10668    6
HS10004107      0.24384    7
HS10004108      0.53340    8
***
***         TEMPERATURE
*HS10004801    391.77       1
*HS10004802    391.49       2
*HS10004803    390.94       3
*HS10004804    389.83       4
*HS10004805    387.60       5
*HS10004806    382.05       6
*HS10004807    369.55       7
*HS10004808    343.16       8
*************************************************************************
***   DRYWELL-STEEL- 101 and 102 and STEEL-100
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10005102      0.00305    2
HS10005103      0.00762    3
HS10005104      0.01747    4
***
***
HS10006102    0.00305        2
HS10006103    0.00762        3
HS10006104    0.01747        4
***
HS10009102    0.00305     2
HS10009103    0.00762     3
HS10009104    0.01747     4
*************************************************************************
***   WETWELL-LINER
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS20001102      0.00305    2
HS20001103      0.00601    3
HS20001104      0.01219    4
HS20001105      0.01588    5
***
*************************************************************************
***  WETWELL-STEEL
***
***SLAB        DISTANCE  NODE
***                      NO.
HS20002102      0.00305    2
HS20002103      0.00795    3
HS20002104      0.01747    4
***
*************************************************************************
***   RPV-CYLINDER
***
```

```
***   SLAB      DISTANCE  NODE
***                       NO.
HS31001102        3.1886    2  *  3.1856 M = LOC OF NODE 1
HS31001103        3.1926    3
HS31001104        3.2006    4
HS31001105        3.2156    5
HS31001106        3.2556    6
HS31001107        3.3412    7  *  3.3412 M - 3.1856 M = 0.1556 M = 6.125 IN
***
*************************************************************************
***   LOWER-HEAD
***
***   SLAB      DISTANCE  NODE
***                       NO.
HS32001102        2.5807    2  *  2.5797 M = LOC OF NODE 1
HS32001103        2.5837    3
HS32001104        2.5907    4
HS32001105        2.6157    5
HS32001106        2.6983    6  *  2.6983 M - 2.5797 M = 0.1176 M = 4.63 IN
***
*************************************************************************
***   TOP-GUIDE COMBINED WITH CORE CELL STEEL MASS
***   SHROUD-DOME COMBINED WITH SEPARATORS
***
***   SEPARATORS
***
***   SLAB      DISTANCE  NODE
***                       NO.
HS35003102        0.0030    2
HS35003103        0.0069    3
HS35003104        0.0119    4
HS35003105        0.0186    5
***
*************************************************************************
***   DRYERS
***
***   SLAB      DISTANCE  NODE
***                       NO.
HS36001102      1.83E-03    2
***
*************************************************************************
***   UPPER-HEAD
***
***   SLAB      DISTANCE  NODE
***                       NO.
HS36002102        3.1886    2  *  3.1856 M = LOC OF NODE 1
HS36002103        3.1926    3
HS36002104        3.2006    4
HS36002105        3.2256    5
HS36002106        3.2872    6  *  3.2872 M - 3.1856 M = 0.1016 M = 4 IN
***
*************************************************************************
***   HS INTERNAL POWER SOURCES
***
***SLAB      INT POW      NAME
***          SOURCE
***           N  Y
HS10001300  -1        *  DRYWELL-LINER-101
HS10002300  -1        *  DRYWELL-LINER-102
HS10010300  -1        *  DRYWELL-FLOOR-100
HS10011300  -1        *  DRYWELL-FLOOR-101
HS10003300  -1        *  REAC-PED-103-101
HS10013300  -1        *  REAC-PED-103-102
HS10004300  -1        *  LO-REAC-PED
```

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HS10005300  -1        *  DRYWELL-STEEL-101
HS10006300  -1        *  DRYWELL-STEEL-102
HS10009300  -1        *  STEEL 100
HS20001300  -1        *  WETWELL-LINER
HS20002300  -1        *  WETWELL-STEEL
HS31001300  -1        *  RPV-CYLINDER
HS32001300  -1        *  LOWER HEAD
HS35003300  -1        *  SEPARATORS
HS36001300  -1        *  DRYERS
HS36002300  -1        *  UPPER-HEAD
*************************************************************************
***   HS LEFT/INSIDE BOUNDARY CONDITIONS
***
***SLAB     TYPE       VOL  COEF.      CRT POOL    POOL  ATM    NAME
***         SYM CONV        FLOW       FRACTION    ONLY  ONLY
***                         TYPE       POOL ATM
HS10001400      1      101  'EXT'      1.0  1.0  *        X     DRYWELL-LINER-101
HS10002400      1      102  'EXT'      1.0  1.0  *        X     DRYWELL-LINER-102
HS10010400      1      100  'EXT'      0.0  0.0  *              DRYWELL-FLOOR-100
HS10011400      1      101   'EXT'     0.0  0.0  *              DRYWELL-FLOOR-101
HS10003400      1      103  'EXT'      1.0  1.0  *        X     REAC-PED-103-101
HS10013400      1      103  'EXT'      1.0  1.0  *        X     RAEC-PED-103-102
HS10004400      1      100  'EXT'      1.0  1.0  *        X     LO-REAC-PED
HS10005400      1      101  'EXT'      1.0  1.0  *        X     DRYWELL-STEEL-101
HS10006400      1      102   'EXT'     1.0  1.0  *        X     DRYWELL-STEEL-102
HS10009400      1      100   'EXT'     1.0  1.0  *        X     STEEL-100
HS20001400      1      200  'EXT'      0.0  0.0  *   X          WETWELL-LINER
HS20002400      1      200  'EXT'      1.0  1.0  *        X     WETWELL-STEEL
HS31001400      1      310  'EXT'  .40593 .40593 *              RPV-CYLINDER
HS32001400      1      320  'EXT'      1.0  1.0  *        X     LOWER HEAD
HS35003400      1      350  'EXT'      1.0  1.0  *        X     SEPARATORS
HS36001400      1      360  'EXT'      1.0  1.0  *        X     DRYERS
HS36002400      1      360  'EXT'      1.0  1.0  *        X     UPPER-HEAD
*****************************************************************************
***   HS RIGHT/OUTSIDE BOUNDARY CONDITIONS
***
***SLAB     TYPE       VOL   COEF.   CRT POOL    POOL  ATM    NAME
***         SYM CONV         FLOW   FRACTION    ONLY  ONLY
***                          TYPE   POOL ATM
HS10001600   0                                  *              DRYWELL-LINER-101
HS10002600   0                                  *              DRYWELL-LINER-102
HS10010600   0                                  *              DRYWELL-FLOOR-100
HS10011600   0                                  *              DRYWELL-FLOOR-101
HS10003600   1         101   'EXT'  1.  1.     *              REAC-PED-103-101
HS10013600   1         102   'EXT'  1.  1.     *              REAC-PED-103-102
HS10004600   1         101   'EXT'  1.  1.     *              LO-REAC-PED
HS10005600   0                                  *              DRYWELL-STEEL-101
HS10006600   0                                  *              DRYWELL-STEEL-102
HS10009600   1         101    'EXT' 1.  1.     *              STEEL-100
HS20001600    1        401   'EXT'  1.    1.   *        X     WETWELL-LINER
HS20002600   0                                  *              WETWELL-STEEL
HS31001600      5120   103   'EXT'  1.0  1.0   *        X     RPV-CYLINDER
HS32001600      5120   100   'EXT'  1.0  1.0   *        X     LOWER HEAD
HS35003600      1      310   'EXT'  1.0  1.0   *        X     SEPARATORS
HS36001600   0                                  *              DRYERS
HS36002600      5120   102   'EXT'  1.0  1.0   *        X     UPPER-HEAD
*****************************************************************************
***      HS LEFT/INSIDE AREAS/LENGTHS
***
***   SLAB     AREA     CH L      AX L          NAME
HS10001500  1235.80   15.105    15.105     *  DRYWELL-LINER-101
HS10002500   500.0    17.0      17.0       *  DRYWELL-LINER-102
HS10010500    29.92    5.50      5.50      *  DRYWELL-FLOOR-100
HS10011500   205.0    14.32     14.32      *  DRYWELL-FLOOR-101
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HS10003500   267.38    3.38      3.38      *  REAC-PED-103-101
HS10013500   300.00    8.9       8.9       *  REAC-PED-103-102
HS10004500   337.24    7.50      7.50      *  LO-REAC-PED
HS10005500   800.58   15.105    15.105     *  DRYWELL-STEEL-101
HS10006500   350.0    10.55     10.55      *  DRYWELL-STEEL-102
HS10009500   496.5     4.874     4.874     *  STEEL-100
HS20001500  1584.00    2.96      2.96      *  WETWELL-LINER
HS20002500  4188.53    5.182     5.182     *  WETWELL-STEEL
HS31001500   317.224  12.245    12.245     *  RPV-CYLINDER
HS32001500    33.141   0.5404    0.5404    *  LOWER HEAD * modified, structure split
****                                       *               into LH
HS35003500   472.43    3.99      3.99      *  SEPARATORS
HS36001500  2945.03    2.23      2.23      *  DRYERS
HS36002500    63.762   3.1856    3.1856    *  UPPER-HEAD
*****************************************************************************
***      HS RIGHT/OUTSIDE AREAS/LENGTHS
***
***   SLAB     AREA     CH L      AX L         NAME
HS10003700   267.38    3.38      3.38      *  REAC-PED-103-101
HS10013700   300.0     8.9       8.9       *  REAC-PED-103-102
HS10004700   337.24    7.5       7.5       *  LO-REAC-PED
HS10009700   496.5     4.874     4.874     *  STEEL-100
HS20001700  1584.00    2.96      2.96      *  WETWELL-LINER
HS31001700   332.716  12.245    12.245     *  RPV-CYLINDER
HS32001700    34.652   0.5404    0.5404    *  LOWER HEAD * modified structure split
****                                       *               into LH
HS35003700   472.43    3.99      3.99      *  SEPARATORS
HS36002700    67.894   3.2872    3.2872    *  UPPER-HEAD
*****************************************************************************
***  ADDITIONAL HEAT STRUCTURES FOR CORE/LP SHROUD
*****************************************************************************
* LOWER PLENUM SHROUD - LOWER PLENUM TO DOWNCOMER HEAT TRANSFER
*
*  TWO HEAT SLABS, HS32002 & HS32003 ADDED DUE TO DT/DZ PROBLEMS * HS32001 SPLIT INTO
*                                                                *      3 HS *
*
HS32002000  6   2   0
HS32002001  LOWER-HEAD2
HS32002002  1.2954
HS32002100  -1   1   3.1877
HS32002102  3.1887     2
HS32002103  3.1917     3
HS32002104  3.1987     4
HS32002105  3.2137     5
HS32002106  3.3063     6
HS32002201  'CARBON STEEL'   5
HS32002300  -1
HS32002400  1     320  'EXT'  1.0  1.0
HS32002500  33.1   0.9803     0.9803
HS32002600  5120   100   'EXT'   1.0  1.0
HS32002700   34.6    0.9803   0.9803
*
HS32003000  6  2  0
HS32003001  LOWER-HEAD3
HS32003002  2.2757
HS32003100  -1  1   2.5797
HS32003102  2.5807   2
HS32003103  2.5837   3
HS32003104  2.5907   4
HS32003105  2.6157   5
HS32003106  2.6983   6
HS32003201  'CARBON STEEL'  5
HS32003300  -1
HS32003400  1   320  'EXT'  1.0  1.0
```

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HS32003500  33.1   0.9803  0.9803
HS32003600  5120   100  'EXT'  1.0  1.0
HS32003700  34.6   0.9803  0.9803
*
HS32004000  5          2          1
HS32004001  'LP SHROUD4'
HS32004002  3.256      1.0                        * modified height
HS32004100 -1          2          2.5             * modified diameter
HS32004101  0.00508     1
HS32004102  0.01016     1
HS32004103  0.01524     1
HS32004104  0.02032     1
HS32004200 -1
HS32004201  'STAINLESS STEEL'       4
HS32004300 -1
HS32004400  1          320        'EXT'      0.2          0.2
HS32004500  18.645     0.9803     0.9803                      * modified
HS32004600  1          310        'EXT'      0.2          0.2
HS32004700  19.012     0.9803     0.9803                      * modified
*
HS32005000  5          2          1
HS32005001  'LP SHROUD5'
HS32005002  4.2363     1.0
HS32005100 -1          2          2.5             * modified diameter
HS32005101  0.00508     1
HS32005102  0.01016     1
HS32005103  0.01524     1
HS32005104  0.02032     1
HS32005200 -1
HS32005201  'STAINLESS STEEL'       4
HS32005300 -1
HS32005400  1          320        'EXT'      0.2          0.2
HS32005500  15.889     0.9803     0.9803
HS32005600  1          310        'EXT'      0.2          0.2
HS32005700  16.202     0.9803     0.9803
*
HS32006000  5          2          1
HS32006001  'LP SHROUD6'
HS32006002  5.2166     1.0
HS32006100 -1          2          2.5797
HS32006101  0.00508     1
HS32006102  0.01016     1
HS32006103  0.01524     1
HS32006104  0.02032     1
HS32006200 -1
HS32006201  'STAINLESS STEEL'       4
HS32006300 -1
HS32006400  1          320        'EXT'      0.2          0.2
HS32006500  4.501      0.2777     0.2777
HS32006600  1          310        'EXT'      0.2          0.2
HS32006700  4.590      0.2777     0.2777
*
* CORE SHROUD - CORE BYPASS TO DOWNCOMER HEAT TRANSFER
*
HS33007000  5          2          1
HS33007001  'CORE SHROUD7'
HS33007002  5.4943     1.0
HS33007100 -1          2          2.5797
HS33007101  0.00508     1
HS33007102  0.01016     1
HS33007103  0.01524     1
HS33007104  0.02032     1
HS33007200 -1
HS33007201  'STAINLESS STEEL'       4
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HS33007300 -1
HS33007400  1          330        'EXT'       0.2         0.2
HS33007500  12.351     0.762      0.762
HS33007600  1          310        'EXT'       0.2         0.2
HS33007700  12.594     0.762      0.762
*
HS33008000  5          2          1
HS33008001  'CORE SHROUD8'
HS33008002  6.2563     1.0
HS33008100 -1          2          2.5797
HS33008101  0.00508     1
HS33008102  0.01016     1
HS33008103  0.01524     1
HS33008104  0.02032     1
HS33008200 -1
HS33008201  'STAINLESS STEEL'       4
HS33008300 -1
HS33008400  1          330        'EXT'       0.2         0.2
HS33008500  12.351     0.762      0.762
HS33008600  1          310        'EXT'       0.2         0.2
HS33008700  12.594     0.762      0.762
*
HS33009000  5          2          1
HS33009001  'CORE SHROUD9'
HS33009002  7.0183     1.0
HS33009100 -1          2          2.5797
HS33009101  0.00508     1
HS33009102  0.01016     1
HS33009103  0.01524     1
HS33009104  0.02032     1
HS33009200 -1
HS33009201  'STAINLESS STEEL'       4
HS33009300 -1
HS33009400  1          330        'EXT'       0.2         0.2
HS33009500  12.351     0.762      0.762
HS33009600  1          310        'EXT'       0.2         0.2
HS33009700  12.594     0.762      0.762
*
HS33010000  5          2          1
HS33010001  'CORE SHROUD10'
HS33010002  7.7803     1.0
HS33010100 -1          2          2.5797
HS33010101  0.00508     1
HS33010102  0.01016     1
HS33010103  0.01524     1
HS33010104  0.02032     1
HS33010200 -1
HS33010201  'STAINLESS STEEL'       4
HS33010300 -1
HS33010400  1          330        'EXT'       0.2         0.2
HS33010500  12.351     0.762      0.762
HS33010600  1          310        'EXT'       0.2         0.2
HS33010700  12.594     0.762      0.762
*
HS33011000  5          2          1
HS33011001  'CORE SHROUD11'
HS33011002  8.5423     1.0
HS33011100 -1          2          2.5797
HS33011101  0.00508     1
HS33011102  0.01016     1
HS33011103  0.01524     1
HS33011104  0.02032     1
HS33011200 -1
HS33011201  'STAINLESS STEEL'       4
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HS33011300 -1
HS33011400  1           330         'EXT'        0.2          0.2
HS33011500  12.351      0.762       0.762
HS33011600  1           310         'EXT'        0.2          0.2
HS33011700  12.594      0.762       0.762
*************************************************************************
*****     TF120 specifies the dependence on temperature
*****     of the heat transfer coefficient for the insulated
*****     exterior of the reactor pressure vessel.  TF120
*****     specifies a constant heat transfer coefficient of
*****     6.62 W/M**2/deg K.
*****
TF12000   'RPV/DRYWELL HTC'   2      1.0      0.0
TF12010    273.15   6.62    5000.0   6.62
*************************************************************************
*****  SECONDARY CONTAINMENT SURFACES
*************************************************************************
*****  TORUS ROOM SURFACES
*****
HS04001000 15 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04001001 CENTRAL-COLUMN       *
HS04001002 -17.2  1.            * BOTTOM ALTITUDE, ORIENTATION
HS04001100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04001102  .001   2            *
HS04001103  .003   3
HS04001104  .007   4
HS04001105  .015   5
HS04001106  .023   6
HS04001107  .039   7
HS04001108  .071   8
HS04001109  .135   9
HS04001110  .263  10
HS04001111  .500  11
HS04001112  .750  12
HS04001113 1.00   13
HS04001114 1.50   14
HS04001115 2.0    15
HS04001201 CONCRETE   14            * MATERIAL TYPE, MESH INTERVAL
HS04001300 0                        * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04001400 1    401  'EXT' 1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04001500 805.  8.9  8.9           * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04001600 0                        * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04002000 11 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04002001 TORUS-ROOM-WALLS     *
HS04002002 -17.2   1.           * BOTTOM ALTITUDE, ORIENTATION
HS04002100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04002102  .001   2            *
HS04002103  .003   3
HS04002104  .007   4
HS04002105  .015   5
HS04002106  .023   6
HS04002107  .039   7
HS04002108  .071   8
HS04002109  .135   9
HS04002110  .263  10
HS04002111  .500  11
HS04002201 CONCRETE   10            * MATERIAL TYPE, MESH INTERVAL
HS04002300 0                        * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04002400 1    401  'EXT'  1.  1.  * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04002500 1391. 8.9  8.9           * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04002600 2210 -1   'EXT'          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04003000 15 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
```

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HS04003001 FLOOR                    *
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04003002 -17.2   1.               * BOTTOM ALTITUDE, ORIENTATION
HS04003100   -1   1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04003102  .001   2                *
HS04003103  .003   3
HS04003104  .007   4
HS04003105  .015   5
HS04003106  .023   6
HS04003107  .039   7
HS04003108  .071   8
HS04003109  .135   9
HS04003110  .263  10
HS04003111  .500  11
HS04003112  .750  12
HS04003113 1.00   13
HS04003114 1.50   14
HS04003115 2.0    15
HS04003201 CONCRETE   14                 * MATERIAL TYPE, MESH INTERVAL
HS04003300 0                             * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04003400 1    401  'EXT'  1.  1.       * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04003500 1166. 15.  5.                 * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04003600 2210 -1   'EXT'               * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04005000 13 1 0 0                 * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04005001 CEILING                  *
HS04005002 -4.7    0.               * BOTTOM ALTITUDE, ORIENTATION
HS04005100 -1 1 0.                  * NODALIZATION FLAGS, INSIDE RADIUS
HS04005102  .001   2                *
HS04005103  .003   3
HS04005104  .007   4
HS04005105  .015   5
HS04005106  .023   6
HS04005107  .039   7
HS04005108  .071   8
HS04005109  .135   9
HS04005110  .263  10
HS04005111  .500  11
HS04005112  .750  12
HS04005113 1.16   13
HS04005201 CONCRETE   12                 * MATERIAL TYPE, MESH INTERVAL
HS04005300 0                             * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04005400 1    401  'EXT'  1.  1.       * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04005500 1166. 11.  11.                * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04005600 0                             * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
*****   LEVEL-135-SOUTH SURFACES
*****
HS04006000 13 1 0 0                 * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04006001 EXTWALL                  *
HS04006002 -4.1  1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04006100 -1 1 0.                  * NODALIZATION FLAGS, INSIDE RADIUS
HS04006102  .001   2                * LOCATION, NODE NO.
HS04006103  .003   3
HS04006104  .007   4
HS04006105  .015   5
HS04006106  .023   6
HS04006107  .039   7
HS04006108  .071   8
HS04006109  .135   9
HS04006110  .263  10
HS04006111  .500  11
HS04006112  .750  12
HS04006113  .900  13
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HS04006201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04006300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04006400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04006500  671. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04006600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04006700  671. 7.5  7.5             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04007000 14 1 0 0              * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04007001 PRIM-CONT-WALLS       *
HS04007002 -4.1    1.            * BOTTOM ALTITUDE, ORIENTATION
HS04007100 -1 1 0.               * NODALIZATION FLAGS, INSIDE RADIUS
HS04007102  .001   2             *
HS04007103  .003   3
HS04007104  .007   4
HS04007105  .015   5
HS04007106  .023   6
HS04007107  .039   7
HS04007108  .071   8
HS04007109  .135   9
HS04007110  .263  10
HS04007111  .500  11
HS04007112  .750  12
HS04007113 1.00   13
HS04007114 1.50   14
HS04007201 CONCRETE   13              * MATERIAL TYPE, MESH INTERVAL
HS04007300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04007400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04007500 315.  7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04007600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04008000 11 1 0 0              * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04008001 INT-WALLS             *
HS04008002 -4.1    1.            * BOTTOM ALTITUDE, ORIENTATION
HS04008100 -1 1 0.               * NODALIZATION FLAGS, INSIDE RADIUS
HS04008102  .001   2             *
HS04008103  .003   3
HS04008104  .007   4
HS04008105  .015   5
HS04008106  .023   6
HS04008107  .039   7
HS04008108  .071   8
HS04008109  .135   9
HS04008110  .263  10
HS04008111  .350  11
HS04008201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04008300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04008400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04008500  950. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04008600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04009000 12 1 0 0              * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04009001 CEILING               *
HS04009002  4.5    0.            * BOTTOM ALTITUDE, ORIENTATION
HS04009100 -1 1 0.               * NODALIZATION FLAGS, INSIDE RADIUS
HS04009102  .001   2             *
HS04009103  .003   3
HS04009104  .007   4
HS04009105  .015   5
HS04009106  .023   6
HS04009107  .039   7
HS04009108  .071   8
HS04009109  .135   9
HS04009110  .263  10
HS04009111  .500  11
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HS04009112  .6    12
HS04009201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04009202 CONCRETE   11
HS04009300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04009400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04009500  588. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04009600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04010000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04010001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04010002 -4.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04010100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04010102  .001   2
HS04010103  .003   3
HS04010104  .007   4
HS04010105  .015   5
HS04010106  .023   6
HS04010107  .039   7
HS04010108  .071   8
HS04010109  .135   9
HS04010110  .263  10
HS04010111  .500  11
HS04010112  .75   12
HS04010113 1.15   13
HS04010201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04010300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04010400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04010500  588. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04010600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04011000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04011001 MISC-STEEL
HS04011002 -4.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04011100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04011102  .0127  2
HS04011201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04011300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04011400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04011500 166.9 3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04011600 1    402  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04011700 166.9 3.    3.
*
*****   LEVEL-135-NORTH SURFACES
*****
HS04012000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04012001 EXTWALL
HS04012002 -4.1  1.                   * BOTTOM ALTITUDE, ORIENTATION
HS04012100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04012102  .001   2                  * LOCATION, NODE NO.
HS04012103  .003   3
HS04012104  .007   4
HS04012105  .015   5
HS04012106  .023   6
HS04012107  .039   7
HS04012108  .071   8
HS04012109  .135   9
HS04012110  .263  10
HS04012111  .500  11
HS04012112  .750  12
HS04012113  .900  13
HS04012201 CONCRETE   12             * MATERIAL TYPE, MESH INTERVAL
HS04012300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04012400 1    403  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
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HS04012500  671. 7.5  7.5            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04012600 4200 410  'EXT'  1.  1.   * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04012700  671. 7.5  7.5            * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04013000 14 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04013001 PRIM-CONT-WALLS
HS04013002 -4.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04013100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04013102  .001   2
HS04013103  .003   3
HS04013104  .007   4
HS04013105  .015   5
HS04013106  .023   6
HS04013107  .039   7
HS04013108  .071   8
HS04013109  .135   9
HS04013110  .263  10
HS04013111  .500  11
HS04013112  .750  12
HS04013113 1.00   13
HS04013114 1.50   14
HS04013201 CONCRETE   13             * MATERIAL TYPE, MESH INTERVAL
HS04013300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04013400 1    403  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04013500 315.  7.5  7.5            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04013600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04014000 11 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04014001 INT-WALLS
HS04014002 -4.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04014100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04014102  .001   2
HS04014103  .003   3
HS04014104  .007   4
HS04014105  .015   5
HS04014106  .023   6
HS04014107  .039   7
HS04014108  .071   8
HS04014109  .135   9
HS04014110  .263  10
HS04014111  .350  11
HS04014201 CONCRETE   10             * MATERIAL TYPE, MESH INTERVAL
HS04014300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04014400 1    403  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04014500  948. 7.5  7.5            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04014600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04015000 12 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04015001 CEILING
HS04015002  4.5    0.                * BOTTOM ALTITUDE, ORIENTATION
HS04015100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04015102  .001   2
HS04015103  .003   3
HS04015104  .007   4
HS04015105  .015   5
HS04015106  .023   6
HS04015107  .039   7
HS04015108  .071   8
HS04015109  .135   9
HS04015110  .263  10
HS04015111  .500  11
HS04015112  .6    12
HS04015201 'CARBON STEEL'     2      * MATERIAL TYPE, MESH INTERVAL
HS04015202 CONCRETE   11
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HS04015300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04015400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04015500  587. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04015600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04016000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04016001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04016002 -4.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04016100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04016102  .001   2
HS04016103  .003   3
HS04016104  .007   4
HS04016105  .015   5
HS04016106  .023   6
HS04016107  .039   7
HS04016108  .071   8
HS04016109  .135   9
HS04016110  .263  10
HS04016111  .500  11
HS04016112  .75   12
HS04016113 1.15   13
HS04016201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04016300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04016400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04016500  587. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04016600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04017000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04017001 MISC-STEEL
HS04017002 -4.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04017100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04017102  .0127  2
HS04017201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04017300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04017400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04017500 166.9 3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04017600 1    403  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04017700 166.9 3.    3.
*
*****   LEVEL-165-SE SURFACES
*****
HS04018000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04018001 EXTWALL
HS04018002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04018100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04018102  .001   2
HS04018103  .003   3
HS04018104  .007   4
HS04018105  .015   5
HS04018106  .023   6
HS04018107  .039   7
HS04018108  .071   8
HS04018109  .135   9
HS04018110  .263  10
HS04018111  .500  11
HS04018112  .750  12
HS04018113  .90   13
HS04018201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04018300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04018400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04018500  345. 8.3  8.3             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04018600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04018700  345. 8.3  8.3             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
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*
HS04019000 15 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04019001 PCWALL
HS04019002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04019100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04019102  .001   2
HS04019103  .003   3
HS04019104  .007   4
HS04019105  .019   5
HS04019106  .023   6
HS04019107  .039   7
HS04019108  .071   8
HS04019109  .135   9
HS04019110  .263  10
HS04019111  .500  11
HS04019112  .750  12
HS04019113 1.00   13
HS04019114 1.50   14
HS04019115 1.70   15
HS04019201 CONCRETE   14               * MATERIAL TYPE, MESH INTERVAL
HS04019300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04019400 1    404  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04019500 153.  8.3  8.3              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04019600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04020000 11 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04020001 INTWALL
HS04020002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04020100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04020102  .001   2
HS04020103  .003   3
HS04020104  .007   4
HS04020105  .015   5
HS04020106  .023   6
HS04020107  .039   7
HS04020108  .071   8
HS04020109  .135   9
HS04020110  .263  10
HS04020111  .450  11
HS04020201 CONCRETE   10               * MATERIAL TYPE, MESH INTERVAL
HS04020300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04020400 1    404  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04020500 1652. 8.3  8.3              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04020600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04021000 11 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04021001 CEILING
HS04021002 13.6    0.                  * BOTTOM ALTITUDE, ORIENTATION
HS04021100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04021102  .001   2
HS04021103  .003   3
HS04021104  .007   4
HS04021105  .015   5
HS04021106  .023   6
HS04021107  .039   7
HS04021108  .071   8
HS04021109  .135   9
HS04021110  .263  10
HS04021111  .500  11
HS04021201 'CARBON STEEL'     2        * MATERIAL TYPE, MESH INTERVAL
HS04021202 CONCRETE   10
HS04021300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04021400 1    404  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04021500  291. 11.   5.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
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HS04021600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04022000 12 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04022001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04022002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04022100 -1  1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04022102  .001   2
HS04022103  .003   3
HS04022104  .007   4
HS04022105  .015   5
HS04022106  .023   6
HS04022107  .039   7
HS04022108  .071   8
HS04022109  .135   9
HS04022110  .263  10
HS04022111  .500  11
HS04022112  .600  12
HS04022201 CONCRETE   11              * MATERIAL TYPE, MESH INTERVAL
HS04022300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04022400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04022500  261. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04022600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04023000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04023001 STEEL
HS04023002  5.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04023100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04023102  .0127  2
HS04023201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04023300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04023400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04023500  7.9  3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04023600 1    404  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04023700  7.9  3.    3.
*
*****   LEVEL-165-MAIN SURFACES
HS04024000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04024001 EXTWALL
HS04024002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04024100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04024102  .001   2
HS04024103  .003   3
HS04024104  .007   4
HS04024105  .015   5
HS04024106  .023   6
HS04024107  .039   7
HS04024108  .071   8
HS04024109  .135   9
HS04024110  .263  10
HS04024111  .500  11
HS04024112  .750  12
HS04024113  .90   13
HS04024201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04024300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04024400 1    405  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04024500 1030. 8.3  8.3             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04024600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04024700 1030. 8.3  8.3             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04025000 15 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04025001 PCWALL
HS04025002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04025100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
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HS04025102  .001   2
HS04025103  .003   3
HS04025104  .007   4
HS04025105  .019   5
HS04025106  .023   6
HS04025107  .039   7
HS04025108  .071   8
HS04025109  .135   9
HS04025110  .263  10
HS04025111  .500  11
HS04025112  .750  12
HS04025113 1.00   13
HS04025114 1.50   14
HS04025115 1.70   15
HS04025201 CONCRETE   14              * MATERIAL TYPE, MESH INTERVAL
HS04025300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04025400 1    405  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04025500 457.  8.3  8.3             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04025600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04026000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04026001 INTWALL
HS04026002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04026100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04026102  .001   2
HS04026103  .003   3
HS04026104  .007   4
HS04026105  .015   5
HS04026106  .023   6
HS04026107  .039   7
HS04026108  .071   8
HS04026109  .135   9
HS04026110  .263  10
HS04026111  .450  11
HS04026201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04026300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04026400 1    405  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04026500  950. 8.3  8.3             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04026600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04027000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04027001 CEILING
HS04027002 13.6    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04027100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04027102  .001   2
HS04027103  .003   3
HS04027104  .007   4
HS04027105  .015   5
HS04027106  .023   6
HS04027107  .039   7
HS04027108  .071   8
HS04027109  .135   9
HS04027110  .263  10
HS04027111  .500  11
HS04027201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04027202 CONCRETE   10
HS04027300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04027400 1    405  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04027500  874. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04027600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04028000 12 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04028001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
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HS04028002  5.1    1.                    * BOTTOM ALTITUDE, ORIENTATION
HS04028100 -1  1 0.                      * NODALIZATION FLAGS, INSIDE RADIUS
HS04028102  .001   2
HS04028103  .003   3
HS04028104  .007   4
HS04028105  .015   5
HS04028106  .023   6
HS04028107  .039   7
HS04028108  .071   8
HS04028109  .135   9
HS04028110  .263  10
HS04028111  .500  11
HS04028112  .600  12
HS04028201 CONCRETE   11                 * MATERIAL TYPE, MESH INTERVAL
HS04028300 0                             * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04028400 1    405  'EXT'  1.  1.       * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04028500  784. 11.   5.                * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04028600 0                             * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04029000  2 1 0 0                      * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04029001 STEEL
HS04029002  5.1   1.                     * BOTTOM ALTITUDE, ORIENTATION
HS04029100 -1 1 0.                       * NODALIZATION FLAGS, INSIDE RADIUS
HS04029102  .0127  2
HS04029201 'CARBON STEEL'     1          * MATERIAL TYPE, MESH INTERVAL
HS04029300 0                             * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04029400 1    405  'EXT'  1.  1.       * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04029500 23.8  3.    3.                * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04029600 1    405  'EXT'  1.  1.       * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04029700 23.8  3.    3.
*
***** LEVEL-195-SE SURFACES
*****
HS04030000 12 1 0 0                      * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04030001 EXTWALL
HS04030002 14.2    1.                    * BOTTOM ALTITUDE, ORIENTATION
HS04030100 -1 1 0.                       * NODALIZATION FLAGS, INSIDE RADIUS
HS04030102  .001   2
HS04030103  .003   3
HS04030104  .007   4
HS04030105  .015   5
HS04030106  .023   6
HS04030107  .039   7
HS04030108  .071   8
HS04030109  .135   9
HS04030110  .263  10
HS04030111  .500  11
HS04030112  .600  12
HS04030201 CONCRETE   11                 * MATERIAL TYPE, MESH INTERVAL
HS04030300 0                             * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04030400 1    406  'EXT'  1.  1.       * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04030500  588. 5.1  5.1                * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04030600 4200 410  'EXT'  1.  1.       * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04030700  588. 5.1  5.1                * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04031000 14 1 0 0                      * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04031001 PCWALL
HS04031002 14.2    1.                    * BOTTOM ALTITUDE, ORIENTATION
HS04031100 -1 1 0.                       * NODALIZATION FLAGS, INSIDE RADIUS
HS04031102  .001   2
HS04031103  .003   3
HS04031104  .007   4
HS04031105  .015   5
HS04031106  .023   6
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HS04031107  .039   7
HS04031108  .071   8
HS04031109  .135   9
HS04031110  .263  10
HS04031111  .500  11
HS04031112  .750  12
HS04031113 1.0    13
HS04031114 1.5    14
HS04031201 CONCRETE   13              * MATERIAL TYPE, MESH INTERVAL
HS04031300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04031400 1    406  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04031500 258.  5.1  5.1             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04031600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04033000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04033001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04033002 14.2   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04033100 -1     1 0.                * NODALIZATION FLAGS, INSIDE RADIUS
HS04033102  .001   2
HS04033103  .003   3
HS04033104  .007   4
HS04033105  .015   5
HS04033106  .023   6
HS04033107  .039   7
HS04033108  .071   8
HS04033109  .135   9
HS04033110  .263  10
HS04033111  .500  11
HS04033201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04033300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04033400 1    406  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04033500 245.  11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04033600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04034000 10 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04034001 CEILING
HS04034002 25.5    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04034100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04034102  .001   2
HS04034103  .003   3
HS04034104  .007   4
HS04034105  .015   5
HS04034106  .023   6
HS04034107  .039   7
HS04034108  .071   8
HS04034109  .135   9
HS04034110  .150  10
HS04034201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04034202 CONCRETE    9
HS04034300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04034400 1    406  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04034500 245.  11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04034600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04035000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04035001 STEEL
HS04035002 14.2    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04035100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04035102  .0127  2
HS04035201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04035300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04035400 1    406  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04035500  4.5  3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
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HS04035600 1    406  'EXT'  1.  1.   * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04035700  4.5  3.    3.
*
***** LEVEL-195-MAIN SURFACES
*****
HS04036000 12 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04036001 EXTWALL
HS04036002 14.2    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04036100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04036102  .001   2
HS04036103  .003   3
HS04036104  .007   4
HS04036105  .015   5
HS04036106  .023   6
HS04036107  .039   7
HS04036108  .071   8
HS04036109  .135   9
HS04036110  .263  10
HS04036111  .500  11
HS04036112  .600  12
HS04036201 CONCRETE   11             * MATERIAL TYPE, MESH INTERVAL
HS04036300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04036400 1    407  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04036500 1222. 5.1  5.1            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04036600 4200 410  'EXT'  1.  1.   * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04036700 1222. 5.1  5.1            * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04037000 14 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04037001 PCWALL
HS04037002 14.2    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04037100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04037102  .001   2
HS04037103  .003   3
HS04037104  .007   4
HS04037105  .015   5
HS04037106  .023   6
HS04037107  .039   7
HS04037108  .071   8
HS04037109  .135   9
HS04037110  .263  10
HS04037111  .500  11
HS04037112  .750  12
HS04037113 1.0    13
HS04037114 1.5    14
HS04037201 CONCRETE   13             * MATERIAL TYPE, MESH INTERVAL
HS04037300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04037400 1    407  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04037500 950.  5.1  5.1            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04037600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04039000 11 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04039001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04039002 14.2   1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04039100 -1     1 0.               * NODALIZATION FLAGS, INSIDE RADIUS
HS04039102  .001   2
HS04039103  .003   3
HS04039104  .007   4
HS04039105  .015   5
HS04039106  .023   6
HS04039107  .039   7
HS04039108  .071   8
HS04039109  .135   9
HS04039110  .263  10
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HS04039111  .500  11
HS04039201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04039300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04039400 1    407  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04039500 307.  11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04039600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04040000 10 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04040001 CEILING
HS04040002 25.5    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04040100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04040102  .001   2
HS04040103  .003   3
HS04040104  .007   4
HS04040105  .015   5
HS04040106  .023   6
HS04040107  .039   7
HS04040108  .071   8
HS04040109  .135   9
HS04040110  .150  10
HS04040201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04040202 CONCRETE    9
HS04040300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04040400 1    407  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04040500 307.  11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04040600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04041000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04041001 STEEL
HS04041002 14.2    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04041100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04041102  .0127  2
HS04041201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04041300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04041400 1    407  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04041500 13.3  3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04041600 1    407  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04041700 13.3  3.    3.
*
*****  REFUELING BAY SURFACES
HS04042000  6 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04042001  EXTWALL
HS04042002 26.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04042100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04042102  .0002  2
HS04042103  .0004  3
HS04042104  .0008  4
HS04042105  .0015  5
HS04042106  .00254 6
HS04042201 'CARBON STEEL'     5       * MATERIAL TYPE, MESH INTERVAL
HS04042300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04042400 1    408  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04042500 3063. 16.  16.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04042600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04043000  6 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04043001  CEILING
HS04043002 45.0    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04043100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04043102  .002   2
HS04043103  .004   3
HS04043104  .008   4
HS04043105  .015   5
HS04043106  .0254  6
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HS04043201 'CARBON STEEL'     5        * MATERIAL TYPE, MESH INTERVAL
HS04043300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04043400 1    408  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04043500 1661. 16.  16.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04043600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04044000 10 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04044001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04044002 26.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04044100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04044102  .001   2
HS04044103  .003   3
HS04044104  .007   4
HS04044105  .015   5
HS04044106  .023   6
HS04044107  .039   7
HS04044108  .071   8
HS04044109  .135   9
HS04044110  .230  10
HS04044201 CONCRETE    9               * MATERIAL TYPE, MESH INTERVAL
HS04044300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04044400 1    408  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04044500 1362. 16.  16.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04044600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04045000  2 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04045001  STEEL
HS04045002 26.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04045100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04045102  .0127  2
HS04045201 'CARBON STEEL'     1        * MATERIAL TYPE, MESH INTERVAL
HS04045300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04045400 1    408  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04045500 356.   3.   3.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04045600 1    408  'EXT'  1.  1.     * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04045700 356.   3.   3.
*
***** TURBINE BUILDING SURFACES
HS04046000  6 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04046001  EXTWALL
HS04046002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04046100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04046102  .0002  2
HS04046103  .0004  3
HS04046104  .0008  4
HS04046105  .0015  5
HS04046106  .00254 6
HS04046201 'CARBON STEEL'     5        * MATERIAL TYPE, MESH INTERVAL
HS04046300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04046400 1    409  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04046500 8137.  16. 16.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04046600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04047000  6 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04047001  CEILING
HS04047002 21.9    0.                  * BOTTOM ALTITUDE, ORIENTATION
HS04047100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04047102  .002   2
HS04047103  .004   3
HS04047104  .008   4
HS04047105  .015   5
HS04047106  .0254  6
HS04047201 'CARBON STEEL'     5        * MATERIAL TYPE, MESH INTERVAL
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HS04047300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04047400 1    409  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04047500 8807. 16.  16.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04047600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04048000  6 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04048001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04048002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04048100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04048102  .2     5
HS04048103  .23    6
HS04048201 CONCRETE    5              * MATERIAL TYPE, MESH INTERVAL
HS04048300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04048400 1    409  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04048500 8807. 16.  16.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04048600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04049000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04049001  STEEL
HS04049002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04049100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04049102 .0127   2
HS04049201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04049300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04049400 1    409  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04049500 356.   3.   3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04049600 1    409  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04049700 356.   3.   3.
*****************************************************************************
***** TABULAR FUNCTION INPUT FOR HEAT SLABS
*****
TF20000 'RHS HT COEF' 1 1. 0. * NAME, NO. PAIRS, MUL CONST, ADD CONST
TF20010 0. 6.08               * TIME, HEAT TRANSFER COEFFICIENT
*
TF21000 'RHS T - 286' 1 1. 0. * NAME, NO. PAIRS, MUL CONST, ADD CONST
TF21010 0. 286.               * TIME, RHS TEMPERATURE
*****************************************************************************
*****************************************************************************
*** CORE PACKAGE INPUT
*****************************************************************************
*
*       CORE NODALIZATION CHANGED FROM 3 RADIAL RINGS AND 6 AXIAL LAYERS TO
*       3 RADIAL RINGS AND 5 AXIAL LAYERS (TOTAL AXIAL NODES 11)
*****************************************************************************
***  GENERAL CORE INPUT
*****************************************************************************
*         NRAD     NAXL      NTLP      NCVOL   NLH     NPNTOT
COR00000  3        11        6         3       5       3
*
*         RFUEL    RCLAD     DRGAP     PITCH   DXCAN   DXSS    DXLH
COR00001  .005207  .0061341  .0001143 .016    .00254  .0012   .2254
*
*         IRTYP   MCRP
COR00002  BWR     B4C
*
*         FCNCL   FSSCN   FCELR   FCELA   FLPUP
COR00003  0.50    0.95    0.30    0.15    0.95   * CHNGED FROM DFLT VALS 1-22-90
*
*         NTPCOR
COR00004  101
*
*         HFRZFU  HFRZZR  HFRZSS  HFRZZX  HFRZSX  HFRZCP
COR00005  1000.0  1000.0  1000.0  1000.0  1000.0  1000.0
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*
*         MTUOZR  MTZXZR  MTSXSS  MTCPSS  FUOZR   FZXZR   FSXSS   FCPSS
COR00007  1       2       2       2       0.2     1.0     1.0     0.0
*
*         DRCLMN  DRSSMN
COR00008  1.0E-06  1.0E-06
*
*         HDBPN    HDBLH     TPFAIL    CDISPN
COR00009  500.0    500.0     1273.15    1.0 *
*
*
*         XFE      XCR      XNI      XCAR
COR00010  0.74     0.18     0.08     0.0
*
*         CELL ELEVATIONS AND POROSITIES
*         Z        DZ       PORIN    PORDP
CORZ0101  0.0      1.2954   0.0      0.9 ** LOWER PLENUM **
CORZ0201  1.2954   0.9803   0.00     0.9
CORZ0301  2.2757   0.9803   0.00     0.9
CORZ0401  3.2560   0.9803   0.00     0.9
CORZ0501  4.2363   0.9803   0.00     0.9
CORZ0601  5.2166   0.2777   0.00     0.9 ** CORE PLATE **
CORZ0701  5.4943   0.7620   0.53     0.9 ** CORE **
CORZ0801  6.2563   0.7620   0.53     0.9
CORZ0901  7.0183   0.7620   0.53     0.9
CORZ1001  7.7803   0.7620   0.53     0.9
CORZ1101  8.5423   0.7620   0.53     0.9
*
*
*         CELL CROSS-SECTIONAL BOUNDARY AREAS
*         ASCELA
CORR0101  7.648
CORR0201  7.287
CORR0301  2.251
*
*         BOUNDARY HEAT STRUCTURES
CORZ0102  32001
CORZ0202  32002    *flag changed to 0
CORZ0302  32003
CORZ0402  32004
CORZ0502  32005
CORZ0602  32006 11  *CORE SUPPORT PLATE
CORZ0702  33007
CORZ0802  33008
CORZ0902  33009
CORZ1002  33010
CORZ1102  33011
*
CORR0102  35003
CORR0202  35003
CORR0302  35003
*****************************************************************************
*         LOWER PLENUM AND CORE INPUT
*****************************************************************************
* CRD HOUSING
* CR GUIDE TUBES (185)
* CORE SUPPORT STRUCTURE (FUEL SUPPORT PIECES, CORE PLATE,
*   AND FUEL ASSEMBLY NOSE PIECES)
*
*  R A    IREFN   ICVHC   ICVHB
COR10101  -1      320     320  *  LOWER PLENUM:  CRD HOUSING
COR20101  101
COR30101  101
*
```

```
COR10201  -1      320     320  *  LOWER PLENUM:  CR GUIDE TUBES
COR20201  102
COR30201  102
*
COR10301  102
COR20301  202
COR30301  302
*
COR10401  102     320     320
COR20401  202
COR30401  302
*
COR10501  102     320     320
COR20501  202
COR30501  302
*
COR10601  -1      320     320  *  LOWER PLENUM:  CORE SUPPORT STRUCTURES
COR20601  106
COR30601  106
*
COR10701  -1      340     330  *  CORE
COR20701  107
COR30701  107
*
COR10801  107
COR20801  207
COR30801  307
*
COR10901  107
COR20901  207
COR30901  307
*
COR11001  107
COR21001  207
COR31001  307
*
COR11101  107
COR21101  207
COR31101  307
*
*            XMFU     XMCL     *XMSS*   XMCP     XMCN
COR10102     0.0      0.0    5420.0     0.0      0.0   *CRD HOUSING steel added
COR20102     0.0      0.0    5094.0     0.0      0.0   * steel added
COR30102     0.0      0.0    1529.0     0.0      0.0   * steel added
*
COR10202     0.0      0.0     6550.00    0.0      0.0   *  CR GUIDE TUBES *modif
COR20202    -1.E3    -1.E3   6100.     -1.E3    -1.E3  * modified JJC 6/92
COR30202    -1.E3    -1.E3   1900.00   -1.E3    -1.E3  * modified JJC 6/92
*
COR10602     0.0      0.0    6675.0     0.0      0.0   *  CORE SUPPORT
COR20602    -1.E3    -1.E3   6360.0    -1.E3    -1.E3  *  STRUCTURES
COR30602    -1.E3    -1.E3   1965.0    -1.E3    -1.E3
*
COR10702  14995.    3153.     1077.    158.9   2339.    *  CORE
COR20702  14287.    3004.     1026.    151.4   2229.
COR30702   4414.     928.      317.     46.8    688.5
*
***  TOP GUIDE INCLUDED WITH AXIAL LEVEL 11 STEEL MASS
COR11102    -1.E3    -1.E3  10744.     -1.E3    -1.E3
COR21102    -1.E3    -1.E3  10237.     -1.E3    -1.E3
COR31102    -1.E3    -1.E3   3163.     -1.E3    -1.E3
*
*         TFU     TCL     TSS     TCN
COR10103  564.0   564.0   564.0   564.0  *  CRD HOUSING
```

```
COR10203  564.0   564.0   564.0   564.0  *  CR GUIDE TUBES
COR10603  564.0   564.0   564.0   564.0  *  CORE SUPPORT STRUCTURES
COR10703  564.0   564.0   564.0   564.0  *  CORE
*
*         DHYCL   DHYSS   DHYDP   DHYCNC  DHYCNB
COR10104  1.0     1.0     0.0254   1.0     1.0   *  CRD HOUSING
COR10204  1.0     0.3     0.0254   1.0     1.0   *  CR GUIDE TUBES
COR10604  1.0     0.15    0.0254   1.0     1.0   *  CORE SUPPORT STRUCTURES
COR10704  0.005   0.003   0.0254   0.005   0.003 *  CORE
*
*         ASCELR  AFLOWC  AFLOWB
COR10105  12.70   7.187   0.0    *  CRD HOUSING modified
COR20105  17.75   6.848   0.0    *  modified
COR30105  19.04   2.115   0.0    *  modified
*
COR10205  9.61    7.348  0.0    *  CR GUIDE TUBES modified - back to original
COR20205  13.43   7.001  0.0    *  modified - back to original values
COR30205  14.41   2.163  0.0    *  modified - back to original values
*
COR10605  2.72    4.6171  0.0    *  CORE SUPPORT STRUCTURES modified - back to orig
COR20605  3.80    4.3992  0.0    *  modified - back to original values
COR30605  4.08    1.3592  0.0    *  modified - back to original values
*
COR10705  7.47    3.53775 1.068  *  CORE
COR20705  10.44   3.3708  1.0176
COR30705  11.20   1.0414  0.3144
*
*           ASFU    ASCL    ASSS    ASCN
COR10106    0.0     0.0    40.0     0.0   *  CRD HOUSING modified 8/92
COR20106    0.0     0.0    30.0     0.0   *   modified 8/92
COR30106    0.0     0.0    14.0     0.0   *   modified 8/92
*
COR10206    0.0     0.0    82.53    0.0   *  CR GUIDE TUBES  modified
COR20206   -1.E3   -1.E3   78.63   -1.E3  *  modified
COR30206   -1.E3   -1.E3   24.3    -1.E3  *  modified
*
COR10606    0.0     0.0     66.75    0.0   *  CORE SUPPORT STRUCTURES
COR20606   -1.E3   -1.E3    63.6   -1.E3
COR30606   -1.E3   -1.E3    19.65  -1.E3
*
COR10706  525.4    639.2  203.4   138.9   *  CORE
COR20706  500.7    609.0  193.9   132.3
COR30706  154.7    188.2   59.9    40.9
*****************************************************************************
*      LOWER HEAD INPUT
*****************************************************************************
*         IRS     IRE     XMLH     TLH     ASLH    ICVLH   ICVCAV
CORLHD01  1       1       13670.0  561.0   7.648   320     100
CORLHD02  2       2       13025.0  561.0   7.287   320     100
CORLHD03  3       3        4024.0  561.0   2.251   320     100
*****************************************************************************
*         LOWER HEAD PENETRATIONS INPUT
*****************************************************************************
*         ALL PENETRATIONS ARE CRD HOUSINGS AND STUB TUBES
*         GEOMETRIC VALUES ARE ESTIMATES
*
*         IPNREF  IRP     XMPN     TPN     ASPN    AXPN    DFLPN
CORPEN01  -1      1       940.0    561.0   24.43   0.575   0.1
CORPEN02  -1      2       895.5    561.0   23.28   0.548   0.1
CORPEN03  -1      3       276.7    561.0    7.19   0.169   0.1
*
*****************************************************************************
*****************************************************************************
*         DTDZ MODEL INPUT - VOLUME INLET SPECIFICATIONS
```

```
*
*          CV        SOURCE
CORTIN00  320       320     *LOWER PLENUM, LOWER PLENUM
CORTIN01  330       320     *BYPASS, LOWER PLENUM
CORTIN02  340       320     *CORE, LOWER PLENUM
*
* FLOW BLOCKAGE INPUT
*
FL39900   'VESSEL BREACH'   320  100  0.0     -0.2254
FL39901   0.01  0.2254  0.0                * INITIALLY CLOSED
FL39902   3 * HORIZONTAL FLOW PATH
FL39903   1.0     1.0
FL399S0   0.01  0.2254  0.1128
FL399V0   -1  130  130
*
CF09100  'FLAREA-1'  MIN  2  1.0  0.0
CF09110  0.0  2.18248  COR-AFLMIN.103.111
CF09111  1.0  0.0      COR-AFLMIN.103.111
*
CF09200  'FLAREA-2'  MIN  2  1.0  0.0
CF09210  0.0  2.07949  COR-AFLMIN.203.211
CF09211  1.0  0.0      COR-AFLMIN.203.211
*
CF09300  'FLAREA-3'  MIN  2  1.0  0.0
CF09310  0.0  0.64249  COR-AFLMIN.303.311
CF09311  1.0  0.0      COR-AFLMIN.303.311
*
CF09400  'FLAREA-T'  ADD  3  1.0  0.0
CF09410  1.0  0.0      CFVALU.091
CF09411  1.0  0.0      CFVALU.092
CF09412  1.0  0.0      CFVALU.093
*
CF09500  'FRAC-AREA'  DIVIDE  2  1.0  0.0
CF09502  3  0.03  0.61748
CF09510  0.0  7.9428   CFVALU.094
CF09511  1.0  0.0      CFVALU.094
*
FL324V0   -1   95  95                    * CF FOR FLOW BLOCKAGE
*
* VESSEL BREACH INPUT
*
CF13000   'VESSEL BREACH'  DIVIDE  2  1.0  0.0
CF13010   0.0  0.01  COR-ABRCH
CF13011   1.0  0.0   COR-ABRCH
*******************************************************************************
*******************************************************************************
*** DECAY HEAT PACKAGE
*******************************************************************************
***  SPECIFY A BWR
DCHREACTOR   BWR
*
*         SET REACTOR SHUTDOWN TIME TO -36 SEC
*
DCHSHUT    0       -36.0
*
*         TABULAR FUNCTION TF077 GIVES DECAY HEAT AS A FRACTION
*         OF THERMAL POWER AT SHUTDOWN VS TIME SINCE SHUTDOWN
*
*         THERMAL POWER AT SHUTDOWN = 3293 MW
*
DCHDECPOW     TF.77
*
TF07700   'DECAY HEAT'  44  3293.0E06  0.0
*
```

```
*         TIME SINCE        DECAY HEAT
*          SHUTDOWN      (FRACTION SHUTDOWN
*                           THERMAL POWER)
TF07711  0.00000E+00  6.00000E-02
TF07712  1.00000E+00  5.71500E-02
TF07713  1.50000E+00  5.55200E-02
TF07714  2.00000E+00  5.43700E-02
TF07715  3.00000E+00  5.20400E-02
TF07716  4.00000E+00  5.04000E-02
TF07717  6.00000E+00  4.80700E-02
TF07718  8.00000E+00  4.61900E-02
TF07719  1.00000E+01  4.47300E-02
TF07720  1.50000E+01  4.20500E-02
TF07721  2.00000E+01  4.01500E-02
TF07722  3.00000E+01  3.75600E-02
TF07723  4.00000E+01  3.57200E-02
TF07724  6.00000E+01  3.31300E-02
TF07725  8.00000E+01  3.13700E-02
TF07726  1.00000E+02  3.00000E-02
TF07727  1.50000E+02  2.77700E-02
TF07728  2.00000E+02  2.61900E-02
TF07729  3.00000E+02  2.42800E-02
TF07730  4.00000E+02  2.29300E-02
TF07731  6.00000E+02  2.10200E-02
TF07732  8.00000E+02  1.96500E-02
TF07733  1.00000E+03  1.85900E-02
TF07734  1.50000E+03  1.66200E-02
TF07735  2.00000E+03  1.52200E-02
TF07736  3.00000E+03  1.35400E-02
TF07737  4.00000E+03  1.23500E-02
TF07738  6.00000E+03  1.06700E-02
TF07739  8.00000E+03  9.81500E-03
TF07740  1.00000E+04  9.15200E-03
TF07741  1.50000E+04  8.19300E-03
TF07742  2.00000E+04  7.51200E-03
TF07743  3.00000E+04  6.76400E-03
TF07744  4.00000E+04  6.23200E-03
TF07745  6.00000E+04  5.48400E-03
TF07746  8.00000E+04  5.03900E-03
TF07747  1.00000E+05  4.69300E-03
TF07748  1.50000E+05  4.14100E-03
TF07749  2.00000E+05  3.74900E-03
TF07750  3.00000E+05  3.27500E-03
TF07751  4.00000E+05  2.94000E-03
TF07752  6.00000E+05  2.46600E-03
TF07753  8.00000E+05  2.18700E-03
TF07754  1.00000E+06  1.97100E-03
*         END OF DECAY HEAT TABLE
*******************************************************************************
*******************************************************************************
*** TRANSFER PROCESS PACKAGE INPUT
*******************************************************************************
*   'IN' TRANSFER PROCESS FOR CORE PACKAGE
*           NMSIN   NTHRM
TPIN10100   6       9
*TPIN10200   5       9
*
*    'OUT' TRANSFER PROCESS FOR FDI PACKAGE
*           NMSOT   NPOTOI  IOTMTX
TPOT10100   5       101     UIN.101
*TPOT10200   5       102     DEF.1
*
*     COR-CAV TRANSLATION MATRIX
*     *** NOTE *** CONTROL POISON MASS IS NOT CONSERVED
```

```
*           NROW    NCOL
TPM1010000  5       6
*           NROW/NCOL  VALUE
TPM1010001  1/1        1.0     * UO2 MASS
TPM1010002  2/2        1.0     * ZRO2 MASS
TPM1010003  3/3        1.0     * STEEL MASS
TPM1010004  4/4        1.0     * ZR MASS
TPM1010005  5/5        1.0     * STEEL OXIDE MASS
*
*          TRANSFER PROCESS INPUT - RADIONUCLIDE MASS
*          NMSIN  NTHRM
TPIN60100   16      1
*TPIN60200   16      1
*          NMSOT  NPOTOI  IOTMTX
TPOT60100   16      601    DEF.1
*TPOT60200   16      602    DEF.1
*************************************************************************
*************************************************************************
*** CAVITY PACKAGE INPUT
*************************************************************************
***       TWO-CAVITY MODEL
CAV0000   100              'CAVITY 1'
CAV00C0   NONSTAND      * PEACH BOTTOM CONCRETE * JJC from Table 4.1 of a
***              Report by S.A.Hodge, C.R.Hyman and L.J.Ott, Nov. 28, 1988
CAV00C1   AL2O3           0.009
CAV00C2   CAO             0.338
CAV00C3   CO2             0.206
CAV00C4   SIO2            0.358
CAV00C5   H2OEVAP         0.045
CAV00C6   H2OCHEM         0.027
CAV00C7   FE               .135
CAV00CA   TABLCT    1500.    *modified as per C.R. Hyman
CAV00CB   TINCT      300.
CAV00CC   EMISCT    .6
CAV00CD   DENSCT    2340.
CAV00CE   TSOLCT    1420.   *modified as per C.R. Hyman
CAV00CF   TLIQCT    1670.   *modified  as per C.R. Hyman
CAV00G0   CORCON    2                  * FLAT BOTTOM CYLINDER
*
*          NRAYS      RO        ZO
CAV00G1      35       0.0       1.
*        ZT   RAD  HIT  RADC  RW  HBB   NBOT NCORN
CAV00G2  2.   2.06 .457  0.1  3.52 1.524  25    3
*       NEXTRA REXTRA ZEXTRA
CAV00GA   20   3.085  1.99
CAV00GB   20   3.085  0.
CAV00TP  101
CAV00U1  EMISS.OX    0.5
CAV00U2  EMISS.MET   0.5
CAV00U3  EMISS.SUR   0.8
CAV00RR  01
*************************************************************************
CAV0100   101              'CAVITY 2'
CAV01C0   NONSTAND      * PEACH BOTTOM CONCRETE * JJC from Table 4.1 of a
***              Report by S.A.Hodge, C.R.Hyman and L.J.Ott, Nov. 28, 1988
CAV01C1   AL2O3           0.009
CAV01C2   CAO             0.338
CAV01C3   CO2             0.206
CAV01C4   SIO2            0.358
CAV01C5   H2OEVAP         0.045
CAV01C6   H2OCHEM         0.027
CAV01C7   FE               .135
CAV01CA   TABLCT    1500.    *modified as per C.R. Hyman
CAV01CB   TINCT      300.
```

```
CAV01CC   EMISCT    .6
CAV01CD   DENSCT    2340.
CAV01CE   TSOLCT    1420.   *modified as per C.R. Hyman
CAV01CF   TLIQCT    1670.   *modified  as per C.R. Hyman
CAV01G0   CORCON    2                  * FLAT BOTTOM CYLINDER
*
*          NRAYS      RO        ZO
CAV01G1      35       0.0       1.
*        ZT   RAD  HIT  RADC  RW  HBB   NBOT NCORN
CAV01G2  2.   2.06 .457  0.1  6.3  1.524  25    3
*       NEXTRA REXTRA ZEXTRA
CAV01GA   40   5.7036  1.99
CAV01GB   20   5.7036  0.
CAV01U1  EMISS.OX    0.5
CAV01U2  EMISS.MET   0.5
CAV01U3  EMISS.SUR   0.8
*************************************************************************
*************************************************************************
*************************************************************************
***  BURN PACKAGE INPUT
*************************************************************************
BUR000 0
*      XH2IGN   XCOIGN  XH2IGY  XCOIGY  XO2IG  XMSCIG
*BUR001
*      CVNUM  IGNTR   CDIM   TFRAC
BUR101  401     1     17.6    .25
BUR102  402     1     11.2    .25
BUR103  403     1     17.3    .25
BUR104  404     1     13.3    .25
BUR105  405     1     19.2    .25
BUR106  406     1     13.5    .25
BUR107  407     1     16.9    .25
BUR108  408     1     31.4    .25
BUR109  409     1     53.0    .25
*************************************************************************
*************************************************************************
***  RADIONUCLIDE PACKAGE INPUT
*************************************************************************
*************************************************************************
*
DCHDEFCLS0 ALL
*
*  CSI CLASS
DCHNEM0100 CI 1.0E-6
DCHNEM0101 0. 8.3807E5  6.12 6.6913E5 61.2 4.6653E5 612. 3.2606E5
DCHNEM0102 3600. 2.2395E5 7200. 1.7296E5 14400. 1.1438E5 36000. .70876E5
DCHNEM0103 54000. .53576E5
DCHCLS0160 CSI
DCHCLS0161 CI
*
DCHCLSNORM YES
*************************************************************************
RN1000 0
RN1001 5 1 16 14 13 0 0
RN1100 1.0E-6 50.E-6 1000.
*
RNACOEF    1
*
*ESF(POOL SCRUBBING INPUT) FOR FL362 & FL020
*
RN2PLS01  362    0.005   1.5   0.20   1.16
RN2PLS02  020    0.005   1.5   0.20   1.16
*
*CAVITY POOL SCRUBBING
```

```
*
RN2PLS03 1000    0.005   1.5   0.20   1.16
*
RNCLS0100 16
RNCLS0101 2 1.0  *CS
RNCLS0102 4 0.5  *I2
*
*   FUEL INVENTORIES
*
RNFP000 -1 * CORSOR W/ S/V RATIO
*
*   RADIAL RING 1
*
RNFPN10701 0 .177 .534
*
RNFPN10801 0 .230 .534
*
RNFPN10901 0 .230 .534
*
RNFPN11001 0 .222 .534
*
RNFPN11101 0 .141 .534
*
*   RADIAL RING 2
*
RNFPN20701 0 .177 .420
*
RNFPN20801 0 .230 .420
*
RNFPN20901 0 .230 .420
*
RNFPN21001 0 .222 .420
*
RNFPN21101 0 .141 .420
*
*   RADIAL RING 3
*
RNFPN30701 0 .177 .046
*
RNFPN30801 0 .230 .046
*
RNFPN30901 0 .230 .046
*
RNFPN31001 0 .222 .046
*
RNFPN31101 0 .141 .046
*
*   GAP RADIONUCLIDES
*
*    RADIAL RING 1
*
RNGAP10700 1173.
RNGAP10701 2 .05      1.0  *CS
RNGAP10702 4 .017     1.0  *I
RNGAP10703 1 .03      1.0  *XE
RNGAP10704 5 .0001    1.0  *TE
RNGAP10705 3 .000001  1.0  *BA,SR
*
RNGAP10800 1173.
RNGAP10801 -107 1. 1.
*
RNGAP10900 1173.
RNGAP10901 -107 1. 1.
*
```

```
RNGAP11000 1173.
RNGAP11001 -107 1. 1.
*
RNGAP11100 1173.
RNGAP11101 -107 1. 1.
*
*    RADIAL RING 2
*
RNGAP20700 1173.
RNGAP20701 -107 1. 1.
*
RNGAP20800 1173.
RNGAP20801 -107 1. 1.
*
RNGAP20900 1173.
RNGAP20901 -107 1. 1.
*
RNGAP21000 1173.
RNGAP21001 -107 1. 1.
*
RNGAP21100 1173.
RNGAP21101 -107 1. 1.
*
*    RADIAL RING 3
*
RNGAP30700 1173.
RNGAP30701 -107 1. 1.
*
RNGAP30800 1173.
RNGAP30801 -107 1. 1.
*
RNGAP30900 1173.
RNGAP30901 -107 1. 1.
*
RNGAP31000 1173.
RNGAP31001 -107 1. 1.
*
RNGAP31100 1173.
RNGAP31101 -107 1. 1.
*
RNVNCL01 25 16
*****************************************************************************
*        DEPOSITION SURFACES
*****************************************************************************
*           IDS   SIDE    TYPE
RNDS000    10001   LHS    FLOOR      * DRYWELL-LINER
RNDS001    36002   RHS    FLOOR      * UPPER-HEAD
RNDS002    20001   LHS    FLOOR      * WETWELL-LINER
RNDS003    32001   LHS    FLOOR      * LOWER-HEAD
RNDS004    36002   LHS    CEILING    * UPPER-HEAD
RNDS005     4003   LHS    FLOOR      *
RNDS007     4010   LHS    FLOOR      *
RNDS009     4016   LHS    FLOOR      *
RNDS011     4022   LHS    FLOOR      *
RNDS013     4028   LHS    FLOOR      *
RNDS016     4033   LHS    FLOOR      *
RNDS018     4039   LHS    FLOOR      *
RNDS019     4044   LHS    FLOOR      *
RNDS021     4048   LHS    FLOOR      *
RNDS022    10010   LHS    FLOOR      * VOLUME 100
RNDS023    10011   LHS    FLOOR      * VOLUME 101
*****************************************************************************
*        SETTLING AREAS
*****************************************************************************
```

```
              IVOLF   IVOLT    ELEV    AREA
RNSET000       310     320    5.4943   .6782       * AN-LP
RNSET001       330     320    5.4943   .0793       * BP-LP
RNSET002       340     320    5.4943  4.905        * CH-LP
RNSET003       350     340    9.667   5.366        * SH-CH
RNSET004       360     350   15.431   4.7763       * SD-SH
RNSET005       410     410    0.01      1.         * ENV-ENV
RNSET006       402     401   -4.1     8.6          * FL401
RNSET007       404     402    5.1     33.2         * FL402
RNSET008       406     404   14.2     33.2         * FL407
RNSET009       408     406   26.1     33.2         * FL411
RNSET010       150     101   -8.5     36.0         *
RNSET011       103     100    3.1      3.2         * FL 14
*******************************************************************************
*******************************************************************************
*** MATERIAL PROPERTIES PACKAGE
*******************************************************************************
***            Property                Units
***
***            temperature             K
***            density                 kg/m*3
***            heat capacity           J/kg-K
***            thermal conductivity    W/m-K
*******************************************************************************
***          Material 2 is concrete
***

MPMAT00200   CONCRETE
***
***          PROPERTY   TAB FUNC
MPMAT00201     RHO         4
MPMAT00202     CPS         5
MPMAT00203     THC         6
***
***          Density of concrete
***
TF00400     'RHO CONCRETE'   2   1.00   0.0
***
***          TEMPERATURE     RHO
TF00412         200.00     2522.60
TF00413        5000.00     2522.60
***
***          Heat capacity of concrete
***
TF00500     'CPS CONCRETE'   2   1.00   0.0
***
***          TEMPERATURE     CPS
TF00512         200.00     1299.97
TF00513        5000.00     1299.97
***
***          Thermal conductivity of concrete
***
TF00600     'THC CONCRETE'   2   1.00   0.0
***
***          TEMPERATURE     THC
TF00612         200.00       1.524
TF00613        5000.00       1.524
*******************************************************************************
***          Material 3 is carbon steel
***
MPMAT00300  'CARBON STEEL'
***
***          PROPERTY   TAB FUNC
***
```

```
MPMAT00301     RHO          7
MPMAT00302     CPS          8
MPMAT00303     THC          9
***
***          Density of carbon steel
***
TF00700     'RHO CARBON STEEL'   2   1.00   0.0
***
***          TEMPERATURE     RHO
TF00712         273.15     7833.0
TF00713        5000.00     7833.0
***
***          Heat capacity of carbon steel
***
TF00800     'CPS CARBON STEEL'   2   1.00   0.0
***
***          TEMPERATURE     CPS
TF00812         273.15      465.0
TF00813        5000.00      465.0
***
***          Thermal conductivty of carbon steel
***
TF00900     'THC CARBON STEEL'  10   1.00   0.0
***
***          TEMPERATURE     THC
TF00910         273.15       55.0
TF00911         373.15       52.0
TF00912         473.15       48.0
TF00913         573.15       45.0
TF00914         673.15       42.0
TF00915         873.15       35.0
TF00916        1073.15       31.0
TF00917        1273.15       29.0
TF00918        1473.15       31.0
TF00919        9973.15       31.0
***
MPMAT00500    ZIRCALOY
*
MPMAT00501    ENH   82
MPMAT00502    TMP   83
MPMAT00550    MLT   2500.0
*
TF08200   EZIRC   17   1.0
TF08211    300.0      0.
TF08212    400.0    21915.
TF08213    640.0   105110.
TF08214   1090.0   263960.
TF08215   1093.0   265275.5
TF08216   1113.0   276195.5
TF08217   1133.0   288245.5
TF08218   1153.0   301585.5
TF08219   1173.0   316935.5
TF08220   1193.0   332795.5
TF08221   1213.0   346685.5
TF08222   1233.0   357565.5
TF08223   1248.0   363753.
TF08224   2098.0   666353.
TF08225   2500.0   809465.
TF08226   2500.01  1034465.
TF08227   3598.0   1425353.
*
TF08300   TZIRC  17   1.0
*
TF08311        0.      300.0
```

```
TF08312     21915.      400.0
TF08313    105110.      640.0
TF08314    263960.     1090.0
TF08315    265275.5    1093.0
TF08316    276195.5    1113.0
TF08317    288245.5    1133.0
TF08318    301585.5    1153.0
TF08319    316935.5    1173.0
TF08320    332795.5    1193.0
TF08321    346685.5    1213.0
TF08322    357565.5    1233.0
TF08323    363753.     1248.0
TF08324    666353.     2098.0
TF08325    809465.     2500.0
TF08326   1034465.     2500.01
TF08327   1425353.     3598.0
*
MPMAT00700   'URANIUM DIOXIDE'
MPMAT00701   ENH  72
MPMAT00702   TMP  73
MPMAT00703   CPS  71
MPMAT00750   MLT  2800.0
*
TF07200   EUO2   31   1.0
TF07211    300.0      33143.
TF07212    400.0      58419.
TF07213    500.0      85883.
TF07214    600.0     114638.
TF07215    700.0     144257.
TF07216    800.0     174517.
TF07217    900.0     205288.
TF07218   1000.0     236492.
TF07219   1100.0     268080.
TF07220   1200.0     300023.
TF07221   1300.0     332309.
TF07222   1400.0     364947.
TF07223   1500.0     397973.
TF07224   1600.0     431455.
TF07225   1700.0     465502.
TF07226   1800.0     500266.
TF07227   1900.0     535945.
TF07228   2000.0     572782.
TF07229   2100.0     611064.
TF07230   2200.0     651111.
TF07231   2300.0     693275.
TF07232   2400.0     737927.
TF07233   2500.0     785450.
TF07234   2600.0     836232.
TF07235   2700.0     890656.
TF07236   2800.0     949096.
TF07237   2800.01   1223096.
TF07238   2900.0    1285906.
TF07239   3000.0    1353422.
TF07240   3113.0    1435764.
TF07241   3513.0    1636964.
*
TF07300   TUO2   31   1.0
TF07311     33143.    300.0
TF07312     58419.    400.0
TF07313     85883.    500.0
TF07314    114638.    600.0
TF07315    144257.    700.0
TF07316    174517.    800.0
TF07317    205288.    900.0
```

```
TF07318    236492.   1000.0
TF07319    268080.   1100.0
TF07320    300023.   1200.0
TF07321    332309.   1300.0
TF07322    364947.   1400.0
TF07323    397973.   1500.0
TF07324    431455.   1600.0
TF07325    465502.   1700.0
TF07326    500266.   1800.0
TF07327    535945.   1900.0
TF07328    572782.   2000.0
TF07329    611064.   2100.0
TF07330    651111.   2200.0
TF07331    693275.   2300.0
TF07332    737927.   2400.0
TF07333    785450.   2500.0
TF07334    836232.   2600.0
TF07335    890656.   2700.0
TF07336    949096.   2800.0
TF07337   1223096.   2800.01
TF07338   1285906.   2900.0
TF07339   1353422.   3000.0
TF07340   1435764.   3113.0
TF07341   1636964.   3513.0
*
TF07100   CPUO2  31   1.0
TF07111    273.15   230.22
TF07112    400.0    265.84
TF07113    500.0    282.07
TF07114    600.0    292.36
TF07115    700.0    299.67
TF07116    800.0    305.31
TF07117    900.0    309.98
TF07118   1000.0    314.03
TF07119   1100.0    317.69
TF07120   1200.0    321.15
TF07121   1300.0    324.59
TF07122   1400.0    328.24
TF07123   1500.0    332.40
TF07124   1600.0    337.43
TF07125   1700.0    343.76
TF07126   1800.0    351.84
TF07127   1900.0    362.14
TF07128   2000.0    375.09
TF07129   2100.0    391.08
TF07130   2200.0    410.45
TF07131   2300.0    433.45
TF07132   2400.0    460.23
TF07133   2500.0    490.88
TF07134   2600.0    525.4
TF07135   2700.0    563.71
TF07136   2800.0    605.67
TF07137   2800.01   503.0
TF07138   2900.0    503.0
TF07139   3000.0    503.0
TF07140   3113.0    503.0
TF07141   5000.0    503.0
*
*************************************************************
********END OF INPUT *************************************************************
*****************************************************************************
```

```
*****************    MELCOR    INPUT    *****************


TITLE        STSB-W-ADS
RESTARTF     ST2.RST
CPULIM      199000.
CPULEFT       10.
OUTPUTF      MELCOR.OUT
TIME1        0     1.0    0.001 4000.    60.    4000.
TIME2        4000.  5.    0.0001 3300.  240.    4000.
TIME3       10000.  5.    0.0001 5000.  240.    5000.
TIME4       20000.  5.    0.0001 10000.0 240.   5000.
TEND       46800.
```

Appendix C

MELCOR Input for the Station Blackout with Flooded Cavity and Multi-Node Drywell Representation

The model for this input is described in Sect. 4.1. This model used a dual-cavity and multi-node representation of the drywell. This appendix has two files. The first file is the input file for MELGEN and contains all the plant and transient data. The second file is the input file for MELCOR.

```
*****************************************************************************
*****************************************************************************
***     FILE NAME:      pb.gen.4     SEP 1992
***     Reactor:        Peach Bottom BWR 4/MK 1
***     Sequence:       Short Term Station Blackout with ADS Depressurization
***     Compartments:   RPV(6), DW(1), WW(1), SC(9), ENV(1)
*****************************************************************************
*****************************************************************************
*       PRELIMINARY DECK FROM SNL, MODIFIED AND TESTED AT BNL
*
* APR/92 - MODIFIED AND CHECKED BY J. J. CARBAJO, ORNL(SRVS, ADS, HF-SEALS
*          FOR MELCOR 1.8.1 AND SHORT-TERM STATION BLACKOUT WITH ADS)
* JUN/92 - STAINLESS STEEL ADDED IN LOWER PLENUM
*          POROSITIES OF CORE INTACT COMPONENTS=0.53
* JUL/92 - POROSITIES OF DEBRIS= 0.9
*
* JUL/92 - TWO HEAT SLABS ADDED TO THE LOWER PLENUM - HS32002 & HS32003
* AUG/92 - SURFACE AREAS IN LOWER PLENUM REDUCED
* SEP/92 - MULTI-NODE DRYWELL MODEL
*          TWO-CAVITY MODEL
* JAN/93 - FLOODED CAVITIES - WETWELL FAILURE BY HIGH PRESSURE (159 psig)
*          FLOWS CHANGED: 10, 12, 400
*****************************************************************************
*
TITLE      STSB-W-ADS
JOBID      ST4
CRTOUT
OUTPUTF    ST4.OUT
RESTARTF   ST4.RST
DIAGF      ST4.DIA
DTTIME     1.
*****************************************************************************
*****************************************************************************
*** NON-CONDENSIBLE GASES PACKAGE
*****************************************************************************
***        GAS   MATERIAL NUMBER
NCG000      O2        4
NCG001      N2        5
NCG002      H2        6
NCG003      CO        7
NCG004      CO2       8
NCG005      CH4       9
*****************************************************************************
*****************************************************************************
*** CONTROL VOLUME HYDRODYNAMICS PACKAGE
*****************************************************************************
***        CV 100 is the Drywell-in Pedestal region
***
CV10000    DRYWELL-IN   2   2   2
CV100A0    3
CV100A1    PVOL    1.08E5   RHUM    0.20
CV100A2    TATM    335.92   TPOL    330.93  * 145 F
CV100A3    MASS.1 28782.0   MASS.2  0.0     * MASS IN FLOODED CAVITY
CV100A4    MLFR.5  1.00
* CRD PUMP WATER INTO CAVITY
CV100C0    MASS.1   1  2
CV100C1    TE       2  8
TF00100    MASS-100 4  1.0  0.0
TF00110    0.0 0.0  9860.0 0.0  10000.0 10.0  6.857E4  10.0
TF00200    TEMP-100 2  1.0  0.0
TF00210    0.0  300.0  6.857E4  300.0
***
***        ALTITUDE   VOLUME
CV100B1     -9.093       0.
```

```
CV100B2    -8.636       5.830     * SUMP
CV100B3    -7.8527     29.25      * FLOODED CAVITY
CV100B4    -7.085      46.376
CV100B5    -6.397      80.0
CV100B6    -3.7       161.34
CV100B7     3.26      242.016
***
*****************************************************************************

***        CV  101 is the Drywell-ex Pedestal region
***
CV10100   DRYWELL-EX   2  2  2
CV101A0   3
CV101A1   PVOL   1.08E5   RHUM  0.20
CV101A2   TATM   335.92   TPOL  330.93
CV101A3   MASS.1 78769.0  MASS.2  0.0  * MASS IN FLOODED CAVITY
CV101A4   MLFR.5  1.0
***
CV101B1   -8.636     0.0
CV101B2   -7.8527  80.05    *  FLOODED CAVITY
CV101B3   -3.701   713.0
CV101B4    0.0    1710.0
CV101B5    6.47   2877.5
***
*****************************************************************************
***        CV  102 is the Drywell-Top region
***
CV10200   DRYWELL-TOP  2  2  2
CV102A0   3
CV102A1   PVOL  1.08E5    RHUM  0.20
CV102A2   TATM  335.92    TPOL  330.93
CV102A3   MASS.1  0.0   MASS.2  0.0   MLFR.5  1.0
***
CV102B1    6.47    0.0
CV102B2   23.495  1036.5
***
*****************************************************************************
***        CV   103 is the Drywell-Annulus region
***
CV10300    DRYWELL-ANN  2  2  2
CV103A0    3
CV103A1    PVOL  1.08E5    RHUM  0.2
CV103A2    TATM  400.0   TPOL  400.0
CV103A3    MASS.1  0.0  MASS.2  0.0  MLFR.5  1.0
***
CV103B1     3.086   0.0
CV103B2     9.2585 39.971
CV103B3    15.431  78.942
*****************************************************************************
***       CV 150 is the Downcomer Volume
***
CV15000   VENT/DOWNCOMER   2   2   2
CV150A0   3
CV150A1   PVOL    1.08E5        RHUM  0.20
CV150A2   TATM    335.92        TPOL  305.93  *  145 F, POOL 90 F
CV150A3   ZPOL    -12.205        VFOG    0.0
CV150A4   MLFR.5  1.0
***
***       ALTITUDE   VOLUME
CV150B1    -12.81       0.0
CV150B2    -10.53      82.0
CV150B3     -9.07     257.0
CV150B4     -5.59     565.0
*****************************************************************************
```

```
***        CV 200 is the Wetwell
***
CV20000    WETWELL   2   2   3
CV20003    47.33  *  CV area for velocity calculation
CV200A0    3
CV200A1    PVOL     .99974E5  PH2O     -1.0
CV200A2    TATM     305.85    TPOL     305.87  *  90 F
CV200A3    ZPOL    -11.435    VFOG     0.0
CV200A4    MLFR.5  1.00
***
***        ALTITUDE   VOLUME
CV200B1     -16.38       0.0
CV200B2     -15.16     572.7
CV200B3     -13.33    2114.3
CV200B4     -12.81    2629.6
CV200B5     -12.11    3298.1
CV200B6     -11.76    3647.5
CV200B7     -11.50    3898.0
CV200B8     -10.53    4837.2
CV200B9     -10.28    5058.3
CV200BA      -9.07    6035.7
CV200BB      -8.46    6547.6
CV200BC      -6.93    7132.5
***
*****************************************************************************
***        SIX-VOLUME PRIMARY SYSTEM FROM MARCON VOLUME/ALTITUDE TABLES
*****************************************************************************
***        CV 310 is the Reactor Pressure Vessel Annulus
***
CV31000    ANNULUS  2  2  1     *  NON-EQ TH, VERT FLOW, PRI CV
CV310A0    3                    *
CV310A1    PVOL      7.1340E6   *  1034.7 PSI * INITIAL CONDITION * JJC April 92
CV310A2    PH2O     -1.0        *  PH20 = PVOL
CV310A3    TATM     -1.0        *  TATM = T(SAT) AT PH20
CV310A4    TPOL    560.00       *  DEG K,
CV310A5    ZPOL   14.1249   *  JJC, Initial level 556.1 in (14.1249 m)
***
***        ALTITUDE   VOLUME
CV310BA      3.086    0.0000 * BOTTOM OF SHROUD BAFFLE
CV310BM      8.080   41.0323 * JET PUMP THROAT
CV310BP      9.152   51.5666
CV310BV     10.460   61.1004 * BOTTOM OF SHROUD DOME
CV310B0     11.242   74.3757 * TOP OF SHROUD DOME
CV310B9     15.431  183.7962 * TOP OF SEPARATORS
*****************************************************************************
***        CV 320 is the Reactor Pressure Vessel Lower Plenum
***        including the internal volume of the jet pumps
***
CV32000    LOWER-PLENUM  2 2 1 *  NON-EQ TH, VERT FLOW, PRI CV
CV320A0    2                   *  P/T/X DATA
CV320A1    PVOL      7.1340E6  *  1034.7 PSI
CV320A2    PH2O     -1.0       *  PH20 = PVOL
CV320A3    TATM     -1.0       *  TATM = T(SAT) AT PH20
CV320A4    TPOL    560.00      *  DEG K,
CV320A5    MFRC.1    1.000     *  MFRC POOL, 166093.9 LBS H2O
CV320A6    MFRC.2    0.0       *  MFRC FOG
CV320A7    MFRC.3    0.0       *  MFRC STEAM
***
***        ALTITUDE   VOLUME
CV320B1      0.000     0.0000  * BOTTOM OF RPV
CV320B2      1.2954   22.4064  * increased from 11.4064 *JULY 92****************
CV320B3      2.2757   34.7348
CV320B4      3.2560   61.3489
CV320B5      4.2363   81.8691
```

```
CV320B6     5.2166   99.2356
CV320B7     5.4943  103.4594  * BOTTOM OF ACTIVE FUEL
*****************************************************************************
***       CV 330 is the Reactor Pressure Vessel By-Pass
***
CV33000   BY-PASS  2  2  1    *  NON-EQ TH, VERT FLOW, PRI CV
CV330A0   2                   *  P/T/X DATA
CV330A1   PVOL     7.1340E6   *  1034.7 PSI
CV330A2   PH2O    -1.0        *  PH20 = PVOL
CV330A3   TATM    -1.0        *  TATM = T(SAT) AT PH20
CV330A4   TPOL   560.00       *  DEG K,
CV330A5   MFRC.1   1.000      *  MFRC POOL, FULL H2O
CV330A6   MFRC.2   0.0        *  MFRC FOG
CV330A7   MFRC.3   0.0000     *  MFRC STEAM,
***
***       ALTITUDE   VOLUME
CV330B7     5.4943    0.0000  * BOTTOM OF ACTIVE FUEL
CV330B8     6.2563    4.7889
CV330B9     7.0183    9.5779
CV330BA     7.7803   14.3668
CV330BB     8.5423   18.9546
CV330BC     9.3043   23.4455
CV330BD     9.667    25.7814  * TOP OF CORE TOP GUIDE
*****************************************************************************
***       CV 340 is the Reactor Pressure Vessel Channel
***
CV34000   CHANNEL  2  2  1    *  NON-EQ TH, VERT FLOW, PRI CV
CV340A0   2                   *  P/T/X DATA
CV340A1   PVOL     7.1340E6   *  1034.7 PSI
CV340A2   PH2O    -1.0        *  PH20 = PVOL
CV340A3   TATM    -1.0        *  TATM = T(SAT) AT PH20
CV340A4   TPOL   560.00       *  DEG K,
CV340A5   MFRC.1   1.0000     *  MFRC POOL, FULL H2O
CV340A6   MFRC.2   0.0        *  MFRC FOG
CV340A7   MFRC.3   0.0000     *  MFRC STEAM
***
***       ALTITUDE   VOLUME
CV340B7     5.4943    0.0000  * BOTTOM OF ACTIVE FUEL
CV340B8     6.2563    6.1869
CV340B9     7.0183   12.3739
CV340BA     7.7803   18.5608
CV340BB     8.5423   24.4793
CV340BC     9.3043   30.2791
CV340BD     9.667    33.2959  * TOP OF CORE TOP GUIDE
*****************************************************************************
***       CV 350 is the Reactor Pressure Vessel
***       Shroud Dome, Pipes, and Separators
***
CV35000   SHROUD-DOME  2 2 1  *  NON-EQ TH, VERT FLOW, PRI CV
CV350A0   3                   *
CV350A1   PVOL     7.1340E6   *  1034.7 PSI
CV350A2   PH2O    -1.0        *  PH20 = PVOL
CV350A3   TATM    -1.0        *  TATM = T(SAT) AT PH20
CV350A4   TPOL   560.00       *  DEG K,
CV350A5   ZPOL   14.1249       *  POOL level 556.1 in (14.1249 m)
***
***       ALTITUDE   VOLUME
CV350BA     9.667    0.0000 * TOP OF CORE TOP GUIDE
CV350BD    10.460   17.9923 * BOTTOM OF SHROUD DOME
CV350BH    11.082   27.2877 * TOP OF SHROUD DOME
CV350BR    15.431   44.9011 * TOP OF SEPARATORS
*****************************************************************************
***       CV 360 is the Reactor Pressure Vessel
***       Dryer Region and Steam Dome
```

```
***
CV36000   STEAM-DOME   2 2 1  *  NON-EQ TH, VERT FLOW, PRI CV
CV360A0   2                   *  P/T/X DATA
CV360A1   PVOL     7.1340E6   *  1034.7 PSI
CV360A2   PH2O    -1.0        *  PH20 = PVOL
CV360A3   TATM    -1.0        *  TATM = T(SAT) AT PH20
CV360A4   TPOL   560.00       *  DEG K,
CV360A5   MFRC.1   0.0        *  MFRC POOL
CV360A6   MFRC.2   0.0        *  MFRC FOG
CV360A7   MFRC.3   1.000      *  MFRC STEAM, 18796.2 LBS H2O
***
***       ALTITUDE   VOLUME
CV360BA    15.431    0.0000 * TOP OF SEPARATORS
CV360BC    16.439   30.5896 * BOTTOM OF MAIN STEAM LINE
CV360BE    17.018   89.1637 * TOP OF MAIN STEAM LINE
CV360BR    22.243  218.5968 * TOP OF RPV
*****************************************************************************
***       CV 401 is the Torus Room
***
CV40100 'TORUS ROOM'      2  2  4       *  NON-EQ TH, VERT FLOW, CONT CV
CV401A0 2                               *  P/T/X DATA
CV401A1 PVOL 101210.      PH2O  9118.
CV401A2 TATM 305.8        TPOL 305.8  *  90 F
CV401A3 MFRC.1 0.         MFRC.3 1.
CV401A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV      VOL
CV401B1  -17.2        0.
CV401B2   -4.1     5426.
*****************************************************************************
***       CV 402 is the Southern half of the 135 Level
***
CV40200 LEV-135-SOUTH     2  2  4
CV402A0 2
CV402A1 PVOL  101180.     PH2O 3500.
CV402A2 TATM  301.        TPOL 301.
CV402A3 MFRC.1 0.         MFRC.3 1.
CV402A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV    VOL
CV402B1   -4.1       0.
CV402B2    5.1    5154.
*****************************************************************************
***       CV 403 is the Northern half of the 135 Level
***
CV40300 LEV-135-NORTH     2  2  4
CV403A0 2
CV403A1 PVOL  101180.     PH2O 3500.
CV403A2 TATM  301.        TPOL 301.
CV403A3 MFRC.1 0.         MFRC.3 1.
CV403A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV    VOL
CV403B1   -4.1       0.
CV403B2    4.5    5154.
*****************************************************************************
***       CV 404 is the Southeast quadrant of the 165 Level
***
CV40400 LEVEL-165-SE    2  2  4
CV404A0 2
CV404A1 PVOL  101080.     PH2O 3480.
CV404A2 TATM  299.8       TPOL 299.8
CV404A3 MFRC.1 0.         MFRC.3 1.
CV404A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV404B1    5.1       0.
CV404B2   14.2    2356.
```

```
*****************************************************************************
***       CV 405 is the remainder of the 165 Level
***
CV40500 LEVEL-165-MAIN  2  2  4
CV405A0 2
CV405A1 PVOL  101080.     PH2O 3480.
CV405A2 TATM  299.8       TPOL 299.8
CV405A3 MFRC.1 0.         MFRC.3 1.
CV405A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV405B1    5.1       0.
CV405B2   13.6    7066.
*****************************************************************************
***       CV 406 is the Southeast quadrant of the 195 Level
***
CV40600 LEVEL-195-SE    2  2  4
CV406A0 2
CV406A1 PVOL  100980.     PH2O 3480.
CV406A2 TATM  299.8       TPOL 299.8
CV406A3 MFRC.1 0.         MFRC.3 1.
CV406A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV406B1   14.2       0.
CV406B2   26.1    2452.
*****************************************************************************
***       CV 407 is the remainder of the 195 Level
***
CV40700 LEVEL-195-MAIN  2  2  4
CV407A0 2
CV407A1 PVOL  100980.     PH2O 3480.
CV407A2 TATM  299.8       TPOL 299.8
CV407A3 MFRC.1 0.         MFRC.3 1.
CV407A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV407B1   14.2       0.
CV407B2   25.5    4866.
*****************************************************************************
***       CV 408 is the Refueling Bay
***
CV40800 REFUELING-BAY   2  2  7
CV408A0 2
CV408A1 PVOL  100840.     PH2O 3480.
CV408A2 TATM  299.8       TPOL 299.8
CV408A3 MFRC.1 0.         MFRC.3 1.
CV408A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV408B1   26.1       0.
CV408B2   45.0   31048.
*****************************************************************************
***       CV 409 is the Turbine Building
***
CV40900 TURBINE-BUILDING  2  2  5
CV409A0 2
CV409A1 PVOL  101080.     PH2O 3480.
CV409A2 TATM  299.8       TPOL 299.8
CV409A3 MFRC.1 0.         MFRC.3 1.
CV409A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV409B1     5.1         0.
CV409B2    21.9    148825.
*****************************************************************************
***       CV 410 is the Environment
***
CV41000 ENVIRONMENT   2  2  6
```

```
CV410A0 2
CV410A1 PVOL  101326.     PH2O 3480.
CV410A2 TATM  299.8       TPOL 299.8
CV410A3 MFRC.1 0.         MFRC.3 1.
CV410A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV  VOL
CV410B1  -17.2     0.
CV410B2    45.     1.E10
*******************************************************************************
*******************************************************************************
*** FLOW PATH PACKAGE INPUT
*******************************************************************************
*****     MSL/SRV Flow Path
*****     From RPV MSL outlet to T-Quencher in Wetwell
*****     Modified by J. J. Carbajo, ORNL
*****
FL36200  STEAM-LINE-SRV  360  200  16.73  -15.01
FL36201  0.1201   47.15   0.0   0.1955   0.2794 *modified by JJC
FL36202  0  0  0  1  *  VERT, ACTIVE, NO BUBBLES, BUBBLES
FL36203  4.0  5.0   * modified by JJC
FL362V0  -1  105  105
FL362S1  0.1201   47.15   0.39104  5.E-6 * modified by JJC
***
***
***        CF105 GIVES FRACTION OPEN OF THE MSL/SRV FLOW PATH (FL362)
***        IT IS THE SUM OF 4 CONTROL FUNCTIONS, EACH GIVING THE NUMBER
***        OF VALVES OPEN IN ONE SUBSET WITH MONOTONE OPEN/CLOSE
***        CHARACTERISTICS
***
CF10500   SRV   ADD     4    0.07692  0.0  *SF = 1./13  *  modified by JJC
CF10511    1.    0.   CFVALU.101          *NUMBER OPEN IN GROUP 1
CF10512    1.    0.   CFVALU.102          *NUMBER OPEN IN GROUP 2
CF10513    1.    0.   CFVALU.103          *NUMBER OPEN IN GROUP 3
CF10514    1.    0.   CFVALU.104          *NUMBER OPEN IN GROUP 4
***
CF10100   SRV-1  HYST   1    1.0     0.0  *GROUP 1, SRVS 1,6,9
CF10101   0.0                             *INITIAL VALUE
CF10103   -11   -21                       *LOAD/UNLOAD TF NUMBERS
CF10110   1.0   0.0     CFVALU.99
***
***        TF011 GIVES THE NUMBER OF VALVES IN GROUP 1
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01100  SRV-LOAD-1     6    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF01110  7.68759E6  0.0
TF01111  7.68760E6  1.0   *SRV 1 (1115 PSI)
TF01160  7.79101E6  1.0
TF01161  7.79102E6  2.0   *SRV 6 (1130 PSI)
TF01190  7.84617E6  2.0
TF01191  7.84618E6  3.0   *SRV 9 (1138 PSI)
***
***        TF021 GIVES THE NUMBER OF VALVES IN GROUP 1
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02100  SRV-UNLOAD-1   6    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF02110  7.25322E6  0.0
TF02111  7.25323E6  1.0   *SRV 1 (1052 PSI)
TF02160  7.32217E6  1.0
TF02161  7.32218E6  2.0   *SRV 6 (1062 PSI)
TF02190  7.39112E6  2.0
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```
TF02191  7.39113E6  3.0   *SRV 9 (1072 PSI)
***
CF10200   SRV-2  HYST   1    1.0     0.0  *GROUP 2, SRVS 2,3,7,8,12
CF10201   0.0                             *INITIAL VALUE
CF10203   -12   -22                       *LOAD/UNLOAD TF NUMBERS
CF10210   1.0   0.0     CFVALU.99
***
***        TF012 GIVES THE NUMBER OF VALVES IN GROUP 2
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01200  SRV-LOAD-2    10    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF01220  7.70827E6  0.0
TF01221  7.70828E6  1.0   *SRV 2 (1118 PSI)
TF01230  7.72206E6  1.0
TF01231  7.72207E6  2.0   *SRV 3 (1120 PSI)
TF01270  7.79791E6  2.0
TF01271  7.79792E6  3.0   *SRV 7 (1131 PSI)
TF01280  7.82548E6  3.0
TF01281  7.82549E6  4.0   *SRV 8 (1135 PSI)
TF012C0  1.03420E7  4.0  *  modified by JJC
TF012C1  1.03421E7  5.0  ****SRV 12 (1500 PSI) SPRING VALVE ***** mod. JJC
***
***        TF022 GIVES THE NUMBER OF VALVES IN GROUP 2
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02200  SRV-UNLOAD-2   8    1.0     0.0
***
***      PRESSURE  FRACTION OPEN
TF02220  7.10154E6  0.0
TF02221  7.10155E6  1.0   *SRV 2 (1030 PSI)
TF02230  7.18428E6  1.0
TF02271  7.18429E6  3.0   *SRVS 3+7 (1042 PSI)
TF02280  7.24633E6  3.0
TF02281  7.24634E6  4.0   *SRV 8 (1051 PSI)
TF022C0  7.26012E6  4.0
TF022C1  7.26013E6  5.0   *SRV 12 (1053 PSI)
***
CF10300   SRV-3  HYST   1    1.0     0.0  *GROUP 3, SRVS 4,5,10,11
CF10301   0.0                             *INITIAL VALUE
CF10303   -13   -23                       *LOAD/UNLOAD TF NUMBERS
CF10310   1.0   0.0     CFVALU.99
***
***        TF013 GIVES THE NUMBER OF VALVES IN GROUP 3
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01300  SRV-LOAD-3     8    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF01340  7.75654E6  0.0
TF01341  7.75655E6  1.0   *SRV 4 (1125 PSI)
TF01350  7.76343E6  1.0
TF01351  7.76344E6  2.0   *SRV 5 (1126 PSI)
TF013A0  7.85996E6  2.0
TF013A1  7.85997E6  3.0   *SRV 10 (1140 PSI)
TF013B0  7.86685E6  3.0
TF013B1  7.86686E6  4.0   *SRV 11 (1141 PSI)
***
***        TF023 GIVES THE NUMBER OF VALVES IN GROUP 3
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02300  SRV-UNLOAD-3   8    1.0     0.0
***
```

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***       PRESSURE  NUMBER OPEN
TF02340   6.99123E6  0.0
TF02341   6.99124E6  1.0   *SRV 4 (1014 PSI)
TF02350   7.05328E6  1.0
TF02351   7.05329E6  2.0   *SRV 5 (1023 PSI)
TF023A0   7.11533E6  2.0
TF023A1   7.11534E6  3.0   *SRV 10 (1032 PSI)
TF023B0   7.30838E6  3.0
TF023B1   7.30839E6  4.0   *SRV 11 (1060 PSI)
***
CF10400    SRV-4  HYST   1    1.0     0.0  *GROUP 4, SRV  13
CF10401    0.0                             *INITIAL VALUE
CF10403    -14   -24                       *LOAD/UNLOAD TF NUMBERS
CF10410    1.0   0.0     CFVALU.99
***
***         TF014 GIVES THE NUMBER OF VALVES IN GROUP 4
***         WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01400   SRV-LOAD-4     2    1.0     0.0
***
***       PRESSURE  NUMBER OPEN
TF014D0   1.03420E7  0.0  *  modified by JJC
TF014D1   1.03421E7  1.0   *****SRV 13 (1500 PSI) SPRING VALVE ***** Mod. JJC
***
***         TF024 GIVES THE NUMBER OF VALVES IN GROUP 4
***         WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02400   SRV-UNLOAD-4   2    1.0     0.0
***
***       PRESSURE  NUMBER OPEN
TF024D0   6.99812E6  0.0
TF024D1   6.99813E6  1.0   *SRV 13 (1015 PSI)
***
***        CF99  gives the pressure difference between the primary system
***        and the drywell
***
CF09900   PDIF  ADD  2  1. 0.
CF09910   1.0  1.08E5  CVH-P.360  *  PRESSURE IN STEAM DOME * modif. JJC
CF09911 -1.0  0.0  CVH-P.101  *  PRESSURE IN DRYWELL
**********************************************************************
***        ADS SYSTEM - 5 SRV VALVES  *   by JJC  April 1992  *
***
FL36300    ADS-5-SRVS 360  200  16.73  -15.01
FL36301    0.046195  47.15  0.0 0.0542 0.2794
FL36302    0 0 0 1
FL36303    4.0 5.0
FL363V0    -1  106 106
FL363S1    0.046195 47.15 0.242523 5.0E-6
***
CF10600    'OPEN ADS'  L-A-IFTE  3  1.0  0.0
CF10601    0.0   *  INITIAL  VALUE
CF10605    'NORMAL'
CF10610    1.0  0.0  CFVALU.107
CF10611    0.0  0.0  TIME
CF10612    0.0  1.0  TIME
***
CF10700    'LEVEL-IN-VESSEL'  L-GT  2  1.0  0.0
CF10701    .TRUE.
CF10705    'LATCH'
CF10706    2 'WATER LEVEL AT 1/3 OF ACTIVE CORE'
CF10710    1.0   0.0   CVH-CLIQLEV.340  *  Colapsed liq.level in core
CF10711    0.0   6.7643  TIME  *  Liquid level 50 inches above BAF ** 1/3 CORE *
***
***
```

```
*************************************************************************
***       Manual Depressurization
***       JJC    April 1992
***
FL36400   MANUAL-DEPRES   360  200  16.73  -15.01
FL36401   0.009239  47.15   0.0  0.04542  0.2794
FL36402   0 0 0 1
FL36403   4.0  4.0
FL364V0   -1  108  108
FL364S1   0.009239  47.15  0.1085  5.0E-6
***
CF10800   SRV-MANUAL L-A-IFTE  3  1.0 0.0
CF10801   0.0
CF10810   1.0  0.0  CFVALU.200
CF10811   1.0  0.0  CFVALU.201
CF10812   0.0  0.0  TIME
***
CF20000   TIME-CRITER   L-GT  2  1.0 0.0
CF20001   .FALSE.
CF20010   1.0  0.0  TIME
CF20011   0.0  200.0  TIME
***
CF20100   VALVE-OPEN  HYST  1  1.0  0.0
CF20101   0.0
CF20103   -202  -203
CF20110   1.0  0.0  CFVALU.99
***
TF20200   SRV-OPEN  3  1.0  0.0
TF20210   7.101581E6 0.0
TF20211   7.101599E6 1.0 *open at 1030 psig as per PECO
TF20212   8.0E6      1.0
***
TF20300   SRV-CLOSE  3  1.0  0.0
TF20310   6.429361E6  0.0  * close at 930 psig as per PECO fax
TF20311   6.429371E6  1.0
TF20312   8.0E6       1.0
***
*************************************************************************
***       Drywell head flange seals failure
****      JJC  April 1992
***
FL39800   DW-HD-FAILURE   102  408   18.42   26.1
FL39801   0.04  0.1016   0.0  *  normally closed
FL39802   0  0  0  0
FL39803   10.0  10.0
FL398S0   0.04   0.1016   0.0043  1.0E-4
FL398V0   -1   151  151
****
CF15100   DW-HD-FAILFRAC   L-A-IFTE   3   1.0  0.0
CF15101   0.0    *  initial value
CF15111   1.0  0.0  CFVALU.152
CF15112   1.0  0.0  CFVALU.160
CF15113   0.0  0.0  TIME
***
CF15200   DW-HD-FAIL    L-AND 2  1.0  0.0
CF15201   .FALSE.
CF15211   1.0  0.0   CFVALU.153     *   Temp. criterion
CF15212   1.0  0.0   CFVALU.154     *    DP   criterion
***
CF15300   TEMP-CRIT.    L-GT   2   1.0  0.0
CF15301   .FALSE.
CF15305   'LATCH'
CF15306   2 'DRYWELL HEAD FLANGE SEALS FAILURE TEMP. EXCEEDED'
CF15311   1.0  0.0   HS-TEMP.1000203    *  Node  3  of Drywell liner in Volume 102
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```
CF15312   0.0  644.3  TIME  *   700 F  Temperature
****
CF15400    DP-CRITE   L-GT   2   1.0   0.0
CF15401   .FALSE.
CF15406   2 'CONTAINMENT PRES. FOR HEAD FLANGE SEALS EXCEEDED'
CF15411   1.0  0.0   CFVALU.155
CF15412   0.0  565370.0   TIME   *  82  psig   DP
***
CF15500    DIFF-PRES    ADD    2   1.0  0.0
CF15511    1.0  0.0   CVH-P.102
CF15512   -1.0  0.0   CVH-P.408
***
CF16000    FRAC-OPEN   TAB-FUN    1   1.0  0.0
CF16003   161
CF16010    1.0 0.0  CFVALU.155
****
TF16100    AREA-VS-DP     4    1.0  0.0
TF16111     -1.0E9     0.0
TF16112     565370.0   0.0
TF16113    1378951.4   1.0
TF16114      1.0E9     1.0
***
*************************************************************************
***       Wetwell/Drywell vacuum breaker Flow Path
***
***       From the Wetwell through the vacuum breakers
***         to the Vent Lines (effectively to the Drywell)* CORRECTED **
***
FL02100  WET-DRY-VACRV   200   150   -10.13   -9.61 * modified JJC
FL02101  1.86   0.5   0.0   0.445   2.06
FL02102  3  0  0  0  *  HORIZ, ACTIVE, ATMOS/ATMOS, ATMOS/ATMOS
FL02103  1.0  1.0
FL021V0  -1    2    2
FL021S1  1.86   0.5   0.445   5.E-6
***
***     CF001, CF002, and TF030 open and close the
***       vacuum relief valves at 0.5 psi (3447 Pa)
***       differential pressure between the wetwell
***       and the drywell
***
***         CF002 = SF*TF030 where SF = 1.0
***         TF030 = function (CF001)
***         CF001 = P.CV200 - P.CV100
***
CF00200  VAC-RV   TAB-FUN   1   1.00   0.00
CF00203  30
CF00210  1.00    0.00   CFVALU.001
***
***       CF200 = wetwell pressure - drywell pressure
***
CF00100  VAC-RV-DP    ADD   2   1.00   0.00
CF00110   1.00  0.00  CVH-P.200
CF00111  -1.00  0.00  CVH-P.150
***
TF03000  VAC-RV-AREA   4   1.00   0.00
***
***      FRACTION OPEN   PRESSURE
TF03010  0.00            0.00
TF03011  3.444E+03       0.00
TF03012  3.447E+03       1.00
TF03013  2.000E+04       1.00
*************************************************************************
***       Vent Lines/Vent Header/Downcomers
***       From the Drywell to the Wetwell
```

```
***
FL01200  VENT-OPENING  101  150  -6.7   -6.7
FL01201  26.6   13.1   1.0   2.30   0.73 * CHANGED HEIGHT TO HALF of 2.3 M
FL01202  3  0  0  0 * CHANGED TO HORIZONTAL FLOW
FL01203  6.7  6.7
FL012S1  26.6   13.1   1.31   5.E-6
*****************************************************************************
FL02000  DOWNCOMEREX   150   200    -12.81     -12.81
FL02001  26.6   3.9   1.0   0.001    0.001
FL02002  0   0   0   1
FL02003  1.0   1.0
FL020S1  26.6    3.9   1.31   5.0E-6
*****************************************************************************
*****    NEW FLOWS FOR MULTI-CELL DRYWELL
*****
FL01000  DW-LOW-H   100  101  -6.195 -6.195
FL01001  8.6  1.0  1.0  3.31  3.31
FL01002  3  0  0  0
FL01003  1.0  1.0
FL010S1  8.6  1.0  1.5  5.0E-6
*****
FL01100  DW-EX-V    101  102   6.47  6.47
FL01101  62.592  0.5  1.0
FL01102  0  0  0  0
FL01103  1.0  1.0
FL011S1  62.592  0.5  6.0  5.0E-6
*****
FL01300  DW-MED-H  101  103   5.0  5.0
FL01301   0.21361   1.0  1.0
FL01302  3  0  0  0
FL01303  1.0  1.0
FL013S1  0.21361  1.0  1.0  5.0E-6
*****
FL01400  DW-IN-V  100   103   2.0   3.086
FL01401  3.2  1.1  1.0
FL01402  0  0  0  0
FL01403  1.5  1.5
FL014S1  3.2  1.1  0.5  5.0E-6
*****
FL01500  DW-TOP   102  103   15.431  15.431
FL01501  5.292  0.5  1.0
FL01502  0  0  0  0
FL01503  1.0  1.0
F1015S1  5.292  0.5  1.0  5.0E-6
*****************************************************************************
*****    Pump Seal Leakage Taken From Downcomer Vol 310 (45%)
*****
FL37000  LEAKAGE-DOWN   310  100  6.838   -6.0
FL37001  2.783E-6   0.15   1.0
FL37002  3  0  0  0
FL37003  1.0  1.0
FL370S1  2.783E-6   0.15   0.001631
*****************************************************************************
*****    CRD Seal Leakage Taken From Lower Plenum (55%)
*****
FL37100  LEAKAGE-LP   320  100    0.1     -6.0
FL37101  3.399E-6   0.15   1.0
FL37102  0  0  0  0
FL37103  1.0  1.0
FL371S1  3.399E-6   0.15   0.001804
*****************************************************************************
***      RPV FLOW PATHS
***
***  FLOW PATH ZFM AND ZTO CONSISTENT WITH HEIGHTS AND BOTTOM OF CONTROL VOLUMES
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***  HYDRAULIC DIAMETERS AND FRICTION FACTORS CONSISTENT WITH LASALLE DECK
***  JMM  01/16/86
*****************************************************************************
***PATH  FLNAME  KCVFM  KCVTO   ZFM      ZTO
FL31200  AN-LP   310    320    8.080    3.086 * 8.080 M = JET PUMP THROAT
FL32300  LP-BP   320    330    5.4943   5.4943
FL32400  LP-CH   320    340    5.4943   5.4943
FL34500  CH-SH   340    350    9.667    9.667
FL33500  BP-SH   330    350    9.667    9.667
FL35600  SH-SD   350    360   15.431   15.431
FL36100  SD-AN   360    310   15.431   15.431
***
***PATH  FLARA   FLLEN   FLOPO   FLHGTF   FLHGTT     FLNAME
FL31201  0.6782  4.9936   1.0    0.1524   0.1524  *  AN-LP
FL32301  6.1502  1.9050   .01289 0.1524   0.0254  *  LP-BP
FL32401  7.9428  1.9050   .61748 0.1524   0.1016  *  LP-CH
FL33501  6.1502  1.9050   1.0    0.0254   0.0254  *  BP-SH
FL34501  7.9428  1.9050   .67561 0.1325   0.1325  *  CH-SH
FL35601  4.7763  4.1885   1.0    0.1676   0.1676  *  SH-SD
FL36101 26.1069  5.3492   1.0    0.6484   0.6484  *  SD-AN
***
***PATH  SAREA   SLEN    SHYD    SRGH     SLAM     FLNAME
FL312S1  0.0339  4.9936  .27783  5.0E-06  16.0  *  AN-LP
FL323S1  6.1502  1.9050  .05841  5.0E-06  16.0  *  LP-BP
FL324S1  7.9428  1.9050  .01359  5.0E-06  16.0  *  LP-CH
FL335S1  6.1502  1.9050  .05841  5.0E-06  16.0  *  BP-SH
FL345S1  7.9428  1.9050  .01359  5.0E-06  16.0  *  CH-SH
FL356S1  4.7763  4.1885  .00878  5.0E-06  16.0  *  SH-SD
FL361S1 26.1069  5.3492  .73944  5.0E-06  16.0  *  SD-AN
***
***PATH  FRICFO   FRICRO     FLNAME   DF      DT
FL31203  0.0785   17.0    *  AN-LP    0.2078  5.3066
FL32303  0.5188   4.97    *  LP-BP    5.0201  2.7983
FL32403  10.216   13.267  *  LP-CH    5.0201  3.1801
FL33503  50.0     0.5     *  BP-SH    2.7983  4.3326
FL34503  5.6885   5.6885  *  CH-SH    3.1801  4.3326
FL35603  12.585   5.0475  *  SH-SD    2.4660  6.3557
FL36103  0.11     0.11    *  SD-AN    6.3557  5.7654
***
***PATH  KFLGFL  KACTFL   IBUBF   IBUBT   FLNAME
FL31202    0       0       0       0  *  AN-LP
FL32302    0       0       0       0  *  LP-BP
FL32402    0       0       0       0  *  LP-CH
FL33502    0       0       0       0  *  BP-SH
FL34502    0       0       0       0  *  CH-SH
FL35602    0       0       0       0  *  SH-SD
FL36102    0       0       0       0  *  SD-AN
*****************************************************************************
***      SECONDARY CONTAINMENT FLOW PATHS
*****************************************************************************
FL40000   'CONT FAIL'   200  401  -9.0    -9.0 * CHANGED TO WETWELL
FL40001   .100  0.001 0.0          * INITIALLY CLOSED
FL40002   3 * HORIZONTAL FLOW PATH
FL40003   0.593   0.593
FL400S0   .102  0.001  1.0
FL400V0   150  145  145
***
***       CF150 opens the flow path from the WETwell to the reactor
***       building at containment failure, CF145 sets the fraction open
***       CF149 writes the time of occurrence
CF14500   CONT-BRK  EQUALS  1  0.0  1.0
CF14510   1.0  0.0  TIME
***
CF15000   'FAIL THRESH' T-O-F  1  1. 0.
```

```
CF15003    -1.E9  1.1935E6
CF15010    1. 0. CVH-P.200
***
CF14900   'CONT-FAIL MES'  L-GT  2  1.0  0.0
CF14901   .FALSE.
CF14905   'LATCH'
CF14906   2  'CONTAINMENT FAILURE BY HIGH WETWELL PRESSURE'
CF14911   1.0  0.0  CVH-P.200
CF14912   0.0  1.1935E6  TIME
***
***
***       NAME              FROM     TO     ZFROM      ZTO
FL40100 TORUS-135           401      402    -4.7       -4.1
FL40200 135-165-SHAFT       402      404     4.5        5.1
FL40300 135-SO-NO           402      403      .2         .2
FL40400 LEAK-135-SO         402      410      .2         .2
FL40500 BO-135-TURB         403      409      .2        6.2
FL40600 LEAK-135-NO         403      410      .2         .2
FL40700 165-195-SHAFT       404      406    13.6       14.2
FL40800 165-SE-MAIN         404      405     9.35       9.35
FL40900 LEAK-165-SE         404      410     9.35       9.35
FL41000 LEAK-165-MAIN       405      410     9.35       9.35
FL41100 195-SE-REFUEL       406      408    25.5       26.1
FL41200 195-SE-MAIN         406      407    19.85      19.85
FL41300 LEAK-195-SE         406      410    19.85      19.85
FL41400 LEAK-195-MAIN       407      410    19.85      19.85
FL41500 BO-REFUEL-ENV       408      410    34.9       34.9
FL41600 LEAK-REFUEL         408      410    35.55      35.55
FL41700 LEAK-TURB           409      410    13.5       13.5
***
***       AREA      LENGTH    FLOPO   HGTF   HGTTO
FL40101    8.6       .86      1.      .3      .3
FL40201   33.2      3.32      1.      .3      .3
FL40301   25.       2.5       1.      .3      .3
FL40401    0.025     .0025    1.      .1      .1
FL40501    2.8       .28      0.      .3      .3
FL40601    0.025     .0025    1.      .1      .1
FL40701   33.2      3.32      1.      .3      .3
FL40801   43.8      4.38      1.      .3      .3
FL40901    0.025     .0025    1.      .1      .1
FL41001    0.025     .0025    1.      .1      .1
FL41101   33.2      3.32      1.      .3      .3
FL41201   74.6      7.46      1.      .3      .3
FL41301    0.025     .0025    1.      .1      .1
FL41401    0.025     .0025    1.      .1      .1
FL41501   22.3      2.23      0.      .3      .3
FL41601    0.109     0.0109   1.      .1      .1
FL41701    0.29      0.0109   1.      .1      .1
***
***       TYPE   ACTIVE   IBUBF   IBUBTO
FL40102    1       0       0       0
FL40202    1       0       0       0
FL40302    4       0       0       0
FL40402    4       0       0       0
FL40502    1       0       0       0
FL40602    4       0       0       0
FL40702    1       0       0       0
FL40802    4       0       0       0
FL40902    4       0       0       0
FL41002    4       0       0       0
FL41102    1       0       0       0
FL41202    4       0       0       0
FL41302    4       0       0       0
FL41402    4       0       0       0
```

```
FL41502    4       0       0       0
FL41602    4       0       0       0
FL41702    4       0       0       0
***
***       FRICFO     FRICREV
FL40103     .5         .5
FL40203     .5         .5
FL40303     .5         .5
FL40403    1.         1.
FL40503     .5         .5
FL40603     .5         .5
FL40703     .5         .5
FL40803     .5         .5
FL40903    1.         1.
FL41003    1.         1.
FL41103     .5         .5
FL41203     .5         .5
FL41303    1.         1.
FL41403    1.         1.
FL41503     .5         .5
FL41603    1.         1.
FL41703    1.         1.
***
***       SAREA     SLEN   SHYD    SRGH   SLAM
FL401S1   8.6       .01      1.
FL402S1  33.2       .01      1.
FL403S1  25.        .01      1.
FL404S1   0.025     .01      1.
FL405S1   2.8       .01      1.
FL406S1   0.025     .01      1.
FL407S1  33.2       .01      1.
FL408S1  43.8       .01      1.
FL409S1    .025     .01      1.
FL410S1    .025     .01      1.
FL411S1  33.2       .01      1.
FL412S1  74.6       .01      1.
FL413S1   0.025     .01      1.
FL414S1   0.025     .01      1.
FL415S1  22.3       .01      1.
FL416S1    .109     .01      1.
FL417S1    .29      .01      1.
***
***                --- VALVES ---
***       TRIP NO.   CF-ON-FORWARD  CF-ON-REVERSE
FL405V1     110          111           111
FL415V1     140          141           141
***
***       TABULAR AND CONTROL FUNCTIONS FOR VALVE INPUT
***
CF10900  405-DP    ADD    4  1.  0.
CF10910   1.    0.  CVH-P.403
CF10911  -1.    0.  CVH-P.409
CF10912 -42.18  0.  CVH-RHOA.403
CF10913  10.79  0.  CVH-RHOA.409
***
CF11000  405-TRIP  T-O-F  1  1.  0.
CF11003  -1.E6  1551.3
CF11010  1.  0.  CFVALU.109
***
CF11100  405-FRAC  HYST    1   1.  0.
CF11103  -410   -400
CF11110  1.  0.  CFVALU.109
***
TF40000  405-UNLOAD  1  1.  0.
```

```
TF40010  0.     1.
***
TF41000  405-A-DP  5 1. 0.
TF41010  1551.3  0.1
TF41011  1637.5  0.1857
TF41012  1723.7  0.7429
TF41013  1809.9  0.8357
TF41014  1898.0  1.
***
CF13900  415-DP    ADD    4  1.  0.
CF13910   1.    0.  CVH-P.408
CF13911  -1.    0.  CVH-P.410
CF13912 -86.33  0.  CVH-RHOA.408
CF13913 511.1   0.  CVH-RHOA.410
***
CF14000  415-TRIP  T-O-F  1  1.  0.
CF14003  -1.E6  2154.6
CF14010  1.  0.  CFVALU.139
***
CF14100  415-FRAC  HYST    1   1.  0.
CF14103  -440   -400
CF14110  1.  0.  CFVALU.139
***
TF44000  415-A-DP  5 1. 0.
TF44010  2154.6  0.1
TF44011  2274.3  0.2
TF44012  2394.0  0.8
TF44013  2513.7  0.9
TF44014  2633.4  1.
*******************************************************************************
*******************************************************************************
*** HEAT SLAB PACKAGE INPUT
*******************************************************************************
***   HS NAMES
***
***SLAB        NAME
HS10001001  DW-LINER-101
HS10002001  DW-LINER-102
HS10010001  DW-FLOOR-100
HS10011001  DW-FLOOR-101
HS10003001  REAC-PED-103-101
HS10013001  REAC-PED-103-102
HS10004001  LO-REAC-PED
HS10005001  DW-STEEL-101
HS10006001  DW-STEEL-102
HS10009001  STEEL-100
HS20001001  WETWELL-LINER
HS20002001  WETWELL-STEEL
HS31001001  RPV-CYLINDER
HS32001001  LOWER-HEAD
HS35003001  SEPARATORS
HS36001001  DRYERS
HS36002001  UPPER-HEAD
*************************************************************************
***   HS MATERIALS
***
***SLAB        MATERIAL       INT     NAME
HS10001201    'CARBON STEEL'   4  *  DRYWELL-LINER-101
HS10002201    'CARBON STEEL'   4  *  DRYWELL-LINER-102
HS10010201     CONCRETE       10  *  DRYWELL-FLOOR-100
HS10011201     CONCRETE       10  *  DRYWELL-FLOOR-101
HS10003201     CONCRETE        7  *  REAC-PED-103-101
HS10013201     CONCRETE        7  *  REAC-PED-103-102
HS10004201     CONCRETE        7  *  LO-REAC-PED
```

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HS10005201    'CARBON STEEL'    3  *  DRYWELL-STEEL-101
HS10006201    'CARBON STEEL'    3  *  DRYWELL-STEEL-102
HS10009201    'CARBON STEEL'    3  *  STEEL-100
HS20001201    'CARBON STEEL'    4  *  WETWELL-LINER
HS20002201    'CARBON STEEL'    3  *  WETWELL-STEEL
HS31001201    'CARBON STEEL'    6  *  RPV-CYLINDER
HS32001201    'CARBON STEEL'    5  *  LOWER-HEAD
HS35003201   'STAINLESS STEEL' 4  *  SEPARATORS
HS36001201   'STAINLESS STEEL' 1  *  DRYERS
HS36002201    'CARBON STEEL'    5  *  UPPER-HEAD
*************************************************************************
***   HS GEOMETRIES
***
***SLAB      NO. T  GEOMETRY        INITIAL     NAME
***          NODES  SL CY SP HB HT  N  Y  I
HS10001000    5      1               0        *  DRYWELL-LINER-101
HS10002000    5      1               0        *  DRYWELL-LINER-102
HS10010000   11      1               0        *  DRYWELL-FLOOR-100
HS10011000   11      1               0        *  DRYWELL-FLOOR-101
HS10003000    8      1               0        *  REAC-PED-103-101
HS10013000    8      1               0        *  REAC-PED-103-102
HS10004000    8      1               0        *  LO-REAC-PED
HS10005000    4      1               0        *  DRYWELL-STEEL-101
HS10006000    4      1               0        *  DRYWELL-STEEL-102
HS10009000    4      1               0        *  STEEL-100
HS20001000    5      1               0        *  WETWELL-LINER
HS20002000    4      1               0        *  WETWELL-STEEL
HS31001000    7         2            0        *  RPV-CYLINDER
HS32001000    6         2            0        *  LOWER-HEAD, MODELLED AS CYLINDER
HS35003000    5      1               0        *  SEPARATORS
HS36001000    2      1               0        *  DRYERS
HS36002000    6                   5  0        *  UPPER-HEAD
*************************************************************************
***   HS ELEVATIONS/ORIENTATIONS
***
***SLAB      ELEVATION  ORIENTATION         NAME
***                     VT  HZ  OT
HS10001002     -8.635  1.0              *  DRYWELL-LINER-101
HS10002002      6.470  1.0              *  DRYWELL-LINER-102
HS10010002     -8.635  0.0              *  DRYWELL-FLOOR-100
HS10011002     -8.635  0.0              *  DRYWELL-FLOOR-101
HS10003002      3.086  1.0              *  REAC-PED-103-101
HS10013002      6.47   1.0              *  REAC-PED-103-102
HS10004002     -8.635  1.0              *  LO-REAC-PED
HS10005002     -8.635  1.0              *  DRYWELL-STEEL-101
HS10006002      6.470  1.0              *  DRYWELL-STEEL-102
HS10009002     -3.0    1.0              *  STEEL-100
HS20001002    -11.660  1.0              *  WETWELL-LINER
HS20002002    -13.18   1.0              *  WETWELL-STEEL
HS31001002      3.1856 1.0              *  RPV-CYLINDER
HS32001002      0.7550                  *  LOWER-HEAD (TOP OF STUB TUBES) *modified
HS35003002     10.92   1.0              *  SEPARATORS
HS36001002     16.18   1.0              *  DRYERS
HS36002002     19.0343 1.0              *  UPPER-HEAD
*************************************************************************
***   HS D/T FORMATS
***
***SLAB      LOC T   FORMAT   LOCATION        NAME
***          DATA    D/T N-M  L/I BOUNDRY
HS10001100     -1    1            0.0     *  DRYWELL-LINER-101
HS10002100     -1    1            0.0     *  DRYWELL-LINER-102
HS10010100     -1    1            0.0     *  DRYWELL-FLOOR-100
HS10011100     -1    1            0.0     *  DRYWELL-FLOOR-101
HS10003100     -1    1            0.0     *  REAC-PED-103-101
```

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HS10013100     -1    1            0.0     *  REAC-PED-103-102
HS10004100     -1    1            0.0     *  LO-REAC-PED
HS10005100     -1    1            0.0     *  DRYWELL-STEEL-101
HS10006100     -1    1            0.0     *  DRYWELL-STEEL-102
HS10009100     -1    1            0.0     *  STEEL-100
HS20001100     -1    1            0.0     *  WETWELL-LINER
HS20002100     -1    1            0.0     *  WETWELL-STEEL
HS31001100     -1    1            3.1856  *  RPV-CYLINDER
HS32001100     -1    1            2.5797  *  LOWER-HEAD (RAD OF SHROUD)
HS35003100     -1    1            0.0     *  SEPARATORS
HS36001100     -1    1            0.0     *  DRYERS
HS36002100     -1    1            3.1856  *  UPPER-HEAD
*************************************************************************
***   HS D/T DATA
*************************************************************************
***   DRYWELL-LINER- 101 and  102
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10001102      0.00305    2
HS10001103      0.00914    3
HS10001104      0.01524    4
HS10001105      0.02858    5
***
HS10002102      0.00305    2
HS10002103      0.00914    3
HS10002104      0.01524    4
HS10002105      0.02858    5
***
*************************************************************************
***   DRYWELL-FLOOR- 100 and 101
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10010102      0.00305    2
HS10010103      0.00914    3
HS10010104      0.02134    4
HS10010105      0.04572    5
HS10010106      0.09144    6
HS10010107      0.18288    7
HS10010108      0.36576    8
HS10010109      0.67056    9
HS10010110      1.00584   10
HS10010111      1.44250   11
***
***
HS10011102    0.00305       2
HS10011103    0.00914       3
HS10011104    0.02134       4
HS10011105    0.04572       5
HS10011106    0.09144       6
HS10011107    0.18288       7
HS10011108    0.36576       8
HS10011109    0.67056       9
HS10011110    1.00584      10
HS10011111    1.44250      11
*************************************************************************
***   REAC-PED
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10003102      0.00305    2
HS10003103      0.00914    3
HS10003104      0.02134    4
```

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HS10003105      0.04572    5
HS10003106      0.09144    6
HS10003107      0.18288    7
HS10003108      0.34930    8
***
***
HS10013102    0.00305       2
HS10013103    0.00914       3
HS10013104    0.02134       4
HS10013105    0.04572       5
HS10013106    0.09144       6
HS10013107    0.18288       7
HS10013108    0.34930       8
*****************************************************************************
***   LO-REAC-PED
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10004102      0.00305    2
HS10004103      0.00914    3
HS10004104      0.02134    4
HS10004105      0.04572    5
HS10004106      0.10668    6
HS10004107      0.24384    7
HS10004108      0.53340    8
***
***         TEMPERATURE
*HS10004801    391.77       1
*HS10004802    391.49       2
*HS10004803    390.94       3
*HS10004804    389.83       4
*HS10004805    387.60       5
*HS10004806    382.05       6
*HS10004807    369.55       7
*HS10004808    343.16       8
*****************************************************************************
***   DRYWELL-STEEL- 101 and 102 and STEEL-100
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10005102      0.00305    2
HS10005103      0.00762    3
HS10005104      0.01747    4
***
***
HS10006102    0.00305        2
HS10006103    0.00762        3
HS10006104    0.01747        4
***
HS10009102    0.00305     2
HS10009103    0.00762     3
HS10009104    0.01747     4
*****************************************************************************
***   WETWELL-LINER
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS20001102      0.00305    2
HS20001103      0.00601    3
HS20001104      0.01219    4
HS20001105      0.01588    5
***
*****************************************************************************
***  WETWELL-STEEL
```

```
***
***SLAB          DISTANCE  NODE
***                         NO.
HS20002102        0.00305    2
HS20002103        0.00795    3
HS20002104        0.01747    4
***
*****************************************************************************
***   RPV-CYLINDER
***
***   SLAB       DISTANCE  NODE
***                         NO.
HS31001102         3.1886    2  *  3.1856 M = LOC OF NODE 1
HS31001103         3.1926    3
HS31001104         3.2006    4
HS31001105         3.2156    5
HS31001106         3.2556    6
HS31001107         3.3412    7  *  3.3412 M - 3.1856 M = 0.1556 M = 6.125 IN
***
*****************************************************************************
***   LOWER-HEAD
***
***   SLAB       DISTANCE  NODE
***                         NO.
HS32001102         2.5807    2  *  2.5797 M = LOC OF NODE 1
HS32001103         2.5837    3
HS32001104         2.5907    4
HS32001105         2.6157    5
HS32001106         2.6983    6  *  2.6983 M - 2.5797 M = 0.1176 M = 4.63 IN
***
*****************************************************************************
***   TOP-GUIDE COMBINED WITH CORE CELL STEEL MASS
***   SHROUD-DOME COMBINED WITH SEPARATORS
***
***   SEPARATORS
***
***   SLAB       DISTANCE  NODE
***                         NO.
HS35003102         0.0030    2
HS35003103         0.0069    3
HS35003104         0.0119    4
HS35003105         0.0186    5
***
*****************************************************************************
***   DRYERS
***
***   SLAB       DISTANCE  NODE
***                         NO.
HS36001102       1.83E-03    2
***
*****************************************************************************
***   UPPER-HEAD
***
***   SLAB       DISTANCE  NODE
***                         NO.
HS36002102         3.1886    2  *  3.1856 M = LOC OF NODE 1
HS36002103         3.1926    3
HS36002104         3.2006    4
HS36002105         3.2256    5
HS36002106         3.2872    6  *  3.2872 M - 3.1856 M = 0.1016 M = 4 IN
***
*****************************************************************************
***   HS INTERNAL POWER SOURCES
***
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```
***SLAB      INT POW      NAME
***          SOURCE
***           N  Y
HS10001300   -1        *  DRYWELL-LINER-101
HS10002300   -1        *  DRYWELL-LINER-102
HS10010300   -1        *  DRYWELL-FLOOR-100
HS10011300   -1        *  DRYWELL-FLOOR-101
HS10003300   -1        *  REAC-PED-103-101
HS10013300   -1        *  REAC-PED-103-102
HS10004300   -1        *  LO-REAC-PED
HS10005300   -1        *  DRYWELL-STEEL-101
HS10006300   -1        *  DRYWELL-STEEL-102
HS10009300   -1        *  STEEL 100
HS20001300   -1        *  WETWELL-LINER
HS20002300   -1        *  WETWELL-STEEL
HS31001300   -1        *  RPV-CYLINDER
HS32001300   -1        *  LOWER HEAD
HS35003300   -1        *  SEPARATORS
HS36001300   -1        *  DRYERS
HS36002300   -1        *  UPPER-HEAD
*************************************************************************
***   HS LEFT/INSIDE BOUNDARY CONDITIONS
***
***SLAB      TYPE        VOL  COEF.       CRT POOL     POOL  ATM    NAME
***          SYM CONV         FLOW        FRACTION     ONLY  ONLY
***                           TYPE        POOL ATM
HS10001400      1        101  'EXT'       1.0  1.0  *         X     DRYWELL-LINER-101
HS10002400      1        102  'EXT'       1.0  1.0  *         X     DRYWELL-LINER-102
HS10010400      1        100  'EXT'       0.0  0.0  *               DRYWELL-FLOOR-100
HS10011400      1        101   'EXT'      0.0  0.0  *               DRYWELL-FLOOR-101
HS10003400      1        103  'EXT'       1.0  1.0  *         X     REAC-PED-103-101
HS10013400      1        103  'EXT'       1.0  1.0  *         X     RAEC-PED-103-102
HS10004400      1        100  'EXT'       1.0  1.0  *         X     LO-REAC-PED
HS10005400      1        101  'EXT'       1.0  1.0  *         X     DRYWELL-STEEL-101
HS10006400      1        102   'EXT'      1.0  1.0  *         X     DRYWELL-STEEL-102
HS10009400      1        100   'EXT'      1.0  1.0  *         X     STEEL-100
HS20001400      1        200  'EXT'       0.0  0.0  *    X          WETWELL-LINER
HS20002400      1        200  'EXT'       1.0  1.0  *         X     WETWELL-STEEL
HS31001400      1        310  'EXT'   .40593 .40593 *               RPV-CYLINDER
HS32001400      1        320  'EXT'       1.0  1.0  *         X     LOWER HEAD
HS35003400      1        350  'EXT'       1.0  1.0  *         X     SEPARATORS
HS36001400      1        360  'EXT'       1.0  1.0  *         X     DRYERS
HS36002400      1        360  'EXT'       1.0  1.0  *         X     UPPER-HEAD
**************************************************************************
***   HS RIGHT/OUTSIDE BOUNDARY CONDITIONS
***
***SLAB      TYPE        VOL   COEF.    CRT POOL     POOL  ATM    NAME
***          SYM CONV          FLOW     FRACTION     ONLY  ONLY
***                            TYPE     POOL ATM
HS10001600   0                                     *              DRYWELL-LINER-101
HS10002600   0                                     *              DRYWELL-LINER-102
HS10010600   0                                     *              DRYWELL-FLOOR-100
HS10011600   0                                     *              DRYWELL-FLOOR-101
HS10003600   1          101   'EXT'   1.  1.      *              REAC-PED-103-101
HS10013600   1          102   'EXT'   1.  1.      *              REAC-PED-103-102
HS10004600   1          101   'EXT'   1.  1.      *              LO-REAC-PED
HS10005600   0                                     *              DRYWELL-STEEL-101
HS10006600   0                                     *              DRYWELL-STEEL-102
HS10009600   1          101    'EXT'  1.  1.      *              STEEL-100
HS20001600    1         401   'EXT'   1.    1.    *        X     WETWELL-LINER
HS20002600   0                                     *              WETWELL-STEEL
HS31001600      5120    103   'EXT'   1.0  1.0    *        X     RPV-CYLINDER
HS32001600      5120    100   'EXT'   1.0  1.0    *        X     LOWER HEAD
HS35003600      1       310   'EXT'   1.0  1.0    *        X     SEPARATORS
```

```
HS36001600   0                                  *              DRYERS
HS36002600      5120   102   'EXT'   1.0  1.0  *        X     UPPER-HEAD
*****************************************************************************
***      HS LEFT/INSIDE AREAS/LENGTHS
***
***   SLAB    AREA     CH L      AX L          NAME
HS10001500  1235.80   15.105    15.105     *  DRYWELL-LINER-101
HS10002500   500.0    17.0      17.0       *  DRYWELL-LINER-102
HS10010500    29.92    5.50      5.50      *  DRYWELL-FLOOR-100
HS10011500   205.0    14.32     14.32      *  DRYWELL-FLOOR-101
HS10003500   267.38    3.38      3.38      *  REAC-PED-103-101
HS10013500   300.00    8.9       8.9       *  REAC-PED-103-102
HS10004500   337.24    7.50      7.50      *  LO-REAC-PED
HS10005500   800.58   15.105    15.105     *  DRYWELL-STEEL-101
HS10006500   350.0    10.55     10.55      *  DRYWELL-STEEL-102
HS10009500   496.5     4.874     4.874     *  STEEL-100
HS20001500  1584.00    2.96      2.96      *  WETWELL-LINER
HS20002500  4188.53    5.182     5.182     *  WETWELL-STEEL
HS31001500   317.224  12.245    12.245     *  RPV-CYLINDER
HS32001500    33.141   0.5404    0.5404    *  LOWER HEAD * modified, structure split
***                                        *               into LH
HS35003500   472.43    3.99      3.99      *  SEPARATORS
HS36001500  2945.03    2.23      2.23      *  DRYERS
HS36002500    63.762   3.1856    3.1856    *  UPPER-HEAD
*****************************************************************************
***      HS RIGHT/OUTSIDE AREAS/LENGTHS
***
***   SLAB    AREA     CH L      AX L         NAME
HS10003700   267.38    3.38      3.38      *  REAC-PED-103-101
HS10013700   300.0     8.9       8.9       *  REAC-PED-103-102
HS10004700   337.24    7.5       7.5       *  LO-REAC-PED
HS10009700   496.5     4.874     4.874     *  STEEL-100
HS20001700  1584.00    2.96      2.96      *  WETWELL-LINER
HS31001700   332.716  12.245    12.245     *  RPV-CYLINDER
HS32001700    34.652   0.5404    0.5404    *  LOWER HEAD * modified structure split
****                                       *               into LH
HS35003700   472.43    3.99      3.99      *  SEPARATORS
HS36002700    67.894   3.2872    3.2872    *  UPPER-HEAD
*****************************************************************************
***  ADDITIONAL HEAT STRUCTURES FOR CORE/LP SHROUD
*****************************************************************************
* LOWER PLENUM SHROUD - LOWER PLENUM TO DOWNCOMER HEAT TRANSFER
*
*  TWO HEAT SLABS, HS32002 & HS32003 ADDED DUE TO DT/DZ PROBLEMS * HS32001 SPLIT INTO
*                                                                 * 3 HS *
*
HS32002000  6   2   0
HS32002001  LOWER-HEAD2
HS32002002  1.2954
HS32002100  -1   1   3.1877
HS32002102  3.1887     2
HS32002103  3.1917     3
HS32002104  3.1987     4
HS32002105  3.2137     5
HS32002106  3.3063     6
HS32002201  'CARBON STEEL'   5
HS32002300  -1
HS32002400  1     320  'EXT'  1.0  1.0
HS32002500  33.1   0.9803     0.9803
HS32002600  5120   100   'EXT'   1.0  1.0
HS32002700   34.6    0.9803   0.9803
*
HS32003000  6  2  0
HS32003001  LOWER-HEAD3
```

```
HS32003002  2.2757
HS32003100  -1  1   2.5797
HS32003102  2.5807   2
HS32003103  2.5837   3
HS32003104  2.5907   4
HS32003105  2.6157   5
HS32003106  2.6983   6
HS32003201  'CARBON STEEL'  5
HS32003300  -1
HS32003400  1   320  'EXT'  1.0  1.0
HS32003500  33.1  0.9803  0.9803
HS32003600  5120  100  'EXT'  1.0  1.0
HS32003700  34.6  0.9803  0.9803
*
HS32004000  5          2          1
HS32004001  'LP SHROUD4'
HS32004002  3.256      1.0                        * modified height
HS32004100 -1          2          2.5             * modified diameter
HS32004101  0.00508     1
HS32004102  0.01016     1
HS32004103  0.01524     1
HS32004104  0.02032     1
HS32004200 -1
HS32004201  'STAINLESS STEEL'       4
HS32004300 -1
HS32004400  1          320        'EXT'      0.2         0.2
HS32004500  18.645     0.9803     0.9803                     * modified
HS32004600  1          310        'EXT'      0.2         0.2
HS32004700  19.012     0.9803     0.9803                     * modified
*
HS32005000  5          2          1
HS32005001  'LP SHROUD5'
HS32005002  4.2363     1.0
HS32005100 -1          2          2.5             * modified diameter
HS32005101  0.00508     1
HS32005102  0.01016     1
HS32005103  0.01524     1
HS32005104  0.02032     1
HS32005200 -1
HS32005201  'STAINLESS STEEL'       4
HS32005300 -1
HS32005400  1          320        'EXT'      0.2         0.2
HS32005500  15.889     0.9803     0.9803
HS32005600  1          310        'EXT'      0.2         0.2
HS32005700  16.202     0.9803     0.9803
*
HS32006000  5          2          1
HS32006001  'LP SHROUD6'
HS32006002  5.2166     1.0
HS32006100 -1          2          2.5797
HS32006101  0.00508     1
HS32006102  0.01016     1
HS32006103  0.01524     1
HS32006104  0.02032     1
HS32006200 -1
HS32006201  'STAINLESS STEEL'       4
HS32006300 -1
HS32006400  1          320        'EXT'      0.2         0.2
HS32006500  4.501      0.2777     0.2777
HS32006600  1          310        'EXT'      0.2         0.2
HS32006700  4.590      0.2777     0.2777
*
* CORE SHROUD - CORE BYPASS TO DOWNCOMER HEAT TRANSFER
*
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HS33007000  5           2           1
HS33007001  'CORE SHROUD7'
HS33007002  5.4943      1.0
HS33007100 -1           2           2.5797
HS33007101  0.00508      1
HS33007102  0.01016      1
HS33007103  0.01524      1
HS33007104  0.02032      1
HS33007200 -1
HS33007201  'STAINLESS STEEL'        4
HS33007300 -1
HS33007400  1           330         'EXT'       0.2         0.2
HS33007500  12.351      0.762       0.762
HS33007600  1           310         'EXT'       0.2         0.2
HS33007700  12.594      0.762       0.762
*
HS33008000  5           2           1
HS33008001  'CORE SHROUD8'
HS33008002  6.2563      1.0
HS33008100 -1           2           2.5797
HS33008101  0.00508      1
HS33008102  0.01016      1
HS33008103  0.01524      1
HS33008104  0.02032      1
HS33008200 -1
HS33008201  'STAINLESS STEEL'        4
HS33008300 -1
HS33008400  1           330         'EXT'       0.2         0.2
HS33008500  12.351      0.762       0.762
HS33008600  1           310         'EXT'       0.2         0.2
HS33008700  12.594      0.762       0.762
*
HS33009000  5           2           1
HS33009001  'CORE SHROUD9'
HS33009002  7.0183      1.0
HS33009100 -1           2           2.5797
HS33009101  0.00508      1
HS33009102  0.01016      1
HS33009103  0.01524      1
HS33009104  0.02032      1
HS33009200 -1
HS33009201  'STAINLESS STEEL'        4
HS33009300 -1
HS33009400  1           330         'EXT'       0.2         0.2
HS33009500  12.351      0.762       0.762
HS33009600  1           310         'EXT'       0.2         0.2
HS33009700  12.594      0.762       0.762
*
HS33010000  5           2           1
HS33010001  'CORE SHROUD10'
HS33010002  7.7803      1.0
HS33010100 -1           2           2.5797
HS33010101  0.00508      1
HS33010102  0.01016      1
HS33010103  0.01524      1
HS33010104  0.02032      1
HS33010200 -1
HS33010201  'STAINLESS STEEL'        4
HS33010300 -1
HS33010400  1           330         'EXT'       0.2         0.2
HS33010500  12.351      0.762       0.762
HS33010600  1           310         'EXT'       0.2         0.2
HS33010700  12.594      0.762       0.762
*
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HS33011000  5           2           1
HS33011001  'CORE SHROUD11'
HS33011002  8.5423      1.0
HS33011100 -1           2           2.5797
HS33011101  0.00508      1
HS33011102  0.01016      1
HS33011103  0.01524      1
HS33011104  0.02032      1
HS33011200 -1
HS33011201  'STAINLESS STEEL'        4
HS33011300 -1
HS33011400  1           330         'EXT'        0.2          0.2
HS33011500  12.351      0.762       0.762
HS33011600  1           310         'EXT'        0.2          0.2
HS33011700  12.594      0.762       0.762
*************************************************************************
*****     TF120 specifies the dependence on temperature
*****     of the heat transfer coefficient for the insulated
*****     exterior of the reactor pressure vessel.  TF120
*****     specifies a constant heat transfer coefficient of
*****     6.62 W/M**2/deg K.
*****
TF12000   'RPV/DRYWELL HTC'   2      1.0      0.0
TF12010    273.15   6.62    5000.0   6.62
*************************************************************************
*****  SECONDARY CONTAINMENT SURFACES
*************************************************************************
*****  TORUS ROOM SURFACES
*****
HS04001000 15 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04001001 CENTRAL-COLUMN       *
HS04001002 -17.2  1.            * BOTTOM ALTITUDE, ORIENTATION
HS04001100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04001102  .001   2            *
HS04001103  .003   3
HS04001104  .007   4
HS04001105  .015   5
HS04001106  .023   6
HS04001107  .039   7
HS04001108  .071   8
HS04001109  .135   9
HS04001110  .263  10
HS04001111  .500  11
HS04001112  .750  12
HS04001113 1.00   13
HS04001114 1.50   14
HS04001115 2.0    15
HS04001201 CONCRETE   14            * MATERIAL TYPE, MESH INTERVAL
HS04001300 0                        * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04001400 1    401  'EXT' 1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04001500 805.  8.9  8.9           * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04001600 0                        * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04002000 11 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04002001 TORUS-ROOM-WALLS     *
HS04002002 -17.2   1.           * BOTTOM ALTITUDE, ORIENTATION
HS04002100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04002102  .001   2            *
HS04002103  .003   3
HS04002104  .007   4
HS04002105  .015   5
HS04002106  .023   6
HS04002107  .039   7
HS04002108  .071   8
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HS04002109  .135   9
HS04002110  .263  10
HS04002111  .500  11
HS04002201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04002300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04002400 1    401  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04002500 1391. 8.9  8.9             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04002600 2210 -1   'EXT'            * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04003000 15 1 0 0              * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04003001 FLOOR                 *
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04003002 -17.2   1.            * BOTTOM ALTITUDE, ORIENTATION
HS04003100   -1   1 0.           * NODALIZATION FLAGS, INSIDE RADIUS
HS04003102  .001   2             *
HS04003103  .003   3
HS04003104  .007   4
HS04003105  .015   5
HS04003106  .023   6
HS04003107  .039   7
HS04003108  .071   8
HS04003109  .135   9
HS04003110  .263  10
HS04003111  .500  11
HS04003112  .750  12
HS04003113 1.00   13
HS04003114 1.50   14
HS04003115 2.0    15
HS04003201 CONCRETE   14              * MATERIAL TYPE, MESH INTERVAL
HS04003300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04003400 1    401  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04003500 1166. 15.  5.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04003600 2210 -1   'EXT'            * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04005000 13 1 0 0              * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04005001 CEILING               *
HS04005002 -4.7    0.            * BOTTOM ALTITUDE, ORIENTATION
HS04005100 -1 1 0.               * NODALIZATION FLAGS, INSIDE RADIUS
HS04005102  .001   2             *
HS04005103  .003   3
HS04005104  .007   4
HS04005105  .015   5
HS04005106  .023   6
HS04005107  .039   7
HS04005108  .071   8
HS04005109  .135   9
HS04005110  .263  10
HS04005111  .500  11
HS04005112  .750  12
HS04005113 1.16   13
HS04005201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04005300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04005400 1    401  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04005500 1166. 11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04005600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
*****   LEVEL-135-SOUTH SURFACES
*****
HS04006000 13 1 0 0              * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04006001 EXTWALL               *
HS04006002 -4.1  1.              * BOTTOM ALTITUDE, ORIENTATION
HS04006100 -1 1 0.               * NODALIZATION FLAGS, INSIDE RADIUS
HS04006102  .001   2             * LOCATION, NODE NO.
HS04006103  .003   3
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HS04006104  .007   4
HS04006105  .015   5
HS04006106  .023   6
HS04006107  .039   7
HS04006108  .071   8
HS04006109  .135   9
HS04006110  .263  10
HS04006111  .500  11
HS04006112  .750  12
HS04006113  .900  13
HS04006201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04006300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04006400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04006500  671. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04006600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04006700  671. 7.5  7.5             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04007000 14 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04007001 PRIM-CONT-WALLS      *
HS04007002 -4.1    1.           * BOTTOM ALTITUDE, ORIENTATION
HS04007100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04007102  .001   2            *
HS04007103  .003   3
HS04007104  .007   4
HS04007105  .015   5
HS04007106  .023   6
HS04007107  .039   7
HS04007108  .071   8
HS04007109  .135   9
HS04007110  .263  10
HS04007111  .500  11
HS04007112  .750  12
HS04007113 1.00   13
HS04007114 1.50   14
HS04007201 CONCRETE   13              * MATERIAL TYPE, MESH INTERVAL
HS04007300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04007400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04007500 315.  7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04007600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04008000 11 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04008001 INT-WALLS            *
HS04008002 -4.1    1.           * BOTTOM ALTITUDE, ORIENTATION
HS04008100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04008102  .001   2            *
HS04008103  .003   3
HS04008104  .007   4
HS04008105  .015   5
HS04008106  .023   6
HS04008107  .039   7
HS04008108  .071   8
HS04008109  .135   9
HS04008110  .263  10
HS04008111  .350  11
HS04008201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04008300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04008400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04008500  950. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04008600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04009000 12 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04009001 CEILING              *
HS04009002  4.5    0.           * BOTTOM ALTITUDE, ORIENTATION
HS04009100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
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HS04009102  .001   2
HS04009103  .003   3
HS04009104  .007   4
HS04009105  .015   5
HS04009106  .023   6
HS04009107  .039   7
HS04009108  .071   8
HS04009109  .135   9
HS04009110  .263  10
HS04009111  .500  11
HS04009112  .6    12
HS04009201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04009202 CONCRETE   11
HS04009300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04009400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04009500  588. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04009600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04010000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04010001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04010002 -4.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04010100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04010102  .001   2
HS04010103  .003   3
HS04010104  .007   4
HS04010105  .015   5
HS04010106  .023   6
HS04010107  .039   7
HS04010108  .071   8
HS04010109  .135   9
HS04010110  .263  10
HS04010111  .500  11
HS04010112  .75   12
HS04010113 1.15   13
HS04010201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04010300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04010400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04010500  588. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04010600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04011000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04011001 MISC-STEEL
HS04011002 -4.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04011100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04011102  .0127  2
HS04011201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04011300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04011400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04011500 166.9 3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04011600 1    402  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04011700 166.9 3.    3.
*
*****   LEVEL-135-NORTH SURFACES
*****
HS04012000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04012001 EXTWALL
HS04012002 -4.1  1.                   * BOTTOM ALTITUDE, ORIENTATION
HS04012100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04012102  .001   2                  * LOCATION, NODE NO.
HS04012103  .003   3
HS04012104  .007   4
HS04012105  .015   5
HS04012106  .023   6
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HS04012107  .039   7
HS04012108  .071   8
HS04012109  .135   9
HS04012110  .263  10
HS04012111  .500  11
HS04012112  .750  12
HS04012113  .900  13
HS04012201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04012300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04012400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04012500  671. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04012600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04012700  671. 7.5  7.5             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04013000 14 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04013001 PRIM-CONT-WALLS
HS04013002 -4.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04013100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04013102  .001   2
HS04013103  .003   3
HS04013104  .007   4
HS04013105  .015   5
HS04013106  .023   6
HS04013107  .039   7
HS04013108  .071   8
HS04013109  .135   9
HS04013110  .263  10
HS04013111  .500  11
HS04013112  .750  12
HS04013113 1.00   13
HS04013114 1.50   14
HS04013201 CONCRETE   13              * MATERIAL TYPE, MESH INTERVAL
HS04013300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04013400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04013500 315.  7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04013600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04014000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04014001 INT-WALLS
HS04014002 -4.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04014100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04014102  .001   2
HS04014103  .003   3
HS04014104  .007   4
HS04014105  .015   5
HS04014106  .023   6
HS04014107  .039   7
HS04014108  .071   8
HS04014109  .135   9
HS04014110  .263  10
HS04014111  .350  11
HS04014201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04014300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04014400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04014500  948. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04014600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04015000 12 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04015001 CEILING
HS04015002  4.5    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04015100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04015102  .001   2
HS04015103  .003   3
HS04015104  .007   4
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HS04015105  .015   5
HS04015106  .023   6
HS04015107  .039   7
HS04015108  .071   8
HS04015109  .135   9
HS04015110  .263  10
HS04015111  .500  11
HS04015112  .6    12
HS04015201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04015202 CONCRETE   11
HS04015300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04015400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04015500  587. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04015600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04016000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04016001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04016002 -4.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04016100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04016102  .001   2
HS04016103  .003   3
HS04016104  .007   4
HS04016105  .015   5
HS04016106  .023   6
HS04016107  .039   7
HS04016108  .071   8
HS04016109  .135   9
HS04016110  .263  10
HS04016111  .500  11
HS04016112  .75   12
HS04016113 1.15   13
HS04016201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04016300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04016400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04016500  587. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04016600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04017000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04017001 MISC-STEEL
HS04017002 -4.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04017100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04017102  .0127  2
HS04017201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04017300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04017400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04017500 166.9 3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04017600 1    403  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04017700 166.9 3.    3.
*
*****   LEVEL-165-SE SURFACES
*****
HS04018000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04018001 EXTWALL
HS04018002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04018100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04018102  .001   2
HS04018103  .003   3
HS04018104  .007   4
HS04018105  .015   5
HS04018106  .023   6
HS04018107  .039   7
HS04018108  .071   8
HS04018109  .135   9
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HS04018110  .263  10
HS04018111  .500  11
HS04018112  .750  12
HS04018113  .90   13
HS04018201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04018300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04018400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04018500  345. 8.3  8.3             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04018600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04018700  345. 8.3  8.3             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04019000 15 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04019001 PCWALL
HS04019002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04019100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04019102  .001   2
HS04019103  .003   3
HS04019104  .007   4
HS04019105  .019   5
HS04019106  .023   6
HS04019107  .039   7
HS04019108  .071   8
HS04019109  .135   9
HS04019110  .263  10
HS04019111  .500  11
HS04019112  .750  12
HS04019113 1.00   13
HS04019114 1.50   14
HS04019115 1.70   15
HS04019201 CONCRETE   14              * MATERIAL TYPE, MESH INTERVAL
HS04019300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04019400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04019500 153.  8.3  8.3             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04019600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04020000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04020001 INTWALL
HS04020002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04020100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04020102  .001   2
HS04020103  .003   3
HS04020104  .007   4
HS04020105  .015   5
HS04020106  .023   6
HS04020107  .039   7
HS04020108  .071   8
HS04020109  .135   9
HS04020110  .263  10
HS04020111  .450  11
HS04020201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04020300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04020400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04020500 1652. 8.3  8.3             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04020600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04021000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04021001 CEILING
HS04021002 13.6    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04021100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04021102  .001   2
HS04021103  .003   3
HS04021104  .007   4
HS04021105  .015   5
HS04021106  .023   6
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HS04021107  .039   7
HS04021108  .071   8
HS04021109  .135   9
HS04021110  .263  10
HS04021111  .500  11
HS04021201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04021202 CONCRETE   10
HS04021300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04021400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04021500  291. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04021600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04022000 12 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04022001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04022002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04022100 -1  1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04022102  .001   2
HS04022103  .003   3
HS04022104  .007   4
HS04022105  .015   5
HS04022106  .023   6
HS04022107  .039   7
HS04022108  .071   8
HS04022109  .135   9
HS04022110  .263  10
HS04022111  .500  11
HS04022112  .600  12
HS04022201 CONCRETE   11              * MATERIAL TYPE, MESH INTERVAL
HS04022300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04022400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04022500  261. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04022600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04023000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04023001 STEEL
HS04023002  5.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04023100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04023102  .0127  2
HS04023201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04023300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04023400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04023500  7.9  3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04023600 1    404  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04023700  7.9  3.    3.
*
*****   LEVEL-165-MAIN SURFACES
HS04024000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04024001 EXTWALL
HS04024002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04024100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04024102  .001   2
HS04024103  .003   3
HS04024104  .007   4
HS04024105  .015   5
HS04024106  .023   6
HS04024107  .039   7
HS04024108  .071   8
HS04024109  .135   9
HS04024110  .263  10
HS04024111  .500  11
HS04024112  .750  12
HS04024113  .90   13
HS04024201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
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HS04024300 0                                  * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04024400 1     405   'EXT'  1.  1.          * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04024500 1030. 8.3   8.3                    * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04024600 4200 410   'EXT'  1.  1.           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04024700 1030. 8.3   8.3                    * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04025000 15 1 0 0                           * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04025001 PCWALL
HS04025002  5.1     1.                        * BOTTOM ALTITUDE, ORIENTATION
HS04025100 -1 1 0.                            * NODALIZATION FLAGS, INSIDE RADIUS
HS04025102  .001    2
HS04025103  .003    3
HS04025104  .007    4
HS04025105  .019    5
HS04025106  .023    6
HS04025107  .039    7
HS04025108  .071    8
HS04025109  .135    9
HS04025110  .263   10
HS04025111  .500   11
HS04025112  .750   12
HS04025113 1.00    13
HS04025114 1.50    14
HS04025115 1.70    15
HS04025201 CONCRETE    14                     * MATERIAL TYPE, MESH INTERVAL
HS04025300 0                                  * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04025400 1     405   'EXT'  1.  1.          * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04025500 457.  8.3   8.3                    * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04025600 0                                  * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04026000 11 1 0 0                           * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04026001 INTWALL
HS04026002  5.1     1.                        * BOTTOM ALTITUDE, ORIENTATION
HS04026100 -1 1 0.                            * NODALIZATION FLAGS, INSIDE RADIUS
HS04026102  .001    2
HS04026103  .003    3
HS04026104  .007    4
HS04026105  .015    5
HS04026106  .023    6
HS04026107  .039    7
HS04026108  .071    8
HS04026109  .135    9
HS04026110  .263   10
HS04026111  .450   11
HS04026201 CONCRETE    10                     * MATERIAL TYPE, MESH INTERVAL
HS04026300 0                                  * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04026400 1     405   'EXT'  1.  1.          * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04026500  950. 8.3   8.3                    * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04026600 0                                  * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04027000 11 1 0 0                           * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04027001 CEILING
HS04027002 13.6     0.                        * BOTTOM ALTITUDE, ORIENTATION
HS04027100 -1 1 0.                            * NODALIZATION FLAGS, INSIDE RADIUS
HS04027102  .001    2
HS04027103  .003    3
HS04027104  .007    4
HS04027105  .015    5
HS04027106  .023    6
HS04027107  .039    7
HS04027108  .071    8
HS04027109  .135    9
HS04027110  .263   10
HS04027111  .500   11
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HS04027201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04027202 CONCRETE   10
HS04027300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04027400 1    405  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04027500  874. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04027600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04028000 12 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04028001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04028002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04028100 -1  1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04028102  .001   2
HS04028103  .003   3
HS04028104  .007   4
HS04028105  .015   5
HS04028106  .023   6
HS04028107  .039   7
HS04028108  .071   8
HS04028109  .135   9
HS04028110  .263  10
HS04028111  .500  11
HS04028112  .600  12
HS04028201 CONCRETE   11              * MATERIAL TYPE, MESH INTERVAL
HS04028300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04028400 1    405  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04028500  784. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04028600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04029000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04029001 STEEL
HS04029002  5.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04029100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04029102  .0127  2
HS04029201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04029300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04029400 1    405  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04029500 23.8  3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04029600 1    405  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04029700 23.8  3.    3.
*
***** LEVEL-195-SE SURFACES
*****
HS04030000 12 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04030001 EXTWALL
HS04030002 14.2    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04030100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04030102  .001   2
HS04030103  .003   3
HS04030104  .007   4
HS04030105  .015   5
HS04030106  .023   6
HS04030107  .039   7
HS04030108  .071   8
HS04030109  .135   9
HS04030110  .263  10
HS04030111  .500  11
HS04030112  .600  12
HS04030201 CONCRETE   11              * MATERIAL TYPE, MESH INTERVAL
HS04030300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04030400 1    406  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04030500  588. 5.1  5.1             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04030600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04030700  588. 5.1  5.1             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
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HS04031000 14 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04031001 PCWALL
HS04031002 14.2    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04031100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04031102  .001   2
HS04031103  .003   3
HS04031104  .007   4
HS04031105  .015   5
HS04031106  .023   6
HS04031107  .039   7
HS04031108  .071   8
HS04031109  .135   9
HS04031110  .263  10
HS04031111  .500  11
HS04031112  .750  12
HS04031113 1.0    13
HS04031114 1.5    14
HS04031201 CONCRETE   13               * MATERIAL TYPE, MESH INTERVAL
HS04031300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04031400 1    406  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04031500 258.  5.1  5.1              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04031600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04033000 11 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04033001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04033002 14.2   1.                   * BOTTOM ALTITUDE, ORIENTATION
HS04033100 -1     1 0.                 * NODALIZATION FLAGS, INSIDE RADIUS
HS04033102  .001   2
HS04033103  .003   3
HS04033104  .007   4
HS04033105  .015   5
HS04033106  .023   6
HS04033107  .039   7
HS04033108  .071   8
HS04033109  .135   9
HS04033110  .263  10
HS04033111  .500  11
HS04033201 CONCRETE   10               * MATERIAL TYPE, MESH INTERVAL
HS04033300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04033400 1    406  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04033500 245.  11.  11.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04033600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04034000 10 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04034001 CEILING
HS04034002 25.5    0.                  * BOTTOM ALTITUDE, ORIENTATION
HS04034100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04034102  .001   2
HS04034103  .003   3
HS04034104  .007   4
HS04034105  .015   5
HS04034106  .023   6
HS04034107  .039   7
HS04034108  .071   8
HS04034109  .135   9
HS04034110  .150  10
HS04034201 'CARBON STEEL'     2        * MATERIAL TYPE, MESH INTERVAL
HS04034202 CONCRETE    9
HS04034300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04034400 1    406  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04034500 245.  11.  11.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04034600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
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*
HS04035000  2 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04035001 STEEL
HS04035002 14.2    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04035100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04035102  .0127  2
HS04035201 'CARBON STEEL'     1        * MATERIAL TYPE, MESH INTERVAL
HS04035300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04035400 1    406  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04035500  4.5  3.    3.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04035600 1    406  'EXT'  1.  1.     * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04035700  4.5  3.    3.
*
***** LEVEL-195-MAIN SURFACES
*****
HS04036000 12 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04036001 EXTWALL
HS04036002 14.2    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04036100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04036102  .001   2
HS04036103  .003   3
HS04036104  .007   4
HS04036105  .015   5
HS04036106  .023   6
HS04036107  .039   7
HS04036108  .071   8
HS04036109  .135   9
HS04036110  .263  10
HS04036111  .500  11
HS04036112  .600  12
HS04036201 CONCRETE   11               * MATERIAL TYPE, MESH INTERVAL
HS04036300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04036400 1    407  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04036500 1222. 5.1  5.1              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04036600 4200 410  'EXT'  1.  1.     * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04036700 1222. 5.1  5.1              * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04037000 14 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04037001 PCWALL
HS04037002 14.2    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04037100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04037102  .001   2
HS04037103  .003   3
HS04037104  .007   4
HS04037105  .015   5
HS04037106  .023   6
HS04037107  .039   7
HS04037108  .071   8
HS04037109  .135   9
HS04037110  .263  10
HS04037111  .500  11
HS04037112  .750  12
HS04037113 1.0    13
HS04037114 1.5    14
HS04037201 CONCRETE   13               * MATERIAL TYPE, MESH INTERVAL
HS04037300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04037400 1    407  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04037500 950.  5.1  5.1              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04037600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04039000 11 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04039001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04039002 14.2   1.                   * BOTTOM ALTITUDE, ORIENTATION
```

```
HS04039100 -1     1 0.                  * NODALIZATION FLAGS, INSIDE RADIUS
HS04039102  .001   2
HS04039103  .003   3
HS04039104  .007   4
HS04039105  .015   5
HS04039106  .023   6
HS04039107  .039   7
HS04039108  .071   8
HS04039109  .135   9
HS04039110  .263  10
HS04039111  .500  11
HS04039201 CONCRETE   10                 * MATERIAL TYPE, MESH INTERVAL
HS04039300 0                            * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04039400 1    407  'EXT'  1.  1.      * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04039500 307.  11.  11.               * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04039600 0                            * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04040000 10 1 0 0                     * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04040001 CEILING
HS04040002 25.5    0.                   * BOTTOM ALTITUDE, ORIENTATION
HS04040100 -1 1 0.                      * NODALIZATION FLAGS, INSIDE RADIUS
HS04040102  .001   2
HS04040103  .003   3
HS04040104  .007   4
HS04040105  .015   5
HS04040106  .023   6
HS04040107  .039   7
HS04040108  .071   8
HS04040109  .135   9
HS04040110  .150  10
HS04040201 'CARBON STEEL'     2         * MATERIAL TYPE, MESH INTERVAL
HS04040202 CONCRETE    9
HS04040300 0                            * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04040400 1    407  'EXT'  1.  1.      * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04040500 307.  11.  11.               * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04040600 0                            * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04041000  2 1 0 0                     * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04041001 STEEL
HS04041002 14.2    1.                   * BOTTOM ALTITUDE, ORIENTATION
HS04041100 -1 1 0.                      * NODALIZATION FLAGS, INSIDE RADIUS
HS04041102  .0127  2
HS04041201 'CARBON STEEL'     1         * MATERIAL TYPE, MESH INTERVAL
HS04041300 0                            * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04041400 1    407  'EXT'  1.  1.      * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04041500 13.3  3.    3.               * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04041600 1    407  'EXT'  1.  1.      * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04041700 13.3  3.    3.
*
*****  REFUELING BAY SURFACES
HS04042000  6 1 0 0                     * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04042001  EXTWALL
HS04042002 26.1    1.                   * BOTTOM ALTITUDE, ORIENTATION
HS04042100 -1 1 0.                      * NODALIZATION FLAGS, INSIDE RADIUS
HS04042102  .0002  2
HS04042103  .0004  3
HS04042104  .0008  4
HS04042105  .0015  5
HS04042106  .00254 6
HS04042201 'CARBON STEEL'     5         * MATERIAL TYPE, MESH INTERVAL
HS04042300 0                            * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04042400 1    408  'EXT'  1.  1.      * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04042500 3063. 16.  16.               * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04042600 0                            * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
```

```
*
HS04043000  6 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04043001  CEILING
HS04043002 45.0    0.                  * BOTTOM ALTITUDE, ORIENTATION
HS04043100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04043102  .002   2
HS04043103  .004   3
HS04043104  .008   4
HS04043105  .015   5
HS04043106  .0254  6
HS04043201 'CARBON STEEL'     5        * MATERIAL TYPE, MESH INTERVAL
HS04043300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04043400 1    408  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04043500 1661. 16.  16.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04043600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04044000 10 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04044001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04044002 26.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04044100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04044102  .001   2
HS04044103  .003   3
HS04044104  .007   4
HS04044105  .015   5
HS04044106  .023   6
HS04044107  .039   7
HS04044108  .071   8
HS04044109  .135   9
HS04044110  .230  10
HS04044201 CONCRETE    9               * MATERIAL TYPE, MESH INTERVAL
HS04044300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04044400 1    408  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04044500 1362. 16.  16.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04044600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04045000  2 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04045001  STEEL
HS04045002 26.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04045100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04045102  .0127  2
HS04045201 'CARBON STEEL'     1        * MATERIAL TYPE, MESH INTERVAL
HS04045300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04045400 1    408  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04045500 356.   3.   3.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04045600 1    408  'EXT'  1.  1.     * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04045700 356.   3.   3.
*
***** TURBINE BUILDING SURFACES
HS04046000  6 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04046001  EXTWALL
HS04046002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04046100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04046102  .0002  2
HS04046103  .0004  3
HS04046104  .0008  4
HS04046105  .0015  5
HS04046106  .00254 6
HS04046201 'CARBON STEEL'     5        * MATERIAL TYPE, MESH INTERVAL
HS04046300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04046400 1    409  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04046500 8137.  16. 16.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04046600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
```

```
HS04047000  6 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04047001  CEILING
HS04047002 21.9    0.                  * BOTTOM ALTITUDE, ORIENTATION
HS04047100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04047102  .002   2
HS04047103  .004   3
HS04047104  .008   4
HS04047105  .015   5
HS04047106  .0254  6
HS04047201 'CARBON STEEL'     5        * MATERIAL TYPE, MESH INTERVAL
HS04047300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04047400 1    409  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04047500 8807. 16.  16.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04047600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04048000  6 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04048001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04048002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04048100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04048102  .2     5
HS04048103  .23    6
HS04048201 CONCRETE    5               * MATERIAL TYPE, MESH INTERVAL
HS04048300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04048400 1    409  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04048500 8807. 16.  16.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04048600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04049000  2 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04049001  STEEL
HS04049002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04049100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04049102 .0127   2
HS04049201 'CARBON STEEL'     1        * MATERIAL TYPE, MESH INTERVAL
HS04049300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04049400 1    409  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04049500 356.   3.   3.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04049600 1    409  'EXT'  1.  1.     * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04049700 356.   3.   3.
*****************************************************************************
***** TABULAR FUNCTION INPUT FOR HEAT SLABS
*****
TF20000 'RHS HT COEF' 1 1. 0. * NAME, NO. PAIRS, MUL CONST, ADD CONST
TF20010 0. 6.08               * TIME, HEAT TRANSFER COEFFICIENT
*
TF21000 'RHS T - 286' 1 1. 0. * NAME, NO. PAIRS, MUL CONST, ADD CONST
TF21010 0. 286.               * TIME, RHS TEMPERATURE
*****************************************************************************
*****************************************************************************
*** CORE PACKAGE INPUT
*****************************************************************************
*
*       CORE NODALIZATION CHANGED FROM 3 RADIAL RINGS AND 6 AXIAL LAYERS TO
*       3 RADIAL RINGS AND 5 AXIAL LAYERS (TOTAL AXIAL NODES 11)
*****************************************************************************
***  GENERAL CORE INPUT
*****************************************************************************
*         NRAD     NAXL      NTLP     NCVOL   NLH     NPNTOT
COR00000  3        11        6        3       5       3
*
*         RFUEL    RCLAD     DRGAP    PITCH   DXCAN   DXSS    DXLH
COR00001  .005207  .0061341  .0001143 .016    .00254  .0012   .2254
*
*         IRTYP   MCRP
```

```
COR00002  BWR     B4C
*
*         FCNCL   FSSCN   FCELR   FCELA   FLPUP
COR00003  0.50    0.95    0.30    0.15    0.95   * CHNGED FROM DFLT VALS 1-22-90
*
*         NTPCOR
COR00004  101
*
*         HFRZFU  HFRZZR  HFRZSS  HFRZZX  HFRZSX  HFRZCP
COR00005  1000.0  1000.0  1000.0  1000.0  1000.0  1000.0
*
*         MTUOZR  MTZXZR  MTSXSS  MTCPSS  FUOZR   FZXZR   FSXSS   FCPSS
COR00007  1       2       2       2       0.2     1.0     1.0     0.0
*
*         DRCLMN  DRSSMN
COR00008  1.0E-06  1.0E-06
*
*         HDBPN    HDBLH    TPFAIL    CDISPN
COR00009  500.0    500.0    1273.15    1.0 *
*
*
*         XFE      XCR      XNI      XCAR
COR00010  0.74     0.18     0.08     0.0
*
*         CELL ELEVATIONS AND POROSITIES
*         Z        DZ       PORIN    PORDP
CORZ0101  0.0      1.2954   0.0      0.9 ** LOWER PLENUM **
CORZ0201  1.2954   0.9803   0.00     0.9
CORZ0301  2.2757   0.9803   0.00     0.9
CORZ0401  3.2560   0.9803   0.00     0.9
CORZ0501  4.2363   0.9803   0.00     0.9
CORZ0601  5.2166   0.2777   0.00     0.9 ** CORE PLATE **
CORZ0701  5.4943   0.7620   0.53     0.9 ** CORE **
CORZ0801  6.2563   0.7620   0.53     0.9
CORZ0901  7.0183   0.7620   0.53     0.9
CORZ1001  7.7803   0.7620   0.53     0.9
CORZ1101  8.5423   0.7620   0.53     0.9
*
*
*         CELL CROSS-SECTIONAL BOUNDARY AREAS
*         ASCELA
CORR0101  7.648
CORR0201  7.287
CORR0301  2.251
*
*         BOUNDARY HEAT STRUCTURES
CORZ0102  32001
CORZ0202  32002    *flag changed to 0
CORZ0302  32003
CORZ0402  32004
CORZ0502  32005
CORZ0602  32006 11  *CORE SUPPORT PLATE
CORZ0702  33007
CORZ0802  33008
CORZ0902  33009
CORZ1002  33010
CORZ1102  33011
*
CORR0102  35003
CORR0202  35003
CORR0302  35003
*******************************************************************************
*         LOWER PLENUM AND CORE INPUT
*******************************************************************************
```

```
* CRD HOUSING
* CR GUIDE TUBES (185)
* CORE SUPPORT STRUCTURE (FUEL SUPPORT PIECES, CORE PLATE,
*   AND FUEL ASSEMBLY NOSE PIECES)
*
*  R A     IREFN    ICVHC    ICVHB
COR10101   -1       320      320  *  LOWER PLENUM:  CRD HOUSING
COR20101   101
COR30101   101
*
COR10201   -1       320      320  *  LOWER PLENUM:  CR GUIDE TUBES
COR20201   102
COR30201   102
*
COR10301   102
COR20301   202
COR30301   302
*
COR10401   102      320      320
COR20401   202
COR30401   302
*
COR10501   102      320      320
COR20501   202
COR30501   302
*
COR10601   -1       320      320  *  LOWER PLENUM:  CORE SUPPORT STRUCTURES
COR20601   106
COR30601   106
*
COR10701   -1       340      330  *  CORE
COR20701   107
COR30701   107
*
COR10801   107
COR20801   207
COR30801   307
*
COR10901   107
COR20901   207
COR30901   307
*
COR11001   107
COR21001   207
COR31001   307
*
COR11101   107
COR21101   207
COR31101   307
*
*              XMFU      XMCL      *XMSS*    XMCP      XMCN
COR10102       0.0       0.0    5420.0      0.0       0.0    *CRD HOUSING steel added
COR20102       0.0       0.0    5094.0      0.0       0.0    * steel added
COR30102       0.0       0.0    1529.0      0.0       0.0    * steel added
*
COR10202       0.0       0.0    6550.00     0.0       0.0    *  CR GUIDE TUBES *modif
COR20202      -1.E3     -1.E3   6100.      -1.E3     -1.E3   * modified JJC 6/92
COR30202      -1.E3     -1.E3   1900.00    -1.E3     -1.E3   * modified JJC 6/92
*
COR10602       0.0       0.0    6675.0      0.0       0.0    *  CORE SUPPORT
COR20602      -1.E3     -1.E3   6360.0     -1.E3     -1.E3   *  STRUCTURES
COR30602      -1.E3     -1.E3   1965.0     -1.E3     -1.E3
*
COR10702  14995.     3153.     1077.     158.9    2339.     *  CORE
```

```
COR20702  14287.    3004.     1026.    151.4   2229.
COR30702   4414.     928.      317.     46.8    688.5
*
***  TOP GUIDE INCLUDED WITH AXIAL LEVEL 11 STEEL MASS
COR11102     -1.E3    -1.E3  10744.     -1.E3    -1.E3
COR21102     -1.E3    -1.E3  10237.     -1.E3    -1.E3
COR31102     -1.E3    -1.E3   3163.     -1.E3    -1.E3
*
*         TFU     TCL     TSS     TCN
COR10103  564.0   564.0   564.0   564.0  *  CRD HOUSING
COR10203  564.0   564.0   564.0   564.0  *  CR GUIDE TUBES
COR10603  564.0   564.0   564.0   564.0  *  CORE SUPPORT STRUCTURES
COR10703  564.0   564.0   564.0   564.0  *  CORE
*
*         DHYCL   DHYSS   DHYDP   DHYCNC  DHYCNB
COR10104  1.0     1.0     0.0254   1.0     1.0   *  CRD HOUSING
COR10204  1.0     0.3     0.0254   1.0     1.0   *  CR GUIDE TUBES
COR10604  1.0     0.15    0.0254   1.0     1.0   *  CORE SUPPORT STRUCTURES
COR10704  0.005   0.003   0.0254   0.005   0.003 *  CORE
*
*         ASCELR  AFLOWC  AFLOWB
COR10105  12.70   7.187   0.0    *  CRD HOUSING modified
COR20105  17.75   6.848   0.0    *  modified
COR30105  19.04   2.115   0.0    *  modified
*
COR10205  9.61    7.348  0.0    *  CR GUIDE TUBES modified - back to original
COR20205  13.43   7.001  0.0    *  modified - back to original values
COR30205  14.41   2.163  0.0    *  modified - back to original values
*
COR10605  2.72    4.6171  0.0    *  CORE SUPPORT STRUCTURES modified - back to orig
COR20605  3.80    4.3992  0.0    *  modified - back to original values
COR30605  4.08    1.3592  0.0    *  modified - back to original values
*
COR10705  7.47    3.53775 1.068  *  CORE
COR20705  10.44   3.3708  1.0176
COR30705  11.20   1.0414  0.3144
*
*           ASFU    ASCL    ASSS    ASCN
COR10106    0.0     0.0   40.0     0.0   *  CRD HOUSING modified 8/92
COR20106    0.0     0.0   30.0     0.0   *   modified 8/92
COR30106    0.0     0.0   14.0     0.0   *   modified 8/92
*
COR10206    0.0     0.0   82.53    0.0   *  CR GUIDE TUBES  modified
COR20206   -1.E3   -1.E3  78.63   -1.E3  *  modified
COR30206   -1.E3   -1.E3  24.3    -1.E3  *  modified
*
COR10606    0.0     0.0    66.75    0.0   *  CORE SUPPORT STRUCTURES
COR20606   -1.E3   -1.E3   63.6    -1.E3
COR30606   -1.E3   -1.E3   19.65   -1.E3
*
COR10706  525.4    639.2  203.4   138.9   *  CORE
COR20706  500.7    609.0  193.9   132.3
COR30706  154.7    188.2   59.9    40.9
*****************************************************************************
*      LOWER HEAD INPUT
*****************************************************************************
*         IRS     IRE    XMLH     TLH     ASLH    ICVLH   ICVCAV
CORLHD01  1       1      13670.0  561.0   7.648   320     100
CORLHD02  2       2      13025.0  561.0   7.287   320     100
CORLHD03  3       3       4024.0  561.0   2.251   320     100
*****************************************************************************
*         LOWER HEAD PENETRATIONS INPUT
*****************************************************************************
*         ALL PENETRATIONS ARE CRD HOUSINGS AND STUB TUBES
```

```
*          GEOMETRIC VALUES ARE ESTIMATES
*
*          IPNREF  IRP     XMPN    TPN     ASPN    AXPN    DFLPN
CORPEN01   -1      1       940.0   561.0   24.43   0.575   0.1
CORPEN02   -1      2       895.5   561.0   23.28   0.548   0.1
CORPEN03   -1      3       276.7   561.0    7.19   0.169   0.1
*
*******************************************************************************
*******************************************************************************
*          DTDZ MODEL INPUT - VOLUME INLET SPECIFICATIONS
*
*          CV      SOURCE
CORTIN00   320     320     *LOWER PLENUM, LOWER PLENUM
CORTIN01   330     320     *BYPASS, LOWER PLENUM
CORTIN02   340     320     *CORE, LOWER PLENUM
*
* FLOW BLOCKAGE INPUT
*
FL39900    'VESSEL BREACH'   320  100  0.0     -0.2254
FL39901    0.01  0.2254  0.0                 * INITIALLY CLOSED
FL39902    3 * HORIZONTAL FLOW PATH
FL39903    1.0     1.0
FL399S0    0.01  0.2254  0.1128
FL399V0    -1  130  130
*
CF09100   'FLAREA-1'  MIN  2  1.0  0.0
CF09110   0.0  2.18248  COR-AFLMIN.103.111
CF09111   1.0  0.0      COR-AFLMIN.103.111
*
CF09200   'FLAREA-2'  MIN  2  1.0  0.0
CF09210   0.0  2.07949  COR-AFLMIN.203.211
CF09211   1.0  0.0      COR-AFLMIN.203.211
*
CF09300   'FLAREA-3'  MIN  2  1.0  0.0
CF09310   0.0  0.64249  COR-AFLMIN.303.311
CF09311   1.0  0.0      COR-AFLMIN.303.311
*
CF09400   'FLAREA-T'  ADD  3  1.0  0.0
CF09410   1.0  0.0      CFVALU.091
CF09411   1.0  0.0      CFVALU.092
CF09412   1.0  0.0      CFVALU.093
*
CF09500   'FRAC-AREA'  DIVIDE  2  1.0  0.0
CF09502   3  0.03  0.61748
CF09510   0.0  7.9428   CFVALU.094
CF09511   1.0  0.0      CFVALU.094
*
FL324V0    -1   95  95                    * CF FOR FLOW BLOCKAGE
*
* VESSEL BREACH INPUT
*
CF13000    'VESSEL BREACH'  DIVIDE  2  1.0  0.0
CF13010    0.0  0.01  COR-ABRCH
CF13011    1.0  0.0   COR-ABRCH
*******************************************************************************
*******************************************************************************
*** DECAY HEAT PACKAGE
*******************************************************************************
***  SPECIFY A BWR
DCHREACTOR   BWR
*
*          SET REACTOR SHUTDOWN TIME TO -36 SEC
*
DCHSHUT     0       -36.0
```

```
*
*         TABULAR FUNCTION TF077 GIVES DECAY HEAT AS A FRACTION
*         OF THERMAL POWER AT SHUTDOWN VS TIME SINCE SHUTDOWN
*
*         THERMAL POWER AT SHUTDOWN = 3293 MW
*
DCHDECPOW     TF.77
*
TF07700   'DECAY HEAT'  44  3293.0E06  0.0
*
*        TIME SINCE        DECAY HEAT
*         SHUTDOWN      (FRACTION SHUTDOWN
*                          THERMAL POWER)
TF07711  0.00000E+00  6.00000E-02
TF07712  1.00000E+00  5.71500E-02
TF07713  1.50000E+00  5.55200E-02
TF07714  2.00000E+00  5.43700E-02
TF07715  3.00000E+00  5.20400E-02
TF07716  4.00000E+00  5.04000E-02
TF07717  6.00000E+00  4.80700E-02
TF07718  8.00000E+00  4.61900E-02
TF07719  1.00000E+01  4.47300E-02
TF07720  1.50000E+01  4.20500E-02
TF07721  2.00000E+01  4.01500E-02
TF07722  3.00000E+01  3.75600E-02
TF07723  4.00000E+01  3.57200E-02
TF07724  6.00000E+01  3.31300E-02
TF07725  8.00000E+01  3.13700E-02
TF07726  1.00000E+02  3.00000E-02
TF07727  1.50000E+02  2.77700E-02
TF07728  2.00000E+02  2.61900E-02
TF07729  3.00000E+02  2.42800E-02
TF07730  4.00000E+02  2.29300E-02
TF07731  6.00000E+02  2.10200E-02
TF07732  8.00000E+02  1.96500E-02
TF07733  1.00000E+03  1.85900E-02
TF07734  1.50000E+03  1.66200E-02
TF07735  2.00000E+03  1.52200E-02
TF07736  3.00000E+03  1.35400E-02
TF07737  4.00000E+03  1.23500E-02
TF07738  6.00000E+03  1.06700E-02
TF07739  8.00000E+03  9.81500E-03
TF07740  1.00000E+04  9.15200E-03
TF07741  1.50000E+04  8.19300E-03
TF07742  2.00000E+04  7.51200E-03
TF07743  3.00000E+04  6.76400E-03
TF07744  4.00000E+04  6.23200E-03
TF07745  6.00000E+04  5.48400E-03
TF07746  8.00000E+04  5.03900E-03
TF07747  1.00000E+05  4.69300E-03
TF07748  1.50000E+05  4.14100E-03
TF07749  2.00000E+05  3.74900E-03
TF07750  3.00000E+05  3.27500E-03
TF07751  4.00000E+05  2.94000E-03
TF07752  6.00000E+05  2.46600E-03
TF07753  8.00000E+05  2.18700E-03
TF07754  1.00000E+06  1.97100E-03
*         END OF DECAY HEAT TABLE
*******************************************************************************
*******************************************************************************
*** TRANSFER PROCESS PACKAGE INPUT
*******************************************************************************
*   'IN' TRANSFER PROCESS FOR CORE PACKAGE
*           NMSIN   NTHRM
```

```
TPIN10100   6       9
*TPIN10200   5       9
*
*    'OUT' TRANSFER PROCESS FOR FDI PACKAGE
*           NMSOT   NPOTOI  IOTMTX
TPOT10100   5       101     UIN.101
*TPOT10200   5       102     DEF.1
*
*     COR-CAV TRANSLATION MATRIX
*     *** NOTE *** CONTROL POISON MASS IS NOT CONSERVED
*           NROW    NCOL
TPM1010000  5       6
*           NROW/NCOL  VALUE
TPM1010001  1/1        1.0     * UO2 MASS
TPM1010002  2/2        1.0     * ZRO2 MASS
TPM1010003  3/3        1.0     * STEEL MASS
TPM1010004  4/4        1.0     * ZR MASS
TPM1010005  5/5        1.0     * STEEL OXIDE MASS
*
*          TRANSFER PROCESS INPUT - RADIONUCLIDE MASS
*          NMSIN  NTHRM
TPIN60100   16      1
*TPIN60200   16      1
*          NMSOT  NPOTOI  IOTMTX
TPOT60100   16      601    DEF.1
*TPOT60200   16      602    DEF.1
*************************************************************************
*************************************************************************
*** CAVITY PACKAGE INPUT
*************************************************************************
***       TWO-CAVITY MODEL
CAV0000   100              'CAVITY 1'
CAV00C0   NONSTAND      * PEACH BOTTOM CONCRETE * JJC from Table 4.1 of a
***               Report by S.A.Hodge, C.R.Hyman and L.J.Ott, Nov. 28, 1988
CAV00C1   AL2O3           0.009
CAV00C2   CAO             0.338
CAV00C3   CO2             0.206
CAV00C4   SIO2            0.358
CAV00C5   H2OEVAP         0.045
CAV00C6   H2OCHEM         0.027
CAV00C7   FE               .135
CAV00CA   TABLCT    1500.    *modified as per C.R. Hyman
CAV00CB   TINCT      300.
CAV00CC   EMISCT    .6
CAV00CD   DENSCT    2340.
CAV00CE   TSOLCT    1420.   *modified as per C.R. Hyman
CAV00CF   TLIQCT    1670.   *modified  as per C.R. Hyman
CAV00G0   CORCON    2                  * FLAT BOTTOM CYLINDER
*
*          NRAYS      RO        ZO
CAV00G1      35       0.0       1.
*        ZT   RAD  HIT  RADC  RW  HBB   NBOT NCORN
CAV00G2  2.   2.06 .457  0.1  3.52 1.524  25    3
*       NEXTRA REXTRA ZEXTRA
CAV00GA   20   3.085  1.99
CAV00GB   20   3.085  0.
CAV00TP  101
CAV00U1  EMISS.OX    0.5
CAV00U2  EMISS.MET   0.5
CAV00U3  EMISS.SUR   0.8
CAV00RR  01
*************************************************************************
CAV0100   101              'CAVITY 2'
CAV01C0   NONSTAND      * PEACH BOTTOM CONCRETE * JJC from Table 4.1 of a
```

```
***              Report by S.A.Hodge, C.R.Hyman and L.J.Ott, Nov. 28, 1988
CAV01C1   AL2O3          0.009
CAV01C2   CAO            0.338
CAV01C3   CO2            0.206
CAV01C4   SIO2           0.358
CAV01C5   H2OEVAP        0.045
CAV01C6   H2OCHEM        0.027
CAV01C7   FE              .135
CAV01CA   TABLCT    1500.    *modified as per C.R. Hyman
CAV01CB   TINCT      300.
CAV01CC   EMISCT    .6
CAV01CD   DENSCT    2340.
CAV01CE   TSOLCT    1420.   *modified as per C.R. Hyman
CAV01CF   TLIQCT    1670.   *modified  as per C.R. Hyman
CAV01G0   CORCON    2                  * FLAT BOTTOM CYLINDER
*
*          NRAYS      RO        ZO
CAV01G1      35       0.0       1.
*        ZT   RAD  HIT  RADC  RW  HBB   NBOT NCORN
CAV01G2  2.   2.06 .457  0.1  6.3  1.524  25    3
*       NEXTRA REXTRA ZEXTRA
CAV01GA   40   5.7036  1.99
CAV01GB   20   5.7036  0.
CAV01U1  EMISS.OX    0.5
CAV01U2  EMISS.MET   0.5
CAV01U3  EMISS.SUR   0.8
*************************************************************************
*************************************************************************
*************************************************************************
***  BURN PACKAGE INPUT
*************************************************************************
BUR000 0
*      XH2IGN   XCOIGN  XH2IGY  XCOIGY  XO2IG  XMSCIG
*BUR001
*      CVNUM  IGNTR   CDIM   TFRAC
BUR101  401     1     17.6    .25
BUR102  402     1     11.2    .25
BUR103  403     1     17.3    .25
BUR104  404     1     13.3    .25
BUR105  405     1     19.2    .25
BUR106  406     1     13.5    .25
BUR107  407     1     16.9    .25
BUR108  408     1     31.4    .25
BUR109  409     1     53.0    .25
*************************************************************************
*************************************************************************
***  RADIONUCLIDE PACKAGE INPUT
*************************************************************************
*************************************************************************
*
DCHDEFCLS0 ALL
*
*  CSI CLASS
DCHNEM0100 CI 1.0E-6
DCHNEM0101 0. 8.3807E5  6.12 6.6913E5 61.2 4.6653E5 612. 3.2606E5
DCHNEM0102 3600. 2.2395E5 7200. 1.7296E5 14400. 1.1438E5 36000. .70876E5
DCHNEM0103 54000. .53576E5
DCHCLS0160 CSI
DCHCLS0161 CI
*
DCHCLSNORM YES
*************************************************************************
RN1000 0
RN1001 5 1 16 14 13 0 0
```

```
RN1100 1.0E-6 50.E-6 1000.
*
RNACOEF    1
*
*ESF(POOL SCRUBBING INPUT) FOR FL362 & FL020
*
RN2PLS01  362    0.005   1.5   0.20   1.16
RN2PLS02  020    0.005   1.5   0.20   1.16
*
*CAVITY POOL SCRUBBING
*
RN2PLS03 1000    0.005   1.5   0.20   1.16
*
RNCLS0100 16
RNCLS0101 2 1.0  *CS
RNCLS0102 4 0.5  *I2
*
*   FUEL INVENTORIES
*
RNFP000 -1 * CORSOR W/ S/V RATIO
*
*   RADIAL RING 1
*
RNFPN10701 0 .177 .534
*
RNFPN10801 0 .230 .534
*
RNFPN10901 0 .230 .534
*
RNFPN11001 0 .222 .534
*
RNFPN11101 0 .141 .534
*
*   RADIAL RING 2
*
RNFPN20701 0 .177 .420
*
RNFPN20801 0 .230 .420
*
RNFPN20901 0 .230 .420
*
RNFPN21001 0 .222 .420
*
RNFPN21101 0 .141 .420
*
*   RADIAL RING 3
*
RNFPN30701 0 .177 .046
*
RNFPN30801 0 .230 .046
*
RNFPN30901 0 .230 .046
*
RNFPN31001 0 .222 .046
*
RNFPN31101 0 .141 .046
*
*   GAP RADIONUCLIDES
*
*    RADIAL RING 1
*
RNGAP10700 1173.
RNGAP10701 2 .05}     1.0  *CS
RNGAP10702 4 .017     1.0  *I
```

```
RNGAP10703 1 .03       1.0  *XE
RNGAP10704 5 .0001     1.0  *TE
RNGAP10705 3 .000001   1.0  *BA,SR
*
RNGAP10800 1173.
RNGAP10801 -107 1. 1.
*
RNGAP10900 1173.
RNGAP10901 -107 1. 1.
*
RNGAP11000 1173.
RNGAP11001 -107 1. 1.
*
RNGAP11100 1173.
RNGAP11101 -107 1. 1.
*
*    RADIAL RING 2
*
RNGAP20700 1173.
RNGAP20701 -107 1. 1.
*
RNGAP20800 1173.
RNGAP20801 -107 1. 1.
*
RNGAP20900 1173.
RNGAP20901 -107 1. 1.
*
RNGAP21000 1173.
RNGAP21001 -107 1. 1.
*
RNGAP21100 1173.
RNGAP21101 -107 1. 1.
*
*    RADIAL RING 3
*
RNGAP30700 1173.
RNGAP30701 -107 1. 1.
*
RNGAP30800 1173.
RNGAP30801 -107 1. 1.
*
RNGAP30900 1173.
RNGAP30901 -107 1. 1.
*
RNGAP31000 1173.
RNGAP31001 -107 1. 1.
*
RNGAP31100 1173.
RNGAP31101 -107 1. 1.
*
RNVNCL01 25 16
*****************************************************************************
*        DEPOSITION SURFACES
*****************************************************************************
*           IDS   SIDE    TYPE
RNDS000    10001   LHS    FLOOR      * DRYWELL-LINER
RNDS001    36002   RHS    FLOOR      * UPPER-HEAD
RNDS002    20001   LHS    FLOOR      * WETWELL-LINER
RNDS003    32001   LHS    FLOOR      * LOWER-HEAD
RNDS004    36002   LHS    CEILING    * UPPER-HEAD
RNDS005     4003   LHS    FLOOR      *
RNDS007     4010   LHS    FLOOR      *
RNDS009     4016   LHS    FLOOR      *
RNDS011     4022   LHS    FLOOR      *
```

```
RNDS013      4028   LHS    FLOOR      *
RNDS016      4033   LHS    FLOOR      *
RNDS018      4039   LHS    FLOOR      *
RNDS019      4044   LHS    FLOOR      *
RNDS021      4048   LHS    FLOOR      *
RNDS022     10010   LHS    FLOOR      * VOLUME 100
RNDS023     10011   LHS    FLOOR      * VOLUME 101
*****************************************************************************
*        SETTLING AREAS
*****************************************************************************
*           IVOLF   IVOLT    ELEV    AREA
RNSET000     310     320     5.4943   .6782       * AN-LP
RNSET001     330     320     5.4943   .0793       * BP-LP
RNSET002     340     320     5.4943  4.905        * CH-LP
RNSET003     350     340     9.667   5.366        * SH-CH
RNSET004     360     350    15.431   4.7763       * SD-SH
RNSET005     410     410     0.01      1.         * ENV-ENV
RNSET006     402     401    -4.1     8.6          * FL401
RNSET007     404     402     5.1     33.2         * FL402
RNSET008     406     404    14.2     33.2         * FL407
RNSET009     408     406    26.1     33.2         * FL411
RNSET010     150     101    -6.7     36.0         *
RNSET011     103     100     3.1      3.2         * FL 14
*****************************************************************************
*****************************************************************************
*** MATERIAL PROPERTIES PACKAGE
*****************************************************************************
***            Property              Units
***
***            temperature           K
***            density               kg/m*3
***            heat capacity         J/kg-K
***            thermal conductivity  W/m-K
*****************************************************************************
***          Material 2 is concrete
***

MPMAT00200   CONCRETE
***
***          PROPERTY   TAB FUNC
MPMAT00201     RHO         4
MPMAT00202     CPS         5
MPMAT00203     THC         6
***
***          Density of concrete
***
TF00400     'RHO CONCRETE'   2   1.00   0.0
***
***          TEMPERATURE     RHO
TF00412         200.00     2522.60
TF00413        5000.00     2522.60
***
***          Heat capacity of concrete
***
TF00500     'CPS CONCRETE'   2   1.00   0.0
***
***          TEMPERATURE     CPS
TF00512         200.00     1299.97
TF00513        5000.00     1299.97
***
***          Thermal conductivity of concrete
***
TF00600     'THC CONCRETE'   2   1.00   0.0
***
```

```
***          TEMPERATURE     THC
TF00612         200.00        1.524
TF00613        5000.00        1.524
*******************************************************************************
***          Material 3 is carbon steel
***
MPMAT00300  'CARBON STEEL'
***
***          PROPERTY   TAB FUNC
***
MPMAT00301     RHO          7
MPMAT00302     CPS          8
MPMAT00303     THC          9
***
***          Density of carbon steel
***
TF00700     'RHO CARBON STEEL'   2   1.00   0.0
***
***          TEMPERATURE     RHO
TF00712         273.15     7833.0
TF00713        5000.00     7833.0
***
***          Heat capacity of carbon steel
***
TF00800     'CPS CARBON STEEL'   2   1.00   0.0
***
***          TEMPERATURE     CPS
TF00812         273.15      465.0
TF00813        5000.00      465.0
***
***          Thermal conductivty of carbon steel
***
TF00900     'THC CARBON STEEL'  10   1.00   0.0
***
***          TEMPERATURE     THC
TF00910         273.15       55.0
TF00911         373.15       52.0
TF00912         473.15       48.0
TF00913         573.15       45.0
TF00914         673.15       42.0
TF00915         873.15       35.0
TF00916        1073.15       31.0
TF00917        1273.15       29.0
TF00918        1473.15       31.0
TF00919        9973.15       31.0
***
MPMAT00500    ZIRCALOY
*
MPMAT00501    ENH   82
MPMAT00502    TMP   83
MPMAT00550    MLT   2500.0
*
TF08200   EZIRC   17   1.0
TF08211    300.0      0.
TF08212    400.0    21915.
TF08213    640.0   105110.
TF08214   1090.0   263960.
TF08215   1093.0   265275.5
TF08216   1113.0   276195.5
TF08217   1133.0   288245.5
TF08218   1153.0   301585.5
TF08219   1173.0   316935.5
TF08220   1193.0   332795.5
TF08221   1213.0   346685.5
```

```
TF08222   1233.0   357565.5
TF08223   1248.0   363753.
TF08224   2098.0   666353.
TF08225   2500.0   809465.
TF08226   2500.01  1034465.
TF08227   3598.0   1425353.
*
TF08300   TZIRC  17   1.0
*
TF08311        0.      300.0
TF08312     21915.     400.0
TF08313    105110.     640.0
TF08314    263960.    1090.0
TF08315    265275.5   1093.0
TF08316    276195.5   1113.0
TF08317    288245.5   1133.0
TF08318    301585.5   1153.0
TF08319    316935.5   1173.0
TF08320    332795.5   1193.0
TF08321    346685.5   1213.0
TF08322    357565.5   1233.0
TF08323    363753.    1248.0
TF08324    666353.    2098.0
TF08325    809465.    2500.0
TF08326   1034465.    2500.01
TF08327   1425353.    3598.0
*
MPMAT00700   'URANIUM DIOXIDE'
MPMAT00701   ENH  72
MPMAT00702   TMP  73
MPMAT00703   CPS  71
MPMAT00750   MLT  2800.0
*
TF07200   EUO2   31   1.0
TF07211    300.0      33143.
TF07212    400.0      58419.
TF07213    500.0      85883.
TF07214    600.0     114638.
TF07215    700.0     144257.
TF07216    800.0     174517.
TF07217    900.0     205288.
TF07218   1000.0     236492.
TF07219   1100.0     268080.
TF07220   1200.0     300023.
TF07221   1300.0     332309.
TF07222   1400.0     364947.
TF07223   1500.0     397973.
TF07224   1600.0     431455.
TF07225   1700.0     465502.
TF07226   1800.0     500266.
TF07227   1900.0     535945.
TF07228   2000.0     572782.
TF07229   2100.0     611064.
TF07230   2200.0     651111.
TF07231   2300.0     693275.
TF07232   2400.0     737927.
TF07233   2500.0     785450.
TF07234   2600.0     836232.
TF07235   2700.0     890656.
TF07236   2800.0     949096.
TF07237   2800.01   1223096.
TF07238   2900.0    1285906.
TF07239   3000.0    1353422.
TF07240   3113.0    1435764.
```

```
TF07241   3513.0    1636964.
*
TF07300   TUO2   31   1.0
TF07311     33143.    300.0
TF07312     58419.    400.0
TF07313     85883.    500.0
TF07314    114638.    600.0
TF07315    144257.    700.0
TF07316    174517.    800.0
TF07317    205288.    900.0
TF07318    236492.   1000.0
TF07319    268080.   1100.0
TF07320    300023.   1200.0
TF07321    332309.   1300.0
TF07322    364947.   1400.0
TF07323    397973.   1500.0
TF07324    431455.   1600.0
TF07325    465502.   1700.0
TF07326    500266.   1800.0
TF07327    535945.   1900.0
TF07328    572782.   2000.0
TF07329    611064.   2100.0
TF07330    651111.   2200.0
TF07331    693275.   2300.0
TF07332    737927.   2400.0
TF07333    785450.   2500.0
TF07334    836232.   2600.0
TF07335    890656.   2700.0
TF07336    949096.   2800.0
TF07337   1223096.   2800.01
TF07338   1285906.   2900.0
TF07339   1353422.   3000.0
TF07340   1435764.   3113.0
TF07341   1636964.   3513.0
*
TF07100   CPUO2  31   1.0
TF07111    273.15   230.22
TF07112    400.0    265.84
TF07113    500.0    282.07
TF07114    600.0    292.36
TF07115    700.0    299.67
TF07116    800.0    305.31
TF07117    900.0    309.98
TF07118   1000.0    314.03
TF07119   1100.0    317.69
TF07120   1200.0    321.15
TF07121   1300.0    324.59
TF07122   1400.0    328.24
TF07123   1500.0    332.40
TF07124   1600.0    337.43
TF07125   1700.0    343.76
TF07126   1800.0    351.84
TF07127   1900.0    362.14
TF07128   2000.0    375.09
TF07129   2100.0    391.08
TF07130   2200.0    410.45
TF07131   2300.0    433.45
TF07132   2400.0    460.23
TF07133   2500.0    490.88
TF07134   2600.0    525.4
TF07135   2700.0    563.71
TF07136   2800.0    605.67
TF07137   2800.01   503.0
TF07138   2900.0    503.0
```

```
TF07139   3000.0    503.0
TF07140   3113.0    503.0
TF07141   5000.0    503.0
*
*************************************************************
********END OF INPUT ************************************************************
*****************************************************************************
```

```
*****************    MELCOR    INPUT    *****************


TITLE        STSB-W-ADS
RESTARTF     ST4.RST
CPULIM      199000.
CPULEFT       10.
OUTPUTF      MELCOR.OUT
TIME1        0    1.0    0.001 4000.    60.   4000.
TIME2        4000.  5.   0.0001 3300.  240.   4000.
TIME3       10000.  5.   0.0001 5000.  240.   5000.
TIME4       20000.  5.   0.0001 10000.0 240.  5000.
TEND       46800.
.
```

Appendix D

MELCOR Input for the LOCA Sequence

The model for this input is described in Sect. 4.1. This model used a dual-cavity and multi-node representation of the drywell. This appendix has two files. The first file is the input file for MELGEN and contains all the plant and transient data. The second file is the input file for MELCOR.

```
*****************************************************************************
*****************************************************************************
***     FILE NAME:      pb.gen.5  FEB 1993
***     Reactor:        Peach Bottom BWR 4/MK 1
***     Sequence:       Design Basis LOCA without ECCS
***     Compartments:   RPV(6), DW(4), WW(1), SC(9), ENV(1)
*****************************************************************************
*****************************************************************************
*       PRELIMINARY DECK FROM SNL, MODIFIED AND TESTED AT BNL
*
* APR/92 - MODIFIED AND CHECKED BY J. J. CARBAJO, ORNL(SRVS, ADS, HF-SEALS
*          FOR MELCOR 1.8.1 AND SHORT-TERM STATION BLACKOUT WITH ADS)
* JUN/92 - STAINLESS STEEL ADDED IN LOWER PLENUM
*          POROSITIES OF CORE INTACT COMPONENTS=0.53
* JUL/92 - POROSITIES OF DEBRIS= 0.9
*
* JUL/92 - TWO HEAT SLABS ADDED TO THE LOWER PLENUM - HS32002 & HS32003
* AUG/92 - SURFACE AREAS IN LOWER PLENUM REDUCED
* SEP/92 - MULTI-NODE DRYWELL MODEL
*          TWO-CAVITY MODEL
* FEB/93 - LOCA ADDED
*****************************************************************************
*
TITLE     LOCA
JOBID     ST5
CRTOUT
OUTPUTF   ST5.OUT
RESTARTF  ST5.RST
DIAGF     ST5.DIA
DTTIME    0.01
*****************************************************************************
*****************************************************************************
*** NON-CONDENSIBLE GASES PACKAGE
*****************************************************************************
***       GAS   MATERIAL NUMBER
NCG000     O2        4
NCG001     N2        5
NCG002     H2        6
NCG003     CO        7
NCG004     CO2       8
NCG005     CH4       9
*****************************************************************************
*****************************************************************************
*** CONTROL VOLUME HYDRODYNAMICS PACKAGE
*****************************************************************************
***       CV 100 is the Drywell-in Pedestal region
***
CV10000   DRYWELL-IN   2   2   2
CV100A0   3
CV100A1   PVOL    1.08E5   RHUM    0.20
CV100A2   TATM    335.92   TPOL    330.93  * 145 F
CV100A3   MASS.1 1467.7     MASS.2  0.0    ** water in sump
CV100A4   MLFR.5  1.00
***
***       ALTITUDE   VOLUME
CV100B1    -9.093       0.
CV100B2    -8.636       5.830    * SUMP LEVEL
CV100B3    -7.8527     29.25
CV100B4    -7.085      46.376
CV100B5    -6.397      80.0
CV100B6    -3.7       161.34
CV100B7     3.26      242.016
***
*****************************************************************************
```

```
***        CV  101 is the Drywell-ex Pedestal region
***
CV10100   DRYWELL-EX   2  2  2
CV101A0   3
CV101A1   PVOL   1.08E5   RHUM  0.20
CV101A2   TATM   335.92   TPOL  330.93
CV101A3   MASS.1     0.0  MASS.2  0.0
CV101A4   MLFR.5  1.0
***
CV101B1   -8.636     0.0
CV101B2   -7.8527  80.05
CV101B3   -3.701   713.0
CV101B4    0.0    1710.0
CV101B5    6.47   2877.5
***
*****************************************************************************
***        CV  102 is the Drywell-Top region
***
CV10200   DRYWELL-TOP  2  2  2
CV102A0   3
CV102A1   PVOL  1.08E5    RHUM  0.20
CV102A2   TATM  335.92    TPOL  330.93
CV102A3   MASS.1  0.0   MASS.2  0.0   MLFR.5  1.0
***
CV102B1    6.47    0.0
CV102B2   23.495  1036.5
***
*****************************************************************************
***        CV   103 is the Drywell-Annulus region
***
CV10300    DRYWELL-ANN  2  2  2
CV103A0    3
CV103A1    PVOL  1.08E5    RHUM  0.2
CV103A2    TATM  400.0   TPOL  400.0
CV103A3    MASS.1  0.0  MASS.2  0.0  MLFR.5  1.0
***
CV103B1     3.086   0.0
CV103B2     9.2585 39.971
CV103B3    15.431  78.942
*****************************************************************************
***       CV 150 is the Downcomer Volume
***
CV15000   VENT/DOWNCOMER   2   2   2
CV150A0   3
CV150A1   PVOL    1.08E5        RHUM  0.20
CV150A2   TATM    335.92        TPOL  305.93  *  145 F, POOL 90 F
CV150A3   ZPOL    -12.205        VFOG    0.0
CV150A4   MLFR.5  1.0
***
***       ALTITUDE   VOLUME
CV150B1    -12.81       0.0
CV150B2    -10.53      82.0
CV150B3     -9.07     257.0
CV150B4     -5.59     565.0
*****************************************************************************
***       CV 200 is the Wetwell
***
CV20000   WETWELL   2   2   3
CV20003   47.33  *  CV area for velocity calculation
CV200A0   3
CV200A1   PVOL    .99974E5  PH2O    -1.0
CV200A2   TATM    305.85    TPOL    305.87  *  90 F
CV200A3   ZPOL   -11.435    VFOG    0.0
```

```
CV200A4   MLFR.5  1.00
***
***       ALTITUDE   VOLUME
CV200B1    -16.38       0.0
CV200B2    -15.16     572.7
CV200B3    -13.33    2114.3
CV200B4    -12.81    2629.6
CV200B5    -12.11    3298.1
CV200B6    -11.76    3647.5
CV200B7    -11.50    3898.0
CV200B8    -10.53    4837.2
CV200B9    -10.28    5058.3
CV200BA     -9.07    6035.7
CV200BB     -8.46    6547.6
CV200BC     -6.93    7132.5
***
*******************************************************************************
***       SIX-VOLUME PRIMARY SYSTEM FROM MARCON VOLUME/ALTITUDE TABLES
*******************************************************************************
***       CV 310 is the Reactor Pressure Vessel Annulus
***
CV31000   ANNULUS  2  2  1    *  NON-EQ TH, VERT FLOW, PRI CV
CV310A0   3                   *
CV310A1   PVOL     7.042E6   *  1025.0 PSI * INITIAL CONDITION
CV310A2   PH2O    -1.0       *  PH2O = PVOL
CV310A3   TATM    -1.0       *  TATM = T(SAT) AT PH2O
CV310A4   TPOL   559.00      *  DEG K,
CV310A5   ZPOL  14.25   *  JJC, Initial level 561.0 in (14.25 m)
****      Model feedwater flow into downcomer
CV310C0   MASS.1   1   2
CV310C1   TE       2   8
TF00100   FDW-MASS  4  1.0 0.0
TF00110   0.0  1696.0  6.0  1696.0  36.0  0.0  1.0E5  0.0
TF00200   FDW-TEM   2  1.0 0.0
TF00210   0.0  465.0  1.0E5  465.0
***
***       ALTITUDE   VOLUME
CV310BA     3.086    0.0000 * BOTTOM OF SHROUD BAFFLE
CV310BM     8.080   41.0323 * JET PUMP THROAT
CV310BP     9.152   51.5666
CV310BV    10.460   61.1004 * BOTTOM OF SHROUD DOME
CV310B0    11.242   74.3757 * TOP OF SHROUD DOME
CV310B9    15.431  183.7962 * TOP OF SEPARATORS
*******************************************************************************
***       CV 320 is the Reactor Pressure Vessel Lower Plenum
***       including the internal volume of the jet pumps
***
CV32000   LOWER-PLENUM  2 2 1 *  NON-EQ TH, VERT FLOW, PRI CV
CV320A0   2                   *  P/T/X DATA
CV320A1   PVOL     7.042E6   *  1034.7 PSI
CV320A2   PH2O    -1.0       *  PH2O = PVOL
CV320A3   TATM    -1.0       *  TATM = T(SAT) AT PH2O
CV320A4   TPOL   559.466     *  DEG K,
CV320A5   MFRC.1   1.000     *  MFRC POOL, 166093.9 LBS H2O
CV320A6   MFRC.2   0.0       *  MFRC FOG
CV320A7   MFRC.3   0.0       *  MFRC STEAM
***
***       ALTITUDE   VOLUME
CV320B1     0.000     0.0000  * BOTTOM OF RPV
CV320B2     1.2954   22.4064  * increased from 11.4064 *JULY 92****************
CV320B3     2.2757   34.7348
CV320B4     3.2560   61.3489
CV320B5     4.2363   81.8691
CV320B6     5.2166   99.2356
```

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CV320B7     5.4943  103.4594  * BOTTOM OF ACTIVE FUEL
*****************************************************************************
***       CV 330 is the Reactor Pressure Vessel By-Pass
***
CV33000   BY-PASS  2  2  1    *  NON-EQ TH, VERT FLOW, PRI CV
CV330A0   2                   *  P/T/X DATA
CV330A1   PVOL     7.042E6   *  1034.7 PSI
CV330A2   PH2O    -1.0        *  PH20 = PVOL
CV330A3   TATM    -1.0        *  TATM = T(SAT) AT PH20
CV330A4   TPOL   559.466      *  DEG K,
CV330A5   MFRC.1   1.000      *  MFRC POOL, FULL H2O
CV330A6   MFRC.2   0.0        *  MFRC FOG
CV330A7   MFRC.3   0.0000     *  MFRC STEAM,
***
***       ALTITUDE   VOLUME
CV330B7     5.4943    0.0000  * BOTTOM OF ACTIVE FUEL
CV330B8     6.2563    4.7889
CV330B9     7.0183    9.5779
CV330BA     7.7803   14.3668
CV330BB     8.5423   18.9546
CV330BC     9.3043   23.4455
CV330BD     9.667    25.7814  * TOP OF CORE TOP GUIDE
*****************************************************************************
***       CV 340 is the Reactor Pressure Vessel Channel
***
CV34000   CHANNEL  2  2  1    *  NON-EQ TH, VERT FLOW, PRI CV
CV340A0   2                   *  P/T/X DATA
CV340A1   PVOL     7.042E6   *  1034.7 PSI
CV340A2   PH2O    -1.0        *  PH20 = PVOL
CV340A3   TATM    -1.0        *  TATM = T(SAT) AT PH20
CV340A4   TPOL   559.466      *  DEG K,
CV340A5   MFRC.1   1.0000     *  MFRC POOL, FULL H2O
CV340A6   MFRC.2   0.0        *  MFRC FOG
CV340A7   MFRC.3   0.0000     *  MFRC STEAM
***
***       ALTITUDE   VOLUME
CV340B7     5.4943    0.0000  * BOTTOM OF ACTIVE FUEL
CV340B8     6.2563    6.1869
CV340B9     7.0183   12.3739
CV340BA     7.7803   18.5608
CV340BB     8.5423   24.4793
CV340BC     9.3043   30.2791
CV340BD     9.667    33.2959  * TOP OF CORE TOP GUIDE
*****************************************************************************
***       CV 350 is the Reactor Pressure Vessel
***       Shroud Dome, Pipes, and Separators
***
CV35000   SHROUD-DOME  2 2 1  *  NON-EQ TH, VERT FLOW, PRI CV
CV350A0   3                   *
CV350A1   PVOL     7.042E6   *  1025. PSI
CV350A2   PH2O    -1.0        *  PH20 = PVOL
CV350A3   TATM    -1.0        *  TATM = T(SAT) AT PH20
CV350A4   TPOL   559.00       *  DEG K,
CV350A5   ZPOL   14.25        *  POOL level 561.0 in (14.25 m)
***
***       ALTITUDE   VOLUME
CV350BA     9.667    0.0000 * TOP OF CORE TOP GUIDE
CV350BD    10.460   17.9923 * BOTTOM OF SHROUD DOME
CV350BH    11.082   27.2877 * TOP OF SHROUD DOME
CV350BR    15.431   44.9011 * TOP OF SEPARATORS
*****************************************************************************
***       CV 360 is the Reactor Pressure Vessel
***       Dryer Region and Steam Dome
***
```

```
CV36000   STEAM-DOME   2 2 1  *  NON-EQ TH, VERT FLOW, PRI CV
CV360A0   2                   *  P/T/X DATA
CV360A1   PVOL     7.042E6   *  1025. PSI
CV360A2   PH2O    -1.0       *  PH20 = PVOL
CV360A3   TATM    -1.0       *  TATM = T(SAT) AT PH20
CV360A4   TPOL   559.00      *  DEG K,
CV360A5   MFRC.1   0.0       *  MFRC POOL
CV360A6   MFRC.2   0.0       *  MFRC FOG
CV360A7   MFRC.3   1.000     *  MFRC STEAM, 18796.2 LBS H2O
***    Model steam leaving though MSIVs
CV360C0   MASS.3   15  2
CV360C1   TE       16  8
TF01500   STM-MASS  4  1.0  0.0
TF01510   0.0  -1686.0  1.0  -1686.0  4.0  0.0  1.0E5  0.0
TF01600   STM-TEM   2  1.0  0.0
TF01610   0.0  446.0  1.0E5  446.0
***
***       ALTITUDE   VOLUME
CV360BA    15.431    0.0000 * TOP OF SEPARATORS
CV360BC    16.439   30.5896 * BOTTOM OF MAIN STEAM LINE
CV360BE    17.018   89.1637 * TOP OF MAIN STEAM LINE
CV360BR    22.243  218.5968 * TOP OF RPV
*****************************************************************************
***       CV 401 is the Torus Room
***
CV40100 'TORUS ROOM'      2  2  4       *  NON-EQ TH, VERT FLOW, CONT CV
CV401A0 2                               *  P/T/X DATA
CV401A1 PVOL 101210.      PH2O  9118.
CV401A2 TATM 305.8        TPOL 305.8  *  90 F
CV401A3 MFRC.1 0.         MFRC.3 1.
CV401A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV      VOL
CV401B1  -17.2        0.
CV401B2   -4.1     5426.
*****************************************************************************
***       CV 402 is the Southern half of the 135 Level
***
CV40200 LEV-135-SOUTH     2  2  4
CV402A0 2
CV402A1 PVOL  101180.     PH2O 3500.
CV402A2 TATM  301.        TPOL 301.
CV402A3 MFRC.1 0.         MFRC.3 1.
CV402A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV    VOL
CV402B1   -4.1       0.
CV402B2    5.1    5154.
*****************************************************************************
***       CV 403 is the Northern half of the 135 Level
***
CV40300 LEV-135-NORTH     2  2  4
CV403A0 2
CV403A1 PVOL  101180.     PH2O 3500.
CV403A2 TATM  301.        TPOL 301.
CV403A3 MFRC.1 0.         MFRC.3 1.
CV403A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV    VOL
CV403B1   -4.1       0.
CV403B2    4.5    5154.
*****************************************************************************
***       CV 404 is the Southeast quadrant of the 165 Level
***
CV40400 LEVEL-165-SE    2  2  4
CV404A0 2
CV404A1 PVOL  101080.     PH2O 3480.
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CV404A2 TATM  299.8       TPOL 299.8
CV404A3 MFRC.1 0.         MFRC.3 1.
CV404A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV404B1    5.1       0.
CV404B2   14.2    2356.
*****************************************************************************
***       CV 405 is the remainder of the 165 Level
***
CV40500 LEVEL-165-MAIN  2  2  4
CV405A0 2
CV405A1 PVOL  101080.     PH2O 3480.
CV405A2 TATM  299.8       TPOL 299.8
CV405A3 MFRC.1 0.         MFRC.3 1.
CV405A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV405B1    5.1       0.
CV405B2   13.6    7066.
*****************************************************************************
***       CV 406 is the Southeast quadrant of the 195 Level
***
CV40600 LEVEL-195-SE    2  2  4
CV406A0 2
CV406A1 PVOL  100980.     PH2O 3480.
CV406A2 TATM  299.8       TPOL 299.8
CV406A3 MFRC.1 0.         MFRC.3 1.
CV406A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV406B1   14.2       0.
CV406B2   26.1    2452.
*****************************************************************************
***       CV 407 is the remainder of the 195 Level
***
CV40700 LEVEL-195-MAIN  2  2  4
CV407A0 2
CV407A1 PVOL  100980.     PH2O 3480.
CV407A2 TATM  299.8       TPOL 299.8
CV407A3 MFRC.1 0.         MFRC.3 1.
CV407A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV407B1   14.2       0.
CV407B2   25.5    4866.
*****************************************************************************
***       CV 408 is the Refueling Bay
***
CV40800 REFUELING-BAY   2  2  7
CV408A0 2
CV408A1 PVOL  100840.     PH2O 3480.
CV408A2 TATM  299.8       TPOL 299.8
CV408A3 MFRC.1 0.         MFRC.3 1.
CV408A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
CV408B1   26.1       0.
CV408B2   45.0   31048.
*****************************************************************************
***       CV 409 is the Turbine Building
***
CV40900 TURBINE-BUILDING  2  2  5
CV409A0 2
CV409A1 PVOL  101080.     PH2O 3480.
CV409A2 TATM  299.8       TPOL 299.8
CV409A3 MFRC.1 0.         MFRC.3 1.
CV409A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV     VOL
```

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CV409B1     5.1         0.
CV409B2    21.9    148825.
*****************************************************************************
***       CV 410 is the Environment
***
CV41000 ENVIRONMENT   2  2  6
CV410A0 2
CV410A1 PVOL  101326.     PH2O 3480.
CV410A2 TATM  299.8       TPOL 299.8
CV410A3 MFRC.1 0.         MFRC.3 1.
CV410A4 MFRC.5 .7671      MFRC.4 .2329
***       ELEV  VOL
CV410B1  -17.2     0.
CV410B2    45.     1.E10
*****************************************************************************
*****************************************************************************
*** FLOW PATH PACKAGE INPUT
*****************************************************************************
*****     MSL/SRV Flow Path
*****     From RPV MSL outlet to T-Quencher in Wetwell
*****     Modified by J. J. Carbajo, ORNL
*****
FL36200  STEAM-LINE-SRV  360  200  16.73  -15.01
FL36201  0.1201   47.15   0.0   0.1955   0.2794 *modified by JJC
FL36202  0  0  0  1  *  VERT, ACTIVE, NO BUBBLES, BUBBLES
FL36203  4.0  5.0   * modified by JJC
FL362V0  -1  105  105
FL362S1  0.1201   47.15   0.39104  5.E-6 * modified by JJC
***
***
***        CF105 GIVES FRACTION OPEN OF THE MSL/SRV FLOW PATH (FL362)
***        IT IS THE SUM OF 4 CONTROL FUNCTIONS, EACH GIVING THE NUMBER
***        OF VALVES OPEN IN ONE SUBSET WITH MONOTONE OPEN/CLOSE
***        CHARACTERISTICS
***
CF10500   SRV   ADD     4    0.07692  0.0  *SF = 1./13  *  modified by JJC
CF10511    1.    0.   CFVALU.101          *NUMBER OPEN IN GROUP 1
CF10512    1.    0.   CFVALU.102          *NUMBER OPEN IN GROUP 2
CF10513    1.    0.   CFVALU.103          *NUMBER OPEN IN GROUP 3
CF10514    1.    0.   CFVALU.104          *NUMBER OPEN IN GROUP 4
***
CF10100   SRV-1  HYST   1    1.0     0.0  *GROUP 1, SRVS 1,6,9
CF10101   0.0                             *INITIAL VALUE
CF10103   -11   -21                       *LOAD/UNLOAD TF NUMBERS
CF10110   1.0   0.0     CFVALU.99
***
***        TF011 GIVES THE NUMBER OF VALVES IN GROUP 1
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01100  SRV-LOAD-1     6    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF01110  7.68759E6  0.0
TF01111  7.68760E6  1.0   *SRV 1 (1115 PSI)
TF01160  7.79101E6  1.0
TF01161  7.79102E6  2.0   *SRV 6 (1130 PSI)
TF01190  7.84617E6  2.0
TF01191  7.84618E6  3.0   *SRV 9 (1138 PSI)
***
***        TF021 GIVES THE NUMBER OF VALVES IN GROUP 1
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02100  SRV-UNLOAD-1   6    1.0     0.0
***
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***       PRESSURE  NUMBER OPEN
TF02110  7.25322E6  0.0
TF02111  7.25323E6  1.0   *SRV 1 (1052 PSI)
TF02160  7.32217E6  1.0
TF02161  7.32218E6  2.0   *SRV 6 (1062 PSI)
TF02190  7.39112E6  2.0
TF02191  7.39113E6  3.0   *SRV 9 (1072 PSI)
***
CF10200   SRV-2  HYST   1    1.0     0.0  *GROUP 2, SRVS 2,3,7,8,12
CF10201   0.0                             *INITIAL VALUE
CF10203   -12   -22                       *LOAD/UNLOAD TF NUMBERS
CF10210   1.0   0.0     CFVALU.99
***
***        TF012 GIVES THE NUMBER OF VALVES IN GROUP 2
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01200  SRV-LOAD-2    10    1.0     0.0
***
***       PRESSURE  NUMBER OPEN
TF01220  7.70827E6  0.0
TF01221  7.70828E6  1.0   *SRV 2 (1118 PSI)
TF01230  7.72206E6  1.0
TF01231  7.72207E6  2.0   *SRV 3 (1120 PSI)
TF01270  7.79791E6  2.0
TF01271  7.79792E6  3.0   *SRV 7 (1131 PSI)
TF01280  7.82548E6  3.0
TF01281  7.82549E6  4.0   *SRV 8 (1135 PSI)
TF012C0  1.03420E7  4.0  *  modified by JJC
TF012C1  1.03421E7  5.0  ****SRV 12 (1500 PSI) SPRING VALVE ***** mod. JJC
***
***        TF022 GIVES THE NUMBER OF VALVES IN GROUP 2
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02200  SRV-UNLOAD-2   8    1.0     0.0
***
***       PRESSURE  FRACTION OPEN
TF02220  7.10154E6  0.0
TF02221  7.10155E6  1.0   *SRV 2 (1030 PSI)
TF02230  7.18428E6  1.0
TF02271  7.18429E6  3.0   *SRVS 3+7 (1042 PSI)
TF02280  7.24633E6  3.0
TF02281  7.24634E6  4.0   *SRV 8 (1051 PSI)
TF022C0  7.26012E6  4.0
TF022C1  7.26013E6  5.0   *SRV 12 (1053 PSI)
***
CF10300   SRV-3  HYST   1    1.0     0.0  *GROUP 3, SRVS 4,5,10,11
CF10301   0.0                             *INITIAL VALUE
CF10303   -13   -23                       *LOAD/UNLOAD TF NUMBERS
CF10310   1.0   0.0     CFVALU.99
***
***        TF013 GIVES THE NUMBER OF VALVES IN GROUP 3
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01300  SRV-LOAD-3     8    1.0     0.0
***
***       PRESSURE  NUMBER OPEN
TF01340  7.75654E6  0.0
TF01341  7.75655E6  1.0   *SRV 4 (1125 PSI)
TF01350  7.76343E6  1.0
TF01351  7.76344E6  2.0   *SRV 5 (1126 PSI)
TF013A0  7.85996E6  2.0
TF013A1  7.85997E6  3.0   *SRV 10 (1140 PSI)
TF013B0  7.86685E6  3.0
TF013B1  7.86686E6  4.0   *SRV 11 (1141 PSI)
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***
***        TF023 GIVES THE NUMBER OF VALVES IN GROUP 3
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02300  SRV-UNLOAD-3   8    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF02340  6.99123E6  0.0
TF02341  6.99124E6  1.0   *SRV 4 (1014 PSI)
TF02350  7.05328E6  1.0
TF02351  7.05329E6  2.0   *SRV 5 (1023 PSI)
TF023A0  7.11533E6  2.0
TF023A1  7.11534E6  3.0   *SRV 10 (1032 PSI)
TF023B0  7.30838E6  3.0
TF023B1  7.30839E6  4.0   *SRV 11 (1060 PSI)
***
CF10400   SRV-4  HYST   1    1.0     0.0  *GROUP 4, SRV  13
CF10401   0.0                             *INITIAL VALUE
CF10403   -14   -24                       *LOAD/UNLOAD TF NUMBERS
CF10410   1.0   0.0     CFVALU.99
***
***        TF014 GIVES THE NUMBER OF VALVES IN GROUP 4
***        WHICH ARE OPEN AS A FUNCTION OF RISING PRESSURE DIFFERENCE
***
TF01400  SRV-LOAD-4     2    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF014D0  1.03420E7  0.0  *  modified by JJC
TF014D1  1.03421E7  1.0   *****SRV 13 (1500 PSI) SPRING VALVE ***** Mod. JJC
***
***        TF024 GIVES THE NUMBER OF VALVES IN GROUP 4
***        WHICH ARE OPEN AS A FUNCTION OF FALLING PRESSURE DIFFERENCE
***
TF02400  SRV-UNLOAD-4   2    1.0     0.0
***
***      PRESSURE  NUMBER OPEN
TF024D0  6.99812E6  0.0
TF024D1  6.99813E6  1.0   *SRV 13 (1015 PSI)
***
***       CF99  gives the pressure difference between the primary system
***       and the drywell
***
CF09900  PDIF  ADD  2  1. 0.
CF09910  1.0  1.08E5  CVH-P.360  *  PRESSURE IN STEAM DOME * modif. JJC
CF09911 -1.0  0.0  CVH-P.101  *  PRESSURE IN DRYWELL
*************************************************************************
***       ADS SYSTEM - 5 SRV VALVES  *   by JJC  April 1992  *
***
FL36300   ADS-5-SRVS 360  200  16.73  -15.01
FL36301   0.046195  47.15  0.0 0.0542 0.2794
FL36302   0 0 0 1
FL36303   4.0 5.0
FL363V0   -1  106 106
FL363S1   0.046195 47.15 0.242523 5.0E-6
***
CF10600   'OPEN ADS'  L-A-IFTE  3  0.0  0.0 *ADS DISCONNECTED
CF10601   0.0   *  INITIAL  VALUE
CF10605   'NORMAL'
CF10610   1.0  0.0  CFVALU.107
CF10611   0.0  0.0  TIME
CF10612   0.0  1.0  TIME
***
CF10700   'LEVEL-IN-VESSEL'  L-GT  2  1.0  0.0
CF10701   .TRUE.
```

```
CF10705   'LATCH'
CF10706   2 'WATER LEVEL AT 1/3 OF ACTIVE CORE'
CF10710   1.0   0.0   CVH-CLIQLEV.340  *  Colapsed liq.level in core
CF10711   0.0   6.7643  TIME  *  Liquid level 50 inches above BAF ** 1/3 CORE *
***
***
*************************************************************************
***       Manual Depressurization
***       JJC    April 1992
***
FL36400   MANUAL-DEPRES   360  200  16.73  -15.01
FL36401   0.009239  47.15   0.0  0.04542  0.2794
FL36402   0 0 0 1
FL36403   4.0  4.0
FL364V0   -1  108  108
FL364S1   0.009239  47.15  0.1085  5.0E-6
***
CF10800   SRV-MANUAL L-A-IFTE  3  1.0 0.0
CF10801   0.0
CF10810   1.0  0.0  CFVALU.200
CF10811   1.0  0.0  CFVALU.201
CF10812   0.0  0.0  TIME
***
CF20000   TIME-CRITER   L-GT  2  1.0 0.0
CF20001   .FALSE.
CF20010   1.0  0.0  TIME
CF20011   0.0  200.0  TIME
***
CF20100   VALVE-OPEN\ HYST  1  1.0  0.0
CF20101   0.0
CF20103   -202  -203
CF20110   1.0  0.0  CFVALU.99
***
TF20200   SRV-OPEN  3  1.0  0.0
TF20210   7.101581E6 0.0
TF20211   7.101599E6 1.0 *open at 1030 psig as per PECO
TF20212   8.0E6      1.0
***
TF20300   SRV-CLOSE  3  1.0  0.0
TF20310   6.429361E6  0.0  * close at 930 psig as per PECO fax
TF20311   6.429371E6  1.0
TF20312   8.0E6       1.0
***
*************************************************************************
***       Drywell head flange seals failure
****      JJC  April 1992
***
FL39800   DW-HD-FAILURE   102  408   18.42   26.1
FL39801   0.04  0.1016   0.0  *  normally closed
FL39802   0  0  0  0
FL39803   10.0  10.0
FL398S0   0.04   0.1016   0.0043  1.0E-4
FL398V0   -1   151  151
****
CF15100   DW-HD-FAILFRAC   L-A-IFTE   3   1.0  0.0
CF15101   0.0    *  initial value
CF15111   1.0  0.0  CFVALU.152
CF15112   1.0  0.0  CFVALU.160
CF15113   0.0  0.0  TIME
***
CF15200   DW-HD-FAIL    L-AND 2  1.0  0.0
CF15201   .FALSE.
CF15211   1.0  0.0   CFVALU.153     *   Temp. criterion
CF15212   1.0  0.0   CFVALU.154     *    DP   criterion
```

```
***
CF15300   TEMP-CRIT.    L-GT   2   1.0  0.0
CF15301   .FALSE.
CF15305   'LATCH'
CF15306   2 'DRYWELL HEAD FLANGE SEALS FAILURE TEMP. EXCEEDED'
CF15311   1.0  0.0   HS-TEMP.1000203    *  Node  3  of Drywell liner in Volume 102
CF15312   0.0  644.3  TIME  *   700 F  Temperature
****
CF15400    DP-CRITE   L-GT   2   1.0   0.0
CF15401   .FALSE.
CF15406   2 'CONTAINMENT PRES. FOR HEAD FLANGE SEALS EXCEEDED'
CF15411   1.0  0.0   CFVALU.155
CF15412   0.0   565370.0   TIME   *  82  psig   DP
***
CF15500    DIFF-PRES    ADD    2   1.0  0.0
CF15511    1.0  0.0   CVH-P.102
CF15512   -1.0  0.0   CVH-P.408
***
CF16000    FRAC-OPEN   TAB-FUN    1   1.0  0.0
CF16003   161
CF16010    1.0 0.0  CFVALU.155
****
TF16100    AREA-VS-DP     4    1.0  0.0
TF16111     -1.0E9     0.0
TF16112     565370.0   0.0
TF16113    1378951.4   1.0
TF16114      1.0E9     1.0
***
*************************************************************************
***       Wetwell/Drywell vacuum breaker Flow Path
***
***       From the Wetwell through the vacuum breakers
***         to the Vent Lines (effectively to the Drywell)* CORRECTED **
***
FL02100  WET-DRY-VACRV   200   150   -10.13   -9.61 * modified JJC
FL02101  1.86   0.5   0.0   0.445   2.06
FL02102  3  0  0  0  *  HORIZ, ACTIVE, ATMOS/ATMOS, ATMOS/ATMOS
FL02103  1.0  1.0
FL021V0  -1    2    2
FL021S1  1.86   0.5   0.445   5.E-6
***
***     CF001, CF002, and TF030 open and close the
***       vacuum relief valves at 0.5 psi (3447 Pa)
***       differential pressure between the wetwell
***       and the drywell
***
***         CF002 = SF*TF030 where SF = 1.0
***         TF030 = function (CF001)
***         CF001 = P.CV200 - P.CV100
***
CF00200  VAC-RV   TAB-FUN   1   1.00   0.00
CF00203  30
CF00210  1.00    0.00   CFVALU.001
***
***       CF200 = wetwell pressure - drywell pressure
***
CF00100  VAC-RV-DP    ADD   2   1.00   0.00
CF00110   1.00  0.00  CVH-P.200
CF00111  -1.00  0.00  CVH-P.150
***
TF03000  VAC-RV-AREA   4   1.00   0.00
***
***      FRACTION OPEN   PRESSURE
TF03010  0.00            0.00
```

```
TF03011  3.444E+03       0.00
TF03012  3.447E+03       1.00
TF03013  2.000E+04       1.00
*************************************************************************
***       Vent Lines/Vent Header/Downcomers
***       From the Drywell to the Wetwell
***
FL01200  VENT-OPENING  101  150  -6.7   -6.7
FL01201  26.6   13.1   1.0   2.30   2.30 * CHANGED HEIGHT TO 2.3 M
FL01202  3  0  0  0 * CHANGED TO HORIZONTAL FLOW
FL01203  1.0  1.0
FL012S1  26.6   13.1   2.06   5.E-6
*************************************************************************
FL02000  DOWNCOMEREX   150   200    -12.81     -12.81
FL02001  26.8   3.9   1.0 0.01 1.00
FL02002  0   0   0   1
FL02003  1.0   1.0
FL020S1  26.8    3.9   1.31   5.0E-6
*************************************************************************
*****    NEW FLOWS FOR MULTI-CELL DRYWELL
*****
FL01000  DW-LOW-H   100  101  -6.195 -6.195
FL01001  8.6  1.0  1.0  3.31  3.31
FL01002  3  0  0  0
FL01003  1.0  1.0
FL010S1  8.6  1.0  1.5  5.0E-6
*****
FL01100  DW-EX-V    101  102   6.47  6.47
FL01101  62.592  0.5  1.0
FL01102  0  0  0  0
FL01103  1.0  1.0
FL011S1  62.592  0.5  6.0  5.0E-6
*****
FL01300  DW-MED-H  101  103   5.0  5.0
FL01301   0.21361   1.0  1.0
FL01302  3  0  0  0
FL01303  1.0  1.0
FL013S1  0.21361  1.0  1.0  5.0E-6
*****
FL01400  DW-IN-V  100   103   2.0   3.086
FL01401  3.2  1.1  1.0
FL01402  0  0  0  0
FL01403  1.5  1.5
FL014S1  3.2  1.1  0.5  5.0E-6
*****
FL01500  DW-TOP   102  103   15.431  15.431
FL01501  5.292  0.5  1.0
FL01502  0  0  0  0
FL01503  1.0  1.0
F1015S1  5.292  0.5  1.0  5.0E-6
*************************************************************************
*****    Pump LOCA Taken From Downcomer Vol 310
*****
FL37000  LOCA   310  101  8.080   -6.0
FL37001  0.3639   1.15   1.0
FL37002  3  0  0  0
FL37003  1.0  1.0 0.68 0.68
FL370S1  0.3639   1.15   0.6807
*****    Second LOCA flow
FL37200  LOCA2  310  101  4.180   -6.0
FL37201  0.3639   5.0   1.0
FL37202  3  0  0  0
FL37203  9.0  9.0 0.68  0.68
FL372s1  0.3639   5.0  0.6807
```

```
*****    Recirculation pump working
FL31100  RCPUMP  310  320   4.10  3.08
FL31101  0.3391  10.0  1.0  0.15  0.15
FL31102  0 0 0 0
FL311S1  0.3391  10.0  0.27783
FL311T0  1   3
TF00300  RCP-VEL  4  1.0  0.0
TF00310  0.0  25.1  1.0  25.0 15.0  0.0  1.0E5  0.0
*****************************************************************************
*****    CRD Seal Leakage Taken From Lower Plenum (55%)
*****
FL37100  LEAKAGE-LP   320  100    0.1     -6.0
FL37101  3.399E-6   0.15   1.0
FL37102  0  0  0  0
FL37103  1.0  1.0
FL371S1  3.399E-6   0.15   0.001804
*****************************************************************************
***      RPV FLOW PATHS
***
***  FLOW PATH ZFM AND ZTO CONSISTENT WITH HEIGHTS AND BOTTOM OF CONTROL VOLUMES
***  HYDRAULIC DIAMETERS AND FRICTION FACTORS CONSISTENT WITH LASALLE DECK
***  JMM  01/16/86
*****************************************************************************
***PATH  FLNAME  KCVFM  KCVTO   ZFM      ZTO
FL31200  AN-LP    310    320    8.080    3.086 * 8.080 M = JET PUMP THROAT
FL32300  LP-BP    320    330    5.4943   5.4943
FL32400  LP-CH    320    340    5.4943   5.4943
FL34500  CH-SH    340    350    9.667    9.667
FL33500  BP-SH    330    350    9.667    9.667
FL35600  SH-SD    350    360   15.431   15.431
FL36100  SD-AN    360    310   15.431   15.431
***
***PATH  FLARA   FLLEN   FLOPO   FLHGTF   FLHGTT     FLNAME
FL31201  0.6782  4.9936   1.0    0.1524   0.1524  *  AN-LP
FL32301  6.1502  1.9050   .01289 0.1524   0.0254  *  LP-BP
FL32401  7.9428  1.9050   .61748 0.1524   0.1016  *  LP-CH
FL33501  6.1502  1.9050   1.0    0.0254   0.0254  *  BP-SH
FL34501  7.9428  1.9050   .67561 0.1325   0.1325  *  CH-SH
FL35601  4.7763  4.1885   1.0    0.1676   0.1676  *  SH-SD
FL36101 26.1069  5.3492   1.0    0.6484   0.6484  *  SD-AN
***
***PATH  SAREA   SLEN    SHYD    SRGH     SLAM     FLNAME
FL312S1  0.0339  4.9936  .27783  5.0E-06  16.0  *  AN-LP
FL323S1  6.1502  1.9050  .05841  5.0E-06  16.0  *  LP-BP
FL324S1  7.9428  1.9050  .01359  5.0E-06  16.0  *  LP-CH
FL335S1  6.1502  1.9050  .05841  5.0E-06  16.0  *  BP-SH
FL345S1  7.9428  1.9050  .01359  5.0E-06  16.0  *  CH-SH
FL356S1  4.7763  4.1885  .00878  5.0E-06  16.0  *  SH-SD
FL361S1 26.1069  5.3492  .73944  5.0E-06  16.0  *  SD-AN
***
***PATH  FRICFO   FRICRO     FLNAME   DF       DT
FL31203  0.0785   17.0    *  AN-LP    0.2078   5.3066
FL32303  0.5188   4.97    *  LP-BP    5.0201   2.7983
FL32403  10.216   13.267  *  LP-CH    5.0201   3.1801
FL33503  50.0     0.5     *  BP-SH    2.7983   4.3326
FL34503  5.6885   5.6885  *  CH-SH    3.1801   4.3326
FL35603  12.585   5.0475  *  SH-SD    2.4660   6.3557
FL36103  0.11     0.11    *  SD-AN    6.3557   5.7654
***
***PATH  KFLGFL  KACTFL   IBUBF   IBUBT   FLNAME
FL31202    0       0       0       0  *  AN-LP
FL32302    0       0       0       0  *  LP-BP
FL32402    0       0       0       0  *  LP-CH
FL33502    0       0       0       0  *  BP-SH
```

```
FL34502    0       0       0       0  *  CH-SH
FL35602    0       0       0       0  *  SH-SD
FL36102    0       0       0       0  *  SD-AN
*****************************************************************************
***      SECONDARY CONTAINMENT FLOW PATHS
*****************************************************************************
FL40000   'CONT FAIL'   200  401  -9.0    -9.0 * CHANGED TO WETWELL
FL40001   .100  0.001 0.0          * INITIALLY CLOSED
FL40002   3 * HORIZONTAL FLOW PATH
FL40003   0.593   0.593
FL400S0   .102  0.001  1.0
FL400V0   150  145  145
***
***       CF150 opens the flow path from the WETwell to the reactor
***       building at containment failure, CF145 sets the fraction open
***       CF149 writes the time of occurrence
CF14500   CONT-BRK  EQUALS  1  0.0  1.0
CF14510   1.0  0.0  TIME
***
CF15000   'FAIL THRESH' T-O-F  1  1. 0.
CF15003    -1.E9  1.1935E6
CF15010    1. 0. CVH-P.200
***
CF14900   'CONT-FAIL MES'  L-GT  2  1.0  0.0
CF14901   .FALSE.
CF14905   'LATCH'
CF14906   2  'CONTAINMENT FAILURE BY HIGH WETWELL PRESSURE'
CF14911   1.0  0.0  CVH-P.200
CF14912   0.0  1.1935E6  TIME
***
***
***      NAME              FROM     TO     ZFROM       ZTO
FL40100 TORUS-135           401     402     -4.7       -4.1
FL40200 135-165-SHAFT       402     404      4.5        5.1
FL40300 135-SO-NO           402     403       .2         .2
FL40400 LEAK-135-SO         402     410       .2         .2
FL40500 BO-135-TURB         403     409       .2        6.2
FL40600 LEAK-135-NO         403     410       .2         .2
FL40700 165-195-SHAFT       404     406     13.6       14.2
FL40800 165-SE-MAIN         404     405      9.35       9.35
FL40900 LEAK-165-SE         404     410      9.35       9.35
FL41000 LEAK-165-MAIN       405     410      9.35       9.35
FL41100 195-SE-REFUEL       406     408     25.5       26.1
FL41200 195-SE-MAIN         406     407     19.85      19.85
FL41300 LEAK-195-SE         406     410     19.85      19.85
FL41400 LEAK-195-MAIN       407     410     19.85      19.85
FL41500 BO-REFUEL-ENV       408     410     34.9       34.9
FL41600 LEAK-REFUEL         408     410     35.55      35.55
FL41700 LEAK-TURB           409     410     13.5       13.5
***
***      AREA      LENGTH    FLOPO    HGTF    HGTTO
FL40101   8.6        .86      1.      .3       .3
FL40201  33.2       3.32      1.      .3       .3
FL40301  25.        2.5       1.      .3       .3
FL40401   0.025      .0025    1.      .1       .1
FL40501   2.8        .28      0.      .3       .3
FL40601   0.025      .0025    1.      .1       .1
FL40701  33.2       3.32      1.      .3       .3
FL40801  43.8       4.38      1.      .3       .3
FL40901   0.025      .0025    1.      .1       .1
FL41001   0.025      .0025    1.      .1       .1
FL41101  33.2       3.32      1.      .3       .3
FL41201  74.6       7.46      1.      .3       .3
FL41301   0.025      .0025    1.      .1       .1
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FL41401   0.025     .0025    1.     .1      .1
FL41501  22.3      2.23      0.     .3      .3
FL41601   0.109     0.0109   1.     .1      .1
FL41701   0.29      0.0109   1.     .1      .1
***
***      TYPE   ACTIVE   IBUBF   IBUBTO
FL40102    1       0       0       0
FL40202    1       0       0       0
FL40302    4       0       0       0
FL40402    4       0       0       0
FL40502    1       0       0       0
FL40602    4       0       0       0
FL40702    1       0       0       0
FL40802    4       0       0       0
FL40902    4       0       0       0
FL41002    4       0       0       0
FL41102    1       0       0       0
FL41202    4       0       0       0
FL41302    4       0       0       0
FL41402    4       0       0       0
FL41502    4       0       0       0
FL41602    4       0       0       0
FL41702    4       0       0       0
***
***       FRICFO     FRICREV
FL40103     .5         .5
FL40203     .5         .5
FL40303     .5         .5
FL40403    1.         1.
FL40503     .5         .5
FL40603     .5         .5
FL40703     .5         .5
FL40803     .5         .5
FL40903    1.         1.
FL41003    1.         1.
FL41103     .5         .5
FL41203     .5         .5
FL41303    1.         1.
FL41403    1.         1.
FL41503     .5         .5
FL41603    1.         1.
FL41703    1.         1.
***
***       SAREA     SLEN   SHYD    SRGH   SLAM
FL401S1   8.6       .01     1.
FL402S1  33.2       .01     1.
FL403S1  25.        .01     1.
FL404S1   0.025     .01     1.
FL405S1   2.8       .01     1.
FL406S1   0.025     .01     1.
FL407S1  33.2       .01     1.
FL408S1  43.8       .01     1.
FL409S1    .025     .01     1.
FL410S1    .025     .01     1.
FL411S1  33.2       .01     1.
FL412S1  74.6       .01     1.
FL413S1   0.025     .01     1.
FL414S1   0.025     .01     1.
FL415S1  22.3       .01     1.
FL416S1    .109     .01     1.
FL417S1    .29      .01     1.
***
***                 ---   VALVES   ---
***       TRIP NO.   CF-ON-FORWARD  CF-ON-REVERSE
```

```
FL405V1     110          111          111
FL415V1     140          141          141
***
***       TABULAR AND CONTROL FUNCTIONS FOR VALVE INPUT
***
CF10900  405-DP    ADD    4  1.  0.
CF10910   1.    0.  CVH-P.403
CF10911  -1.    0.  CVH-P.409
CF10912 -42.18  0.  CVH-RHOA.403
CF10913  10.79  0.  CVH-RHOA.409
***
CF11000  405-TRIP  T-O-F  1  1.  0.
CF11003  -1.E6  1551.3
CF11010  1.  0.  CFVALU.109
***
CF11100  405-FRAC  HYST    1   1.  0.
CF11103  -410   -400
CF11110  1.  0.  CFVALU.109
***
TF40000  405-UNLOAD  1  1.  0.
TF40010  0.     1.
***
TF41000  405-A-DP  5 1. 0.
TF41010  1551.3  0.1
TF41011  1637.5  0.1857
TF41012  1723.7  0.7429
TF41013  1809.9  0.8357
TF41014  1898.0  1.
***
CF13900  415-DP    ADD    4  1.  0.
CF13910   1.    0.  CVH-P.408
CF13911  -1.    0.  CVH-P.410
CF13912 -86.33  0.  CVH-RHOA.408
CF13913 511.1   0.  CVH-RHOA.410
***
CF14000  415-TRIP  T-O-F  1  1.  0.
CF14003  -1.E6  2154.6
CF14010  1.  0.  CFVALU.139
***
CF14100  415-FRAC  HYST    1   1.  0.
CF14103  -440   -400
CF14110  1.  0.  CFVALU.139
***
TF44000  415-A-DP  5 1. 0.
TF44010  2154.6  0.1
TF44011  2274.3  0.2
TF44012  2394.0  0.8
TF44013  2513.7  0.9
TF44014  2633.4  1.
*******************************************************************************
*******************************************************************************
*** HEAT SLAB PACKAGE INPUT
*******************************************************************************
***   HS NAMES
***
***SLAB        NAME
HS10001001  DW-LINER-101
HS10002001  DW-LINER-102
HS10010001  DW-FLOOR-100
HS10011001  DW-FLOOR-101
HS10003001  REAC-PED-103-101
HS10013001  REAC-PED-103-102
HS10004001  LO-REAC-PED
HS10005001  DW-STEEL-101
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HS10006001  DW-STEEL-102
HS10009001  STEEL-100
HS20001001  WETWELL-LINER
HS20002001  WETWELL-STEEL
HS31001001  RPV-CYLINDER
HS32001001  LOWER-HEAD
HS35003001  SEPARATORS
HS36001001  DRYERS
HS36002001  UPPER-HEAD
*****************************************************************************
***   HS MATERIALS
***
***SLAB        MATERIAL       INT      NAME
HS10001201    'CARBON STEEL'   4   *  DRYWELL-LINER-101
HS10002201    'CARBON STEEL'   4   *  DRYWELL-LINER-102
HS10010201     CONCRETE       10   *  DRYWELL-FLOOR-100
HS10011201     CONCRETE       10   *  DRYWELL-FLOOR-101
HS10003201     CONCRETE        7   *  REAC-PED-103-101
HS10013201     CONCRETE        7   *  REAC-PED-103-102
HS10004201     CONCRETE        7   *  LO-REAC-PED
HS10005201    'CARBON STEEL'   3   *  DRYWELL-STEEL-101
HS10006201    'CARBON STEEL'   3   *  DRYWELL-STEEL-102
HS10009201    'CARBON STEEL'   3   *  STEEL-100
HS20001201    'CARBON STEEL'   4   *  WETWELL-LINER
HS20002201    'CARBON STEEL'   3   *  WETWELL-STEEL
HS31001201    'CARBON STEEL'   6   *  RPV-CYLINDER
HS32001201    'CARBON STEEL'   5   *  LOWER-HEAD
HS35003201   'STAINLESS STEEL' 4   *  SEPARATORS
HS36001201   'STAINLESS STEEL' 1   *  DRYERS
HS36002201    'CARBON STEEL'   5   *  UPPER-HEAD
*****************************************************************************
***   HS GEOMETRIES
***
***SLAB     NO. T  GEOMETRY        INITIAL     NAME
***         NODES  SL CY SP HB HT  N  Y  I
HS10001000    5     1              0        *  DRYWELL-LINER-101
HS10002000    5     1              0        *  DRYWELL-LINER-102
HS10010000   11     1              0        *  DRYWELL-FLOOR-100
HS10011000   11     1              0        *  DRYWELL-FLOOR-101
HS10003000    8     1              0        *  REAC-PED-103-101
HS10013000    8     1              0        *  REAC-PED-103-102
HS10004000    8     1              0        *  LO-REAC-PED
HS10005000    4     1              0        *  DRYWELL-STEEL-101
HS10006000    4     1              0        *  DRYWELL-STEEL-102
HS10009000    4     1              0        *  STEEL-100
HS20001000    5     1              0        *  WETWELL-LINER
HS20002000    4     1              0        *  WETWELL-STEEL
HS31001000    7        2           0        *  RPV-CYLINDER
HS32001000    6        2           0        *  LOWER-HEAD, MODELLED AS CYLINDER
HS35003000    5     1              0        *  SEPARATORS
HS36001000    2     1              0        *  DRYERS
HS36002000    6                 5  0        *  UPPER-HEAD
*****************************************************************************
***   HS ELEVATIONS/ORIENTATIONS
***
***SLAB     ELEVATION  ORIENTATION        NAME
***                    VT  HZ  OT
HS10001002    -8.635  1.0              *  DRYWELL-LINER-101
HS10002002     6.470  1.0              *  DRYWELL-LINER-102
HS10010002    -8.635  0.0              *  DRYWELL-FLOOR-100
HS10011002    -8.635  0.0              *  DRYWELL-FLOOR-101
HS10003002     3.086  1.0              *  REAC-PED-103-101
HS10013002     6.47   1.0              *  REAC-PED-103-102
HS10004002    -8.635  1.0              *  LO-REAC-PED
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HS10005002     -8.635  1.0              *  DRYWELL-STEEL-101
HS10006002      6.470  1.0              *  DRYWELL-STEEL-102
HS10009002     -3.0    1.0              *  STEEL-100
HS20001002    -11.660  1.0              *  WETWELL-LINER
HS20002002    -13.18   1.0              *  WETWELL-STEEL
HS31001002      3.1856 1.0              *  RPV-CYLINDER
HS32001002      0.7550                  *  LOWER-HEAD (TOP OF STUB TUBES) *modified
HS35003002     10.92   1.0              *  SEPARATORS
HS36001002     16.18   1.0              *  DRYERS
HS36002002     19.0343 1.0              *  UPPER-HEAD
***************************************************************************
***   HS D/T FORMATS
***
***SLAB     LOC T   FORMAT   LOCATION        NAME
***         DATA    D/T N-M  L/I BOUNDRY
HS10001100     -1    1            0.0     *  DRYWELL-LINER-101
HS10002100     -1    1            0.0     *  DRYWELL-LINER-102
HS10010100     -1    1            0.0     *  DRYWELL-FLOOR-100
HS10011100     -1    1            0.0     *  DRYWELL-FLOOR-101
HS10003100     -1    1            0.0     *  REAC-PED-103-101
HS10013100     -1    1            0.0     *  REAC-PED-103-102
HS10004100     -1    1            0.0     *  LO-REAC-PED
HS10005100     -1    1            0.0     *  DRYWELL-STEEL-101
HS10006100     -1    1            0.0     *  DRYWELL-STEEL-102
HS10009100     -1    1            0.0     *  STEEL-100
HS20001100     -1    1            0.0     *  WETWELL-LINER
HS20002100     -1    1            0.0     *  WETWELL-STEEL
HS31001100     -1    1            3.1856  *  RPV-CYLINDER
HS32001100     -1    1            2.5797  *  LOWER-HEAD (RAD OF SHROUD)
HS35003100     -1    1            0.0     *  SEPARATORS
HS36001100     -1    1            0.0     *  DRYERS
HS36002100     -1    1            3.1856  *  UPPER-HEAD
***************************************************************************
***   HS D/T DATA
***************************************************************************
***   DRYWELL-LINER- 101 and  102
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10001102      0.00305    2
HS10001103      0.00914    3
HS10001104      0.01524    4
HS10001105      0.02858    5
***
HS10002102      0.00305    2
HS10002103      0.00914    3
HS10002104      0.01524    4
HS10002105      0.02858    5
***
***************************************************************************
***   DRYWELL-FLOOR- 100 and 101
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10010102      0.00305    2
HS10010103      0.00914    3
HS10010104      0.02134    4
HS10010105      0.04572    5
HS10010106      0.09144    6
HS10010107      0.18288    7
HS10010108      0.36576    8
HS10010109      0.67056    9
HS10010110      1.00584   10
HS10010111      1.44250   11
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***
***
HS10011102    0.00305       2
HS10011103    0.00914       3
HS10011104    0.02134       4
HS10011105    0.04572       5
HS10011106    0.09144       6
HS10011107    0.18288       7
HS10011108    0.36576       8
HS10011109    0.67056       9
HS10011110    1.00584      10
HS10011111    1.44250      11
*************************************************************************
***   REAC-PED
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10003102      0.00305    2
HS10003103      0.00914    3
HS10003104      0.02134    4
HS10003105      0.04572    5
HS10003106      0.09144    6
HS10003107      0.18288    7
HS10003108      0.34930    8
***
***
HS10013102    0.00305       2
HS10013103    0.00914       3
HS10013104    0.02134       4
HS10013105    0.04572       5
HS10013106    0.09144       6
HS10013107    0.18288       7
HS10013108    0.34930       8
*************************************************************************
***   LO-REAC-PED
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10004102      0.00305    2
HS10004103      0.00914    3
HS10004104      0.02134    4
HS10004105      0.04572    5
HS10004106      0.10668    6
HS10004107      0.24384    7
HS10004108      0.53340    8
***
***         TEMPERATURE
*HS10004801    391.77       1
*HS10004802    391.49       2
*HS10004803    390.94       3
*HS10004804    389.83       4
*HS10004805    387.60       5
*HS10004806    382.05       6
*HS10004807    369.55       7
*HS10004808    343.16       8
*************************************************************************
***   DRYWELL-STEEL- 101 and 102 and STEEL-100
***
***   SLAB     DISTANCE  NODE
***                      NO.
HS10005102      0.00305    2
HS10005103      0.00762    3
HS10005104      0.01747    4
***
```

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***
HS10006102    0.00305        2
HS10006103    0.00762        3
HS10006104    0.01747        4
***
HS10009102    0.00305     2
HS10009103    0.00762     3
HS10009104    0.01747     4
*************************************************************************
***   WETWELL-LINER
***
***   SLAB      DISTANCE  NODE
***                       NO.
HS20001102      0.00305    2
HS20001103      0.00601    3
HS20001104      0.01219    4
HS20001105      0.01588    5
***
*************************************************************************
***  WETWELL-STEEL
***
***SLAB         DISTANCE  NODE
***                       NO.
HS20002102      0.00305    2
HS20002103      0.00795    3
HS20002104      0.01747    4
***
*************************************************************************
***   RPV-CYLINDER
***
***   SLAB      DISTANCE  NODE
***                       NO.
HS31001102        3.1886    2  *  3.1856 M = LOC OF NODE 1
HS31001103        3.1926    3
HS31001104        3.2006    4
HS31001105        3.2156    5
HS31001106        3.2556    6
HS31001107        3.3412    7  *  3.3412 M - 3.1856 M = 0.1556 M = 6.125 IN
***
*************************************************************************
***   LOWER-HEAD
***
***   SLAB      DISTANCE  NODE
***                       NO.
HS32001102        2.5807    2  *  2.5797 M = LOC OF NODE 1
HS32001103        2.5837    3
HS32001104        2.5907    4
HS32001105        2.6157    5
HS32001106        2.6983    6  *  2.6983 M - 2.5797 M = 0.1176 M = 4.63 IN
***
*************************************************************************
***   TOP-GUIDE COMBINED WITH CORE CELL STEEL MASS
***   SHROUD-DOME COMBINED WITH SEPARATORS
***
***   SEPARATORS
***
***   SLAB      DISTANCE  NODE
***                       NO.
HS35003102        0.0030    2
HS35003103        0.0069    3
HS35003104        0.0119    4
HS35003105        0.0186    5
***
*************************************************************************
```

```
***   DRYERS
***
***   SLAB      DISTANCE  NODE
***                        NO.
HS36001102      1.83E-03    2
***
*************************************************************************
***   UPPER-HEAD
***
***   SLAB      DISTANCE  NODE
***                        NO.
HS36002102        3.1886    2  *  3.1856 M = LOC OF NODE 1
HS36002103        3.1926    3
HS36002104        3.2006    4
HS36002105        3.2256    5
HS36002106        3.2872    6  *  3.2872 M - 3.1856 M = 0.1016 M = 4 IN
***
*************************************************************************
***   HS INTERNAL POWER SOURCES
***
***SLAB      INT POW      NAME
***          SOURCE
***           N  Y
HS10001300  -1        *  DRYWELL-LINER-101
HS10002300  -1        *  DRYWELL-LINER-102
HS10010300  -1        *  DRYWELL-FLOOR-100
HS10011300  -1        *  DRYWELL-FLOOR-101
HS10003300  -1        *  REAC-PED-103-101
HS10013300  -1        *  REAC-PED-103-102
HS10004300  -1        *  LO-REAC-PED
HS10005300  -1        *  DRYWELL-STEEL-101
HS10006300  -1        *  DRYWELL-STEEL-102
HS10009300  -1        *  STEEL 100
HS20001300  -1        *  WETWELL-LINER
HS20002300  -1        *  WETWELL-STEEL
HS31001300  -1        *  RPV-CYLINDER
HS32001300  -1        *  LOWER HEAD
HS35003300  -1        *  SEPARATORS
HS36001300  -1        *  DRYERS
HS36002300  -1        *  UPPER-HEAD
*************************************************************************
***   HS LEFT/INSIDE BOUNDARY CONDITIONS
***
***SLAB      TYPE        VOL  COEF.       CRT POOL     POOL  ATM    NAME
***          SYM CONV         FLOW        FRACTION     ONLY  ONLY
***                           TYPE        POOL ATM
HS10001400      1        101  'EXT'       1.0  1.0  *         X     DRYWELL-LINER-101
HS10002400      1        102  'EXT'       1.0  1.0  *         X     DRYWELL-LINER-102
HS10010400      1        100  'EXT'       0.0  0.0  *               DRYWELL-FLOOR-100
HS10011400      1        101   'EXT'      0.0  0.0  *               DRYWELL-FLOOR-101
HS10003400      1        103  'EXT'       1.0  1.0  *         X     REAC-PED-103-101
HS10013400      1        103  'EXT'       1.0  1.0  *         X     RAEC-PED-103-102
HS10004400      1        100  'EXT'       1.0  1.0  *         X     LO-REAC-PED
HS10005400      1        101  'EXT'       1.0  1.0  *         X     DRYWELL-STEEL-101
HS10006400      1        102   'EXT'      1.0  1.0  *         X     DRYWELL-STEEL-102
HS10009400      1        100   'EXT'      1.0  1.0  *         X     STEEL-100
HS20001400      1        200  'EXT'       0.0  0.0  *   X           WETWELL-LINER
HS20002400      1        200  'EXT'       1.0  1.0  *         X     WETWELL-STEEL
HS31001400      1        310  'EXT'  .40593 .40593 *               RPV-CYLINDER
HS32001400      1        320  'EXT'       1.0  1.0  *         X     LOWER HEAD
HS35003400      1        350  'EXT'       1.0  1.0  *         X     SEPARATORS
HS36001400      1        360  'EXT'       1.0  1.0  *         X     DRYERS
HS36002400      1        360  'EXT'       1.0  1.0  *         X     UPPER-HEAD
*************************************************************************
```

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***   HS RIGHT/OUTSIDE BOUNDARY CONDITIONS
***
***SLAB      TYPE        VOL    COEF.    CRT POOL    POOL  ATM    NAME
***          SYM CONV           FLOW     FRACTION    ONLY  ONLY
***                             TYPE     POOL ATM
HS10001600   0                                     *             DRYWELL-LINER-101
HS10002600   0                                     *             DRYWELL-LINER-102
HS10010600   0                                     *             DRYWELL-FLOOR-100
HS10011600   0                                     *             DRYWELL-FLOOR-101
HS10003600   1          101    'EXT'    1.  1.     *             REAC-PED-103-101
HS10013600   1          102    'EXT'    1.  1.     *             REAC-PED-103-102
HS10004600   1          101    'EXT'    1.  1.     *             LO-REAC-PED
HS10005600   0                                     *             DRYWELL-STEEL-101
HS10006600   0                                     *             DRYWELL-STEEL-102
HS10009600   1          101     'EXT'   1.  1.     *             STEEL-100
HS20001600    1         401    'EXT'    1.    1.   *        X    WETWELL-LINER
HS20002600   0                                     *             WETWELL-STEEL
HS31001600      5120    103    'EXT'    1.0  1.0   *        X    RPV-CYLINDER
HS32001600      5120    100    'EXT'    1.0  1.0   *        X    LOWER HEAD
HS35003600      1       310    'EXT'    1.0  1.0   *        X    SEPARATORS
HS36001600   0                                     *             DRYERS
HS36002600      5120    102    'EXT'    1.0  1.0   *        X    UPPER-HEAD
*****************************************************************************
***      HS LEFT/INSIDE AREAS/LENGTHS
***
***   SLAB     AREA     CH L      AX L          NAME
HS10001500  1235.80   15.105    15.105     *  DRYWELL-LINER-101
HS10002500   500.0    17.0      17.0       *  DRYWELL-LINER-102
HS10010500    29.92    5.50      5.50      *  DRYWELL-FLOOR-100
HS10011500   205.0    14.32     14.32      *  DRYWELL-FLOOR-101
HS10003500   267.38    3.38      3.38      *  REAC-PED-103-101
HS10013500   300.00    8.9       8.9       *  REAC-PED-103-102
HS10004500   337.24    7.50      7.50      *  LO-REAC-PED
HS10005500   800.58   15.105    15.105     *  DRYWELL-STEEL-101
HS10006500   350.0    10.55     10.55      *  DRYWELL-STEEL-102
HS10009500   496.5     4.874     4.874     *  STEEL-100
HS20001500  1584.00    2.96      2.96      *  WETWELL-LINER
HS20002500  4188.53    5.182     5.182     *  WETWELL-STEEL
HS31001500   317.224  12.245    12.245     *  RPV-CYLINDER
HS32001500    33.141   0.5404    0.5404    *  LOWER HEAD * structure split into LH
HS35003500   472.43    3.99      3.99      *  SEPARATORS
HS36001500  2945.03    2.23      2.23      *  DRYERS
HS36002500    63.762   3.1856    3.1856    *  UPPER-HEAD
*****************************************************************************
***      HS RIGHT/OUTSIDE AREAS/LENGTHS
***
***   SLAB     AREA     CH L      AX L         NAME
HS10003700   267.38    3.38      3.38      *  REAC-PED-103-101
HS10013700   300.0     8.9       8.9       *  REAC-PED-103-102
HS10004700   337.24    7.5       7.5       *  LO-REAC-PED
HS10009700   496.5     4.874     4.874     *  STEEL-100
HS20001700  1584.00    2.96      2.96      *  WETWELL-LINER
HS31001700   332.716  12.245    12.245     *  RPV-CYLINDER
HS32001700    34.652   0.5404    0.5404    *  LOWER HEAD * structure split into LH
HS35003700   472.43    3.99      3.99      *  SEPARATORS
HS36002700    67.894   3.2872    3.2872    *  UPPER-HEAD
*****************************************************************************
***  ADDITIONAL HEAT STRUCTURES FOR CORE/LP SHROUD
*****************************************************************************
* LOWER PLENUM SHROUD - LOWER PLENUM TO DOWNCOMER HEAT TRANSFER
*
*TWO HEAT SLABS, HS32002 & HS32003 ADDED DUE TO DT/DZ PROBLEM* HS32001 SPLIT INTO 3 HS
*
*
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HS32002000  6   2   0
HS32002001  LOWER-HEAD2
HS32002002  1.2954
HS32002100  -1   1   3.1877
HS32002102  3.1887     2
HS32002103  3.1917     3
HS32002104  3.1987     4
HS32002105  3.2137     5
HS32002106  3.3063     6
HS32002201  'CARBON STEEL'   5
HS32002300  -1
HS32002400  1     320  'EXT'  1.0  1.0
HS32002500  33.1   0.9803     0.9803
HS32002600  5120   100   'EXT'   1.0  1.0
HS32002700   34.6    0.9803   0.9803
*
HS32003000  6  2  0
HS32003001  LOWER-HEAD3
HS32003002  2.2757
HS32003100  -1  1   2.5797
HS32003102  2.5807   2
HS32003103  2.5837   3
HS32003104  2.5907   4
HS32003105  2.6157   5
HS32003106  2.6983   6
HS32003201  'CARBON STEEL'  5
HS32003300  -1
HS32003400  1   320  'EXT'  1.0  1.0
HS32003500  33.1  0.9803  0.9803
HS32003600  5120  100  'EXT'  1.0  1.0
HS32003700  34.6  0.9803  0.9803
*
HS32004000  5           2           1
HS32004001  'LP SHROUD4'
HS32004002  3.256       1.0                         * modified height
HS32004100 -1           2           2.5             * modified diameter
HS32004101  0.00508      1
HS32004102  0.01016      1
HS32004103  0.01524      1
HS32004104  0.02032      1
HS32004200 -1
HS32004201  'STAINLESS STEEL'        4
HS32004300 -1
HS32004400  1           320         'EXT'       0.2          0.2
HS32004500  18.645      0.9803      0.9803                       * modified
HS32004600  1           310         'EXT'       0.2          0.2
HS32004700  19.012      0.9803      0.9803                       * modified
*
HS32005000  5           2           1
HS32005001  'LP SHROUD5'
HS32005002  4.2363      1.0
HS32005100 -1           2           2.5             * modified diameter
HS32005101  0.00508      1
HS32005102  0.01016      1
HS32005103  0.01524      1
HS32005104  0.02032      1
HS32005200 -1
HS32005201  'STAINLESS STEEL'        4
HS32005300 -1
HS32005400  1           320         'EXT'        0.2          0.2
HS32005500  15.889      0.9803      0.9803
HS32005600  1           310         'EXT'        0.2          0.2
HS32005700  16.202      0.9803      0.9803
*
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HS32006000  5           2           1
HS32006001  'LP SHROUD6'
HS32006002  5.2166      1.0
HS32006100 -1           2           2.5797
HS32006101  0.00508      1
HS32006102  0.01016      1
HS32006103  0.01524      1
HS32006104  0.02032      1
HS32006200 -1
HS32006201  'STAINLESS STEEL'        4
HS32006300 -1
HS32006400  1           320         'EXT'        0.2          0.2
HS32006500  4.501       0.2777      0.2777
HS32006600  1           310         'EXT'        0.2          0.2
HS32006700  4.590       0.2777      0.2777
*
* CORE SHROUD - CORE BYPASS TO DOWNCOMER HEAT TRANSFER
*
HS33007000  5           2           1
HS33007001  'CORE SHROUD7'
HS33007002  5.4943      1.0
HS33007100 -1           2           2.5797
HS33007101  0.00508      1
HS33007102  0.01016      1
HS33007103  0.01524      1
HS33007104  0.02032      1
HS33007200 -1
HS33007201  'STAINLESS STEEL'        4
HS33007300 -1
HS33007400  1           330         'EXT'        0.2          0.2
HS33007500  12.351      0.762       0.762
HS33007600  1           310         'EXT'        0.2          0.2
HS33007700  12.594      0.762       0.762
*
HS33008000  5           2           1
HS33008001  'CORE SHROUD8'
HS33008002  6.2563      1.0
HS33008100 -1           2           2.5797
HS33008101  0.00508      1
HS33008102  0.01016      1
HS33008103  0.01524      1
HS33008104  0.02032      1
HS33008200 -1
HS33008201  'STAINLESS STEEL'        4
HS33008300 -1
HS33008400  1           330         'EXT'        0.2          0.2
HS33008500  12.351      0.762       0.762
HS33008600  1           310         'EXT'        0.2          0.2
HS33008700  12.594      0.762       0.762
*
HS33009000  5           2           1
HS33009001  'CORE SHROUD9'
HS33009002  7.0183      1.0
HS33009100 -1           2           2.5797
HS33009101  0.00508      1
HS33009102  0.01016      1
HS33009103  0.01524      1
HS33009104  0.02032      1
HS33009200 -1
HS33009201  'STAINLESS STEEL'        4
HS33009300 -1
HS33009400  1           330         'EXT'        0.2          0.2
HS33009500  12.351      0.762       0.762
HS33009600  1           310         'EXT'        0.2          0.2
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HS33009700  12.594      0.762       0.762
*
HS33010000  5           2           1
HS33010001  'CORE SHROUD10'
HS33010002  7.7803      1.0
HS33010100 -1           2           2.5797
HS33010101  0.00508      1
HS33010102  0.01016      1
HS33010103  0.01524      1
HS33010104  0.02032      1
HS33010200 -1
HS33010201  'STAINLESS STEEL'        4
HS33010300 -1
HS33010400  1           330         'EXT'        0.2          0.2
HS33010500  12.351      0.762       0.762
HS33010600  1           310         'EXT'        0.2          0.2
HS33010700  12.594      0.762       0.762
*
HS33011000  5           2           1
HS33011001  'CORE SHROUD11'
HS33011002  8.5423      1.0
HS33011100 -1           2           2.5797
HS33011101  0.00508      1
HS33011102  0.01016      1
HS33011103  0.01524      1
HS33011104  0.02032      1
HS33011200 -1
HS33011201  'STAINLESS STEEL'        4
HS33011300 -1
HS33011400  1           330         'EXT'        0.2          0.2
HS33011500  12.351      0.762       0.762
HS33011600  1           310         'EXT'        0.2          0.2
HS33011700  12.594      0.762       0.762
*************************************************************************
*****     TF120 specifies the dependence on temperature
*****     of the heat transfer coefficient for the insulated
*****     exterior of the reactor pressure vessel.  TF120
*****     specifies a constant heat transfer coefficient of
*****     6.62 W/M**2/deg K.
*****
TF12000   'RPV/DRYWELL HTC'   2      1.0      0.0
TF12010    273.15   6.62    5000.0   6.62
*************************************************************************
*****  SECONDARY CONTAINMENT SURFACES
*************************************************************************
*****  TORUS ROOM SURFACES
*****
HS04001000 15 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04001001 CENTRAL-COLUMN       *
HS04001002 -17.2  1.            * BOTTOM ALTITUDE, ORIENTATION
HS04001100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04001102  .001   2            *
HS04001103  .003   3
HS04001104  .007   4
HS04001105  .015   5
HS04001106  .023   6
HS04001107  .039   7
HS04001108  .071   8
HS04001109  .135   9
HS04001110  .263  10
HS04001111  .500  11
HS04001112  .750  12
HS04001113 1.00   13
HS04001114 1.50   14
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HS04001115 2.0    15
HS04001201 CONCRETE   14            * MATERIAL TYPE, MESH INTERVAL
HS04001300 0                        * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04001400 1    401  'EXT' 1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04001500 805.  8.9  8.9           * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04001600 0                        * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04002000 11 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04002001 TORUS-ROOM-WALLS     *
HS04002002 -17.2   1.           * BOTTOM ALTITUDE, ORIENTATION
HS04002100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04002102  .001   2            *
HS04002103  .003   3
HS04002104  .007   4
HS04002105  .015   5
HS04002106  .023   6
HS04002107  .039   7
HS04002108  .071   8
HS04002109  .135   9
HS04002110  .263  10
HS04002111  .500  11
HS04002201 CONCRETE   10            * MATERIAL TYPE, MESH INTERVAL
HS04002300 0                        * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04002400 1    401  'EXT'  1.  1.  * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04002500 1391. 8.9  8.9           * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04002600 2210 -1   'EXT'          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04003000 15 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04003001 FLOOR                *
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04003002 -17.2   1.           * BOTTOM ALTITUDE, ORIENTATION
HS04003100   -1   1 0.          * NODALIZATION FLAGS, INSIDE RADIUS
HS04003102  .001   2            *
HS04003103  .003   3
HS04003104  .007   4
HS04003105  .015   5
HS04003106  .023   6
HS04003107  .039   7
HS04003108  .071   8
HS04003109  .135   9
HS04003110  .263  10
HS04003111  .500  11
HS04003112  .750  12
HS04003113 1.00   13
HS04003114 1.50   14
HS04003115 2.0    15
HS04003201 CONCRETE   14            * MATERIAL TYPE, MESH INTERVAL
HS04003300 0                        * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04003400 1    401  'EXT'  1.  1.  * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04003500 1166. 15.  5.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04003600 2210 -1   'EXT'          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04005000 13 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04005001 CEILING              *
HS04005002 -4.7    0.           * BOTTOM ALTITUDE, ORIENTATION
HS04005100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04005102  .001   2            *
HS04005103  .003   3
HS04005104  .007   4
HS04005105  .015   5
HS04005106  .023   6
HS04005107  .039   7
HS04005108  .071   8
HS04005109  .135   9
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HS04005110  .263  10
HS04005111  .500  11
HS04005112  .750  12
HS04005113 1.16   13
HS04005201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04005300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04005400 1    401  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04005500 1166. 11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04005600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
*****   LEVEL-135-SOUTH SURFACES
*****
HS04006000 13 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04006001 EXTWALL              *
HS04006002 -4.1  1.             * BOTTOM ALTITUDE, ORIENTATION
HS04006100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04006102  .001   2            * LOCATION, NODE NO.
HS04006103  .003   3
HS04006104  .007   4
HS04006105  .015   5
HS04006106  .023   6
HS04006107  .039   7
HS04006108  .071   8
HS04006109  .135   9
HS04006110  .263  10
HS04006111  .500  11
HS04006112  .750  12
HS04006113  .900  13
HS04006201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04006300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04006400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04006500  671. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04006600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04006700  671. 7.5  7.5             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04007000 14 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04007001 PRIM-CONT-WALLS      *
HS04007002 -4.1    1.           * BOTTOM ALTITUDE, ORIENTATION
HS04007100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04007102  .001   2            *
HS04007103  .003   3
HS04007104  .007   4
HS04007105  .015   5
HS04007106  .023   6
HS04007107  .039   7
HS04007108  .071   8
HS04007109  .135   9
HS04007110  .263  10
HS04007111  .500  11
HS04007112  .750  12
HS04007113 1.00   13
HS04007114 1.50   14
HS04007201 CONCRETE   13              * MATERIAL TYPE, MESH INTERVAL
HS04007300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04007400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04007500 315.  7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04007600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04008000 11 1 0 0             * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04008001 INT-WALLS            *
HS04008002 -4.1    1.           * BOTTOM ALTITUDE, ORIENTATION
HS04008100 -1 1 0.              * NODALIZATION FLAGS, INSIDE RADIUS
HS04008102  .001   2            *
HS04008103  .003   3
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HS04008104  .007   4
HS04008105  .015   5
HS04008106  .023   6
HS04008107  .039   7
HS04008108  .071   8
HS04008109  .135   9
HS04008110  .263  10
HS04008111  .350  11
HS04008201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04008300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04008400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04008500  950. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04008600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04009000 12 1 0 0              * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04009001 CEILING               *
HS04009002  4.5    0.            * BOTTOM ALTITUDE, ORIENTATION
HS04009100 -1 1 0.               * NODALIZATION FLAGS, INSIDE RADIUS
HS04009102  .001   2             *
HS04009103  .003   3
HS04009104  .007   4
HS04009105  .015   5
HS04009106  .023   6
HS04009107  .039   7
HS04009108  .071   8
HS04009109  .135   9
HS04009110  .263  10
HS04009111  .500  11
HS04009112  .6    12
HS04009201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04009202 CONCRETE   11
HS04009300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04009400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04009500  588. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04009600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04010000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04010001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04010002 -4.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04010100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04010102  .001   2
HS04010103  .003   3
HS04010104  .007   4
HS04010105  .015   5
HS04010106  .023   6
HS04010107  .039   7
HS04010108  .071   8
HS04010109  .135   9
HS04010110  .263  10
HS04010111  .500  11
HS04010112  .75   12
HS04010113 1.15   13
HS04010201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04010300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04010400 1    402  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04010500  588. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04010600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04011000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04011001 MISC-STEEL
HS04011002 -4.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04011100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04011102  .0127  2
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HS04011201 'CARBON STEEL'     1        * MATERIAL TYPE, MESH INTERVAL
HS04011300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04011400 1    402  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04011500 166.9 3.    3.              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04011600 1    402  'EXT'  1.  1.     * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04011700 166.9 3.    3.
*
*****   LEVEL-135-NORTH SURFACES
*****
HS04012000 13 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04012001 EXTWALL
HS04012002 -4.1  1.                    * BOTTOM ALTITUDE, ORIENTATION
HS04012100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04012102  .001   2                   * LOCATION, NODE NO.
HS04012103  .003   3
HS04012104  .007   4
HS04012105  .015   5
HS04012106  .023   6
HS04012107  .039   7
HS04012108  .071   8
HS04012109  .135   9
HS04012110  .263  10
HS04012111  .500  11
HS04012112  .750  12
HS04012113  .900  13
HS04012201 CONCRETE   12               * MATERIAL TYPE, MESH INTERVAL
HS04012300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04012400 1    403  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04012500  671. 7.5  7.5              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04012600 4200 410  'EXT'  1.  1.     * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04012700  671. 7.5  7.5              * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04013000 14 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04013001 PRIM-CONT-WALLS
HS04013002 -4.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04013100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04013102  .001   2
HS04013103  .003   3
HS04013104  .007   4
HS04013105  .015   5
HS04013106  .023   6
HS04013107  .039   7
HS04013108  .071   8
HS04013109  .135   9
HS04013110  .263  10
HS04013111  .500  11
HS04013112  .750  12
HS04013113 1.00   13
HS04013114 1.50   14
HS04013201 CONCRETE   13               * MATERIAL TYPE, MESH INTERVAL
HS04013300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04013400 1    403  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04013500 315.  7.5  7.5              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04013600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04014000 11 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04014001 INT-WALLS
HS04014002 -4.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04014100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04014102  .001   2
HS04014103  .003   3
HS04014104  .007   4
HS04014105  .015   5
HS04014106  .023   6
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HS04014107  .039   7
HS04014108  .071   8
HS04014109  .135   9
HS04014110  .263  10
HS04014111  .350  11
HS04014201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04014300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04014400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04014500  948. 7.5  7.5             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04014600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04015000 12 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04015001 CEILING
HS04015002  4.5    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04015100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04015102  .001   2
HS04015103  .003   3
HS04015104  .007   4
HS04015105  .015   5
HS04015106  .023   6
HS04015107  .039   7
HS04015108  .071   8
HS04015109  .135   9
HS04015110  .263  10
HS04015111  .500  11
HS04015112  .6    12
HS04015201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04015202 CONCRETE   11
HS04015300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04015400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04015500  587. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04015600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04016000 13 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04016001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04016002 -4.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04016100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04016102  .001   2
HS04016103  .003   3
HS04016104  .007   4
HS04016105  .015   5
HS04016106  .023   6
HS04016107  .039   7
HS04016108  .071   8
HS04016109  .135   9
HS04016110  .263  10
HS04016111  .500  11
HS04016112  .75   12
HS04016113 1.15   13
HS04016201 CONCRETE   12              * MATERIAL TYPE, MESH INTERVAL
HS04016300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04016400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04016500  587. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04016600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04017000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04017001 MISC-STEEL
HS04017002 -4.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04017100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04017102  .0127  2
HS04017201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04017300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04017400 1    403  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
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HS04017500 166.9 3.    3.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04017600 1    403  'EXT'  1.  1.   * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04017700 166.9 3.    3.
*
*****   LEVEL-165-SE SURFACES
*****
HS04018000 13 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04018001 EXTWALL
HS04018002  5.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04018100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04018102  .001   2
HS04018103  .003   3
HS04018104  .007   4
HS04018105  .015   5
HS04018106  .023   6
HS04018107  .039   7
HS04018108  .071   8
HS04018109  .135   9
HS04018110  .263  10
HS04018111  .500  11
HS04018112  .750  12
HS04018113  .90   13
HS04018201 CONCRETE   12             * MATERIAL TYPE, MESH INTERVAL
HS04018300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04018400 1    404  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04018500  345. 8.3  8.3            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04018600 4200 410  'EXT'  1.  1.   * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04018700  345. 8.3  8.3            * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04019000 15 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04019001 PCWALL
HS04019002  5.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04019100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04019102  .001   2
HS04019103  .003   3
HS04019104  .007   4
HS04019105  .019   5
HS04019106  .023   6
HS04019107  .039   7
HS04019108  .071   8
HS04019109  .135   9
HS04019110  .263  10
HS04019111  .500  11
HS04019112  .750  12
HS04019113 1.00   13
HS04019114 1.50   14
HS04019115 1.70   15
HS04019201 CONCRETE   14             * MATERIAL TYPE, MESH INTERVAL
HS04019300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04019400 1    404  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04019500 153.  8.3  8.3            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04019600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04020000 11 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04020001 INTWALL
HS04020002  5.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04020100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04020102  .001   2
HS04020103  .003   3
HS04020104  .007   4
HS04020105  .015   5
HS04020106  .023   6
HS04020107  .039   7
HS04020108  .071   8
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HS04020109  .135   9
HS04020110  .263  10
HS04020111  .450  11
HS04020201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04020300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04020400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04020500 1652. 8.3  8.3             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04020600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04021000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04021001 CEILING
HS04021002 13.6    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04021100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04021102  .001   2
HS04021103  .003   3
HS04021104  .007   4
HS04021105  .015   5
HS04021106  .023   6
HS04021107  .039   7
HS04021108  .071   8
HS04021109  .135   9
HS04021110  .263  10
HS04021111  .500  11
HS04021201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04021202 CONCRETE   10
HS04021300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04021400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04021500  291. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04021600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04022000 12 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04022001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04022002  5.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04022100 -1  1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04022102  .001   2
HS04022103  .003   3
HS04022104  .007   4
HS04022105  .015   5
HS04022106  .023   6
HS04022107  .039   7
HS04022108  .071   8
HS04022109  .135   9
HS04022110  .263  10
HS04022111  .500  11
HS04022112  .600  12
HS04022201 CONCRETE   11              * MATERIAL TYPE, MESH INTERVAL
HS04022300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04022400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04022500  261. 11.   5.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04022600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04023000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04023001 STEEL
HS04023002  5.1   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04023100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04023102  .0127  2
HS04023201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04023300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04023400 1    404  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04023500  7.9  3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04023600 1    404  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04023700  7.9  3.    3.
*
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*****   LEVEL-165-MAIN SURFACES
HS04024000 13 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04024001 EXTWALL
HS04024002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04024100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04024102  .001   2
HS04024103  .003   3
HS04024104  .007   4
HS04024105  .015   5
HS04024106  .023   6
HS04024107  .039   7
HS04024108  .071   8
HS04024109  .135   9
HS04024110  .263  10
HS04024111  .500  11
HS04024112  .750  12
HS04024113  .90   13
HS04024201 CONCRETE   12               * MATERIAL TYPE, MESH INTERVAL
HS04024300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04024400 1    405  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04024500 1030. 8.3  8.3              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04024600 4200 410  'EXT'  1.  1.     * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04024700 1030. 8.3  8.3              * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04025000 15 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04025001 PCWALL
HS04025002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04025100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04025102  .001   2
HS04025103  .003   3
HS04025104  .007   4
HS04025105  .019   5
HS04025106  .023   6
HS04025107  .039   7
HS04025108  .071   8
HS04025109  .135   9
HS04025110  .263  10
HS04025111  .500  11
HS04025112  .750  12
HS04025113 1.00   13
HS04025114 1.50   14
HS04025115 1.70   15
HS04025201 CONCRETE   14               * MATERIAL TYPE, MESH INTERVAL
HS04025300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04025400 1    405  'EXT'  1.  1.     * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04025500 457.  8.3  8.3              * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04025600 0                           * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04026000 11 1 0 0                    * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04026001 INTWALL
HS04026002  5.1    1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04026100 -1 1 0.                     * NODALIZATION FLAGS, INSIDE RADIUS
HS04026102  .001   2
HS04026103  .003   3
HS04026104  .007   4
HS04026105  .015   5
HS04026106  .023   6
HS04026107  .039   7
HS04026108  .071   8
HS04026109  .135   9
HS04026110  .263  10
HS04026111  .450  11
HS04026201 CONCRETE   10               * MATERIAL TYPE, MESH INTERVAL
HS04026300 0                           * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
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HS04026400 1    405  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04026500  950. 8.3  8.3            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04026600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04027000 11 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04027001 CEILING
HS04027002 13.6    0.                * BOTTOM ALTITUDE, ORIENTATION
HS04027100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04027102  .001   2
HS04027103  .003   3
HS04027104  .007   4
HS04027105  .015   5
HS04027106  .023   6
HS04027107  .039   7
HS04027108  .071   8
HS04027109  .135   9
HS04027110  .263  10
HS04027111  .500  11
HS04027201 'CARBON STEEL'     2      * MATERIAL TYPE, MESH INTERVAL
HS04027202 CONCRETE   10
HS04027300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04027400 1    405  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04027500  874. 11.   5.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04027600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04028000 12 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04028001 FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04028002  5.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04028100 -1  1 0.                  * NODALIZATION FLAGS, INSIDE RADIUS
HS04028102  .001   2
HS04028103  .003   3
HS04028104  .007   4
HS04028105  .015   5
HS04028106  .023   6
HS04028107  .039   7
HS04028108  .071   8
HS04028109  .135   9
HS04028110  .263  10
HS04028111  .500  11
HS04028112  .600  12
HS04028201 CONCRETE   11             * MATERIAL TYPE, MESH INTERVAL
HS04028300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04028400 1    405  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04028500  784. 11.   5.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04028600 0 .                       * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04029000  2 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04029001 STEEL
HS04029002  5.1   1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04029100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04029102  .0127  2
HS04029201 'CARBON STEEL'     1      * MATERIAL TYPE, MESH INTERVAL
HS04029300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04029400 1    405  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04029500 23.8  3.    3.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04029600 1    405  'EXT'  1.  1.   * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04029700 23.8  3.    3.
*
***** LEVEL-195-SE SURFACES
*****
HS04030000 12 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04030001 EXTWALL
HS04030002 14.2    1.                * BOTTOM ALTITUDE, ORIENTATION
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HS04030100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04030102  .001   2
HS04030103  .003   3
HS04030104  .007   4
HS04030105  .015   5
HS04030106  .023   6
HS04030107  .039   7
HS04030108  .071   8
HS04030109  .135   9
HS04030110  .263  10
HS04030111  .500  11
HS04030112  .600  12
HS04030201 CONCRETE   11              * MATERIAL TYPE, MESH INTERVAL
HS04030300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04030400 1    406  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04030500  588. 5.1  5.1             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04030600 4200 410  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04030700  588. 5.1  5.1             * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04031000 14 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04031001 PCWALL
HS04031002 14.2    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04031100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04031102  .001   2
HS04031103  .003   3
HS04031104  .007   4
HS04031105  .015   5
HS04031106  .023   6
HS04031107  .039   7
HS04031108  .071   8
HS04031109  .135   9
HS04031110  .263  10
HS04031111  .500  11
HS04031112  .750  12
HS04031113 1.0    13
HS04031114 1.5    14
HS04031201 CONCRETE   13              * MATERIAL TYPE, MESH INTERVAL
HS04031300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04031400 1    406  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04031500 258.  5.1  5.1             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04031600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04033000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04033001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04033002 14.2   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04033100 -1     1 0.                * NODALIZATION FLAGS, INSIDE RADIUS
HS04033102  .001   2
HS04033103  .003   3
HS04033104  .007   4
HS04033105  .015   5
HS04033106  .023   6
HS04033107  .039   7
HS04033108  .071   8
HS04033109  .135   9
HS04033110  .263  10
HS04033111  .500  11
HS04033201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04033300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04033400 1    406  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04033500 245.  11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04033600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04034000 10 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
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HS04034001 CEILING
HS04034002 25.5    0.                    * BOTTOM ALTITUDE, ORIENTATION
HS04034100 -1 1 0.                       * NODALIZATION FLAGS, INSIDE RADIUS
HS04034102  .001   2
HS04034103  .003   3
HS04034104  .007   4
HS04034105  .015   5
HS04034106  .023   6
HS04034107  .039   7
HS04034108  .071   8
HS04034109  .135   9
HS04034110  .150  10
HS04034201 'CARBON STEEL'     2          * MATERIAL TYPE, MESH INTERVAL
HS04034202 CONCRETE    9
HS04034300 0                             * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04034400 1    406  'EXT'  1.  1.       * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04034500 245.  11.  11.                * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04034600 0                             * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04035000  2 1 0 0                      * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04035001 STEEL
HS04035002 14.2    1.                    * BOTTOM ALTITUDE, ORIENTATION
HS04035100 -1 1 0.                       * NODALIZATION FLAGS, INSIDE RADIUS
HS04035102  .0127  2
HS04035201 'CARBON STEEL'     1          * MATERIAL TYPE, MESH INTERVAL
HS04035300 0                             * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04035400 1    406  'EXT'  1.  1.       * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04035500  4.5  3.    3.                * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04035600 1    406  'EXT'  1.  1.       * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04035700  4.5  3.    3.
*
***** LEVEL-195-MAIN SURFACES
*****
HS04036000 12 1 0 0                      * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04036001 EXTWALL
HS04036002 14.2    1.                    * BOTTOM ALTITUDE, ORIENTATION
HS04036100 -1 1 0.                       * NODALIZATION FLAGS, INSIDE RADIUS
HS04036102  .001   2
HS04036103  .003   3
HS04036104  .007   4
HS04036105  .015   5
HS04036106  .023   6
HS04036107  .039   7
HS04036108  .071   8
HS04036109  .135   9
HS04036110  .263  10
HS04036111  .500  11
HS04036112  .600  12
HS04036201 CONCRETE   11                 * MATERIAL TYPE, MESH INTERVAL
HS04036300 0                             * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04036400 1    407  'EXT'  1.  1.       * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04036500 1222. 5.1  5.1                * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04036600 4200 410  'EXT'  1.  1.       * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04036700 1222. 5.1  5.1                * RHS AREA, CHARAC LENGTH, AXIAL LENGTH
*
HS04037000 14 1 0 0                      * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04037001 PCWALL
HS04037002 14.2    1.                    * BOTTOM ALTITUDE, ORIENTATION
HS04037100 -1 1 0.                       * NODALIZATION FLAGS, INSIDE RADIUS
HS04037102  .001   2
HS04037103  .003   3
HS04037104  .007   4
HS04037105  .015   5
HS04037106  .023   6
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HS04037107  .039   7
HS04037108  .071   8
HS04037109  .135   9
HS04037110  .263  10
HS04037111  .500  11
HS04037112  .750  12
HS04037113 1.0    13
HS04037114 1.5    14
HS04037201 CONCRETE   13              * MATERIAL TYPE, MESH INTERVAL
HS04037300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04037400 1    407  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04037500 950.  5.1  5.1             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04037600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04039000 11 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04039001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04039002 14.2   1.                  * BOTTOM ALTITUDE, ORIENTATION
HS04039100 -1     1 0.                * NODALIZATION FLAGS, INSIDE RADIUS
HS04039102  .001   2
HS04039103  .003   3
HS04039104  .007   4
HS04039105  .015   5
HS04039106  .023   6
HS04039107  .039   7
HS04039108  .071   8
HS04039109  .135   9
HS04039110  .263  10
HS04039111  .500  11
HS04039201 CONCRETE   10              * MATERIAL TYPE, MESH INTERVAL
HS04039300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04039400 1    407  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04039500 307.  11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04039600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04040000 10 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04040001 CEILING
HS04040002 25.5    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04040100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04040102  .001   2
HS04040103  .003   3
HS04040104  .007   4
HS04040105  .015   5
HS04040106  .023   6
HS04040107  .039   7
HS04040108  .071   8
HS04040109  .135   9
HS04040110  .150  10
HS04040201 'CARBON STEEL'     2       * MATERIAL TYPE, MESH INTERVAL
HS04040202 CONCRETE    9
HS04040300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04040400 1    407  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04040500 307.  11.  11.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04040600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04041000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04041001 STEEL
HS04041002 14.2    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04041100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04041102  .0127  2
HS04041201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04041300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04041400 1    407  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04041500 13.3  3.    3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
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HS04041600 1    407  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04041700 13.3  3.    3.
*
*****  REFUELING BAY SURFACES
HS04042000  6 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04042001  EXTWALL
HS04042002 26.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04042100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04042102  .0002  2
HS04042103  .0004  3
HS04042104  .0008  4
HS04042105  .0015  5
HS04042106  .00254 6
HS04042201 'CARBON STEEL'     5       * MATERIAL TYPE, MESH INTERVAL
HS04042300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04042400 1    408  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04042500 3063. 16.  16.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04042600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04043000  6 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04043001  CEILING
HS04043002 45.0    0.                 * BOTTOM ALTITUDE, ORIENTATION
HS04043100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04043102  .002   2
HS04043103  .004   3
HS04043104  .008   4
HS04043105  .015   5
HS04043106  .0254  6
HS04043201 'CARBON STEEL'     5       * MATERIAL TYPE, MESH INTERVAL
HS04043300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04043400 1    408  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04043500 1661. 16.  16.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04043600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04044000 10 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04044001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04044002 26.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04044100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04044102  .001   2
HS04044103  .003   3
HS04044104  .007   4
HS04044105  .015   5
HS04044106  .023   6
HS04044107  .039   7
HS04044108  .071   8
HS04044109  .135   9
HS04044110  .230  10
HS04044201 CONCRETE    9              * MATERIAL TYPE, MESH INTERVAL
HS04044300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04044400 1    408  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04044500 1362. 16.  16.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04044600 0                          * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04045000  2 1 0 0                   * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04045001  STEEL
HS04045002 26.1    1.                 * BOTTOM ALTITUDE, ORIENTATION
HS04045100 -1 1 0.                    * NODALIZATION FLAGS, INSIDE RADIUS
HS04045102  .0127  2
HS04045201 'CARBON STEEL'     1       * MATERIAL TYPE, MESH INTERVAL
HS04045300 0                          * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04045400 1    408  'EXT'  1.  1.    * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04045500 356.   3.   3.             * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04045600 1    408  'EXT'  1.  1.    * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
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HS04045700 356.   3.   3.
*
***** TURBINE BUILDING SURFACES
HS04046000  6 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04046001  EXTWALL
HS04046002  5.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04046100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04046102  .0002  2
HS04046103  .0004  3
HS04046104  .0008  4
HS04046105  .0015  5
HS04046106  .00254 6
HS04046201 'CARBON STEEL'     5      * MATERIAL TYPE, MESH INTERVAL
HS04046300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04046400 1    409  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04046500 8137.  16. 16.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04046600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04047000  6 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04047001  CEILING
HS04047002 21.9    0.                * BOTTOM ALTITUDE, ORIENTATION
HS04047100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04047102  .002   2
HS04047103  .004   3
HS04047104  .008   4
HS04047105  .015   5
HS04047106  .0254  6
HS04047201 'CARBON STEEL'     5      * MATERIAL TYPE, MESH INTERVAL
HS04047300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04047400 1    409  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04047500 8807. 16.  16.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04047600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04048000  6 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04048001  FLOOR
* USED VERTICAL ORIENTATION TO ELIMINATE POOL HEAT TRANSFER
HS04048002  5.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04048100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04048102  .2     5
HS04048103  .23    6
HS04048201 CONCRETE    5             * MATERIAL TYPE, MESH INTERVAL
HS04048300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04048400 1    409  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04048500 8807. 16.  16.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04048600 0                         * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
*
HS04049000  2 1 0 0                  * NO. NODES, TYPE, NO SS INIT, TRANS ITER
HS04049001  STEEL
HS04049002  5.1    1.                * BOTTOM ALTITUDE, ORIENTATION
HS04049100 -1 1 0.                   * NODALIZATION FLAGS, INSIDE RADIUS
HS04049102 .0127   2
HS04049201 'CARBON STEEL'     1      * MATERIAL TYPE, MESH INTERVAL
HS04049300 0                         * SOURCE TYPE, FLAG, SOURCE MULTIPLIER
HS04049400 1    409  'EXT'  1.  1.   * LHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04049500 356.   3.   3.            * LHS AREA, CHARAC LENGTH, AXIAL LENGTH
HS04049600 1    409  'EXT'  1.  1.   * RHS BC TYPE, ASSOC CV, POOL HT FLAGS
HS04049700 356.   3.   3.
*****************************************************************************
***** TABULAR FUNCTION INPUT FOR HEAT SLABS
*****
TF20000 'RHS HT COEF' 1 1. 0. * NAME, NO. PAIRS, MUL CONST, ADD CONST
TF20010 0. 6.08               * TIME, HEAT TRANSFER COEFFICIENT
*
TF21000 'RHS T - 286' 1 1. 0. * NAME, NO. PAIRS, MUL CONST, ADD CONST
```

```
TF21010 0. 286.                    * TIME, RHS TEMPERATURE
*******************************************************************************
*******************************************************************************
*** CORE PACKAGE INPUT
*******************************************************************************
*
*       CORE NODALIZATION CHANGED FROM 3 RADIAL RINGS AND 6 AXIAL LAYERS TO
*       3 RADIAL RINGS AND 5 AXIAL LAYERS (TOTAL AXIAL NODES 11)
*******************************************************************************
***  GENERAL CORE INPUT
*******************************************************************************
*         NRAD     NAXL     NTLP     NCVOL    NLH      NPNTOT
COR00000  3        11       6        3        5        3
*
*         RFUEL    RCLAD    DRGAP    PITCH    DXCAN    DXSS     DXLH
COR00001  .005207  .0061341 .0001143 .016     .00254   .0012    .2254
*
*         IRTYP    MCRP
COR00002  BWR      B4C
*
*         FCNCL    FSSCN    FCELR    FCELA    FLPUP
COR00003  0.50     0.95     0.30     0.15     0.95     * CHNGED FROM DFLT VALS 1-22-90
*
*         NTPCOR
COR00004  101
*
*         HFRZFU   HFRZZR   HFRZSS   HFRZZX   HFRZSX   HFRZCP
COR00005  1000.0   1000.0   1000.0   1000.0   1000.0   1000.0
*
*         MTUOZR   MTZXZR   MTSXSS   MTCPSS   FUOZR    FZXZR    FSXSS    FCPSS
COR00007  1        2        2        2        0.2      1.0      1.0      0.0
*
*         DRCLMN   DRSSMN
COR00008  1.0E-06  1.0E-06
*
*         HDBPN    HDBLH    TPFAIL   CDISPN
COR00009  500.0    500.0    1273.15   1.0 *
*
*
*         XFE      XCR      XNI      XCAR
COR00010  0.74     0.18     0.08     0.0
*
*         CELL ELEVATIONS AND POROSITIES
*         Z        DZ       PORIN    PORDP
CORZ0101  0.0      1.2954   0.0      0.9 ** LOWER PLENUM **
CORZ0201  1.2954   0.9803   0.00     0.9
CORZ0301  2.2757   0.9803   0.00     0.9
CORZ0401  3.2560   0.9803   0.00     0.9
CORZ0501  4.2363   0.9803   0.00     0.9
CORZ0601  5.2166   0.2777   0.00     0.9 ** CORE PLATE **
CORZ0701  5.4943   0.7620   0.53     0.9 ** CORE **
CORZ0801  6.2563   0.7620   0.53     0.9
CORZ0901  7.0183   0.7620   0.53     0.9
CORZ1001  7.7803   0.7620   0.53     0.9
CORZ1101  8.5423   0.7620   0.53     0.9
*
*
*         CELL CROSS-SECTIONAL BOUNDARY AREAS
*         ASCELA
CORR0101  7.648
CORR0201  7.287
CORR0301  2.251
*
*         BOUNDARY HEAT STRUCTURES
```

```
CORZ0102  32001
CORZ0202  32002    *flag changed to 0
CORZ0302  32003
CORZ0402  32004
CORZ0502  32005
CORZ0602  32006 11  *CORE SUPPORT PLATE
CORZ0702  33007
CORZ0802  33008
CORZ0902  33009
CORZ1002  33010
CORZ1102  33011
*
CORR0102  35003
CORR0202  35003
CORR0302  35003
*****************************************************************************
*         LOWER PLENUM AND CORE INPUT
*****************************************************************************
* CRD HOUSING
* CR GUIDE TUBES (185)
* CORE SUPPORT STRUCTURE (FUEL SUPPORT PIECES, CORE PLATE,
*   AND FUEL ASSEMBLY NOSE PIECES)
*
*  R A    IREFN   ICVHC   ICVHB
COR10101  -1      320     320  *  LOWER PLENUM:  CRD HOUSING
COR20101  101
COR30101  101
*
COR10201  -1      320     320  *  LOWER PLENUM:  CR GUIDE TUBES
COR20201  102
COR30201  102
*
COR10301  102
COR20301  202
COR30301  302
*
COR10401  102     320     320
COR20401  202
COR30401  302
*
COR10501  102     320     320
COR20501  202
COR30501  302
*
COR10601  -1      320     320  *  LOWER PLENUM:  CORE SUPPORT STRUCTURES
COR20601  106
COR30601  106
*
COR10701  -1      340     330  *  CORE
COR20701  107
COR30701  107
*
COR10801  107
COR20801  207
COR30801  307
*
COR10901  107
COR20901  207
COR30901  307
*
COR11001  107
COR21001  207
COR31001  307
*
```

```
COR11101  107
COR21101  207
COR31101  307
*
*            XMFU     XMCL     *XMSS*   XMCP     XMCN
COR10102     0.0      0.0    5420.0     0.0      0.0   *CRD HOUSING steel added
COR20102     0.0      0.0    5094.0     0.0      0.0   * steel added
COR30102     0.0      0.0    1529.0     0.0      0.0   * steel added
*
COR10202     0.0      0.0    6550.00    0.0      0.0   *  CR GUIDE TUBES *modif
COR20202    -1.E3    -1.E3   6100.     -1.E3    -1.E3  * modified JJC 6/92
COR30202    -1.E3    -1.E3   1900.00   -1.E3    -1.E3  * modified JJC 6/92
*
COR10602     0.0      0.0    6675.0     0.0      0.0   *  CORE SUPPORT
COR20602    -1.E3    -1.E3   6360.0    -1.E3    -1.E3  *  STRUCTURES
COR30602    -1.E3    -1.E3   1965.0    -1.E3    -1.E3
*
COR10702  14995.    3153.     1077.    158.9   2339.    *  CORE
COR20702  14287.    3004.     1026.    151.4   2229.
COR30702   4414.     928.      317.     46.8    688.5
*
***  TOP GUIDE INCLUDED WITH AXIAL LEVEL 11 STEEL MASS
COR11102    -1.E3    -1.E3  10744.     -1.E3    -1.E3
COR21102    -1.E3    -1.E3  10237.     -1.E3    -1.E3
COR31102    -1.E3    -1.E3   3163.     -1.E3    -1.E3
*
*         TFU     TCL     TSS     TCN
COR10103  564.0   564.0   564.0   564.0  *  CRD HOUSING
COR10203  564.0   564.0   564.0   564.0  *  CR GUIDE TUBES
COR10603  564.0   564.0   564.0   564.0  *  CORE SUPPORT STRUCTURES
COR10703  564.0   564.0   564.0   564.0  *  CORE
*
*         DHYCL   DHYSS   DHYDP   DHYCNC  DHYCNB
COR10104  1.0     1.0     0.0254   1.0     1.0   *  CRD HOUSING
COR10204  1.0     0.3     0.0254   1.0     1.0   *  CR GUIDE TUBES
COR10604  1.0     0.15    0.0254   1.0     1.0   *  CORE SUPPORT STRUCTURES
COR10704  0.005   0.003   0.0254   0.005   0.003 *  CORE
*
*         ASCELR  AFLOWC  AFLOWB
COR10105  12.70   7.187   0.0     *  CRD HOUSING modified
COR20105  17.75   6.848   0.0     *  modified
COR30105  19.04   2.115   0.0     *  modified
*
COR10205  9.61    7.348  0.0     *  CR GUIDE TUBES modified - back to original
COR20205  13.43   7.001  0.0     *  modified - back to original values
COR30205  14.41   2.163  0.0     *  modified - back to original values
*
COR10605  2.72    4.6171  0.0     *  CORE SUPPORT STRUCTURES modified - back to orig
COR20605  3.80    4.3992  0.0     *  modified - back to original values
COR30605  4.08    1.3592  0.0     *  modified - back to original values
*
COR10705  7.47    3.53775 1.068   *  CORE
COR20705  10.44   3.3708  1.0176
COR30705  11.20   1.0414  0.3144
*
*           ASFU    ASCL    ASSS    ASCN
COR10106    0.0     0.0    40.0     0.0   *  CRD HOUSING modified 8/92
COR20106    0.0     0.0    30.0     0.0   *   modified 8/92
COR30106    0.0     0.0    14.0     0.0   *   modified 8/92
*
COR10206    0.0     0.0    82.53    0.0   *  CR GUIDE TUBES  modified
COR20206   -1.E3   -1.E3   78.63   -1.E3  *  modified
COR30206   -1.E3   -1.E3   24.3    -1.E3  *  modified
*
```

```
COR10606    0.0      0.0     66.75    0.0    *  CORE SUPPORT STRUCTURES
COR20606   -1.E3    -1.E3    63.6    -1.E3
COR30606   -1.E3    -1.E3    19.65   -1.E3
*
COR10706  525.4     639.2  203.4   138.9    *  CORE
COR20706  500.7     609.0  193.9   132.3
COR30706  154.7     188.2   59.9    40.9
*****************************************************************************
*      LOWER HEAD INPUT
*****************************************************************************
*         IRS      IRE     XMLH      TLH      ASLH     ICVLH    ICVCAV
CORLHD01  1        1       13670.0   561.0    7.648    320      100
CORLHD02  2        2       13025.0   561.0    7.287    320      100
CORLHD03  3        3        4024.0   561.0    2.251    320      100
*****************************************************************************
*         LOWER HEAD PENETRATIONS INPUT
*****************************************************************************
*         ALL PENETRATIONS ARE CRD HOUSINGS AND STUB TUBES
*         GEOMETRIC VALUES ARE ESTIMATES
*
*         IPNREF   IRP      XMPN     TPN      ASPN     AXPN     DFLPN
CORPEN01  -1       1        940.0    561.0    24.43    0.575    0.1
CORPEN02  -1       2        895.5    561.0    23.28    0.548    0.1
CORPEN03  -1       3        276.7    561.0     7.19    0.169    0.1
*
*******************************************************************************
*****************************************************************************
*         DTDZ MODEL INPUT - VOLUME INLET SPECIFICATIONS
*
*         CV        SOURCE
CORTIN00  320       320     *LOWER PLENUM, LOWER PLENUM
CORTIN01  330       320     *BYPASS, LOWER PLENUM
CORTIN02  340       320     *CORE, LOWER PLENUM
*
* FLOW BLOCKAGE INPUT
*
FL39900   'VESSEL BREACH'   320  100  0.0     -0.2254
FL39901   0.01  0.2254  0.0                 * INITIALLY CLOSED
FL39902   3 * HORIZONTAL FLOW PATH
FL39903   1.0     1.0
FL399S0   0.01  0.2254  0.1128
FL399V0   -1  130  130
*
CF09100  'FLAREA-1'  MIN  2  1.0  0.0
CF09110  0.0  2.18248  COR-AFLMIN.103.111
CF09111  1.0  0.0      COR-AFLMIN.103.111
*
CF09200  'FLAREA-2'  MIN  2  1.0  0.0
CF09210  0.0  2.07949  COR-AFLMIN.203.211
CF09211  1.0  0.0      COR-AFLMIN.203.211
*
CF09300  'FLAREA-3'  MIN  2  1.0  0.0
CF09310  0.0  0.64249  COR-AFLMIN.303.311
CF09311  1.0  0.0      COR-AFLMIN.303.311
*
CF09400  'FLAREA-T'  ADD  3  1.0  0.0
CF09410  1.0  0.0      CFVALU.091
CF09411  1.0  0.0      CFVALU.092
CF09412  1.0  0.0      CFVALU.093
*
CF09500  'FRAC-AREA'  DIVIDE  2  1.0  0.0
CF09502  3  0.03  0.61748
CF09510  0.0  7.9428   CFVALU.094
CF09511  1.0  0.0      CFVALU.094
```

```
*
FL324V0   -1   95  95                    * CF FOR FLOW BLOCKAGE
*
* VESSEL BREACH INPUT
*
CF13000   'VESSEL BREACH'  DIVIDE  2  1.0  0.0
CF13010   0.0  0.01  COR-ABRCH
CF13011   1.0  0.0   COR-ABRCH
*******************************************************************************
*******************************************************************************
*** DECAY HEAT PACKAGE
*******************************************************************************
***  SPECIFY A BWR
DCHREACTOR   BWR
*
*         SET REACTOR SHUTDOWN TIME TO 0 SEC
*
DCHSHUT    0       0.0
*
*         TABULAR FUNCTION TF077 GIVES DECAY HEAT AS A FRACTION
*         OF THERMAL POWER AT SHUTDOWN VS TIME SINCE SHUTDOWN
*
*         THERMAL POWER AT SHUTDOWN = 3293 MW
*
DCHDECPOW     TF.77
*
TF07700   'DECAY HEAT'  45  3293.0E06  0.0
*
*        TIME SINCE        DECAY HEAT
*         SHUTDOWN     (FRACTION SHUTDOWN
*                        THERMAL POWER)
TF07710  0.000000     1.0
TF07711  0.20000E+00  1.00000E-01
TF07712  1.00000E+00  5.71500E-02
TF07713  1.50000E+00  5.55200E-02
TF07714  2.00000E+00  5.43700E-02
TF07715  3.00000E+00  5.20400E-02
TF07716  4.00000E+00  5.04000E-02
TF07717  6.00000E+00  4.80700E-02
TF07718  8.00000E+00  4.61900E-02
TF07719  1.00000E+01  4.47300E-02
TF07720  1.50000E+01  4.20500E-02
TF07721  2.00000E+01  4.01500E-02
TF07722  3.00000E+01  3.75600E-02
TF07723  4.00000E+01  3.57200E-02
TF07724  6.00000E+01  3.31300E-02
TF07725  8.00000E+01  3.13700E-02
TF07726  1.00000E+02  3.00000E-02
TF07727  1.50000E+02  2.77700E-02
TF07728  2.00000E+02  2.61900E-02
TF07729  3.00000E+02  2.42800E-02
TF07730  4.00000E+02  2.29300E-02
TF07731  6.00000E+02  2.10200E-02
TF07732  8.00000E+02  1.96500E-02
TF07733  1.00000E+03  1.85900E-02
TF07734  1.50000E+03  1.66200E-02
TF07735  2.00000E+03  1.52200E-02
TF07736  3.00000E+03  1.35400E-02
TF07737  4.00000E+03  1.23500E-02
TF07738  6.00000E+03  1.06700E-02
TF07739  8.00000E+03  9.81500E-03
TF07740  1.00000E+04  9.15200E-03
TF07741  1.50000E+04  8.19300E-03
TF07742  2.00000E+04  7.51200E-03
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TF07743  3.00000E+04  6.76400E-03
TF07744  4.00000E+04  6.23200E-03
TF07745  6.00000E+04  5.48400E-03
TF07746  8.00000E+04  5.03900E-03
TF07747  1.00000E+05  4.69300E-03
TF07748  1.50000E+05  4.14100E-03
TF07749  2.00000E+05  3.74900E-03
TF07750  3.00000E+05  3.27500E-03
TF07751  4.00000E+05  2.94000E-03
TF07752  6.00000E+05  2.46600E-03
TF07753  8.00000E+05  2.18700E-03
TF07754  1.00000E+06  1.97100E-03
*         END OF DECAY HEAT TABLE
*******************************************************************************
*******************************************************************************
*** TRANSFER PROCESS PACKAGE INPUT
*******************************************************************************
*   'IN' TRANSFER PROCESS FOR CORE PACKAGE
*           NMSIN   NTHRM
TPIN10100   6       9
*TPIN10200   5       9
*
*    'OUT' TRANSFER PROCESS FOR FDI PACKAGE
*           NMSOT   NPOTOI  IOTMTX
TPOT10100   5       101     UIN.101
*TPOT10200   5       102     DEF.1
*
*     COR-CAV TRANSLATION MATRIX
*     *** NOTE *** CONTROL POISON MASS IS NOT CONSERVED
*           NROW    NCOL
TPM1010000  5       6
*           NROW/NCOL  VALUE
TPM1010001  1/1        1.0     * UO2 MASS
TPM1010002  2/2        1.0     * ZRO2 MASS
TPM1010003  3/3        1.0     * STEEL MASS
TPM1010004  4/4        1.0     * ZR MASS
TPM1010005  5/5        1.0     * STEEL OXIDE MASS
*
*          TRANSFER PROCESS INPUT - RADIONUCLIDE MASS
*          NMSIN  NTHRM
TPIN60100   16      1
*TPIN60200   16      1
*          NMSOT  NPOTOI  IOTMTX
TPOT60100   16      601    DEF.1
*TPOT60200   16      602    DEF.1
*************************************************************************
*************************************************************************
*** CAVITY PACKAGE INPUT
*************************************************************************
***       TWO-CAVITY MODEL
CAV0000   100              'CAVITY 1'
CAV00C0   NONSTAND      * PEACH BOTTOM CONCRETE * JJC from Table 4.1 of a
***             Report by S.A.Hodge, C.R.Hyman and L.J.Ott, Nov. 28, 1988
CAV00C1   AL2O3          0.009
CAV00C2   CAO            0.338
CAV00C3   CO2            0.206
CAV00C4   SIO2           0.358
CAV00C5   H2OEVAP        0.045
CAV00C6   H2OCHEM        0.027
CAV00C7   FE              .135
CAV00CA   TABLCT    1500.    *modified as per C.R. Hyman
CAV00CB   TINCT      300.
CAV00CC   EMISCT    .6
CAV00CD   DENSCT    2340.
```

```
CAV00CE   TSOLCT    1420.   *modified as per C.R. Hyman
CAV00CF   TLIQCT    1670.   *modified  as per C.R. Hyman
CAV00G0   CORCON    2                  * FLAT BOTTOM CYLINDER
*
*          NRAYS      RO        ZO
CAV00G1      35       0.0       1.
*        ZT   RAD  HIT  RADC  RW  HBB   NBOT NCORN
CAV00G2  2.   2.06 .457  0.1  3.52 1.524  25    3
*       NEXTRA REXTRA ZEXTRA
CAV00GA   20   3.085  1.99
CAV00GB   20   3.085  0.
CAV00TP  101
CAV00U1  EMISS.OX    0.5
CAV00U2  EMISS.MET   0.5
CAV00U3  EMISS.SUR   0.8
CAV00RR  01
*************************************************************************
CAV0100   101              'CAVITY 2'
CAV01C0   NONSTAND      * PEACH BOTTOM CONCRETE * JJC from Table 4.1 of a
***              Report by S.A.Hodge, C.R.Hyman and L.J.Ott, Nov. 28, 1988
CAV01C1   AL2O3           0.009
CAV01C2   CAO             0.338
CAV01C3   CO2             0.206
CAV01C4   SIO2            0.358
CAV01C5   H2OEVAP         0.045
CAV01C6   H2OCHEM         0.027
CAV01C7   FE               .135
CAV01CA   TABLCT    1500.    *modified as per C.R. Hyman
CAV01CB   TINCT      300.
CAV01CC   EMISCT    .6
CAV01CD   DENSCT    2340.
CAV01CE   TSOLCT    1420.   *modified as per C.R. Hyman
CAV01CF   TLIQCT    1670.   *modified  as per C.R. Hyman
CAV01G0   CORCON    2                  * FLAT BOTTOM CYLINDER
*
*          NRAYS      RO        ZO
CAV01G1      35       0.0       1.
*        ZT   RAD  HIT  RADC  RW  HBB   NBOT NCORN
CAV01G2  2.   2.06 .457  0.1  6.3  1.524  25    3
*       NEXTRA REXTRA ZEXTRA
CAV01GA   40   5.7036  1.99
CAV01GB   20   5.7036  0.
CAV01U1  EMISS.OX    0.5
CAV01U2  EMISS.MET   0.5
CAV01U3  EMISS.SUR   0.8
*************************************************************************
*************************************************************************
*************************************************************************
***  BURN PACKAGE INPUT
*************************************************************************
BUR000 0
*      XH2IGN   XCOIGN  XH2IGY  XCOIGY  XO2IG  XMSCIG
*BUR001
*      CVNUM  IGNTR   CDIM   TFRAC
BUR101  401     1     17.6    .25
BUR102  402     1     11.2    .25
BUR103  403     1     17.3    .25
BUR104  404     1     13.3    .25
BUR105  405     1     19.2    .25
BUR106  406     1     13.5    .25
BUR107  407     1     16.9    .25
BUR108  408     1     31.4    .25
BUR109  409     1     53.0    .25
*************************************************************************
```

```
*****************************************************************************
***  RADIONUCLIDE PACKAGE INPUT
*****************************************************************************
*****************************************************************************
*
DCHDEFCLS0 ALL
*
*  CSI CLASS
DCHNEM0100 CI 1.0E-6
DCHNEM0101 0. 8.3807E5  6.12 6.6913E5 61.2 4.6653E5 612. 3.2606E5
DCHNEM0102 3600. 2.2395E5 7200. 1.7296E5 14400. 1.1438E5 36000. .70876E5
DCHNEM0103 54000. .53576E5
DCHCLS0160 CSI
DCHCLS0161 CI
*
DCHCLSNORM YES
*****************************************************************************
RN1000 0
RN1001 5 1 16 14 13 0 0
RN1100 1.0E-6 50.E-6 1000.
*
RNACOEF    1
*
*ESF(POOL SCRUBBING INPUT) FOR FL362 & FL020
*
RN2PLS01  362    0.005   1.5   0.20   1.16
RN2PLS02  020    0.005   1.5   0.20   1.16
*
*CAVITY POOL SCRUBBING
*
RN2PLS03 1000    0.005   1.5   0.20   1.16
*
RNCLS0100 16
RNCLS0101 2 1.0  *CS
RNCLS0102 4 0.5  *I2
*
*   FUEL INVENTORIES
*
RNFP000 -1 * CORSOR W/ S/V RATIO
*
*   RADIAL RING 1
*
RNFPN10701 0 .177 .534
*
RNFPN10801 0 .230 .534
*
RNFPN10901 0 .230 .534
*
RNFPN11001 0 .222 .534
*
RNFPN11101 0 .141 .534
*
*   RADIAL RING 2
*
RNFPN20701 0 .177 .420
*
RNFPN20801 0 .230 .420
*
RNFPN20901 0 .230 .420
*
RNFPN21001 0 .222 .420
*
RNFPN21101 0 .141 .420
*
```

```
*   RADIAL RING 3
*
RNFPN30701 0 .177 .046
*
RNFPN30801 0 .230 .046
*
RNFPN30901 0 .230 .046
*
RNFPN31001 0 .222 .046
*
RNFPN31101 0 .141 .046
*
*   GAP RADIONUCLIDES
*
*    RADIAL RING 1
*
RNGAP10700 1173.
RNGAP10701 2 .05       1.0  *CS
RNGAP10702 4 .017      1.0  *I
RNGAP10703 1 .03       1.0  *XE
RNGAP10704 5 .0001     1.0  *TE
RNGAP10705 3 .000001   1.0  *BA,SR
*
RNGAP10800 1173.
RNGAP10801 -107 1. 1.
*
RNGAP10900 1173.
RNGAP10901 -107 1. 1.
*
RNGAP11000 1173.
RNGAP11001 -107 1. 1.
*
RNGAP11100 1173.
RNGAP11101 -107 1. 1.
*
*    RADIAL RING 2
*
RNGAP20700 1173.
RNGAP20701 -107 1. 1.
*
RNGAP20800 1173.
RNGAP20801 -107 1. 1.
*
RNGAP20900 1173.
RNGAP20901 -107 1. 1.
*
RNGAP21000 1173.
RNGAP21001 -107 1. 1.
*
RNGAP21100 1173.
RNGAP21101 -107 1. 1.
*
*    RADIAL RING 3
*
RNGAP30700 1173.
RNGAP30701 -107 1. 1.
*
RNGAP30800 1173.
RNGAP30801 -107 1. 1.
*
RNGAP30900 1173.
RNGAP30901 -107 1. 1.
*
RNGAP31000 1173.
```

```
RNGAP31001 -107 1. 1.
*
RNGAP31100 1173.
RNGAP31101 -107 1. 1.
*
RNVNCL01 25 16
*****************************************************************************
*        DEPOSITION SURFACES
*****************************************************************************
*           IDS   SIDE    TYPE
RNDS000    10001   LHS    FLOOR      * DRYWELL-LINER
RNDS001    36002   RHS    FLOOR      * UPPER-HEAD
RNDS002    20001   LHS    FLOOR      * WETWELL-LINER
RNDS003    32001   LHS    FLOOR      * LOWER-HEAD
RNDS004    36002   LHS    CEILING    * UPPER-HEAD
RNDS005     4003   LHS    FLOOR      *
RNDS007     4010   LHS    FLOOR      *
RNDS009     4016   LHS    FLOOR      *
RNDS011     4022   LHS    FLOOR      *
RNDS013     4028   LHS    FLOOR      *
RNDS016     4033   LHS    FLOOR      *
RNDS018     4039   LHS    FLOOR      *
RNDS019     4044   LHS    FLOOR      *
RNDS021     4048   LHS    FLOOR      *
RNDS022    10010   LHS    FLOOR      * VOLUME 100
RNDS023    10011   LHS    FLOOR      * VOLUME 101
*****************************************************************************
*        SETTLING AREAS
*****************************************************************************
*           IVOLF   IVOLT    ELEV    AREA
RNSET000     310     320     5.4943   .6782      * AN-LP
RNSET001     330     320     5.4943   .0793      * BP-LP
RNSET002     340     320     5.4943  4.905       * CH-LP
RNSET003     350     340     9.667   5.366       * SH-CH
RNSET004     360     350    15.431   4.7763      * SD-SH
RNSET005     410     410     0.01      1.        * ENV-ENV
RNSET006     402     401    -4.1     8.6         * FL401
RNSET007     404     402     5.1     33.2        * FL402
RNSET008     406     404    14.2     33.2        * FL407
RNSET009     408     406    26.1     33.2        * FL411
RNSET010     150     101    -6.7     36.0        *
RNSET011     103     100     3.1      3.2        * FL 14
*****************************************************************************
*****************************************************************************
*** MATERIAL PROPERTIES PACKAGE
*****************************************************************************
***            Property              Units
***
***            temperature           K
***            density               kg/m*3
***            heat capacity         J/kg-K
***            thermal conductivity  W/m-K
*****************************************************************************
***          Material 2 is concrete
***

MPMAT00200   CONCRETE
***
***          PROPERTY   TAB FUNC
MPMAT00201     RHO         4
MPMAT00202     CPS         5
MPMAT00203     THC         6
***
***          Density of concrete
```

```
***
TF00400     'RHO CONCRETE'   2   1.00   0.0
***
***          TEMPERATURE     RHO
TF00412         200.00     2522.60
TF00413        5000.00     2522.60
***
***          Heat capacity of concrete
***
TF00500     'CPS CONCRETE'   2   1.00   0.0
***
***          TEMPERATURE     CPS
TF00512         200.00     1299.97
TF00513        5000.00     1299.97
***
***          Thermal conductivity of concrete
***
TF00600     'THC CONCRETE'   2   1.00   0.0
***
***          TEMPERATURE     THC
TF00612         200.00       1.524
TF00613        5000.00       1.524
*******************************************************************************
***          Material 3 is carbon steel
***
MPMAT00300  'CARBON STEEL'
***
***          PROPERTY   TAB FUNC
***
MPMAT00301     RHO          7
MPMAT00302     CPS          8
MPMAT00303     THC          9
***
***          Density of carbon steel
***
TF00700     'RHO CARBON STEEL'   2   1.00   0.0
***
***          TEMPERATURE     RHO
TF00712         273.15     7833.0
TF00713        5000.00     7833.0
***
***          Heat capacity of carbon steel
***
TF00800     'CPS CARBON STEEL'   2   1.00   0.0
***
***          TEMPERATURE     CPS
TF00812         273.15      465.0
TF00813        5000.00      465.0
***
***          Thermal conductivty of carbon steel
***
TF00900     'THC CARBON STEEL'  10   1.00   0.0
***
***          TEMPERATURE     THC
TF00910         273.15       55.0
TF00911         373.15       52.0
TF00912         473.15       48.0
TF00913         573.15       45.0
TF00914         673.15       42.0
TF00915         873.15       35.0
TF00916        1073.15       31.0
TF00917        1273.15       29.0
TF00918        1473.15       31.0
TF00919        9973.15       31.0
```

```
***
MPMAT00500    ZIRCALOY
*
MPMAT00501    ENH   82
MPMAT00502    TMP   83
MPMAT00550    MLT   2500.0
*
TF08200   EZIRC   17   1.0
TF08211    300.0      0.
TF08212    400.0    21915.
TF08213    640.0   105110.
TF08214   1090.0   263960.
TF08215   1093.0   265275.5
TF08216   1113.0   276195.5
TF08217   1133.0   288245.5
TF08218   1153.0   301585.5
TF08219   1173.0   316935.5
TF08220   1193.0   332795.5
TF08221   1213.0   346685.5
TF08222   1233.0   357565.5
TF08223   1248.0   363753.
TF08224   2098.0   666353.
TF08225   2500.0   809465.
TF08226   2500.01  1034465.
TF08227   3598.0   1425353.
*
TF08300   TZIRC  17   1.0
*
TF08311        0.      300.0
TF08312     21915.     400.0
TF08313    105110.     640.0
TF08314    263960.    1090.0
TF08315    265275.5   1093.0
TF08316    276195.5   1113.0
TF08317    288245.5   1133.0
TF08318    301585.5   1153.0
TF08319    316935.5   1173.0
TF08320    332795.5   1193.0
TF08321    346685.5   1213.0
TF08322    357565.5   1233.0
TF08323    363753.    1248.0
TF08324    666353.    2098.0
TF08325    809465.    2500.0
TF08326   1034465.    2500.01
TF08327   1425353.    3598.0
*
MPMAT00700   'URANIUM DIOXIDE'
MPMAT00701   ENH  72
MPMAT00702   TMP  73
MPMAT00703   CPS  71
MPMAT00750   MLT  2800.0
*
TF07200   EUO2   31   1.0
TF07211    300.0      33143.
TF07212    400.0      58419.
TF07213    500.0      85883.
TF07214    600.0     114638.
TF07215    700.0     144257.
TF07216    800.0     174517.
TF07217    900.0     205288.
TF07218   1000.0     236492.
TF07219   1100.0     268080.
TF07220   1200.0     300023.
TF07221   1300.0     332309.
```

```
TF07222   1400.0      364947.
TF07223   1500.0      397973.
TF07224   1600.0      431455.
TF07225   1700.0      465502.
TF07226   1800.0      500266.
TF07227   1900.0      535945.
TF07228   2000.0      572782.
TF07229   2100.0      611064.
TF07230   2200.0      651111.
TF07231   2300.0      693275.
TF07232   2400.0      737927.
TF07233   2500.0      785450.
TF07234   2600.0      836232.
TF07235   2700.0      890656.
TF07236   2800.0      949096.
TF07237   2800.01    1223096.
TF07238   2900.0     1285906.
TF07239   3000.0     1353422.
TF07240   3113.0     1435764.
TF07241   3513.0     1636964.
*
TF07300   TUO2   31   1.0
TF07311     33143.    300.0
TF07312     58419.    400.0
TF07313     85883.    500.0
TF07314    114638.    600.0
TF07315    144257.    700.0
TF07316    174517.    800.0
TF07317    205288.    900.0
TF07318    236492.   1000.0
TF07319    268080.   1100.0
TF07320    300023.   1200.0
TF07321    332309.   1300.0
TF07322    364947.   1400.0
TF07323    397973.   1500.0
TF07324    431455.   1600.0
TF07325    465502.   1700.0
TF07326    500266.   1800.0
TF07327    535945.   1900.0
TF07328    572782.   2000.0
TF07329    611064.   2100.0
TF07330    651111.   2200.0
TF07331    693275.   2300.0
TF07332    737927.   2400.0
TF07333    785450.   2500.0
TF07334    836232.   2600.0
TF07335    890656.   2700.0
TF07336    949096.   2800.0
TF07337   1223096.   2800.01
TF07338   1285906.   2900.0
TF07339   1353422.   3000.0
TF07340   1435764.   3113.0
TF07341   1636964.   3513.0
*
TF07100   CPUO2  31   1.0
TF07111    273.15   230.22
TF07112    400.0    265.84
TF07113    500.0    282.07
TF07114    600.0    292.36
TF07115    700.0    299.67
TF07116    800.0    305.31
TF07117    900.0    309.98
TF07118   1000.0    314.03
TF07119   1100.0    317.69
```

```
TF07120   1200.0    321.15
TF07121   1300.0    324.59
TF07122   1400.0    328.24
TF07123   1500.0    332.40
TF07124   1600.0    337.43
TF07125   1700.0    343.76
TF07126   1800.0    351.84
TF07127   1900.0    362.14
TF07128   2000.0    375.09
TF07129   2100.0    391.08
TF07130   2200.0    410.45
TF07131   2300.0    433.45
TF07132   2400.0    460.23
TF07133   2500.0    490.88
TF07134   2600.0    525.4
TF07135   2700.0    563.71
TF07136   2800.0    605.67
TF07137   2800.01   503.0
TF07138   2900.0    503.0
TF07139   3000.0    503.0
TF07140   3113.0    503.0
TF07141   5000.0    503.0
*
*************************************************************
********END OF INPUT *************************************************************
*****************************************************************************
```

```
******************    MELCOR   INPUT    *****************


TITLE        LOCA
RESTARTF     ST5.RST
CPULIM      199000.
CPULEFT       10.
OUTPUTF      LOCA.OUT
TIME1        0    1.0    0.0001 40.    2.0   40.
TIME2        40.  5.   0.0001 3360.  240.   4000.
TIME3       1780.  5.   0.0001 9000.  240.   5000.
TIME4       9000.  0.5  0.0001 5000.  240.   5000.
TIME5       10000.  1.   0.0001 10000.0 340.  5000.
TIME6       15000.0 5.0  0.0001 5000.0  340.0 1000.0
TIME7       20000.0 5.0  0.0001 10000.0 340.0  5000.0
TEND      46800.
.
```

Appendix E

CORBH Input

The model for this input is described in Sect. 4.2. This MELGEN input file has been used in conjunction with a MELGEN input file with a single-node drywell model. The same MELCOR file of Appendix B was used.

```
*********************************************************************
*
*     CORE INPUT
*
*********************************************************************
* This card replaces the penetration card parameters in MELCOR
*
*          HDBPN    HDBLH    TPFAIL   CDISPN
COR00009  1.E-3    1.E-3    10000.0   1.0
*
*
*
*  ORNL BOTTOM HEAD INPUT
CORBH0000  'PEACH BOTTOM SHORT TERM STATION BLACKOUT WITH ADS ACTUATION'
*
*            HBSB      NA    NPS  IEUTEC NMELTX  TMLTBD
CORBH0100    3.086     26    26     4      0      2672.
*
*            AMTMEL    AMMLWT    AMLAMF
*             (K)                (J/KG)
CORBH0201    2124.8    91.22    2.51208E5  *  ZR
CORBH0202    1899.8    55.847   2.72142E5  *  FE
CORBH0203    2144.3    51.996   3.16336E5  *  CR
CORBH0204    1899.8    58.700   3.00054E5  *  NI
CORBH0205    4272.0    12.011   8.71552E6  *  C
CORBH0206    2310.9    10.810   1.74450E6  *  B
CORBH0207    1405.4   238.030   5.34980E4  *  U
CORBH0208       0.0     0.0      0.0       *
CORBH0209       0.0     0.0      0.0       *
CORBH0210    2727.6    55.260   1.89336E6  *  B4C
CORBH0211    2977.6   123.220   7.07104E5  *  ZRO2
CORBH0212    1649.8    71.850   4.41940E5  *  FEO
CORBH0213    1733.2   159.690   5.25676E5  *  FE2O3
CORBH0214    1838.7   231.540   5.95456E5  *  FE3O4
CORBH0215    2572.0   152.02    6.88496E5  *  CR2O3
CORBH0216    2244.3    74.710   6.79192E5  *  NIO
CORBH0217    2727.6    69.620   3.44248E5  *  B2O3
CORBH0218    3010.9   270.070   2.74468E5  *  UO2
CORBH0219       0.0     0.0      0.0       *
CORBH0220       0.0     0.0      0.0       *
*
*
*            HH        VCORE     VSHRD
*           (M)       (M**3)    (M**3)
CORBH0301   0.0       0.0        0.0
CORBH0302   .15113    1.48918E-1 0.0
CORBH0303   .27686    5.53594E-1 0.0
CORBH0304   .39726    1.18169E0  0.0
CORBH0305   .56134    2.37785E0  0.0
CORBH0306   .76454    4.33282E0  0.0
CORBH0307  1.02870    7.54596E0  0.0
CORBH0308  1.29540    1.18312E1  0.0
CORBH0309  1.83515    2.36323E1  0.0
CORBH0310  2.28600    3.54289E1  0.0
CORBH0311  2.70510    4.74398E1  0.0
CORBH0312  3.02514    5.67102E1  0.0
CORBH0313  3.0861     5.80584E1  0.0
CORBH0314  3.3401     6.36094E1  1.83977E0
```

```
CORBH0315  3.59918    6.90128E1   4.02748E0
CORBH0316  3.75158    7.21913E1   5.34959E0
CORBH0317  4.41198    8.59646E1   1.33031E1
CORBH0318  4.48056    8.73949E1   1.39174E1
CORBH0319  4.57200    8.92048E1   1.47468E1
CORBH0320  4.75234    9.25459E1   1.62619E1
CORBH0321  4.85394    9.42685E2   1.70658E1
CORBH0322  5.08000    9.86582E2   1.89002E1
CORBH0323  5.21462    1.00691E2   1.98541E1
CORBH0324  5.26796    1.01099E2   2.02944E1
CORBH0325  5.36702    1.02823E2   2.11121E1
CORBH0326  5.49402    1.05100E2   2.21604E1
*
*            HPS        VPS
*            (M)       (M**3)
CORBH0401   0.0        0.0
CORBH0402    .15113    7.62000E-2
CORBH0403    .27686    1.91800E-1
CORBH0404    .39726    3.33100E-1
CORBH0405    .56134    5.92500E-1
CORBH0406    .76454    1.05290E0
CORBH0407   1.02870    1.91160E0
CORBH0408   1.29540    2.69730E0
CORBH0409   1.83515    3.62210E0
CORBH0410   2.28600    4.39460E0
CORBH0411   2.70510    5.11260E0
CORBH0412   3.02514    5.94570E0
CORBH0413   3.08610    6.04010E0
CORBH0414   3.34010    6.43320E0
CORBH0415   3.59918    6.83420E0
CORBH0416   3.75158    7.07010E0
CORBH0417   4.41198    8.09230E0
CORBH0418   4.48056    8.19840E0
CORBH0419   4.57200    8.34000E0
CORBH0420   4.75234    8.61910E0
CORBH0421   4.85394    8.77640E0
CORBH0422   5.08000    9.12630E0
CORBH0423   5.21462    9.89880E0
CORBH0424   5.26796    1.02049E1
CORBH0425   5.36702    1.06539E1
CORBH0426   5.49402    1.11631E1
*
*        PORBOX  PORBM DTHEAD  H1MAX   HD1D2    HRVDW   HBSKRT
CORBH0500  0.4    0.2   60.0   0.66    1.067  3.54654  3.54654
*
*         HSKIRT   THKCRS    THKHD1     THKHD2     THK6   THK60
CORBH0600 1.5240 0.050801  0.214         0.16   1672.0  1560.9
*
*       IMWDEB  SFCRDB  FZRMX1  FZRMX2  DRXID  TFAIL2    HCYL    RCYL
CORBH0700 1      4.0     1.0    1.0    6.3754  1922.0  3.1877  3.1877
*
*          TMLIEU  IEUKEY  FRCKEY
CORBH0801   1723.2   2     .63100
CORBH0802   1733.2   3     .19020
CORBH0803   1873.2   1     .30000
CORBH0804   2573.2  11     .75000
*
*     IEU(J,II) 1.LE.J.LE.20, 1.LE.II.LE.IEUTEC, 1.LE.K.LE.4
```

```
*          PURE SPECIES INDEX:J
*          /1  2  3  4  5 = / ZR    FE    CR    NI    C
*           6  7  8  9 10 =   B     U     -     -     B4C
*          11 12 13 14 15 =   ZRO2  FEO   FE2O3 FE3O4 CR2O3
*          16 17 18 19 20/=   NIO   B2O3  UO2   -     - /
*
*     IEU(J,II)=0 MEANS THAT SPECIES J IS NOT IN EUTECTIC II
*              =1 MEANS THAT SPECIES J IS IN EUTECTIC II
*CORBH09IIK
*      II=EUTECTIC INDEX
*       J=PURE SPECIES INDEX
*       K=CARD COUNTER
* EUTECTIC 1
CORBH09011  1  1  1  0  0
CORBH09012  0  0  0  0  0
CORBH09013  0  0  0  0  0
CORBH09014  0  0  0  0  0
* EUTECTIC 2
CORBH09021  0  1  1  1  0
CORBH09022  0  0  0  0  0
CORBH09023  0  0  0  0  0
CORBH09024  0  0  0  0  0
* EUTECTIC 3
CORBH09031  1  1  0  1  0
CORBH09032  0  0  0  0  0
CORBH09033  0  0  0  0  0
CORBH09034  0  0  1  0  0
* EUTECTIC 4
CORBH09041  0  0  0  0  0
CORBH09042  0  0  0  0  0
CORBH09043  1  0  0  0  0
CORBH09044  0  0  1  0  0
*
*CORBH10IIK
*      II=EUTECTIC INDEX
*       J=PURE SPECIES INDEX
*       K=CARD COUNTER
*       XRNKEY(J,II)  1.LE.J.LE.20, 1.LE.II.LE.IEUTEC, 1.LE.K.LE.4
* EUTECTIC 1
CORBH10011  0.193  0.631  0.176  0.0    0.0
CORBH10012  0.0    0.0    0.0    0.0    0.0
CORBH10013  0.0    0.0    0.0    0.0    0.0
CORBH10014  0.0    0.0    0.0    0.0    0.0
* EUTECTIC 2
CORBH10021  0.0    .7306 .1902  .0792  0.0
CORBH10022  0.0    0.0    0.0    0.0    0.0
CORBH10023  0.0    0.0    0.0    0.0    0.0
CORBH10024  0.0    0.0    0.0    0.0    0.0
* EUTECTIC 3
CORBH10031  .300  .008    0.0    .592   0.0
CORBH10032  0.0    0.0    0.0    0.0    0.0
CORBH10033  0.0    0.0    0.0    0.0    0.0
CORBH10034  0.0    0.0    0.1    0.0    0.0
* EUTECTIC 4
CORBH10041  0.0    0.0    0.0    0.0    0.0
CORBH10042  0.0    0.0    0.0    0.0    0.0
CORBH10043  .75    0.0    0.0    0.0    0.0
CORBH10044  0.0    0.0    .25    0.0    0.0
```

```
*
*            ---- NPIPES----  DPIPES    HPIPES       TABLAT
*            (1)   (2)   (3)   (M)      (W/M**2-K)    (K)
CORBH1100     8    25    22   .04600    1.0214E3     1755.4
*
*            CVH VOLUME           CVH VOLUME
*            REPRESENT.           REPRESENT.
*             JET PUMP              D W S
*
CORBH1200       310                  100
*
*    User controlled print frequency for bottom head output
*            DTPNTB(sec)
CORBH1300     300.0
*************************************************************************
*************************************************************************
 * end of file
```

Appendix F

Selected MELCOR Output

Selected output at time zero for the best-estimate run of the station blackout with a dry cavity is included. This run used the dual-cavity, multi-node drywell model (described in Sect. 4.1), and the input files of Appendix B.

```
1* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

 MELGEN    BASE CODE VERSION
 1.8.1      JUL-19-1991

 CURRENT CODE VERSION
 BASE CODE KH

 PEDIGREE OF THIS CODE
 Linked  7/14/92  08:12:12  ker
 ornl basic mods                        14 jul 92


 ST2    KH/ 4/26/93 /13:23:40


 STSB-W-ADS

 TIME=  0.000E+00 S =  0.000E+00 MIN =  0.000E+00 HRS =  0.000E+00 DAYS
 DT=  1.00000E+00 S          CYCLE=     0          CPU TIME=  0.000E+00
 CYCLES/CPU =   .000E+00 (1/S)    TIME/CPU=   .000E+00


              *** GLOBAL ENERGY BALANCE EDIT ***

    GLOBAL ENERGY ERROR                      =     0.00000E+00
    GLOBAL ENERGY ERROR / ENERGY IN PROBLEM =     0.00000E+00


  ENERGY EDIT FOR PACKAGE TP
  ENERGY NOW          =     0.00000E+00     ORIGINAL ENERGY  =     0.00000E+00
  ENERGY TRANSMITTED =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
  ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00

  ENERGY EDIT FOR PACKAGE DCH
  ENERGY NOW          =     0.00000E+00     ORIGINAL ENERGY  =     0.00000E+00
  ENERGY TRANSMITTED =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
  ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00

  ENERGY EDIT FOR PACKAGE COR
  ENERGY NOW          =     4.28479E+10     ORIGINAL ENERGY  =     4.28479E+10
  ENERGY TRANSMITTED =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
  ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00

  ENERGY EDIT FOR PACKAGE HS
  ENERGY NOW          =     2.22815E+13     ORIGINAL ENERGY  =     2.22815E+13
  ENERGY TRANSMITTED =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
  ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00

  ENERGY EDIT FOR PACKAGE BUR
  ENERGY NOW          =     0.00000E+00     ORIGINAL ENERGY  =     0.00000E+00
  ENERGY TRANSMITTED =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
  ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00

  ENERGY EDIT FOR PACKAGE CAV
  ENERGY NOW          =     0.00000E+00     ORIGINAL ENERGY  =     0.00000E+00
  ENERGY TRANSMITTED =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
  ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00

  ENERGY EDIT FOR PACKAGE RN1
  ENERGY NOW          =     0.00000E+00     ORIGINAL ENERGY  =     0.00000E+00
  ENERGY TRANSMITTED =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
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ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00

ENERGY EDIT FOR PACKAGE CVH
ENERGY NOW          =     4.76581E+16     ORIGINAL ENERGY  =     4.76581E+16
ENERGY TRANSMITTED  =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00

ENERGY EDIT FOR PACKAGE FL
ENERGY NOW          =     0.00000E+00     ORIGINAL ENERGY  =     0.00000E+00
ENERGY TRANSMITTED  =     0.00000E+00     ENERGY CREATED   =     0.00000E+00
ENERGY ERROR        =     0.00000E+00     REL ENERGY ERROR =     0.00000E+00


END OF EDIT FOR MEX PACKAGE


    NON-CONDENSIBLE GAS TIME INDEPENDENT DATA EDIT

        9 MATERIALS ARE DEFINED FOR THIS CALCULATION

MATERIAL  MATERIAL   MOLECULAR    INTERNAL
 NUMBER     NAME      WEIGHT    ENERGY ZERO
                     (KG/MOL)     (J/KG)

    1      POOL      1.8016E-02  8.2715E-01-ELV
    2      FOG       1.8016E-02  8.2715E-01-ELV
    3      H2O-VAP   1.8016E-02  8.2715E-01
    4      O2        3.2000E-02  1.7404E+07
    5      N2        2.8010E-02  1.4882E+06
    6      H2        2.0162E-03  2.2242E+07
    7      CO        2.8000E-02  7.7187E+06
    8      CO2       4.4000E-02  5.7812E+06
    9      CH4       1.6032E-02 -4.8633E+06


    MATERIAL CONSTANTS FOR CV(T)

NUMB     CV0          CV1          CV2          CV3        CVSQRT
       J/KG-K     J/KG-K**2    J/KG-K**3    J/KG-K**4   J/KG-K**(3/2)
        CVM1         CVM2         TLOW         TUP
        J/KG        J-K/KG         K            K

   3   1.507E+03   0.000E+00   0.000E+00   0.000E+00   0.000E+00
       0.000E+00   0.000E+00   1.000E+00   1.000E+04
   4   1.246E+03   0.000E+00   0.000E+00   0.000E+00  -1.676E+04
       1.111E+05   0.000E+00   3.000E+02   2.778E+03
   5   1.118E+03   0.000E+00   0.000E+00   0.000E+00   0.000E+00
      -2.880E+05   5.348E+07   3.000E+02   5.000E+03
   6  -1.785E+04   1.128E+01  -2.108E-03   1.564E-07   8.656E+05
      -8.188E+06   1.925E+08   1.000E+02   6.000E+03
   7   1.117E+03   0.000E+00   0.000E+00   0.000E+00   0.000E+00
      -2.731E+05   4.935E+07   3.000E+02   5.000E+03
   8   1.352E+03   0.000E+00   0.000E+00   0.000E+00   0.000E+00
      -3.450E+05   4.138E+07   3.000E+02   3.500E+03
   9   6.610E+02   3.462E+00   0.000E+00   0.000E+00   0.000E+00
       0.000E+00   0.000E+00   3.000E+02   8.333E+02

END OF EDIT FOR NCG PACKAGE


          ****************************************
          *                                      *
          *  CONTROL VOLUME HYDRODYNAMICS EDIT   *
          *                                      *
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VOLUME NUMB	PRESSURE PA	TLIQ K	TVAP K	MASS KG	ENERGY J/KG	DENSITY KG/M**3
100	1.0800E+05	330.9298	335.9204	1.7034E+03	2.1984E+05	7.0382E+00
101	1.0800E+05	335.9200	335.9200	3.0702E+03	9.6000E+04	1.0670E+00
102	1.0800E+05	335.9200	335.9200	1.1059E+03	9.6000E+04	1.0670E+00
103	1.0800E+05	400.0000	400.0000	6.0275E+01	9.4263E+05	7.6354E-01
150	1.0800E+05	305.9299	335.9222	2.2226E+04	1.3631E+05	3.9339E+01
200	9.9974E+04	305.8700	305.8513	3.9440E+06	1.3709E+05	5.5297E+02
310	7.1340E+06	559.9999	560.3457	1.1178E+05	1.2775E+06	6.0818E+02
320	7.0977E+06	560.0000	560.0000	7.6310E+04	1.2626E+06	7.3759E+02
330	7.0977E+06	560.0000	560.0000	1.9016E+04	1.2626E+06	7.3759E+02
340	7.0977E+06	560.0000	560.0000	2.4559E+04	1.2626E+06	7.3759E+02
350	7.1340E+06	560.0000	560.3459	2.9443E+04	1.2713E+06	6.5572E+02
360	7.1340E+06	560.3457	560.3457	8.1569E+03	2.5793E+06	3.7315E+01
401	9.7019E+04	305.8000	305.8000	5.8593E+03	4.1028E+06	1.0799E+00
402	1.0118E+05	301.0000	301.0000	5.9332E+03	4.1174E+06	1.1512E+00
403	1.0118E+05	301.0000	301.0000	5.9332E+03	4.1174E+06	1.1512E+00
404	1.0109E+05	299.8000	299.8000	2.7207E+03	4.1166E+06	1.1548E+00
405	1.0109E+05	299.8000	299.8000	8.1597E+03	4.1166E+06	1.1548E+00
406	1.0099E+05	299.8000	299.8000	2.8287E+03	4.1166E+06	1.1536E+00
407	1.0099E+05	299.8000	299.8000	5.6135E+03	4.1166E+06	1.1536E+00
408	1.0085E+05	299.8000	299.8000	3.5767E+04	4.1165E+06	1.1520E+00
409	1.0109E+05	299.8000	299.8000	1.7186E+05	4.1166E+06	1.1548E+00
410	1.0133E+05	299.8000	299.8000	1.1576E+10	4.1167E+06	1.1576E+00

VOLUME NUMB	ENTHALPY J/KG	QUALITY	VOID FRACTION	VELCVLIQ M/S	VELCVVAP M/S	TH	FF	PF	TYP	ACT
100	2.352E+05	1.507E-01	9.939E-01	0.000E+00	0.000E+00	2	2	0	2	0
101	1.972E+05	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	2	0
102	1.972E+05	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	2	0
103	1.084E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	2	0
150	1.391E+05	2.608E-02	9.615E-01	0.000E+00	0.000E+00	2	2	0	2	0
200	1.373E+05	8.700E-04	4.447E-01	0.000E+00	0.000E+00	2	2	0	3	0
310	1.289E+06	1.139E-02	1.856E-01	0.000E+00	0.000E+00	2	2	0	1	0
320	1.272E+06	4.627E-05	9.209E-04	0.000E+00	0.000E+00	2	2	0	1	0
330	1.272E+06	4.631E-05	9.209E-04	0.000E+00	0.000E+00	2	2	0	1	0
340	1.272E+06	4.629E-05	9.209E-04	0.000E+00	0.000E+00	2	2	0	1	0
350	1.282E+06	6.704E-03	1.178E-01	0.000E+00	0.000E+00	2	2	0	1	0
360	2.770E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	1	0
401	4.193E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	4	0
402	4.205E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	4	0
403	4.205E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	4	0
404	4.204E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	4	0
405	4.204E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	4	0
406	4.204E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	4	0
407	4.204E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	4	0
408	4.204E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	7	0
409	4.204E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	5	0
410	4.204E+06	1.000E+00	1.000E+00	0.000E+00	0.000E+00	2	2	0	6	0

VOLUME NUMB	VOLLIQ M**3	VOLFOG M**3	VOLVAP M**3	VIRVOLLIQ M**3	VIRVOLVAP M**3	ENERGY J
100	1.470E+00	0.000E+00	2.405E+02	0.000E+00	0.000E+00	3.745E+08
101	0.000E+00	0.000E+00	2.878E+03	0.000E+00	0.000E+00	2.947E+08
102	0.000E+00	0.000E+00	1.036E+03	0.000E+00	0.000E+00	1.062E+08
103	0.000E+00	0.000E+00	7.894E+01	0.000E+00	0.000E+00	5.682E+07
150	2.176E+01	0.000E+00	5.432E+02	0.000E+00	0.000E+00	3.030E+09
200	3.961E+03	0.000E+00	3.172E+03	0.000E+00	0.000E+00	5.407E+11
310	1.497E+02	1.452E-06	3.412E+01	3.199E-02	1.449E-02	1.428E+11

320	1.034E+02	0.000E+00	9.528E-02	1.071E+01	4.267E-02	9.635E+10
330	2.576E+01	2.371E-07	2.374E-02	4.974E+00	0.000E+00	2.401E+10
340	3.327E+01	0.000E+00	3.066E-02	2.487E+01	0.000E+00	3.101E+10
350	3.961E+01	0.000E+00	5.290E+00	3.252E-02	1.396E-02	3.743E+10
360	0.000E+00	2.326E-06	2.186E+02	0.000E+00	3.188E-02	2.104E+10
401	0.000E+00	0.000E+00	5.426E+03	0.000E+00	1.279E+00	2.404E+10
402	0.000E+00	0.000E+00	5.154E+03	0.000E+00	0.000E+00	2.443E+10
403	0.000E+00	0.000E+00	5.154E+03	0.000E+00	0.000E+00	2.443E+10
404	0.000E+00	0.000E+00	2.356E+03	0.000E+00	0.000E+00	1.120E+10
405	0.000E+00	0.000E+00	7.066E+03	0.000E+00	0.000E+00	3.359E+10
406	0.000E+00	0.000E+00	2.452E+03	0.000E+00	0.000E+00	1.164E+10
407	0.000E+00	0.000E+00	4.866E+03	0.000E+00	0.000E+00	2.311E+10
408	0.000E+00	0.000E+00	3.105E+04	0.000E+00	0.000E+00	1.472E+11
409	0.000E+00	0.000E+00	1.488E+05	0.000E+00	0.000E+00	7.075E+11
410	0.000E+00	0.000E+00	1.000E+10	0.000E+00	0.000E+00	4.766E+16

VOLUME NUMB	S-Z-POOL M	C-Z-POOL M	ENERGY J	AREA M**2	NAME
100	-8.9830E+00	-8.9830E+00	3.7446E+08	1.9592E+01	DRYWELL-IN
101	-8.6360E+00	-8.6360E+00	2.9474E+08	1.9049E+02	DRYWELL-EX
102	6.4700E+00	6.4700E+00	1.0617E+08	6.0881E+01	DRYWELL-TOP
103	3.0860E+00	3.0860E+00	5.6817E+07	6.3947E+00	DRYWELL-ANN
150	-1.2205E+01	-1.2205E+01	3.0296E+09	7.8255E+01	VENT/DOWNCOMER
200	-1.1435E+01	-1.1435E+01	5.4069E+11	4.7330E+01	WETWELL
310	1.4125E+01	1.4125E+01	1.4280E+11	1.4888E+01	ANNULUS
320	5.4880E+00	5.4880E+00	9.6349E+10	1.8830E+01	LOWER-PLENUM
330	9.6633E+00	9.6633E+00	2.4010E+10	6.1786E+00	BY-PASS
340	9.6633E+00	9.6633E+00	3.1008E+10	7.9795E+00	CHANNEL
350	1.4125E+01	1.4125E+01	3.7430E+10	7.7899E+00	SHROUD-DOME
360	1.5431E+01	1.5431E+01	2.1039E+10	3.2090E+01	STEAM-DOME
401	-1.7200E+01	-1.7200E+01	2.4039E+10	4.1420E+02	TORUS ROOM
402	-4.1000E+00	-4.1000E+00	2.4429E+10	5.6022E+02	LEV-135-SOUTH
403	-4.1000E+00	-4.1000E+00	2.4429E+10	5.9930E+02	LEV-135-NORTH
404	5.1000E+00	5.1000E+00	1.1200E+10	2.5890E+02	LEVEL-165-SE
405	5.1000E+00	5.1000E+00	3.3590E+10	8.3129E+02	LEVEL-165-MAIN
406	1.4200E+01	1.4200E+01	1.1645E+10	2.0605E+02	LEVEL-195-SE
407	1.4200E+01	1.4200E+01	2.3109E+10	4.3062E+02	LEVEL-195-MAIN
408	2.6100E+01	2.6100E+01	1.4724E+11	1.6428E+03	REFUELING-BAY
409	5.1000E+00	5.1000E+00	7.0748E+11	8.8586E+03	TURBINE-BUILDING
410	-1.7200E+01	-1.7200E+01	4.7656E+16	1.6077E+08	ENVIRONMENT

VOLUME NUMB	T(P) K
100	3.7497E+02
101	3.7497E+02
102	3.7497E+02
103	3.7497E+02
150	3.7497E+02
200	3.7280E+02
310	5.6035E+02
320	5.6000E+02
330	5.6000E+02
340	5.6000E+02
350	5.6035E+02
360	5.6035E+02
401	3.7196E+02
402	3.7314E+02
403	3.7314E+02
404	3.7311E+02
405	3.7311E+02
406	3.7308E+02
407	3.7308E+02

408	3.7304E+02
409	3.7311E+02
410	3.7318E+02

VOL	MATERIAL NUM	MATERIAL NAME	MASS KG	DENSITY KG/M**3	E J/KG	PPART PA	ECV J
100	1	POOL	1.4467E+03	9.8430E+02	2.4181E+05	1.0800E+05	3.4982E+08
	3	H2O-VAP	7.0209E+00	2.9187E-02	2.4629E+06	4.5199E+03	1.7292E+07
	5	N2	2.4963E+02	1.0378E+00	2.9430E+04	1.0348E+05	7.3466E+06
101	3	H2O-VAP	8.3987E+01	2.9187E-02	2.4629E+06	4.5199E+03	2.0685E+08
	5	N2	2.9862E+03	1.0378E+00	2.9430E+04	1.0348E+05	8.7883E+07
102	3	H2O-VAP	3.0253E+01	2.9187E-02	2.4629E+06	4.5199E+03	7.4511E+07
	5	N2	1.0757E+03	1.0378E+00	2.9430E+04	1.0348E+05	3.1656E+07
103	3	H2O-VAP	2.1097E+01	2.6725E-01	2.5515E+06	4.9073E+04	5.3829E+07
	5	N2	3.9178E+01	4.9629E-01	7.6284E+04	5.8927E+04	2.9886E+06
150	1	POOL	2.1647E+04	9.9485E+02	1.3739E+05	1.0800E+05	2.9740E+09
	3	H2O-VAP	1.5856E+01	2.9187E-02	2.4629E+06	4.5199E+03	3.9052E+07
	5	N2	5.6376E+02	1.0378E+00	2.9430E+04	1.0348E+05	1.6591E+07
200	1	POOL	3.9406E+06	9.9487E+02	1.3714E+05	9.9974E+04	5.4040E+11
	3	H2O-VAP	1.1122E+02	3.5067E-02	2.4203E+06	4.9404E+03	2.6917E+08
	5	N2	3.3199E+03	1.0468E+00	7.1713E+03	9.5034E+04	2.3808E+07
310	1	POOL	1.1051E+05	7.3830E+02	1.2625E+06	7.1340E+06	1.3951E+11
	2	FOG	1.0709E-03	7.3759E+02	1.2643E+06	7.1340E+06	1.3540E+03
	3	H2O-VAP	1.2731E+03	3.7315E+01	2.5793E+06	7.1340E+06	3.2836E+09
320	1	POOL	7.6307E+04	7.3823E+02	1.2625E+06	7.0977E+06	9.6340E+10
	3	H2O-VAP	3.5347E+00	3.7099E+01	2.5796E+06	7.0977E+06	9.1184E+06
330	1	POOL	1.9015E+04	7.3823E+02	1.2625E+06	7.0977E+06	2.4007E+10
	2	FOG	1.7500E-04	7.3823E+02	1.2625E+06	7.0977E+06	2.2094E+02
	3	H2O-VAP	8.8083E-01	3.7099E+01	2.5796E+06	7.0977E+06	2.2722E+06
340	1	POOL	2.4557E+04	7.3823E+02	1.2625E+06	7.0977E+06	3.1005E+10
	3	H2O-VAP	1.1376E+00	3.7099E+01	2.5796E+06	7.0977E+06	2.9345E+06
350	1	POOL	2.9245E+04	7.3830E+02	1.2625E+06	7.1340E+06	3.6921E+10
	3	H2O-VAP	1.9738E+02	3.7315E+01	2.5793E+06	7.1340E+06	5.0911E+08
360	2	FOG	1.7155E-03	7.3759E+02	1.2643E+06	7.1340E+06	2.1689E+03
	3	H2O-VAP	8.1569E+03	3.7315E+01	2.5793E+06	7.1340E+06	2.1039E+10
401	3	H2O-VAP	1.8977E+02	3.4975E-02	2.4202E+06	4.9265E+03	4.5928E+08
	4	O2	1.3204E+03	2.4335E-01	1.7834E+07	1.9335E+04	2.3549E+10
	5	N2	4.3491E+03	8.0152E-01	7.1339E+03	7.2757E+04	3.1026E+07
402	3	H2O-VAP	1.3005E+02	2.5232E-02	2.4137E+06	3.5000E+03	3.1389E+08
	4	O2	1.3516E+03	2.6223E-01	1.7831E+07	2.0509E+04	2.4100E+10
	5	N2	4.4516E+03	8.6372E-01	3.5358E+03	7.7171E+04	1.5740E+07
403	3	H2O-VAP	1.3005E+02	2.5232E-02	2.4137E+06	3.5000E+03	3.1389E+08
	4	O2	1.3516E+03	2.6223E-01	1.7831E+07	2.0509E+04	2.4100E+10
	5	N2	4.4516E+03	8.6372E-01	3.5358E+03	7.7171E+04	1.5740E+07
404	3	H2O-VAP	5.9479E+01	2.5246E-02	2.4120E+06	3.4879E+03	1.4347E+08
	4	O2	6.1979E+02	2.6307E-01	1.7830E+07	2.0492E+04	1.1051E+10
	5	N2	2.0414E+03	8.6646E-01	2.6336E+03	7.7108E+04	5.3761E+06
405	3	H2O-VAP	1.7839E+02	2.5246E-02	2.4120E+06	3.4879E+03	4.3028E+08
	4	O2	1.8588E+03	2.6307E-01	1.7830E+07	2.0492E+04	3.3144E+10
	5	N2	6.1224E+03	8.6646E-01	2.6336E+03	7.7108E+04	1.6124E+07
406	3	H2O-VAP	6.1903E+01	2.5246E-02	2.4120E+06	3.4879E+03	1.4931E+08
	4	O2	6.4438E+02	2.6280E-01	1.7830E+07	2.0471E+04	1.1490E+10
	5	N2	2.1224E+03	8.6558E-01	2.6337E+03	7.7029E+04	5.5896E+06
407	3	H2O-VAP	1.2285E+02	2.5246E-02	2.4120E+06	3.4879E+03	2.9631E+08
	4	O2	1.2788E+03	2.6280E-01	1.7830E+07	2.0471E+04	2.2801E+10
	5	N2	4.2119E+03	8.6558E-01	2.6336E+03	7.7029E+04	1.1092E+07
408	3	H2O-VAP	7.8383E+02	2.5246E-02	2.4120E+06	3.4879E+03	1.8906E+09
	4	O2	8.1476E+03	2.6242E-01	1.7830E+07	2.0441E+04	1.4528E+11
	5	N2	2.6836E+04	8.6433E-01	2.6337E+03	7.6919E+04	7.0678E+07
409	3	H2O-VAP	3.7572E+03	2.5246E-02	2.4120E+06	3.4879E+03	9.0625E+09
	4	O2	3.9151E+04	2.6307E-01	1.7830E+07	2.0492E+04	6.9808E+11
	5	N2	1.2895E+05	8.6646E-01	2.6337E+03	7.7108E+04	3.3961E+08
410	3	H2O-VAP	2.5246E+08	2.5246E-02	2.4120E+06	3.4879E+03	6.0894E+14

4	O2	2.6373E+09	2.6373E-01	1.7830E+07	2.0543E+04	4.7024E+16
5	N2	8.6865E+09	8.6865E-01	2.6335E+03	7.7303E+04	2.2876E+13

MATERIAL NUM	NAME	TOTAL MASS (KG)	ORIGINAL MASS (KG)	MASS SOURCE (KG)	MASS ERROR (KG)
1-3	WATER	2.56697E+08	2.56697E+08	0.00000E+00	0.00000E+00
4	O2	2.63737E+09	2.63737E+09	0.00000E+00	0.00000E+00
5	N2	8.68667E+09	8.68667E+09	0.00000E+00	0.00000E+00
6	H2	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
7	CO	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
8	CO2	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
9	CH4	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00

TOTAL ENERGY (J)	ORIGINAL ENERGY (J)	POOL ENERGY SOURCE (J)	ATMOS ENERGY SOURCE (J)	POOL SURFACE (J)	ENERGY ERROR (J)
4.7658E+16	4.7658E+16	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

MASS SOURCE EDIT

```
MASS SOURCE OF CONTROL VOLUME 100
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 101
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 102
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 103
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 150
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 200
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 310
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 320
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 330
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 340
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 350
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 360
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 401
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 402
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 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 403
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 404
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 405
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 406
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 407
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 408
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 409
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
MASS SOURCE OF CONTROL VOLUME 410
 DELM( 1: 5)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
 DELM( 6: 9)=  0.0000E+00  0.0000E+00  0.0000E+00  0.0000E+00
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ENERGY SOURCE EDIT

NVOL	POOL ENERGY (J)	ATMOS ENERGY (J)	POOL S ENERGY (J)
100	0.0000E+00	0.0000E+00	0.0000E+00
101	0.0000E+00	0.0000E+00	0.0000E+00
102	0.0000E+00	0.0000E+00	0.0000E+00
103	0.0000E+00	0.0000E+00	0.0000E+00
150	0.0000E+00	0.0000E+00	0.0000E+00
200	0.0000E+00	0.0000E+00	0.0000E+00
310	0.0000E+00	0.0000E+00	0.0000E+00
320	0.0000E+00	0.0000E+00	0.0000E+00
330	0.0000E+00	0.0000E+00	0.0000E+00
340	0.0000E+00	0.0000E+00	0.0000E+00
350	0.0000E+00	0.0000E+00	0.0000E+00
360	0.0000E+00	0.0000E+00	0.0000E+00
401	0.0000E+00	0.0000E+00	0.0000E+00
402	0.0000E+00	0.0000E+00	0.0000E+00
403	0.0000E+00	0.0000E+00	0.0000E+00
404	0.0000E+00	0.0000E+00	0.0000E+00
405	0.0000E+00	0.0000E+00	0.0000E+00
406	0.0000E+00	0.0000E+00	0.0000E+00
407	0.0000E+00	0.0000E+00	0.0000E+00
408	0.0000E+00	0.0000E+00	0.0000E+00
409	0.0000E+00	0.0000E+00	0.0000E+00
410	0.0000E+00	0.0000E+00	0.0000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 100

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
6	3.26000E+00	2.42016E+02	2.42016E+02	0.00000E+00
5	-3.70000E+00	1.61340E+02	1.61340E+02	0.00000E+00
4	-6.39700E+00	8.00000E+01	8.00000E+01	0.00000E+00
3	-8.33100E+00	4.63760E+01	4.63760E+01	0.00000E+00
2	-8.63600E+00	6.10600E+00	6.10600E+00	0.00000E+00

1	-9.09300E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 101

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
5	6.47000E+00	2.87750E+03	2.87750E+03	0.00000E+00
4	0.00000E+00	1.71000E+03	1.71000E+03	0.00000E+00
3	-3.70100E+00	7.13000E+02	7.13000E+02	0.00000E+00
2	-6.39700E+00	8.00000E+01	8.00000E+01	0.00000E+00
1	-8.63600E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 102

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
2	2.34950E+01	1.03650E+03	1.03650E+03	0.00000E+00
1	6.47000E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 103

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
3	1.54310E+01	7.89420E+01	7.89420E+01	0.00000E+00
2	9.25850E+00	3.99710E+01	3.99710E+01	0.00000E+00
1	3.08600E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 150

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
4	-5.59000E+00	5.65000E+02	5.65000E+02	0.00000E+00
3	-9.07000E+00	2.57000E+02	2.57000E+02	0.00000E+00
2	-1.05300E+01	8.20000E+01	8.20000E+01	0.00000E+00
1	-1.28100E+01	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 200

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
12	-6.93000E+00	7.13250E+03	7.13250E+03	0.00000E+00
11	-8.46000E+00	6.54760E+03	6.54760E+03	0.00000E+00
10	-9.07000E+00	6.03570E+03	6.03570E+03	0.00000E+00
9	-1.02800E+01	5.05830E+03	5.05830E+03	0.00000E+00
8	-1.05300E+01	4.83720E+03	4.83720E+03	0.00000E+00
7	-1.15000E+01	3.89800E+03	3.89800E+03	0.00000E+00
6	-1.17600E+01	3.64750E+03	3.64750E+03	0.00000E+00
5	-1.21100E+01	3.29810E+03	3.29810E+03	0.00000E+00
4	-1.28100E+01	2.62960E+03	2.62960E+03	0.00000E+00
3	-1.33300E+01	2.11430E+03	2.11430E+03	0.00000E+00
2	-1.51600E+01	5.72700E+02	5.72700E+02	0.00000E+00
1	-1.63800E+01	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 310

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
6	1.54310E+01	1.83843E+02	1.83796E+02	4.64783E-02
5	1.12420E+01	7.43757E+01	7.43757E+01	0.00000E+00
4	1.04600E+01	6.11004E+01	6.11004E+01	0.00000E+00
3	9.15200E+00	5.15666E+01	5.15666E+01	0.00000E+00
2	8.08000E+00	4.10323E+01	4.10323E+01	0.00000E+00
1	3.08600E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 320

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
7	5.49430E+00	1.14209E+02	1.03459E+02	1.07494E+01
6	5.21660E+00	1.08093E+02	9.92356E+01	8.85786E+00
5	4.23630E+00	8.88922E+01	8.18691E+01	7.02306E+00
4	3.25600E+00	6.65372E+01	6.13489E+01	5.18827E+00
3	2.27570E+00	3.80883E+01	3.47348E+01	3.35347E+00
2	1.29540E+00	2.39251E+01	2.24064E+01	1.51866E+00
1	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 330

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
7	9.66700E+00	3.07553E+01	2.57814E+01	4.97385E+00
6	9.30430E+00	2.84194E+01	2.34455E+01	4.97385E+00
5	8.54230E+00	2.07421E+01	1.89546E+01	1.78751E+00
4	7.78030E+00	1.57074E+01	1.43668E+01	1.34063E+00
3	7.01830E+00	1.04717E+01	9.57790E+00	8.93753E-01
2	6.25630E+00	5.23578E+00	4.78890E+00	4.46876E-01
1	5.49430E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 340

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
7	9.66700E+00	5.81616E+01	3.32959E+01	2.48657E+01
6	9.30430E+00	5.51448E+01	3.02791E+01	2.48657E+01
5	8.54230E+00	4.43719E+01	2.44793E+01	1.98926E+01
4	7.78030E+00	3.34802E+01	1.85608E+01	1.49194E+01
3	7.01830E+00	2.23202E+01	1.23739E+01	9.94629E+00
2	6.25630E+00	1.11600E+01	6.18690E+00	4.97314E+00
1	5.49430E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 350

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
4	1.54310E+01	4.49476E+01	4.49011E+01	4.64783E-02
3	1.10820E+01	2.72877E+01	2.72877E+01	0.00000E+00
2	1.04600E+01	1.79923E+01	1.79923E+01	0.00000E+00
1	9.66700E+00	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 360

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
4	2.22430E+01	2.18629E+02	2.18597E+02	3.18756E-02
3	1.70180E+01	8.91637E+01	8.91637E+01	0.00000E+00
2	1.64390E+01	3.05896E+01	3.05896E+01	0.00000E+00
1	1.54310E+01	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 401

	ALTITUDE (M)	VOLUME (M**3)	MATL VOLUME (M**3)	VIRT VOLUME (M**3)
2	-4.10000E+00	5.42728E+03	5.42600E+03	1.27832E+00
1	-1.72000E+01	0.00000E+00	0.00000E+00	0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER 402

ALTITUDE	VOLUME	MATL VOLUME	VIRT VOLUME

```
            (M)            (M**3)          (M**3)          (M**3)
 2     5.10000E+00    5.15400E+03    5.15400E+03    0.00000E+00
 1    -4.10000E+00    0.00000E+00    0.00000E+00    0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER   403

        ALTITUDE        VOLUME       MATL VOLUME    VIRT VOLUME
            (M)          (M**3)         (M**3)         (M**3)
 2     4.50000E+00    5.15400E+03    5.15400E+03    0.00000E+00
 1    -4.10000E+00    0.00000E+00    0.00000E+00    0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER   404

        ALTITUDE        VOLUME       MATL VOLUME    VIRT VOLUME
            (M)          (M**3)         (M**3)         (M**3)
 2     1.42000E+01    2.35600E+03    2.35600E+03    0.00000E+00
 1     5.10000E+00    0.00000E+00    0.00000E+00    0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER   405

        ALTITUDE        VOLUME       MATL VOLUME    VIRT VOLUME
            (M)          (M**3)         (M**3)         (M**3)
 2     1.36000E+01    7.06600E+03    7.06600E+03    0.00000E+00
 1     5.10000E+00    0.00000E+00    0.00000E+00    0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER   406

        ALTITUDE        VOLUME       MATL VOLUME    VIRT VOLUME
            (M)          (M**3)         (M**3)         (M**3)
 2     2.61000E+01    2.45200E+03    2.45200E+03    0.00000E+00
 1     1.42000E+01    0.00000E+00    0.00000E+00    0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER   407

        ALTITUDE        VOLUME       MATL VOLUME    VIRT VOLUME
            (M)          (M**3)         (M**3)         (M**3)
 2     2.55000E+01    4.86600E+03    4.86600E+03    0.00000E+00
 1     1.42000E+01    0.00000E+00    0.00000E+00    0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER   408

        ALTITUDE        VOLUME       MATL VOLUME    VIRT VOLUME
            (M)          (M**3)         (M**3)         (M**3)
 2     4.50000E+01    3.10480E+04    3.10480E+04    0.00000E+00
 1     2.61000E+01    0.00000E+00    0.00000E+00    0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER   409

        ALTITUDE        VOLUME       MATL VOLUME    VIRT VOLUME
            (M)          (M**3)         (M**3)         (M**3)
 2     2.19000E+01    1.48825E+05    1.48825E+05    0.00000E+00
 1     5.10000E+00    0.00000E+00    0.00000E+00    0.00000E+00

VOLUME - ALTITUDE TABLE FOR CONTROL VOLUME NUMBER   410

        ALTITUDE        VOLUME       MATL VOLUME    VIRT VOLUME
            (M)          (M**3)         (M**3)         (M**3)
 2     4.50000E+01    1.00000E+10    1.00000E+10    0.00000E+00
 1    -1.72000E+01    0.00000E+00    0.00000E+00    0.00000E+00


*** VELOCITY CALCULATION STATISTICS EDIT ***
    NUMBER OF MATRIX INVERSIONS              =        0
    NUMBER OF FLOW REVERSALS                 =        0
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    NUMBER OF EXPLICIT INTEGRATIONS          =       0
    NUMBER OF SIGNIFICANT DIGITS INVERSIONS =       0
    NUMBER OF WATER PACKINGS IDENTIFIED      =       0
    NUMBER OF CHOKED FLOWS IDENTIFIED        =       0

  TOTAL CPU TIME FOR CVH AND FL PACKAGES     =    0.00000E+00
  CPU TIME FOR CVH AND FL PKGS CALCULATIONS =    0.00000E+00
  CPU TIME FOR CVH AND FL PKGS EDITS         =    0.00000E+00
  CPU TIME FOR CVH AND FL PACKAGES RESTARTS =    0.00000E+00

  *** SUBCYCLE STATISTICS EDIT ***
    NUMBER OF SUBCYCLES                      =       0
    NUMBER OF REPEATED SUBCYCLES             =       0
    NUMBER OF MOMENTUM BALANCE CALLS         =       0
    PRESENT SUBCYCLE TIMESTEP                =    0.00000E+00

END OF EDIT FOR CVH PACKAGE

        ******************************
        *                            *
        *   FLOW PATH PACKAGE EDIT   *
        *                            *
        ******************************
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FLOW PATH	FROM VOL.	TO VOL.	VELLIQ M/S	VELVAP M/S	MFLOW KG/S	AREA M**2	TYP	ACT
10	100	101	0.0000E+00	0.0000E+00	0.0000E+00	8.6000E+00	3	0
11	101	102	0.0000E+00	0.0000E+00	0.0000E+00	6.2592E+01	0	0
12	101	150	0.0000E+00	0.0000E+00	0.0000E+00	2.6600E+01	0	0
13	101	103	0.0000E+00	0.0000E+00	0.0000E+00	2.1361E-01	3	0
14	100	103	0.0000E+00	0.0000E+00	0.0000E+00	3.2000E+00	0	0
15	102	103	0.0000E+00	0.0000E+00	0.0000E+00	5.2920E+00	0	0
20	150	200	0.0000E+00	0.0000E+00	0.0000E+00	2.6600E+01	0	0
21	200	150	0.0000E+00	0.0000E+00	0.0000E+00	1.8600E+00	3	0
312	310	320	0.0000E+00	0.0000E+00	0.0000E+00	6.7820E-01	0	0
323	320	330	0.0000E+00	0.0000E+00	0.0000E+00	6.1502E+00	0	0
324	320	340	0.0000E+00	0.0000E+00	0.0000E+00	7.9428E+00	0	0
335	330	350	0.0000E+00	0.0000E+00	0.0000E+00	6.1502E+00	0	0
345	340	350	0.0000E+00	0.0000E+00	0.0000E+00	7.9428E+00	0	0
356	350	360	0.0000E+00	0.0000E+00	0.0000E+00	4.7763E+00	0	0
361	360	310	0.0000E+00	0.0000E+00	0.0000E+00	2.6107E+01	0	0
362	360	200	0.0000E+00	0.0000E+00	0.0000E+00	1.2010E-01	0	0
363	360	200	0.0000E+00	0.0000E+00	0.0000E+00	4.6195E-02	0	0
364	360	200	0.0000E+00	0.0000E+00	0.0000E+00	9.2390E-03	0	0
370	310	100	0.0000E+00	0.0000E+00	0.0000E+00	2.7830E-06	3	0
371	320	100	0.0000E+00	0.0000E+00	0.0000E+00	3.3990E-06	0	0
398	102	408	0.0000E+00	0.0000E+00	0.0000E+00	4.0000E-02	0	0
399	320	100	0.0000E+00	0.0000E+00	0.0000E+00	1.0000E-02	3	0
400	101	401	0.0000E+00	0.0000E+00	0.0000E+00	6.5000E-01	3	0
401	401	402	0.0000E+00	0.0000E+00	0.0000E+00	8.6000E+00	1	0
402	402	404	0.0000E+00	0.0000E+00	0.0000E+00	3.3200E+01	1	0
403	402	403	0.0000E+00	0.0000E+00	0.0000E+00	2.5000E+01	4	0
404	402	410	0.0000E+00	0.0000E+00	0.0000E+00	2.5000E-02	4	0
405	403	409	0.0000E+00	0.0000E+00	0.0000E+00	2.8000E+00	1	0
406	403	410	0.0000E+00	0.0000E+00	0.0000E+00	2.5000E-02	4	0
407	404	406	0.0000E+00	0.0000E+00	0.0000E+00	3.3200E+01	1	0
408	404	405	0.0000E+00	0.0000E+00	0.0000E+00	4.3800E+01	4	0
409	404	410	0.0000E+00	0.0000E+00	0.0000E+00	2.5000E-02	4	0

410	405	410	0.0000E+00	0.0000E+00	0.0000E+00	2.5000E-02	4	0
411	406	408	0.0000E+00	0.0000E+00	0.0000E+00	3.3200E+01	1	0
412	406	407	0.0000E+00	0.0000E+00	0.0000E+00	7.4600E+01	4	0
413	406	410	0.0000E+00	0.0000E+00	0.0000E+00	2.5000E-02	4	0
414	407	410	0.0000E+00	0.0000E+00	0.0000E+00	2.5000E-02	4	0
415	408	410	0.0000E+00	0.0000E+00	0.0000E+00	2.2300E+01	4	0
416	408	410	0.0000E+00	0.0000E+00	0.0000E+00	1.0900E-01	4	0
417	409	410	0.0000E+00	0.0000E+00	0.0000E+00	2.9000E-01	4	0

FLOW PATH	FROM VOL.	TO VOL.	MATERIAL NUM	MATERIAL NAME	MFLOW KG/S	INT-MFLOW KG	
10	100	101	1	POOL	0.00000E+00	0.00000E+00	DW-LOW-H
11	101	102	1	POOL	0.00000E+00	0.00000E+00	DW-EX-V
12	101	150	1	POOL	0.00000E+00	0.00000E+00	VENT-OPENING
13	101	103	1	POOL	0.00000E+00	0.00000E+00	DW-MED-H
14	100	103	1	POOL	0.00000E+00	0.00000E+00	DW-IN-V
15	102	103	1	POOL	0.00000E+00	0.00000E+00	DW-TOP
20	150	200	1	POOL	0.00000E+00	0.00000E+00	DOWNCOMEREX
21	200	150	1	POOL	0.00000E+00	0.00000E+00	WET-DRY-VACRV
312	310	320	1	POOL	0.00000E+00	0.00000E+00	AN-LP
323	320	330	1	POOL	0.00000E+00	0.00000E+00	LP-BP
324	320	340	1	POOL	0.00000E+00	0.00000E+00	LP-CH
335	330	350	1	POOL	0.00000E+00	0.00000E+00	BP-SH
345	340	350	1	POOL	0.00000E+00	0.00000E+00	CH-SH
356	350	360	1	POOL	0.00000E+00	0.00000E+00	SH-SD
361	360	310	1	POOL	0.00000E+00	0.00000E+00	SD-AN
362	360	200	1	POOL	0.00000E+00	0.00000E+00	STEAM-LINE-SRV
363	360	200	1	POOL	0.00000E+00	0.00000E+00	ADS-5-SRVS
364	360	200	1	POOL	0.00000E+00	0.00000E+00	MANUAL-DEPRES
370	310	100	1	POOL	0.00000E+00	0.00000E+00	LEAKAGE-DOWN
371	320	100	1	POOL	0.00000E+00	0.00000E+00	LEAKAGE-LP
398	102	408	1	POOL	0.00000E+00	0.00000E+00	DW-HD-FAILURE
399	320	100	1	POOL	0.00000E+00	0.00000E+00	VESSEL BREACH
400	101	401	1	POOL	0.00000E+00	0.00000E+00	CONT FAIL
401	401	402	1	POOL	0.00000E+00	0.00000E+00	TORUS-135
402	402	404	1	POOL	0.00000E+00	0.00000E+00	135-165-SHAFT
403	402	403	1	POOL	0.00000E+00	0.00000E+00	135-SO-NO
404	402	410	1	POOL	0.00000E+00	0.00000E+00	LEAK-135-SO
405	403	409	1	POOL	0.00000E+00	0.00000E+00	BO-135-TURB
406	403	410	1	POOL	0.00000E+00	0.00000E+00	LEAK-135-NO
407	404	406	1	POOL	0.00000E+00	0.00000E+00	165-195-SHAFT
408	404	405	1	POOL	0.00000E+00	0.00000E+00	165-SE-MAIN
409	404	410	1	POOL	0.00000E+00	0.00000E+00	LEAK-165-SE
410	405	410	1	POOL	0.00000E+00	0.00000E+00	LEAK-165-MAIN
411	406	408	1	POOL	0.00000E+00	0.00000E+00	195-SE-REFUEL
412	406	407	1	POOL	0.00000E+00	0.00000E+00	195-SE-MAIN
413	406	410	1	POOL	0.00000E+00	0.00000E+00	LEAK-195-SE
414	407	410	1	POOL	0.00000E+00	0.00000E+00	LEAK-195-MAIN
415	408	410	1	POOL	0.00000E+00	0.00000E+00	BO-REFUEL-ENV
416	408	410	1	POOL	0.00000E+00	0.00000E+00	LEAK-REFUEL
417	409	410	1	POOL	0.00000E+00	0.00000E+00	LEAK-TURB

FLOW PATH	P HEAD (PA)	FRACTION OPEN	OPEN AREA (M**2)	ALPHA
10	0.0000E+00	1.0000E+00	8.6000E+00	1.0000E+00
11	0.0000E+00	1.0000E+00	6.2592E+01	1.0000E+00
12	0.0000E+00	1.0000E+00	2.6600E+01	1.0000E+00
13	0.0000E+00	1.0000E+00	2.1361E-01	1.0000E+00
14	0.0000E+00	1.0000E+00	3.2000E+00	1.0000E+00
15	0.0000E+00	1.0000E+00	5.2920E+00	1.0000E+00
20	0.0000E+00	1.0000E+00	2.6600E+01	0.0000E+00
21	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

312	0.0000E+00	1.0000E+00	6.7820E-01	0.0000E+00
323	0.0000E+00	1.2890E-02	7.9276E-02	2.0552E-02
324	0.0000E+00	6.1747E-01	4.9045E+00	2.0552E-02
335	0.0000E+00	1.0000E+00	6.1502E+00	7.2576E-02
345	0.0000E+00	6.7561E-01	5.3662E+00	1.3913E-02
356	0.0000E+00	1.0000E+00	4.7763E+00	1.0000E+00
361	0.0000E+00	1.0000E+00	2.6107E+01	1.0000E+00
362	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
363	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
364	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
370	0.0000E+00	1.0000E+00	2.7830E-06	5.0000E-01
371	0.0000E+00	1.0000E+00	3.3990E-06	5.0000E-01
398	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
399	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
400	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
401	0.0000E+00	1.0000E+00	8.6000E+00	1.0000E+00
402	0.0000E+00	1.0000E+00	3.3200E+01	1.0000E+00
403	0.0000E+00	1.0000E+00	2.5000E+01	1.0000E+00
404	0.0000E+00	1.0000E+00	2.5000E-02	1.0000E+00
405	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
406	0.0000E+00	1.0000E+00	2.5000E-02	1.0000E+00
407	0.0000E+00	1.0000E+00	3.3200E+01	1.0000E+00
408	0.0000E+00	1.0000E+00	4.3800E+01	1.0000E+00
409	0.0000E+00	1.0000E+00	2.5000E-02	1.0000E+00
410	0.0000E+00	1.0000E+00	2.5000E-02	1.0000E+00
411	0.0000E+00	1.0000E+00	3.3200E+01	1.0000E+00
412	0.0000E+00	1.0000E+00	7.4600E+01	1.0000E+00
413	0.0000E+00	1.0000E+00	2.5000E-02	1.0000E+00
414	0.0000E+00	1.0000E+00	2.5000E-02	1.0000E+00
415	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
416	0.0000E+00	1.0000E+00	1.0900E-01	1.0000E+00
417	0.0000E+00	1.0000E+00	2.9000E-01	1.0000E+00

VALVE DATA

FLOW PATH NUMBER	NUMBER ON OR OFF
21	0
324	0
362	0
363	0
364	0
398	0
399	0
400	0
405	0
415	0

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*****************************************
*                                       *
*  FLOW PATH TIME INDEPENDENT DATA EDIT *
*                                       *
*****************************************
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FLOW PATH	VOLUME FM	VOLUME TO	ORIENTATION	FLOW TYPE	OTHER MODEL	SPARC FM	SPARC TO	
10	100	101	HORIZONTAL	NORMAL		N	N	DW-LOW-H
11	101	102	VERTICAL	NORMAL		N	N	DW-EX-V
12	101	150	VERTICAL	NORMAL		N	N	VENT-OPENING
13	101	103	HORIZONTAL	NORMAL		N	N	DW-MED-H
14	100	103	VERTICAL	NORMAL		N	N	DW-IN-V

15	102	103	VERTICAL	NORMAL	N	N	DW-TOP
20	150	200	VERTICAL	NORMAL	N	Y	DOWNCOMEREX
21	200	150	HORIZONTAL	NORMAL	N	N	WET-DRY-VACRV
312	310	320	VERTICAL	NORMAL	N	N	AN-LP
323	320	330	VERTICAL	NORMAL	N	N	LP-BP
324	320	340	VERTICAL	NORMAL	N	N	LP-CH
335	330	350	VERTICAL	NORMAL	N	N	BP-SH
345	340	350	VERTICAL	NORMAL	N	N	CH-SH
356	350	360	VERTICAL	NORMAL	N	N	SH-SD
361	360	310	VERTICAL	NORMAL	N	N	SD-AN
362	360	200	VERTICAL	NORMAL	N	Y	STEAM-LINE-SRV
363	360	200	VERTICAL	NORMAL	N	Y	ADS-5-SRVS
364	360	200	VERTICAL	NORMAL	N	Y	MANUAL-DEPRES
370	310	100	HORIZONTAL	NORMAL	N	N	LEAKAGE-DOWN
371	320	100	VERTICAL	NORMAL	N	N	LEAKAGE-LP
398	102	408	VERTICAL	NORMAL	N	N	DW-HD-FAILURE
399	320	100	HORIZONTAL	NORMAL	N	N	VESSEL BREACH
400	101	401	HORIZONTAL	NORMAL	N	N	CONT FAIL
401	401	402	VERTICAL	ATM-FIRST	N	N	TORUS-135
402	402	404	VERTICAL	ATM-FIRST	N	N	135-165-SHAFT
403	402	403	HORIZONTAL	ATM-FIRST	N	N	135-SO-NO
404	402	410	HORIZONTAL	ATM-FIRST	N	N	LEAK-135-SO
405	403	409	VERTICAL	ATM-FIRST	N	N	BO-135-TURB
406	403	410	HORIZONTAL	ATM-FIRST	N	N	LEAK-135-NO
407	404	406	VERTICAL	ATM-FIRST	N	N	165-195-SHAFT
408	404	405	HORIZONTAL	ATM-FIRST	N	N	165-SE-MAIN
409	404	410	HORIZONTAL	ATM-FIRST	N	N	LEAK-165-SE
410	405	410	HORIZONTAL	ATM-FIRST	N	N	LEAK-165-MAIN
411	406	408	VERTICAL	ATM-FIRST	N	N	195-SE-REFUEL
412	406	407	HORIZONTAL	ATM-FIRST	N	N	195-SE-MAIN
413	406	410	HORIZONTAL	ATM-FIRST	N	N	LEAK-195-SE
414	407	410	HORIZONTAL	ATM-FIRST	N	N	LEAK-195-MAIN
415	408	410	HORIZONTAL	ATM-FIRST	N	N	BO-REFUEL-ENV
416	408	410	HORIZONTAL	ATM-FIRST	N	N	LEAK-REFUEL
417	409	410	HORIZONTAL	ATM-FIRST	N	N	LEAK-TURB

FLOW	VOLUME		JUNCTION ELEVATION		LENGTH	AREA	FRACT OPEN
PATH	FM	TO	FM (M)	TO (M)	(M)	(M**2)	(-)
10	100	101	-4.5000E+00	-4.5000E+00	1.0000E+00	8.6000E+00	1.0000E+00
11	101	102	6.4700E+00	6.4700E+00	5.0000E-01	6.2592E+01	1.0000E+00
12	101	150	-6.7000E+00	-6.7000E+00	1.3100E+01	2.6600E+01	1.0000E+00
13	101	103	5.0000E+00	5.0000E+00	1.0000E+00	2.1361E-01	1.0000E+00
14	100	103	2.0000E+00	3.0860E+00	1.1000E+00	3.2000E+00	1.0000E+00
15	102	103	1.5431E+01	1.5431E+01	5.0000E-01	5.2920E+00	1.0000E+00
20	150	200	-1.2810E+01	-1.2810E+01	3.9000E+00	2.6600E+01	1.0000E+00
21	200	150	-1.0130E+01	-9.6100E+00	5.0000E-01	1.8600E+00	VALVE
312	310	320	8.0800E+00	3.0860E+00	4.9936E+00	6.7820E-01	1.0000E+00
323	320	330	5.4943E+00	5.4943E+00	1.9050E+00	6.1502E+00	1.2890E-02
324	320	340	5.4943E+00	5.4943E+00	1.9050E+00	7.9428E+00	VALVE
335	330	350	9.6670E+00	9.6670E+00	1.9050E+00	6.1502E+00	1.0000E+00
345	340	350	9.6670E+00	9.6670E+00	1.9050E+00	7.9428E+00	6.7561E-01
356	350	360	1.5431E+01	1.5431E+01	4.1885E+00	4.7763E+00	1.0000E+00
361	360	310	1.5431E+01	1.5431E+01	5.3492E+00	2.6107E+01	1.0000E+00
362	360	200	1.6730E+01	-1.5010E+01	4.7150E+01	1.2010E-01	VALVE
363	360	200	1.6730E+01	-1.5010E+01	4.7150E+01	4.6195E-02	VALVE
364	360	200	1.6730E+01	-1.5010E+01	4.7150E+01	9.2390E-03	VALVE
370	310	100	6.8380E+00	-6.0000E+00	1.5000E-01	2.7830E-06	1.0000E+00
371	320	100	1.0000E-01	-6.0000E+00	1.5000E-01	3.3990E-06	1.0000E+00
398	102	408	1.8420E+01	2.6100E+01	1.0160E-01	4.0000E-02	VALVE
399	320	100	0.0000E+00	-2.2540E-01	2.2540E-01	1.0000E-02	VALVE
400	101	401	-5.0000E+00	-5.0000E+00	1.0000E-03	6.5000E-01	VALVE
401	401	402	-4.7000E+00	-4.1000E+00	8.6000E-01	8.6000E+00	1.0000E+00
402	402	404	4.5000E+00	5.1000E+00	3.3200E+00	3.3200E+01	1.0000E+00

403	402	403	2.0000E-01	2.0000E-01	2.5000E+00	2.5000E+01	1.0000E+00
404	402	410	2.0000E-01	2.0000E-01	2.5000E-03	2.5000E-02	1.0000E+00
405	403	409	2.0000E-01	6.2000E+00	2.8000E-01	2.8000E+00	VALVE
406	403	410	2.0000E-01	2.0000E-01	2.5000E-03	2.5000E-02	1.0000E+00
407	404	406	1.3600E+01	1.4200E+01	3.3200E+00	3.3200E+01	1.0000E+00
408	404	405	9.3500E+00	9.3500E+00	4.3800E+00	4.3800E+01	1.0000E+00
409	404	410	9.3500E+00	9.3500E+00	2.5000E-03	2.5000E-02	1.0000E+00
410	405	410	9.3500E+00	9.3500E+00	2.5000E-03	2.5000E-02	1.0000E+00
411	406	408	2.5500E+01	2.6100E+01	3.3200E+00	3.3200E+01	1.0000E+00
412	406	407	1.9850E+01	1.9850E+01	7.4600E+00	7.4600E+01	1.0000E+00
413	406	410	1.9850E+01	1.9850E+01	2.5000E-03	2.5000E-02	1.0000E+00
414	407	410	1.9850E+01	1.9850E+01	2.5000E-03	2.5000E-02	1.0000E+00
415	408	410	3.4900E+01	3.4900E+01	2.2300E+00	2.2300E+01	VALVE
416	408	410	3.5550E+01	3.5550E+01	1.0900E-02	1.0900E-01	1.0000E+00
417	409	410	1.3500E+01	1.3500E+01	1.0900E-02	2.9000E-01	1.0000E+00

FLOW	VOLUME		'FM' JUNCTION OPENING		'TO' JUNCTION OPENING		MOM.EXCH.L
PATH	FM	TO	BOTTOM (M)	TOP (M)	BOTTOM (M)	TOP (M)	(M)
10	100	101	-6.1545E+00	-2.8455E+00	-6.1545E+00	-2.8455E+00	1.0000E+00
11	101	102	2.0064E+00	6.4700E+00	6.4700E+00	1.0934E+01	8.9272E+00
12	101	150	-7.0650E+00	-6.3350E+00	-7.0650E+00	-6.3350E+00	7.3000E-01
13	101	103	4.7392E+00	5.2608E+00	4.7392E+00	5.2608E+00	1.0000E+00
14	100	103	1.4954E+00	2.5046E+00	3.0860E+00	4.0953E+00	2.5999E+00
15	102	103	1.4782E+01	1.6080E+01	1.4133E+01	1.5431E+01	1.9468E+00
20	150	200	-1.2810E+01	-1.2809E+01	-1.2811E+01	-1.2810E+01	1.5001E-03
21	200	150	-1.0352E+01	-9.9075E+00	-1.0640E+01	-8.5800E+00	5.0000E-01
312	310	320	8.0038E+00	8.1562E+00	3.0098E+00	3.1622E+00	5.1464E+00
323	320	330	5.3419E+00	5.4943E+00	5.4943E+00	5.5197E+00	1.7780E-01
324	320	340	5.3419E+00	5.4943E+00	5.4943E+00	5.5959E+00	2.5400E-01
335	330	350	9.6416E+00	9.6670E+00	9.6670E+00	9.6924E+00	5.0800E-02
345	340	350	9.5345E+00	9.6670E+00	9.6670E+00	9.7995E+00	2.6500E-01
356	350	360	1.5263E+01	1.5431E+01	1.5431E+01	1.5599E+01	3.3520E-01
361	360	310	1.5431E+01	1.6079E+01	1.4783E+01	1.5431E+01	1.2968E+00
362	360	200	1.6632E+01	1.6828E+01	-1.5150E+01	-1.4870E+01	3.1977E+01
363	360	200	1.6703E+01	1.6757E+01	-1.5150E+01	-1.4870E+01	3.1907E+01
364	360	200	1.6707E+01	1.6753E+01	-1.5150E+01	-1.4870E+01	3.1902E+01
370	310	100	6.8371E+00	6.8389E+00	-6.0009E+00	-5.9991E+00	1.5000E-01
371	320	100	9.9480E-02	1.0052E-01	-6.0005E+00	-5.9995E+00	6.1010E+00
398	102	408	1.8364E+01	1.8476E+01	2.6100E+01	2.6213E+01	7.8493E+00
399	320	100	0.0000E+00	5.6419E-02	-2.8182E-01	-1.6898E-01	2.2540E-01
400	101	401	-5.4549E+00	-4.5451E+00	-5.4549E+00	-4.5451E+00	1.0000E-03
401	401	402	-4.8500E+00	-4.5500E+00	-4.1000E+00	-3.8000E+00	1.0500E+00
402	402	404	4.3500E+00	4.6500E+00	5.1000E+00	5.4000E+00	1.0500E+00
403	402	403	5.0000E-02	3.5000E-01	5.0000E-02	3.5000E-01	2.5000E+00
404	402	410	1.5000E-01	2.5000E-01	1.5000E-01	2.5000E-01	2.5000E-03
405	403	409	5.0000E-02	3.5000E-01	6.0500E+00	6.3500E+00	6.3000E+00
406	403	410	1.5000E-01	2.5000E-01	1.5000E-01	2.5000E-01	2.5000E-03
407	404	406	1.3450E+01	1.3750E+01	1.4200E+01	1.4500E+01	1.0500E+00
408	404	405	9.2000E+00	9.5000E+00	9.2000E+00	9.5000E+00	4.3800E+00
409	404	410	9.3000E+00	9.4000E+00	9.3000E+00	9.4000E+00	2.5000E-03
410	405	410	9.3000E+00	9.4000E+00	9.3000E+00	9.4000E+00	2.5000E-03
411	406	408	2.5350E+01	2.5650E+01	2.6100E+01	2.6400E+01	1.0500E+00
412	406	407	1.9700E+01	2.0000E+01	1.9700E+01	2.0000E+01	7.4600E+00
413	406	410	1.9800E+01	1.9900E+01	1.9800E+01	1.9900E+01	2.5000E-03
414	407	410	1.9800E+01	1.9900E+01	1.9800E+01	1.9900E+01	2.5000E-03
415	408	410	3.4750E+01	3.5050E+01	3.4750E+01	3.5050E+01	2.2300E+00
416	408	410	3.5500E+01	3.5600E+01	3.5500E+01	3.5600E+01	1.0900E-02
417	409	410	1.3450E+01	1.3550E+01	1.3450E+01	1.3550E+01	1.0900E-02

FLOW	VOLUME		LOSS COEFFICIENT		DISCHARGE COEFFICIENT	
PATH	FM	TO	FWD (-)	REV (-)	FWD (-)	REV (-)
10	100	101	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00

11	101	102	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
12	101	150	6.7000E+00	6.7000E+00	1.0000E+00	1.0000E+00
13	101	103	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
14	100	103	1.5000E+00	1.5000E+00	1.0000E+00	1.0000E+00
15	102	103	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
20	150	200	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
21	200	150	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
312	310	320	7.8500E-02	1.7000E+01	1.0000E+00	1.0000E+00
323	320	330	5.1880E-01	4.9700E+00	1.0000E+00	1.0000E+00
324	320	340	1.0216E+01	1.3267E+01	1.0000E+00	1.0000E+00
335	330	350	5.0000E+01	5.0000E-01	1.0000E+00	1.0000E+00
345	340	350	5.6885E+00	5.6885E+00	1.0000E+00	1.0000E+00
356	350	360	1.2585E+01	5.0475E+00	1.0000E+00	1.0000E+00
361	360	310	1.1000E-01	1.1000E-01	1.0000E+00	1.0000E+00
362	360	200	4.0000E+00	5.0000E+00	1.0000E+00	1.0000E+00
363	360	200	4.0000E+00	5.0000E+00	1.0000E+00	1.0000E+00
364	360	200	4.0000E+00	4.0000E+00	1.0000E+00	1.0000E+00
370	310	100	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
371	320	100	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
398	102	408	1.0000E+01	1.0000E+01	1.0000E+00	1.0000E+00
399	320	100	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
400	101	401	5.9300E-01	5.9300E-01	1.0000E+00	1.0000E+00
401	401	402	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
402	402	404	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
403	402	403	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
404	402	410	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
405	403	409	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
406	403	410	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
407	404	406	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
408	404	405	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
409	404	410	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
410	405	410	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
411	406	408	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
412	406	407	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
413	406	410	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
414	407	410	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
415	408	410	5.0000E-01	5.0000E-01	1.0000E+00	1.0000E+00
416	408	410	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00
417	409	410	1.0000E+00	1.0000E+00	1.0000E+00	1.0000E+00

FLOW PATH	VOLUME FM	TO	SEG AREA (M**2)	SEG LEN (M)	HYD DIA (M)	ROUGHNESS (M)	F.LAMINAR (-)
10	100	101	8.6000E+00	1.0000E+00	1.5000E+00	5.0000E-06	1.6000E+01
11	101	102	6.2592E+01	5.0000E-01	6.0000E+00	5.0000E-06	1.6000E+01
12	101	150	2.6600E+01	1.3100E+01	1.3100E+00	5.0000E-06	1.6000E+01
13	101	103	2.1361E-01	1.0000E+00	1.0000E+00	5.0000E-06	1.6000E+01
14	100	103	3.2000E+00	1.1000E+00	5.0000E-01	5.0000E-06	1.6000E+01
15	102	103	5.2920E+00	5.0000E-01	1.0000E+00	5.0000E-06	1.6000E+01
20	150	200	2.6600E+01	3.9000E+00	1.3100E+00	5.0000E-06	1.6000E+01
21	200	150	1.8600E+00	5.0000E-01	4.4500E-01	5.0000E-06	1.6000E+01
312	310	320	3.3900E-02	4.9936E+00	2.7783E-01	5.0000E-06	1.6000E+01
323	320	330	6.1502E+00	1.9050E+00	5.8410E-02	5.0000E-06	1.6000E+01
324	320	340	7.9428E+00	1.9050E+00	1.3590E-02	5.0000E-06	1.6000E+01
335	330	350	6.1502E+00	1.9050E+00	5.8410E-02	5.0000E-06	1.6000E+01
345	340	350	7.9428E+00	1.9050E+00	1.3590E-02	5.0000E-06	1.6000E+01
356	350	360	4.7763E+00	4.1885E+00	8.7800E-03	5.0000E-06	1.6000E+01
361	360	310	2.6107E+01	5.3492E+00	7.3944E-01	5.0000E-06	1.6000E+01
362	360	200	1.2010E-01	4.7150E+01	3.9104E-01	5.0000E-06	1.6000E+01
363	360	200	4.6195E-02	4.7150E+01	2.4252E-01	5.0000E-06	1.6000E+01
364	360	200	9.2390E-03	4.7150E+01	1.0850E-01	5.0000E-06	1.6000E+01
370	310	100	2.7830E-06	1.5000E-01	1.6310E-03	5.0000E-05	1.6000E+01
371	320	100	3.3990E-06	1.5000E-01	1.8040E-03	5.0000E-05	1.6000E+01
398	102	408	4.0000E-02	1.0160E-01	4.3000E-03	1.0000E-04	1.6000E+01

399	320	100	1.0000E-02	2.2540E-01	1.1280E-01	5.0000E-05	1.6000E+01
400	101	401	1.0200E-01	1.0000E-03	1.0000E+00	5.0000E-05	1.6000E+01
401	401	402	8.6000E+00	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
402	402	404	3.3200E+01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
403	402	403	2.5000E+01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
404	402	410	2.5000E-02	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
405	403	409	2.8000E+00	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
406	403	410	2.5000E-02	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
407	404	406	3.3200E+01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
408	404	405	4.3800E+01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
409	404	410	2.5000E-02	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
410	405	410	2.5000E-02	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
411	406	408	3.3200E+01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
412	406	407	7.4600E+01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
413	406	410	2.5000E-02	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
414	407	410	2.5000E-02	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
415	408	410	2.2300E+01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
416	408	410	1.0900E-01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01
417	409	410	2.9000E-01	1.0000E-02	1.0000E+00	5.0000E-05	1.6000E+01

*** VALVE DATA ***

FLOW PATH	TRIP	FRACTION OPEN (-)
21	NONE	CF 2
324	NONE	CF 95
362	NONE	CF105
363	NONE	CF106
364	NONE	CF108
398	NONE	CF151
399	NONE	CF130
400	CF150	CF145 IF TRIP>0., CF145 IF TRIP<0., NO CHANGE IF TRIP=0.
405	CF110	CF111 IF TRIP>0., CF111 IF TRIP<0., NO CHANGE IF TRIP=0.
415	CF140	CF141 IF TRIP>0., CF141 IF TRIP<0., NO CHANGE IF TRIP=0.

*** CONTROL VOLUME CONNECTIVITY DATA ***

VOLUME		CONNECTING FLOW PATH			VOLUME	
100	DRYWELL-IN	10	DW-LOW-H	TO	101	DRYWELL-EX
		14	DW-IN-V	TO	103	DRYWELL-ANN
		370	LEAKAGE-DOWN	FROM	310	ANNULUS
		371	LEAKAGE-LP	FROM	320	LOWER-PLENUM
		399	VESSEL BREACH	FROM	320	LOWER-PLENUM
101	DRYWELL-EX	10	DW-LOW-H	FROM	100	DRYWELL-IN
		11	DW-EX-V	TO	102	DRYWELL-TOP
		12	VENT-OPENING	TO	150	VENT/DOWNCOMER
		13	DW-MED-H	TO	103	DRYWELL-ANN
		400	CONT FAIL	TO	401	TORUS ROOM
102	DRYWELL-TOP	11	DW-EX-V	FROM	101	DRYWELL-EX
		15	DW-TOP	TO	103	DRYWELL-ANN
		398	DW-HD-FAILURE	TO	408	REFUELING-BAY
103	DRYWELL-ANN	13	DW-MED-H	FROM	101	DRYWELL-EX
		14	DW-IN-V	FROM	100	DRYWELL-IN
		15	DW-TOP	FROM	102	DRYWELL-TOP
150	VENT/DOWNCOMER	12	VENT-OPENING	FROM	101	DRYWELL-EX
		20	DOWNCOMEREX	TO	200	WETWELL
		21	WET-DRY-VACRV	FROM	200	WETWELL
200	WETWELL	20	DOWNCOMEREX	FROM	150	VENT/DOWNCOMER
		21	WET-DRY-VACRV	TO	150	VENT/DOWNCOMER
		362	STEAM-LINE-SRV	FROM	360	STEAM-DOME
		363	ADS-5-SRVS	FROM	360	STEAM-DOME
		364	MANUAL-DEPRES	FROM	360	STEAM-DOME
310	ANNULUS	312	AN-LP	TO	320	LOWER-PLENUM
		361	SD-AN	FROM	360	STEAM-DOME

		370	LEAKAGE-DOWN	TO	100	DRYWELL-IN
320	LOWER-PLENUM	312	AN-LP	FROM	310	ANNULUS
		323	LP-BP	TO	330	BY-PASS
		324	LP-CH	TO	340	CHANNEL
		371	LEAKAGE-LP	TO	100	DRYWELL-IN
		399	VESSEL BREACH	TO	100	DRYWELL-IN
330	BY-PASS	323	LP-BP	FROM	320	LOWER-PLENUM
		335	BP-SH	TO	350	SHROUD-DOME
340	CHANNEL	324	LP-CH	FROM	320	LOWER-PLENUM
		345	CH-SH	TO	350	SHROUD-DOME
350	SHROUD-DOME	335	BP-SH	FROM	330	BY-PASS
		345	CH-SH	FROM	340	CHANNEL
		356	SH-SD	TO	360	STEAM-DOME
360	STEAM-DOME	356	SH-SD	FROM	350	SHROUD-DOME
		361	SD-AN	TO	310	ANNULUS
		362	STEAM-LINE-SRV	TO	200	WETWELL
		363	ADS-5-SRVS	TO	200	WETWELL
		364	MANUAL-DEPRES	TO	200	WETWELL
401	TORUS ROOM	400	CONT FAIL	FROM	101	DRYWELL-EX
		401	TORUS-135	TO	402	LEV-135-SOUTH
402	LEV-135-SOUTH	401	TORUS-135	FROM	401	TORUS ROOM
		402	135-165-SHAFT	TO	404	LEVEL-165-SE
		403	135-SO-NO	TO	403	LEV-135-NORTH
		404	LEAK-135-SO	TO	410	ENVIRONMENT
403	LEV-135-NORTH	403	135-SO-NO	FROM	402	LEV-135-SOUTH
		405	BO-135-TURB	TO	409	TURBINE-BUILDING
		406	LEAK-135-NO	TO	410	ENVIRONMENT
404	LEVEL-165-SE	402	135-165-SHAFT	FROM	402	LEV-135-SOUTH
		407	165-195-SHAFT	TO	406	LEVEL-195-SE
		408	165-SE-MAIN	TO	405	LEVEL-165-MAIN
		409	LEAK-165-SE	TO	410	ENVIRONMENT
405	LEVEL-165-MAIN	408	165-SE-MAIN	FROM	404	LEVEL-165-SE
		410	LEAK-165-MAIN	TO	410	ENVIRONMENT
406	LEVEL-195-SE	407	165-195-SHAFT	FROM	404	LEVEL-165-SE
		411	195-SE-REFUEL	TO	408	REFUELING-BAY
		412	195-SE-MAIN	TO	407	LEVEL-195-MAIN
		413	LEAK-195-SE	TO	410	ENVIRONMENT
407	LEVEL-195-MAIN	412	195-SE-MAIN	FROM	406	LEVEL-195-SE
		414	LEAK-195-MAIN	TO	410	ENVIRONMENT
408	REFUELING-BAY	398	DW-HD-FAILURE	FROM	102	DRYWELL-TOP
		411	195-SE-REFUEL	FROM	406	LEVEL-195-SE
		415	BO-REFUEL-ENV	TO	410	ENVIRONMENT
		416	LEAK-REFUEL	TO	410	ENVIRONMENT
409	TURBINE-BUILDING	405	BO-135-TURB	FROM	403	LEV-135-NORTH
		417	LEAK-TURB	TO	410	ENVIRONMENT
410	ENVIRONMENT	404	LEAK-135-SO	FROM	402	LEV-135-SOUTH
		406	LEAK-135-NO	FROM	403	LEV-135-NORTH
		409	LEAK-165-SE	FROM	404	LEVEL-165-SE
		410	LEAK-165-MAIN	FROM	405	LEVEL-165-MAIN
		413	LEAK-195-SE	FROM	406	LEVEL-195-SE
		414	LEAK-195-MAIN	FROM	407	LEVEL-195-MAIN
		415	BO-REFUEL-ENV	FROM	408	REFUELING-BAY
		416	LEAK-REFUEL	FROM	408	REFUELING-BAY
		417	LEAK-TURB	FROM	409	TURBINE-BUILDING

END OF EDIT FOR FL PACKAGE

***** CONTROL VOLUME THERMODYNAMICS STATISTICS EDIT *****
VALUES SINCE LAST EDIT

CALLS TO MAIN PROGRAM (CVTHRM)

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    NUMBER OF CONTROL VOLUMES PROCESSED                =      22
  CALLS TO WATER EQUILIBRIUM PACKAGE (CVTWE)           =       0
  CALLS TO GAS EQUILIBRIUM PACKAGE (CVTGE)             =       0
  CALLS TO WATER + GAS EQUILIBRIUM PACKAGE (CVTWGE)    =      17
    STATISTICS ON WATER + GAS EQUILIBRIUM PACKAGE
    NUMBER OF TEMPERATURE ITERATIONS =      0
    AVERAGE TEMPERATURE ITERATIONS PER CALL = 0.00000E+00
    NUMBER OF DENSITY ITERATIONS =      0
    AVERAGE DENSITY ITERATIONS PER CALL = 0.00000E+00
    AVERAGE DENSITY ITERATIONS PER TEMPERATURE ITERATION =  0.00000E+00
  CALLS TO WATER + GAS NON-EQUILIBRIUM PACKAGE (CVTNEQ) =      5
    STATISTICS ON WATER + GAS NON-EQUILIBRIUM PACKAGE
    NUMBER OF ITERATIONS =      0
    AVERAGE ITERATIONS PER CALL = 0.00000E+00


END OF EDIT FOR CVT PACKAGE


        ***********************************************
        *                                             *
        *                CORE PACKAGE                 *
        *                                             *
        ***********************************************


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NUMBER OF RADIAL RINGS IN CORE/LOWER PLENUM    =   3
NUMBER OF AXIAL SEGMENTS IN CORE/LOWER PLENUM  =  11
NUMBER OF AXIAL SEGMENTS IN LOWER PLENUM ONLY  =   6
TOTAL NUMBER OF CORE/LOWER PLENUM CELLS        =  33
NUMBER OF CORE/LOWER PLENUM FLUID VOLUMES      =   3
NUMBER OF NODES IN LOWER HEAD                  =   5
NUMBER OF LOWER HEAD PENETRATIONS              =   3

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CORE GEOMETRY PARAMETERS (M) :
    FUEL PELLET RADIUS          =     .00521
    CLADDING OUTER RADIUS       =     .00613
    FUEL-CLADDING GAP THICKNESS =     .00011
    FUEL ROD PITCH              =     .01600
    CANISTER THICKNESS          =     .00254
    CR/STRUCTURE THICKNESS      =     .00120
    LOWER HEAD THICKNESS        =     .22540

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REACTOR TYPE IS BWR
CONTROL POISON IS B4C

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RADIATION EXCHANGE FACTORS:
    CANISTER TO CLADDING                      =      .5000
    STEEL STRUCTURE TO CANISTER               =      .9500
    RADIALLY BETWEEN CELLS                    =      .3000
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    AXIALLY BETWEEN CELLS                          =      .1500
    LIQUID POOL TO CORE COMPONENTS                 =      .9500

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TRANSFER PROCESS NUMBER FOR CORE DEBRIS EJECTION = 101
CONTROL FUNCTION NUMBER FOR CORE FISSION POWER   =   0
CONTROL FUNCTION NUMBER FOR GAP CONDUCTANCE      =   0

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CANDLING HEAT TRANSFER COEFFICIENTS:
    UO2 REFREEZING COEFFICIENT                     =  1000.0000 W/M**2-K
    ZIRCALOY REFREEZING COEFFICIENT                =  1000.0000 W/M**2-K
    STEEL REFREEZING COEFFICIENT                   =  1000.0000 W/M**2-K
    ZRO2 REFREEZING COEFFICIENT                    =  1000.0000 W/M**2-K
    STEEL OXIDE REFREEZING COEFFICIENT             =  1000.0000 W/M**2-K
    CONTROL POISON REFREEZING COEFFICIENT          =  1000.0000 W/M**2-K

*************************************************************


CANDLING SECONDARY MATERIALS TRANSPORT PARAMETERS:
    UO2 IN MOLTEN ZIRCALOY          - M = 1, F =      .200
    ZRO2 IN MOLTEN ZIRCALOY         - M = 2, F =     1.000
    STEEL OXIDE IN MOLTEN STEEL     - M = 2, F =     1.000
    CONTROL POISON IN MOLTEN STEEL - M = 2, F =      .000

*************************************************************


DEBRIS FORMATION PARAMETERS:
    CRITICAL MINIMUM CLADDING THICKNESS            =    .1000E-05 M
    CRITICAL MINIMUM STEEL STRUCT THICKNESS        =    .1000E-05 M

*************************************************************


LOWER HEAD FAILURE MODELING PARAMETERS:
    DEBRIS TO PENETRATION HEAT TRANSFER COEF       =   500.0000 W/M**2-K
    DEBRIS TO LOWER HEAD HEAT TRANSFER COEF        =   500.0000 W/M**2-K
    PENETRATION FAILURE TEMPERATURE                =  1273.1500 K
    DISCHARGE COEFFICIENT                          =     1.0000

*************************************************************


STEEL AND STEEL OXIDE COMPOSITION:
    FRACTION OF FE IN STEEL                        =      .7400
    FRACTION OF CR IN STEEL                        =      .1800
    FRACTION OF NI IN STEEL                        =      .0800
    FRACTION OF C  IN STEEL                        =      .0000
    FRACTION OF FEO IN STEEL OXIDE                 =      .7229
    FRACTION OF CR2O3 IN STEEL OXIDE               =      .1998
    FRACTION OF NIO IN STEEL OXIDE                 =      .0773

*************************************************************


EDIT OF AXIAL SEGMENT INPUT

 LEVEL  ELEVATION   LENGTH    INTACT    DEBRIS    FISSION     BOUND
```

	(M)	(M)	POROSITY	POROSITY	POWER FRAC	HS
11	8.5423	.7620	.5300	.9000	1.0000	33011
10	7.7803	.7620	.5300	.9000	1.0000	33010
9	7.0183	.7620	.5300	.9000	1.0000	33009
8	6.2563	.7620	.5300	.9000	1.0000	33008
7	5.4943	.7620	.5300	.9000	1.0000	33007
6	5.2166	.2777	.0000	.9000	1.0000	32006
5	4.2363	.9803	.0000	.9000	1.0000	32005
4	3.2560	.9803	.0000	.9000	1.0000	32004
3	2.2757	.9803	.0000	.9000	1.0000	32003
2	1.2954	.9803	.0000	.9000	1.0000	32002
1	.0000	1.2954	.0000	.9000	1.0000	32001

****

EDIT OF RADIAL RING INPUT

RING	X-SEC AREA (M**2)	FISSION POWER FRAC	BOUND HS	LH FAIL CF
1	7.648	1.000	35003	0
2	7.287	1.000	35003	0
3	2.251	1.000	35003	0

****

EDIT OF ADJACENT FLUID VOLUMES IN CORE

ICVHC = CHANNEL VOLUME
ICVHB = BYPASS VOLUME

IA	**** IR =	1	2	3
11	ICVHC =	340	340	340
	ICVHB =	330	330	330
10	ICVHC =	340	340	340
	ICVHB =	330	330	330
9	ICVHC =	340	340	340
	ICVHB =	330	330	330
8	ICVHC =	340	340	340
	ICVHB =	330	330	330
7	ICVHC =	340	340	340
	ICVHB =	330	330	330
6	ICVHC =	320	320	320
	ICVHB =	320	320	320
5	ICVHC =	320	320	320
	ICVHB =	320	320	320
4	ICVHC =	320	320	320
	ICVHB =	320	320	320
3	ICVHC =	320	320	320
	ICVHB =	320	320	320
2	ICVHC =	320	320	320

```
    ICVHB =        320       320       320

 1  ICVHC =        320       320       320
    ICVHB =        320       320       320

*************************************************************

EDIT OF OXIDATION CUTOFF CONTROL FUNCTIONS

IA **** IR =         1         2         3

11 ICFNOX =          0         0         0

10 ICFNOX =          0         0         0

 9 ICFNOX =          0         0         0

 8 ICFNOX =          0         0         0

 7 ICFNOX =          0         0         0

 6 ICFNOX =          0         0         0

 5 ICFNOX =          0         0         0

 4 ICFNOX =          0         0         0

 3 ICFNOX =          0         0         0

 2 ICFNOX =          0         0         0

 1 ICFNOX =          0         0         0

*************************************************************

EDIT OF CELL COMPONENT HYDRAULIC DIAMETERS (M)

    DHYCL = CLADDING                DHYCN = CANISTER (INSIDE)
    DHYSS = STEEL STRUCTURE         DHYCB = CANISTER (OUT, BLADE)
    DHYDP = PARTICULATE DEBRIS      DHYCX = CANISTER (OUT, NO BLADE)

IA **** IR =         1         2         3

11  DHYCL =  5.0000E-3 5.0000E-3 5.0000E-3
    DHYCN =  5.0000E-3 5.0000E-3 5.0000E-3
    DHYSS =  3.0000E-3 3.0000E-3 3.0000E-3
    DHYCB =  3.0000E-3 3.0000E-3 3.0000E-3
    DHYCX =  3.0000E-3 3.0000E-3 3.0000E-3
    DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

10  DHYCL =  5.0000E-3 5.0000E-3 5.0000E-3
    DHYCN =  5.0000E-3 5.0000E-3 5.0000E-3
    DHYSS =  3.0000E-3 3.0000E-3 3.0000E-3
    DHYCB =  3.0000E-3 3.0000E-3 3.0000E-3
    DHYCX =  3.0000E-3 3.0000E-3 3.0000E-3
    DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

 9  DHYCL =  5.0000E-3 5.0000E-3 5.0000E-3
    DHYCN =  5.0000E-3 5.0000E-3 5.0000E-3
    DHYSS =  3.0000E-3 3.0000E-3 3.0000E-3
    DHYCB =  3.0000E-3 3.0000E-3 3.0000E-3
    DHYCX =  3.0000E-3 3.0000E-3 3.0000E-3
```

```
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

   8  DHYCL =  5.0000E-3 5.0000E-3 5.0000E-3
      DHYCN =  5.0000E-3 5.0000E-3 5.0000E-3
      DHYSS =  3.0000E-3 3.0000E-3 3.0000E-3
      DHYCB =  3.0000E-3 3.0000E-3 3.0000E-3
      DHYCX =  3.0000E-3 3.0000E-3 3.0000E-3
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

   7  DHYCL =  5.0000E-3 5.0000E-3 5.0000E-3
      DHYCN =  5.0000E-3 5.0000E-3 5.0000E-3
      DHYSS =  3.0000E-3 3.0000E-3 3.0000E-3
      DHYCB =  3.0000E-3 3.0000E-3 3.0000E-3
      DHYCX =  3.0000E-3 3.0000E-3 3.0000E-3
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

   6  DHYCL =   1.000     1.000     1.000
      DHYCN =   1.000     1.000     1.000
      DHYSS =   .1500     .1500     .1500
      DHYCB =   1.000     1.000     1.000
      DHYCX =   1.000     1.000     1.000
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

   5  DHYCL =   1.000     1.000     1.000
      DHYCN =   1.000     1.000     1.000
      DHYSS =   .3000     .3000     .3000
      DHYCB =   1.000     1.000     1.000
      DHYCX =   1.000     1.000     1.000
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

   4  DHYCL =   1.000     1.000     1.000
      DHYCN =   1.000     1.000     1.000
      DHYSS =   .3000     .3000     .3000
      DHYCB =   1.000     1.000     1.000
      DHYCX =   1.000     1.000     1.000
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

   3  DHYCL =   1.000     1.000     1.000
      DHYCN =   1.000     1.000     1.000
      DHYSS =   .3000     .3000     .3000
      DHYCB =   1.000     1.000     1.000
      DHYCX =   1.000     1.000     1.000
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

   2  DHYCL =   1.000     1.000     1.000
      DHYCN =   1.000     1.000     1.000
      DHYSS =   .3000     .3000     .3000
      DHYCB =   1.000     1.000     1.000
      DHYCX =   1.000     1.000     1.000
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2

   1  DHYCL =   1.000     1.000     1.000
      DHYCN =   1.000     1.000     1.000
      DHYSS =   1.000     1.000     1.000
      DHYCB =   1.000     1.000     1.000
      DHYCX =   1.000     1.000     1.000
      DHYDP =  2.5400E-2 2.5400E-2 2.5400E-2


TOTAL NUMBER OF SUBCYCLES IN CORE PACKAGE =       0
TOTAL CPU TIME USED BY CORE RUN PACKAGE   =        .0000 S
LAST TIME STEP IN CORE PACKAGE            =       1.0000 S
COMPONENT 0 IN CELL   0 HAS CONTROLLED THE CORE
PACKAGE TIME STEP FOR THE LAST     0 SUBCYCLES
```

TEMPERATURE CHANGE LAST SUBCYCLE FOR THIS COMPONENT = .00 K

EDIT OF CORE CELL AVERAGE TEMPERATURES (K)

TOP NUMBER IS AVERAGE COMPONENT TEMPERATURE
BOTTOM NUMBER IS CHANNEL FLUID TEMPERATURE

IA **** IR =	1	2	3
11	564.00	564.00	564.00
	560.00	560.00	560.00
10	564.00	564.00	564.00
	560.00	560.00	560.00
9	564.00	564.00	564.00
	560.00	560.00	560.00
8	564.00	564.00	564.00
	560.00	560.00	560.00
7	564.00	564.00	564.00
	560.00	560.00	560.00
6	564.00	564.00	564.00
	560.00	560.00	560.00
5	564.00	564.00	564.00
	560.00	560.00	560.00
4	564.00	564.00	564.00
	560.00	560.00	560.00
3	564.00	564.00	564.00
	560.00	560.00	560.00
2	564.00	564.00	564.00
	560.00	560.00	560.00
1	564.00	564.00	564.00
	560.00	560.00	560.00

EDIT OF CORE CELL COMPONENT TEMPERATURES (K)

UPPER BOUNDARY HEAT STRUCTURE (RING 1) IS 35003, TEMP = 560.35

CELL	FUEL	CLAD	DEBRIS	CHANNEL	CAN	CAN-B	BYPASS	STRUC
111	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
110	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
109	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
108	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
107	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
106			.00	560.00				564.00
105			.00	560.00				564.00
104			.00	560.00				564.00
103			.00	560.00				564.00
102			.00	560.00				564.00
101			.00	560.00				564.00

THE CHANNEL LIQUID LEVEL IN RING 1 IS IN CELL 106

THE BYPASS LIQUID LEVEL IN RING 1 IS IN CELL 106

POOL/ATMOSPHERE FRACTIONS AND TEMPERATURES FOR CHANNEL COMPONENTS

	CH FRAC	FUEL	CLAD	DEBRIS	CAN	CAN-B
ATM	.0226	.00	.00	.00	.00	.00
POOL	.9774	.00	.00	.00	.00	.00

POOL/ATMOSPHERE FRACTIONS AND TEMPERATURES FOR BYPASS COMPONENTS

	BY FRAC	STRUC
ATM	.0226	564.00
POOL	.9774	564.00

UPPER BOUNDARY HEAT STRUCTURE (RING 2) IS 35003, TEMP = 560.35

CELL	FUEL	CLAD	DEBRIS	CHANNEL	CAN	CAN-B	BYPASS	STRUC
211	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
210	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
209	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
208	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
207	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00
206			.00	560.00				564.00
205			.00	560.00				564.00
204			.00	560.00				564.00
203			.00	560.00				564.00
202			.00	560.00				564.00
201			.00	560.00				564.00

THE CHANNEL LIQUID LEVEL IN RING 2 IS IN CELL 206

THE BYPASS LIQUID LEVEL IN RING 2 IS IN CELL 206

POOL/ATMOSPHERE FRACTIONS AND TEMPERATURES FOR CHANNEL COMPONENTS

	CH FRAC	FUEL	CLAD	DEBRIS	CAN	CAN-B
ATM	.0226	.00	.00	.00	.00	.00
POOL	.9774	.00	.00	.00	.00	.00

POOL/ATMOSPHERE FRACTIONS AND TEMPERATURES FOR BYPASS COMPONENTS

	BY FRAC	STRUC
ATM	.0226	564.00
POOL	.9774	564.00

UPPER BOUNDARY HEAT STRUCTURE (RING 3) IS 35003, TEMP = 560.35

CELL	FUEL	CLAD	DEBRIS	CHANNEL	CAN	CAN-B	BYPASS	STRUC	BND HS
311	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00	560.00
310	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00	560.00
309	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00	560.00
308	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00	560.00
307	564.00	564.00	.00	560.00	564.00	564.00	560.00	564.00	560.00
306			.00	560.00				564.00	560.00

305	.00	560.00	564.00	560.00
304	.00	560.00	564.00	560.00
303	.00	560.00	564.00	558.11
302	.00	560.00	564.00	558.12
301	.00	560.00	564.00	558.11

THE CHANNEL LIQUID LEVEL IN RING 3 IS IN CELL 306

THE BYPASS LIQUID LEVEL IN RING 3 IS IN CELL 306

POOL/ATMOSPHERE FRACTIONS AND TEMPERATURES FOR CHANNEL COMPONENTS

	CH FRAC	FUEL	CLAD	DEBRIS	CAN	CAN-B
ATM	.0226	.00	.00	.00	.00	.00
POOL	.9774	.00	.00	.00	.00	.00

POOL/ATMOSPHERE FRACTIONS AND TEMPERATURES FOR BYPASS COMPONENTS

	BY FRAC	STRUC
ATM	.0226	564.00
POOL	.9774	564.00

PENETRATION TEMPERATURES:

TLH(1)= 561.00 TPN(1)= 561.00 ABOVE, 561.00 BELOW LIQUID LEVEL

TLH(2)= 561.00 TPN(2)= 561.00 ABOVE, 561.00 BELOW LIQUID LEVEL

TLH(3)= 561.00 TPN(3)= 561.00 ABOVE, 561.00 BELOW LIQUID LEVEL

LOWER HEAD TEMPERATURES:

I **** IR =	1	2	3
5	561.00	561.00	561.00
4	561.00	561.00	561.00
3	561.00	561.00	561.00
2	561.00	561.00	561.00
1	561.00	561.00	561.00

EDIT OF CELL COMPONENT DECAY POWER (W)

CELL	FUEL	CLAD	CAN	CAN-B	STRUC	DEBRIS
111	9.0390E+6	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0
110	1.4232E+7	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0
109	1.4744E+7	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0
108	1.4744E+7	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0
107	1.1347E+7	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0	0.0000E+0
106					0.0000E+0	0.0000E+0
105					0.0000E+0	0.0000E+0
104					0.0000E+0	0.0000E+0
103					0.0000E+0	0.0000E+0
102					0.0000E+0	0.0000E+0
101					0.0000E+0	0.0000E+0

CELL	FUEL	CLAD	CAN	CAN-B	STRUC	DEBRIS

```
211   7.1093E+6 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
210   1.1193E+7 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
209   1.1597E+7 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
208   1.1597E+7 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
207   8.9245E+6 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
206                                           0.0000E+0 0.0000E+0
205                                           0.0000E+0 0.0000E+0
204                                           0.0000E+0 0.0000E+0
203                                           0.0000E+0 0.0000E+0
202                                           0.0000E+0 0.0000E+0
201                                           0.0000E+0 0.0000E+0

CELL     FUEL      CLAD      CAN      CAN-B     STRUC    DEBRIS
----     ----      ----      ---      -----     -----    ------
311   7.7864E+5 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
310   1.2259E+6 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
309   1.2701E+6 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
308   1.2701E+6 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
307   9.7744E+5 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
306                                           0.0000E+0 0.0000E+0
305                                           0.0000E+0 0.0000E+0
304                                           0.0000E+0 0.0000E+0
303                                           0.0000E+0 0.0000E+0
302                                           0.0000E+0 0.0000E+0
301                                           0.0000E+0 0.0000E+0

TOTAL ENERGY IN CORE PACKAGE          =    4.284791E+10 J
TOTAL INITIAL ENERGY IN CORE PACKAGE =    4.284791E+10 J
TOTAL FISSION/DECAY ENERGY GENERATED =    0.000000E+00 J
TOTAL OXIDATION ENERGY GENERATED      =    0.000000E+00 J
TOTAL ENERGY TRANSFER TO CVH PACKAGE =    0.000000E+00 J
TOTAL ENERGY TRANSFER TO HS PACKAGE  =    0.000000E+00 J
TOTAL ENERGY TRANSFER TO CAV PACKAGE =    0.000000E+00 J

ENERGY ERROR                          =    0.000000E+00 J
ENERGY ERROR / (TOTAL-E - INITIAL-E) =    0.000000E+00


ENERGY TRANSFER RATE TO VOLUME  320 ATMOSPHERE =    2.067237E+08 W

ENERGY TRANSFER RATE TO VOLUME  340 ATMOSPHERE =    6.652899E+07 W

ENERGY TRANSFER RATE TO VOLUME  330 ATMOSPHERE =    5.151417E+07 W


EDIT OF CORE COMPONENT MASSES (KG)

CELL  111        UO2        ZR       ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------        ---        --       ----     -----  --------  --------     -----
FUEL       1.4995E+4                                                      1.4995E+4
CLADDING   0.0000E+0  3153.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3153.
CANISTER   0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
CAN-BLAD   0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
ST STRUC   0.0000E+0 0.0000E+0 0.0000E+0 1.0744E+4 0.0000E+0  158.9    1.0903E+4
PT DEBRIS  0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  110        UO2        ZR       ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------        ---        --       ----     -----  --------  --------     -----
FUEL       1.4995E+4                                                      1.4995E+4
CLADDING   0.0000E+0  3153.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3153.
CANISTER   0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
CAN-BLAD   0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
```

```
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1077.    0.0000E+0  158.9     1236.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  109       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
FUEL      1.4995E+4                                                     1.4995E+4
CLADDING  0.0000E+0  3153.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3153.
CANISTER  0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
CAN-BLAD  0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1077.    0.0000E+0  158.9     1236.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  108       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
FUEL      1.4995E+4                                                     1.4995E+4
CLADDING  0.0000E+0  3153.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3153.
CANISTER  0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
CAN-BLAD  0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1077.    0.0000E+0  158.9     1236.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  107       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
FUEL      1.4995E+4                                                     1.4995E+4
CLADDING  0.0000E+0  3153.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3153.
CANISTER  0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
CAN-BLAD  0.0000E+0  1170.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1170.
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1077.    0.0000E+0  158.9     1236.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  106       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6675.    0.0000E+0 0.0000E+0  6675.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  11 ***

CELL  105       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6550.    0.0000E+0 0.0000E+0  6550.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  104       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6550.    0.0000E+0 0.0000E+0  6550.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  103       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6550.    0.0000E+0 0.0000E+0  6550.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  102       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6550.    0.0000E+0 0.0000E+0  6550.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***
```

```
CELL  101        UO2         ZR       ZRO2      STEEL   ST OXIDE  B4C          TOTAL
---------        -           --       ----      -----   --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  5420.     0.0000E+0 0.0000E+0  5420.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  211        UO2         ZR       ZRO2      STEEL   ST OXIDE  B4C          TOTAL
---------        ---         --       ----      -----   --------  --------     -----
FUEL      1.4287E+4                                                          1.4287E+4
CLADDING  0.0000E+0  3004.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3004.
CANISTER  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
CAN-BLAD  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0 1.0237E+4 0.0000E+0  151.4    1.0388E+4
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  210        UO2         ZR       ZRO2      STEEL   ST OXIDE  B4C          TOTAL
---------        ---         --       ----      -----   --------  --------     -----
FUEL      1.4287E+4                                                          1.4287E+4
CLADDING  0.0000E+0  3004.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3004.
CANISTER  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
CAN-BLAD  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1026.     0.0000E+0  151.4     1177.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  209        UO2         ZR       ZRO2      STEEL   ST OXIDE  B4C          TOTAL
---------        ---         --       ----      -----   --------  --------     -----
FUEL      1.4287E+4                                                          1.4287E+4
CLADDING  0.0000E+0  3004.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3004.
CANISTER  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
CAN-BLAD  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1026.     0.0000E+0  151.4     1177.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  208        UO2         ZR       ZRO2      STEEL   ST OXIDE  B4C          TOTAL
---------        ---         --       ----      -----   --------  --------     -----
FUEL      1.4287E+4                                                          1.4287E+4
CLADDING  0.0000E+0  3004.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3004.
CANISTER  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
CAN-BLAD  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1026.     0.0000E+0  151.4     1177.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  207        UO2         ZR       ZRO2      STEEL   ST OXIDE  B4C          TOTAL
---------        ---         --       ----      -----   --------  --------     -----
FUEL      1.4287E+4                                                          1.4287E+4
CLADDING  0.0000E+0  3004.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  3004.
CANISTER  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
CAN-BLAD  0.0000E+0  1114.    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  1114.
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1026.     0.0000E+0  151.4     1177.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  206        UO2         ZR       ZRO2      STEEL   ST OXIDE  B4C          TOTAL
---------        ---         --       ----      -----   --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6360.     0.0000E+0 0.0000E+0  6360.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  11 ***

CELL  205        UO2         ZR       ZRO2      STEEL   ST OXIDE  B4C          TOTAL
---------        ---         --       ----      -----   --------  --------     -----
```

```
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6100.    0.0000E+0 0.0000E+0  6100.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  204       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6100.    0.0000E+0 0.0000E+0  6100.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  203       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6100.    0.0000E+0 0.0000E+0  6100.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  202       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  6100.    0.0000E+0 0.0000E+0  6100.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  201       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  5094.    0.0000E+0 0.0000E+0  5094.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  311       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
FUEL       4414.                                                          4414.
CLADDING  0.0000E+0  928.0    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  928.0
CANISTER  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
CAN-BLAD  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  3163.    0.0000E+0  46.80     3210.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  310       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
FUEL       4414.                                                          4414.
CLADDING  0.0000E+0  928.0    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  928.0
CANISTER  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
CAN-BLAD  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  317.0    0.0000E+0  46.80     363.8
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  309       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
FUEL       4414.                                                          4414.
CLADDING  0.0000E+0  928.0    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  928.0
CANISTER  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
CAN-BLAD  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  317.0    0.0000E+0  46.80     363.8
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  308       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
FUEL       4414.                                                          4414.
CLADDING  0.0000E+0  928.0    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  928.0
CANISTER  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
CAN-BLAD  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
```

```
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  317.0    0.0000E+0  46.80     363.8
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  307       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
FUEL       4414.                                                        4414.
CLADDING  0.0000E+0  928.0    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  928.0
CANISTER  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
CAN-BLAD  0.0000E+0  344.2    0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0  344.2
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  317.0    0.0000E+0  46.80     363.8
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  306       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1965.    0.0000E+0 0.0000E+0  1965.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  11 ***

CELL  305       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1900.    0.0000E+0 0.0000E+0  1900.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  304       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1900.    0.0000E+0 0.0000E+0  1900.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  303       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1900.    0.0000E+0 0.0000E+0  1900.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  302       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1900.    0.0000E+0 0.0000E+0  1900.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

CELL  301       UO2        ZR      ZRO2     STEEL  ST OXIDE  B4C          TOTAL
---------       ---        --      ----     -----  --------  --------     -----
ST STRUC  0.0000E+0 0.0000E+0 0.0000E+0  1529.    0.0000E+0 0.0000E+0  1529.
PT DEBRIS 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0 0.0000E+0
  *** SUPPORT FLAG =  00 ***

TOTAL FUEL MASS                  =  1.6848E+5 KG
TOTAL ZIRCALOY MASS              =  6.1708E+4 KG
TOTAL ZRO2 MASS                  =  0.0000E+0 KG
TOTAL STEEL MASS                 =  1.1907E+5 KG
TOTAL STEEL OXIDE MASS           =  0.0000E+0 KG
TOTAL CONTROL POISON MASS        =   1785.    KG
TOTAL HEATING ELEMENT MASS       =  0.0000E+0 KG

TOTAL MASS OF H2O CONSUMED       =  0.0000E+0 KG
TOTAL MASS OF H2 PRODUCED        =  0.0000E+0 KG
TOTAL MASS OF CO PRODUCED        =  0.0000E+0 KG
TOTAL MASS OF CO2 PRODUCED       =  0.0000E+0 KG
TOTAL MASS OF CH4 PRODUCED       =  0.0000E+0 KG
TOTAL MASS OF B2O3 PRODUCED      =  0.0000E+0 KG
```

TOTAL MASS EJECTED TO CAVITY = 0.0000E+0 KG

MASS ERROR = 0.0000E+00 KG

EDIT OF CORE VOLUMES (M**3)

CELL	FUEL	CLAD	CAN	CAN-B	STR	P DEB	FLUID	FREE	TOTAL
111	1.37E+0	4.85E-1	1.80E-1	1.80E-1	1.42E+0	0.00E+0	3.51E+0	1.42E+0	7.14E+0
110	1.37E+0	4.85E-1	1.80E-1	1.80E-1	1.99E-1	0.00E+0	3.51E+0	1.42E+0	5.92E+0
109	1.37E+0	4.85E-1	1.80E-1	1.80E-1	1.99E-1	0.00E+0	3.51E+0	1.42E+0	5.92E+0
108	1.37E+0	4.85E-1	1.80E-1	1.80E-1	1.99E-1	0.00E+0	3.51E+0	1.42E+0	5.92E+0
107	1.37E+0	4.85E-1	1.80E-1	1.80E-1	1.99E-1	0.00E+0	3.51E+0	1.42E+0	5.92E+0
106	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.42E-1	0.00E+0	1.28E+0	1.28E+0	2.12E+0
105	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.26E-1	0.00E+0	7.20E+0	7.20E+0	8.03E+0
104	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.26E-1	0.00E+0	7.20E+0	7.20E+0	8.03E+0
103	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.26E-1	0.00E+0	7.20E+0	7.20E+0	8.03E+0
102	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.26E-1	0.00E+0	7.20E+0	7.20E+0	8.03E+0
101	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.83E-1	0.00E+0	9.31E+0	9.31E+0	9.99E+0

CELL	FUEL	CLAD	CAN	CAN-B	STR	P DEB	FLUID	FREE	TOTAL
211	1.30E+0	4.62E-1	1.71E-1	1.71E-1	1.35E+0	0.00E+0	3.34E+0	1.35E+0	6.80E+0
210	1.30E+0	4.62E-1	1.71E-1	1.71E-1	1.89E-1	0.00E+0	3.34E+0	1.35E+0	5.64E+0
209	1.30E+0	4.62E-1	1.71E-1	1.71E-1	1.89E-1	0.00E+0	3.34E+0	1.35E+0	5.64E+0
208	1.30E+0	4.62E-1	1.71E-1	1.71E-1	1.89E-1	0.00E+0	3.34E+0	1.35E+0	5.64E+0
207	1.30E+0	4.62E-1	1.71E-1	1.71E-1	1.89E-1	0.00E+0	3.34E+0	1.35E+0	5.64E+0
206	0.00E+0	0.00E+0	0.00E+0	0.00E+0	8.02E-1	0.00E+0	1.22E+0	1.22E+0	2.02E+0
205	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.69E-1	0.00E+0	6.86E+0	6.86E+0	7.63E+0
204	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.69E-1	0.00E+0	6.86E+0	6.86E+0	7.63E+0
203	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.69E-1	0.00E+0	6.86E+0	6.86E+0	7.63E+0
202	0.00E+0	0.00E+0	0.00E+0	0.00E+0	7.69E-1	0.00E+0	6.86E+0	6.86E+0	7.63E+0
201	0.00E+0	0.00E+0	0.00E+0	0.00E+0	6.42E-1	0.00E+0	8.87E+0	8.87E+0	9.51E+0

CELL	FUEL	CLAD	CAN	CAN-B	STR	P DEB	FLUID	FREE	TOTAL
311	4.03E-1	1.43E-1	5.30E-2	5.30E-2	4.17E-1	0.00E+0	1.03E+0	4.18E-1	2.10E+0
310	4.03E-1	1.43E-1	5.30E-2	5.30E-2	5.85E-2	0.00E+0	1.03E+0	4.18E-1	1.74E+0
309	4.03E-1	1.43E-1	5.30E-2	5.30E-2	5.85E-2	0.00E+0	1.03E+0	4.18E-1	1.74E+0
308	4.03E-1	1.43E-1	5.30E-2	5.30E-2	5.85E-2	0.00E+0	1.03E+0	4.18E-1	1.74E+0
307	4.03E-1	1.43E-1	5.30E-2	5.30E-2	5.85E-2	0.00E+0	1.03E+0	4.18E-1	1.74E+0
306	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.48E-1	0.00E+0	3.77E-1	3.77E-1	6.25E-1
305	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.40E-1	0.00E+0	2.12E+0	2.12E+0	2.36E+0
304	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.40E-1	0.00E+0	2.12E+0	2.12E+0	2.36E+0
303	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.40E-1	0.00E+0	2.12E+0	2.12E+0	2.36E+0
302	0.00E+0	0.00E+0	0.00E+0	0.00E+0	2.40E-1	0.00E+0	2.12E+0	2.12E+0	2.36E+0
301	0.00E+0	0.00E+0	0.00E+0	0.00E+0	1.93E-1	0.00E+0	2.74E+0	2.74E+0	2.93E+0

TOTAL INITIAL CORE VOLUME = 168.6 M**3

VOLUME ERROR / INITIAL VOLUME = .000E+00

EDIT OF CORE CELL COMPONENT SURFACE AREAS (M**2)
(BYPASS-SIDE AREAS OF CN AND CB COMPONENTS NOT PRINTED)

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
111	525.4	639.2	69.45	69.45	203.4	0.0000E+00
110	525.4	639.2	69.45	69.45	203.4	0.0000E+00
109	525.4	639.2	69.45	69.45	203.4	0.0000E+00
108	525.4	639.2	69.45	69.45	203.4	0.0000E+00
107	525.4	639.2	69.45	69.45	203.4	0.0000E+00

106	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	66.75	0.0000E+00
105	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
104	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
103	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
102	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
101	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	40.00	0.0000E+00

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
211	500.7	609.0	66.15	66.15	193.9	0.0000E+00
210	500.7	609.0	66.15	66.15	193.9	0.0000E+00
209	500.7	609.0	66.15	66.15	193.9	0.0000E+00
208	500.7	609.0	66.15	66.15	193.9	0.0000E+00
207	500.7	609.0	66.15	66.15	193.9	0.0000E+00
206	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	63.60	0.0000E+00
205	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
204	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
203	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
202	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
201	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	30.00	0.0000E+00

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
311	154.7	188.2	20.45	20.45	59.90	0.0000E+00
310	154.7	188.2	20.45	20.45	59.90	0.0000E+00
309	154.7	188.2	20.45	20.45	59.90	0.0000E+00
308	154.7	188.2	20.45	20.45	59.90	0.0000E+00
307	154.7	188.2	20.45	20.45	59.90	0.0000E+00
306	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	19.65	0.0000E+00
305	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
304	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
303	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
302	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
301	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	14.00	0.0000E+00

EDIT OF CONGLOMERATE DEBRIS SURFACE AREAS (M**2)

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
111	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
110	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
109	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
108	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
107	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
106	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
105	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
104	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
103	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
102	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
101	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
211	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
210	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
209	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
208	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
207	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
206	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
205	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
204	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
203	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
202	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

201 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
311	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
310	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
309	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
308	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
307	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
306	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
305	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
304	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
303	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
302	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
301	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

EDIT OF COMPONENT UNBLOCKED SURFACE AREAS (M**2)

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
111	525.4	639.2	69.45	69.45	203.4	0.0000E+00
110	525.4	639.2	69.45	69.45	203.4	0.0000E+00
109	525.4	639.2	69.45	69.45	203.4	0.0000E+00
108	525.4	639.2	69.45	69.45	203.4	0.0000E+00
107	525.4	639.2	69.45	69.45	203.4	0.0000E+00
106	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	66.75	0.0000E+00
105	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
104	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
103	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
102	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
101	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	40.00	0.0000E+00

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
211	500.7	609.0	66.15	66.15	193.9	0.0000E+00
210	500.7	609.0	66.15	66.15	193.9	0.0000E+00
209	500.7	609.0	66.15	66.15	193.9	0.0000E+00
208	500.7	609.0	66.15	66.15	193.9	0.0000E+00
207	500.7	609.0	66.15	66.15	193.9	0.0000E+00
206	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	63.60	0.0000E+00
205	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
204	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
203	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
202	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
201	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	30.00	0.0000E+00

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
311	154.7	188.2	20.45	20.45	59.90	0.0000E+00
310	154.7	188.2	20.45	20.45	59.90	0.0000E+00
309	154.7	188.2	20.45	20.45	59.90	0.0000E+00
308	154.7	188.2	20.45	20.45	59.90	0.0000E+00
307	154.7	188.2	20.45	20.45	59.90	0.0000E+00
306	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	19.65	0.0000E+00
305	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
304	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
303	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
302	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
301	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	14.00	0.0000E+00

EDIT OF TOTAL EFFECTIVE SURFACE AREAS (M**2)

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
111	525.4	639.2	69.45	69.45	203.4	0.0000E+00
110	525.4	639.2	69.45	69.45	203.4	0.0000E+00
109	525.4	639.2	69.45	69.45	203.4	0.0000E+00
108	525.4	639.2	69.45	69.45	203.4	0.0000E+00
107	525.4	639.2	69.45	69.45	203.4	0.0000E+00
106	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	66.75	0.0000E+00
105	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
104	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
103	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
102	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	82.53	0.0000E+00
101	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	40.00	0.0000E+00

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
211	500.7	609.0	66.15	66.15	193.9	0.0000E+00
210	500.7	609.0	66.15	66.15	193.9	0.0000E+00
209	500.7	609.0	66.15	66.15	193.9	0.0000E+00
208	500.7	609.0	66.15	66.15	193.9	0.0000E+00
207	500.7	609.0	66.15	66.15	193.9	0.0000E+00
206	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	63.60	0.0000E+00
205	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
204	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
203	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
202	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	78.63	0.0000E+00
201	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	30.00	0.0000E+00

CELL	FUEL	CLAD	CAN-CN	CAN-CB	ST STR	PT DEB
311	154.7	188.2	20.45	20.45	59.90	0.0000E+00
310	154.7	188.2	20.45	20.45	59.90	0.0000E+00
309	154.7	188.2	20.45	20.45	59.90	0.0000E+00
308	154.7	188.2	20.45	20.45	59.90	0.0000E+00
307	154.7	188.2	20.45	20.45	59.90	0.0000E+00
306	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	19.65	0.0000E+00
305	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
304	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
303	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
302	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	24.30	0.0000E+00
301	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	14.00	0.0000E+00

EDIT OF LOWER HEAD VARIABLES

ADJACENT FLUID VOLUME = 320
REACTOR CAVITY VOLUME = 100

NODE	MASS (KG)	TEMP (K)	SURF AREA (M**2)
1	13670.0000	561.0000	7.6480
2	13025.0000	561.0000	7.2870
3	4024.0000	561.0000	2.2510

EDIT OF PENETRATION VARIABLES

PEN	MASS (KG)	TEMP (K)	SURF AREA (M**2)	X-SEC AREA (M**2)	DIAMETER (M)
1	940.0000	561.0000	24.4300	.5750	-.1000
2	895.5000	561.0000	23.2800	.5480	-.1000
3	276.7000	561.0000	7.1900	.1690	-.1000

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TOTAL CPU TIME USED BY CORE EDIT PACKAGE =        .2200 S

END OF EDIT FOR COR PACKAGE

END OF EDIT FOR INP PACKAGE

END OF EDIT FOR CRA PACKAGE


    ************************************
    *                                  *
    *       CONTROL FUNCTION EDIT      *
    *                                  *
    ************************************


    NUMBER OF CONTROL FUNCTIONS                  =    34
    NUMBER OF REAL VALUED CONTROL FUNCTIONS      =    28
    NUMBER OF LOGICAL VALUED CONTROL FUNCTIONS =       6
    NUMBER OF ARGUMENTS                          =    65


 CONTROL FUNCTION NUMBER    1 IS REAL TYPE ADD       ITS NAME IS VAC-RV-DP
   VALUE = -8.0264E+03
   SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
   UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
   NUMBER OF ARGUMENTS =    2
   ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CVH-P.200
     IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
     MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
   ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CVH-P.150
     IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
     MULTIPLICATIVE CONSTANT =  -1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

 CONTROL FUNCTION NUMBER    2 IS REAL TYPE TAB-FUN   ITS NAME IS VAC-RV
   VALUE =  0.0000E+00
   SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
   UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
   NUMBER OF ARGUMENTS =    1
   ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.001
     IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
     MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
   MISC NUMBER =   1 HAS VALUE =   3.0000E+01

 CONTROL FUNCTION NUMBER   91 IS REAL TYPE MIN       ITS NAME IS FLAREA-1
   VALUE =  2.1825E+00
   SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
   UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
   NUMBER OF ARGUMENTS =    2
   ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =COR-AFLMIN.103.111
     IS REAL VALUED AND IS IN PACKAGE COR DATABASE ARRAY
     MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   2.1825E+00
   ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =COR-AFLMIN.103.111
     IS REAL VALUED AND IS IN PACKAGE COR DATABASE ARRAY
     MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

 CONTROL FUNCTION NUMBER   92 IS REAL TYPE MIN       ITS NAME IS FLAREA-2
   VALUE =  2.0795E+00
   SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
   UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
   NUMBER OF ARGUMENTS =    2
   ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =COR-AFLMIN.203.211
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IS REAL VALUED AND IS IN PACKAGE COR DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   2.0795E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =COR-AFLMIN.203.211
    IS REAL VALUED AND IS IN PACKAGE COR DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER   93 IS REAL TYPE MIN       ITS NAME IS FLAREA-3
  VALUE =  6.4249E-01
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =COR-AFLMIN.303.311
    IS REAL VALUED AND IS IN PACKAGE COR DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   6.4249E-01
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =COR-AFLMIN.303.311
    IS REAL VALUED AND IS IN PACKAGE COR DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER   94 IS REAL TYPE ADD       ITS NAME IS FLAREA-T
  VALUE =  4.9045E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    3
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.091
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CFVALU.092
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    3 HAS CHARACTER IDENTIFIER =CFVALU.093
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER   95 IS REAL TYPE DIVIDE    ITS NAME IS FRAC-AREA
  VALUE =  6.1747E-01
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     6.1748E-01  LOWER BOUND =     3.0000E-02
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.094
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   7.9428E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CFVALU.094
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER   99 IS REAL TYPE ADD       ITS NAME IS PDIF
  VALUE =  7.1340E+06
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CVH-P.360
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   1.0800E+05
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CVH-P.101
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =  -1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  101 IS REAL TYPE HYST      ITS NAME IS SRV-1
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.99
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
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    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -1.1000E+01
  MISC NUMBER =   2 HAS VALUE =  -2.1000E+01
  MISC NUMBER =   3 HAS VALUE =   7.1340E+06

CONTROL FUNCTION NUMBER  102 IS REAL TYPE HYST      ITS NAME IS SRV-2
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.99
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -1.2000E+01
  MISC NUMBER =   2 HAS VALUE =  -2.2000E+01
  MISC NUMBER =   3 HAS VALUE =   7.1340E+06

CONTROL FUNCTION NUMBER  103 IS REAL TYPE HYST      ITS NAME IS SRV-3
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.99
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -1.3000E+01
  MISC NUMBER =   2 HAS VALUE =  -2.3000E+01
  MISC NUMBER =   3 HAS VALUE =   7.1340E+06

CONTROL FUNCTION NUMBER  104 IS REAL TYPE HYST      ITS NAME IS SRV-4
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.99
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -1.4000E+01
  MISC NUMBER =   2 HAS VALUE =  -2.4000E+01
  MISC NUMBER =   3 HAS VALUE =   7.1340E+06

CONTROL FUNCTION NUMBER  105 IS REAL TYPE ADD       ITS NAME IS SRV
  VALUE =  0.0000E+00
  SCALE FACTOR =  7.6920E-02  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    4
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.101
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CFVALU.102
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    3 HAS CHARACTER IDENTIFIER =CFVALU.103
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    4 HAS CHARACTER IDENTIFIER =CFVALU.104
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  106 IS REAL TYPE L-A-IFTE  ITS NAME IS OPEN ADS
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    3
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  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.107
    IS LOGICAL VALUED AND IS IN MAIN DATABASE ARRAY
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    3 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   1.0000E+00

CONTROL FUNCTION NUMBER  107 IS LOGICAL TYPE L-GT      ITS NAME IS LEVEL-IN-VESSEL
  VALUE = T   CLASS = LATCH      STATUS = UNLATCHED
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CVH-CLIQLEV.340
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   6.7643E+00

CONTROL FUNCTION NUMBER  108 IS REAL TYPE L-A-IFTE  ITS NAME IS SRV-MANUAL
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    3
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.200
    IS LOGICAL VALUED AND IS IN MAIN DATABASE ARRAY
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CFVALU.201
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    3 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  109 IS REAL TYPE ADD       ITS NAME IS 405-DP
  VALUE =  5.6028E+01
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    4
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CVH-P.403
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CVH-P.409
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =  -1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    3 HAS CHARACTER IDENTIFIER =CVH-RHOA.403
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =  -4.2180E+01  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    4 HAS CHARACTER IDENTIFIER =CVH-RHOA.409
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0790E+01  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  110 IS REAL TYPE T-O-F     ITS NAME IS 405-TRIP
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.109
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -1.0000E+06
  MISC NUMBER =   2 HAS VALUE =   1.5513E+03
  MISC NUMBER =   3 HAS VALUE =   5.6028E+01

CONTROL FUNCTION NUMBER  111 IS REAL TYPE HYST      ITS NAME IS 405-FRAC
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  VALUE =  1.0000E-01
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.109
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -4.1000E+02
  MISC NUMBER =   2 HAS VALUE =  -4.0000E+02
  MISC NUMBER =   3 HAS VALUE =   5.6028E+01

CONTROL FUNCTION NUMBER  130 IS REAL TYPE DIVIDE    ITS NAME IS VESSEL BREACH
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =COR-ABRCH
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   1.0000E-02
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =COR-ABRCH
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  139 IS REAL TYPE ADD       ITS NAME IS 415-DP
  VALUE =  6.2097E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    4
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CVH-P.408
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CVH-P.410
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =  -1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    3 HAS CHARACTER IDENTIFIER =CVH-RHOA.408
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =  -8.6330E+01  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    4 HAS CHARACTER IDENTIFIER =CVH-RHOA.410
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   5.1110E+02  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  140 IS REAL TYPE T-O-F     ITS NAME IS 415-TRIP
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.139
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -1.0000E+06
  MISC NUMBER =   2 HAS VALUE =   2.1546E+03
  MISC NUMBER =   3 HAS VALUE =   6.2097E+00

CONTROL FUNCTION NUMBER  141 IS REAL TYPE HYST      ITS NAME IS 415-FRAC
  VALUE =  1.0000E-01
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.139
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -4.4000E+02
  MISC NUMBER =   2 HAS VALUE =  -4.0000E+02
  MISC NUMBER =   3 HAS VALUE =   6.2097E+00
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CONTROL FUNCTION NUMBER  145 IS REAL TYPE EQUALS    ITS NAME IS CONT-BRK
  VALUE =  1.0000E+00
  SCALE FACTOR =  0.0000E+00  ADDITIVE CONSTANT =  1.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  149 IS LOGICAL TYPE L-GT      ITS NAME IS CONT-FAIL MES
  VALUE = F   CLASS = LATCH      STATUS = UNLATCHED
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CVH-P.101
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   9.1000E+05

CONTROL FUNCTION NUMBER  150 IS REAL TYPE T-O-F     ITS NAME IS FAIL THRESH
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CVH-P.101
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -1.0000E+09
  MISC NUMBER =   2 HAS VALUE =   9.1000E+05
  MISC NUMBER =   3 HAS VALUE =   1.0800E+05

CONTROL FUNCTION NUMBER  151 IS REAL TYPE L-A-IFTE  ITS NAME IS DW-HD-FAILFRAC
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    3
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.152
    IS LOGICAL VALUED AND IS IN MAIN DATABASE ARRAY
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CFVALU.160
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    3 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  152 IS LOGICAL TYPE L-AND     ITS NAME IS DW-HD-FAIL
  VALUE = F   CLASS = NORMAL     STATUS = ACTIVE
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.153
    IS LOGICAL VALUED AND IS IN MAIN DATABASE ARRAY
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CFVALU.154
    IS LOGICAL VALUED AND IS IN MAIN DATABASE ARRAY

CONTROL FUNCTION NUMBER  153 IS LOGICAL TYPE L-GT      ITS NAME IS TEMP-CRIT.
  VALUE = F   CLASS = LATCH      STATUS = UNLATCHED
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =HS-TEMP.1000203
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   6.4430E+02
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CONTROL FUNCTION NUMBER  154 IS LOGICAL TYPE L-GT      ITS NAME IS DP-CRITE
  VALUE = F   CLASS = NORMAL     STATUS = ACTIVE
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.155
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   5.6537E+05

CONTROL FUNCTION NUMBER  155 IS REAL TYPE ADD       ITS NAME IS DIFF-PRES
  VALUE =  7.1521E+03
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CVH-P.102
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =CVH-P.408
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =  -1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00

CONTROL FUNCTION NUMBER  160 IS REAL TYPE TAB-FUN   ITS NAME IS FRAC-OPEN
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.155
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =   1.6100E+02

CONTROL FUNCTION NUMBER  200 IS LOGICAL TYPE L-GT      ITS NAME IS TIME-CRITER
  VALUE = F   CLASS = NORMAL     STATUS = ACTIVE
  NUMBER OF ARGUMENTS =    2
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  ARGUMENT NUMBER =    2 HAS CHARACTER IDENTIFIER =TIME
    IS REAL VALUED AND IS IN PACKAGE MEX DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   0.0000E+00  ADDITIVE CONSTANT =   2.0000E+02

CONTROL FUNCTION NUMBER  201 IS REAL TYPE HYST      ITS NAME IS VALVE-OPEN
  VALUE =  0.0000E+00
  SCALE FACTOR =  1.0000E+00  ADDITIVE CONSTANT =  0.0000E+00
  UPPER BOUND =     3.4000E+38  LOWER BOUND =    -3.4000E+38
  NUMBER OF ARGUMENTS =    1
  ARGUMENT NUMBER =    1 HAS CHARACTER IDENTIFIER =CFVALU.99
    IS REAL VALUED AND IS IN MAIN DATABASE ARRAY
    MULTIPLICATIVE CONSTANT =   1.0000E+00  ADDITIVE CONSTANT =   0.0000E+00
  MISC NUMBER =   1 HAS VALUE =  -2.0200E+02
  MISC NUMBER =   2 HAS VALUE =  -2.0300E+02
  MISC NUMBER =   3 HAS VALUE =   7.1340E+06

END OF EDIT FOR CF  PACKAGE
1      ***** TABULAR FUNCTION EDIT *****


 TOTAL NUMBER OF TABULAR FUNCTIONS                    =    30
 TOTAL NUMBER OF DATA PAIRS                           =   270
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EDIT OF TABULAR FUNCTION NUMBER     4
    MULTIPLICATIVE CONSTANT =     1.00000E+00
    ADDITIVE CONSTANT       =     0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =RHO CONCRETE
      I              X                  Y
      1        2.00000E+02        2.52260E+03
      2        5.00000E+03        2.52260E+03


EDIT OF TABULAR FUNCTION NUMBER     5
    MULTIPLICATIVE CONSTANT =     1.00000E+00
    ADDITIVE CONSTANT       =     0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =CPS CONCRETE
      I              X                  Y
      1        2.00000E+02        1.29997E+03
      2        5.00000E+03        1.29997E+03


EDIT OF TABULAR FUNCTION NUMBER     6
    MULTIPLICATIVE CONSTANT =     1.00000E+00
    ADDITIVE CONSTANT       =     0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =THC CONCRETE
      I              X                  Y
      1        2.00000E+02        1.52400E+00
      2        5.00000E+03        1.52400E+00


EDIT OF TABULAR FUNCTION NUMBER     7
    MULTIPLICATIVE CONSTANT =     1.00000E+00
    ADDITIVE CONSTANT       =     0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =RHO CARBON STEEL
      I              X                  Y
      1        2.73150E+02        7.83300E+03
      2        5.00000E+03        7.83300E+03


EDIT OF TABULAR FUNCTION NUMBER     8
    MULTIPLICATIVE CONSTANT =     1.00000E+00
    ADDITIVE CONSTANT       =     0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =CPS CARBON STEEL
      I              X                  Y
      1        2.73150E+02        4.65000E+02
      2        5.00000E+03        4.65000E+02


EDIT OF TABULAR FUNCTION NUMBER     9
    MULTIPLICATIVE CONSTANT =     1.00000E+00
    ADDITIVE CONSTANT       =     0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =THC CARBON STEEL
      I              X                  Y
      1        2.73150E+02        5.50000E+01
      2        3.73150E+02        5.20000E+01
      3        4.73150E+02        4.80000E+01
      4        5.73150E+02        4.50000E+01
      5        6.73150E+02        4.20000E+01
      6        8.73150E+02        3.50000E+01
```

```
      7        1.07315E+03        3.10000E+01
      8        1.27315E+03        2.90000E+01
      9        1.47315E+03        3.10000E+01
     10        9.97315E+03        3.10000E+01


EDIT OF TABULAR FUNCTION NUMBER   11
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-LOAD-1
      I              X                  Y
      1        7.68759E+06        0.00000E+00
      2        7.68760E+06        1.00000E+00
      3        7.79101E+06        1.00000E+00
      4        7.79102E+06        2.00000E+00
      5        7.84617E+06        2.00000E+00
      6        7.84618E+06        3.00000E+00


EDIT OF TABULAR FUNCTION NUMBER   12
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-LOAD-2
      I              X                  Y
      1        7.70827E+06        0.00000E+00
      2        7.70828E+06        1.00000E+00
      3        7.72206E+06        1.00000E+00
      4        7.72207E+06        2.00000E+00
      5        7.79791E+06        2.00000E+00
      6        7.79792E+06        3.00000E+00
      7        7.82548E+06        3.00000E+00
      8        7.82549E+06        4.00000E+00
      9        1.03420E+07        4.00000E+00
     10        1.03421E+07        5.00000E+00


EDIT OF TABULAR FUNCTION NUMBER   13
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-LOAD-3
      I              X                  Y
      1        7.75654E+06        0.00000E+00
      2        7.75655E+06        1.00000E+00
      3        7.76343E+06        1.00000E+00
      4        7.76344E+06        2.00000E+00
      5        7.85996E+06        2.00000E+00
      6        7.85997E+06        3.00000E+00
      7        7.86685E+06        3.00000E+00
      8        7.86686E+06        4.00000E+00


EDIT OF TABULAR FUNCTION NUMBER   14
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-LOAD-4
      I              X                  Y
      1        1.03420E+07        0.00000E+00
      2        1.03421E+07        1.00000E+00
```

```
EDIT OF TABULAR FUNCTION NUMBER   21
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-UNLOAD-1
      I              X                  Y
      1        7.25322E+06        0.00000E+00
      2        7.25323E+06        1.00000E+00
      3        7.32217E+06        1.00000E+00
      4        7.32218E+06        2.00000E+00
      5        7.39112E+06        2.00000E+00
      6        7.39113E+06        3.00000E+00


EDIT OF TABULAR FUNCTION NUMBER   22
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-UNLOAD-2
      I              X                  Y
      1        7.10154E+06        0.00000E+00
      2        7.10155E+06        1.00000E+00
      3        7.18428E+06        1.00000E+00
      4        7.18429E+06        3.00000E+00
      5        7.24633E+06        3.00000E+00
      6        7.24634E+06        4.00000E+00
      7        7.26012E+06        4.00000E+00
      8        7.26013E+06        5.00000E+00


EDIT OF TABULAR FUNCTION NUMBER   23
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-UNLOAD-3
      I              X                  Y
      1        6.99123E+06        0.00000E+00
      2        6.99124E+06        1.00000E+00
      3        7.05328E+06        1.00000E+00
      4        7.05329E+06        2.00000E+00
      5        7.11533E+06        2.00000E+00
      6        7.11534E+06        3.00000E+00
      7        7.30838E+06        3.00000E+00
      8        7.30839E+06        4.00000E+00


EDIT OF TABULAR FUNCTION NUMBER   24
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-UNLOAD-4
      I              X                  Y
      1        6.99812E+06        0.00000E+00
      2        6.99813E+06        1.00000E+00


EDIT OF TABULAR FUNCTION NUMBER   30
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =VAC-RV-AREA
      I              X                  Y
      1        0.00000E+00        0.00000E+00
      2        3.44400E+03        0.00000E+00
```

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  3        3.44700E+03        1.00000E+00
  4        2.00000E+04        1.00000E+00


EDIT OF TABULAR FUNCTION NUMBER   71
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =CPUO2
      I              X                  Y
      1        2.73150E+02        2.30220E+02
      2        4.00000E+02        2.65840E+02
      3        5.00000E+02        2.82070E+02
      4        6.00000E+02        2.92360E+02
      5        7.00000E+02        2.99670E+02
      6        8.00000E+02        3.05310E+02
      7        9.00000E+02        3.09980E+02
      8        1.00000E+03        3.14030E+02
      9        1.10000E+03        3.17690E+02
     10        1.20000E+03        3.21150E+02
     11        1.30000E+03        3.24590E+02
     12        1.40000E+03        3.28240E+02
     13        1.50000E+03        3.32400E+02
     14        1.60000E+03        3.37430E+02
     15        1.70000E+03        3.43760E+02
     16        1.80000E+03        3.51840E+02
     17        1.90000E+03        3.62140E+02
     18        2.00000E+03        3.75090E+02
     19        2.10000E+03        3.91080E+02
     20        2.20000E+03        4.10450E+02
     21        2.30000E+03        4.33450E+02
     22        2.40000E+03        4.60230E+02
     23        2.50000E+03        4.90880E+02
     24        2.60000E+03        5.25400E+02
     25        2.70000E+03        5.63710E+02
     26        2.80000E+03        6.05670E+02
     27        2.80001E+03        5.03000E+02
     28        2.90000E+03        5.03000E+02
     29        3.00000E+03        5.03000E+02
     30        3.11300E+03        5.03000E+02
     31        5.00000E+03        5.03000E+02


EDIT OF TABULAR FUNCTION NUMBER   72
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =EUO2
      I              X                  Y
      1        3.00000E+02        3.31430E+04
      2        4.00000E+02        5.84190E+04
      3        5.00000E+02        8.58830E+04
      4        6.00000E+02        1.14638E+05
      5        7.00000E+02        1.44257E+05
      6        8.00000E+02        1.74517E+05
      7        9.00000E+02        2.05288E+05
      8        1.00000E+03        2.36492E+05
      9        1.10000E+03        2.68080E+05
     10        1.20000E+03        3.00023E+05
     11        1.30000E+03        3.32309E+05
     12        1.40000E+03        3.64947E+05
     13        1.50000E+03        3.97973E+05
     14        1.60000E+03        4.31455E+05
     15        1.70000E+03        4.65502E+05
```

16	1.80000E+03	5.00266E+05
17	1.90000E+03	5.35945E+05
18	2.00000E+03	5.72782E+05
19	2.10000E+03	6.11064E+05
20	2.20000E+03	6.51111E+05
21	2.30000E+03	6.93275E+05
22	2.40000E+03	7.37927E+05
23	2.50000E+03	7.85450E+05
24	2.60000E+03	8.36232E+05
25	2.70000E+03	8.90656E+05
26	2.80000E+03	9.49096E+05
27	2.80001E+03	1.22310E+06
28	2.90000E+03	1.28591E+06
29	3.00000E+03	1.35342E+06
30	3.11300E+03	1.43576E+06
31	3.51300E+03	1.63696E+06

EDIT OF TABULAR FUNCTION NUMBER 73
MULTIPLICATIVE CONSTANT = 1.00000E+00
ADDITIVE CONSTANT = 0.00000E+00
LOWER BD CONDITION SWITCH = 0 UPPER BD CONDITION SWITCH = 0
TABULAR FUNCTION NAME =TUO2

I	X	Y
1	3.31430E+04	3.00000E+02
2	5.84190E+04	4.00000E+02
3	8.58830E+04	5.00000E+02
4	1.14638E+05	6.00000E+02
5	1.44257E+05	7.00000E+02
6	1.74517E+05	8.00000E+02
7	2.05288E+05	9.00000E+02
8	2.36492E+05	1.00000E+03
9	2.68080E+05	1.10000E+03
10	3.00023E+05	1.20000E+03
11	3.32309E+05	1.30000E+03
12	3.64947E+05	1.40000E+03
13	3.97973E+05	1.50000E+03
14	4.31455E+05	1.60000E+03
15	4.65502E+05	1.70000E+03
16	5.00266E+05	1.80000E+03
17	5.35945E+05	1.90000E+03
18	5.72782E+05	2.00000E+03
19	6.11064E+05	2.10000E+03
20	6.51111E+05	2.20000E+03
21	6.93275E+05	2.30000E+03
22	7.37927E+05	2.40000E+03
23	7.85450E+05	2.50000E+03
24	8.36232E+05	2.60000E+03
25	8.90656E+05	2.70000E+03
26	9.49096E+05	2.80000E+03
27	1.22310E+06	2.80001E+03
28	1.28591E+06	2.90000E+03
29	1.35342E+06	3.00000E+03
30	1.43576E+06	3.11300E+03
31	1.63696E+06	3.51300E+03

EDIT OF TABULAR FUNCTION NUMBER 77
MULTIPLICATIVE CONSTANT = 3.29300E+09
ADDITIVE CONSTANT = 0.00000E+00
LOWER BD CONDITION SWITCH = 0 UPPER BD CONDITION SWITCH = 0
TABULAR FUNCTION NAME =DECAY HEAT

I	X	Y
1	0.00000E+00	6.00000E-02

2	1.00000E+00	5.71500E-02
3	1.50000E+00	5.55200E-02
4	2.00000E+00	5.43700E-02
5	3.00000E+00	5.20400E-02
6	4.00000E+00	5.04000E-02
7	6.00000E+00	4.80700E-02
8	8.00000E+00	4.61900E-02
9	1.00000E+01	4.47300E-02
10	1.50000E+01	4.20500E-02
11	2.00000E+01	4.01500E-02
12	3.00000E+01	3.75600E-02
13	4.00000E+01	3.57200E-02
14	6.00000E+01	3.31300E-02
15	8.00000E+01	3.13700E-02
16	1.00000E+02	3.00000E-02
17	1.50000E+02	2.77700E-02
18	2.00000E+02	2.61900E-02
19	3.00000E+02	2.42800E-02
20	4.00000E+02	2.29300E-02
21	6.00000E+02	2.10200E-02
22	8.00000E+02	1.96500E-02
23	1.00000E+03	1.85900E-02
24	1.50000E+03	1.66200E-02
25	2.00000E+03	1.52200E-02
26	3.00000E+03	1.35400E-02
27	4.00000E+03	1.23500E-02
28	6.00000E+03	1.06700E-02
29	8.00000E+03	9.81500E-03
30	1.00000E+04	9.15200E-03
31	1.50000E+04	8.19300E-03
32	2.00000E+04	7.51200E-03
33	3.00000E+04	6.76400E-03
34	4.00000E+04	6.23200E-03
35	6.00000E+04	5.48400E-03
36	8.00000E+04	5.03900E-03
37	1.00000E+05	4.69300E-03
38	1.50000E+05	4.14100E-03
39	2.00000E+05	3.74900E-03
40	3.00000E+05	3.27500E-03
41	4.00000E+05	2.94000E-03
42	6.00000E+05	2.46600E-03
43	8.00000E+05	2.18700E-03
44	1.00000E+06	1.97100E-03

EDIT OF TABULAR FUNCTION NUMBER 82
MULTIPLICATIVE CONSTANT = 1.00000E+00
ADDITIVE CONSTANT = 0.00000E+00
LOWER BD CONDITION SWITCH = 0 UPPER BD CONDITION SWITCH = 0
TABULAR FUNCTION NAME =EZIRC

I	X	Y
1	3.00000E+02	0.00000E+00
2	4.00000E+02	2.19150E+04
3	6.40000E+02	1.05110E+05
4	1.09000E+03	2.63960E+05
5	1.09300E+03	2.65276E+05
6	1.11300E+03	2.76196E+05
7	1.13300E+03	2.88246E+05
8	1.15300E+03	3.01586E+05
9	1.17300E+03	3.16936E+05
10	1.19300E+03	3.32796E+05
11	1.21300E+03	3.46686E+05
12	1.23300E+03	3.57566E+05
13	1.24800E+03	3.63753E+05

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 14        2.09800E+03        6.66353E+05
 15        2.50000E+03        8.09465E+05
 16        2.50001E+03        1.03446E+06
 17        3.59800E+03        1.42535E+06


EDIT OF TABULAR FUNCTION NUMBER   83
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =TZIRC
      I              X                  Y
      1        0.00000E+00        3.00000E+02
      2        2.19150E+04        4.00000E+02
      3        1.05110E+05        6.40000E+02
      4        2.63960E+05        1.09000E+03
      5        2.65276E+05        1.09300E+03
      6        2.76196E+05        1.11300E+03
      7        2.88246E+05        1.13300E+03
      8        3.01586E+05        1.15300E+03
      9        3.16936E+05        1.17300E+03
     10        3.32796E+05        1.19300E+03
     11        3.46686E+05        1.21300E+03
     12        3.57566E+05        1.23300E+03
     13        3.63753E+05        1.24800E+03
     14        6.66353E+05        2.09800E+03
     15        8.09465E+05        2.50000E+03
     16        1.03446E+06        2.50001E+03
     17        1.42535E+06        3.59800E+03


EDIT OF TABULAR FUNCTION NUMBER  120
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =RPV/DRYWELL HTC
      I              X                  Y
      1        2.73150E+02        6.62000E+00
      2        5.00000E+03        6.62000E+00


EDIT OF TABULAR FUNCTION NUMBER  161
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =AREA-VS-DP
      I              X                  Y
      1       -1.00000E+09        0.00000E+00
      2        5.65370E+05        0.00000E+00
      3        1.37895E+06        1.00000E+00
      4        1.00000E+09        1.00000E+00


EDIT OF TABULAR FUNCTION NUMBER  200
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT       =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =RHS HT COEF
      I              X                  Y
      1        0.00000E+00        6.08000E+00


EDIT OF TABULAR FUNCTION NUMBER  202
    MULTIPLICATIVE CONSTANT =    1.00000E+00
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    ADDITIVE CONSTANT        =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-OPEN
      I              X                  Y
      1        7.10158E+06        0.00000E+00
      2        7.10160E+06        1.00000E+00
      3        8.00000E+06        1.00000E+00


EDIT OF TABULAR FUNCTION NUMBER  203
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT        =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =SRV-CLOSE
      I              X                  Y
      1        6.42936E+06        0.00000E+00
      2        6.42937E+06        1.00000E+00
      3        8.00000E+06        1.00000E+00


EDIT OF TABULAR FUNCTION NUMBER  210
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT        =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =RHS T - 286
      I              X                  Y
      1        0.00000E+00        2.86000E+02


EDIT OF TABULAR FUNCTION NUMBER  400
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT        =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =405-UNLOAD
      I              X                  Y
      1        0.00000E+00        1.00000E+00


EDIT OF TABULAR FUNCTION NUMBER  410
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT        =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =405-A-DP
      I              X                  Y
      1        1.55130E+03        1.00000E-01
      2        1.63750E+03        1.85700E-01
      3        1.72370E+03        7.42900E-01
      4        1.80990E+03        8.35700E-01
      5        1.89800E+03        1.00000E+00


EDIT OF TABULAR FUNCTION NUMBER  440
    MULTIPLICATIVE CONSTANT =    1.00000E+00
    ADDITIVE CONSTANT        =    0.00000E+00
    LOWER BD CONDITION SWITCH =  0    UPPER BD CONDITION SWITCH =  0
    TABULAR FUNCTION NAME =415-A-DP
      I              X                  Y
      1        2.15460E+03        1.00000E-01
      2        2.27430E+03        2.00000E-01
      3        2.39400E+03        8.00000E-01
      4        2.51370E+03        9.00000E-01
      5        2.63340E+03        1.00000E+00
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              EDIT OF TFPNT POINTERS
     KTFNUM=   95 KTFPAR=  125 KTFSCL=    1 KTFADC=   31
     KTFBDL=  155 KTFBDU=  185 KTFNMS=  215 KPTPAR=  245
     KTFNAM=    1 KTFX  =   61 KTFY  =  331 NUMTF =   30
     NMTF  =   30 MXTFPR=   44 NUMPAR=  270 NMPAR=   270


 END OF EDIT FOR TF  PACKAGE

 END OF EDIT FOR MES PACKAGE


 H2O PACKAGE CALL STATISTICS

 CALLS TO    H2OEST     H2O1PH     H2O2PH     H2OSAT
 EDIT      6.1700E+02 6.4400E+02 2.9700E+02 4.1200E+02
 RUN       6.1700E+02 6.4400E+02 2.9700E+02 4.1200E+02
 THE AVERAGE NUMBER OF ITERATIONS FOR 1.0000E-20 ATTEMPTS IS 0.0000E+00
 NUMBER OF CORRECTED ITERATION FAILURES  0.0000E+00


 END OF EDIT FOR H2O PACKAGE
0
          ********************************************
          *                                          *
          *              BURN PACKAGE                *
          *                                          *
          ********************************************


  CPU TIME USED BY BURN RUN ROUTINES     =       .00 SECS
  CPU TIME USED BY BURN EDIT ROUTINES    =       .00 SECS
  CPU TIME USED BY BURN RESTART ROUTINES =       .00 SECS


  PROBLEM COMBUSTION PARAMETERS

 MINIMUM MOLE FRACTION OF H2 FOR IGNITION
                        WITHOUT IGNITERS =  .1000
                           WITH IGNITERS =  .0700

 MINIMUM MOLE FRACTION OF CO FOR IGNITION
                        WITHOUT IGNITERS =  .1670
                           WITH IGNITERS =  .1290

 MINIMUM MOLE FRACTION OF O2 FOR IGNITION
                              BOTH CASES =  .0500
 MAXIMUM MOLE FRACTION OF H2O + CO2 FOR IGNITION
                              BOTH CASES =  .5500


 MINIMUM MOLE FRACTION OF H2 FOR DETONATION  =  .1400
 MINIMUM MOLE FRACTION OF O2 FOR DETONATION  =  .0900
 MAXIMUM MOLE FRACTION OF H2O FOR DETONATION =  .3000


 LECHATLIER H2 WEIGHT FOR COMBUSTION COMPLETENESS =  .0800
 LECHATLIER CO WEIGHT FOR COMBUSTION COMPLETENESS =  .1480
```

PROBLEM BURN PROPAGATION PARAMETERS

	H2 MOLE FRACTION	CO MOLE FRACTION
UPWARD PROPAGATION	.0410	.1250
HORIZONTAL PROPAGATION	.0600	.1380
DOWNWARD PROPAGATION	.0900	.1500

PROBLEM COMBUSTION RATE PARAMETERS

NO.	USER NO.	IGNITER (0=N,1=Y)	CHARACTERISTIC DIMENSION(M)	PROPAGATION TIME FRACTION
1	100	0	3.8659E+00	.0000
2	101	0	8.8235E+00	.0000
3	102	0	6.2781E+00	.0000
4	103	0	2.6612E+00	.0000
5	150	0	5.1285E+00	.0000
6	200	0	1.1941E+01	.0000
7	310	0	3.5271E+00	.0000
8	320	0	2.9122E+00	.0000
9	330	0	1.8326E+00	.0000
10	340	0	1.9957E+00	.0000
11	350	0	2.2049E+00	.0000
12	360	0	3.7370E+00	.0000
13	401	1	1.7600E+01	.2500
14	402	1	1.1200E+01	.2500
15	403	1	1.7300E+01	.2500
16	404	1	1.3300E+01	.2500
17	405	1	1.9200E+01	.2500
18	406	1	1.3500E+01	.2500
19	407	1	1.6900E+01	.2500
20	408	1	3.1400E+01	.2500
21	409	1	5.3000E+01	.2500
22	410	0	1.3365E+03	.0000

NODE CONNECTIVITY ARRAY FOR BURN PROPAGATION

NO.	USER NO.	CONNECTING VOLUME	FLOW PATH NO.	ORIENTATION (-1,0,1)
1	100			
		101	10	0
		103	14	1
		310	370	1
		320	371	1
		320	399	1
2	101			
		100	10	0
		102	11	0

		150	12	0
		103	13	0
		401	400	0
3	102			
		101	11	0
		103	15	0
		408	398	1
4	103			
		101	13	0
		100	14	-1
		102	15	0
5	150			
		101	12	0
		200	20	0
		200	21	-1
6	200			
		150	20	0
		150	21	1
		360	362	1
		360	363	1
		360	364	1
7	310			
		320	312	-1
		360	361	0
		100	370	-1
8	320			
		310	312	1
		330	323	0
		340	324	0
		100	371	-1
		100	399	-1
9	330			
		320	323	0
		350	335	0
10	340			
		320	324	0
		350	345	0
11	350			
		330	335	0
		340	345	0
		360	356	0
12	360			
		350	356	0
		310	361	0
		200	362	-1
		200	363	-1
		200	364	-1
13	401			
		101	400	0
		402	401	1
14	402			
		401	401	-1
		404	402	1
		403	403	0
		410	404	0
15	403			
		402	403	0
		409	405	1
		410	406	0
16	404			
		402	402	-1
		406	407	1
		405	408	0
		410	409	0

```
17      405
                        404          408          0
                        410          410          0
18      406
                        404          407         -1
                        408          411          1
                        407          412          0
                        410          413          0
19      407
                        406          412          0
                        410          414          0
20      408
                        102          398         -1
                        406          411         -1
                        410          415          0
                        410          416          0
21      409
                        403          405         -1
                        410          417          0
22      410
                        402          404          0
                        403          406          0
                        404          409          0
                        405          410          0
                        406          413          0
                        407          414          0
                        408          415          0
                        408          416          0
                        409          417          0

THE BURN TIME STEP IS       .200 SECONDS


CONTROL VOLUME      FLAME SPEED OPTION
     100            CORRELATION
     101            CORRELATION
     102            CORRELATION
     103            CORRELATION
     150            CORRELATION
     200            CORRELATION
     310            CORRELATION
     320            CORRELATION
     330            CORRELATION
     340            CORRELATION
     350            CORRELATION
     360            CORRELATION
     401            CORRELATION
     402            CORRELATION
     403            CORRELATION
     404            CORRELATION
     405            CORRELATION
     406            CORRELATION
     407            CORRELATION
     408            CORRELATION
     409            CORRELATION
     410            CORRELATION

CONTROL VOLUME    COMBUSTION COMPLETENESS OPTION
     100            CORRELATION
     101            CORRELATION
     102            CORRELATION
     103            CORRELATION
     150            CORRELATION
     200            CORRELATION
```

310	CORRELATION
320	CORRELATION
330	CORRELATION
340	CORRELATION
350	CORRELATION
360	CORRELATION
401	CORRELATION
402	CORRELATION
403	CORRELATION
404	CORRELATION
405	CORRELATION
406	CORRELATION
407	CORRELATION
408	CORRELATION
409	CORRELATION
410	CORRELATION

MOLE FRACTIONS ARE

VOL	H2	CO	H2O	CO2	O2	N2
100	.0000E+00	.0000E+00	.4189E-01	.0000E+00	.0000E+00	.9581E+00
101	.0000E+00	.0000E+00	.4189E-01	.0000E+00	.0000E+00	.9581E+00
102	.0000E+00	.0000E+00	.4189E-01	.0000E+00	.0000E+00	.9581E+00
103	.0000E+00	.0000E+00	.4557E+00	.0000E+00	.0000E+00	.5443E+00
150	.0000E+00	.0000E+00	.4189E-01	.0000E+00	.0000E+00	.9581E+00
200	.0000E+00	.0000E+00	.4951E-01	.0000E+00	.0000E+00	.9505E+00
310	.0000E+00	.0000E+00	.1000E+01	.0000E+00	.0000E+00	.0000E+00
320	.0000E+00	.0000E+00	.1000E+01	.0000E+00	.0000E+00	.0000E+00
330	.0000E+00	.0000E+00	.1000E+01	.0000E+00	.0000E+00	.0000E+00
340	.0000E+00	.0000E+00	.1000E+01	.0000E+00	.0000E+00	.0000E+00
350	.0000E+00	.0000E+00	.1000E+01	.0000E+00	.0000E+00	.0000E+00
360	.0000E+00	.0000E+00	.1000E+01	.0000E+00	.0000E+00	.0000E+00
401	.0000E+00	.0000E+00	.5087E-01	.0000E+00	.1993E+00	.7499E+00
402	.0000E+00	.0000E+00	.3464E-01	.0000E+00	.2027E+00	.7627E+00
403	.0000E+00	.0000E+00	.3464E-01	.0000E+00	.2027E+00	.7627E+00
404	.0000E+00	.0000E+00	.3455E-01	.0000E+00	.2027E+00	.7627E+00
405	.0000E+00	.0000E+00	.3455E-01	.0000E+00	.2027E+00	.7627E+00
406	.0000E+00	.0000E+00	.3459E-01	.0000E+00	.2027E+00	.7627E+00
407	.0000E+00	.0000E+00	.3459E-01	.0000E+00	.2027E+00	.7627E+00
408	.0000E+00	.0000E+00	.3463E-01	.0000E+00	.2027E+00	.7627E+00
409	.0000E+00	.0000E+00	.3455E-01	.0000E+00	.2027E+00	.7627E+00
410	.0000E+00	.0000E+00	.3447E-01	.0000E+00	.2027E+00	.7628E+00

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*************************************
*                                   *
*   DECAY HEAT PACKAGE EDIT         *
*                                   *
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POWER FROM FISSION PRODUCT CLASSES

CLASS NUMBER	CLASS NAME	POWER/MASS W/KG	POWER W
16	CSI	.51371D+06	.51371D+00
1	NOBLE GASES	.22459D+05	.10414D+08
2	ALKALI METALS	.61682D+05	.16552D+08
3	ALKALINE EARTHS	.57894D+05	.12014D+08
4	HALOGENS	.65630D+06	.13737D+08

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  5          CHALCOGENS                          .13568D+06      .55345D+07
  6          PLATINOIDS                          .10371D+05      .31838D+07
  7          TRANSITION METALS                   .40385D+05      .14161D+08
  8          TETRAVALENTS                        .15462D+05      .91836D+07
  9          TRIVALENTS                          .43847D+05      .25039D+08
 10          URANIUM                             .30280D+02      .40087D+07
 11          MORE VOLATILE MAIN GRP ELEMENTS     .36212D+07      .50933D+07
 12          LESS VOLATILE MAIN GRP ELEMENTS     .13135D+06      .11279D+07
 13          BORON                               .00000D+00      .00000D+00
 14          WATER                               .00000D+00      .00000D+00
 15          CONCRETE                            .00000D+00      .00000D+00

TOTAL POWER FROM FISSION PRODUCT CLASSES =   .12005D+09 WATTS

FISSION PRODUCT CLASS DECAY POWERS ARE BEING PROPORTIONED TO WHOLE CORE DECAY POWER

WHOLE REACTOR CORE DECAY HEAT POWER COMPUTED FROM TABULAR FUNCTION    77

END OF EDIT FOR DCH PACKAGE


GRAPHICS FILE MASTER KEY CONTAINS
   607 VARIABLE NAMES  9979 KEY VARIABLES
 THERE ARE   8162 VARIABLES PER TIME RECORD
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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

The purpose of this report is to compare in-containment source terms developed for NUREG-1159, which used the Source Term Code Package (STCP), with those generated by MELCOR to identify significant differences. For this comparison, two short-term depressurized station blackout sequences (with a dry cavity and with a flooded cavity) and a Loss-Of-Coolant Accident (LOCA) concurrent with complete loss of the Emergency Core Cooling System (ECCS) were analyzed for the Peach Bottom Atomic Power Station (a BWR-4 with a Mark I containment). The results indicate that for the sequences analyzed, the two codes predict similar total in-containment release fractions for each of the element groups. However, the MELCOR/CORBH Package predicts significantly longer times for vessel failure and reduced energy of the released material for the station blackout sequences (when compared to the STCP results). MELCOR also calculated smaller releases into the environment than STCP for the station blackout sequences.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)
boiling water reactors
Mark I containment
severe accidents
short-term station blackout
beyond design Loss-Of-Coolant-Accident (LOCA)

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Unlimited

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